THE AUSTRALIAN NAVAL ARCHITECT

Volume 25 Number 2
May 2021

The first of the RAN's new replenishment ships, HMAS *Supply*, was commissioned on 10 April 2021 at Fleet Base East in Sydney. HMAS *Supply* replaces HMAS *Success*, which has been scrapped.

This photograph also shows (in the background) the progress which has been made with the replacement of the old Cruiser and Oil Wharves at Garden Island with a new modern wharf to accommodate the RAN's larger ships. The wharf will also have a new crane (RAN photograph)

THE AUSTRALIAN NAVAL ARCHITECT

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(Australian Division)

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Cover Photo:

The 24 m Great Barrier Reef patrol boat *Reef Resilience* was recently completed by Norman R. Wright & Sons to a design by Incat Crowther (Photo courtesy Incat Crowther)

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RINA Australian Division
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From the Division President

Welcome to the May edition of *The Australian Naval Architect*; I trust this finds you all well.

It has been a busy quarter from the administrative side of the Institution, with the Australian Division Council Meeting on 16 March, followed by the exceptionally-well-attended Annual General Meeting on 17 March at which the announcement of the appointments to the Australian Division Council were made. Members interested in joining the Australian Division Council should note that there are still vacant positions available and indicate to the Secretary their willingness to be appointed to Council for the coming two years.

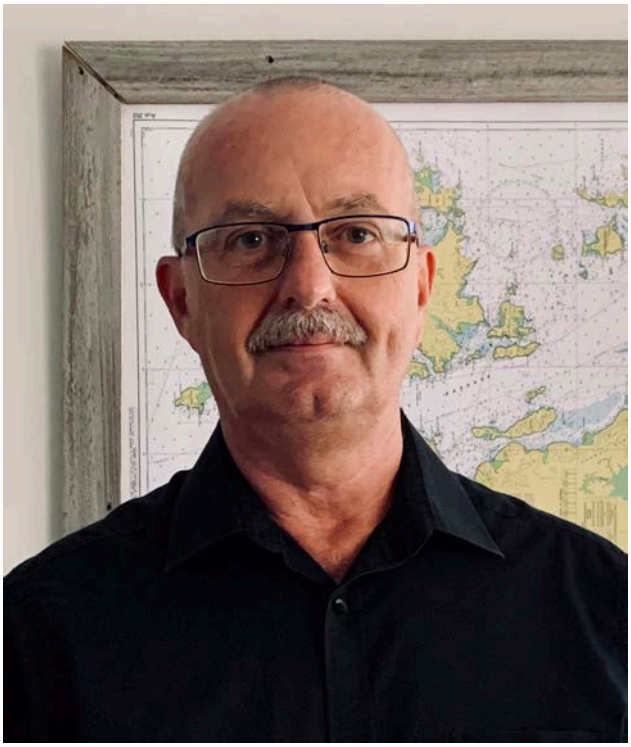
The Institution's London-based Council meeting was held on 13 April in the lead-up to the RINA AGM on 29 April to which members should have received an invitation.

The importance of shipping to world trade was brought home sharply on Tuesday morning 23 March, when the 400 m 219 079 GT *Ever Given* container ship ran aground diagonally across the southern section of the Suez Canal, apparently after losing the ability to steer amid 40 kn winds and a dust storm. By Sunday, there were 369 ships stuck in the tailbacks on either side of the blockage waiting to pass through the 193 km canal. It has been estimated that the grounded ship was holding up an estimated $9.6 billion of trade which passes along the waterway each day. The impact on global trade has been far reaching, beyond the one week during which the canal remained closed. The closure has resulted in a chronic container shortage, extended booking delays and cargo backlogs at key trans-shipment hubs, and it is estimated that it will take the next three or four months for carriers to catch up with their schedules. In the wake of the incident, there will undoubtedly be a plethora of reviews examining not only the technical risk but also the commercial and strategic risk exposure. The Suez Canal Authority is already considering expanding the southern section of the waterway where *Ever Given* became stranded, and is also looking into procuring cranes which could potentially offload cargo at heights of up to 250 m, and procure two more tugs, with bollard pulls of more than 250–280 t.

The level of activity in the Australian Defence community continues apace, with the Hunter-class frigate program commencing the System Definition Review milestone on 30 March 2021. NUSHIP *Supply* is at Fleet Base East for Navy preparations for Initial Operational Release while NUSHIP *Stalwart* has successfully completed her sea trials in Spain prior to leaving for Australia in late May.

The Arafura-class Offshore Patrol Vessels continue outfitting on OPV1 and block consolidation for OPV2 in South Australia, while block construction continues in the west for OPV3 and the build of OPV4 has also commenced.

The Guardian-class Pacific Patrol Boat Replacement Program has Austal delivering 21 steel-hulled 39.5 m boats to 12 Pacific Island countries and Timor Leste, with boat 10 being handed over on 15 March 2021 while sea trials continue for Boat 11. Austal is also delivering six evolved Cape-class patrol boats as an interim measure for the Royal Australian Navy to transition from the Armidale-class patrol boats to the new Arafura-class vessels. Three boats are currently in production, with the first scheduled for delivery in December 2021 and the last in April 2023.



Gordon MacDonald

The Cairns-based builders Tropical Reef Shipyard and BME NQ have also announced that they will collaborate on the supply of new multi-mission watercraft for the Australian Army. The boats will each have a length overall of 7.75 m, a beam of 2.45 m, a draught of 0.4 m and a lightship displacement of 2135 kg. The Great Barrier Reef International Marine College will provide training support for the army personnel who will eventually operate the watercraft [Source: *Baird Maritime daily newsletter*, 25 March 2021].

In coming months you should notice the first of some substantial changes being driven by RINA's new Chief Executive, Chris Boyd. In particular, you should keep an eye out for the May (50th Anniversary) issue of *The Naval Architect* journal which, I understand, will reflect a new style and seek to improve the journal's content to us as maritime professionals. Work is also being commenced to thoroughly overhaul the Institution's digital systems, including website and communications, to make them more user friendly. The results of this work will take a year or two to emerge and may be dependent on the pace of emergence from the COVID-19 pandemic, but you should be aware that it is happening!

A reminder that I am seeking your assistance in providing ideas of how we can improve the services of the Institution to make it more relevant to your needs. Please email your thoughts directly to me at gdmacdonald@gmail.com.

Gordon MacDonald

[*As this issue goes to press we have been advised of the passing on 18 May of Past President Dr Tony Armstrong after a prolonged battle with cancer. His passing will be marked further in our next issue* — Ed.]

Editorial

In my Editorial in the November 2019 edition of *The Australian Naval Architect*, I referred to the release of the Part One Report of the Accident Investigation Board Norway and the Norwegian Defence Accident Investigation Board into the collision between the Norwegian frigate HNoMS *Helge Ingstad* and the oil tanker *Sola TS* on 8 November 2018 which resulted in severe damage to the frigate and her subsequent grounding and sinking. The frigate was later raised but has since been declared beyond economical repair and has been scrapped.

In the period of speculation and commentary which followed, there were suggestions that design deficiencies may have contributed to the loss of the frigate, including the fitting of hollow intermediate propeller shafts which resulted in flooding of the gearing room forward of the damaged area.

The Norwegian Safety Investigation Authority has now released a Part Two Report, a document of some 214 pages plus annexes, after a thorough study of all the facts relating to the actions of the crew of the frigate and her behaviour after the collision which makes interesting reading [1].

Helge Ingstad was the fourth of five Nansen class frigates built for the Royal Norwegian Navy by Navantia. Completed in 2009, she had a waterline length of 121.4 m and a complement at the time of collision of 137. The ship was designed to survive a damage length of 15% of the waterline length, or 18.2 m. In the worst case scenario, that length could affect three watertight compartments. In the collision the frigate sustained damage 46 m long, affecting five watertight compartments, although most of the damage was above the waterline at the time of the collision.

In its conclusions the report states:

"The damage sustained in the collision caused flooding of several compartments. After the frigate ran around, water also ingressed to the reduction gear room through the hollow propeller shafts. Eventually, the flooding was considered so extensive that the frigate was deemed to be lost, and it was decided to evacuate the crew. Doors, hatches and other openings in the frigate that were supposed to be closed to maintain stability and buoyancy were not closed by the crew at the time of evacuation. The frigate subsequently sank.

"The investigation has shown that efforts to prevent the frigate from sinking and prioritisation of the right measures could have helped to gain control of the situation on board. For the crew to be able to consider actions other than those that were taken, however, they would have needed a better understanding of the frigate's stability characteristics. Furthermore, they would have needed additional competence, training and practice, and better decision support tools than those that were available to them. Given the crew's knowledge at the time, the situation they faced and the prevailing circumstances, it is, after all, understandable that a decision was taken to evacuate the frigate rather than put human life and health at risk.

"The crew attempted to pump water out of the vessel, but were never able to make effective use of the bilge system. The investigation has shown that, even if effective pumping had been initiated, the flooding would eventually have become too extensive for the system to handle the large volumes of water. Doors, hatches and other openings in the frigate that were supposed to be closed to maintain stability and buoyancy were not closed at the time of evacuation. A shutdown of the frigate could have prevented her from sinking. In this context, stability calculations show that neither the grounding nor the flooding through the hollow propeller shafts was a decisive factor in causing the frigate to sink, as the failure to shut her down would have caused her to sink in any case."

The report's recommendations mainly related to organisation and training issues for the Norwegian defence authorities. However, modern warships are becoming increasingly complex and every incident has lessons for their designers and builders. I recommend this report to the readers of *The ANA*.

John Jeremy

1. Report Marine 2021/05, *Part Two Report on the Collision Between the Frigate HNoMS* Helge Ingstad *and the Oil Tanker* Sola TS *outside the Sture Terminal in the Jeltefjord in Hordaland County on 8 November 2018*, Norwegian Safety Investigation Authority, April 2021. The report is available at https://www.aibn.no/Marine/Published-reports/2021-05-eng

HNoMS *Helge Ingstad* sinking at about 1027 on the morning of 8 November 2018
(Photo from [1] Page 194)

COMING EVENTS

NSW Section Technical Presentations

Technical presentations in 2021 will continue as webinars for the foreseeable future, generally hosted by Engineers Australia using the WebEx platform and starting at 6:30 pm AEST. Registration for each presentation is required, and details will be provided in the flyer for each meeting. The *Coming Events* page on the RINA NSW Section website will be updated with details as soon as they become available.

The program of meetings remaining for 2021 is as follows:

2 Jun Ian Moon, Head of Engineering, Naval Ship Management (Australia)
An Inclusive Approach to Naval Ship Sustainment

7 July Lawrence Doctors, Professor Emeritus, UNSW Sydney
Optimisation of Marine Vessels on the Basis of Tests on Model Series

4 Aug Piermatteo Nissotti, General Manager Marine, Eptec Group
Application of Intershield 6GV to a Royal Australian Navy Flight Deck

1 Sep Chris Skinner, Editor Nuclear Propulsion Roadmap for Australia
Nuclear Maritime Propulsion Roadmap for Australia

6 Oct Warren Smith, Associate Professor, Ahmed Swidan, Senior Lecturer, and David Lyons, Lecturer, UNSW Canberra
The New Naval Architecture Degree Program at UNSW Canberra
(Joint meeting with ACT Section)

2 Dec SMIX Bash 2021

ACT Section Technical Presentations

Technical presentations in 2021 will continue as webinars for the foreseeable future, generally hosted by RINA using the Zoom platform and starting at 6:30 pm AEST. Registration for each presentation is required, and details will be provided in the flyer for each meeting. The ACT Section's LinkedIn page at https://www.linkedin.com/groups/13915641/ will be updated with details as soon as they become available
The program of meetings remaining for 2021 is as follows:

25 May Harry Hubbert, Greenroom Robotics
Applying Naval Architecture to Maritime Autonomy and Robotics

June AGM of ACT Section — exact date and venue TBA.

6 Oct Warren Smith, Associate Professor, Ahmed Swidan, Senior Lecturer, and David Lyons, Lecturer, UNSW Canberra
The New Naval Architecture Degree Program at UNSW Canberra
(Joint meeting with ACT Section)

FAST 2021

FAST (International Conference on Fast Sea Transportation) is the premier global conference for high-performance ships and craft and is of great interest to all who are engaged in researching, designing, building, and operating them. The objective of FAST 2021 is to bring together experts from around the world to present/exchange knowledge and network around the most comprehensive and latest information available on high-performance vessels and their technology.

FAST 2021 will be held 25–26 October 2021 in Providence, Rhode Island, USA. At this time and based on the current outlook for returning to live events post COVID-19, FAST is being planned as an in-person, face-to-face event. Contingency plans are being made in the event that we do not see the expected recovery and have to pivot to a virtual conference at a later date.

The call for papers has closed, and authors have been notified of acceptance of abstracts.

Important Dates:

15 Jul First drafts due
15 Aug Reviews due back to authors
15 Sep Final papers due

An advanced ship or craft is one offering capabilities well beyond what is achievable by conventional designs, which generally means significantly higher speed or significantly enhanced ability to operate in high waves. These higher levels of capability can be gained in a broad range of configurations: planing craft, fast multi-hull designs, hydrofoils, SWATH (small waterplane area twin hull) ships, WIG (wing-in-ground-effect) craft, air-cushion vehicles/hovercraft, surface-effect ships and seaplanes, as well as hybrids of these and novel concepts not yet even envisioned. These tend to be relatively small, but a large ship which attains high speed or enhanced seakeeping, possibly by means of an unconventional hull form or appendages, is also included. Even in the smallest sizes, craft for personal and leisure use often break new ground, and they can also grow large over time.

Some topics of interest for the conference include, but are not limited to:

- Novel configurations and concepts
- Advances in foil supported craft
- Hullforms and hydrodynamics
- Propulsion systems
- Application of electronic propulsion to fast craft
- Motions and manoeuvring, control systems and devices
- Operational uses of fast ships and craft
- Considerations for the development of the wind-farm vessel fleet for service in the United States
- Structural design, materials and construction
- Design processes and tools
- Application of artificial intelligence to the design of fast craft
- Modeling, simulation and analysis
- Advanced computational techniques for resistance and seakeeping prediction
- Autonomous systems and operations
- Advances in navigational autonomy

- Self-adaptive health monitoring for unmanned systems
- Environmental effects and mitigation
- IMO Tier 3 and its impact on fast craft design
- Alternative fuels and power sources
- Economics and the value of speed
- Risk, safety, survivability
- Classification and regulation

Indo-Pacific 2022

AMDA Foundation has provided an update for the Pacific International Maritime Exposition which was to be held in August 2021, with that show now planned for May 2022 due to the fallout from the COVID-19 pandemic and renamed the Indo-Pacific International Maritime Exposition instead. In its news release announcing the change, organiser AMDA Foundation noted that "the Indo-Pacific has become increasingly central to world commerce, international stability and security. The Indian and Pacific Oceans include the world's busiest trade corridors, driving commercial and geopolitical connections that embrace much of the globe.

"Key Australian and international stakeholders, as well as the world's naval defence and commercial maritime industries, are increasingly focused on the "Indo-Pacific". It is, therefore, appropriate that the name of the event, which provides a platform for discussion in the national interest among those key groups and is an essential engagement and promotional opportunity for industry, should reflect that focus."

The inaugural Indo-Pacific exposition will also be held in Sydney on 10–12 May 2022. AMDA says that once the world has transitioned past the aftermath of the pandemic, it intends that its expositions will resume their normal biennial cycle, with Indo-Pacific returning to its regular timing in the latter half of odd-numbered years i.e. during the second half 2023.

Maritime Robot X Challenge 2022

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

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

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

The base platform for Robot X Challenge 2022 is the Wave Adaptive Modular Vehicle (WAM-V), which teams must outfit with propulsion, control systems, sensors, and other systems necessary to accomplish the competition challenges. All teams competing in Robot X must use the same core platform as the basis for their multi-vehicle multi-domain autonomous maritime system of systems.

RoboNation intends to award a limited number of the WAM-V platforms to teams that commit to participate in this and future Maritime RobotX Challenges and Forums. The Robot X WAM-V application process closed on 30 April.

NEWS FROM THE SECTIONS

ACT

Intact and Damaged Survivability

Ahmed Elhanafi, Naval Architect, Directorate of Navy Engineering, Department of Defence, gave a presentation on *Intact and Damaged Survivability of an Offshore Floating–Moored Oscillating Water Column Device* as a webinar hosted by RINA using the Zoom software platform with the Chair of the ACT Section, A/Prof. Warren Smith as MC, on 23 March. This presentation attracted 12 participating on the evening.

Dr Ahmed Elhanafi graduated from Alexandria University, Egypt, in 2009 with a bachelor's degree in Naval Architecture and Marine Engineering. In 2013 he was awarded a Master of Science degree in Naval Architecture (Ship Structural Design) also from Alexandria University. In 2014, he commenced his PhD at the Australian Maritime College, being awarded his PhD degree and the Rob Lewis Medal for Excellence in Postgraduate Research in 2017. In February 2021, after two years with Austal Ships, he started working as a Naval Architect within the Directorate of Navy Engineering, Department of Defence in Canberra.

Ahmed discussed elements of his PhD research which utilised both experimental and computational fluid dynamics (CFD) techniques to examine the hydrodynamics of oscillating water column (OWC) wave energy converters. The presentation was based on one previously provided at ISOPE-2017 in San Francisco with co-authors A/Prof. Gregor Macfarlane, Dr Alan Fleming and Dr Zhi Leong.

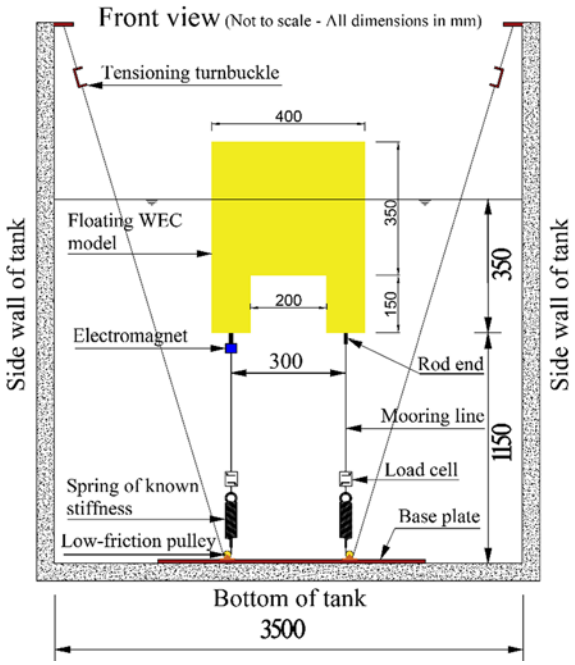
The presentation commenced with an explanation of the motivation for the project: that designing the mooring systems for an OWC using offshore structure design guidelines or codes may not be applicable, and may also lead to excessively-conservative OWC mooring-system designs. He then provided an outline of the set-up and conduct of the physical model experiments of a representative 1:50 scale floating–moored OWC device at the AMC, including the modelling of mooring-line failure at different instants relative to the wave front when subjected to unidirectional regular waves. The set-up of the RANS CFD analysis of the same cases was also described. Ahmed then compared the experimental results of transient motions and mooring-line loads to those from the 3D CFD model. These showed that good agreement could be achieved.

The CFD and experimental approaches were used to investigate the transient effects of partial mooring-line failures to understand the degree of redundancy available when such damage occurs to mooring lines during extreme wave conditions. A case using only four mooring lines (with one failing at various points in the wave encounter cycle) and a case with eight mooring lines (again with one failing) were both examined. The work clearly demonstrated that it was important to take into account the transient response in the remaining mooring lines immediately after one mooring line fails. The magnitude of this transient is dependent on the instant at which the initial line fails.

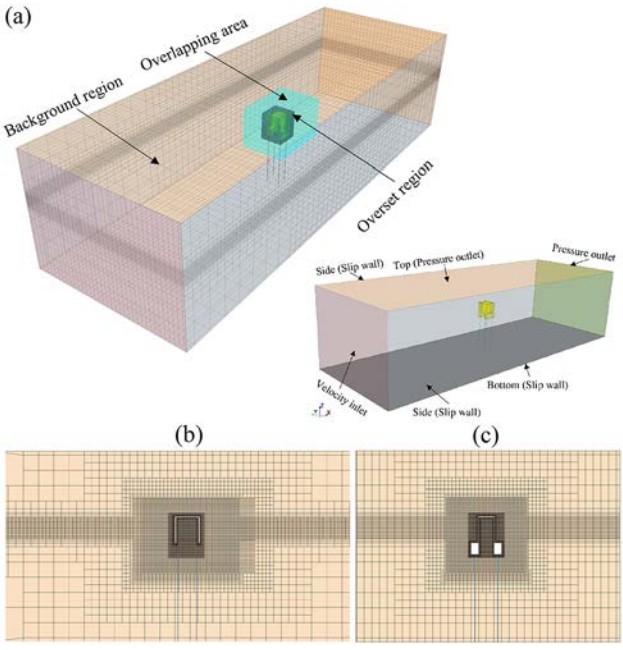
A/Prof. Warren Smith fielded the questions for Ahmed. The questions were diverse, including clarification of the typical mooring arrangements adopted for such systems, how the degree of pre-tensioning was decided, and how the mooring system influenced the power-generating efficiency of the OWC device.

[*Further information on this work may be found at https://www.amc.edu.au/about-amc/news-and-events/news-items/best-and-brightest-recognised-at-awards-presentation and papers related to the work may be found at https://www.researchgate.net/profile/Ahmed-Elhanafi/research* —Ed]

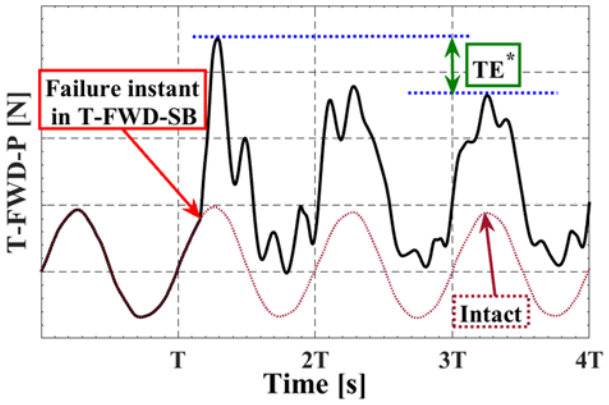
Ahmed's presentation was recorded, and is now available on the RINA YouTube channel (see *The Internet* column).



Experimental set-up of floating-moored OWC tests at AMC
(Drawing courtesy Ahmed Elhanafi)



CFD model mesh and boundary conditions
of floating-moored OWC
(Image courtesy Ahmed Elhanafi)



Sample time trace of the tension experienced in a remaining forward mooring line following failure of another line showing initial response of intact system, transient tensile response upon failure of one line, and steady state response after that failure
(Graph courtesy Ahmed Elhanafi)

Structural Design and Fabrication of Aluminium High-speed Vessels

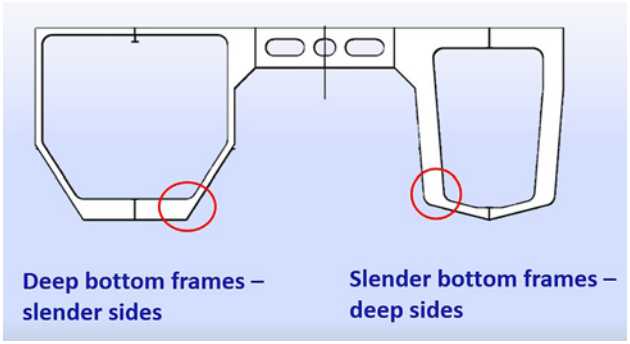
John Kecsmar, Principal of Ad Hoc Marine Designs, gave a presentation on *Structural Design and Fabrication of Aluminium High-speed Vessels — the Good, the Bad and the Ugly* as a webinar hosted by RINA using the Zoom software platform with the Chair of the ACT Section, A/Prof. Warren Smith as MC, on 27 April. This presentation attracted 47 participating on the evening, including many from interstate and overseas.

John began his presentation by asking the audience to consider whether designing aluminium high-speed vessels only to class rules would achieve the desired outcome for the vessel owner as far as its fitness-for-purpose and longevity were concerned. He made the case that design was the responsibility of the naval architect and that an owner should not rely on the classification society to ensure that this is satisfactory. He provided examples of this by way of poorly-balanced structural sections which would still be compliant with class rules.

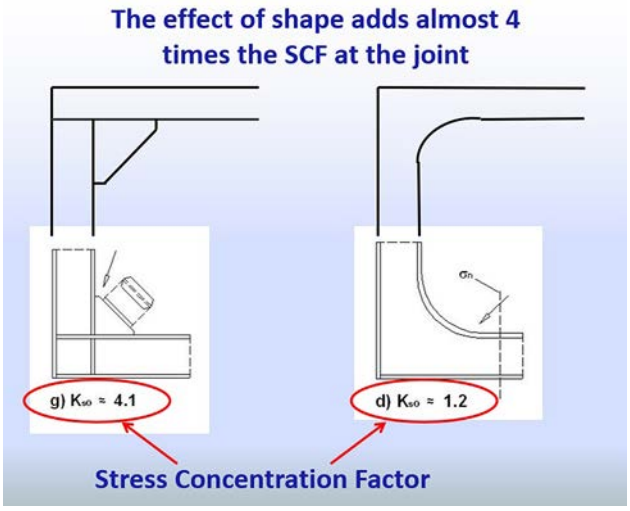
He continued with illustrations of areas on a ship which could be expected to have areas of high stress concentration, and design approaches to minimise such trouble spots, including through the use of FEA. This included, for example, the use of suitably-radiused frame corners in place of cheaper-to-fabricate though crude bracket arrangements to significantly reduce stress concentration factors and, in turn, fatigue damage. Structural arrangements which permit good access for quality welding were also raised at this point.

John then turned to welding sequences, welding locations and welding quality, and examined the impact of getting these wrong with a range of illustrations of the consequences. He also discussed the choice of aluminium alloy temper and the influence of cold forming of, for example, frame webs, ensuring that excessively-small bend radii are avoided. Fabrication of a waterjet intake duct was given as an example where small bend radii are required, thus influencing choice of alloy temper.

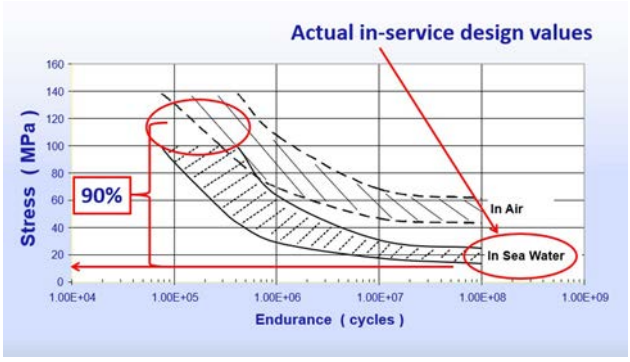
Quality control and quality assurance were then discussed, including misconceptions about such terms which John has encountered. He illustrated how testing requirements based on a typical set of classification society rules would not ensure quality. This section was amply illustrated with examples of 'ugly' welding which John had encountered.



Illustrative examples of structural sections with poor continuity of stiffness yet compliant with class rules
(Drawing courtesy John Kecsmar)



Comparison of stress concentration for alternative structural details for frames
(Drawing courtesy John Kecsmar)



Comparison of strength of aluminium alloy in air for low cycles vs in sea water for high cycles
(Drawing courtesy John Kecsmar)

The focus then turned more specifically to fatigue. John demonstrated the differences between typical fatigue characteristics of steel and aluminium alloys, and the further detrimental influence of exposure to sea water on fatigue properties of aluminium. This was perhaps best highlighted by comparing the static or low-cycle strength of aluminium in air against high-cycle fatigue strength when exposed to sea water, around a 90% reduction! He gave specific examples

of designing for fatigue, including a waterjet attachment flange. He also briefly outlined the impact of lack of weld penetration or porosity and mis-alignment of welded components on fatigue strength, again illustrated with examples found in the field. He highlighted the significant differences that can result with alternative numerical methodologies of attempting fatigue-life predictions.

In wrapping up his presentation, John showed a series of photos of poor production practices which would invariably result in early fatigue failures if not rectified. Ultimately, he emphasised that longevity and fitness-for-purpose is not the role of a classification society; it is the role of the naval architect and the shipyard building the design. With plenty of evidence presented showing shipyard "quality" as being somewhat lacking, it is implied that such roles must be undertaken by subject-matter experts on behalf of clients.

A/Prof. Warren Smith fielded questions for John. These included detailed questions and observations as well as more general issues. For example, the benefit offered by peening was queried, and John agreed that this can be beneficial. A key issue posed was how the client for an aluminium alloy vessel could ensure that the quality they expected would be achieved. John considered this was only realistically possible by ensuring that the client had adequately skilled and experienced owner's representatives on site to sign off on design/production quality and to link such sign-offs to stage payments. Such an approach must be articulated in any contract beforehand, so that it is clearly understood at an early stage of a project.

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

Martin Grimm

Victoria

Committee Meetings

Regrettably, it has been six months since our last news for *The ANA*, back in August last year. During that time, we came out of our second lockdown, and one that sent us into relative hibernation as a committee. We did hold two subsequent committee meetings, in September and November 2020, where the focus was on two key topics:

- Technical Presentations: What can we make available to members? and
- Delivery of Technical Presentations: What is the best technology to present and manage the presentations?

In between these meetings, the committee was hard at work trying to stand up a social event as a deferral of the event which was cancelled in early 2020. A massive shout-out to Luke Shields for his efforts in standing up an event which we were able to offer not just to RINA members, but to the maritime community in Victoria as a whole. Unfortunately, ticket sales meant that this event too was cancelled, and presumably due to uncertainty around COVID-19, but also some issues sending invitations. We'll be looking to run the event later this year, and have a few lessons learned to make the event a huge success.

The current Victorian Section Committee comprises:

Chair	Jesse Millar
Secretary	Keegan Parker
Deputy Secretary	Alex Conway
Treasurer	Tom Dearling
Deputy Treasurer	Jon Emonson
Nominee to ADC	Nathan Wallace
Social Secretary	Luke Shields
Social Media	Nathan Wallace
Committee Members	Owen Tregenza
	Karl Slater

Invention of the Tilting Pad Thrust Bearing

Stephen Phillip, Mechanical Engineer, gave a presentation on *Invention of the Tilting Pad Thrust Bearing* as a webinar hosted by RINA using the Zoom software platform on 18 March. This presentation attracted 12 participating on the evening.

Stephen presented his research into the life of Anthony George Maldon (AGM) Michell, inventor of the tilting pad thrust bearing. It's unfortunate that we don't adequately celebrate the remarkable technical achievements of people like Michell, or acknowledge their significant contributions to Australia's engineering heritage, so we were extremely grateful to Stephen for giving us his time.

Anthony Michell was undoubtedly one of the greatest Australian engineers. A prolific inventor, he is best known for his tilting-pad thrust bearing. It remains one of the greatest inventions in lubrication science, and revolutionised ship propulsion; without it, modern shipping would not be possible.

The presentation revealed the story of Michell's fascinating life and astonishing achievements, and the motivations of the man behind the inventions. It weaves engineering and technology into the history of the early twentieth century. Michell made significant contributions to Australia's proud engineering heritage and is truly one of our unsung heroes.

The presentation was appealing not only for the content, but for the early innovation and amazing networking ability of early inventors. Despite all the modern communication channels available to us, I'd argue that, back in the early 1900s, they did at least as well as we do today.

Stephen, as the researcher of Michell and the presenter, has an extensive career in product development, and is himself the co-inventor on four international patents. His fascination with Michell began while studying at the University of Melbourne. He has written a book on the topic, documenting a fascinating journey of discovery spanning many years.

The story of the invention of the tilting-pad thrust bearing was written up in the February 2021 issue of *The ANA*.

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

Jesse Millar

Western Australia

Controlling Marine Engine Emissions

Lachlan Colquhoun, Marine Engine Sales Manager Australia and New Zealand, MAN Energy Solutions, gave a presentation on *Controlling Marine Engine Emissions* as a webinar hosted by RINA using the Zoom software platform on 24 February. This presentation attracted 11 participating on the evening.

Lachlan first provided an overview of the types of emissions produced by internal combustion engines used in marine applications, and some of the key drivers behind current and future emission limits set by the International Maritime Organisation and local regulators.

He then looked at existing and emerging marine fuels and their relative benefits from the emissions-reduction, shipbuilder's and operator's perspectives, and went on to examine some of the technologies employed by engine manufacturers to reduce or 'scrub' emissions, and touched on some current areas of development.

This presentation was a repeat of presentations previously given to the NSW Section on 5 February 2020 and the Queensland Section on 8 September 2020.

Lachlan's presentation was recorded by the NSW Section, and is now available on the RINA YouTube channel (see *The Internet* column).

Maintenance Improvement on Cape-class Patrol Boats

Domenic Pansini, Senior Maintenance Engineer, Austal, gave a presentation on *Maintenance Improvement on Cape Class Patrol Boats* as a webinar hosted by RINA using the Zoom software platform with the Chair of the WA Section, Piotr Sujkowski, as MC on 28 April. This presentation attracted 41 participating on the evening.

Domenic's presentation covered:

- the current role of naval architects at Austal;
- the expanding market of shipbuilding in WA;
- the direction in which Austal is heading, and how graduate naval architects can capitalise on this;
- how naval architect graduates can improve their role and secure further work within the company;
- the answer to the above is conditioned-based maintenance (CBM);
- how graduate naval architects can assist/integrate here; and
- CBM is the new "growth industry"

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

Syed Zaidi

New South Wales

Annual General Meeting

The NSW Section held its 23rd AGM in video-conference on the evening of 3 March, following the March webinar technical presentation hosted by Engineers Australia on the WebEx software platform, with Valerio Corniani in the chair.

Valerio in his fourth and final Chair's Report (circulated to members by email prior to the meeting), touched on some of the highlights of 2020, which included two joint technical meetings with the IMarEST (ACT & NSW Branch**)** pre-COVID-19, and eight webinars, with attendances varying between 400 (!!!) for Levi Catton's presentation on *Design and Construction of the RAN's New Hunter-class Frigates*, and 28 for Bruce Cartwright's presentation on *Structural Integrity of Ships*. SMIX Bash 2020 was, unfortunately, cancelled due to the COVID-19 restrictions, but we have booked *James Craig* for SMIX Bash 2021.

Adrian Broadbent in his Treasurer's Report (circulated to members by email prior to the meeting), advised that with technical presentations last year mostly by webinar, we have had minimal expenses, and so our bank balance has improved somewhat. SMIX Bash is funded separately through the Social account which currently has a healthy balance which enables preliminary arrangements for SMIX Bash 2021.

There is a number of changes to the NSW Committee for 2021. Rob Tulk has resigned from the Committee due to the pressure of other things. Nominations were called for and Greg Byrne put his hand up, and was elected unopposed to the Committee. Valerio Corniani has served his full four-year term as Chair of the Section and has stepped down. Belinda Tayler has accepted the position as Chair, thus becoming the first female chair of an Australian Section of RINA; a trailblazer!

As a result, the committee for 2021 is as follows:

Chair	Belinda Tayler
Deputy Chair	Phil Helmore
Treasurer	Adrian Broadbent
Secretary	Jason Steward
AD Council Nominee	Adrian Broadbent
Auditor	David Wong
TM Program Coordinator	Phil Helmore
Members	Craig Boulton
	John Butler
	Greg Byrne
	Valerio Corniani
	Molly McManus
	Alan Taylor

Committee Meetings

The NSW Section Committee met in video-conference on 16 February and, other than routine matters, discussed:

- SMIX Bash: Some companies elected to roll over sponsorships from SMIX Bash 2020 to 2021, and others have been refunded; *James Craig* has been booked for SMIX Bash 2021.
- TM Program: In concert with IMarEST (ACT & NSW Branch), all technical presentations for February through October have been scheduled; it was decided that presentations should be held as webinars throughout

2021, with consideration given to a return to face-to-face in 2022; the issue of equal branding for RINA and IMarEST with host Engineers Australia to be raised with EA.

- Finance: Accounts for 2020 have been audited and will be forwarded to the Australian Division.

The NSW Section Committee also met in video-conference on 30 March and, other than routine matters, discussed:

- SMIX Bash: Sydney Heritage Fleet have advised that bookings are on track for December; SMIX Bash Committee to meet and progress arrangements.
- TM Program: Equal branding of RINA and IMarEST with Engineers Australia has been achieved in presentation flyers and slides at beginning and end of presentations.
- AD Council Report: The Chief Executive of RINA, Chris Boyd, is expected in Sydney for the inaugural Indo-Pacific Expo and IMC in May 2022, and will be delivering a keynote speech.

The next meeting of the NSW Section Committee is scheduled for 25 May.

Ballast Water Treatment: Challenges, Solutions and Operations

Asif Ghauri, National Manager—Marine and Diesel, Alfa Laval Australia, gave a presentation on *Ballast Water Treatment: Challenges, Solutions and Operations* as a webinar hosted by RINA using the Zoom software platform with the Secretary of the ACT & NSW Branch of the IMarEST, Geoffrey Fawcett, as MC on 24 February. This presentation attracted 23 participating on the evening.

Introduction

Asif began his presentation with o short introduction to Alfa Laval, a leading global provider of specialised products and engineered solutions. They have 39 production units plus a number of minor production and assembly units, more than 100 service centres, sales companies in 55 countries and other sales representation in 45 countries. They have been operating in Australia for over 95 years.

Over 100 years ago, in 1917, the US Navy asked Alfa Laval to develop a centrifugal oil-cleaning separator, which was delivered later that year and kick-started the growth of the company.

Alfa Laval has been a pioneer in ballast water treatment systems since 2003. They have achieved compliance in all waters, and type approval with all major classification societies and the US Coast Guard. Their PureBallast system has seen more than 6000 systems sold with more than 3000 retrofit installations.

In all, Alfa Laval now has 17 product groups for ship installations, including oily waste treatment, ballast water treatment, inert gas systems, gas combustion, cargo pumping, tank cleaning, oil treatment, filtration, fuel conditioning, crankcase gas cleaning, exhaust gas cleaning, EGR water cleaning, waster heat recovery, steam and heat generation, thermal fluid heating, cooling and heating, and desalination.

Ballast Water Treatment

The United Nations recognizes the spread of aquatic invasive species as one of the four greatest threats to the world's oceans. That is why the IMO Ballast Water Convention has been in force since 8 September 2017. This convention applies globally (signed up to by 86 flag states covering 91% of world gross tonnage), and there are now some 70 type-approved systems.

In addition, a shipowner or ship operator who intends to deballast within US Waters must also have a US Coast Guard-compliant BWTS approved before the vessel's compliance date. This is a stricter requirement, and has been in force since December 2013. There are now 17 USCG type-approved systems, including Alfa Laval's PureBallast which received approval on 23 December 2016.

In addition to IMO and USCG type approvals, Alfa Laval's PureBallast 3 system also has revised IMO G8 certification for zero-day holding time in all water salinities.

IMO Ballast Water Treatment Convention

The IMO Ballast Water Treatment Convention was ratified by 86 flag states and 91 % of world gross tonnage, coming into force on 8 September 2017.

Under the convention, new vessels should be equipped with a BWMS at delivery. Existing vessels should install a BWTS over a 5 year period between 2019 and 2024. Revised G8 test guidelines have been in force since October 2020. The MEPC 75 Committee has approved revised guidance for the commissioning and testing of ballast water management systems, and these amendments are expected to enter into force on 1 June 2022. Operational experience and sampling and analysis will be in focus now under the experience-building phase.

USCG/EPA Regulations

The US Coast Guard/Environmental Protection Agency regulations have been in force since December 2013, but several extensions have been issued. There are now some 30 type-approved systems. The old 2013 Vessel General Permit will be substituted by the VIDA Act (Vessel Incidental Discharge Standards Act). The aim of the US authorities has been to introduce national standards and not to regulate waterways on a state-by-state basis. States, though, have a say, and e.g. California and Great Lakes states, gain some provisions for stricter regulations in the national standard. The act calls for approval of the MPN method [*Most Probable Number method is a method used to estimate the concentration of viable microorganisms in a sample* — Ed.] by IMO. This approval by IMO of the MPN method is way overdue!

Water Characteristics

For treatment of ballast water, the three primary characteristics to keep in mind are the salinity, temperature and ultra-violet (UV) transmittance.

Salinity

Electro-chlorination (EC) systems require high-salinity water. Most ports are exposed to river run-off, which means that their average salinity levels are generally lower. In order to be effective in brackish or fresh water, EC systems require the addition of salt or high-salinity water, which must be stored on board, in order to be effective. UV systems are not dependent on water salinity.

Temperature

Optimal water temperature for the operation of EC systems is above 15°C, with normal low-end temperatures in the range of 10–17°C. Water below 10°C significantly reduces the formation of chlorine, and colder seawater therefore needs preheating in order for the system to perform effectively and ensure compliance.

Ultra-violet Transmittance

UV transmittance is the main parameter for UV systems. It is important to know the UV-T value of the water which will be treated. UV-T levels in harbors usually range from 90% down to 60%, but can sometimes fall to 50% or below. When UV-T is low, more UV power is needed to treat the water in order to meet the discharge standards. High UV-T is from clear water, low UV-T is from poor-quality water.

Ballast Water Treatment Technologies

The three main technologies for treatment of ballast water include electro-chlorination, chemical dosing, and ultra-violet (UV) treatment.

Electro-chlorination

Electrolysis of sea water forms chlorine and hydrogen gas. Chlorine gas dissolved in the water produces sodium hypochlorite (NaOCl), which is a disinfectant. In fresh water, power consumption is significantly increased. Hydrogen traps, flame arrestors or other methods are required to safely handle the formed hydrogen gas. This method allows for ballasting treatment, but a deballasting operation requires neutralisation, for which neutralisation chemicals are also required, posing added risks to the crew and the environment. Cleaning of the electrodes requires acid wash or other external electrode-cleaning methods. A big disadvantage of the method is that often the holding time exceeds 24 h.

Efficiency varies according to the conditions of the water, such as pH, salinity and temperature. The process may affect the corrosion rate negatively for plain and stainless steels, and shorten the expected lifetime for polymers.

The IMO regulation does not permit the concentration of Total Residual Oxidants (TRO) to exceed 0.2 ppm (mg/L) in the discharge water.

Chemical Dosing

Chemicals from a tank are mixed with the ballast flow, and the most-common system is chlorine dosing using approximately 1–10 ppm (mg/L). The chlorine level is neutralised prior to discharge, i.e. neutralisation chemicals and monitoring are required. There is the potential for corrosion of plain and stainless steels. Chemical handling and the environmental impact must be considered. A holding time, typically 24 h or more, is required for the chemicals to work.

Ultra-violet Treatment

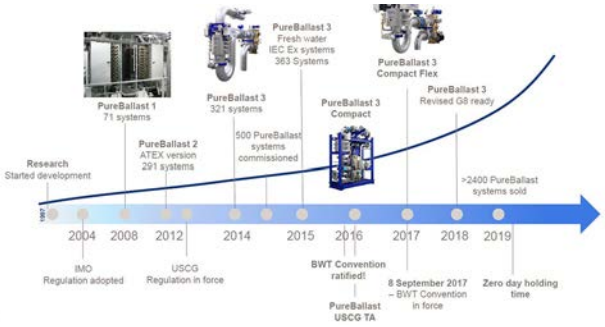
There are no hazardous chemicals, it is easy to operate, easy to install, has low maintenance costs, and is a safe and effective treatment method. However, it usually has higher power consumption than electrolysis.

Alfa Laval's PureBallast System

Alfa Laval's PureBallast system is equipped with medium-pressure UV lamps. These have very high output, typically 50 times higher output than low-pressure lampsmaking them very effective.

The PureBallast system is type approved by all major class societies (e.g. DNV, Lloyd's Register, ABS etc.) and the US Coast Guard and, in addition, meets IMO's revised G8 standard.

Alfa Laval has over a decade in ballast water treatment.



Alfa Laval's experience in ballast water treatment
(Image courtesy Alfa Laval)

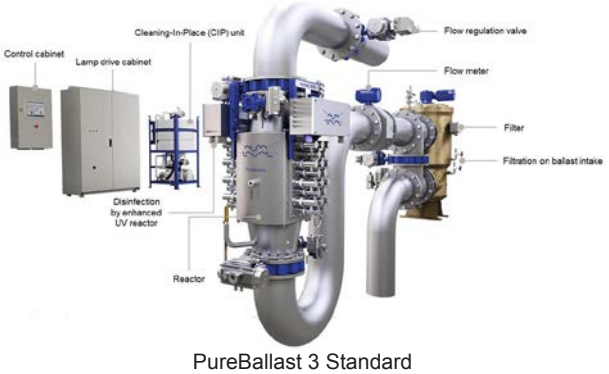
	PureBallast 170 m³/h	PureBallast 300 m³/h	PureBallast 600 m³/h	PureBallast 1000 m³/h	PureBallast 1500 m³/h
Lamps	6 x 3 kW	10 x 3 kW	20 x 3 kW	16 x 6 kW	25 x 6 kW
Min. power	11 kW	17 kW	33 kW	52 kW	81 kW
Max. power	20 kW	32 kW	63 kW	100 kW	156 kW

400 - 440 VAC, 50/60 Hz

Alfa Laval's PureBallast family of capacities
(Image courtesy Alfa Laval)

The reactor design has been optimised through research and real-life experience. It is highly-resistant to corrosion and uses SMO254, a high-alloy austenitic stainless steel which has been specially developed for seawater applications and has significantly-higher corrosion resistance than 316L stainless steel. It is available in Standard, Compact, Compact Flex, Explosion-proof and Deckhouse configurations.

Alfa Laval's PureBallast 3 family
(Image courtesy Alfa Laval)



PureBallast 3 Standard
(Image courtesy Alfa Laval)

PureBallast 3 Compact

The Compact version has a smaller footprint to meet installation challenges, and comes either skid-mounted or with loose components. It boasts market-leading disinfection performance, and the best functionality in varying water conditions: three-water compliant and down to 42% UV-T in IMO mode. There is reduced power consumption through UV-dosage control. Available flow rates are from 85 to 300 m^3/h. The compact version is simpler to retrofit on existing vessels.

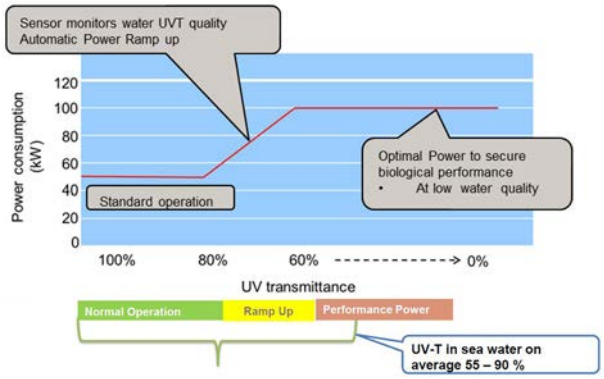
PureBallast 3 Compact
(Image courtesy Alfa Laval)

PureBallast 3 Compact Flex

The Compact Flex version addresses the specific challenges associated with retrofits on existing vessels, i.e. space and flexibility. The system is delivered as loose components, but all are plug-and-play, reducing installation cost and time. This has up to 20% reduced footprint compared to PureBallast 3 Standard, but builds on the successful design of PureBallast 3 Compact and has the same market-leading performance as the PureBallast 3 family. Available flow rates are from 85 to 1000 m^3/h.

Power Consumption

The power consumption depends on the UV transmittance of the water, ramping up significantly when the UV-T falls below 80%. In sea water, on average the UV-T is between 90 and 55%.



PureBallast 3 power consumption
(Image courtesy Alfa Laval)

Retrofit Process

Alfa Laval has a global pool of engineering partners and these assist customers during the design and engineering-review phases. They then provide ongoing assistance, pre-installation checks, installation checks, commissioning and training, after-sales support, compliance service packages, and international marine service. The compliance service packages are currently available in four ports around the world and, from March 2021, will also be available in Australia.

Alfa Laval's Retrofit Experience

Alfa Laval has over 6000 systems sold worldwide, with more than 3000 of these being retrofit systems installed. Their policy is that "No customer is the same, no ship is the same, and no project is the same".

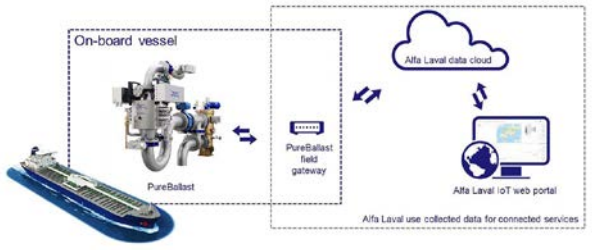
In Australia, systems have been sold to the Royal Australian Navy (12 systems, including HMA Ships *Choules*, *Canberra* and *Adelaide*), Sea Swift, Inco Ships and Teekay Shipping (Australia).

Lessons Learned from Retrofits

It pays dividends to invest time in the very beginning to set up the project team. Similarly, involve a professional engineering company to do the engineering design review with respect to location and integration. Plan the project well ahead and minimise changes in the scope of supply which affects delivery time. Good preparation is the key to success. Installation supervision is crucial for successful installation. Commissioning and training must be provided. It is always better dealing directly with the OEM (original equipment manufacturer) rather than a sales agent.

PureBallast Connect

Alfa Laval can also supply remote monitoring of the system as an option.



PureBallast Connect for remote monitoring of the system
(Image courtesy Alfa Laval)

Critical Success Factors

Choice of the most-suitable system for a vessel requires careful evaluation and analysis of the operating routines, i.e. voyage duration, operating route, water salinity, etc. Based on operating routes, beware of water salinities in ports as some systems require a minimum holding time, thus restricting the vessel's operation. Early planning and formation of the project team involving all the key partners, including the vessel's crew, is critical for retrofits. Consider ease of operation and maintenance, as this impacts on the crew workload. Be mindful that, for ongoing compliance, the supplier must have good after-sales and service back-up in the regions where the vessel operates.

Conclusion

Alfa Laval has been in the ballast water treatment business for a decade now. Their PureBallast UV treatment system has achieved compliance in all waters, and type approval with all major classification societies and the US Coast Guard. They have many systems installed worldwide, both new and retrofits, and the experience and after-sales service to back it all up.

Questions

Question time elicited some more interesting points.

The PureBallast system applies to the flow of the incoming ballasting or outgoing deballasting water; there is no holding time outside of the USA. In the USA, Alfa Laval PureBallast 3 was awarded an updated certificate from the USCG on 4 April 2019, granting the system type approval with zero-day holding time in all water salinities. PureBallast 3 owners in USA waters now have the option of discharging ballast water just 2.5 hours after taking it on. The holding time of 2.5 hours, which is due solely to a technical testing procedure, is only applicable if the vessel crosses over into another Captain of the Port Zone within this very short time.

The annual compliance certification is an IMO requirement placed on the OEM.

Other ballast water treatment systems can be affected by the temperature range of the water. The PureBallast system can operate in water up to 50°C as sometimes (but rarely) occurs in the Persian Gulf.

With the system on split skids, there are limits on how far apart the components can be placed; e.g. there is a maximum distance between the reactor and the filter. The limits are spelled out in the *Design Guide.*

Remote monitoring can be retrofitted if required. The ongoing cost for monitoring is of the order of a few hundred euros per month.

The lifespan of the UV lamps is of the order of 3000 h. In CIP (clean-in-place) systems, the UV lamps are cleaned after each operation. However, single lamps can be replaced at any time if broken or faulty.

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

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

Construction of Advanced Composite Racing Yachts

Eric Desjardins, General Manager Australia, McConaghy Boats, gave a presentation on *Construction of Advanced Composite Racing Yachts* as a webinar hosted by Engineers Australia using the WebEx software platform with the Deputy Chair of the NSW Section of RINA, Phil Helmore, as MC on 3 March. This presentation attracted 156 participating on the evening.

Introduction

Eric began his presentation with an overview of the initial stage of the construction of a high-performance racing yacht—the feasibility study, which aims to find out whether the yard can do what the customer wants in the required time. Items to be considered include the type of racing envisaged, the design considerations for that type of racing, and the timing and budget for the construction.

Types of yacht racing include:

- Twilight racing: Social evening (or afternoon) racing held throughout the summer months; the criterion often being "Ïs the Esky big enough to hold all the beers?"
- Club racing: Weekend racing hosted by a local yacht club, generally more competitive than twilight racing.
- Windward–leeward: Windward–leeward courses consist of an upwind and a downwind leg, each sailed between one and four times; these are short, fast races where precision is key.
- Passage: A race of varying distance which passes around multiple marks (buoys or landmarks) usually encompassing multiple points of sail.
- One design: Competitive, fast and generally close racing using a single type of yacht; class rules determine allowable crew numbers, sail and vessel requirements; this includes match racing.
- Regatta: Multiple races held over several days with an overall winner determined for the event.
- Offshore: A long-distance race held over many days or even weeks; held in open waters, where navigation, endurance and experience are critical — e.g. the Sydney–Hobart Yacht Race.
- Special Races: Such as the America's Cup, the Volvo race, the Vendee Globe, and the TP52 Circuit.

The designs of yachts to suit these different types of racing are very different.

Design considerations include:

- Lightness: Lightness and strength are prime considerations. Success for race yachts largely boils down to how light a structure can be achieved. The materials of choice are predominantly cored carbon fibre and epoxy solutions.
- Naval Architecture and Preliminary Design Considerations: Is this for offshore or inshore racing? What are the dominant conditions? Will the yacht be fully crewed or single handed? Are there class rules and/or regatta rules? Are there other regulations? Other things to consider include hydrostatics, hydrodynamics and aerodynamics.

- Engineering: Dynamic loads, slamming, wave loads, safety margins, class rules, regulations and certification bodies.
- Design development: Appendages, sails, mast, equipment (electronics, systems, etc.)

For example, a customer may advise that he/she wants to win the Sydney–Hobart Yacht Race or, in rare cases, wants a yacht like *Name*. This tells the designer basically what they need to know about the type of racing and they can get to work on the shape of the yacht. The outcomes of the preliminary study generally result in a new custom design comprising a deck and profile drawing, an interior general arrangement drawing, a sail plan, an appendages drawing, a mass estimate, a preliminary bill of materials and, ideally, some detailed specifications.

Timing and budget considerations include:

- How long does it take to build a racing yacht?: A 45 ft (13.7 m) racer with 10 people working on it can be completed in 9 months; a 60 ft (18.3 m) racer with 20 people working in 12 months; a 100 ft (30.5 m) maxi racer with 30 people working in 16 months. There have been notable exceptions to these rules-of-thumb: *Wild Oats XI*, 100 ft (30.5 m) was completed in 9 months, and a Trans-Pacific 52 ft (15.8 m), commonly referred to as a TP52, was completed in 3 months—but they would not do that again! Race yachts typically have minimal interiors ("spartan" is not inapt), whereas cruising vessels demand a much higher standard of comfort and take much longer to fit out.
- How much does it cost to build a racing yacht? For a 45 ft (13.7 m) racer, the labour involved is of the order of 15 000 hours; 60 ft (18.3 m) racer, 40 000 hours; and 100 ft (30.5 m) maxi racer, 70 000 hours.
- The cost of the composite materials varies from around $230 000 for a 45 ft (13.7 m racer) to $1 million for a 100 ft maxi racer.
- However, this is only the tip of the iceberg; there are other elements, including the design fee, rigging, sails, safety gear, shipping, and on-going costs (maintenance, slipping, crew, etc.), none of which are included.

Project Kick-off

Who are they building for? Fairly obviously, the owner. However, the owner selects the naval architect to do the design, and the naval architect may recommend the yard (if the owner has not already chosen). Additionally the owner usually selects all the specialists (such as the hydrodynamicists, the mast maker, the sailmaker, etc.)

When the owner selects the yard, this may be for a "turn-key"" solution, where the owner talks only to the yard, or a "bare-boat" solution, in which the owner has a team of professional sailors who can assemble and fit out the yacht. In this latter case, the yard would complete the structure and install the owner-supplied items.

Ideally, there would be a contract for the construction. However, quite a few builds have gone ahead with a simple agreement and do not always have a contract!

Here Eric showed a slide of a 42 ft (12.8 m) Reichel Pugh design which had an extreme canting keel, able to cant to 90° either side of the centreline. This sounds simple, but was extremely difficult to achieve on a short vessel. Anything difficult like this becomes a cost-plus item.

Reichel Pugh 42 with extreme canting keel
(Photo courtesy McConaghy Boats)

Following the meeting with the owner to kick the project off, one of the principal tasks is ordering the materials, as composite materials are not on the shelf at the yard, and often require two months for delivery. During this time, the yard is busy tooling up the mould, while the naval architect is hard at work preparing the hull construction drawings so that they are ready to go. The materials are required on site on the day they complete tooling, and about one week after the drawings are received.

Once the deck is on, they can move to painting and fit-out. The main driver of success throughout the project is whether the design work can stay ahead of the build.

Tooling

Any shape is achievable in composite materials, but each part needs adequate tooling.

Tooling considerations include:

- Materials to be used for the structure, and their stability at temperature if heating is required.
- The number of uses of the mould: Racing yachts are usually one-off, so the mould is only used once and tooling must be started from scratch each time.
- Accuracy required: They work to a general accuracy of 1 mm; however, for canting keels they have to work more closely than that.
- Will the mould be male or female?: this determines which side the laminate will be on.
- The level of surface finish.
- Air-tightness of the tooling surface: It must be airtight for vacuum bagging.

A traditional female mould starts with a base jig which is set up on a plane horizontal surface, and a centreline string is set up. Everything is measured from the horizontal reference plane and the centreline string.

The frames are set up, the stringers are installed, and then 3 mm plywood is laid inside to make the mould. The mould is usually used only once; twice if they are lucky!

Base jig, centreline string, and frames stacked at side
(Photo courtesy McConaghy Boats)

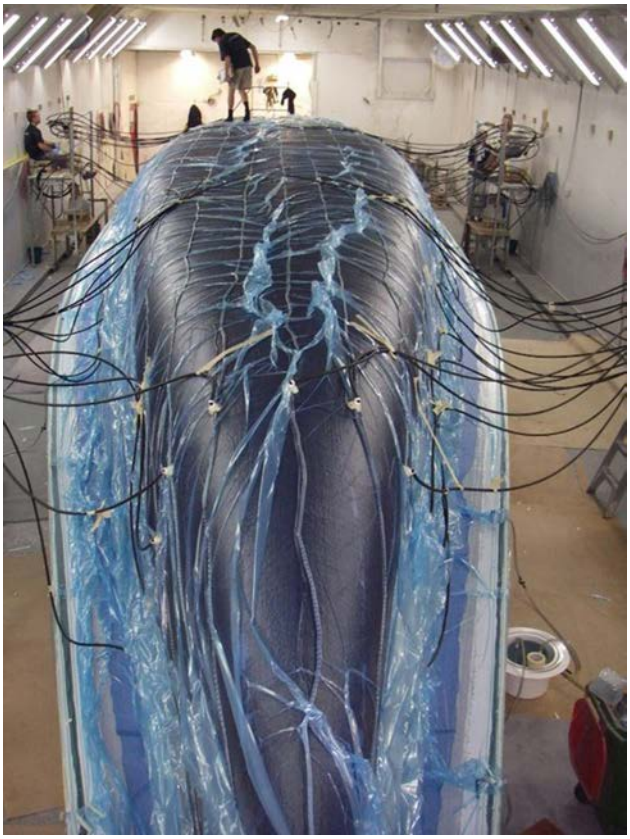
Frames up and stringers going in
(Photo courtesy McConaghy Boats)

Plywood being installed
(Photo courtesy McConaghy Boats)

Female mould for 44 ft (13.7 m) hull with Teflon release film, keel plant and red centreline, midships and waterline marks, ready for laminating
(Photo courtesy McConaghy Boats)

There are tooling solutions other than the standard female mould; these include:

- CNC aluminium tooling: this is not really possible for racing yachts, as it is much too expensive.
- CNC epoxy tooling boards.
- CNC foam tooling.
- 3D printed moulds and fixtures; these have started being used for small parts in the last 5–10 years.
- Infused carbon (vacuum bag) tooling over a pattern/plug (male mould).



Vacuum bag infusion over a male mould with pipes feeding the resin to the laminate
(Photo courtesy McConaghy Boats)

Staff and Factory

McConaghy Australia currently employs over 45 skilled composite specialists, craftsmen, engineers and designers, forming a team of unmatched passion and commitment. These include shipwrights, pattern makers, spray painters, CNC machinists, labourers and apprentices, project managers, engineers and naval architects.

McConaghy factory at Gosford
(Photo courtesy McConaghy Boats)

The factory in Gosford is a dedicated manufacturing facility for large carbon-fibre prepreg structures, featuring a 30×8×4.5 m computer-controlled oven capable of reaching 120°C.

In addition to the facilities and staff, a yard needs logistics and other manufacturing capacities. It must have experience in manufacturing or contracting all required activities supporting the manufacturing and finishing of the composite parts, from concept to their safe delivery. These include tool design, licenced CAD and CAM software, scaffolding, heating and environment-control facilities, coordinating lifts up to 20 t on the premises, and purpose-built and certified storage chassis.

Black Jack ex-*Alfa Romeo*, completed in 2005
(Photo courtesy McConaghy Boats)

Racing Yacht Construction

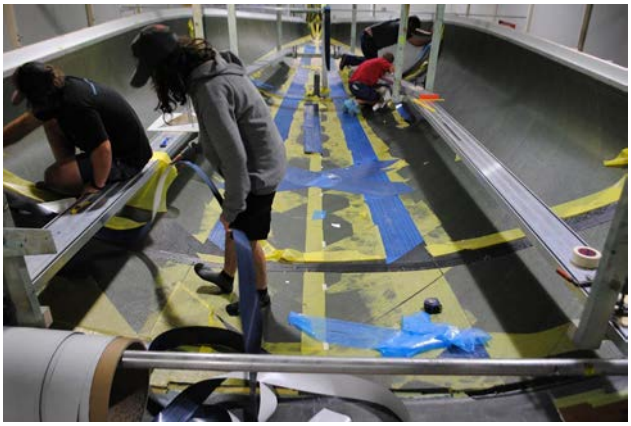
Composite construction comprises a fibre and a matrix. There are different types, brands, weights and fire-retardancy of fibres. The usual fibres are carbon, glass and Kevlar, but also Dyneema, quartz and "bio" fibres. The usual resins are mostly epoxies, vinylesters, polyesters and phenolics. A variety of cores can be used (for panels and cored structures). To add to the possible combinations, fibres come with different types of stitching, and weights per unit area. On occasion, fillers can be used for the resin, such as flame-retardant products. Then there are different manufacturing processes, including hand laminating, infusion, and prepreg under vacuum bagging and/or autoclave.

Carbon fibre and epoxy resin are the materials of choice for their mechanical properties, mostly in a "prepreg" form. Pre-impregnated materials (prepregs) are reinforcement fibres or fabrics into which a pre-catalysed resin system has been impregnated by a machine, giving the perfect fibre-to-resin ratio. The resin systems in these materials react very slowly at room temperature, so there is plenty of time for set up. The parts are usually made of thin carbon skins, laminated on each side of a core made of honeycomb or structural foam. The parts are then cured at 100°C for 10–15 hours, under vacuum bag consolidation.

McConaghy builds all tools and composite structures from raw elements, and offers a full spectrum of services: prototyping, manufacturing, final assembly, launching and testing.

Here Eric showed a slide of laminating the hull outside skin. The carbon prepregs come with backings of different colours, depending on whether they are unidirectional or off-axis.

The fibres have to be orientated as per the drawings of the structural engineers. Each layer is 0.2–0.5 mm thick, and layup is very labour intensive. The black colour is the outside laminate.



Laminating the hull outside skin
(Photo courtesy McConaghy Boats)

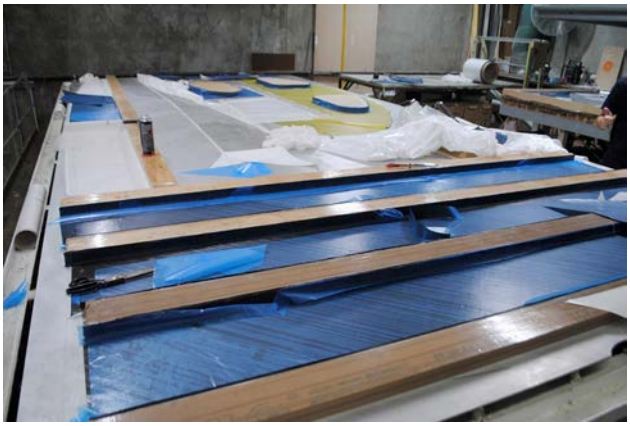
The next step is fitting the honeycomb core. It can be done in strip plank fashion, or thermoformed to the hull shape.

Fitting the honeycomb core
(Photo courtesy McConaghy Boats)

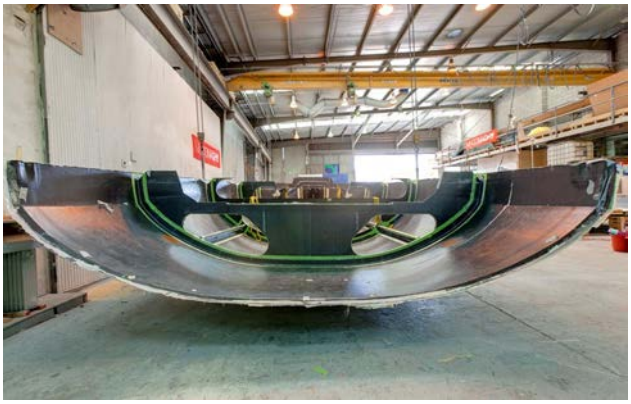
Then, with the hull shell completed, it is time to fit the bulkheads.

Hull shell completed
(Photo courtesy McConaghy Boats)

Flat structural elements (beams, bulkheads, etc.) are laid up on a table, then installed in the boat.



Flat structural elements being laid up
(Photo courtesy McConaghy Boats)



Installation of bulkheads
(Photo courtesy McConaghy Boats)

With the bulkheads installed, it is time to fit the deck, which is one of the milestones of the project.

Fitting the deck
(Photo courtesy McConaghy Boats)

Rig attachments to the hull are of vital importance, as these points are heavily loaded—especially on the maxis! A substantial amount of unidirectional strands is used to distribute the loads.

The painting process is important, as the yacht has to look good for the sponsors. McConaghy Boats pays attention to the detail, and respects the designer's wishes. Then comes the hardware installation, systems integration, painting and transport.

The construction of the TP52 *All4One* was completed in three months. All the design work had been done, as she was a sister to a yacht previously built in Europe. She was

Rig attachment
(Photo courtesy McConaghy Boats)

trucked to a ship in Sydney for transport to Europe, together with the mast, keel, etc., all built separately. McConaghy Boats sent a team to Europe for the assembly, launching, trials and, finally, race day!

Transport
(Photo courtesy McConaghy Boats)

Race day
(Photo courtesy McConaghy Boats)

Quality Control

It is important to have a culture of quality excellence and weight optimisation, because lighter and stronger means faster—which is the name of the game.

A constant focus on weight saving is required to optimise the weight of every component going into a race yacht at each step of the manufacturing process. The weight of each component (big and small) is checked against its theoretical value, and tracked and recorded individually in a weight register before the final assembly to the main structure. The

yard needs to remain in constant contact with the designer throughout the build process. The measured weights are regularly communicated back to ensure that the weight study will remain as current and accurate as possible throughout construction.

The international moth class has been using hydrofoils for years, and is exciting to race. These boats are all carbon everywhere and have a complete mass, ready to race, of 30 kg. They are foiling above 8 kn and can reach speeds of 40 kn!

International moth class
(Photo courtesy McConaghy Boats)

McConaghy's quality-control systems have been developed over decades of practical application and in conjunction with external certifying bodies, composite engineers and materials suppliers.

These quality-control processes include:

- test panel construction and analysis;
- weighing parts;
- recording and batch selecting core materials and prepregs;
- 3D scanning and template checking moulds for dimensional accuracy;
- laminate schedules and key processes recorded with sign-off by independent supervisors;
- curing cycles and vacuum pressure data logged and recorded; and
- where appropriate, some components are bend tested or samples tested to destruction.

Optimisation and Refit

McConaghy Boats also undertakes optimisation and refit work.

Wild Oats XI, a Reichel Pugh design, was launched in 2005 and was immediately successful—in her first Sydney–Hobart Yacht Race she became the first yacht to win the "treble", i.e. both line and handicap honours and in a race-record time, since *Rani* in the inaugural event in 1945.

However, in 2015 she was facing stiff competition from the much beamier *Comanche*, and needed some modifications to remain competitive. The proposal was to move the mast and keel aft by about 2 m. The easiest way to achieve this was to move the boat around the keel and mast, rather than the other way around. In a highly-publicised event at Woolwich Dock, the bow was cut off nearly back at the mast, and the boat then transported to the factory at Gosford.

Bow removal on *Wild Oats XI* at Woolwich Dock
(Photo courtesy McConaghy Boats)

McConaghy Boats made up a new bow, 2 m longer than the previous one, fitted it to the forward end, and then cut 2m off the stern. The new bow shape made a significant difference to the yacht's speed both upwind and down and, when racing downwind offshore, she could be sailed at more than 30 kn without any fear of nose-diving.

In a tribute to the expertise at McConaghy Boats, you cannot now tell where the cut in the hull was made!

New bow being fitted to *Wild Oats XI*
(Photo courtesy McConaghy Boats)

Wild Oats XI racing again
(Photo courtesy McConaghy Boats)

Future Trends in Yacht Construction

Some future trends in yacht construction — this is not an exhaustive list! — include:

Additive Technology

In 2019 the first 3D printed 25 ft (7,62 m) motor boat was produced and launched. For sailing race yachts operating under specific loads and being extremely weight sensitive, this may be a long-term evolution. In the short term, however, there is high potential for 3D-printed tooling, rather than for the boat itself.

Automatised Fibre Placement

This technology has existed for a long time in aviation. A multi-axis robotic arm lays strips of pre-impregnated fibre with high precision and reliability.

Electrical Stored Power and Propulsion

Currently yachts requiring power are running on diesel engines which power hydraulic motors. Going forward, more and more racers will use electrical winch motors, taking advantage of the recent improvements in batteries.

Embedded Sensors

Embedded sensors are already at play in America's Cup yachts, with over 1000 sensors collecting 100 measurements per second each, enabling dynamic load recording and fine tuning of the yacht when racing. These record such things as loads on winch handles, heart rates of crew, fibre optics on the mast and in hydrofoils, etc. These are becoming more important, not only for fine tuning, but also for passing knowledge of working loads back to the naval architects and engineers.

New Materials

Who knows? Carbon nano-tubes show promise.

Conclusion

Construction of racing yachts using advanced composite materials is a complex business. It requires good communication between the owner, the designer and the yard, detailed knowledge of the materials and their properties, significant trade skills in the yard, project management, and a command of the logistics required.

Questions

Question time was, unfortunately, limited and we fielded less than half the queued questions, but some more interesting points were elicited.

Impact loads on the hull and keel are not always known with absolute data, and they have to rely on safety margins. For items like frictional resistance, one option is to use towing tank modelling.

One attendee reported that a TP52 experienced delamination after falling off a 3–4 m wave. This could have been a manufacturing fault, but not necessarily. There is a racing circuit for TP52s in the Mediterranean which is a less harsh environment, and these boats are often second-hand by the time they are converted to race offshore! However, if the hull has received a significant impact load (as in falling off a wave), this could have started a delamination. If no-one noticed, then the delamination will expand over time.

Sourcing the materials at the beginning of a project is always a challenge. On one project, the specific fibres they wanted were all being used in the aircraft industry, and so there were none available! Honeycomb core is manufactured in Europe, and so the order needs to be placed before the design is completed.

What are the drivers for using a male or female mould? A rudder, for example, would use a female mould. A male mould is easier to machine or fabricate than a female one, and so usually quicker and cheaper, but it depends a lot on the shape.

The fibre:resin ratio remains pretty standard for each project when using prepregs, usually within ±3%, although this can vary from one supplier to another. It is usually engineered to give the optimum ratio.

McConaghy Boats undertakes work other than marine. For example, the have done work for sUNSWift, UNSW Sydney's solar car, components for the square-kilometre array for CSIRO Astronomy, the Sydney Opera House, and on the submarine for James Cameron to dive the Marianas Trench.

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

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

The Effect of Mooring Systems on Floating Wave Energy Converters

Eric Gubesch, PhD Candidate at the Australian Maritime College, gave a presentation on *The Effect of Mooring Systems on Floating Wave Energy Converters* as a webinar hosted by Engineers Australia using the WebEx software platform with Greg Hellessey, ACT & NSW Branch Committee Member IMarEST, as MC on 7 April.

Eric's presentation discussed the hydrodynamic performance and motion characteristics of a column-stabilised asymmetrical oscillating water column (OWC) wave-energy converter. A 1:36 scale model of the OWC was experimentally tested at the Australian Maritime College and was numerically modelled with Star CCM+ computational fluid dynamics (CFD) software.

The design incorporated several geometric relationships for high-performance asymmetrical OWCs and typical design requirements utilised in the offshore oil and gas industry. Detailed analysis included physical and numerical decay tests to quantify the natural period of the OWC moonpool and rigid-body motions, response amplitude operators, turbine damping coefficients for the power take-off system, and hydrodynamic capture-width ratios.

Question time was lengthy and elicited many more interesting points.

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

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

Characterising the Southern Ocean and Ross Sea Wave Climate

Sally Garrett, Defence Technology Agency, New Zealand Defence Force, gave a presentation on *Characterising the Southern Ocean and Ross Sea Wave Climate* as a webinar hosted by RINA using the Zoom software platform with Phil Helmore, Deputy Chair of the NSW Section, as MC on 5 May. This presentation attracted 17 participating on the evening.

Sally began her presentation with a video of Royal New Zealand Navy ships at sea in the Southern Ocean, showing why the RNZN and NZDF are interested in the Southern Ocean and Ross Sea wave climate.

The waves of the Southern Ocean and the Ross Sea are largely unstudied. The NZDF routinely operates in these areas and is currently engaged in a shipbuilding program which requires a detailed understanding of the wave climate for sea-keeping analysis and ice-belt design. Unlike other areas, the Southern Ocean and the Ross Sea have limited ship traffic and therefore limited wave observations from volunteer observing ships. Moreover, due to the difficult conditions and remote locations, limited scientific measurements of waves have been completed. In 2017, the NZDF deployed the first wave buoy in the open ocean south of 47°S anywhere in the world. In addition, 21 free-floating buoys were also deployed between 42°S and 67°S. This array has provided an understanding of wave characteristics across the Southern Ocean and the Ross Sea.

The data from these platforms have been used to optimise the WaveWatch III wave forecast model. The optimised setup was then used to create a 24-year hindcast wave atlas for the ice-free areas south of 31°S.

In the presentation, this previously unpublished wave atlas for the Southern Ocean and Ross Sea was presented. A limited comparison was also made between the wave statistics from both wave-buoy observations and the wave atlas in these regions with the bivariate frequency wave height–period occurrence tables recommended for the North Atlantic by the International Association of Classification Societies.

Question time was lengthy and elicited many more interesting points.

The "thank you" certificate was subsequently posted to Sally.

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

[*This was an updated version of Sally Garrett and Tom Durrant's presentation on this topic at Pacific 2019 IMC, which was also published in the May 2020 issue of* The ANA, *with the addition of their latest work which is concentrating on the wave climate in ice-infested waters* — Ed.]

Phil Helmore

THE INTERNET

RINA Webcasts

RINA has set up a YouTube channel and RINA webcasts can be viewed there. The RINA YouTube channel is at https://www.youtube.com/channel/UChb1sfHbWfQmG-iwpp_QGJg/videos

Bookmark this website and keep your eye on it!

Video recordings of presentations should be sent to Jaime Perez Martinez <jmartinez@rina.org.uk> at RINA HQ for uploading.

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

ACT Section Webcasts

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

- *Intact and Damaged Survivability of an Offshore Floating — Moored Oscillating Water Column Device* presented by Ahmed Elhanafi as a webinar hosted by RINA using the Zoom software platform on 23 March.

Lily Webster

NSW Section Webcasts

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

- *Ballast Water Treatment: Challenges, Solutions and Operations* presented by Asif Ghauri, National Manager — Marine and Diesel, Alfa Laval Australia, as a webinar hosted by RINA using the Zoom software platform on 24 February.
- *Construction of Advanced Composite Racing Yachts* by Eric Desjardins, General Manager Australia, McConaghy Boats, as a webinar hosted by Engineers Australia using the WebEx software platform on 3 March.

Phil Helmore

Victorian Section Webcasts

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

- *The Invention of the Tilting-pad Thrust Bearing* presented by Stephen Phillip, Mechanical Engineer, as a webinar hosted by RINA using the Zoom software platform on 18 March.

Keegan Parker

WA Section Webcasts

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

- *Controlling Marine Engine Emissions* presented by Lachlan Colquhoun, Marine Engine Sales Manager Australia and New Zealand, MAN Energy Solutions, as a webinar hosted by RINA using the Zoom software platform on 24 February. This was a repeat of the presentations previously given to the NSW Section on 5 February 2020 (already on the RINA YouTube channel) and the Queensland Section on 8 September 2020.

Syed Zaidi

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

CLASSIFICATION SOCIETY NEWS

ABS Guides Industry on Shipping Power Generation and Propulsion

ABS has published industry-leading guidance evaluating a range of shipboard propulsion and power-generation technologies with the potential to contribute to shipping's sustainability goals.

The *ABS Advisory on Decarbonisation Applications for Power Generation and Propulsion Systems* considers the technological complexity, current application, available fuel options, current regulatory requirements and safety concerns of the main systems which could reduce greenhouse gas (GHG) emissions.

"Recognizing the overall challenge of the 2050 IMO targets, ABS has developed a series of documents to reference available carbon-reduction strategies. This advisory is the latest assistance for shipowners evaluating their power-generation and propulsion-system options for future fleets. These technologies will be the cornerstone of achieving the industry's decarbonisation ambitions, and this advisory is another example of ABS' commitment to supporting the industry in reaching 2050 safely," said Georgios Plevrakis, ABS Director, Global Sustainability.

While GHG impact is a complex issue which encompasses the total emissions generated during the well-to-wake lifecycle, the advisory focuses on the impact from tank-to-wake that is directly linked to the vessel's power generation and propulsion.

Technologies covered by the advisory include steam and gas turbines, fuel cells, wind, solar and nuclear as well as batteries and super capacitors, carbon capture and internal combustion engines.

A copy of the ABS *Advisory on Decarbonization Applications for Power Generation and Propulsion Systems* may be downloaded at

https://absinfo.eagle.org/acton/attachment/16130/f-1ea25456-52e0-4729-8c54-7b491a3cf5b8/1/-/-/-/-/ABS-Advisory-on-Decarbonization-Applications-for-Power-Generation-and-Propulsion-Systems.pdf

ABS News, 14 April 2021

Transition Timeline for DNV Certificates and Certification Marks

DNV GL is changing brand name to DNV from 1 March. Certificates and certification marks have been redesigned to reflect the DNV brand. All new customers will get DNV-branded certificates and marks, while existing management system and product certificates continue to be valid.

Guidelines have been established for customers to transition at re-certification, which means:

- Management system certificates and marks are to be transitioned within 3 years.
- Product certificates are to be transitioned within 5 years.

Existing customers are not required to change/update marketing material or packaging immediately. "The transition should be as organic as possible, making it smooth and minimising any waste. The DNV GL and DNV brands will continue to live side-by-side for a while, which is completely normal in such processes," said Luisa Grottola, Global Communications Director, DNV GL.

For questions on the new certificates, marks or transition guidelines, please contact your local unit or, alternatively, contact DNV GL at

https://www.dnv.com/assurance/general-inquiry.html

DNV GL News, 25 February 2021

RRS *Sir David Attenborough* Delivered to LR Class

Britain's new polar research ship, RRS *Sir David Attenborough* has been awarded LR certification after a four-year-long construction period. The vessel was delivered to Natural Environment Research Council and British Antarctic Survey (BAS) by Cammell Laird Shipbuilders. BAS undertakes vital research in the polar regions, leading in polar science and polar operations, addressing issues of global importance and helping society adapt to a changing world.

The highly-complex vessel has been designed to support science in extreme environments. A wide range of specialist scientific facilities, instruments and laboratories enable scientists to conduct multi-disciplinary sciences to study the ocean, seafloor, ice and atmosphere.

An ice-strengthened hull, designed to break through ice up to one metre thick, and the ability to spend up to 60 days at sea, means that RRS *Sir David Attenborough* can undertake extensive voyages in polar regions. The vessel will spend the northern summer supporting Arctic research cruises and the austral summer in Antarctica carrying out research programmes and bringing people and supplies to BAS research stations.

LR's Marine & Offshore Service Delivery Manager for UK&I, Mike Williams, said "The delivery of RRS *Sir David Attenborou*gh marks an important milestone for UK commercial shipbuilding, demonstrating the industry's commitment to innovation and sustainability. We're delighted to have worked with Cammell Laird Shipbuilders on this state-of-the-art vessel which highlights LR's technical experience and expertise."

British Antarctic Survey Director, Professor Dame Jane Francis, said "Achieving certification is a significant milestone. This gives us assurance that our ship is in a fit and efficient condition, and ready to go to sea. Over the coming months our crew will be conducting sea trials in readiness for our maiden voyage to Antarctica later this year."

Linton Roberts, Operations Director at Cammell Laird, said "Cammell Laird is immensely proud to have built RRS *Sir David Attenborough*; a project which has showcased our shipbuilding capabilities and demonstrates our commitment to sustainability. A great deal of collective expertise and commitment has gone into this build. The Lloyd's Register team has utilised its technical experience and expertise to support Cammell Laird in delivering one of the most technologically-advanced research vessels in the world."

The vessel is expected to commence polar operations in 2021 after a period of intensive mariner training, testing and trialling the many technical, scientific and operational features and capabilities.

LR News, 1 March 2021

RRS *Sir David Attenborough* at her ceremonial naming at Cammell Laird shipyard on 26 September 2019 (Photo courtesy British Antarctic Survey)

Birds-eye view of RRS *Sir David Attenborough* (Photo courtesy British Antarctic Survey)

Approval in Principle for Cargo Containment System for Large Liquefied Hydrogen Carrier

Classification Society ClassNK has issued an Approval in Principle (AiP) to Kawasaki Heavy Industries for the design of a cargo containment system (CCS) of the world's largest capacity (40 000 m^3 per tank) developed for use on a large liquefied hydrogen carrier.

Hydrogen is expected to be used as a clean energy source to realise a decarbonised society as its burning does not emit CO_2. To contribute to the maritime transportation of hydrogen, which is anticipated to expand its use worldwide, in 2017 ClassNK published the *Guidelines for Liquefied Hydrogen Carriers*, describing the safety requirements for liquefied hydrogen carriers based on IMO's *Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk*. Also, ClassNK was engaged in the classification survey during construction of a pioneering liquefied hydrogen carrier, *Suiso Frontier*, a 1250 m^3 carrying capacity ship built by Kawasaki according to its rules and guidelines.

Suiso Frontier was constructed by Kawasaki as a member of the CO_2-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA) as part of the demonstration project for establishment of mass hydrogen marine transportation supply chain derived from unused brown coal by the New Energy and Industrial Technology Development Organisation (NEDO).

Suiso Frontier will be used for technology demonstration testing aimed at the establishment of an international hydrogen energy supply chain in which liquefied hydrogen produced in Australia will be shipped to Japan.

Having received an application from Kawasaki, ClassNK carried out the design review of the newly-developed CCS for a hydrogen liquefied carrier based on its Part N of *Rules for the Survey and Construction of Steel Ships* incorporating the IGC Code, and its guidelines incorporating the IMO's interim recommendations. In addition, a comprehensive safety assessment of the CCS was conducted based on the HAZID risk assessment results, which has led to the issuing of the AiP.

The main features of the CCS announced by Kawasaki are as follows:

- Enables transportation of cryogenic liquefied hydrogen in large amounts thanks to tank capacity on par with tanks used on large liquefied natural gas carriers,
- Utilises an independent self-supporting design with a structure capable of responding flexibly to thermal contraction which occurs when loading cryogenic liquefied hydrogen,
- Features a newly-developed, high-performance heat insulation system which mitigates boil-off gas which occurs in response to heat ingress.
- Designed to effectively utilise boil-off gas as fuel to power the ship, thus contributing to reduced CO_2 emissions from liquefied hydrogen transport operations.

An impression of a large liquefied hydrogen carrier with a cargo carrying capacity of 40 000 m^3 per tank in four tanks (Image courtesy of Kawasaki)

FROM THE CROWS NEST

WWSR Spirit 2

On 8 October 1978, 42 years ago, Ken Warby blasted across Blowering Dam to set his second (and current) World Water Speed Record of 317.6 mph (511.1 km/h), thus becoming the first person to officially break the 300 mph and 500 km/h barriers, the only person to ever design, build and drive a boat to a World Water Speed Record, and still the only person in the world to hold this record.

Dave Warby of Warby Motorsport is attempting to break his father Ken's World Water Speed Record in *Spirit of Australia* in their latest vessel, *Spirit of Australia 2*.

Spirit of Australia 2 on Blowering Dam in December 2020
(Photo from Warby Motorsport website)

The Warby Motorsport team expected to run tests on *Spirit 2* on the Manning river at Taree in March, but these were cancelled due to flooding in the area. The team will now return to Blowering Dam on 22 and 23 May. Their last run at Blowering last December was hampered by crosswinds which made it difficult to dial in the setup of the new tailplane. They are hoping for favourable weather so that the team can have a few good runs to improve the boat's setup towards 300 mph (483 km/h).

Phil Helmore

WWSR Longbow

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

The heavy frost in Lancashire over much of February and the first half of March put a hold on using epoxy in the workshop for most of the month, given that the minimum temperatures required for it to cure could not be met without dimming all the lights in the neighbourhood with the amount of electricity that it would have required!

The trailer for transporting *Longbow* has been completed by the apprentices at sponsor WEC Group Training Academy in Darwen, Lancashire, under the guidance of their Training Manager, Kris Mercer. The trailer was then disassembled, and the steel framework sent off by haulier to sponsor Manchester Galvanizing for galvanizing. When completed, the now gleaming trailer frame was then sent back to WEC

for reassembly by their apprentices, and the trailer delivered to David Aldred's cottage workshop where they are building *Longbow*. At present the hull is inverted on the build table in the workshop and, when the underside of the craft is completed, they will bring it out of the workshop, turn the hull over and put it on to the trailer. At that stage the build table can be removed and *Longbow*, complete with trailer, can then be taken back into the workshop for the rest of her construction to be continued.

The complete underside of the hull has now been sheathed in Dynel and epoxy resin.

[*For further details, visit the Longbow website, https://www.jet-hydroplane.uk/* — Ed.]

Longbow's completed trailer in David Aldred's driveway
(Photo from Longbow website)

Longbow's underside sheathed in Dynel and epoxy resin
(Photo from Longbow website)

Donald Campbell 100th Birthday Anniversary

23 March marked the 100th year since the birth of land and water speed record breaker Donald Campbell CBE, and this was commemorated by the Trustees of the Ruskin Museum working with the Royal Air Force to arrange for two Hawk aircraft to undertake a low-level high-speed flight over the length of Coniston Water where Donald broke the outright unlimited World Water Speed Record in his jet hydroplane *Bluebird K7* on five separate occasions between 1956 and 1959. Donald's only child, Gina Campbell QSO, herself having twice achieved the Ladies outright unlimited World Water Speed Record, was present at the flypast and to say happy birthday to her dad.

Longbow website

SP80 Aims for World Sailing Speed Record

The world sailing speed record is currently held by Australian Paul Larsen in *Vestas Sailrocket 2* at an average speed of 65.45 kn (121.1 km/h) over the 500 m track. *SP80* is the vessel being designed and built by three young engineering students from the Swiss engineering school École Polytechnique Fédérale de Lausanne (EPFL) to attempt the world sailing speed record in 2022 and take it back to Europe. To achieve their goal they are aiming for a speed of 80 kn (148 km/h) using a boat with shaped hulls, propelled by a the usual kite wing, while the overall stability is achieved via super-ventilating hydrofoils. The team built a prototype model at a scale of 1:2 and instrumented it, and have completed tests, towing with a RIB in place of the usual kite.

Conventional drop-shaped hydrodynamic profiles tend to cavitate at around 50 kn. However, with a triangular shape, this type of profile allows air from the atmosphere to ventilate the back of the foil, thus forming a large stable air bubble which will prevent cavitation inception. In order to get the best out of the submerged profiles, the SP80 team carried out numerous kitesurfing tests, testing more than 30 different profiles in the space of a few months. These tests allowed them to empirically validate the potential of such a solution. They then implemented an optimisation approach based on cavitation-tunnel tests coupled with numerical simulations carried out on ANSYS Fluent, all powered by artificial intelligence thanks to Neural Concept. Throughout the process, CADFEM advised the students and engineers in charge of these simulations, at the heart of the record quest.

Swiss watchmaker Richard Mille has now joined the team as title sponsor. North Thin Ply Technology (NTPT™), a world leader in pre-impregnated materials, has also contributed to the endeavour by supplying Carbon TPT® for the boat's structure. The team can now get to work on the crucial stage of producing the full-size sailing boat for the record, which the team expects to reach a speed of 80 kn (150 km/h) using the wind as its sole source of power.

[*For further details, visit the SP80 website, https://sp80.ch/* — Ed.]

SP80 website

GENERAL NEWS

Austal Delivers Guardian-class Patrol Boat Number Ten

In early May Austal Australia delivered the tenth Guardian-class patrol boat to the Australian Department of Defence. The vessel, RSIPV *Taro*, was then gifted by the Australian Government to the Solomon Islands Government at a certificate-signing ceremony held at Austal Australia's Henderson shipyard, attended by His Excellency Mr Robert Sisilo, Solomon Islands High Commissioner to Australia, Mr Vince Connelly MP, Federal Member for Stirling, and RADM Katherine Richards RAN, Head of Navy Engineering.

The vessel is the second of two Guardian-class patrol boats to be delivered to the Solomon Islands under the Pacific Patrol Boat Replacement Project, part of the Australian Government's Pacific Maritime Security Program, and follows the delivery of RSIPV *Gizo* in November 2019.

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery of the second Guardian-class patrol boat to the Solomon Islands signifies the halfway mark in the delivery of the Pacific Patrol Boat Replacement Project.

"RSIPV *Taro* is the tenth Guardian-class patrol boat we have completed for the Australian Government, out of a total 21 vessels which we are constructing and sustaining under the Pacific Patrol Boat Replacement Project," Mr Gregg said.

"Based on our current productivity, and despite the challenges of the COVID-19 pandemic, our Australian shipyard is well on track for delivery of all 21 Guardian-class Patrol Boats, on time, by the end of 2023.

RSIPV *Taro*
(Photo courtesy Austal)

"We're very grateful to the Minister for Defence, the Hon. Peter Dutton MP, Minister for Defence Industry, the Hon. Melissa Price MP, and the Department of Defence Capability Acquisition and Sustainment Group for their continued support of this sovereign shipbuilding program.

"Our warmest congratulations go to the Solomon Islands Prime Minister, Manasseh Sogavare, Solomon Islands Minister of Police, National Security and Correctional Services, the Hon. Anthony Veke, Commissioner of the Royal Solomon Islands Police, Mostyn Mangau, and the

The mast of the future HMAS *Arafura* was erected during a ceremony at the Osborne Naval Shipyard in South Australia on 25 February. Outfit, trials and painting of the new offshore patrol vessel is progressing with the expectation that the ship will be launched later this year
(RAN photograph)

people of the Solomon Islands on the handover of *Taro* to the Royal Solomon Islands Police Force."

Faster, with improved seakeeping, better amenities and an enhanced mission capability — including an integrated RHIB stern launch-and-recovery system — the Guardian-class patrol boats provide the Royal Solomon Islands Police Force with a much-improved naval asset to carry out border patrols, regional policing, search-and-rescue, and many other operations domestically and internationally. *Taro* is named after Taro Island, capital of the Choiseul Province, located in the far northwest of the Solomon Islands archipelago.

Mr Vince Connelly MP, Member for Stirling, with His Excellency Mr Robert Sisilo at the certificate signing, gifting the Guardian-class Patrol Boat from Australia to the Solomon Islands (Photo courtesy Austal)

Austal CEO Patrick Gregg, RADM Katherine Richards RAN, His Excellency Mr Robert Sisilo, Solomon Islands High Commissioner to Australia, Mr Vince Connelly MP, Member for Stirling, and Air Commodore Fiona Dowse, Senior Officer ADF, with the crew of RSIPV *Taro* at Austal's Henderson shipyard (Photo courtesy Austal)

The Pacific Patrol Boat Replacement Project was awarded to Austal in May 2016, with an additional contract option awarded in April 2018, taking the program to 21 vessels, valued at more than $335 million.

Twelve Pacific Island nations including Papua New Guinea, Fiji, the Federated States of Micronesia, Tonga, Solomon Islands, Cook Islands, Kiribati, Marshall Islands, Palau, Samoa, Tuvalu, Vanuatu and Timor Leste will receive the vessels through to 2023.

Largest High-speed Ferry Constructed in the Philippines Delivered by Austal

On 1 March 2021 Austal announced that Austal Philippines had delivered a 109 m high-speed catamaran ferry, to Fjord Line of Norway. The vehicle-passenger ferry, named *FSTR*, is the largest aluminium vessel ever constructed in the Philippines — and currently the largest ferry (by volume) to be constructed by Austal at any of the company's shipyards worldwide.

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery of *FSTR* during the current COVID-19 pandemic was a significant achievement and a testament to the resilience, commitment, skills and safety of the Austal Philippines team. "It's impressive to see a large high-speed ferry like this delivered in the best of times, but for the team to deliver this new vessel during a global pandemic is simply outstanding.

The Austal Philippines team has clearly demonstrated its ability to deliver multiple, complex projects under challenging circumstances, while maintaining a safe working environment," Mr Gregg said. "My congratulations go to the entire Austal Philippines team and Fjord Line on the delivery of this exciting new ship, the largest high-speed ferry ever constructed in the Philippines."

Fjord Line's *FSTR* is capable of transporting 1200 passengers at up to 40 kn and features Austal's largest-ever vehicle-carrying capacity constructed to date, with a beam of 30.5 m enabling 404 cars to be carried across two decks.

The ship features several key design innovations which enhance operating performance and passenger comfort, including a new, optimised hullform which will minimise fuel consumption and wake wash when operating on the Skagerrak Sea between Hirtshals, Denmark, and Kristiansand, Norway.

At the vessel handover held at the Balamban Cebu shipyard, Austal Philippines President, Wayne Murray, said that the delivery of *FSTR* was just the first of three large high-speed ferries to be constructed at the company's newly-expanded shipyard.

"With the delivery of *FSTR*, we're now preparing for the launch of Hull 395, *Bañaderos Express*; a 118 m trimaran ferry under construction for Fred. Olsen Express of the Canary Islands. Following closely behind that, we have the 115 m *Express 5* under construction for Molslinjen of Denmark" Mr Murray said.

Austal Philippines Launches Trimaran for Fred.Olsen Express

Austal Philippines in Balamban, Cebu, has launched *Bañaderos Express* for Fred. Olsen Express. The second of two Auto Express 118 high-speed trimaran ferries ordered by Fred. Olsen Express of the Canary Islands, *Bañaderos Express* is scheduled for delivery in the second half of 2021.

Austal Australia delivered the first trimaran of the two-vessel $190 million contract, *Bajamar Express*, in July 2020.

Austal's Chief Executive Officer, Paddy Gregg, said that the successful launch was the first to be completed using Austal Philippines' new floating dry dock, *Hercules*, procured in 2020.

"The launch of *Bañaderos Express* has been completed according to plan and she looks great in the water, ready for final fit-out to commence," Mr Gregg said.

"Austal Philippines' new floating dry dock has performed exceptionally well and added tremendous capability and

Fjord Line's *FSTR*, a 109 m high-speed vehicle-passenger ferry, designed by Austal Australia and constructed by Austal Philippines (Photo courtesy Austal Philippines)

efficiency to our shipbuilding operations in Balamban."

Austal Philippines President, Wayne Murray, said that the launch of *Bañaderos Express* was yet another milestone in the continuing development of the shipyard's capability and congratulated his team on another successful launch.

"It's truly impressive that our team have capably managed the launch of a 118 m trimaran ferry, just weeks after the departure of a 109 m catamaran, delivered to Fjord Line. In between, they've prepared our new floating dry dock while also working on yet another large ferry, the 115 m *Express 5* catamaran, ready to take up position in our main assembly bay," Mr Murray said.

Fred. Olsen S.A. CEO, Andrés Marín, said: "Seeing the images of *Bañaderos Express* already afloat has been exciting. This is the moment when you realise that the new trimaran, and its incorporation to the Gran Canaria and Tenerife "maritime bridge", is an imminent fact".

Mr Marín highlighted that *Bajamar* and *Bañaderos* are sister vessels, hence our third trimaran maintains the characteristics and innovations of *Bajamar Express*, where all the design details have been oriented to offer an unbeatable passenger experience".

Bañaderos Express is a 118 m aluminium trimaran, capable of transporting more than 1100 passengers and 276 cars at cruising speeds up to 38 kn. Along with her sister ship, *Bajamar Express*, the ship features an optimised trimaran hullform and Austal's industry-leading MARINELINK monitoring and control system.

Bañaderos Express also features class-leading interior amenities and facilities, including multiple bars, kiosks, a retail shop and children's play area. The vessel will operate on Fred. Olsen Express' Santa Cruz, Tenerife, and Agaete, Gran Canaria, routes in the Canary Islands.

Austal Philippines launching *Bañaderos Express* using their recently-acquired floating dock (Photo courtesy Austal Philippines).

Bañaderos Express afloat for the first time (Photo courtesy Austal Phillipines)

New Army Watercraft to be built in Cairns

It was announced on 24 March that two North Queensland businesses will build seven new watercraft as part of the Commonwealth Government's commitment to strengthening the Australian Army's amphibious capability.

The vessels, which will be built locally in Cairns, will assist Army amphibious operations and support systems.

The Acting Minister for Defence, Senator the Hon. Marise Payne said that the watercraft will replace Army's water safety and inshore hydrographic capability.

"The vessels will provide dedicated and agile watercraft for survey, safety, planning and command and control," Minister Payne said.

"These important watercraft will enable the Army to safely conduct a range of amphibious training activities and operations, which is a critical capability for the ADF."

Tropical Reef Shipyards and BME NQ will manufacture the 7.5 m vessels, and provide spares and trailers, as well as operator and maintainer training.

The watercraft will be based on a Chris Tucker Marine Design product, at a cost of $4.05 million.

Defence Innovation Investment in Veteran-owned NSW Company

It was announced on 24 April that the Commonwealth Government has invested $7.35 million in a veteran-owned NSW company's project to support the development of its next-generation, high-performance watercraft.

A prototype of The Whiskey Project Group's new tactical watercraft during trials on Sydney Harbour (RAN photograph)

The Minister for Defence Industry, the Hon. Melissa Price MP, welcomed the investment in The Whiskey Project, one of the biggest from the Government's Defence Innovation Hub.

"This sort of investment in Australian defence industry is critical to growing a sustainable and globally competitive sovereign defence industry," Minister Price said.

The Whiskey Project integrates cutting-edge technologies and a highly innovative hull form in the design of its new tactical watercraft.

Existing forms of tactical watercraft, like rigid-hulled inflatable boats (RHIBs), are used by the Royal Australia Navy to provide high-speed interception and boarding capability.

The small maritime design and manufacturing firm's watercraft will incorporate composite material technology and a novel 'sea blade' hull which provides enhanced stability, and reduced shock and vibration, that could be adapted to meet multiple Defence needs.

"This investment will support The Whiskey Project's development of local naval design and manufacturing know-how which translates to an advantage for the Australian Defence Force and strengthens our performance in maritime operations," Minister Price said.

New Contract for Incat Tasmania

On 25 March Incat Tasmania and leading South Korean coastal passenger transport company Seaworld Express Ferry announced an order for a new-generation fast ferry.

The 76 m bespoke high-speed wave-piercing catamaran ferry will accommodate up to 700 passengers and 79 cars when it enters service on the new route between Jindo and Jeju, South Korea, early in 2022.

A Southern Korean state-sponsored service, Seaworld Express Ferry, was selected as operator for the route in recognition of its past track record, current financial health and superior business plan.

Seaworld Express Ferry Chairman, Hyuk Young Lee, said "We were most impressed with Incat Tasmania's modern shipyard facilities, the advanced passenger safety systems incorporated into the Incat Tasmania design, the very high levels of on board passenger comfort and indeed, the yard's record for on-time and on-budget deliveries with some of the lowest warranty claims in the fast ferry industry."

"As the leading ferry operator in South Korea, it is this world-class expertise that led us to select Incat Tasmania for

our new high-speed service and it was an important aspect of our winning tender submission" he said.

Incat Tasmania Chairman, Robert Clifford AO, said that Incat Tasmania is no stranger in Korean waters having delivered its first vessel to the region in 1995, the still highly-regarded *Sunflower*. "With Incat Tasmania's track record in delivering vessels with speed, efficiency, reliability and superior seakeeping, the client was moved to inspect the Incat Tasmania-built 112 m high-speed ferry *Natchan Rera* trading in Taiwan in mid-2019" he said.

"Impressed with how much more advanced this wave-piercing catamaran was compared with other vessels operating in South Korean waters, Seaworld Express Ferry knew immediately that taking this Incat Tasmania design and production expertise and applying it to a customised bespoke vessel would represent a significant step change for South Korean high-speed ferry operations."

An impression of the 76 m ferry to be built by Incat Tasmania for Seaworld Express Ferry of South Korea
(Image courtesy Incat Tasmania)

The new 76 m vessel will be radically different from the 74 and 78 m vessels which were the world's first vehicle-carrying high-speed catamarans in the early 1990s and for which Incat Tasmania became well known around the world.

Benefitting from Incat Tasmania's recent redesign of its tried-and-proven hullforms, incorporating a completely new bow arrangement, the ferry will lead the market in terms of seakeeping for vessels of its size.

Incat Tasmania CEO, Tim Burnell, said "With a significant improvement to both the waterline length and vessel trim compared with those earlier craft, the 76 m ferry will also benefit from vastly improved speed and fuel consumption. The new design, by Revolution Design, very much reflects thirty years of experience building market-leading high-speed vehicle-passenger ferries."

"There is an increasing recognition among discerning operators like Seaworld Express Ferry that Incat Tasmania is not only providing fantastic value for money but we are also delivering on the client's vision for a high-quality vessel which offers the finest passenger experience, industry leading in-service operational uptime and the lowest incidence of warranty issues."

In these extraordinary days, this new order is good news for both Incat Tasmania and Seaworld Express Ferry.

"Seaworld Express Ferry has made a strategic investment to secure the transport rights of local Jeju residents and tourists, thereby making a significant contribution to the revitalisation of the local economy" Tim Burnell said.

"At Incat Tasmania we are fortunate to have the best quality, most highly experienced workforce in the global fast ferry industry and we are pleased to add this new vessel to the three already under construction for customers around the world."

The general particulars of the new ferry are

Length	75.7 m
Breadth	20.6 m
Draft	2.35 m
Deadweight	300 t
GRT	3000
Passengers and crew	700
Cars	79
Speed	42 kn

Type 26 Blocks Become a Ship

The aft block of the future HMS *Glasgow*, the first City-class Type 26 frigate being built for the Royal Navy, has been rolled out of the build hall to join the forward block at BAE Systems' shipyard on the River Clyde.

In a busy period for HMS *Glasgow*, teams at the Govan shipyard prepared and completed a series of complex manoeuvres to bring the aft block out of the build hall and into position to meet the forward block. This significant moment brings the two blocks together and, for the first time, the full size, scale and the lines of HMS *Glasgow* are out in the open.

The aft block contains the versatile mission bay and hangar which is capable of supporting helicopters, boats, mission loads and disaster-relief stores, while the flight deck is capable of landing a Chinook helicopter for transport of embarked forces.

HMS *Glasgow* is the first in a new generation of cutting-edge Type 26 frigates, designed and built in her namesake city. Australia's Hunter-class frigates and the new Canadian Surface Combatant will be based on this design.

HMS *Glasgow* taking shape in Scotland
(Photo courtesy BAE Systems)

Major Maintenance of HMAS *Canberra* Completed

The recent completion of HMAS *Canberra's* maintenance is the first time an operation on such a scale has been performed in Australia.

Capability Acquisition and Sustainment Group's Head of Maritime Systems, Rear Admiral Wendy Malcolm, said that successful completion of the maintenance period at Fleet Base East in Sydney was testament to the collaboration between Defence and Australian industry.

RADM Malcolm said that the maintenance period of the landing helicopter dock (LHD), undertaken at the Captain Cook Graving Dock, was a challenging undertaking.

Ready for undocking — HMAS *Canberra's* new pods have four bladed propellers. The ship's original propellers had three blades (RAN Photograph)

"This task was particularly complicated, not just because of the sheer size and weight of the equipment, but also because this has never been undertaken in Australia, and all while in a COVID-19 environment," RADM Malcolm said.

"HMAS *Canberra* had her two pods and associated propellers replaced and she returns to Navy service in great shape with some much improved capabilities.

"The magnitude of this undertaking exemplifies the commitment of so many people, including prime contractor NSM and our own Amphibious Combat and Sealift Enterprise," she said.

RADM Malcolm said that the pod replacement entailed intrusive internal work and significant preservation activities, but also required a large number of support structures and accessories which were designed and constructed locally, in order to complete the installation.

"The Australianisation of the supply chain and upskilling of the local Siemens technicians has also been a real highlight of the project, underscoring our commitment to a sovereign shipbuilding and sustainment industry," RADM Malcolm said.

"A naval maintenance operation of this scale has never before been undertaken in this country's history, from the design and manufacture of a range of supporting equipment, the complicated logistics of delivering the huge pods and propellers and, finally, to a suite of engineering and sustainment challenges involved with conducting a task of such large proportions."

Similar work will soon be undertaken on HMAS *Adelaide*.

TT Line Contract Signed

On 14 April 2021, the Premier of Tasmania granted permission for the Tasmanian TT-Line Company to sign a contract with Finnish shipbuilder Rauma Marine Constructions for the construction of two car and passenger ferries for the Bass Strait service. On 15 April, both parties signed the contract. The signing ceremony took place remotely via video conference.

The recent agreement brings RMC's total number of shipbuilding projects underway at the shipyard to four: two

HMAS *Canberra* undocking after an extended period in the Captain Cook Graving Dock in Sydney (RAN Photograph)

An impression of the new ferries to be built for TT-Line
(Image courtesy Rauma Marine Constructions)

car and passenger ferries for TT-Line Company, a car and passenger ferry, *Aurora Botnia*, for the Finnish shipping company Wasaline, and a car and passenger ferry, *MyStar,* for the Estonian shipping company Tallink, as well as four multi-purpose corvettes for the Finnish Defence Forces.

The construction of the car and passenger ferries for TT-Line will begin in the northern spring of 2022 and the vessels will be constructed alongside the multi-purpose corvettes for the Finnish Defence Forces. The first of the vessels will be delivered to TT-Line at the end of 2023 and the second at the end of 2024.

Xin Hai Yun and *Xin Hai Jun* from Incat Crowther

Incat Crowther has announced the launch of two Incat Crowther 40s for Zhuhai Fast Ferry Company. *Xin Hai Yun* and *Xin Hai Jun* were built by Afai Southern Shipyard in Guangzhou, People's Republic of China, and delivered in December 2020. They represent the next generation of sleek, fast, low-fuel-consumption ferries operating in the Pearl River Delta region.

Afai Southern Shipyard's winning bid for the project was underpinned by the partnership's ability to deliver a high-speed low-fuel-consumption vessel which offers a step change in passenger experience.

Xin Hai Yun and *Xin Hai Jun* each accommodate 199 economy-class passengers on a single deck, with VIP passengers having a dedicated cabin on the upper deck. The main passenger deck features all amenities aft to maximise crew comfort and deliver an open, airy cabin with clean forward visibility.

The Incat Crowther 40s are powered by twin MTU 12V2000 M72 main engines driving Rolls-Royce Kamewa S71-4 waterjets.

The vessels utilise Incat Crowther's latest hullform, featuring a unique reverse-bow design which optimises hull efficiency and seakeeping characteristics, delivering reduced operating costs and exceptional passenger comfort. This proven hullform has been rigorously tested in service and continues to support Incat Crowther in delivering leading designs throughout the industry.

Incat Crowther has delivered over 50 ferries currently in operation in the People's Republic of China.

Principal particulars of *Xin Hai Yun* and *Xin Hai Jun* are

Length OA	42.8 m
Length WL	40.8 m
Beam OA	10.0 m
Depth	3.20 m
Draft (hull)	1.20 m
Passengers	199
Crew	7
Fuel oil	7000 L
Fresh water	1000 L
Sullage	1000 L
Main Engines	2×MTU 12V2000 M72 each 1440 kW @ 2250 rpm
Propulsion	2×Rolls-Royce Kamewa S71-4 waterjets
Construction	Marine-grade aluminium
Flag	People's Republic of China
Class/Survey	CCS

Port side of *Xin Hai Yun*
(Image courtesy Incat Crowther)

Valkyrie and *Wotan* from Incat Crowther

Incat Crowther has announced the sale of the first two WindFlex-27 crew-transfer vessels built by Penguin Shipyard, a unit of Singapore-based Penguin International Ltd. To be named *Valkyrie* and *Wotan*, the vessels will be delivered to Opus Marine GmbH and will start working with Orsted in Taiwan shortly.

Built as stock vessels, the WindFlex-27 is yet another successful co-operation between Incat Crowther and Penguin. The latest project follows on from the successful joint development of Penguin's Flex Ferry X, a stock passenger ferry.

The WindFlex-27 is a development within Incat Crowther's Sea Sherpa design portfolio. In addition to European flag-state compliance, Incat Crowther's Sea Sherpa designs are fully compliant with US, Taiwan and Japanese flag-state requirements.

The WindFlex-27 offers excellent speed, deadweight and seakeeping, making them capable of many roles in the offshore wind industry. The design's 27 m by 9 m platform sports a deadweight capacity in excess of 50 t, offering considerable versatility in terms of fuel and deck cargo transfer.

The vessel features two working decks. A large working deck forward can accommodate up to four 10 ft containers or two 20 ft containers and is equipped with a deck crane. The aft deck can accommodate a 10 ft container. Both decks feature multiple tie-down points for flexibility, accommodating every possible requirement for spares and equipment.

Inside the main cabin is a large wet room with multiple showers, toilets and lockers. The main-deck passenger space is large and open, with forward visibility, seating up to 24 personnel in comfortable business-class seats.

The upper deck features an elevated wheelhouse with commanding views over the bow for safe transfer operations. Behind the wheelhouse is a crew space with mess, bathroom and twin cabin.

The twin hulls feature two single crew cabins per side and bathrooms. All accommodation is MLC compliant.

The designs all benefit from the use of Incat Crowther's resilient bow technology (patent pending), a bow fendering system designed to maximise vessel wave-height transfer capability whilst minimising impact loads.

Port bow of *Wotan*
(Image courtesy Incat Crowther)

Bow view of *Wotan*
(Image courtesy Incat Crowther)

Valkyrie and *Wotan* are powered by quad Scania DI16 077M diesels, with each engine producing 662 kW. Propulsion is via quad Hamilton 521 waterjets, enabling the vessel to achieve speeds of up to 30 kn. The waterjets utilize Hamilton's JETanchor system fitted as standard, offering excellent station-keeping characteristics.

At the same time, Incat Crowther can announce that Farra Marine has confirmed their second vessel with Penguin Shipyard which will be delivered in the first quarter of 2022. The first vessel ordered in 2020 is already nearing completion.

While the Farra Marine CTVs share the same propulsion as *Valkyrie* and *Wotan*, capitalizing on the WindFlex-27 platform's flexibility, the former have been extensively customised to meet the client's unique requirements.

The design is ready for multiple propulsion options as well as parallel hybrid integration.

Penguin Shipyard has a further two WindFlex-27s under construction and currently available for sale.

Principal particulars of the WindFlex-27 are

Length OA	27.1 m
Length WL	24.9 m
Beam OA	9.00 m
Draft (hull)	1.40 m
Depth	3.85 m
Personnel	Up to 24
Crew	6
Fuel oil	35 500 L
Fresh water	3500 L
Sullage	2500 L
Deadweight	50 t

Main engines		4×Scania DI16 077M each 662 kW @ 2300 rpm
Propulsion		4×Hamilton HM521 waterjets
Generators		2×Cummins Onan 40MDDCF
Speed	(service)	27 kn
	(maximum)	30 kn
Construction		Marine-grade aluminium
Flag		UK/Germany/Taiwan/Japan
Class/Survey		BV I ✠ HULL • MACH, WIND FARM SERVICE SHIP SDS — SO, Sea Area 3

Kilimanjaro VIII from Incat Crowther

Incat Crowther has announced a contract to design a 53 m catamaran passenger ferry for Azam Marine of Tanzania, Africa, to be named *Kilimanjaro VIII*. The vessel will be longer and wider than the 2019-delivered *Kilimanjaro VII*, measuring 53 m by 12.5 m, and passenger capacity increases to 654.

Kilimanjaro VIII will continue the use of the operator's trademark parallel-boarding system, whereby five ramps per side load passenger and cargo in segregated flows. VIP and Royal class passengers board into a discreet stair tower leading directly to the upper-deck cabin, whilst economy passengers load separately aft and midships. The fifth ramp is dedicated to luggage-trolley movements. This well-proven boarding system ensures that passenger classes and luggage trolleys remain separated, reducing turnaround time and improving safety, whilst providing exclusivity for premium passengers.

The new design will seat 340 passengers in the main-deck economy cabin, whilst the mid-deck cabin seats 36 VIP passengers and 12 Royal class passengers in full lie-flat seats. The remainder of the mid-deck seats 266 economy class passengers.

The luggage room houses up to 10 t of luggage and cargo, whilst IMO HSC code-compliant stability enhances her safety credentials.

Kilimanjaro VIII will feature a modern evolution of the fleet's style, with an edginess to her lines and a long, sleek profile. Combined with the introduction of a reverse-bow hull configuration, the vessel offers passengers a state-of-the-art ride.

The vessel will be powered by a pair of Cummins QSK95-M main engines. These will be rated to deliver more power to carry the increased payload over *Kilimanjaro VII*, which was the first fast passenger vessel to utilize this configuration. The large twin-engine solution is an effective way of providing more speed and low fuel burn whilst avoiding the through-life cost and complexity of a four-engine power train. Engine room accessibility is improved over a four-engine arrangement, and maintenance and operational requirements are reduced. Additional dividends are realised in the routing and a reduction in the duplication of systems.

Kilimanjaro VIII will be the eleventh Incat Crowther-designed vessel for the operator and the eighth built by Tasmanian builder Richardson Devine Marine Consructions. Not only is the newbuild a sign of increased post-COVID confidence in the passenger market, but it is also an ongoing demonstration of Azam's confidence in the designer and builder.

Starboard bow of *Kilimanjaro VIII*
(Image courtesy Incat Crowther)

Principal particulars of *Kilimanjaro VIII* are

Length OA		53.0 m
Length WL		51.0 m
Beam OA		12.5 m
Depth		4.35 m
Draft (hull)		1.50 m
Passengers		654
Crew		10
Fuel oil		18 600 L
Fuel Oil		4000 L (day tanks)
Fresh water		2000 L
Sullage		3000 L
Main engines		2×Cummins QSK95-M each 2983 kW @ 1800 rpm
Propulsion		2×Kamewa 80-S4 Waterjets
Generators		2×Cummins 6-CP 136DM/5 1×Onan 17.5 MDKR/12503 (harbour)
Speed	(service)	34 kn
	(maximum)	37 kn
Construction		Marine-grade aluminium
Flag		Tanzania
Class/Survey		DNV/NSCV Class 1C

Wayfinder from Incat Crowther

Incat Crowther and YCTS Ltd have announced that the second vessel in the ShadowCat range, *Wayfinder*, has been delivered. *Wayfinder* builds on the exceptional capability of *Hodor* which was delivered in 2019.

Wayfinder has a 68 m length, 14 m beam and 2.40 m draft which permits close coastline navigation. Features include a fully-certified helipad and helicopter hangar, with accommodation and storage over four decks. *Wayfinder* has an impressive carrying capacity which includes a helicopter, five large tenders, jet skis and more. In addition to an 18 crew capacity, the vessel also serves as accommodation for up to 14 extra crew and service personnel.

ShadowCat *Wayfinder* was designed by Incat Crowther and YCTS Ltd, with construction by Astilleros Armón at their Burela shipyard in Spain.

"Custom-designed to exceed exacting standards in every way, *Wayfinder* leads the industry in terms of capacity, capability, safety and performance," said Robert Smith, Director of YCTS Ltd. "Additionally, this latest ShadowCat was delivered on time in a challenging supply chain and economy. We are proud to deliver this incredible vessel

and to continue raising the bar for bespoke shadow-vessel concepts and designs across our industry."

Dan Mace, Technical Manager of Incat Crowther, reports "This latest highly-capable vessel features an innovative catamaran hull which offers 60 percent more deck space and 40 percent more volume capacity, allowing ultimate flexibility and operational efficiency." Of Wayfinder's efficient and stable hull, Mace says "The high speed and low fuel consumption are impressive. The design offers a stable platform for the safe transfer of guests from helicopter, via tenders. The hull provides a 70 percent increase in stability for loading and off-loading its equipment and tenders."

Bird's-eye view of *Wayfinder*
(Photo courtesy Incat Crowther)

Starboard bow of *Wayfinder*
(Photo courtesy Incat Crowther)

Wayfinder's hulls are occupied by a multitude of service spaces including waste management and treatment, tech stores, laundry, workshops and stores.

In a unique design for modern support vessels, this model will meet or exceed IMO Tier III emissions guidelines and has innovative green technology to reduce its impact on the environment by providing a zero-discharge operational capability. An onboard treatment plant cleans all wastewater discharged to a drinkable quality, wet and dry waste is also fully treated onboard to allow the vessel to operate with a zero-discharge policy, to meet a "leave no trace" philosophy.

Wayfinder is the latest example of the ShadowCat range, demonstrating flexibility and capability. The ShadowCat line of bespoke support yachts was designed by catamaran design expert Incat Crowther and yacht industry authority YCTS Ltd. Established in 2018, the working partnership has successfully completed two bespoke ShadowCat vessels, the award-winning 66 m *Hodor* and 68 m *Wayfinder*. Both vessels are products of respected Spanish shipyard Astilleros Armón. More information about ShadowCat can be found at www.theshadowcat.com.

Reef Resilience from Incat Crowther

Incat Crowther has announced the launch of *Reef Resilience*. Delivered by Norman R. Wright & Sons, the new generation Incat Crowther 24 patrol boat will join *Reef Ranger* in protecting the Great Barrier Reef. *Reef Resilience* will service the southern region of the reef from her home port in Gladstone, whilst *Reef Ranger* will continue to service the northern region from Cairns, meaning that the entire reef will now benefit from the capability and operability which this class of vessel offers. The vessels' remit includes compliance monitoring, marine park and island national park management, and diving and research operations. The vessels will also operate in remote offshore waters within the Australian EEZ for extended periods of up to three months.

Incat Crowther collaborated with the Queensland Department of Environment and Science (DES) to optimise the latest design with a focus on operational efficiency. The most significant enhancement is immediately apparent, with the vessel sporting a new hullform.

"The new hull is designed to handle Queensland conditions up to 200 n miles from the coast with strong winds and 3 m significant wave heights." reports Dan Mace, Incat Crowther's Technical Manager. "Long transits at 20 kn in these seas can lead to uncomfortable slamming on a vessel of this size but, with this latest hullform, we have been able to eliminate this, making for a smoother ride and enhanced crew comfort."

Computational fluid dynamics (CFD) was used to optimise the hull, and the performance was independently verified by speed and seakeeping tests at the Australian Maritime College's towing-tank facilities. Powered by twin MAN D2862 LE463 main engines, *Reef Resilience* easily cruises at 20 kn at efficient RPM and impressively-low fuel burn. Recent sea trials saw a top speed of 27 kn. Humphree interceptors with auto trim and active ride control are utilised to increase comfort for crew.

Combining the hull performance with the increased internal space afforded by its large beam, *Reef Resilience* offers capability unparalleled in a vessel of her size.

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

Starboard quarter of *Reef Resilience*
(Photo courtesy Incat Crowther)

The vessel is constructed and fitted out to a very high standard by Norman R. Wright & Sons. The fit out focused on the use of lightweight construction techniques to keep the vessel's displacement in check whilst maintaining a robust hull structure.

A 6.2 m RHIB tender is fitted in a fast-launch cradle between the hulls aft, with the ability to launch whilst underway at 6 kn in offshore sea conditions of 3 m significant wave height. The upper-deck cargo area is rated to 1 t/m^2 and is designed to accommodate two 4.4 m RHIB tenders and one 5.5 m work barge.

Operational flexibility is provided by large transom platforms which allow the tenders to tie up to the mothership in between tasks.

Energy efficiency is aided by 6 kW of roof-mounted solar panels to maximise the use of available renewable energy and reduce environmental impact.

Reef Resilience is the second Incat Crowther-designed vessel for the Marine Parks fleet. Two more vessels are under construction, a 17 m patrol boat and a recently-signed 20 m landing craft. Incat Crowther is proud of its collaboration with the Department of Environment and Science and joint contribution to the success of the Great Barrier Reef Field Management Program.

Principal particulars of *Reef Resilience* are

Length Measured	23.99 m
Length WL	24.86 m
Beam OA	9.50 m

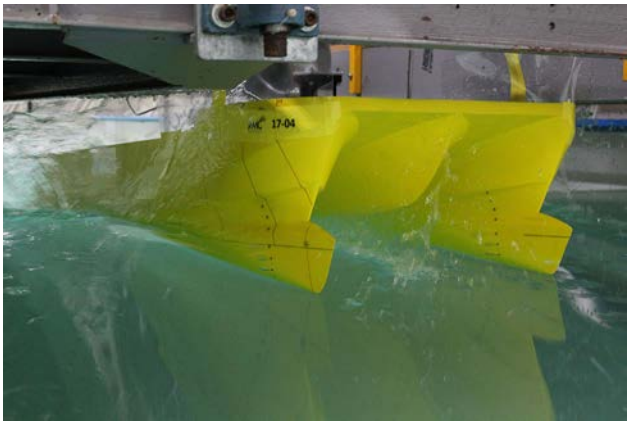
Fast-launch cradle and RHIB on *Reef Resilience*
(Photo courtesy Incat Crowther)

Solar panels on the upper deck of *Reef Resilience*
(Photo courtesy Incat Crowther)

Depth		3.95 m
Draft	(hull)	1.68 m
	(propellers)	2.28 m
Passengers		14
Crew		14
Fuel oil		18 000 L
Fresh water		3000 L
Sullage		1500 L
Main engines		2×MAN D2862 LE463 each 749 kW @ 1950 rpm
Propulsion		2×Fixed-pitch propellers
Generators		2×Cat C4.4 each 69 ekW @ 50 Hz
Speed	(service)	20 kn
	(maximum)	27 kn
Construction		Marine-grade aluminium
Flag		Australia
Class/Survey		NSCV Class 2B (14 pax)/1C (28 pax)

Stewart Marler

Galley facilities on *Reef Resilience*
(Photo courtesy Incat Crowther)

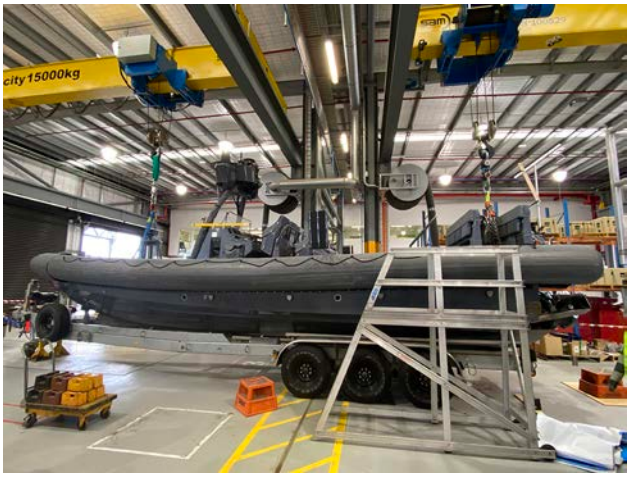


Seakeeping tests on *Reef Resilience* at the Australian Maritime College
(Photo courtesy Incat Crowther)

11 m RHIB Inclining Experiment by John Butler Design

John Butler Design undertook an inclining program on an 11 m SFAD rigid-hull inflatable boat (RHIB) for Hydrographic SPO. As part of the inclining program, a water inclining was undertaken in addition to an air inclining to assess the suitability of the air-inclining method for small boats with lifting lugs.

Inclining of 11 m RHIB in water
(Photo courtesy John Butler Design)



Inclining of 11 m RHIB in air
(Photo courtesy John Butler Design)

Traditionally, inclining weights are moved transversely while the vessel is floating free in water; with a known induced heeling moment, the vertical centre of gravity of the vessel can be determined by measuring the response of the vessel to that heeling moment. The air inclining followed the same process of weight movements; however, the vessel was supported by slings attached to the forward and aft lifting lugs.

Several methods were employed during the air inclining to measure the angular deflection of the RHIB after each weight movement; a traditional suspended pendulum with tick strip, measuring the movement of the transom, and measuring the change of water level in several transverse water tubes placed across the RHIB.

On this vessel, the results of the water inclining were determined to be more accurate than the air inclining. However, the air inclining was deemed to be a promising method for small vessels, adopting lessons learned from this experience.

Both inclining experiments consisted of solid and liquid state surveys to determine the mass of the RHIB. Freeboard readings were undertaken for the water inclining and a load-cell measurement was undertaken for the air inclining to determine the inclined and lightship masses of the vessel.

[*For more details of air inclining procedures, see SNAME's T&R Bulletin 9-1, Standard Guide for Conducting Small Boat Air-Inclining Stability Test*—Ed.]

P&O Vessels update to Stability Books by John Butler Design

With the introduction of *Pacific Encounter* (ex-*Star Princess*) into the P&O family in May 2021, the ship underwent a refit to align it with the P&O brand. As a result, all statutory plans were required to be updated with ship and restaurant name changes.

John Butler Design was tasked with updating all statutory drawings including the General Arrangement, Life-saving Appliances Plan, Structural Fire Protection Plan, Fire and Damage Control Plans, Capacity Plan, Escape Plan and Evacuation & Abandonment Plan. Each drawing was checked against rule requirements to ensure that all changes were compliant.

Due to the increased passenger and crew capacity, John Butler Design also undertook escape calculations to ensure that all passageways and stairs remained compliant.

Inclining experiment on *Pacific Explorer*
(Photo courtesy John Butler Design)

Draft measurement on *Pacific Explorer*
(Photo courtesy John Butler Design)

Following the successful lightship surveys in accordance with statutory regulations, John Butler Design was also tasked with updating the stability books of *Pacific Jewel, Pacific Aria, Pacific Eden, Pacific Dawn* and *Pacific Explorer*. These were reviewed and approved by MCA for continuing safe operation of each vessel.

Mischief AMSA Survey by John Butler Design

In partnership with Australian Superyachts and Slipstream Marine, John Butler Design assisted with *Mischief*'s commercial survey approval, which was recently finalised. The vessel has an overall hull length of 52.45 m, making it the largest luxury yacht in Australian commercial survey, and can carry up to 200 passengers.

The John Butler Design team undertook a gap analysis to determine changes required to the vessel and additional documentation required for AMSA plan approval.

On arrival of the vessel in Newcastle on the vessel *Biglift*, John Butler Design undertook a draft mark survey on the vessel to confirm the location and accuracy of the draft marks. Following launching, a lightship survey was also undertaken, the results of which were used to calculate the vessel's lightship displacement and to update the vessel's stability book.

The vessel was designed, constructed and is in current survey to Registro Italiano Navale (RINa) commercial regulations. As RINa is a recognised IACS signatory, the RINa approval can be used to demonstrate compliance for matters pertaining to the structural integrity, machinery arrangement, electrical and associated systems of the vessel.

Other facets of the design needed to be assessed to AMSA specific regulations; these relate primarily to the general arrangement, safety and stability.

John Butler Design surveyed the vessel and prepared an approved set of drawings for submission to AMSA in support of the vessel's application for certificate of survey. This set included a General Arrangement Drawing, Fire and Safety Plan, Emergency Plan, Damage Control Plan and Draft Marks Plan. The intact and single-compartment damaged stability of the vessel was also assessed, and an approved stability report submitted to AMSA.

Mischief on board *Biglift* in Newcastle Harbour
(Photo courtesy John Butler Design)

Mischief at Jones Bay Wharf in Sydney Harbour
(Photo courtesy John Butler Design)

The Certificate of Survey was recently issued to *Mischief*, finalising the process to place the vessel into commercial survey under AMSA.

John Butler

THE PROFESSION

Survey Matters

Survey Matters is AMSA's e-Newsletter relating to domestic commercial vessel (DCV) survey and is published approximately six times per year. You can request placement on the mailing list by emailing DCV Survey <dcvsurvey@amsa.gov.au>. The e-Newsletters (including August 2020) are now also available online at https://www.amsa.gov.au/news-community/newsletters#collapseArea612

Items included in the March 2021 e-Newsletter included:

- Large file transfer
- What to do if you receive a complaint about a survey
- Owner's responsibilities under Marine Order 503
- Fibreglass sheathing of timber vessels
- Recommendations from the investigation into the loss of the passenger vessel *Conception*
- Battery safety
- Material alert
- Have your say on the new standard for watertight and weathertight integrity

The article on *Large File Transfer* is reproduced below.

Phil Helmore

Large File Transfer

On occasion, we have previously received reports from accredited surveyors via a Dropbox or Google Drive link. Our IT department has advised us not to access these files for security reasons.

AMSA has a file transfer protocol (FTP) site available for use by accredited surveyors. If you need to send large files, then please contact us via <DCVSurvey@amsa.gov.au> and we will provide you with temporary access to upload your files.

Survey Matters, March 2021

EDUCATION NEWS

UNSW Canberra

We are pleased to announce that our Naval Architecture program has now passed successfully through the University's Academic Board processes and that it will soon be publicly listed (by UNSW and the Universities Admissions Centre). Subsequently, UNSW enrolment applications will open in the second half of the year for new and transferring students. We will also be seeking provisional accreditation of our program from Engineers Australia in August.

At UNSW Canberra, the Naval Architectural program runs in parallel with Mechanical Engineering for the first two years. Thus, the specialist Naval Architecture courses reside in third and fourth year of our program. This leads to an arrangement whereby students who satisfy the requirements of the first two years of an accredited Mechanical Engineering four-year degree program at any Australian tertiary institution may seamlessly be admitted into third and fourth year of our program leading to the award of a Bachelor of Engineering degree in Naval Architecture from UNSW Canberra. This arrangement might be considered a "2+2 model". Each application will be considered on its merits, recognising that there are some conditions for attending UNSW Canberra to be met. It is expected that some students entering our Naval Architecture program will take advantage of this transfer opportunity.

From a scheduling perspective, we will be teaching the first cohort of year 3 students in the program in 2022. It is noteworthy, then, that these first students will already be, or have been, at university somewhere in Australia. We want to find them and perhaps you can help us in the "match-making" process as we stand up our new program. We have built a program and are looking for students. As a team, we aspire to build a world's best-practice NA program at UNSW Canberra, and we desire, as does Navy, our distinction to be a grey ship focus. This is in line with the Navy sponsorship of the program.

Please do not hesitate to contact me via email (w.smith@unsw.edu.au, or navarch@adfa.edu.au) or by other means if you have any questions or would like to contribute to our endeavour. Your passing this information on to others who may be interested in participating would be appreciated.

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

UNSW Sydney

Graduates

Tamasin Welch takes the honour of being the last student to graduate from the naval architecture degree program at UNSW Sydney. She has completed the program requirements and is expected to graduate shortly with both bachelor's and master's degrees as follows:

Tamasin Welch BE(Hons) Honours Class 2 Division 1 and MBiomedE

Graduates Employed

Tamasin is now employed in the Naval Civilian Engineer Development Program, starting with an orientation in Canberra, followed by a first placement with the Naval Architecture Centre of Excellence Cell in the Directorate of Navy Engineering, Department of Defence, in Sydney (formerly the Ship Structures Cell in the Naval Technical Bureau, Department of Defence) where she completed her industrial training.

Congratulations, Tamasin!

Vale Naval Architecture at UNSW Sydney

UNSW Sydney produced the first graduate of its degree program in naval architecture, Brian Robson, who graduated with his Bachelor of Engineering degree in naval architecture with Honours Class 2 Division 1 on 24 April 1963. The next graduates were David Hill, John Jeremy and Conan Wu in 1967, followed by Philip Hercus and Richard Caldwell in 1968, Laurie Prandolini in 1969, and then half-a-dozen in 1970. Since then there has been a remarkably steady average of around eight graduates per year, with a minimum of three and a maximum of 14.

In all, UNSW Sydney has graduated 415 naval architects, including two who completed all the requirements for the degree but (for various reasons) did not receive a testamur to that effect. Of those, 400 received Bachelor of Engineering degrees, 259 (65%) with honours of one form or another including 14 with the University Medal (the highest undergraduate honour), and 15 received Bachelor of Science (Technology) or Bachelor of Science (Engineering) degrees, five (33%) with merit.

The naval architecture degree program at UNSW Sydney has now closed (the University uses the euphemism "suspended", implying that it could be re-activated if necessary!) but the program is currently being massaged to align with the requirements of the Department of Defence, and will be implemented at UNSW Canberra for Year 3 students in 2022.

Phil Helmore

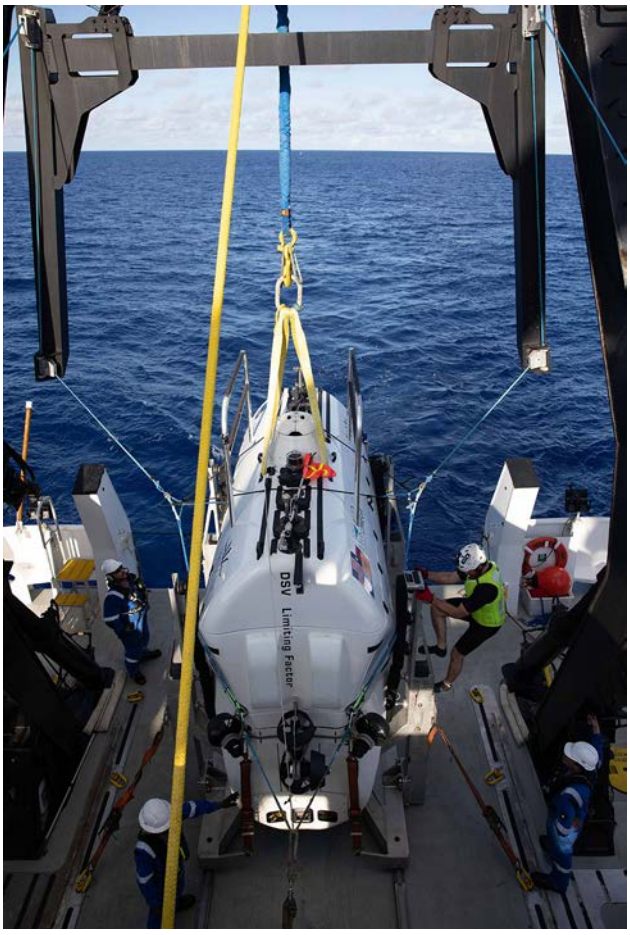
Australian Maritime College

AMC Graduate takes a Deep Dive

On 8 April 2021 Tim Macdonald, a proud Australian and alumnus of the Australian Maritime College, set off alongside good friend Rob McCallum of New Zealand, EYOS Expeditions, in a submersible to dive to the bottom of the Challenger Deep, Mariana Trench. The pair achieved a preliminary depth of 10 925 m at the deepest point of the world's ocean, setting a depth record for both nations as they became the deepest diving Australian and Kiwi ever. The successful dive was announced from *DSSV Pressure Drop*, the expedition's 68 m support ship currently over the Mariana Trench, located 360 kms SW of Guam.

The 12-hour dive was completed in the world's only submersible certified for operations at any depth in any ocean — the DSV *Limiting Factor*. 'The submersible, a Triton 36 000/2 owned by Caladan Oceanic, is the world's only private full-ocean-depth vehicle and is best known as having taken humans to the deepest point in each of the world's five oceans during the world-record-breaking Five

Deeps Expedition in 2019. The two-seat submersible is capable of withstanding pressures of up to 1,400 bar. "That's akin to having 11 000 t/m^2 at full ocean depth. The pressure on the hatch alone is equivalent to a foorce of 22 000 kN or five fully-laden 747s" said pilot Tim Macdonald.



DSV *Limiting Factor*
(Photo courtesy AMC)

"We did spare a thought for Sir Edmund Hillary as we descended through 8850 m (the equivalent height of Everest) and still had another couple of kilometers to go. It's a very long way down and testament to the incredible engineering that has gone into this vehicle, and to the team which supports it" said McCallum.

The dive's primary purpose was to test acoustic navigation equipment which will be used as an aid to deep-ocean research. When operating at extreme depths, researchers need to rely on acoustic telemetry to navigate and know precisely where samples were collected. "It was a busy dive, but we took the time to set a light-hearted world record: the world's deepest ever vegemite sandwich and Anzac biscuits, which is something only Australasians really understand" said Tim Macdonald.

The pair conducted a series of technical acoustic tracking exercises and ran a 2000 m long high-definition camera transect. During the dive the submersible interacted with three autonomous 'landers' which had been placed on the seafloor prior to the dive and used its manipulator to collect geological samples. "This privately-funded vehicle is poised to make some of the greatest gains in ocean science. It demonstrates both our new ability to reach into the hadal zone, but also of the importance that private funding will play in the future exploration of the deep ocean."

Rob McCallum (left) and Tim Macdonald
(Photo courtesy AMC)

"Our team includes 14 nationalities and, while we all work together as one team, there is always a special ANZAC bond between Aussies and Kiwis. The team labeled this 'the ANZAC Dive' and the name stuck long before we were given official permission to use it" said McCallum. The team included friends, AMC alumni Reuben Kent and James Keane, who also work with deep-water communications and underwater navigation in their respective roles in Australia. In total, the team has 34 members who work in ship operations, ocean mapping, science, sub technical and outreach.

Tim Macdonald completed his Maritime Engineering degree in Tasmania at the Australian Maritime College and was part of the design-and-build team for the submersible, he is also the Engineering and Operations Lead for Caladan Oceanic's underwater operations. To add to his achievements, he has now qualified as the third-ever pilot of this submersible. "It is a tremendous privilege to be able to operate a vehicle where every dive is into the unknown. This presents some challenges, but it also presents almost limitless opportunities" said Macdonald.

New Zealander Rob McCallum is a 20-year veteran of ocean exploration and is regarded as an expert in deep-water submersible operations. His company EYOS Expeditions has planned, managed and led hundreds of expeditions, including every expedition that has been undertaken by *DSSV Pressure Drop* and her submersible. "This is a remarkable vehicle, a true pathfinder to the last frontier of exploration on Earth — the deep ocean. She will enable us to explore to any depth in any ocean and the discoveries she will make in the future are almost beyond comprehension" said McCallum. "During the dives conducted in March alone, she has traversed 172 000 vertical metres, enabling us to visit a huge part of the ocean which has previously been unseen by scientists"

"It was terrific to have an Aussie and a Kiwi work side-by-side. In that regard it was a very ANZAC dive — two good mates from opposite sides of the Tasman working together under pressure" said Macdonald. "I guess that's what ANZAC is all about" said McCallum.

The team is now headed to Australia to conduct science research deep in the Indian Ocean, a joint project with the Minderoo University of Western Australia Deep-sea center sponsored by Andrew Forrest.

Engineering Scholarship Program to Prepare Future Shipbuilding Workforce

Forty engineering students from Australian universities have been awarded scholarships as part of the Commonwealth Government's plan to grow the pool of engineering talent for naval shipbuilding.

The National Naval Shipbuilding Pipeline Scholarship program provides students from the Queensland University of Technology and the Royal Melbourne Institute of Technology with funded university study.

Facilitated by the Naval Shipbuilding College, the Program also gives the students the opportunity to gain relevant and meaningful work placements and mentoring.

The Minister for Defence Industry, the Hon. Melissa Price MP, said that the Government had a coordinated plan to ensure that Australian workers could capitalise on the generation of jobs to be delivered through Australia's Naval Shipbuilding Enterprise.

"Recipients of the scholarship pilot program will be supported to study various engineering disciplines which will be in high demand as our naval shipbuilding program ramps up," Minister Price said.

"The National Naval Shipbuilding Enterprise is a hugely ambitious nation-building project which will support 15 000 jobs across Australia.

"We must equip our future workforce with the skills required for a long and successful career in the shipbuilding industry while they're still studying."

This year's recipients join 32 students who are already part of the scholarship program.

These students are specialising in disciplines critical to the future of the shipbuilding industry, including computer and software systems, mechatronics, and mechanical, electrical and electronic engineering.

In addition to financial support, the scholarship program provides hands-on experience through an industry work placement component.

"Scholarship recipients have a unique opportunity to immerse themselves in Australia's defence industry and learn practical skills from engineers who are currently working on shipbuilding projects," Minister Price said.

"We have already seen fantastic support from industry, with 12 companies across the country working with the Naval Shipbuilding College to support work placements for 32 previous recipients over the 2020 summer break."

Traineeship Supports Naval Shipbuilding Enterprise

In April the Government launched a new training initiative aimed at securing a steady stream of skilled and qualified workers to support Australia's naval shipbuilding program.

The Government's Naval Shipbuilding College, Naval Group Australia, BAE Systems Maritime Australia and TAFE SA have joined forces to develop The Designer Traineeship.

The Minister for Defence Industry, the Hon. Melissa Price MP, said that the program would help provide shipbuilding industry work placements, with graduates to be equipped with basic shipbuilding design skills.

Host companies of the Designer Traineeship will provide workplace experiences, mentoring, supervision, training and coaching for students.

Upon completion of their traineeship, some graduates may be seconded to Naval Group in France.

"The trainees will have the opportunity to get both study and work experience, while obtaining a shipbuilding Diploma of Engineering — Technical," Minister Price said.

"I'm proud that our Naval Shipbuilding College and TAFE SA are supporting the joint venture by designing the program, a training plan and providing specific shipbuilding context to the course material.

"With the current lack of shipbuilding design work in Australia, this initiative will help develop the skill sets of naval shipbuilding designers through cooperation with a range of experienced shipbuilding companies.

"By 2030, Australia's continuous shipbuilding sector will support 15 000 workers across the nation."

New Naval Shipbuilding Course

A new naval shipbuilding 'taster course' endorsed by Australia's defence industry is set to be rolled out to its first cohort of students across Australia.

The Introduction to Naval Shipbuilding course was developed by the Naval Shipbuilding College and industry and will be delivered through TAFE SA.

The on-line course will be offered by TAFE SA but will be available to students across Australia to learn about the Government's National Naval Shipbuilding Enterprise — including key concepts, terminology and projects.

This will put the students on a pathway to gaining employment within the enterprise.

On 10 April the Minister for Defence Industry, the Hon. Melissa Price MP and South Australian Minister for Education, John Gardner MP, welcomed the specialist new shipbuilding course.

"The booming naval shipbuilding industry offers a wealth of long-term career opportunities for Australians," Minister Price said.

Minister Gardner said that while the course was online and self-paced, there were chat rooms to give students the chance to talk with lecturers and other students to further their understanding.

"Employers will have access to skilled jobseekers who are well prepared to enter the industry," Minister Gardner said.

"The focus is on preparing students for the shipbuilding jobs of the future and ensuring that they have the appropriate skills and experience as the Enterprise expands."

Minister Price said that individuals from outside shipbuilding who completed the course would be exposed to industry-specific training to address the critical skills and knowledge needs of the current and future national naval shipbuilding workforce.

The Introduction to Naval Shipbuilding short course will start in April, with additional courses scheduled for May and June 2020.

INDUSTRY NEWS

Leidos Acquires Gibbs & Cox

On 7 May Leidos Holdings, Inc. announced the completed acquisition of Gibbs & Cox, Inc. for approximately $US380 million in cash. Gibbs & Cox will operate as a wholly-owned subsidiary and will be combined with Leidos' maritime systems division.

Headquartered in Arlington, Virginia, Gibbs & Cox is the largest independent ship design firm focused on naval architecture and marine engineering in the US. The company's world-class naval architects, designers, engineers and program managers develop innovative vessel designs and naval capabilities. The acquisition positions Leidos to provide a broad set of engineering solutions to the US Navy and to an expanding set of foreign navies.

"We are delighted to welcome the Gibbs & Cox team to the Leidos family," said Leidos Chairman and CEO Roger Krone. "Gibbs & Cox is widely regarded for developing the most talented and experienced naval designers in the world. We look forward to this new era of innovation while combining the best of both companies."

"We are excited to join Leidos, whose employee culture and history of innovation strongly mirror our own legendary 91 year history", said Gibbs & Cox President and Chief Executive, Chris Deegan. "Gibbs & Cox will remain the largest independent provider of maritime services in the US. The combination of our world-class naval architecture, design and engineering services with Leidos' speed, security and scale will significantly enhance our combined offerings in the fast-growing maritime undersea, autonomous and cyber-security segments. We look forward to mapping a new Gibbs & Cox with Leidos for the next 90 years."

Gibbs & Cox Australia is based in Canberra, ACT.

Austal to leave Joint Venture in China

Austal has announced that it has commenced discussions with Guangdong Jianglong Shipbuilding Company (Jianglong Shipbuilding) of Zhuhai, China, to sell Austal's 40% shareholding in the Aulong Shipbuilding Co. Ltd (Aulong), a shipbuilding joint venture operated by the two companies, to Jianglong Shipbuilding.

Jianglong Shipbuilding already owns the other 60% of Aulong.

A letter of intent has been executed by the parties targeting completion of the negotiations by 31 October 2021. Aulong was established in June 2016 with the aim of pursuing commercial passenger and non-military vessel opportunities in mainland China.

Austal (with 40% ownership) has licensed a number of its proven, commercial aluminium vessel designs for marketing throughout mainland China and construction at Jianglong Shipbuilding's established facilities in Guangdong province. Jianglong Shipbuilding (with 60% ownership) brings local shipbuilding infrastructure, experience and expertise, with close to 1000 employees across two shipyards supporting the joint venture.

Government and Naval Group secure a win for Australian Industry

It was announced on 23 March that the Future Submarine Program has reached a major milestone with the conclusion of negotiations between Defence and Naval Group for the amendments to the Strategic Partnering Agreement.

This will see Naval Group's commitment to spend at least 60% of the contract value in Australia over the life of the program reflected formally in the Strategic Partnering Agreement, supporting Australian jobs in the defence industry.

The amendments ensure that the achievement of Naval Group's commitment is now a contractual obligation, measured during the course of the program, driving Australian industry involvement as the Attack-class submarines are designed and delivered.

The Acting Minister for Defence, Senator the Hon. Marise Payne, said that the conclusion of these negotiations reflects the Government's joint commitment with Naval Group to Australian jobs, Australian industry and Australian sovereignty.

"Beyond maximising opportunities for engagement with Australian industry, this will also ensure that the Government's requirement for a sovereign future submarine capability is met," Minister Payne said.

"Importantly, the amendments have been incorporated to uphold the current structure of the Strategic Partnering Agreement, which the Auditor General concluded had established a fit-for-purpose strategic partnering framework which addresses this Government's objectives for the program.

"These include maximising Australian industry involvement in all phases of the program.

"Today's announcement builds on the opportunity for industry to participate in the manufacture of equipment designed by Naval Group worth hundreds of millions of dollars across the 12 boat fleet."

The amendments complement existing requirements under Defence's contractual arrangements with Naval Group to drive Australian industry capability. This includes establishing procurement organisations in Australia, and the need to approach the Australian market in the first instance for the majority of equipment.

Naval Group will continue to report the level of contract expenditure in Australia during the course of the Future Submarine Program.

Launch of Arafura-class OPV Enterprise

On 5 March the Secretary of Defence, Greg Moriarty, together with a large contingent of Defence senior leaders, launched the Arafura-class Offshore Patrol Vessel (OPV) Enterprise and opened the OPV System Program Office at the Henderson maritime precinct.

The OPV Enterprise brings together Commonwealth and defence industry teams under one roof, to build and sustain the Royal Australian Navy's new Arafura-class OPVs, the

Attendees at the official opening of the OPV Enterprise Office in front of *Pilbara*, which is currently under construction at the CIVMEC Henderson Shipyard in Western Australia
(RAN photograph)

first two of which are being constructed in South Australia, with the remaining 10 vessels to be built in Western Australia.

"It is great to see the co-location of Commonwealth shipbuilding and sustainment personnel, and Luerssen, CIVMEC and Raytheon industry partners, delivering outcomes for our Navy," said the Deputy Secretary National Naval Shipbuilding, Tony Dalton.

Head Maritime Systems, RADM Wendy Malcolm, said that the establishment of the OPV Enterprise represented an important milestone under the continuous shipbuilding plan.

"The launch marks a critical step towards the implementation of Plan Galileo, an ambitious Future Maritime Sustainment Model which ensures that our sustainment organisation engages with acquisition teams early in the build process," RADM Malcolm said.

"Evolution of our asset management, supply chain, infrastructure, improved commercial models and professionalism across the enterprise will be the key to success.

"This process ensures that sustainment needs are considered during the design phase, and brings together Defence, primes, small business and service providers to facilitate sustainment of our naval vessels from strategically-located ports around the country.

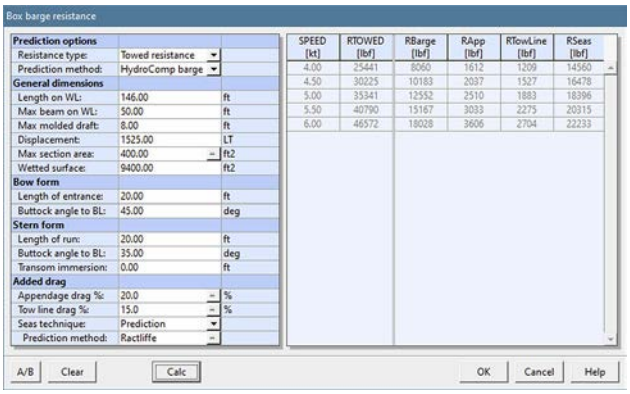
"Not only does this promise to deliver long-term jobs to West Australians and confidence for industry to invest in Perth, but it will also ensure that our Navy is able to meet all Government tasking in order to protect our nation's security."

HydroComp NavCad® 2021 Released

Development in 2021 for HydroComp NavCad offers new features across the range of applications.

Towed Barge Prediction

One of the more component-intensive applications for NavCad is a barge being towed by a tug. Not only do you need to set up the resistance and propulsion for the tug, but the towed barge must also be properly modeled. This includes reliable prediction of the added drags affecting the barge — including appendages (typically skegs), a towline drag supplement, and seas drag. NavCad can now add estimates for appendage drag and towline (with drift) drag. We have also implemented a new added drag in the seas prediction method specifically for barges.



Screen shot of a towed barge resistance prediction
(Image courtesy HydroComp)

New Surface-piercing Propeller Model

This propeller series method was developed by HydroComp from a small family of model tests for cleaver-style wedge-type surface-piercing propellers. Our in-house research also allowed for the development of a new performance metric for a "minimum critical speed", below which SPP propeller performance begins to fall off. This new design criterion can provide information to ensure that the *Vessel-Propulsor-Drive* system running SPPs have the proper gear ratio for the proposed speed and power.

New Electric-motor Drive Module

A major update coming later in 2021 will be a new module for electric motors as the prime mover of NavCad's *Drive* component. Development includes consideration of AC and DC motors, with particular development for easy user definition of standard motor types, such as the popular styles of permanent-magnet synchronous motors (PMSM) found in UVs and other submersibles. A new model for partial load efficiency and current draw will provide engineers and designers with a critical missing piece when conducting trade-off studies, evaluation and validation of trial data, or calculations of operational battery budget.

Enhanced GUI components

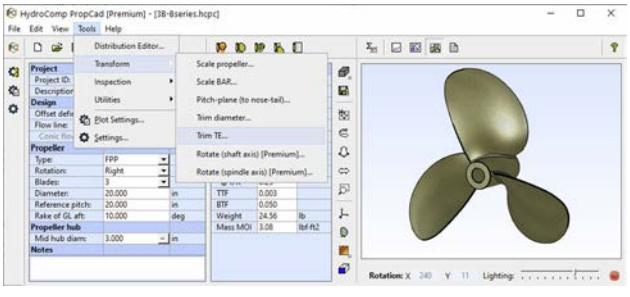
Also for 2021, HydroComp has undertaken a significant in-house initiative to enhance product "look-and-feel" for contemporary themes available in Windows 10. Overall workflow processes will remain comfortable and familiar to users, but with new interface controls and graphs supporting Windows "visual styles".

HydroComp PropCad® 2021 Released

HydroComp PropCad 2021 is the most powerful version of PropCad to date. PropCad has always been the go-to tool for designing marine propellers, 2D drawings, and 3D CAD models — but new features expand PropCad's role into post-delivery modifications such asblade trimming and trailing-edge washback fairing.

PropCad helps engineers and repair professionals accurately plan their cut backs and fairing regions. Reviewing the trimmed geometry in PropCad provides all the critical performance parameters — blade area ratio, mean pitch, and effective blade camber. The trimmed geometry can also be used to generate a new CAD model and 2D drawing of the resulting propeller.

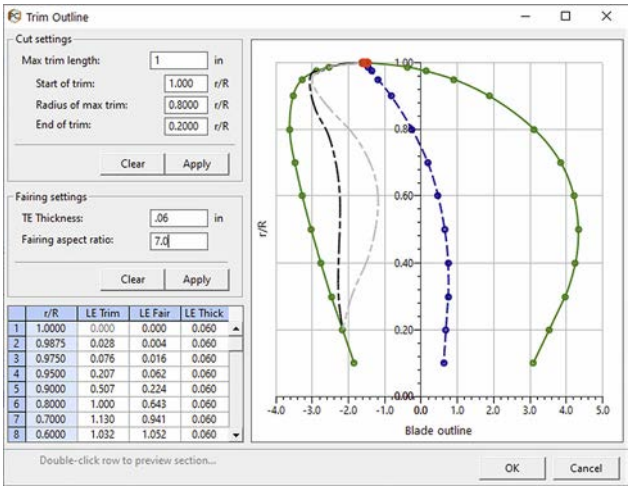
The new trimming utilities can be launched via Tools | Transformations…Blade trimming.



A screen shot showing how to launch the new trimming utilities
(Image courtesy HydroCcomp)

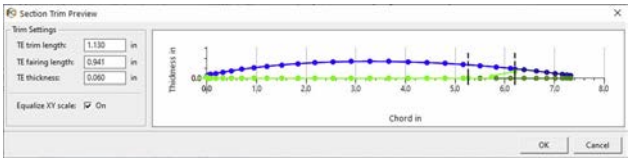
PropCad supports two modes of trimming the blade: diameter trimming and trailing edge cutbacks. The TE Trim utility allows you to visualise trimming in the expanded outline view. The Trim Settings table provides users with a quick and easy way to generate a smooth trim line. The Fairing Settings and Visualisation work in a similar fashion, allowingthe user to specify the resulting edge thickness in the trimmed region and an aspect ratio (removed thickness/ fairing length) to create a smooth region for thickness reduction via surface grinding.

The table contains the trim length, fairing length, and remaining edge thickness for each radial section of the propeller. PropCad users have full control of these values, providing them with a digital analogy of physical templates.



Trim outline screen view
(Image courtesy HydroComp)

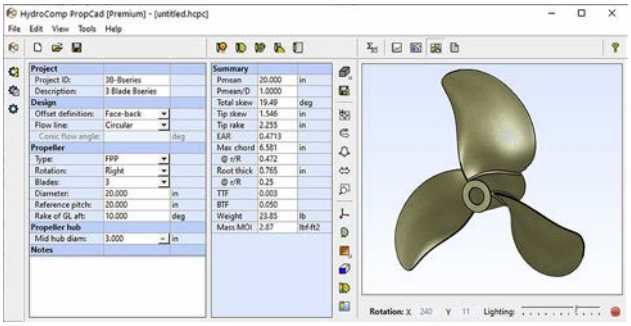
Any of the section cuts can be previewed and modified:



A screen shot of a Section Trim Preview
(Image courtesy HydroComp)

Generate CAD, 2D Drawings, and Reports

After completing the modifications to the blade, the geometry is automatically brought back into PropCad's comprehensive design environment. If any further changes to the propeller are needed, the Parametric Builder and editable Section parameter table provide further control over the design features.



A screen shot showing the Parametric Builder and editable Section parameter table
(Image courtesy HydroComp)

PropCad can export the design to several different CAD formats, including macros for specific CAD programs as well as general-purpose exports like IGES. The 2D drawing and PDF reports are customisable with your logo and company information. The 2D drawing can be exported in PDF and DXF formats.

Wärtsilä seeks Breakthrough in Clean Propulsion

Wärtsilä is participating in a consortium of Finnish research organisations and leading companies researching means for developing radical new solutions for clean and efficient marine and off-road transport. The project is expected to run until spring 2023, and has been granted funding of €7.9 million by Business Finland, the Finnish Government's organisation for innovation funding and trade, travel and investment promotion.

Led by the University of Vaasa, the Clean Propulsion Technologies project addresses tightening emissions legislation and ways by which new technologies can be employed to create sustainable propulsion solutions. Wärtsilä's depth of experience and technical know-how in propulsion systems will play a central role, in particular in establishing a technology roadmap for directing future R&D efforts.

The most significant technological aspects of the anticipated project outcome are a ground-breaking medium-speed engine working in fuel-flexible Reactivity Controlled Compression Ignition (RCCI) mode, the further development of dual-fuel engine technology to enable a drastic reduction in methane emissions at low and partial loads, selective catalytic reduction (SCR) control technology improvements, and the development of machine-learning control technology for greater accuracy in engine automation and control. The research will further focus on developments in advanced after-treatment measures aimed at lowering greenhouse gas emissions by at least 20 percent. Designing and implementing an optimal predictive powertrain control architecture for hybrid propulsion is also on the agenda.

"The common goal is to secure the Finnish powertrain industry's position as a global technology leader by creating a common vision and sustainable business solutions. Wärtsilä is a leading powertrain equipment manufacturer and their expertise, supported and strengthened by that of the other project partners, will play an important role in tackling growing global competition," said Maciej Mikulski, Associate Professor at the University of Vaasa.

"A decarbonised future is essential for the marine industry, and Wärtsilä is an established thought leader as we work towards this target. This project will help us by developing concepts, together with other technology leaders, which will make propulsion even more sustainable than it is today," said Juha Kytölä, Director, R&D and Engineering, Wärtsilä Marine Power.

The Clean Propulsion Technologies project will promote efforts to develop highly-promising innovative powertrain technologies for new products. These developments will be aimed at ensuring compliance with emission and greenhouse gas regulations in the marine and off-road transport segments by 2035. In the longer-term, the goal is to develop a technological roadmap for compliance with the IMO's greenhouse gas emissions reduction target by 2050.

In addition to the University of Vaasa and Wärtsilä, the other project partners are Aalto University, Åbo Akademi University, Tampere University, VTT Research Centre of Finland, Lappeenranta-Lahti University of Technology, AGCO Power, Meyer Turku, Napa, Dinex Finland, Geyser Batteries, Proventia, Bosch Rexroth, and APUGenius.

Wärtsilä Secures Approval in Principle for Cargo Containment System for Liquid CO_2 Carriers

Wärtsilä has conducted a study on the systems and solutions required for Liquid CO_2 Carrier (LCO_2) vessels. Wärtsilä Gas Solutions has developed a cargo tank design suitable for LCO_2 applications, which was recently awarded Approval in Principle (AiP) by the classification society DNV. Since new LCO_2 Carriers are an emerging concept and requires detailed attention during conceptual level, Wärtsilä's experience and know-how in gas cargo and handling systems proved invaluable to the results.

The total cargo capacity of the vessels is 7500 m^3, divided into two containment tanks, each of 3750 m^3. Wärtsilä has carried out an intensive engineering analysis to formulate an optimum design for the vessels' containment system and cargo handling systems, bearing in mind the specific nature of LCO_2.

"Liquid CO_2 is increasingly relevant in global efforts to reduce greenhouse gas emissions and promote a greener future. It represents an important link in the value chain for the entire carbon-capture infrastructure. In developing a robust and proven concept, both in the cargo containment and cargo handling requirements for LCO_2 Carriers, we have drawn on our unparalleled experience in gas carrier segments. The AiP from DNV is a valuable endorsement of this work," said Pål Steinnes GM Sales, Wärtsilä Gas Solutions.

"We have been pleased to work with Wärtsilä Gas Solutions on this reliable design concept. The review process has been extensive, and we trust that their solution will contribute to facilitating the trade in liquid CO_2 as a factor in reducing emission" says Monika Johannesen, Head of Department, Gas Carrier Excellence Centre at DNV.

A liquid CO_2 carrier design by Wärtsilä
(Image courtesy Wärtsilä)

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Tuesday 16 March 2021 by Zoom conference under the chairmanship of our President, Gordon MacDonald in Airlie Beach, with links to Cairns, Gold Coast, Sydney, Canberra, Melbourne, Launceston, Adelaide and Perth.

Among the items discussed were:

Council Membership and Registration as Not-for-profit

Council is attempting to fill its remaining vacancies and, when this has been done will complete the Division's registration under Australian law.

Coordination of Section Technical Meetings

Council noted that its attempts to arrange a single-page program of forthcoming technical meetings had been subsumed by the Institution's digital review. However, in the meantime Section Secretaries are advising each other of such meetings to facilitate widespread participation in virtual meetings across the country.

Elections/Appointments to Division Council for 2021–2023

Council noted that Prof. Jonathan Binns, Ken Goh and Sammar Abbas had been elected following the call for nominations in the November 2020 edition of *The ANA*. In addition, Council appointed our Vice-President, Violeta Gabrovska, to one of the remaining vacancies. Council intends to appoint members to the three remaining vacancies in time for the June Council meeting.

RINA and the Naval Shipbuilding Program

In response to an initiative by the WA Section, Council appointed a working group led by past President Jim Black to examine and report on the role that the Division could and should play in the NSP. The resulting report will be considered by Council at its June meeting.

Annual General Meeting of Division

Council gave initial consideration to the Financial Report to be considered by the AGM which was scheduled to be held by Zoom on the day after the Council meeting. [*The AGM was well attended and successful, thanks to those who made the effort to participate* — Secretary]

Next Meeting of Division Council

The next meeting of the AD Council has been tentatively scheduled for the afternoon of Tuesday 15 June 2021**.**

The draft minutes of the meeting are available to Council members on the Council forum and are available to other members by request to the Secretary.

Rob Gehling

Secretary
ausdiv@rina.org.uk
0403 221 631

Changed contact Details?

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

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

RINA London		hq@rina.org.uk
Aust. Division		ausdiv@rina.org.uk
Section	ACT	rinaact@gmail.com
	NSW	rinansw@gmail.com
	Qld	rinaqlddiv@gmail.com
	SA/NT	rinasantdiv@gmail.com
	Tas	gregorm@amc.edu.au
	Vic	keeganparker@thrustm.com
	WA	wa@rina.org.uk

Phil Helmore

Austal USA launched LCS30, the future USS *Canberra*, on 30 March 2021. She will be the second US Navy ship to be named after the Australian cruiser HMAS *Canberra* lost in the Battle of Savo Island on 9 August 1942. The first was a heavy cruiser, USS *Canberra* (CA70), which served in the US Navy from 1943 to 1970. She was scrapped in 1980
(Photo courtesy Austal)

WALTER ATKINSON AWARD

A PRIZE FOR THE BEST WRITTEN PAPER PRESENTED TO A RINA FORUM IN AUSTRALIA IN 2020–21

Have you presented a written paper at a RINA Section meeting this year? If it is a really good paper you may be eligible for the highly prestigious Walter Atkinson Award named after one of the founders of the Australian Division.

The Walter Atkinson Award was established in 1971 and its aim is to raise the standard of technical papers presented to the naval architecture community in Australia.

The Award comprises three components:

- an engraved trophy or medal.
- a certificate for each author.
- a ticket to the event at which the award is to be presented.

The Award will be presented by the President of the Australian Division (or their nominee).

A nomination must be a written paper, not simply a presentation, first presented either at a RINA Section technical meeting or RINA-supported conference in Australia, or first published in a RINA-supported publication in Australia (e.g. *The ANA*). In (other) years when conference(s) such as Indo-Pacific IMC and AOG sponsored by the Division are held, conference papers would be eligible for the Award.

All authors are eligible — Australian or overseas, members or non-members. Papers by multiple authors are eligible.

Visual presentations are not eligible unless they reflect the content of the presenter's written paper. Nominations of papers published in the period 1 July 2020 – 30 June 2021 must be received by the Secretary no later than 16 July 2021.

For further information refer to the Division's Walter Atkinson Award page on the RINA web-site or contact the Secretary.

Mail: PO Box 462, Jamison Centre, ACT 2614
email: rinaaustraliandivision@iinet.net.au, or ausdiv@rina.org.uk
Phone: 0403 221 631

NAVAL ARCHITECTS ON THE MOVE

The recent moves of which we are aware are as follows:
Jordan Banks, a graduate of the Australian Maritime College, has taken up the position of Naval Architect with John Butler Design in Sydney.

Dylan Dwyer moved on from Oceanic Design and Survey in 2016 and has taken up the position of Naval Architect with the Defence Science and Technology Group in Port Melbourne.

Gerard Engel moved on from London Offshore Consultants in 2018 to Silver Yachts in Henderson, WA, where he has recently taken up the position of Design Manager.

Sophia Holmes (nee Pearce) completed a Master of Design, Product and Textile Design at the University of New South Wales in 2012 and has now taken up the positions of Design Director at twenty2 wallpaper and Teaching Fellow at the University of Tasmania in Hobart.

John McKillop has moved on from Crisp Bros & Haywards and has taken up a position as Senior Naval Architect with BAE Systems, based in Williamstown.

Brett Oldham continues as Toht Product Manager/System Architect with CSC Consulting in Brisbane.

Peter Öman continues as Senior Hydrostatical Engineer with Kockums in Sweden, but has moved from Göteborg to Malmö.

Mate Ostojic moved on from Jayco in 2014 and, after some time at Viking SeaTech, moved to Woodside Energy where he has now taken up the position of FPSO Engineering Support Lead in Perth.

Oscar Palos moved on from Blackwatch Boats Australia in 2006 and, after some time at Barcelona Yacht Design Group, Alutech Marine and Marina Barcelona, has now taken up the position of Project Manager with Tramuntana Yacht Management in Palma, Mallorca, Spain.

Grahame Parker continues consulting as Managing Director of GPD Australia in Sydney.

Jon Pattie continues consulting as Principal Naval Architect/ Director of Naval Architects Australia in Brisbane

Howard Peachey retired from the South Australian Department for Planning, Transport and Infrastructure in 2015 but, soon after, re-commenced consulting as HF and FE Peachey Naval Architects in Adelaide, includes the Mannum Dock Museum and their ageing timber vessels among his principal clients, and is an AMSA-accredited surveyor.

Dugald Peacock has moved on within the TAB, and has taken up a position in their Information Security department in Sydney, providing services throughout Australia.

Bryce Pearce continues as a Research Fellow with the Cavitation Research Laboratory at the Australian Maritime College.

John (Randall) Peterie has moved on from the MCD positions at HMAS *Waterhen* and has taken up the position of Director Maritime Docks and Marine Services with the Capability, Acquisition and Sustainment Group of the Department of Defence in Sydney.

Binh Minh Pham continues as Chairman and CEO of Vietnam Shipbuilding Engineering, and has also founded a new company, Viet Star Cruise Investment, in Hanoi, Vietnam.

Xuan Pham continues as Deputy General Manager with Oil and Gas Production Division, PetroVietnam Group in Hanoi, Vietnam.

Sy Phan has moved on within Lloyd's Register and has now taken up the position of Client Technical Support Manager in Singapore.

Andy Phillips continues as a naval architect at Austal in Henderson, WA.

John van Pham continues with Incat Crowther and has taken up the position of Structural Manager in Sydney.

Geoff Wilhelm has retired from the Naval Technical Bureau of the Department of Defence and is enjoying the pace of life as a retiree.

Shaun Yong obtained his property licence and then moved on from DNV GL in 2017 and began consulting in both property and marine work in Singapore.

Renjie Zhou has moved on within Birdon Group and has taken up the position of Project Engineer in Port Macquarie.

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

Phil Helmore

THE AUSTRALIAN NAVAL ARCHITECT

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

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

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

FROM THE ARCHIVES

Today's destroyers are generally large, commodious ships in which it is rarely necessary to venture onto the open deck to move about the ship. Yesterday's destroyers, descendants of the torpedo-boat destroyers of the late 19th and early 20th Century, were much closer to nature. This photograph was taken on the Australian destroyer HMAS *Vendetta*, one of the famous 'Scrap Iron Flotilla', in the Mediterranean in 1941. One sailor is watching the advancing sea from the watertight hatch to the Engineers' Store.
Hopefully the hatch was not left open too long
(Photo The Naval Historical Society of Australia, Gordon Hill Collection)

HMAS *Pirie*, the first of the RAN's Armidale-class patrol boats to be decommissioned, arriving at Darwin for the last time on 23 March 2021. Commissioned on 29 July 2006, *Pirie* was decommissioned on 26 March (RAN photograph)