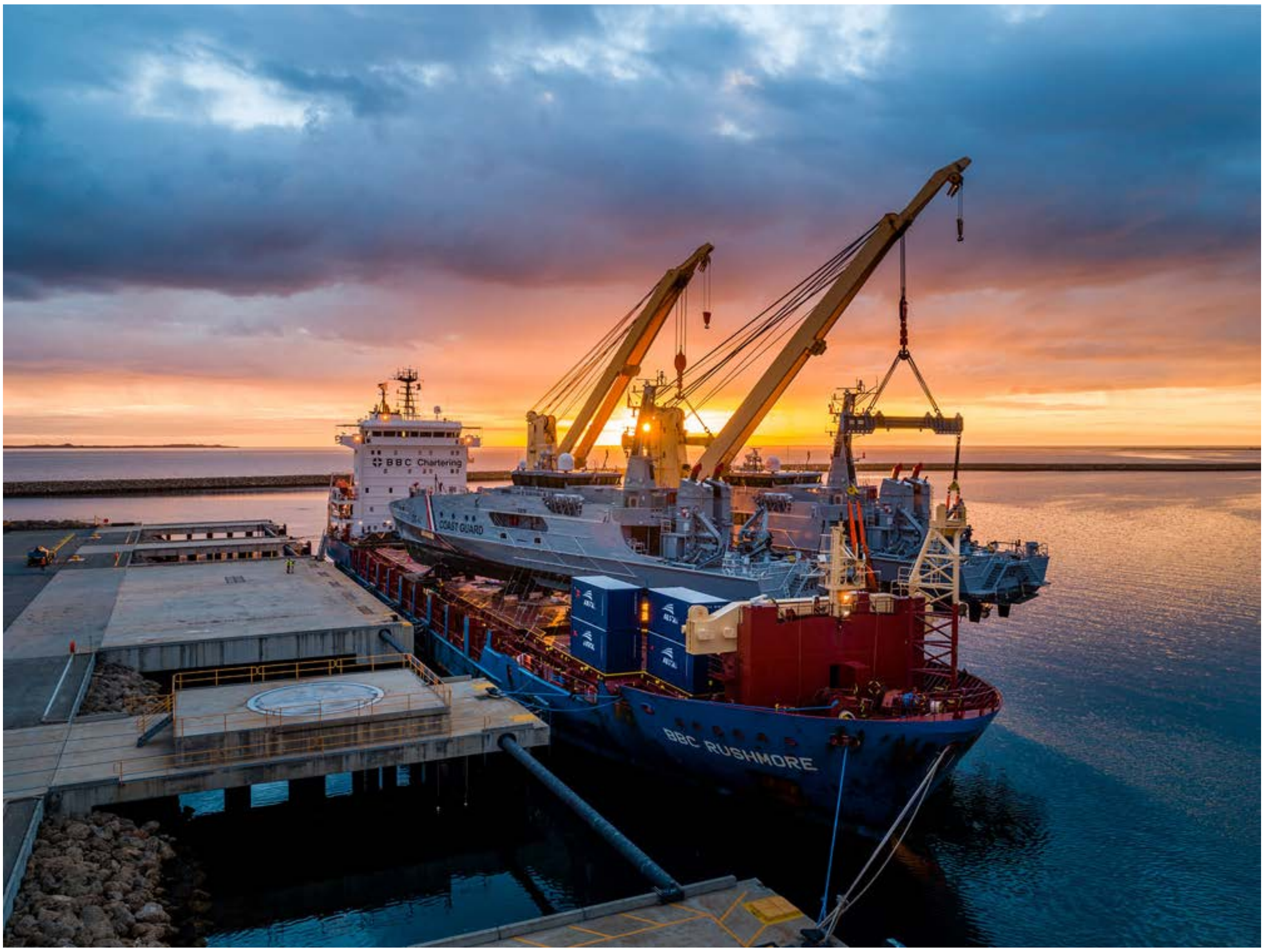
THE AUSTRALIAN NAVAL ARCHITECT



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HMAS *Perth* is moved onto the ship lift at the Australian Marine Complex at Henderson, WA, for undocking after completing a major part of the Anzac Midlife Capability Assurance Program to upgrade radar and communications systems and crew habitablility
(RAN photograph)

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Cover Photo:

The two Cape-class patrol boats built by Austal for the Trinidad and Tobago Coast Guard, TTS *Port of Spain* and TTS *Scarborough*, being loaded on board ship at Henderson, WA, for delivery to Trinidad and Tobago
(Photo courtesy Austal)

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From the Division President

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

We start on a sombre note in announcing the recent passing of Bryan Chapman, Past President of the Division for two periods totalling five years between 1998 and 2003. Bryan was a strong force for the profession and a highly respected and regarded naval architect; he will be sadly missed.

As I progress towards the end of my working career, I am reminded of an essay competition which I entered in my second year at university in 1982. The entrants had to write a paper on the envisaged future of unmanned shipping, an idea that was in its infancy at the time. It presents an excellent example of how our profession has always been forward thinking while also being very conservative.

So fast forward 40 years and it is with some delight that I note the exponential interest in the subject supported by numerous examples of where this trend may take us.

As with many radical industry changes, the move towards adoption has not been so much technology driven but based on perceived needs. The initial uptake of unmanned surface and sub-surface vessels within Defence is being driven by a combination of the desire to remove personnel from harm's way, undertake tasks more effectively and to reduce the cost of materiel assets and manning. In commercial industry, the drive has been similar with respect to reducing the cost of ownership and the ability to conduct tasks more efficiently and effectively.

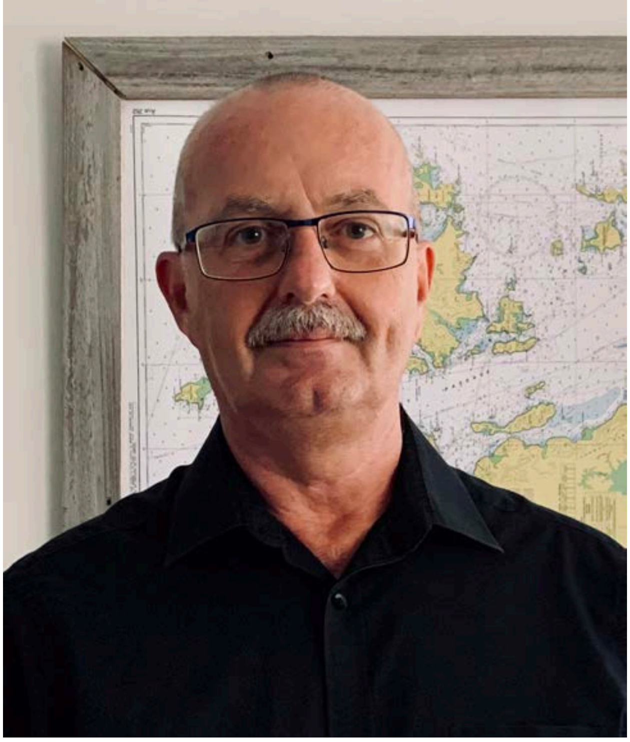
There are many marine functions currently in operation or under autonomous development including:

- river ferries/water taxis;
- coastal cargo ships;
- offshore platform survey, inspection and light repair;
- hydrographic/oceanographic survey vessels;
- mine counter measures;
- anti-submarine warfare; and
- targeting and surveillance.

The move to unmanned systems is not limited to the vessels themselves. For example, new automated mooring systems which eliminate the need for conventional mooring lines by replacing them with automated vacuum pads which moor and release vessels in seconds.

There is no doubt that this disruptive technology is here to stay and the innovation of the marine industry will continue to provide novel applications and consequent challenges, primarily in the area of safety. So far the technology has been primarily applied to Defence vessels or smaller vessels, especially operating in the coastal waters of only one country and, as such, that country can offer separate exemptions and permissions.

As we consider the potential of large unmanned International shipping, we move into the domain of the International Maritime Organisation (IMO) — the global regulatory body for international shipping. IMO commenced work in May 2018 to look into how safe, secure and environmentally sound maritime autonomous surface ship (MASS) operations may be addressed in IMO instruments. The two categories of most interest in the application of the technology being:



Gordon MacDonald

- Remotely controlled ship without seafarers on board: the ship is controlled and operated from another location. There are no seafarers on board.
- Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself.

Industry watchers believe that international rules are unlikely to be in force for more than 15 years and, indeed, the plethora of issues which have to be considered is quite daunting; for example, cyber security and reliability engineering for detecting and working around equipment failures. Unfortunately, the IMO Maritime Safety Committee's work on the subject has been temporarily halted. However, they have completed a Regulatory Scoping Exercise circular and are seeking proposals on how to achieve the best way forward and reports on experience gained in the operation of MASS.

It is worth considering what the adoption of this technology will mean to our industry and to our profession. Will our current skill set still hold us in good stead in the future? It will certainly be a different industry that we serve in the late 30s and early 40s, only 60 years after my original essay on the subject back in 1982!

I would also like to mention the ongoing stellar work which Jesse Millar has been championing in the Institution's digital review which is going to be implemented over the next couple of years, giving a new member experience that will be noticed progressively.

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

Gordon MacDonald

Editorial

It often seems to some of us that the press takes great delight in exposing delays with major Defence projects and departmental 'mismanagement' resulting in additional cost and delay to essential enhancements to Australia's defence capability.

The major projects currently underway — the offshore patrol vessels, the Attack-class submarines and the Hunter-class frigates, are undoubtedly very ambitious. In normal times they would face sufficient challenges, not least because two of the projects (once the two OPVs being built in Adelaide are completed) are being undertaken in the same place, creating a concentration of labour demand which will be hard to meet. An article in *The Australian* of 27 June reported on a meeting between senior executives of Australia's major shipbuilders and Minister for Defence Industry at which industry expressed concern that they may be critically short of skilled labour to meet the requirements of the current programs. It was reported that some 15 000 new positions need to be filled in the next five years, with more in the shipbuilding industry's supply chain.

Never in Australia's history has there been such a concentration of major naval shipbuilding projects in the one location. There can be no doubt that obtaining the necessary skilled labour in South Australia will be an enormous challenge. It will require a sustained training program for people to fill professional and trade positions, assuming that sufficient numbers can be attracted from the available pool within the population.

Meeting this challenge would be hard enough in the best of times but, today, other factors will have a considerable influence on the task. The pandemic is disrupting the movement of labour throughout Australia and, I expect, hampering the training programs already underway. Moreover, immigration has virtually ceased and the nation is even now losing people who have decided to return overseas. Immigration of skilled people has always been a valuable source of skilled labour for the shipbuilding industry in the past and the present hiatus could be long-lasting.

There is another factor which is likely to have a significant impact on labour availability in coming years. New industries taking advantage of Australia's opportunities in the development of new power sources to combat global warming are just one of the sectors of the economy which are likely to draw upon the same sources of skilled people as naval shipbuilding. If past experience is any guide, people trained and experienced in shipbuilding will be in high demand which will add to the turnover of skills that our shipbuilders are likely to experience.

In these circumstances it may be inevitable that there will be delays with our naval shipbuilding program. Minimising the cost and time implications will be a considerable challenge for government and industry.

John Jeremy

HMAS *Canberra* (front) conducts maritime manoeuvres with (L-R) USS *New Orleans*, JS *Makinami* and USS *America* during the Large-Scale Global Exercise in the Western Pacific in early August
(RAN photograph)

COMING EVENTS

NSW Section Technical Presentations

Technical presentations in 2021 will continue as webinars for the foreseeable future, generally hosted by RINA using the Zoom software platform and starting at 6:30 pm. 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:

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

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 on 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 electric propulsion to fast craft
- Motions and manoeuvering, 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, 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 and survivability
- Classification and regulation

SMIX Bash 2021

SMIX Bash was inaugurated in 2000 and is organised as a joint-venture function by the Royal Institution of Naval Architects (NSW Section) and the Institute of Marine Engineering, Science and Technology (Act & NSW Branch). It is a Christmas party for those involved in various marine industries and activities based in the Sydney area and those from further afield. The name was derived as an acronym for "Sydney Marine Industries Christmas Bash". The function is held on board Sydney Heritage Fleet's beautifully-restored barque, *James Craig*. Unfortunately, SMIX Bash 2020 had to be cancelled due to the COVID-19 pandemic.

The 21st SMIX Bash will be held on board *James Craig* alongside Wharf 7 in Darling Harbour from 5:30 to 9:30 pm on Thursday 2 December 2021. Bookings are now open for sponsors and members of RINA and IMarEST on the Trybooking website, https://www.trybooking.com/BQFLY?, and will open for friends in the marine industry on 1 October. Due to prevailing COVID-19 restrictions, numbers for SMIX Bash 2021 are more limited than usual, so members are advised to make bookings early!

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.

Indo-Pacific, the biennial International Maritime Exposition, will combine an extensive exhibition presence, a comprehensive conference program and a schedule of networking and promotional opportunities. It will be the 12th iteration of this internationally-renowned event, and will be a critical link event for Defence, government and industry as Australia defines how it will invest $90 billion on new ships, submarines and their systems and support, more than $1 billion on modern shipyard infrastructure, and more than $25 million on workforce growth and skilling to support its Naval Shipbuilding Plan into the future.

Indo-Pacific is where customers and industry will connect, where commercial maritime and naval defence suppliers will promote their capabilities to decision-makers from around the world, in the only maritime exposition of its kind in the Indo-Asia-Pacific region.

The Indo-Pacific International Maritime Exhibition and Conference will be held on 10–12 May 2022 at the International Convention Centre, Sydney. 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. with the following one in the second half of 2023.

The International Maritime Conference 2022, organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia, will allow delegates to be involved in discussions concerning the latest developments in marine engineering and maritime technology, both in the areas of defence and commercial shipping. The conference will coincide with the prestigious Royal Australian Navy Sea Power Conference.

Collectively, the conference and exhibition will offer a rewarding program for all those with a professional interest in maritime affairs. The conference program will be designed to permit all delegates to visit the many industry displays in the exhibition itself, and to conduct informal professional discussions with exhibitors and fellow delegates. Registration for the International Maritime Conference includes free access to the exposition.

The call for papers was issued on 26 July, and the main themes will include

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

For further information regarding the IMC 2022 International Maritime Conference contact the Conference Secretariat at PO Box 4095, Geelong, Vic 3220 or imc@amda.com.au.

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 (DSTG), 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

Applying Naval Architecture to Maritime Autonomy and Robotics

Harry Hubbert, Director and Chief Technology Officer, Greenroom Robotics, gave a presentation on *Applying Naval Architecture to the Field of Maritime Autonomy and Robotics* 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 25 May. This presentation attracted 21 participating on the evening.

The field of autonomy is fast replacing long-standing capabilities in all domains, and maritime autonomy is fast becoming a focus around the world. The adoption of this technology is largely dependent on industry acceptance, which will only become widespread when it gains trust and utility. The fast-changing landscape of maritime autonomy is having widespread impacts on how these new vessels are regulated, classified and certified.

This presentation explored the current state of maritime autonomous technology, with a focus on the perceived impacts on maritime regulation and certification, as well as some possible paths moving forward.

Harry Hubbert studied at the Australian Maritime College where he obtained his degree in naval architecture with honours. With a passion for maritime autonomy, he founded the Australian Maritime College Autonomous Technology Society (AMCAT), working on a number of maritime technology projects. As a member of the Royal Australian Navy's (RAN) undergraduate program, Harry entered ADF service in 2011 as a Marine Engineer Officer. Over the next nine years he served on a number of RAN vessels in various engineering roles before returning to maritime autonomy. He held positions in the capability implementation team of the SEA1778 project, implementing autonomous systems into the RANs Mine Warfare capability as well as in the Warfare Innovation Navy Branch as a Project Manager for Robotics and Artificial Intelligence. In 2020 he left the Navy and joined a small Australian deep-tech company, Greenroom Robotics, as Chief Technology Officer, later also joining the Board of Directors. Greenroom Robotics is currently developing a range of maritime autonomy products as well as delivering consulting services in the same field. Harry is passionate about developing a sovereign maritime autonomy capability as well as assisting in the development of trust in maritime autonomy through the progression of regulatory and certification processes.

A/Prof. Warren Smith fielded the questions for Harry. The questions were diverse, and raised some further interesting points.

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

Lily Webster

South Australia and Northern Territory

The RINA South Australian and Northern Territory section has had a refreshing beginning to 2021 following an uncertain 2020. Cameron Wilkinson has joined the Section Committee, and John Peel has resigned due to pressure of other things. We extend our thanks to John for his time on the committee and his contribution to the activities of the section.

The 2021 technical presentation calendar started strongly in February with a well-received insight into the life of a uniformed naval architect. LCDR James Heydon attracted a near sell-out audience and presented his experience to date as a naval officer as well as the applications of naval architecture theory within the Royal Australian Navy.

Deputy Chair Nathan Doyle (L) with LCDR James Heydon
(Photo courtesy Christopher Carl)

In March, section members and friends attended a ship tour of the oldest surviving clipper ship in the world, *City of Adelaide*, which is currently located in Port Adelaide. Coupled with a presentation from the Clipper Ship *City of Adelaide* Director, Peter Christopher, and engineering consultant, Mark Gilbert OAM, attendees learned about the ship's history, the process of transporting her from Scotland, and the plans to conserve this iconic piece of South Australia's history.

Committee Member Andrew Harris (L) with Peter Christopher and Mark Gilbert
(Photo courtesy Christopher Carl)

April's presentation stepped forward to more-current maritime technologies, albeit technologies located a significant distance from South Australia, or even Australia. Trevor Dove of BMT gave a presentation on *Coconuts 4 Life*, a project currently being undertaken by BMT. The presentation gave insight into the technological and logistical challenges in designing a solution for the small country of Micronesia to transport and process coconuts as a way of improving the local economy.

Committee Member Andrew Harris (L) with Trevor Dove
(Photo courtesy Christopher Carl)

Our presentation in May took a deep dive into the underwater world, with Stewart Kanev of ASC presenting on underwater radiated noise. Stewart presented the theoretical fundamentals of noise detection and analysis, and discussed a real-life example of such a phenomenon.

Committee Member John Peel (L) with Stewart Kanev
(Photo courtesy Christopher Carl)

Roman Dankiw of Asset Inspection Consultants presented in June on the topic of welding and corrosion. An insightful discussion about types of corrosion within the maritime industry and methods of mitigation attracted audience members from the Australian Corrosion Association as well as RINA SA&NT members and friends. Roman also discussed several welding techniques and applications typical within the industry and was able to answer many related questions.

Section Secretary Christopher Carl (L) with Roman Dankiw
(Photo courtesy Christopher Carl)

In the future, the RINA SA&NT section is expecting presentations promoting the developing maritime industry within South Australia, and highlighting the extraordinary opportunities for naval architects Australia-wide.

Christopher Carl

Western Australia

Translating Oil and Gas ToTex Reduction Experience into Floating Offshore Wind

Enda O'Sullivan, Director and VP Specialist Engineering and Consulting, Wood Australia, gave a presentation on *Translating Oil and Gas ToTex Reduction Experience into Floating Offshore Wind* as a webinar hosted by RINA using the Zoom software platform with the Chair of the WA Section, Piotr Sujkowski, as MC on 30 June. This presentation attracted 35 participating on the evening.

Piotr opened proceedings by acknowledging one of Australia's best-known naval architects, Tony Armstrong (the elder), who passed away in May. He showed a slide of several of Tony's interests and achievements, including design and construction of Australia's Antarctic vessel, *Aurora Australis,* the 127 m trimaran for Fred Olsen Line in the Canary Islands, *Benchchigua Express,* the littoral combat ships (LCS) for the US Navy, and Tony's latest fast car. He will be missed.

Piotr then passed over to Enda for his presentation.

With energy transition having gained unstoppable momentum, the race is on to find and develop the best global renewable-energy resources. Offshore wind is not a new domain but, with the best onshore/fixed wind sites largely allocated, there is growing international interest in developing floating wind sites. The bad news is that these floating wind sites are further from shore and in more hostile environments; the good news is that the oil-and-gas sector has operated in these environments for over 40 years.

Wood has coordinated a program of cross-disciplinary workshops on how to translate the ToTex (total expenditure) cost-saving lessons learned from 40 years of oil-and-gas floating facilities operating in hostile environments into economic, safe and reliable floating wind facilities. The workshops identified 19 topics for ToTex reduction, spread across seven themes. Enda's presentation covered the value to developers of these themes and the actions by industry and government needed to deliver these reductions.

The impact of these lessons and value improvers on ToTex has been assessed using the Wood Floating Wind Cost Model (FWCM). This looks at the impact on both CapEx (capital expenditure) and OpEx (operating expenditure) of designing floating wind farms with high reliability, high automation, and maximum onshore operations. As an imperative going forward, the FWCM assesses the impact of carbon costs when using different locations and labour rates for fabrication of the floating wind facilities.

Enda has 30 years' experience in the offshore energy industry. His first foray was in the wave-energy sector off the coast of Ireland; a great resource but too early in the peace. With subsequent stints spent in Aberdeen, Houston and, since 2006, in Perth, he has held a number of technical and managerial roles. He is the Director of Wood Australia and is truly naturalised, with weekends taken up either at the netball court, the footy oval or the Optus stadium supporting the Dockers.

Piotr fielded the questions for Enda. Question time was lengthy, and raised some further interesting points.

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

Nathan Chappell

Queensland

The Queensland Section held a combined Annual General Meeting and Committee meeting, both face-to-face and streamed live, on Thursday 15 July. The 2020 committee members stood down and a new committee was successfully elected. We would like to thank the outgoing committee and are looking forward to a busy year ahead.

Following the meetings, Stuart Ballantyne, Chair of Sea Transport Solutions based on the Gold Coast, made a presentation on *Sea Transport Solutions' Design and Research*. STS provides specialist marine design and consulting services worldwide, specialising in commercial vessels including ferries, trans-shipment and cargo/workboat vessels. The presentation covered a brief history of the company's achievements regarding ship design and some of the innovative projects in which they have been involved. The presentation also covered some current research work which he is driving. STS has partnered with the University of Strathclyde to look at what effects adding flotation foam to larger vessels may have on survivability, arrangement, and the maintenance costs of the vessels. The research has found that the addition of the foam can significantly increase a vessel's survivability index, depending on the location and amount added. The addition of foam also leads to possible advantages in terms of arrangement and may allow the designer to free up more space below the freeboard deck. We look forward to seeing where this research leads and seeing STS continue to push the boundaries of ship design. The Section thanks Stuart for hosting and providing the section with an insightful presentation.

Stuart's presentation was not recorded.

Ashley Weir

Tasmania

RSV *Nuyina*: Australia's New Icebreaker

Daniel Webster, ASRV Electrical Engineering Manager, Serco Defence, gave a presentation on *RSV* Nuyina*: Australia's New Icebreaker* to a meeting of the Tasmanian Section attended by 18 with the Chair of the Tasmanian Section, Prof. Jonathan Binns as MC, on 12 May in the AMC Auditorium, AMC Newnham Campus, Launceston. The meeting was also streamed live via the RINA Zoom software platform and attracted an additional 57 participants.

Australia will soon take delivery of an extraordinary new icebreaker vessel to support our Antarctic Program. The multi-role RSV *Nuyina*, which will replace *Aurora Australis*, will deliver significantly-increased ship performance, cargo logistics and marine-science support facilities over her much-loved but ageing predecessor. In this presentation the author summarised the design and construction process so far and discussed some of the challenges faced along the way.

Daniel Webster is currently studying for his master's degree in Maritime Design at AMC/UTas. He has 20 years' experience in the design and construction of military and science/research vessels for BAE Systems/Tenix in Australia and Seaspan in Canada. In 2018 Daniel joined Serco Defence as the ASRV Electrical Engineering Manager; where he provides technical support to the design, build, commissioning, and operations of RSV *Nuyina*.

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

Gregor Macfarlane

Tasmanian Historic Vessels

Peter Higgs, retired educator and historic vessels researcher, gave a presentation on *Tasmanian Historic Vessels and Building a Tasmanian Trading Ketch* attended by five with Tasmanian Section Committee Member, Chris Davies, as MC, on 22 June at Brierley Hose and Handling, Hobart. The meeting was also streamed live via the RINA Zoom software platform and attracted an additional four participants.

Peter began his presentation by saying that, to be included on the Australian Register of Historic Vessels, the vessel must have been built prior to 1970, but that there are many vessels on the register which are much older.

SS *West Arm*, for example, was built in 1885 by Priestman Brothers in Hull, UK. She was built as an iron riveted dredge and pontoon for use by the Marine Board of Launceston, Tas. With her own steam engine, SS *West Arm* operated along sections of the Tamar River, widening and deepening the river bed. The actions of SS *West Arm* were significant at a time in the 1880s when Tasmanian ports were experiencing increasing numbers of large vessels. After almost fifty years as a pontoon and dredge, SS *West Arm* was dismantled in 1936, and converted into a houseboat in 1948. She sits today at Beauty Point on the bank of the Tamar as one of the oldest vessels in Tasmania and is owned by the Brooks family. Her adaptive reuse is also a good example of how a heritage vessel can remain extant beyond its original specialised use, and adds to the story of this now-rare type of craft.

Peter went on to discuss some of the Tasmanian-built vessels, including the so-called "mosquito" ketches which traded between Tasmania and Melbourne.

Julie Burgess, for example, is the last of the nearly 150 ketches built or operated by five generations of the Burgess family. She was built in Ned Jack's yard in Launceston in 1936 for Harry Burgess, who named the vessel after his wife Julie. She was used as a fishing vessel her whole life, except during World War II when she was used as a cable ship in Bass Strait. She was restored in 1988 and took part in the Bicentennial celebrations on Sydney Harbour. However, she fell into disrepair, and was eventually purchased and restored by Devonport Council. Operation of the vessel is now handled by Julie Burgess Incorporated, formed by the volunteers who restored and sailed the ship. She now moors at Reg Hope Park, East Devonport.

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

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

Chris Davies

New South Wales

Committee Meetings

The NSW Section Committee met on 25 May and, other than routine matters, discussed:

- SMIX Bash 2021: The Committee has met and actions have been assigned; SHF advised that the numbers will likely be limited to 150 in December rather than 225, and so tickets sales will have to be managed; the Trybooking website has been set up.
- TM Program: Engineers Australia have a new Group Engagement Officer looking after us; the environment and autonomous vessels are becoming more important and cutting edge, and so presenters on these topics will be sought for next year.
- Walter Atkinson Award 2021: Possible nominations canvassed.

The NSW Section Committee also met on 20 July and, other than routine matters, discussed:

- SMIX Bash 2021: Sponsors are being sought, and bookings to open in August.
- TM Program 2021: August presentation moved from 4 to 18 August, and meetings subsequently moved from Engineers Australia's WebEx platform to RINA's Zoom platform.
- TM Program 2022: Presenters on the environment and autonomous vessels being contacted, and other topics sought.
- Walter Atkinson Award 2021: No eligible papers came to light.

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

Naval Ship Sustainment

Ian Moon, Head of Engineering, Naval Ship Management (Australia) (known as NSM), gave a presentation on *An Inclusive Approach to Naval Sustainment* as a webinar hosted by Engineers Australia using the WebEx software platform with IMarEST ACT & NSW Branch Committee Member, Simon Wong, as MC on 2 June. This presentation attracted 118 participating on the evening.

Introduction

Ian began his presentation with some background on NSM, which was established in 2012 as a joint venture between Babcock Australia Pty Ltd (a wholly-owned subsidiary of Babcock International PLC) and UGL Ltd and is Australia's only dedicated warship sustainment company and a steward of multiple classes for the Royal Australian Navy. Their team of sustainment experts, strategically located across Australia, work with their broad Australian and international supply chain to provide cost-effective and responsive solutions which optimise the availability, capability and seaworthiness of critical maritime assets.

Their capability spans the full spectrum of naval sustainment services:

- Asset management
- Ship repair, refit and refurbishment
- Maintenance support
- Engineering support
- Supply chain management
- Procurement and logistics support

Headquartered in Henderson, Western Australia, NSM's national footprint and highly-responsive local Australian supply chain was created and continues to evolve, to support their customers' critical assets wherever and whenever the need may arise.

NSM presence around Australia
(Map courtesy NSM Australia)

NSM provides long-term sustainment contracts in partnership with the Royal Australian Navy (RAN), notably:

- The Anzac (FFH) class frigates as a member of the Warship Asset Management Agreement (WAMA). Awarded in 2016, WAMA represents an Alliance between NSM, BAE Systems Australia, SAAB Australia and the Department of Defence's Capability Acquisition and Sustainment Group (CASG), for the total asset management of the RAN Anzac-class frigates through to the end of operational life. Together, the WAMA Alliance delivers materially seaworthy warships, driving long-term efficiencies for the Royal Australian Navy, at an optimal cost of ownership.
- As the Canberra-class Landing Helicopter Dock (LHD) Asset Class Prime Contractor (ACPC), NSM provides the support and sustainment program for both Canberra-class LHDs, HMA Ships *Canberra* and *Adelaide*, along with 12 LHD Landing Craft (LLC). The ACPC contract includes the Through-life Support Facility and Navy Training System Centre based at Randwick Barracks in NSW.

HMAS *Anzac*
(RAN photograph)

HMAS *Canberra*
(RAN photograph)

Key Building Blocks

NSM provides naval sustainment and support across the In-service and Disposal phases of the capability life cycle. Naval sustainment and support are built upon the Inclusive Prime model, an evolution of NSM's successful Thin-Prime model which provides industry with opportunities to contribute to naval sustainment and to develop their capability. Rather than simply integrating industry, NSM incorporates four key building blocks to deliver effective and efficient sustainment outcomes.

The Right Partnerships

Establishing the right partnerships with shipbuilders, system and sub-system manufacturers, industry and, of course, the Royal Australian Navy, is paramount.

As an example, HMA Ships *Adelaide* and *Canberra* were required to be recalled from their Reduced Activity Period (RAP) at short notice. These assets were needed for Humanitarian Assistance and Disaster Relief (HADR), joining HMAS *Choules* and MV *Sycamore* which were already deployed in support of the newly-declared *Operation Bushfire Assist*. Before her deployment, HMAS *Adelaide* required several outstanding maintenance activities to be performed which were identified after her last overseas deployment late in 2019. HMAS *Canberra* was also in RAP and was undergoing continuous maintenance with multiple systems requiring reactivation and certification before she could be deployed.

In addition to logistics, NSM arranged for several local small-to-medium-sized enterprises (SMEs) to accelerate scheduled maintenance activities to support this mission. Specifically, maintenance on HMAS *Adelaide*'s gas turbine, which was scheduled for January 2020, was performed before Christmas 2019 thanks to the responsiveness of General Electric (GE) Marine.

Following HMAS *Adelaide*'s deployment, HMAS *Canberra* also required preventive and corrective maintenance across the critical systems to be completed by NSM and our approved repair agents, ranging from flight-deck systems, surveillance systems, cranes and davits, and propulsion systems.

HMAS *Adelaide* was reactivated earlier than expected, less than 48 hours after being notified of the requirements to support the deployment for *Operation Bushfire Assist*, as directed by the Commonwealth of Australia.

NSM arranged for our contractor GE Marine to sail with HMAS *Adelaide* and remain on board to facilitate final set-to-work on the gas turbine system. Shadbolt, another of NSM's major local partners, also sailed with HMAS *Adelaide* to provide fitting and set-to-work of mechanical systems. HMAS *Canberra* was also made available for deployment on schedule, within three weeks of notification after undergoing her maintenance.

Notable achievements across both ships include rectification of over 40 high-priority defects along with the conduct of preventive and corrective maintenance to critical systems including propulsion and fire-main and fixed firefighting systems.

Australianised Supply Chain

NSM is nationally recognised for their support for Australian SMEs and their engagement in the sustainment and support of Australia's naval assets. We recognise that development of Australian industry capability is more than a simple headline number on supply-chain participation. We support this development through:

- providing suppliers with assurance, stability and an environment which encourages investment in training, systems, equipment and facilities;
- facilitating engagement with the Centre for Defence Industry Capability (CDIC) and access to Commonwealth development grants; and
- identifying and supporting specific capability development opportunities for Australian SMEs.

As an example, NSM conducted preliminary investigations of alternative coatings with the Australian SME Echo Yachts. This work identified the Tefroka EP® deck-coating system developed by GTF Freese from Germany as the preferred product. Tefroka is a self-levelling mortar polymer system which seals the deck, is jointless, hard wearing, abrasion resistant, watertight, and International Maritime Organization (IMO) approved.

Application of the product required suitably-trained and competent personnel. NSM worked with the Commonwealth, GTF Freese and Echo Yachts, with matched funding from the Sovereign Industrial Capability Priority (SICP) Grant to:

- deliver a proof-of-concept application to HMAS *Ballarat*; and
- upskill Echo Yachts' staff and secure original equipment manufacturer (OEM) approval for the company for the application of the Tefroka EP® deck-coating system.

Following the proof-of-concept, Tefroka was approved for use across the RAN Anzac class with more than 420 m^2 laid in 2020 across five ships.

Effective Collaborative Relationships

In a complex alliance or enterprise, the provision of seaworthy materiel requires strong collaboration across all participants. Furthermore, the dynamic nature of naval ship sustainment requires a level of responsiveness which can only be achieved through effective collaboration. Without effective collaboration, there is a danger that accountabilities and requirements can be interpreted in isolation.

NSM is aligned to ISO44001:2017, Collaborative Business Relationship Management Systems, because:

- NSM provides a clear framework for collaboration which enables specific strategies to be established and supported by a common set of tailorable resources defined in the standard.
- NSM recognises the role of individuals and supports the development of individual competencies as well as organisational development.
- Babcock International PLC (one of NSM's joint-venture partners) is a founding member of and ambassador for the Institute of Collaborative Working (ICW), sponsors of the ISO44001 standard, and supported the benefits of aligning with the standard.

ISO 44001 is built around a collaboration lifecycle of eight stages. The earlier stages are primarily focused on internal alignment with the benefits of business collaboration, whereas the latter stages are related to the mechanics of actual collaboration with your partners. The application of the standard in NSM's context, is focused on three stages:

- Working Together — Governance, management systems and processes.
- Value Creation — Continual improvement processes.
- Staying Together — Team management monitoring, measurement, and behaviour.

A recent paper on Defence Industry Collaboration (Lomas et al. 2019) highlighted three critical elements for this collaboration:

- Core Values and Culture: As with other enterprises established in support of the RAN Fleet, sitting above how we and all enterprise participants will work together, is the enterprise charter.
- Communication: It is important to create a psychologically-safe environment for communication. 'Psychological safety' is a belief that one can openly speak up with ideas, questions, concerns, or mistakes without fear. Research by Google and the Harvard Business School has highlighted that as having the largest impact on a team's success. Fostering psychological safety requires:
    - Leading by example — leaders within the team will be open to opinions, approachable and encouraging of questions, and will acknowledge their mistakes.
    - Encouraging active listening by, for example, showing an understanding by repeating what has been said or communicated, and discouraging phones in meeting rooms.
    - Creating a safe environment by ensuring that people aren't interrupted, not placing blame, and not being judgemental of ideas.
    - Developing an open mind-set by encouraging the sharing of feedback.
- Trust: Trust is nurtured through working in accordance with the processes, principles and responsibilities set out in management plans. However, the measurement of this trust is more challenging — in part because of the broad range of potential trust indicators based on performance, communications, honesty and problem resolution, etc. An example is to identify a small set of trust indicators for collaboration:
    - prompt response to queries;
    - openness and transparent communications; and
    - declaring lack of capability/resource.

As an example, the current repair procedure to change out the aft stern-tube seal on a vessel starts with dry docking. Docking facilities are located on both the west and east coasts of Australia. Once the ship is docked, the stern tube is drained, the seals are removed and replaced. On completion, the stern tube is refilled and the ship undocked and returned to the water.

Through advances in technology, Wärtsilä was able to offer an in-water repair option to replace the aft stern-tube seal on HMAS *Toowoomba* without the need for dry docking. This involved erecting a hyperbaric chamber (habitat) in the water around the shaft line and stern tube. Once the habitat was in place the stern tube was drained of oil, the oil seal assembly was removed, cleaned, refurbished and replaced. On completion, the stern tube was refilled with oil and the habitat removed.

Aft stern-tube seal on HMAS *Toowoomba*
(Photo courtesy iKAD Engineering)

Robust Digitally-enabled Asset Management

Asset management is like the 'keel block' of naval sustainment — providing a solid platform for the effective delivery of all the associated services which work together to maintain ship availability, capability and seaworthiness.

NSM's asset-management capability focuses on balancing costs, opportunities and risks, against the desired asset performance throughout the naval vessel lifecycle, and is founded on our:

- Processes, which are aligned to the ISO 55001 standard for complex and critical equipment and tailored to the needs of all stakeholders.
- People, who provide the 'know how 'and 'know why' required to develop an effective long-term asset management strategy. Competencies, our ability to apply knowledge and skills to achieve intended results.
- Technologies, with a particular focus on 'know what' to deliver a single, accurate and complete source of truth for the delivery of asset management services. This ensures that asset management decisions and planning are not compromised by a poor knowledge of the ships and their systems.

NSM has implemented a digitally-enabled asset-management approach which combines ISO standards with Industry 4.0 technologies such as big data analysis and predictive modelling. In November 2019 NSM was formally awarded certification of its asset-management system capability for the provision of sustainment services for maritime asset sustainment of complex assets under the global standard ISO 55001:2014.

As an example, in 2017 the east coast NSM team was instrumental to the planning and delivery of the first Major Fleet Unit Extended Maintenance Period delivered overseas, for HMAS *Arunta* in Bahrain. Our planning strategy included bringing high-risk works forward to earlier maintenance periods and engaging with the local industry in Bahrain

HMAS *Arunta* undergoing maintenance in Bahrain (RAN photograph)

Another example was the recently completed five-year maintenance period for HMAS *Canberra* which was particularly complex and important. The five-year maintenance:

- was the first for the LHD class delivered by the LHD Enterprise team comprising Amphibious Combat and Sealift Systems Program Office (ACSSPO), Amphibious and Afloat Support Group (AASGRP) and NSM;
- required effective collaboration with Navantia as the ship designer and major OEMs, particularly Siemens for the replacement of the propulsion pods; and
- was completed during the global COVID-19 pandemic and the restrictions which this posed.

The largest single achievement from HMAS *Canberra*'s first five-year maintenance period was the replacement of the 12 t propulsion pods which required an unprecedented level of engineering and local supply-chain support for their transport, loading and installation. For example, it required the following support structures to be designed and constructed locally:

- new A-frames and double beams to support the mass of the propellers and pods;
- a self-propelled modular transporter to move the pods and frames into position;
- new auxiliary cradles to support the bulkier propellers; and
- A 400 t crawler crane to provide reach and lifting capabilities.

The Microsoft technology, Hololens, was used to provide a live link between the waterside crew and the Siemens team in Germany when specific technical support was required.

Other highlights which show how these dockings are so much more than these big-ticket items included:

- 190 000 hours of maintenance activity delivered by more than 50 NSM-approved Australian repair agents;
- a complete colour change of the LHD platform using more than 60 000 L of paint; and
- the application of a new underwater coating system in collaboration with the Defence Science and Technology Group (DST Group)-supported anti-fouling trials.

Conclusion

Naval Ship Management (Australia) is a leading provider of complete maritime sustainment solutions across the In-service and Disposal phases of the capability life cycle of Royal Australian Navy ships. Naval sustainment and support are built upon NSM's Inclusive Prime model, which incorporates four key building blocks to deliver effective and efficient naval services: the right partnerships, an Australianised supply chain, effective collaborative relationships, and robust digitally enabled asset management. This model has been shown to be successful in practice.

Questions

Question time was lengthy and elicited some further interesting points.

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

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

Reference

Lomas, I., Puttergill, R., Humphrey, A. and Stoker, C. (2019), South Australian Defence Industry Leadership Program 2019, *Defence Industry Concept Paper,* December.

Hydrodynamics of the RiverCat Ferries

Lawrence Doctors, Professor Emeritus, UNSW Sydney, gave a presentation on *The Hydrodynamics of the Sydney Harbour RiverCat Ferries* 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 7 July. This presentation attracted 139 participating on the evening.

Lawry has also written up the presentation as a paper which appears elsewhere in this issue of *The ANA.*

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

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

Phil Helmore

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

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.

Click on Playlists in the menu bar. Branch and Section presentations are 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 webcast recorded and uploaded within the last three months is:

- *The Structural Design and Fabrication of Aluminium High Speed Vessels—the Good, the Bad, and the Ugly*, presented by John Kecsmar of Ad hoc Marine Designs, as a webinar hosted by RINA on the Zoom software platform on 27 April 2021.

Lily Webster

NSW Section Webcasts

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

- *The Effect of Mooring Systems on Floating Wave Energy Converters,* presented by Eric Gubesch, PhD Candidate, Australian Maritime College, as a webinar hosted by Engineers Australia on the WebEx software platform on 7 April 2021.
- *Characterising the Southern Ocean and Ross Sea Wave Climate,* presented by Sally Garrett, Defence Technology Agency, New Zealand Defence Force, as a webinar hosted by RINA on the Zoom software platform on 5 May 2021.
- *An Inclusive Approach to Naval Ship Sustainment,* presented by Ian Moon, Head of Engineering, Naval Ship Management (Australia), as a webinar hosted by Engineers Australia on the WebEx software platform on 2 June 2021
- *The Hydrodynamics of the Sydney Harbour RiverCat Ferries,* presented by Lawrence Doctors, Professor Emeritus, UNSW Sydney, as a webinar hosted by Engineers Australia on the WebEx software platform on 7 July 2021.

Phil Helmore

Tasmanian Section Webcasts

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

- *RSV* Nuyina*: Australia's New Icebreaker,* presented by Daniel Webster, ASRV Electrical Engineering Manager, Serco Defence, as a face-to-face meeting and as a webinar hosted by RINA on the Zoom software platform on 12 May 2021.
- *Tasmanian Historic Vessels and Building a Tasmanian Trading Ketch,* presented by Peter Higgs, retired educator and historic vessels researcher, as a face-to-face meeting and as a webinar hosted by RINA on the Zoom software platform on 22 June 2021.

Gregor Macfarlane

Western Australian Section Webcasts

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

- *Translating Oil and Gas TotEx Reduction Experience into Floating Offshore Wind,* presented by Enda O'Sullivan, Director, Wood Australia, as a webinar hosted by RINA on the Zoom software platform on 30 June 2021.

Nathan Chappell

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

CLASSIFICATION SOCIETY NEWS

DNV Handbook for Hydrogen-fuelled Vessels

A consortium of 26 leading companies and associations, led by DNV, has launched the *Handbook for Hydrogen-fuelled Vessels* to address the uncertainties surrounding hydrogen as ship fuel. The MarHySafe joint development project (JDP) aims to create a knowledge base for safe hydrogen operations in shipping.

Green hydrogen could play a crucial role in the maritime industry's journey towards decarbonisation. Many in shipping recognise hydrogen's potential as a fuel, but the barriers to realising this potential are substantial. The consortium of 26 partners and observers have come together in the MarHySafe JDP to examine these challenges. The *Handbook for Hydrogen-fuelled Vessels* offers a roadmap towards safe hydrogen operations using proton exchange membrane fuel cells (PEMFC). It details how to navigate the complex requirements for design and construction, and it covers the most important aspects of hydrogen operations, such as safety and risk mitigation, engineering details for hydrogen systems and implementation phases for maritime applications.

"Green hydrogen is one of the zero-carbon fuels which could be vital to meeting the IMO GHG goals but, as with other new fuels, there are still significant challenges regarding its safe and widespread implementation," said Knut Ørbeck-Nilssen, CEO DNV Maritime. "We are fortunate to be working with companies which are really ahead of the curve in terms of hydrogen operations. Having such esteemed partners and observers on board this project makes the insights gleaned all the more valuable. Furthermore, it shows how the shipping industry can pool its collective expertise and to tackle these crucial issues. We work best when we work together — the handbook is testament to this.”

Some of the main challenges for hydrogen operations in shipping include the current regulatory framework, which is open to interpretation by different stakeholders, existing knowledge gaps on the safe handling, storing and bunkering of hydrogen, as well as the unique properties of hydrogen which make it challenging to work with.

“This handbook provides a comprehensive overview of what companies need to consider with a hydrogen-fuelled vessel, as well as areas requiring further investigation and testing before this technology can be taken up on a larger scale,” said Nathaniel Frithiof, Senior Consultant, Environment Advisory at DNV Maritime and Project Manager for Phase II of MarHySafe. “But as MarHySafe progresses, we are working to ensure that the *Handbook* is much more than a static document, rather a knowledge hub which will be continually updated and will provide a basis for the future development of hydrogen rules.”

In the summer [*northern* — Ed.], the MarHySafe JDP enters into Phase II. This will include pre-calculated risk assessments, experimental testing, as well as more work on hydrogen bunkering and input towards standardisation. Alongside this, the *Handbook for Hydrogen-fuelled Vessels* will be updated continually as the project progresses to reflect the current level of expertise in the industry.

The MarHySafe Phase 1 project partners include the Norwegian Maritime Authority (NMA), the Norwegian Defence Materiel Agency (Naval Systems, NDMA), Equinor, Shell, Air Liquide, Linde, Kawasaki, Chart Industries, Parker, UMOE Advanced Composites, Hexagon Purus, Fincantieri, Feadship, HySeas Energy, Ballard, Cummins (previously Hydrogenics), Corvus Energy, AV Tchouvelev & Associates, Vancouver Fraser Port Authority, Redrock, Hydrogen Technology & Energy Corporation (HTEC), Memorial University, and DNV. The Norwegian Public Roads Administration (NPRA), the Standards Council of Canada, and the Norwegian Directorate for Civil Protection (DSB) were observers in MarHySafe Phase 1.

A PDF copy of the *Handbook* may be downloaded from

https://www.dnv.com/maritime/publications/handbook-for-hydrogen-fuelled-vessels-download.html

DNV News, 30 June 2021

LR Classes World’s First Suspension Crew-transfer Vessel

What if a vessel could be significantly smaller than a conventional crew transfer or service operation vessel, yet able to withstand the rough seas during the transfer to and whilst at a wind turbine generator? A vessel like this could be a gamechanger for the offshore wind industry — minimising the carbon footprint and increasing efficiency while reducing the cost of operations. Wallaby Boats GmbH of Kappeln, Germany, and its crew transfer/daughter craft WB Wind are building such a vessel, the first commercial boat equipped with a suspension system, and has selected Lloyd’s Register (LR) as its classification provider.

The vessel is basically a catamaran with a suspension system connecting the hulls and chassis. Developed and designed by Nauti-Craft in Australia, the hydromechanical suspension allows the hulls to move independently of the vessel’s chassis, absorbing harsh slamming impacts when operating at high speed in tough conditions. With the propulsion and power-generating systems placed in the hulls and the hydraulic unit and batteries stored underneath the chassis, there is free space on deck for cargo, passengers, equipment and automatic crew lifts.

Wallaby Boats, which was founded specifically to design and construct this innovative project, will design and build a series of vessels ranging from 14 m daughter craft/service operation vessels to 20 m crew-transfer vessels. The prototype, *WB 18 Wind*, was classed by LR, and will go through heavy-weather trials in the Baltic Sea and will also be tested in the rougher environments of the North Sea and the English Channel.

The suspension system allows the comparatively small vessel to withstand significant wave heights as well as transport crew members to and from offshore wind parks. The demonstrator currently under development is designed as a crew-transfer vessel seating 31 persons including 2 crew members. As the suspension system can buffer the impact of even large waves, the passengers will be subjected to less motion and *g*–forces during transit. This reduces the risk of seasickness and number of accidents, even in harsh weather, making crew transfers safer and more reliable. The vessel’s heated walkways and handrails can also improve safety in adverse conditions.

Due to its smaller size and substantial wave performance, even at high speeds, the vessel offers savings on resources and cost, reducing CapEx by up to 30% and OpEx by roughly 50%. Not surprisingly, offshore wind developers have already shown interest in the project, with EnBW providing funds and a long-term charter following the Sea Acceptance Test.

Aiming for a net-zero carbon footprint in production and operation of the new vessels, Wallaby Boats is building the demonstrator in accordance with ISO 18001, Blue Angel Ship Design and EU Ship Recycling Regulation standards.

LR News, 9 July 2021

Prototype *WB 18 Wind* suspension crew-transfer vessel (Image courtesy Wallaby Boats)

ABS uses Purely 3D Process to Deliver Commercial Vessel into Class

The first commercial US vessel designed, built and verified using an end-to-end 3D design process is now under construction in a pioneering project by ABS, Robert Allan

Ltd (RAL), Signet Maritime Corporation (Signet) and the United States Coast Guard (USCG).

Designed by RAL, the Advanced Rotortug®, which is designed to escort vessels and offshore assets at the Port of Corpus Christi, TX, will receive its Certificate of Inspection from the USCG and will now be built and operated by Signet to ABS class, making it the first commercial vessel in US history to be produced using only 3D models in design and construction for all structures.

A purely 3D process reduces costs and time investment, while streamlining interaction between all stakeholders throughout the design, verification and construction phases, without compromising safety.

"This landmark achievement sets the bar for future projects both in the US and internationally. Together with our forward-looking partners, we have realised a long-held dream of the industry to leave behind 2D paper plans and move to the next generation of vessel production. ABS is proud to help unlock this capability and to be genuinely leading the industry in this area, once again delivering the advantages of digital classification today. The advantages are significant, and we are confident that, once the industry develops the infrastructure to handle 3D models in shipyards, a pure 3D process will become the default approach," said Christopher Wiernicki, ABS Chairman, President and CEO.

"As naval architects, we find ourselves developing ship structure in 3D more than ever, even at the basic design stage for new vessels. We believe that delivering 3D models instead of traditional 2D drawings benefits all stakeholders — us as the designer, classification societies, clients, shipyards, and equipment suppliers. Direct design of structure in 3D not only streamlines the transition to production design modelling for the shipyard, but also gives us as naval architects earlier estimates of weights and centres, steel quantities as well as the means to check for structural interferences. We are very pleased that ABS has taken the initiative to work with us on a process to review and approve 3D structural models on our project with Signet Maritime Corp. Not only has it become easier to exchange complex structural design information this way, but the time from the basic design stage to the production design stage is shortened, allowing the shipyard to start cutting steel earlier," said Mike Fitzpatrick, CEO of Robert Allan Ltd.

"The understanding and fidelity of this construction model represents a major milestone in the history of the US maritime industry. 3D design review ensures that the designer, engineer, production manager, fitter, welder, and surveyor all work from the same complete model. Each individual has access to both the micro (component) and macro (complete assembly) with which they are working to better understand the bracket, frame, or bulkhead as it relates to the module, section, and ship. Providing that level of awareness to all participants in the process will give ABS, Robert Allan, and Signet a superior finished product and contribute to an overall safer waterway through technological advancement," said Timothy McCallum, Signet Vice President, Engineering and Dynamics.

The milestone is just the latest in a succession of ABS firsts in 3D model-based classification. ABS was the first to develop a process for ingesting 3D models into class software to allow 3D model-based reviews in 2018. ABS then became the first classification organisation to accept 3D models for class surveys in April 2020.

More information about ABS 3D model-based classification services is available at

https://ww2.eagle.org/en/rules-and-resources/3d-model-for-class-approval.html

ABS News, 28 June 2021

Advanced Rotortug® for Port of Corpus Christi, TX
(Image courtesy Robert Allan Ltd)

FROM THE CROWS NEST

Australian Marine Industry Awards 2021

The tenth annual ASMEX Conference was capped off with a celebratory evening commencing with pre-dinner drinks sponsored by Benetti Yachts, followed by industry acknowledgement of the outstanding achievers in Australian Superyacht, Marine Export and Commercial Industries at the 2021 Australian Marine Industry Awards Gala Dinner. The dinner, held at the InterContinental Sanctuary Cove Resort on Tuesday 18 May, honoured the worthy winners across eight highly-competitive categories.

- In the commercial category, Aus Ships Group won the 2021 Commercial Marine Project/Design or Manufacturer of the Year Award presented by Rivergate Marina & Shipyard for its high-profile work on the diverse fleet of vessels including the Brisbane City Cat. Tommy Ericson, CEO of Aus Ships Group, based at Rivergate Marina & Shipyard, Brisbane said "The Award is fitting recognition of our ability to deliver projects from end to end; being concept design to construction to delivery. [*This is the third year in a row in which this award has been won by Aus Ships Group!* — Ed.]
- The 2021 Commercial Marine Service Provider of the Year was won by Harwood Marine and was accepted by Ross Roberts, Managing Director. "Harwood Marine's support for the Commercial Marine sector is our core business and we are one of the very few large commercial shipyards that have

not been secured for defence contracts. Due to the recent acquisitions of large lift capacity shipyards on the East Coast there has been an increased demand on our services for repair and maintenance as well as conversion and new construction, and replacement of ageing fleets," said Roberts.

- In the Superyacht segment, the most hotly-contested category of the night was the Superyacht Industry Service Provider of the Year award, which was awarded to Coral Sea Marina Resort for their outstanding service provided to visiting superyachts, crew and guests and proudly accepted by CSMR's Marketing, Sales & Service Manager, Joscelyn O'Keefe.
- Gold Coast-based Superior Jetties, claimed the 2021 Superyacht Industry Project/Design or Manufacturer of the Year. Their outstanding submission focused on the design and construction of what will be the largest superyacht berth in Australia – a game changer for the industry — a 163 m in length and 4.6 m wide floating pontoon. The berth, currently under construction at the Southport Yacht Club on the Gold Coast, has been engineered and designed to welcome and accommodate some of the world's largest vessels.
- The 2021 Australian Exporter of the Year went to Riviera Australia, back-to-back winners recognising Riviera's immense increase in export sales and export revenue growth for the last two years running.
- The 2021 Marketing Strategy of the Year award was presented to David Trewern, founder of Byron Bay-based Fliteboard. The judges were impressed with company's ability to pivot its marketing strategy during COVID-19 from key marketing initiatives such as trade shows, events and travel, to promoting in a predominantly digital sense. Fliteboard's focus centered around sharing, engagement and growth of its online community.
- The 2021 Apprentice of the Year award, who also receives a trip to the world's largest marine equipment trades show, METSTRADE in Amsterdam, was awarded to Robert Smith from Superior Jetties for his dedication to the industry and focused on the knowledge he has gained from his journey. "Robert's ability has led him to accurately and competently complete an entire job from reading and interpreting drawings, actual fabrication/construction through to installation. These skills have given him the opportunity to work on some of the largest jobs Superior Jetties has recently completed."
- The final award of the night, the 2021 Marine Industry Champion, was presented by Councillor William Owen-Jones from City of Gold Coast. Accompanied by a huge round of applause this was awarded to John Hogan, CEO of Superior Jetties. "John Hogan is a dedicated marine industry professional, passionate about the innovation and manufacture of durable, functional and aesthetically pleasing products for commercial, residential and resort berthing applications. John understands the water and has specialised knowledge of the technical nuances of aquatic structures and the engineering challenges of designing waterfront options," said Councillor Owen-Jones in presenting the award. "It's been a very challenging but rewarding year which saw the whole team pulled together to overcome adversity. I'm humbled to receive the award and to be recognised by my peers," commented John Hogan after receiving the award on stage.

Australian Marine Industry Award winners 2021
(Photo from AIMEX website)

Aus Ships Group's Australian Marine Industry Award 2021
(Photo from LinkedIn website)

AIMEX, Superyacht Australia and the Australian Commercial Marine Group would like to thank the Awards' major sponsors, City of Gold Coast, Queensland Government, and Sanctuary Cove International Boat Show, as well as the presenting partners, TAFE Queensland, Steber International, Bank of Queensland-Business, Rivergate Marina & Shipyard, The Yard Brisbane and the SuperYacht Group Great Barrier Reef.

AIMEX News, 26 May 2021

Ocius Technology Christens Three New Bluebottles

The official christening ceremony of the third, fourth and fifth of Ocius Technology's next generation 6.8 m Bluebottle uncrewed surface vessels (USVs), built under their Defence Innovation Hub contract, took place on 18 June.

There was a limited number of elite guests present at the christening due to the COVID-19 restrictions, with about 30 participating online via the Microsoft Teams software platform. Guests present included

- Senator Hollie Hughes, standing in for the Hon. Melissa Price MP, Minister for Defence industry
- Vice Admiral Paul Maddison, ex-Commander Royal Canadian Navy and ex-High Commissioner to Australia, representing UNSW Defence Research Institute
- RADM Peter Quinn RAN, Head Navy Capability and Lead on Robotics Autonomous Systems and AI Strategy
- RADM Lee Goddard RAN, ex-Head Maritime Border Command
- CDRE Mal Wise RAN, Commander Indo-Pacific Endeavour and Former Chief of Operations, Maritime Border Command
- Dr Andrew Bailey, Group Leader Mine Countermeasures Maritime, DST Group, standing in for Professor Emily Hilder, Chief of Maritime Division, DST Group
- CDRE Peter Scott RAN, ex-Director General Submarines
- Roland Stephens, Executive Director Investment NSW, NSW Government
- CAPT Adam Allica RAN, Director General Warfare Innovation
- Alan Dupont, Northern Territory Defence Advisor
- Professor Nick Fisk, Deputy Vice-Chancellor (Research), UNSW Sydney
- Professors Ian Gibson, Chun Wang, Claude Sammut and Robin Schuck, UNSW Sydney
- Matthew Travers, standing in for Andrew Hodgkinson, CEO Defence Innovation Hub
- Chris Jenkins, CEO Thales
- Nick Gibbs, CEO Rockwell Collins
- Peter Campbell, Managing Director, Sonartech
- Peter Jenkins, CEO and founder, Jenkins Engineering Defence Systems
- Steve Quigley, Managing Director, One2three Naval Architects
- Brett van Munster, Principal, Van Munster Boats

Robert Dane, founder and CEO of Ocius Technology, gave apologies for Mark Bethwaite, Chair of Ocius Technology, welcomed the guests and participants, and opened proceedings with a few words about Ocius and the Bluebottles. In particular, he emphasised the Bluebottle features which competitors don't have:

Guests at the triple christening of Bluebottles
(Photo courtesy Ocius Technology)

- the flipper underneath the bow which enables propulsion due to wave action independently of sun and wind;
- the winch in the keel which enables quick change-over from one mission to another;
- the design of the vessel and trailer which enables two-person trailering operation to and from any launching ramp in Australia (competitors require either a crane for launching, or a larger vessel for transport to an ocean launching site).

Ocius is working with the computer-science faculty at UNSW Sydney, and the latest Bluebottles are intelligent robots which talk to each other and act in concert. Australia has some of the best naval architects and boatbuilders in the world, and here Robert acknowledged Steve Quigley of One2three Naval Architects and Brett van Munster of Van Munster Boats. We also have some of the toughest ocean conditions in the world, plus Botany Bay for flat-water trials, and an AMSA-approved area off Ulladulla, NSW. Australia may not be known for its good cars, but it *is* known for its good naval architects and boatbuilders.

Robert Dane welcoming the guests at the christening
(Photo courtesy Ocius Technology)

The first of the next generation 6.8 m Bluebottles, *Beth*, had been christened and is already operating off Darwin. The second vessel, *Bonnie*, has been christened and will soon be transported to Darwin with the three being christened today so that, in September, October and November, Ocius will have five Bluebottles operating in concert off Darwin. The operation will then move to Fremantle.

Bluey

Here Robert introduced RADM Peter Quinn, RAN, who said that it was good to see a range of people present at the christening from industry, academia and government, and acknowledged Senator Hollie Hughes.

Peter said that the Royal Australian Navy has 15 499 personnel, and 47 ships, so they don't have the capacity for the total presence required for future security. The Bluebottles will significantly improve that capability, as they incorporate world-leading technology.

Peter christened the vessel *Bluey* with champagne, using the Ocius wording "God bless this ship *Bluey* and all those who don't sail in her!"

RADM Peter Quinn christening *Bluey*
(Photo courtesy Ocius Technology)

Brizo

Robert then introduced Michelle Moulos, a long-time Ocius shareholder from Ulladulla, who said that her family is Greek, and so is familiar with Brizo, the Greek goddess of Mariners, Sailors and Fishermen. Brizo was worshipped primarily by the women of the island of Delos, who sent out food offerings in small boats. Brizo was also known as a prophet specialising in the interpretation of dreams.

Michelle said "May this Brizo travel well across the oceans while looking into its depths", before christening the vessel *Brizo* with champagne, using the Ocius wording in Greek: "Ο Θεός να ευλογεί αυτό το πλοίο Brizo και όλους εκείνους που δεν ταξιδεύουν μέσα της!"

Michelle Moulos christening *Brizo*
(Photo courtesy Ocius Technology)

Beacon

Robert then introduced Senator Hollie Hughes, who acknowledged Blanch d'Alpuget, wife of long-time Ocius Chairman Bob Hawke, in the gathering. She said that her father used to go fishing with Bob and their neighbours in Perth, the Kailises. She sometimes represents the Hon. Melissa Price MP, Minister for Defence Industry, and was pleased to be doing so today as the Bluebottle project is part of a $7.2 million investment in the Defence Innovation Hub. It is great to see the innovation coming out of Australia, and the technology which it is generating for security and the possible export opportunities.

Just last week she spent three days at sea on HMAS *Collins* off Stirling in WA, and they had practice torpedoes shot at them by another Collins-class submarine, and had dinner sitting on the sea bed at 135 m depth.

Hollie christened the vessel *Beacon* with champagne, using the Ocius wording "God bless this ship *Beacon* and all those who don't sail in her!"

Senator Hollie Hughes christening *Beacon*
(Photo courtesy Ocius Technology)

Following the christening, Ocius provided champagne toasts for the guests, followed by drinks and canapes.

The speeches and christenings are now up on the Ocius website at

https://www.ocius.com.au/blog/christenings-of-bluey-brizo-beacon/

Phil Helmore

Great Pacific Race Record

Four British women — known as the Ocean Sheroes — have smashed the Guinness World Record for rowing from San Francisco to Hawaii, beating the previous record by 14 days, in a venture supported by Lloyd's Register.

The female four covered the distance of 2400 nautical miles in 35 days, 14 hours and 32 minutes, cutting two weeks off the previous record. They are the first all-British female team of four to complete the Great Pacific Race, enduring 10 m waves, 45 kn winds and a relentless 24/7 schedule of rowing two hours on, two hours off.

The British Ocean Sheroes team of Bella Collins, Purusha Gordon, Mary Sutherland and Lily Lower were supported by Lloyd's Register. The team said, "Thank you for your incredible support! Couldn't have done it without you — so grateful to have had you on our journey with us!"

Mary Sutherland put the team's success down to their toughness, saying "Resilience and being goal-focussed is key, along with knowing your team's capabilities and how hard you can push them. These ladies didn't disappoint. We spent a lot of time learning each other's motivations, personal goals and personalities. Throw in a general 'get it done' attitude and you have a recipe for great things. My personal expectations of what our team could achieve was around the 40-day mark and I'm so happy to have blown that out of the water."

The Sheroes are using their success to raise awareness and funding for the Seabin Project, which automatically captures ocean pollution and plastics, down to a size of 2 mm.

LR News, 6 July 2021

Ocean Sheroes on safe arrival at Hawaii
(Photo from Lloyd's Register website)

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.* The Warby Motorsport team returned to Blowering Dam on 22 and 23 May to try out the latest modifications to the boat. It was a weekend of ups and downs for the team, with a ruptured fuel tank and some starter issues, but the boat's

Spirit 2 on Blowering Dam in May
(Photo from Warby Motorsport Facebook page)

handling has improved significantly with the altered LCG and the wing trim applied. In the last run on the Sunday, the boat held 235 mph for 1.5 km, with Dave happy with the handling.

The team had then been working with water authorities and local councils to schedule their next tests, looking at late July/early August. However, with the pandemic restrictions now in place, they need to look towards later in the year. As with many other motorsport teams and events that have been cancelled in New South Wales, it is very frustrating but, once the restrictions lift, they are ready to go and plan the next runs.

[*There are videos of* Spirit*'s runs on Blowering Dam in May on the Warby Motorsport Facebook page* — Ed.]

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.

Since sheathing the complete underside of the hull, much of the subsequent time has been spent by David Aldred on sanding the fairing coat of West System epoxy sufficient to receive paint, and then applying many coats of primer using a hand roller (spraying is not an option in the confined space of David's garage) to fill low spots, and re-sanding. Coloured topcoats are expected to be applied soon, and then the boat can be turned right-way up and placed on the trailer for the rest of the build.

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

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.

Longbow's underside coated with HMG primer
(Photo from Longbow website)

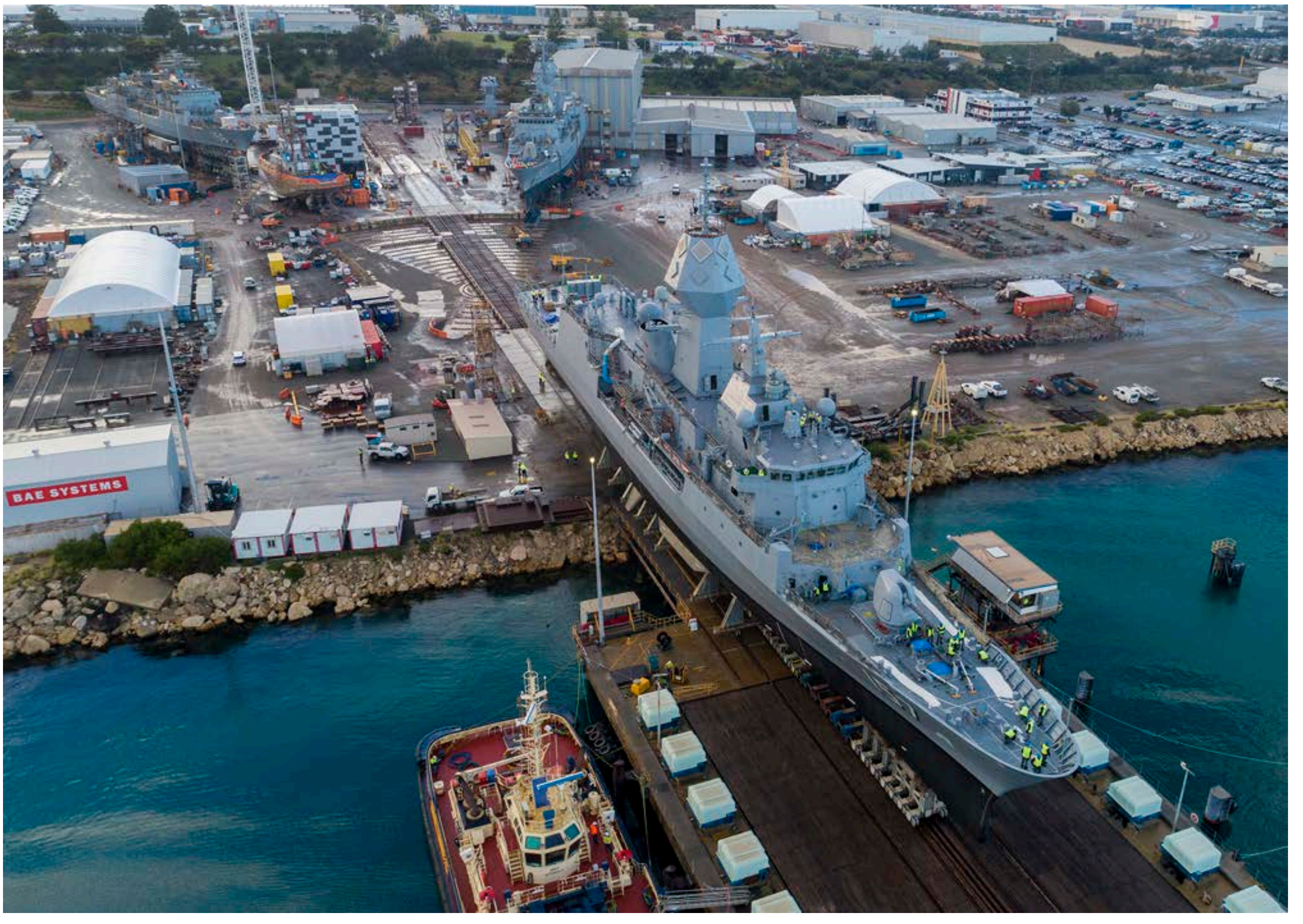
Titanium rudder bearing housings for *SP80*
(Photo from SP80 website)

Onboard the SP80 boat, there is no room for the irrelevant. Each part is carefully studied and optimised to fulfill the task for which it was designed. With the support of their engineers, EPFL students recently focussed on reducing the size and weight of the mechanical systems as much as possible, while guaranteeing the structural integrity of the parts.

As an example, for the bearing housing for the rudder stock, the weight of the optimised part is 420 g compared to 450 g for the raw part. While the weight difference may not seem impressive, the optimised part is much more resistant to the same load. The stresses in the optimised version are only 145 MPa, whereas the original part generates stresses of up to 1100 MPa. Due to their more-complicated shapes, these parts cannot be built in the traditional way, and this is where 3D Precision SA provided valuable support. The additive manufacturing (i.e. 3D printing) method is based on selective laser fusion which uses a high-powered laser to locally and progressively fuse a metal powder. In this case, EPFL is using titanium powder for the rudder bearing housings, but other materials can be used to make parts in aluminium, steel, copper, etc. A further 15 optimised parts are destined for additive manufacturing in titanium for the boat.

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

SP80 website



HMAS *Perth* is moved onto the shiplift at the Australian Marine Complex at Henderson, WA on 1 July after completing a major part of the Anzac Midlife Capability Assurance Program to upgrade radar capabilities, communications systems and crew habitability
(RAN photograph)

NUSHIP *Stalwart* berthing at Fleet Base West in Western Australia on 21 June after her delivery voyage from Spain
(RAN photograph)

Austal Delivers 12th Guardian-class Patrol Boat

On 2 August Austal announced the delivery the 12th Guardian-class patrol boat to the Australian Department of Defence. The vessel, RVS *Takuare*, was then gifted by the Australian Government to the Government of the Republic of Vanuatu at a certificate-signing ceremony held at the Australian Marine Complex in Henderson, Western Australia.

The ceremony was attended in person and online by His Excellency, Mr Samson Vilvil Farray, Vanuatu High Commissioner to Australia; Chief Inspector Dicky Obed from the Vanuatu Police Maritime Wing; Minister for Defence Industry The Hon. Melissa Price MP; RADM Wendy Malcolm, Head of Maritime Systems, Department of Defence, Capability Acquisition and Sustainment Group (CASG); RADM Kath Richards, Head of Navy Engineering, Royal Australian Navy; Air Commodore Fiona Dowse, Senior ADF Officer WA; and Mr Gerald Thomson, First Assistant Secretary, Pacific Bilateral Division, Department of Foreign Affairs and Trade.

The vessel is the first Guardian-class patrol boat to be delivered to Vanuatu under the Pacific Patrol Boat Replacement Project (SEA3036-1), part of the Australian Government's Pacific Maritime Security Program, and replaces RVS *Tukoro*, a Pacific-class patrol boat delivered in 1987.

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery of the 12th Guardian-class patrol boat, less than six weeks after the delivery of the 11th vessel, highlighted the efficiency of the Austal Australia teams and shipyards.

Participating at the handover ceremony for RVS *Takuare* were (from left) RADM Wendy Malcolm, Head of Maritime Systems CASG; Chief Inspector Dicky Obed, Commanding Officer RVS *Takuare*; RADM Kath Richards, Head of Navy Engineering RAN; His Excellency Mr Samson Vilvil Farray; Minister for Defence Industry, The Hon. Melissa Price MP and Austal Chief Executive Officer, Mr Paddy Gregg.
(Department of Defence photo)

"*Takuare* is the 12th Guardian-class patrol boat Austal Australia has delivered in just over 30 months, and the fourth Guardian we have delivered this year alone," Mr Gregg said.

"The Pacific Patrol Boat Replacement Project continues to impress our customers, stakeholders and end users, the Pacific Island nations, with the tremendous efficiency with which we are completing these vessels.

"With effective collaboration between the Department

Vanuatu's RVS *Takuare* is a 39.5 m steel monohull Guardian-class patrol boat designed and constructed by Austal in Henderson, Western Australia
(Photo courtesy Austal)

of Defence, Austal Australia and our Australian Industry Capability (AIC) partners — our trusted supply chain — we are maintaining a delivery schedule of one vessel, on average, every three months. That is an outstanding track record, of which the Australian defence industry should be proud.

"Our warmest congratulations go to the President of Vanuatu, His Excellency Obed Moses Tallis; Prime Minister, the Honourable Bob Loughman Weibur; Commissioner of Vanuatu Police Force, Colonel Robson Iavro; Commanding Officer of RVS *Takuare*, Chief Inspector Dicky Obed, Vanuatu Police Maritime Wing and his crew, and the people of the Republic of Vanuatu, on the handover of this outstanding new patrol boat."

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 Vanuatu Police Maritime Wing with a much improved naval asset to carry out border patrols, regional policing, search-and-rescue, and many other operations domestically and internationally.

The eleventh Guardian-class patrol boat, RKS *Teanoai II*, handed over in June, was gifted to Government of the Republic of Kiribati.

Austal USA Delivers the Future USS *Savannah*

At the end of June Austal USA delivered its 14th Independence-class Littoral Combat Ship (LCS) to the US Navy, from the company's shipyard in Mobile, Alabama. The future USS *Savannah* (LCS 28) was completed in just under three years, a full twelve months earlier than previous ships delivered under the same program.

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery of LCS 28 highlighted Austal USA's proven capabilities to deliver multiple, complex naval shipbuilding programs efficiently, on schedule and within budget.

"*Savannah* is the seventh ship delivered by Austal USA to the US Navy in just two years, which is an incredible achievement," Mr Gregg said.

The future USS *Savannah* (LCS 28) is the 14th Independence-class Littoral Combat Ship to be delivered by Austal USA (Photo courtesy Austal)

Five Independence-class LCS and two Spearhead-class Expeditionary Fast Transport (EPF) ships are currently under construction at Austal USA, with two additional ships, LCS 38 and EPF 15, under contract and soon to commence construction.

Austal USA has recently been awarded a concept and preliminary design contract for the US Navy's Light Amphibious Warship (LAW), which would be built on Austal USA's new steel production line. The shipyard has also been awarded a functional design contract to prepare for construction of the new steel hull Navajo-class Towing, Salvage and Rescue Ship (T-ATS) for the US Navy.

Austal USA will prepare a functional design for the new Navajo-class Towing, Salvage and Rescue Ship (T-ATS) for the US Navy, an 80 m steel monohull with multi-mission capability to support a variety of towing, salvage, search-and-rescue, oil-spill response, humanitarian assistance and surveillance activities (Image courtesy Austal)

Birdon to Build New Firefighting Vessels

On 24 May the NSW Minister for Transport, the Hon. Andrew Constance MP, announced that Birdon is to build two new firefighting vessels for the Port Authority of New South Wales.

The new vessels will be built by Birdon in the NSW regional town of Port Macquarie and the contract is expected to create jobs for 40 Birdon staff members and an additional 20 subcontractors.

An impression of the new firefighting vessels to be built by Birdon in Port Macquarie (Image courtesy Birdon)

Anzac-class Frigates Capability Upgrade with new Air-search Radar System

The Royal Australian Navy is one step closer to operating one of the most advanced, sovereign air search radar capabilities in the world, with the upgraded air-search radar systems in the Navy's Anzac-class frigates having reached Initial Operating Capability.

Under the SEA 1448 Phase 4B project, the existing air-search radar system has been replaced with the Australian-designed

On 8 August the lead ship of the US Navy's new class of aircraft carriers, USS *Gerald R Ford* (CVN 78), successfully completed first-of-class shock trials off the coast of Florida. The third and final test involved the detonation of 18 t of high explosive close to the ship. These trials were the first full-ship shock trials for a US Navy aircraft carrier since 1987. Construction of USS *Gerald R Ford* began in 2009 and she was commissioned in July 2017 at a cost of some $US13 billion (about $A18 billion). After extensive trials and post-delivery shipyard work, the ship is expected to begin her first deployment in 2022. Three more of this class are under construction, the future US Navy ships *John F. Kennedy, Enterprise* and *Doris Miller*. The ships are designed for a fifty-year service life
(US Navy Photo)

and manufactured CEAFAR-2L phased-array radar system. This system complements the first generation CEAFAR-1S phased-array radar capability installed during the Anzac Anti-Ship Missile Defence upgrade.

RAN Chief of Navy, VADM Michael Noonan AO RAN, said that the cutting-edge technology was delivering world-class capability to the Navy through a strategic collaboration with Defence industry partners.

"This technology has delivered a significantly advanced air-warfare and missile self-defence capability to Navy's Anzac-class frigates and provides the Navy with one of the most advanced, sovereign air-search radar capabilities in the world," VADM Noonan said.

"The close partnership between Government and Australian industry is crucial to this Australian success story."

The upgraded Anzac air-search radar replaces the original conventional radar system, which was supplied to Anzac-class frigates as part of the original build program in the 1990s.

Deputy Director Systems, CMDR David Bettell, said that the new radar system had been integrated with the Saab 9LV combat-management system and had been successfully demonstrated at sea.

"The Anzac air-search radar replacement project has not only replaced the ageing air search radar but delivered ground-breaking integrated digital Identification Friend or Foe (IFF) capability, a world first within a phased-array radar system," CMDR Bettell said.

Among the many advantages offered by the SEA 1448 Phase 4B project are the significant improvement of detection, classification and identification of air contacts, a greater level of radar and combat-management system integration, improved levels of radar functionality and significant improvements in equipment support and reliability.

The Anzac air-search radar replacement was jointly completed in collaboration between CEA Technologies, Saab Australia and BAE Systems.

The upgrade project management occurred through the Warship Asset Management Agreement Alliance with the Anzac Ships Program Office and SEA 1448 Phase 4B Project Office.

First RAS for HMAS *Supply*

HMAS *Supply*, the first of the RAN's two new replenishment ships (AOR), has completed her first ever Replenishment at Sea (RAS) with HMAS *Anzac*.

The first RAS marks a significant milestone for Navy's refuelling and resupply at sea capability, which is critical for extending time at sea for Australian and allied ships.

Supply's first RAS took place off Australia's east coast and involved the transfer of diesel fuel to *Anzac*.

HMAS *Supply's* Commanding Officer, CAPT Ben Hissink, said that the successful RAS was a strong indicator of the AOR's versatility and criticality.

"Navy's new AORs are exceptionally versatile and a valuable generational shift from previous logistics ships," Captain Hissink said.

"They can carry larger volumes of fuel, operate in a wider range of sea states and environmental conditions, support smaller ships and are now equipped with a combat management system which enhances their interoperability with Australian and allied assets.

"The success of our first RAS means we are one step closer to completing our operational test and evaluation period and being out on the seas delivering a critical enabling capability."

Supply commissioned in April 2021 and, with the support of Sea Training Group, has been progressing through her operational test and evaluation period to certify her readiness to join the fleet.

So far, the ship has completed combat survivability training, man overboard exercises, boarding party training, gunnery and warfare training and experienced Sea State 6 and executed a heavy jackstay trial — the first completed in the RAN since HMAS *Success's* last heavy jackstay transfer in 2018.

Successful completion of the RAS means that HMAS *Supply* is well on the way to achieving initial operating capability.

HMAS *Supply* and HMAS *Anzac* during *Supply's* first RAS
(RAN photograph)

Austal Vietnam Delivers 41 m Catamaran Ferry to Mauritius

In late May Austal Vietnam delivered *Maria Galanta Express* to Oceanoi Limited of Mauritius.

The 41 m high-speed catamaran ferry will be operated by Société de Gestion et de Transport Maritime (SGTM) in the Comoros Islands, situated off the southeastern coast of Africa.

Austal was awarded the $A15.5 million contract to design and construct the vessel in January 2020 and construction commenced at the company's Vietnam shipyard in Vung Tau in March 2020.

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery was a significant milestone in the company's newest shipyard.

"This new ship for SGTM, is the second vessel we have delivered out of the Vietnam shipyard and highlights the tremendous productivity and efficiency of the local team, who have effectively delivered two vessels in two years," said Mr Gregg

"It's also very pleasing to see another customised variant of our popular, high-speed catamaran ferry design being delivered to yet another new customer, and I offer my warmest congratulations to SGTM Director, Michel Labourdere, on the delivery of his latest addition to their fleet."

The Austal Passenger Express 41 catamaran features a length overall of 41.2 m, beam of 10.9 m and draft of 2 m. Over two decks, the vessel can accommodate 400 passengers and mixed cargo of up to 20 t, loaded via two ramps.

Fitted with Austal's Motion Control System (including active interceptors and T-foils), four MTU-12V2000 M72 engines, and four KaMeWa 56A3 waterjets, the new catamaran achieved 31.9 kn at 100% maximum continuous rating during sea trials and has a range of approximately 370 n miles.

Maria Galanta Express was built by Austal Vietnam and delivered in May (Photo courtesy Austal Vietnam)

Established in 2004, SGTM is The Comoros' leading ferry company, operating three passenger ships and two freight transport ships between the islands of Mayotte, Anjouan and Great Comoros, carrying more than 100 000 passengers annually. With the delivery of *Maria Galanta Express,* SGTM is now operating two Austal-built vessels, joining *Marine View* which was acquired from Japan in 2013.

Austal to Build High-speed Catamaran Ferry for French Polynesia

Austal announced on 11 August that Austal Australasia has been awarded a €20.5 million (approximately $A32.8 million) contract to design and build a 66 m high-speed catamaran ferry for The Degage Group of French Polynesia.

Work will commence on the new ferry in August 2021 at Austal Vietnam, with a scheduled delivery in the first half of 2023.

Austal's Chief Executive Officer, Paddy Gregg, said that the new contract, from repeat customer The Degage Group, was a strong indication of their satisfaction with Austal's innovative commercial ferry designs.

"Over the past two decades The Degage Group has trusted Austal to design and construct five ships for their growing maritime and tourism operations in French Polynesia, and we're delighted that they have again chosen Austal to develop their latest high-speed ferry," Mr Gregg said.

"The Degage Group is an acknowledged leader in commercial maritime transportation and tourism. This contract is a clear demonstration of confidence in our Vietnam shipyard, which recently delivered its second commercial ferry within a period of just two years.

"Our sincere thanks to The Degage Group and especially the team at Aremiti SNC for again showing their trust in us to build them the very latest in high-speed ferry technology, efficiently and cost effectively, to Austal's highest quality standards."

The new Austal Passenger Express 66 catamaran will have a length overall of 66.4 m, beam of 15.2 m and draft of 1.8 m. Over two passenger decks, the vessel can accommodate 574 passengers, with an additional 80 seats available on an external sun deck. Crew accommodation includes seven two-berth cabins and two single-berth cabins. The vessel has four passenger access ramps and can carry up to 16 t of cargo loaded via two cranes.

To be fitted with four diesel engines and four waterjets, as well as Austal's renowned Motion Control System (including active interceptors and T-foils) and the latest MARINELINK and MARINELINK-Smart programs, the new ferry will have a contracted top speed of 35.8 kn and a range of 360 n miles.

Austal has previously designed and built five vessels for The Degage Group, comprising two 69 m monohull cruise ships, a 56 m vehicle passenger catamaran ferry, an 80 m vehicle passenger catamaran ferry and a 49 m vehicle passenger ferry.

The new ferry will operate as *Apetahi Express*, between Pape'ete (Tahiti) and Vaitape (Bora Bora).

Austal's new Passenger Express 66, a high-speed catamaran ferry to be constructed by Austal Vietnam for The Degage Group of French Polynesia (Image courtesy Austal)

Captain Cook Graving Dock receives Heritage Recognition

Built in the midst of World War II and still used to this day, the Captain Cook Graving Dock in Sydney has been added to Engineers Australia's Engineering Heritage Recognition Program.

Engineering Heritage Sydney (EHS) was recently given the opportunity to participate in the recognition of this incredible example of Australian engineering heritage.

EHS was first approached in 2019 by the Naval Historical Society of Australia to see if the Captain Cook Graving Dock could be included in the Engineering Heritage Recognition Program.

After a cancelled recognition ceremony in 2020, on 17 June 2021 the heritage recognition ceremony took place at Garden Island, alongside the Captain Cook Graving Dock.

Engineering Heritage Australia (EHA) Chair, Merv Lindsay, gave a speech about the Heritage Recognition Program and

HMAS *Adelaide* entering the Captain Cook Graving Dock on 17 May for an extended maintenance period. The work to be undertaken is similar to that recently completed in HMAS *Canberra*, berthed at the fitting out wharf on the left
(RAN photograph)

EA's Sydney Division President, Jessica Qiu, unveiled the National Heritage Plaque with senior RAN representative CDRE Shane Glassock, Director General, Maritime Support Branch.

Captain Cook Graving Dock was built during World War II, opening in 1945, to meet the need for a large dry dock to service large naval vessels.

Crews from the Civil Construction Corps and NSW Government Departments dredged some 114 000 t of silt, moved 608 000 t of rock, sand and clay, and poured 250 800 t of concrete to make the dock.

It was regarded as the largest construction project undertaken in Australia at that time. The achievement was even more remarkable, given the shortages of manpower, materials and equipment due to the war.

Jessica Qiu, President, Sydney Division of Engineers Australia, and CDRE Shane Glassock, Director General, Maritime Support Branch, unveiling the National Engineering Heritage Marker at the Captain Cook Graving Dock
(RAN photograph)

A major milestone was achieved recently with the completion of the new wharf at Garden Island in Sydney which replaced the old Oil and Cruiser Wharves. Visiting Sydney over the weekend of 2–4 July prior to taking part in the Talisman Sabre 2021 exercise with the ADF, the Japan Maritime Self-Defence Force destroyer JS *Makinami*, Republic of Korea Navy destroyer ROKS *Wang Geon* and US Navy destroyer USS *Rafael Peralta* were the first ships to berth alongside the new wharf.

The construction of this new wharf, and the new crane for it which is yet to be delivered, comprises Stage 1 of the Garden Island (East) Critical Infrastructure Recovery Program (Photo John Jeremy)

First US Navy LCS is Decommissioned

USS *Independence* (LCS 2), the namesake of the US Navy's Independence-class of Littoral Combat Ships, left the fleet after 11 years in a small ceremony in San Diego on 29 July 2021.

Independence, based in California, was scheduled to formally leave the fleet on 31 July. She has been used as a testbed for mission package development and is leaving the fleet well ahead of her expected 25-year service life.

USS *Independence* and sister-ship USS *Coronado* (LCS 4) were the first two Independence-class trimaran ships built to compete for the Navy's Littoral Combat Ship contract. The ships competed along with the Freedom-class steel monohull LCS USS *Freedom* (LCS 1) and USS *Fort Worth* (LCS 3) before the Navy elected to build both versions of LCS.

Freedom is scheduled to leave the fleet in September. US Navy Chief of Naval Operations, ADM Mike Gilday, told the US Naval Institute in an interview that it would take $2.5 billion to upgrade the first four ships — money he would rather put toward the emerging Constellation-class frigate (FFG 62) program.

In the US Navy's current FY 2022 budget submission, the Navy is asking to decommission four more LCS — *Coronado*, *Fort Worth,* USS *Detroit* (LCS 7) and USS *Little Rock* (LCS 9).

The US Navy commissioned *Forth Worth* in 2012 and *Coronado* in 2014. *Detroit* was commissioned in 2016 and *Little Rock* in 2017.

Meanwhile, the US Navy has completed a repair to the complicated gearing mechanism which links the ship's gas turbines to the diesel engines in the Freedom-class LCS USS *Minneapolis-Saint Paul* (LCS 21).

In January, the US Navy stopped taking delivery of the Freedom-class from Lockheed Martin after determining that the RENK AG-built combining gear was under-engineered following a string of high-profile failures. In total, 13 Freedom-class LCS require the fix to the complicated gearing mechanism deep in the heart of the hulls.

USS *Independence* during her decommissioning ceremony on 29 July (US Navy photograph)

The ships affected are now restricted by Naval Sea Systems Command to using either the ship's diesel engines or its MT-30 gas turbines, but not both — keeping the ships from their 40 kn top speed.

The US Navy, Lockheed Martin and RENK AG tested a fix for the gearing in March in Germany and are finalising the repairs on *Minneapolis-Saint Paul* at Escanaba, MI, where the ship was taken to free up space at Fincantieri Marinette Marine in Wisconsin.

The next steps will be to test the fix in the Great Lakes by putting the repaired gear through a series of elaborate propulsion drills for both *Minneapolis-Saint Paul* and under-construction USS *Cooperstown* (LCS 23). The goal would be to validate the repair on both ships and leave the Great Lakes before the path to the Atlantic freezes.

www.usni.org

Elysium from Incat Crowther

Incat Crowther has announced a new design for a 24 m motor yacht. Titled Project *Elysium*, the design has been contracted for construction, with delivery scheduled for 2023.

Incat Crowther, in collaboration with the client, has implemented many innovative design solutions to meet a multi-faceted project brief. Benefits of the custom design allow maximum use of spaces for the required purposes and greater efficiency at customer-specified transit speeds. Incat Crowther supported the client through preliminary design and yard selection phases, and will perform production naval architecture, exterior and interior design.

The Incat Crowther 24 offers a full-beam saloon with 360 degree panoramic views and generous outdoor living spaces. Accommodation includes one master cabin on the main deck, four cabins in the hulls and a captain's cabin on the wheelhouse deck.

Starboard side of *Elysium*
(Image courtesy Incat Crowther)

Stern of *Elysium*
(Image courtesy Incat Crowther)

Key features include a multi-functional lifting swimming platform which allows easy access to the water and serves as an excellent fishing platform. There is an unmatched main-deck open living area and a capable upper deck with room for two sizable tenders.

The galley and dining area opens into the back deck for a more convivial setting, offering seating for up to eight people outside and six inside. The back deck also features a generous BBQ with a serving area, multiple fridges and a sink to complete the entertaining area.

On the upper deck, a spacious wheelhouse offers a lounge which can accommodate up to five people and three helm chairs. Aft of this is the captain's quarters plus a day head. Access to the foredeck is provided via a Portuguese bridge layout. Designed for a tropical climate, *Elysium* has a dedicated multi-zone air conditioning system throughout the vessel.

Galley and dining area on *Elysium*
(Image courtesy Incat Crowther)

Main deck lounge on *Elysium*
(Image courtesy Incat Crowther)

Master cabin on *Elysium*
(Image courtesy Incat Crowther)

The proven hull design allows *Elysium* to operate at an efficient cruising speed of 21 kn while assuring low fuel consumption and comfort on board. The twin 846 kW Scania DI-16 main engines deliver a top speed of 29 kn. Designed with a practical and functional approach, the vessel offers great manoeuvrability thanks to its layout and the adoption of Twin Disc Express Positioning which administers the gearboxes and main engines, with bow thrusters for station-keeping, ease of docking and slow-speed manoeuvres.

The aluminium hulls will be coupled with a composite superstructure.

Underway, the vessel's pitching motions are reduced by twin Humphree active interceptors on the stern, whilst at rest a twin anchoring system combines with the widely-spaced twin hulls to provide a stable platform which does not require gyro or roll stabilisers.

By offering a bespoke design and guiding hand through the process, Incat Crowther has been able to provide the client with a best-value solution which fills the void between inflexible production vessels and high-end bespoke yacht builders.

Principal particulars of *Elysium* are

Length OA		24.0 m
Length WL		23.3 m
Beam moulded		7.70 m
Depth		3.00 m
Draft (propellers)		1.76 m
Complement		12
Fuel oil		13 400 L
Fresh water		1200 L
Sullage		1200 L
Main engines		2×Scania DI-16 076M
		each 846 kW @ 2300 rpm
Propulsion		2×propellers
Generators		2×gensets
Speed	(cruising)	21 kn
	(maximum)	29 kn
Tenders		15.6 m
		13.6 m
Construction		Hull marine-grade aluminium
		Superstructure composite
Class/Survey		AMSA

Eleanor Roosevelt from Incat Crowther

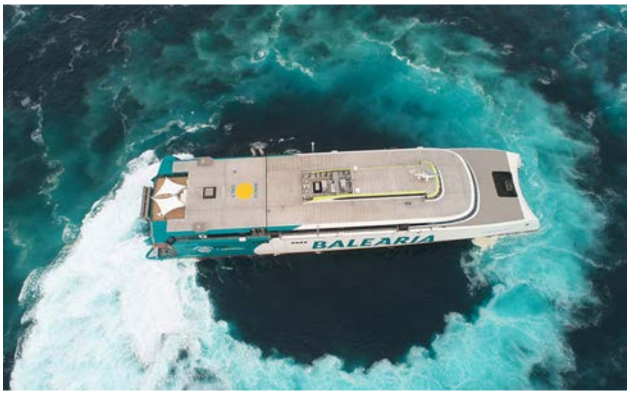
The world's first large catamaran ro-pax ferry powered by dual-fuel reciprocating engines has entered service. The Incat Crowther 123 *Eleanor Roosevelt* was built in Europe by the partnership of Spanish shipyard Astilleros Armon, designer Incat Crowther, and vessel operator Baleària. The Incat Crowther 123 demonstrates fresh thinking in the sector with its highly customised design and raft of new technology.

As well as a design developed to address the operator's specific conditions and requirements, *Eleanor Roosevelt* validates a new local market option for European operators seeking aluminium ships of large size and complexity. Efficiently built by Astilleros Armon at its Gijon shipyard in Spain and using modern, modular construction techniques, the vessel demonstrates a high level of technical capability, capacity and superb build quality.

The operator Baleària has been innovative in introducing LNG powerplants to their fleet, pioneering agreements with fuel and machinery suppliers. Liquefied natural gas is one of the fossil fuels least damaging to the environment. Its use reduces CO_2 emissions by 30%, NOx by 35% and eliminates sulphur and other particulates. The use of LNG fuel combined with Incat Crowther's latest-generation hullform offers relatively low fuel consumption for a vessel of this size.

Interesting interior fitout spaces developed by Oliver Design of Spain are divided into dedicated zones and offer facilities such as multiple bars, a market and a food court, kindergarten and outdoor terrace. There are also kennels to allow travellers to bring their pets, with kennel monitoring via a smart-phone app, and electric-vehicle charging stations. Boarding is by way of QR codes on passengers' mobile devices, whilst high-speed wi-fi is available throughout the vessel.

Eleanor Roosevelt on trials
(Photo courtesy Incat Crowther)



Eleanor Roosevelt turning in her own length
(Photo courtesy Incat Crowther)

As well as state-of-the-art amenities, passengers will be offered a high level of comfort. Motions have been reduced with the latest iteration of Incat Crowther's proven hullform, coupled with an operation-specific centre-bow design. A retractable centre T-foil will also be used to smooth the ride, whilst an isolated superstructure provides ultra-quiet passenger spaces.

Eleanor Roosevelt has capacity for 450 cars and 1200 passengers. The main vehicle deck has a height clearance of 4.85 m, affording 500 lane-metres of truck capacity.

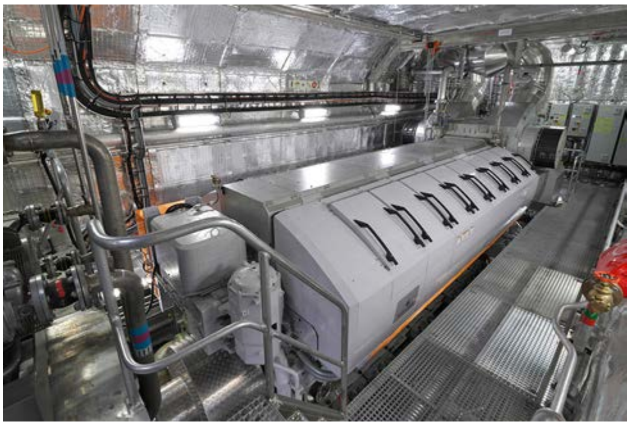
The Incat Crowther 123 dual-fuel ro-pax is powered by a quartet of Wartsila 16V31DF main engines. Each of these engines produces 8800 kW and drives a Wartsila LJX 1500 waterjet.

Eleanor Roosevelt builds on Incat Crowther's and Astilleros Armon's capabilities to offer a quality European-built option for fast ro-pax operators.

Principal particulars of *Eleanor Roosevelt* are

Length OA	123.0 m
Length WL	118.8 m
Beam OA	28.0 m
Depth	7.80 m
Draft (hull)	3.15 m
Passengers	1 200
Crew	21
Vehicles	450 cars
	500 lane m trucks + 250 cars
Fuel oil	310 000 L main tanks
	3000 L day tanks
LNG	190 m^3
Fresh water	10 000 L
Sullage	6500 L
Main engines	4×Wartsila 16V31DF
	each 8800 kW @ 765 rpm
Propulsion	4×Wartsila LJX 1500 waterjets
Generators	2×130 ekW (diesel)
	2×344 ekW (LNG)
Speed (service)	35 kn
(maximum)	40 kn
Construction	Marine-grade aluminium
Flag	Cyprus
Class/Survey	BV I ✠ HULL ✠ MACH
	HSC Cat B /Ro-Ro
	Passenger Ship
	Sea Area 4 ✠ AUT-UMS
	DUALFUEL

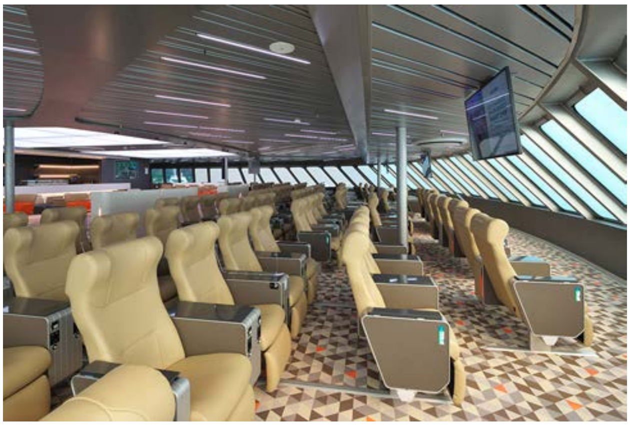
Bridge on *Eleanor Roosevelt*
(Photo courtesy Incat Crowther)



Engine Room on *Eleanor Roosevelt*
(Photo courtesy Incat Crowther)

Main-deck cabin on *Eleanor Roosevelt*
(Photo courtesy Incat Crowther)

Main-deck lounge on *Eleanor Roosevelt*
(Photo courtesy Incat Crowther)



VIP cabin on *Eleanor Roosevelt*
(Photo courtesy Incat Crowther)

Main vehicle deck on *Eleanor Roosevelt*
(Photo courtesy Incat Crowther)

ToyBox from Incat Crowther

Following the recent successful delivery of the 68 m *Wayfinder*, Incat Crowther and YCTS Ltd have announced the release of a new 48 m sub-500 GT catamaran shadow yacht concept, named *ToyBox*. A first of its kind, this innovative shadow yacht can be built at Armon Shipyards, Spain, in only 18 months within a very attractive price range.

The new concept was designed by Incat Crowther and YCTS Ltd to incorporate many of the award-winning features of the larger ShadowCat designs, but on a smaller hull platform to suit the needs of owners who require support for 50–to–70 m superyachts.

The 48 m *ToyBox* has a beam of 12 m and a draft of 2.15 m which permits close coastline navigation. Though all features can be customised to an owner's taste, the concept includes a helipad, 14+ crew accommodation and storage over three decks. The 13 m helipad is fully-certified and CAP437 compliant for helicopters including the Airbus ACH145, AW119 and Bell 429.

The large aft main deck allows for three tenders up to 10 m in length in the base configuration. The launch-and-recovery system consists of overhead beam cranes. Forward of this, the main-deck cabin houses facilities such as deck store, galley, mess and accommodation.

"This latest ShadowCat concept offers a tremendous amount of customisation and meets the needs of buyers who require a moderately-sized shadow yacht to support their existing superyachts without sacrificing quality or performance," said Robert Smith, director of YCTS Ltd.

Starboard quarter of *ToyBox*
(Image courtesy Incat Crowther)

"As well as being more cost-efficient to construct, sub-500 GT vessels are also more economical to crew and operate. This innovative new concept delivers the total package — bespoke design, tangible efficiencies and an expeditious construction schedule — which will meet the needs of any superyacht owner without compromise." said Dan Mace, Technical Manager of Incat Crowther.

"We have found this platform to be the key for every yacht owner to transport everything that they need less than a mile away from their main yacht, no matter when or where, through a compact and cost-effective solution," said Ricardo García, Commercial Director of Armon Shipyards Spain. "We think this concept will revolutionise the megayacht industry."

The innovative catamaran hullform offers 40 percent more volume and 60 percent more deck space, allowing for crew accommodation and greater payload — such as helicopters, tenders, jet skis, submarines and the like — to be stored. Additionally, the catamaran hull design has proven to be more efficient, delivering less fuel burn and higher speeds, with a 70 percent increase in stability during offloading/loading operations.

Principal particulars of *ToyBox* are

Length OA	47.7 m
Length WL	46.8 m
Beam	12.0 m
Depth	4.40 m
Draft (hull)	1.70 m
(propellers)	2.15 m
Crew	14+
Fuel oil	142 000 L
Fresh water	5000 L
Grey water	2500 L
Black water	2500 L
Main engines	2×MTU 12V 4000 M73 each 1920 kW @ 1970 rpm
Propulsion	2×propellers
Service speed	20 kn
Construction	Marine-grade aluminium
Class	Lloyd's Register ✠100A1 SSC Support Catamaran HSC G6 LMC Helicopter Landing Area, UMS

ToyBox at Speed
(Image courtesy Incat Crowther)

Stern of *ToyBox*
(Image courtesy Incat Crowther)

Nordlicht II from Incat Crowther

Incat Crowther has announced the delivery of *Nordlicht II*, a 46 m 450 pax catamaran ferry, by Singapore's Penguin Shipyard International. Penguin delivered *Nordlicht II* in early June to Germany's AG EMS after successfully completing sea trials in Singapore. Built by Penguin's wholly-owned subsidiary PT Kim Seah Shipyard in Batam, Indonesia, the ferry is based on the Incat Crowther 46 design, the largest vessel from the drawing boards of Incat Crowther's Europe office. The vessel will be operated on a number of routes, including serving the North Sea islands Borkum and Helgoland.

Nordlicht II is the product of a highly-efficient consultative process whereby Incat Crowther initially supported the client AG EMS to develop a vessel specific to their own operating requirements. This process included discussions on the propulsion plant and motion-damping system, along with extensive discussions on the internal arrangement and outfitting of the vessel.

The aim and successful outcome of this process was to ensure that AG EMS have a vessel which meets their exacting requirements and standards. With an agreed design, Incat Crowther held an international tendering process for the construction of the vessel, ensuring that AG EMS received directly-comparable quotations for the build of the vessel and simplified the selection of the most suitable shipyard. Penguin was selected through this rigorous tender process.

Port quarter of *Nordlich II*
(Photo courtesy Incat Crowther)

Starboard side of *Nordlich II*
(Photo courtesy Incat Crowther)

Nordlicht II is capable of carrying up to 450 passengers, with an additional 52 exterior passenger seats and tables. The main deck includes 248 economy-class passenger seats with a large kiosk and racks for small luggage items. Aft of the main passenger lounge is a large dedicated luggage room and aft of this is a section of crew accommodation.

The upper deck is divided into two cabins, a 111 passenger cabin amidships and a business-class cabin for 96 passengers forward, with views over the foredeck, as well as discreet boarding facilities. The two passenger decks are linked by an open stairwell and an elevator. The third deck houses the wheelhouse, a crew mess and senior crew cabins.

Nordlicht II is powered by twin MAN 175D main engines, each producing 2960 kW, the first use of these new modern engines in a high-speed ferry. The vessel has a maximum speed of in excess of 36 kn and a service speed of 33 kn.

Designed for the prevailing conditions of the route, *Nordlicht II* features a high bow and possesses excellent seakeeping characteristics with a motion-damping system consisting of T-foils and interceptors provided by Naiad.

Incat Crowther's contribution to *Nordlicht II* demonstrates the firm's position as the ideal shipbuilding partner, providing support from initial concept through to commissioning.

Principal particulars of *Nordlicht II* are

Length OA	46.8 m
Length WL	44.8 m
Beam OA	11.0 m
Depth	4.40 m
Draft (hull)	1.60 m
Passengers	450
Crew	6
Fuel oil	22 000 L
Fresh water	4000 L
Sullage	3000 L
Main Engines	2×MAN 175D MM each 2960 kW @ 1900 rpm
Propulsion	2×Hamilton HT810 waterjets
Generators	2×Caterpillar C7.1
Speed (service)	33 kn
(maximum)	36 kn
Construction	Marine-grade aluminium
Flag	Germany HSC 2000 CAT A
Class/Survey	BV I ✠ HULL ✠ MACH HSC Category A Sea Area 3

Stewart Marler

The Hydrodynamics of the Sydney Harbour RiverCat Ferries

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Abstract

In this paper, we revisit the hydrodynamics supporting the design and development of the RiverCat class of catamaran ferries operating in Sydney Harbor since 1991. More-advanced software is used here. This software accounts for the hydrodynamics of the transom demisterns which experience partial or full ventilation, depending on the vessel speed. This ventilation gives rise to the hydrostatic drag, which adds to the total drag of the vessel. The presence of the transom also creates a hollow in the water. This hollow causes an effective hydrodynamic lengthening of the vessel, which leads to a reduction in the wave resistance. Hence a detailed analysis is required in order to optimise the size of the transom. It is demonstrated that the drag of the vessel and the wave generation can be predicted with good accuracy. Finally, the software is also used to optimise the vessel further by means of affine transformations of the hull geometry.

1 Introduction

1.1 Previous Studies

The principal features of the design philosophy behind the fleet of RiverCat ferries were described by Doctors, Renilson, Parker and Hornsby (1991) and Hornsby, Parker, Doctors and Renilson (1991). These ferries were specifically designed in order to minimise the wave generation, because of the requirement to limit the erosion of the banks of the Parramatta River along which these ferries operate. To this end, a total of ten different proposed designs was considered in the investigation.

These designs were tested as 1/25 scale models in the towing tank at the Australian Maritime College (AMC). Both the physical experiments and the theoretical study suggested that the catamaran design was superior to the trimaran in terms of the wave generation, as characterised by the maximum height of the wave system at the specified speed and distance from the track of the vessel.

Two photographs of the RiverCat are shown in Figure 1.

1.2 Current Investigation

The aim of the current study was to revisit the theoretical analysis supporting the design of this efficient ferry, using more advanced software.

Because of the good correlation between this theory and the experimental data, the software was secondly applied to various modified geometries of the hull. These modifications were effected by means of affine transformations of the individual demihulls.

In this second exercise, we investigated whether one can reduce the overall power requirements and also minimise further the wave generation of the RiverCat.

2 Vessel Characteristics

2.1 General Layout

The general arrangements are shown in plan and profile in Figure 2. The extreme slenderness of the demihulls is very evident.

The particulars of the final design are listed in Table 1. It is particularly noteworthy that the demihull beam-to-length ratio is 0.02857, which is likely to be a record for slenderness and is only possible due to the choice of a catamaran in order to solve the matter of lateral stability.

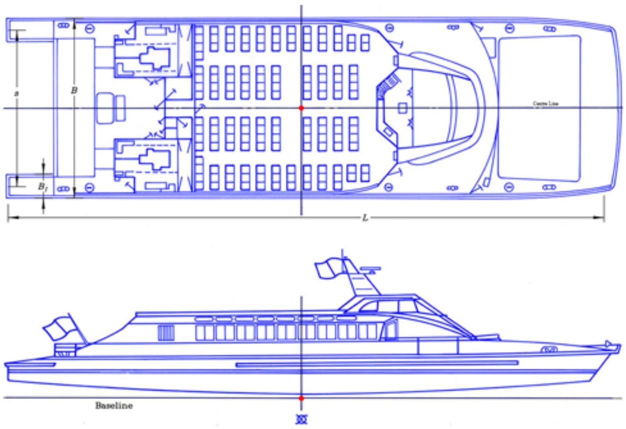


Figure 2: General arrangement of Sydney RiverCat
(Drawing courtesy Grahame Parker Design)

Figure 1: Grahame Parker Design Sydney RiverCat
Dawn Fraser (L) and *Shane Gould* (R)
(Photos courtesy Lawrence Doctors)

Table 1: Principal particulars of Sydney RiverCat

Quantity	Symbol	Value*
Length on waterline	L	35.00 m
Demihull beam	B_1	1.000 m
Beam overall	B	10.06 m
Draft	T	1.226 m
Block coefficient	C_B	0.6262
Prismatic coefficient	C_P	0.6958
Slenderness ratio	$L/\nabla^{1/3}$	11.68
Transom-area ratio	A_T/A_M	0.4311
Displacement mass	Δ	55.00 t
Power	P	2×335 kW
Speed	U	23 kn

*Nominal loading condition

2.2 Demihulls

Two slightly different versions of the demihull for the Sydney RiverCat were considered. Body plans of the towing-tank models were included in the report by Renilson (1989). The computer input mesh of the finalised demihull was derived from this report. For the purpose of the numerical computations, it is expedient and more efficient to make use of equally-spaced stations and vertically-equally-spaced points on the girth lines.

The required conversion from the first geometric format to the second geometric format is achieved by an interpolation process. This was described by Doctors (1995).

3 Resistance

3.1 Decomposition of Resistance

We follow the traditional approach of decomposing the total resistance R_T into reasonably-independent components, as follows:

$$R_T = R_W + R_H + f_F R_F + R_A + R_a \tag{1}$$

Here R_W is the wave resistance, R_H is the hydrostatic resistance caused by the lack of hydrostatic pressure on the partly- or fully-ventilated transoms, R_F is the frictional resistance, R_A is the correlation allowance which accounts for roughness of the ship hull, and R_a is the aerodynamic resistance, which will be neglected in this current effort. Lastly, f_F is the frictional form factor which accounts for the increased friction of a real vessel compared to that of a flat plate. This breakdown into components is similar to that proposed by Froude (1874).

With respect to the wave resistance, we consider that the demihulls are thin, so that one may apply the classic potential-flow theory. The development of this theory can be traced to Michell (1898), whose analysis applies to a monohull travelling in unrestricted water. The influence of laterally-restricted water was included by Sretensky (1936). The effect of the finite depth of the water was added by Newman and Poole (1962). The extension of the analysis to a catamaran was presented by a number of researchers, including Doctors and Day (1997). A very detailed presentation of the theory was published by Doctors (2018a, Section 5.2).

So the theory accounts for the possible finite width and finite depth of the towing tank (in the case of a model) or the waterway (in the case of operation of the prototype in a river).

The transom sterns of the demihulls provide two interesting challenges. Firstly, the process of the ventilation of the transom has been researched by a number of workers. Some of the most practical design guidance was provided by Toby (1987), Toby (1997) and Toby (2002). As well as giving rise to the unwanted hydrostatic drag, the separation of the water flow at the stern creates a hollow in the water which adds to the effective hydrodynamic wavemaking length of the vessel.

This occurrence of the transom hollow is generally favorable in that it reduces the wave resistance. The reader should consult Doctors (2018a, Chapter 4) for an in-depth summary of the research on this question.

The frictional resistance of the model was computed by the use of the ITTC (1957) (International Towing-Tank Conference) formulation, described by Clements (1959, Page 374) and Lewis (1988, Section 3.5, Pages 7 to 15). This process is traditionally based on first calculating the Reynolds number based on the wetted length L of the vessel.

3.2 Model Total Resistance

The analysis of the resistance of the towing-tank model is summarised in Figure 3. For clarification, we firstly provide Figure 3(a), which shows the computer model of the demihull employing regularly-spaced stations.

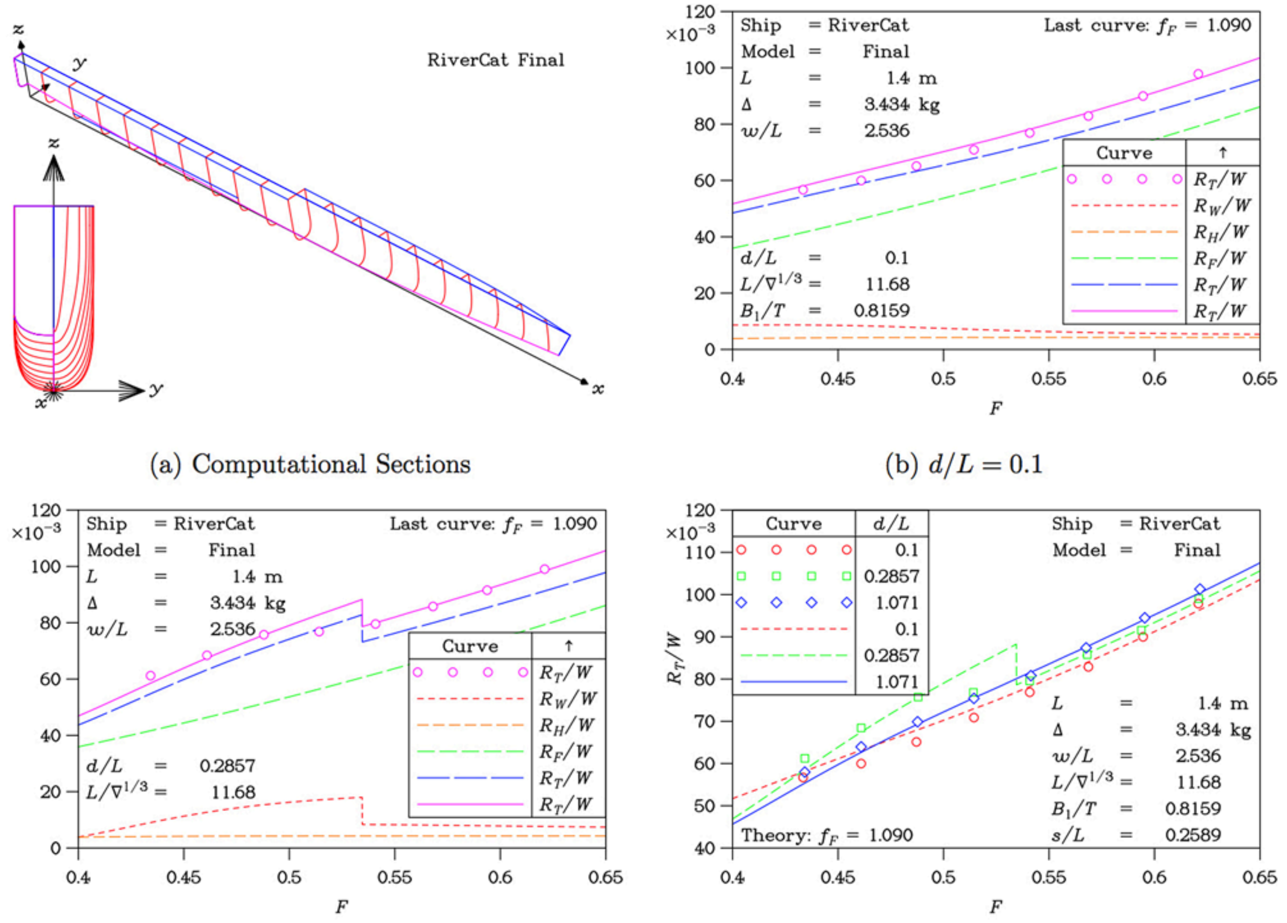
The calculations pertain to a model displacement Δ of 3.434 kg. This corresponds to the prototype displacement of 55 t. The prototype demihull centerplane separation s is 9.060 m in this example.

The RiverCat was designed to operate in very shallow water as well as in deep water. Thus the three considered water depths correspond to depth-to-length ratios d/L of 0.1, 0.2857 and 1.071. The towing-tank width-to-length ratio w/L was 2.536 for the research. The shallowest-water case is presented in Figure 3(b). The data shown are the theoretically computed wave resistance R_W, the hydrostatic resistance R_H, and the ITTC (1957) frictional resistance R_F. The plotted data are nondimensionalised with respect to the displacement weight W, so these are the specific-resistance coefficients. These components are plotted as a function of the Froude number $F = U/\sqrt{gL}$, in which g is the acceleration due to gravity.

It is imperative to emphasise the relatively small rôle which the wave resistance plays in contributing to the total resistance budget. On the other hand, it should be noted that, in accordance with the principles of the Froude extrapolation, the frictional resistance will be less important at prototype scale because of the greater value of the Reynolds number.

The hydrostatic drag is evidently very small and is typically about one half of the wave resistance. The hydrostatic drag is also independent of the speed, at least for the range of speeds covered by these plots. This confirms that the transom is consistently fully ventilated in this speed range.

The plots in Figure 3 also show the total resistance R_T. Circular symbols have been used to indicate the experimental data points. Curves have been used to show the results of the computer predictions. The last dashed curve is the theoretical



(a) Computational Sections

(b) $d/L = 0.1$

(c) $d/L = 0.2857$

(d) Three Depths

Figure 3: Resistance experiments on model of RiverCat
(Graphs courtesy Lawrence Doctors)

prediction according to the simple summation suggested by Equation 1 — with a unit value of the frictional-resistance form factor f_F.

In addition, the last and continuous curve in each case shows the total resistance, also using Equation 1, but with the more realistic choice $f_F = 1.090$. This value was deduced by means of a standard root-mean-square minimisation procedure, such as that described by de Vahl Davis (1986, Section 3.10). The method was applied to Equation 1 with the one unknown f_F.

With this value of f_F, an excellent correlation is obtained between the predicted total resistance and the experimentally-derived data.

The most interesting example, depicted in Figure 3(c), demonstrates the drop in resistance when the speed crosses the critical value. The critical speed corresponds to a depth Froude number of unity. The steady-state resistance theory used here predicts a sharp drop, which is not so evident in the experiments.

The magnitude of this drop in specific resistance is given by the remarkably simple formula:

$$\Delta R_W/W = 3\nabla/2wd^2 \qquad (2)$$

in which ∇ is the displacement volume. This formula is independent of the shape of the vessel hull.

The fact that the discontinuity in the experimental data is somewhat rounded off — unlike the sharp discontinuity in the theory—can be resolved by employing the unsteady wave-resistance theory, published by Day, Clelland and Doctors (2009). It was demonstrated that the time-averaging signal processing, used in recording ship-model-resistance data during typical tests, results in a rounding of the results in the vicinity of $F_d \approx 1$. One must therefore also account for the motion of the tank carriage from rest and use the true time-unsteady theory. Then the rounded characteristic of the resistance curve can be predicted accurately. An example for a case of $w/L = 1.524$ and $d/L = 0.25$ was published by Day, Clelland and Doctors (2009, Figure 6).

The resistance experiments are summarised in Figure 3(d), in which the total specific resistance (only) is plotted for the three water depths noted above. It is pleasing to see that the theory correctly ranks the resistance for both the subcritical-speed case and the supercritical-speed case.

3.3 Transformations of Demihull

The four different types of transformations of the demihull of the Sydney RiverCat are listed in Table 2.

The first transformation involves stretching the demihull and reducing the local beam and local draft in equal proportions, thereby maintaining a fixed value of the displacement.

The second transformation relates to changing the sectional aspect ratio B_1/T, while keeping the local sectional area and the length fixed.

The third transformation is to change the demihull separation s by increasing it from the original value.

Table 2: Affine transformations of Demihull

Index	Parameter	Symbol	Values		
			Affine 0[†]	Affine 1	Affine 2
1*	Slenderness ratio	$L/\nabla^{1/3}$	11.68	14.60	17.52
2	Beam-to-draft ratio	B_1/T	0.8159	1.275	1.836
3	Demihull separation	s/L	0.2589	0.3160	0.3731
4	Transom-area ratio	A_T/A_M	0.4311	0.2156	0

*Corresponding to the four parts in each of Figures 5 and 8
†Data for RiverCat

The fourth and the most-challenging transformation is one in which the significance of the transom, as measured by the metric transom-area ratio A_T/A_M, is examined. In the current effort, the methodology of Doctors (1999) is employed. The first step is to create a pointed-stern version of the original demihull, by replicating the forward half of the vessel.

This demihull is symmetric fore-and-aft. Of course, it is improper to directly compare the hydrodynamics of this demihull with the original transom-stern demihull because its volume is substantially less. Consequently, the local beam and the local draft have each been increased at all stations in an affine manner by a simple factor which is the square root of the desired ratio of volumes. The resulting pointed-stern demihull with the same displacement volume is presented in Figure 4(a).

We now have two extreme parent hulls. These are the original transom-stern demihull in Figure 3(a) and the pointed-stern demihull in Figure 4(a). Next a third and intermediate blended-hull demihull was created by combining equal portions of these two basis demihulls, after the manner of Doctors (1995). That is, the coordinates of the points on the surface of the new and blended hull are simple averages of the original coordinates. The blended-stern vessel is depicted in Figure 4(b).

3.4 Prototype Total Resistance

We emphasise that the main purpose of performing calculations on ship models was to verify the experimental data measured on physical models and to understand the hydrodynamic phenomena. Of course, we are only concerned in a more practical sense with the performance of the prototype vessel. These theoretical results are presented in the four graphs of Figure 5.

To minimise the human effort required for the preparation of the input data for the computer software, these computations for the prototype were instead effected on the 1/25 scale hull geometry — as for the previous computations for the model. The results are presented in a dimensionless manner. So the only necessary change to the input-data file was to reduce the value of the kinematic viscosity ν by a factor of 253/2. Consequently, the software will calculate the required Reynolds number at prototype scale.

In line with standard practice, a correlation or roughness allowance C_A = 0.0004 has been added to the friction coefficient at prototype scale.

Because the major part of the resistance is due to friction — even at prototype scale — most of the variations in demihull geometry considered in Figure 5 cause insignificant changes to the resistance. This is particularly true at the nominal operating point, corresponding to a speed of 23 kn, which is indicated on the four plots.

3.5 Hull Finish

The transport factor, defined as

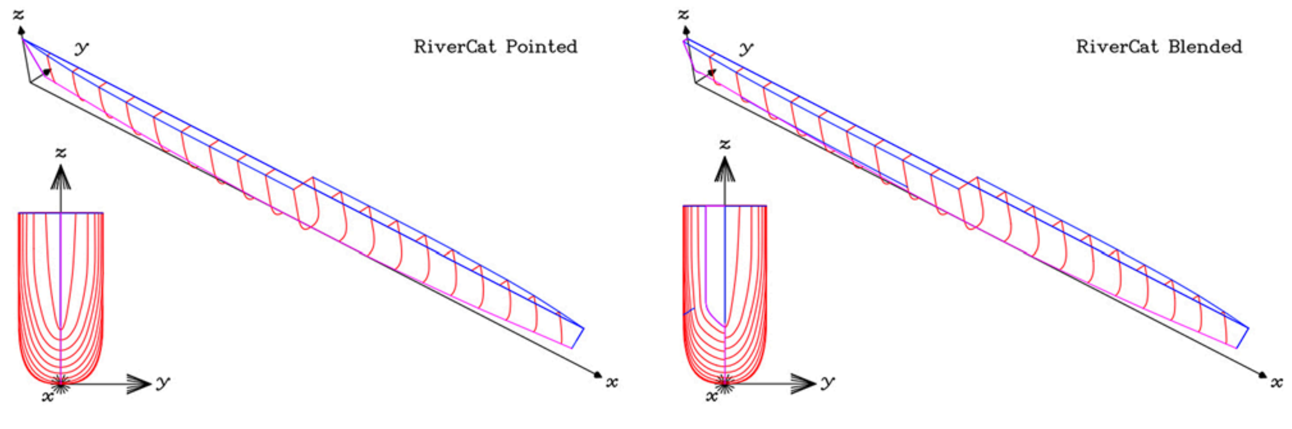
$$\mathrm{TF} = WU/P \quad (3)$$
$$= \eta \times (W/R_T) \quad (4)$$

is here evaluated on the basis of the total weight W, the operational speed U and the installed engine power P. We now use the prototype displacement of 55 t, the nominal operating speed of 23 kn, and the prototype propulsive power of 2 × 335 kW. So the transport factor TF is 9.524.

We also note that at this speed, corresponding to F_∇ = 1.945, we have the predicted value of the specific resistance R_T/W = 0.0652 at the operating point from any of the four plots in Figure 5. This allows us to use Equation 4 and to compute the overall propulsive efficiency of the transmission and the propellers η, which is 0.621. This result is a reasonably-acceptable value in naval architecture usage.

On the other hand, if the hull finish of the vessel could be maintained in an ideal hydraulically-smooth condition, namely C_A = 0, the transport factor rises to a value of 11.03. A strong case can be made for enforcing a strict régime for cleaning the hull on a regular basis, thereby reducing fuel consumption. These results are summarised in Table 3.

Further studies on the matter of hull friction and different methods of implementing the ITTC (1957) extrapolation were published by Clements (1959, Page 374) and by Lewis (1988, Section 3.5, Pages 7 to 15). The ITTC (1978)



(a) Pointed Stern (b) Blended Stern

Figure 4: Transformations of RiverCat demihull
(Drawing courtesy Lawrence Doctors)

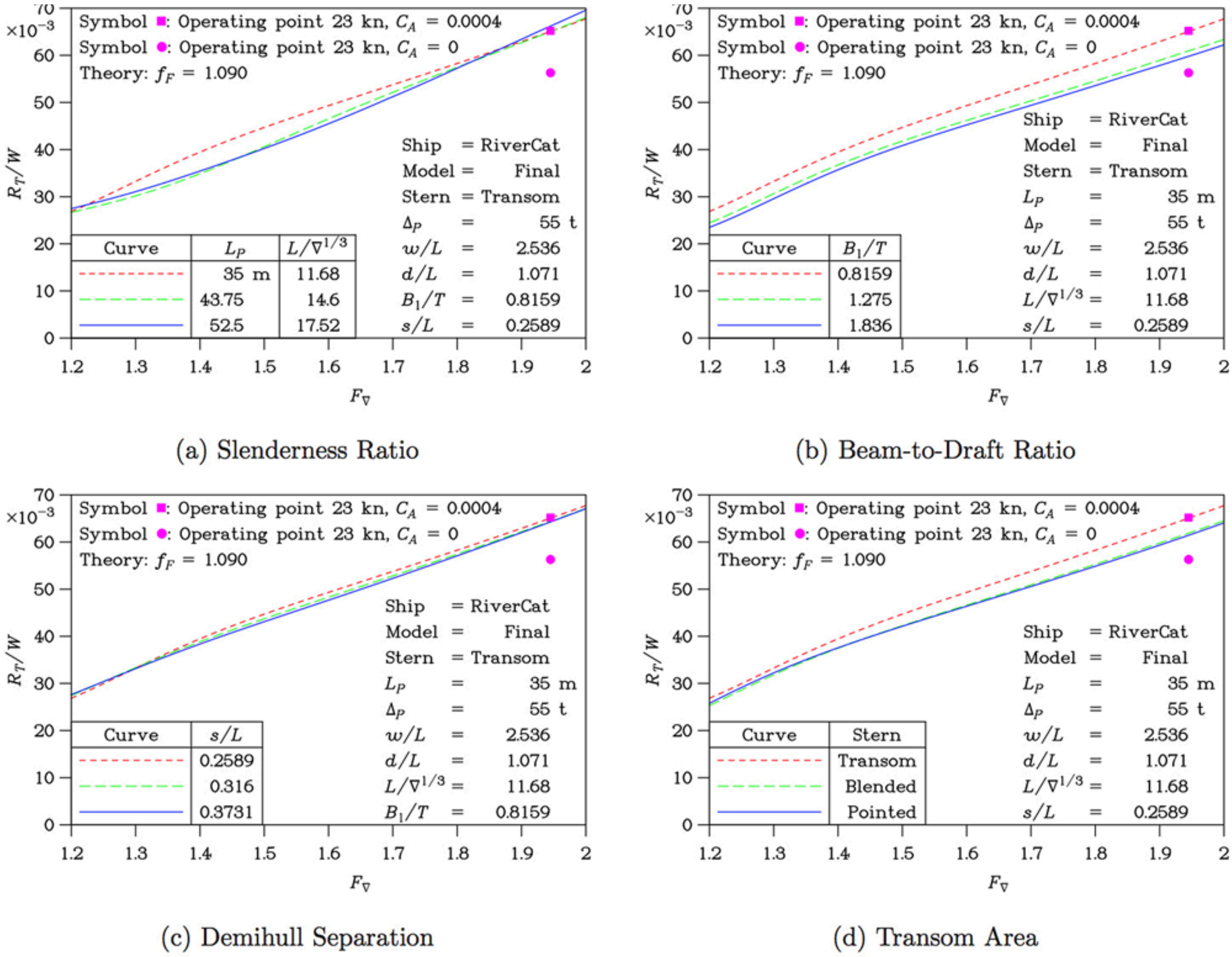


Figure 5: Influence of affine transformations on prototype resistance
(Graphs courtesy Lawrence Doctors)

Table 3: Transport Factor of Sydney RiverCat

Assumption	Transport Factor TF*
ITTC (1957) with $C_A = 0$	11.03
ITTC (1957) with $C_A = 0.0004$	9.52
Measured	9.52

*Nominal operating point: $\Delta = 55$ t, $U = 23$ kn and $\eta = 0.621$

extrapolation was described by Lindgren (1978, Equation 1.19) and by Stern (1999). Lastly, the ITTC (2004) extrapolation was explained by Candries and Atlar (2003, Equation 1) and by Hino (2014, Equation 3).

4 Wave Generation

4.1 Potential-Flow Theory

Classic potential-flow theory has been employed in the current work. This theory considers that the water is inviscid; this allows one to model the vessel by a singularity or a source-sink distribution. We further assume that the demihulls of the vessel are thin. As a consequence, the singularity distribution can be conveniently and conventionally placed on the centerplanes of the two demihulls.

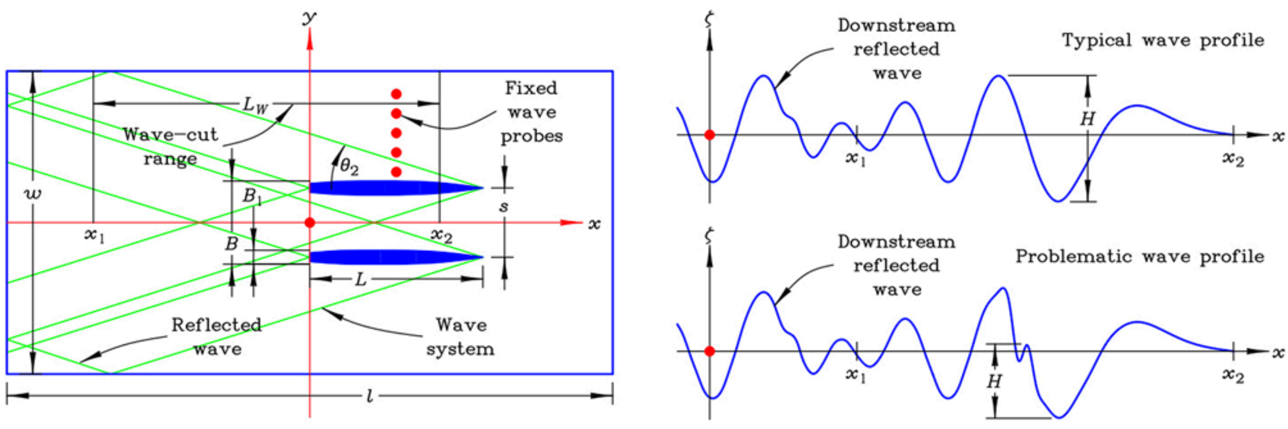
A further useful enhancement to the theory is made. We include in the analysis the fact that the water depth is finite, so that the shallow nature of the river is included. Furthermore, the finite width of the waterway (or the towing tank in the model experiments) is incorporated in the analysis. A detailed development of the theory of wave generation by a general displacement vessel with an arbitrary number of subhulls was published by Doctors (2018b, Section 12.2). The resulting formula in its simplest presentation was displayed as Equation 12.12.

4.2 Experimental Setup

The experiments were conducted in the towing tank at the Australian Maritime College. The experimental setup is shown in Figure 6(a), where the principal dimensions are indicated. Figure 6(a) also illustrates the locations of the stationary wave-elevation probes. There were five in number.

The wave elevation data from these probes were analysed over the range $x_1 \leq x \leq x_2$, as indicated. Thus Figure 6(b) shows two scenarios of a longitudinal wave cut, as measured by one of the wave probes and as recorded on the computer system. The upper wave cut, which is of the more likely form, displays a large wave height near the start of the cut. The height H is here defined as the maximum difference between a peak and a successive trough. It is noteworthy that the experiments were conducted in a towing tank with a finite width.

As a consequence, there is a reflected downstream wave; this is also shown. It is necessary then to analyse a wave cut which is sufficiently long in order to capture the primary wave front but, on the other hand, sufficiently short not to include the reflected wave system, which could conceptually be of greater magnitude.



(a) Experimental Setup

(b) Interpretation of Wave Height

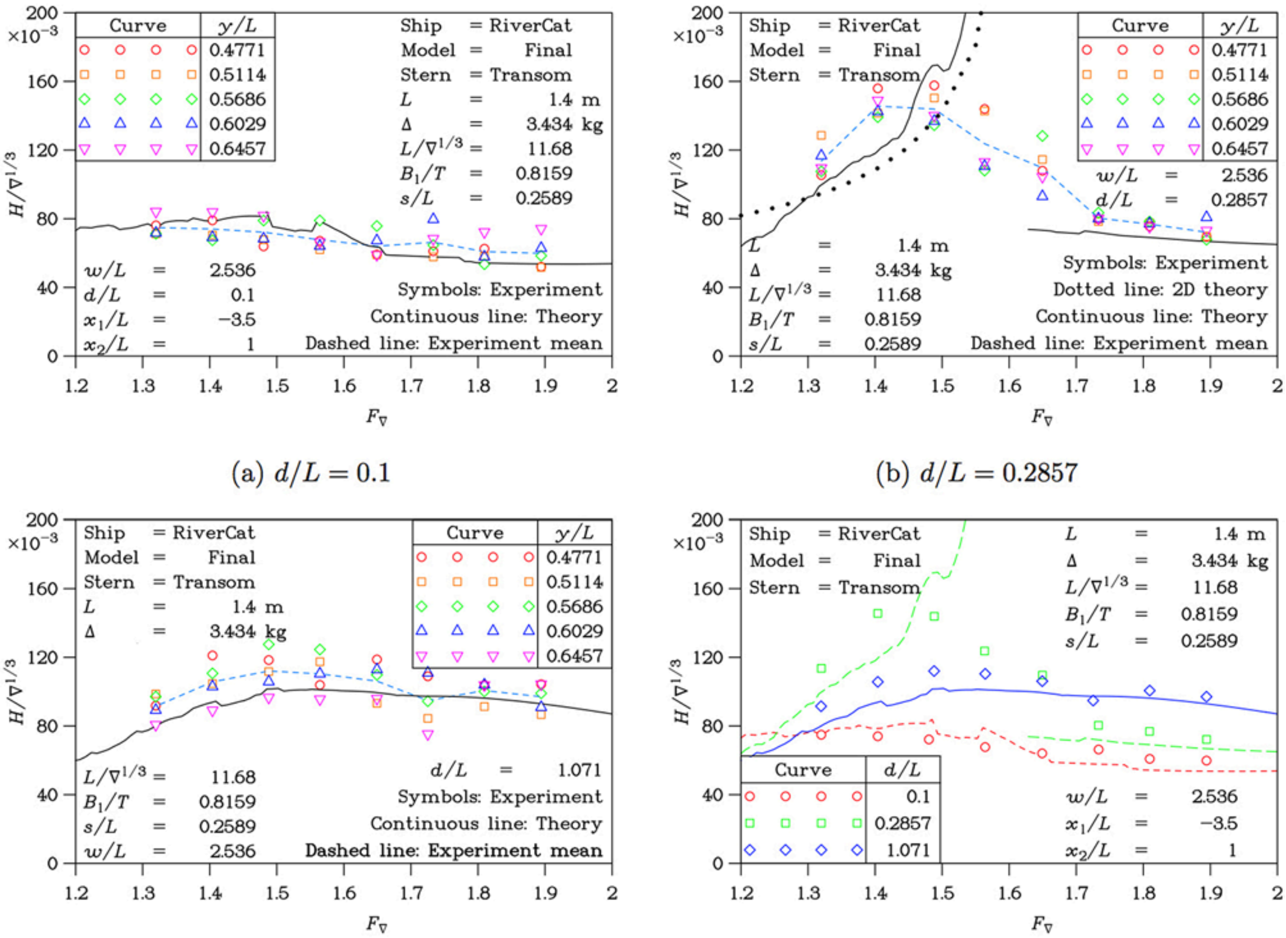
Figure 6: Details of wave experiments
(Diagrams courtesy Lawrence Doctors)

The lower curve in Figure 6(b) is admittedly an unusual possibility. It presents the expected large wave front as already defined. However, because of small errors in the experimental measurements, there is a minor oscillation where the wave front crosses the zero value. Therefore, a very strict interpretation of the wave height would unfortunately miss this wave front and no doubt lead to considering a smaller downstream wave as the metric of wave height.

4.3 Model Tests

The RiverCat was designed to operate in very shallow water as well as in deep water. Thus the first three plots in Figure 7 relate specifically to the depth-to-length ratios *d/L* of 0.1, 0.2857 and 1.071.

Each of these three plots presents the measured wave height, as deduced from the records from the five wave probes. The corresponding dimensionless offsets *y/L* are annotated in Figure 7(a) through (c).



(a) $d/L = 0.1$

(b) $d/L = 0.2857$

(c) $d/L = 1.071$

(d) Three Depths

Figure 7: Wave-generation experiments on model of RiverCat
(Graphs courtesy Lawrence Doctors)

The wave height has been rendered dimensionless with respect to the model volume ∇. It is plotted as a function of the volumetric Froude number $F_\nabla = U/\sqrt{g}\nabla^{1/3}$. This particular method of nondimensionalisation has been chosen over the traditional use of the ship length L because, later in this paper, the vessel length varies between the curves in the study of slenderness variation; so it is necessary to be consistent and to use the non-varying displacement volume ∇ as the basis for rendering nondimensional the wave height and the speed.

The experimental data are indicated by means of plotted symbols, as indicated. A different symbol is used for each dimensionless offset y/L of the wave cut. Also plotted in Figure 7(a) though (c) is the simple average of the five probe recordings. This average is indicated by the dashed line.

Finally, the theoretically-computed mean wave height is shown by means of a continuous curve. This curve possesses a jagged nature. This jaggedness of the wave-height curve as a function of the Froude number is characteristic. It has been demonstrated in previous publications, such as that by Doctors (2003, Figure 5). On the other hand, the jaggedness does not occur in the corresponding calculations for the wave resistance.

Concentrating firstly on Figures 7(a) and (c), the two graphs show that the theoretical predictions demonstrate generally good correlation over the range of Froude number studied.

The case of intermediate depth, namely d/L = 0.2589 in Figure 7(b), requires some detailed explanation and clarification. For small values of the volumetric Froude number and for larger values of the volumetric Froude number, the fairly-good agreement between theory and experiment is comparable to the agreement for the shallow- and deep-water cases already noted in Figure 7(a) and (c). However, in the intermediate Froude-number range, which encompasses the critical speed given by $F_d = 1$, the theory becomes unbounded in value, even though the experiments suggest otherwise.

This matter has been the subject of investigations. In particular, Doctors (2008) compared the steady-state predictions, the true unsteady theory detailed by Doctors (2018b, Section 14.5), and the measured data derived from towing-tank tests. It was amply demonstrated that the unbounded theoretical peak in plots, such as that in Figure 7(b), is due entirely to the assumption of steady-state conditions. This assumption breaks down during a physical experiment in the towing tank at speeds just below the critical speed, because of the ever-increasing time required to generate the significant transverse wave, which possesses an increasing length.

On the other hand, the unsteady theory based on the actual time history from rest of the towing carriage, was able to very accurately reproduce the experimental data. In short, it can be concluded that the towing-tank data are not reliable for predicting steady-state behavior at speeds just below the critical speed.

The steady-state amplitude of the transverse wave just below the critical speed is given by the remarkably simple formula developed by Doctors (2003):

$$A_0 = \frac{\sqrt{3}}{\sqrt{1-F_d^2}} \cdot \frac{\nabla}{wd} \quad (5)$$

In the present context, we will write the wave height $H_0 = 2A_0$ in its dimensionless form as:

$$H_0/\nabla^2 = \frac{2\sqrt{3}}{\sqrt{1-(\nabla^{1/3}/d)F_\nabla^2}} \cdot \frac{\nabla^{2/3}}{wd} \quad (6)$$

This asymptotic formula is plotted as the dotted line in Figure 7(b); it is verified here that the steady-state transverse (two-dimensional) formula adequately explains the unbounded behavior of the theory in the subcritical-speed condition.

Finally, Figure 7(d) is employed to summarise the cases of the three water depths already discussed in some detail. Except for the problematic sub-critical speed range already discussed, the theory properly displays the relationship between the three test cases.

4.4 Transformations of Demihull

Three different values of the slenderness ratio $L/\nabla^{1/3}$ are considered in Figure 8(a), varying between 11.68 for the finalised RiverCat and 17.52 for the longest variant. As noted earlier, the cross-sectional shape has been preserved, so that B_1/T is the same for the three vessels. The nominal operating speed of 23 kn, equivalent to F_∇ = 1.946, is shown on the graphs. There is a significant reduction in wave generation for the slenderest vessel.

This shows that there is much scope for reducing the undesired wave generation.

Modifying the section aspect ratio, as measured by the ratio B_1/T, is considered in Figure 8(b). There is almost no influence of this parameter on wave generation.

The demihull-centerplane separation s is changed in Figure 8(c). Increasing the separation generally reduces the wave generation, as is well known from previous research. However, the effect is not large.

Lastly the influence of the type of vessel stern is examined in Figure 8(d). The finalised RiverCat (with the full transom) is seen to cause the lowest wave generation. This has been explained in the past as being a result of the transom hollow creating an effectively longer hydrodynamic shape in the water, which is favorable.

4.5 Monohull Version

A primary hydrodynamic feature of a catamaran is that it generates a weaker wave system compared to that of a traditional monohull with the same displacement. This matter is investigated further in Figure 9. Firstly, the equivalent monohull is depicted in Figure 9(a).

This drawing should be compared to the RiverCat demihull presented in Figure 3(a). The monohull is a simple affine transformation of the demihull by firstly preserving the same length and secondly increasing both the local beam and the local draft by the factor √2. So the displacements of the monohull and the original catamaran are the same. Also the local section shapes are the same. The slenderness ratio of the monohull is 9.272; this is the slenderness ratio of the catamaran demihull computed by the formula $11.68/2^{1/3}$.

The three remaining parts of Figure 9 relate to the same three water depths which have been discussed previously.

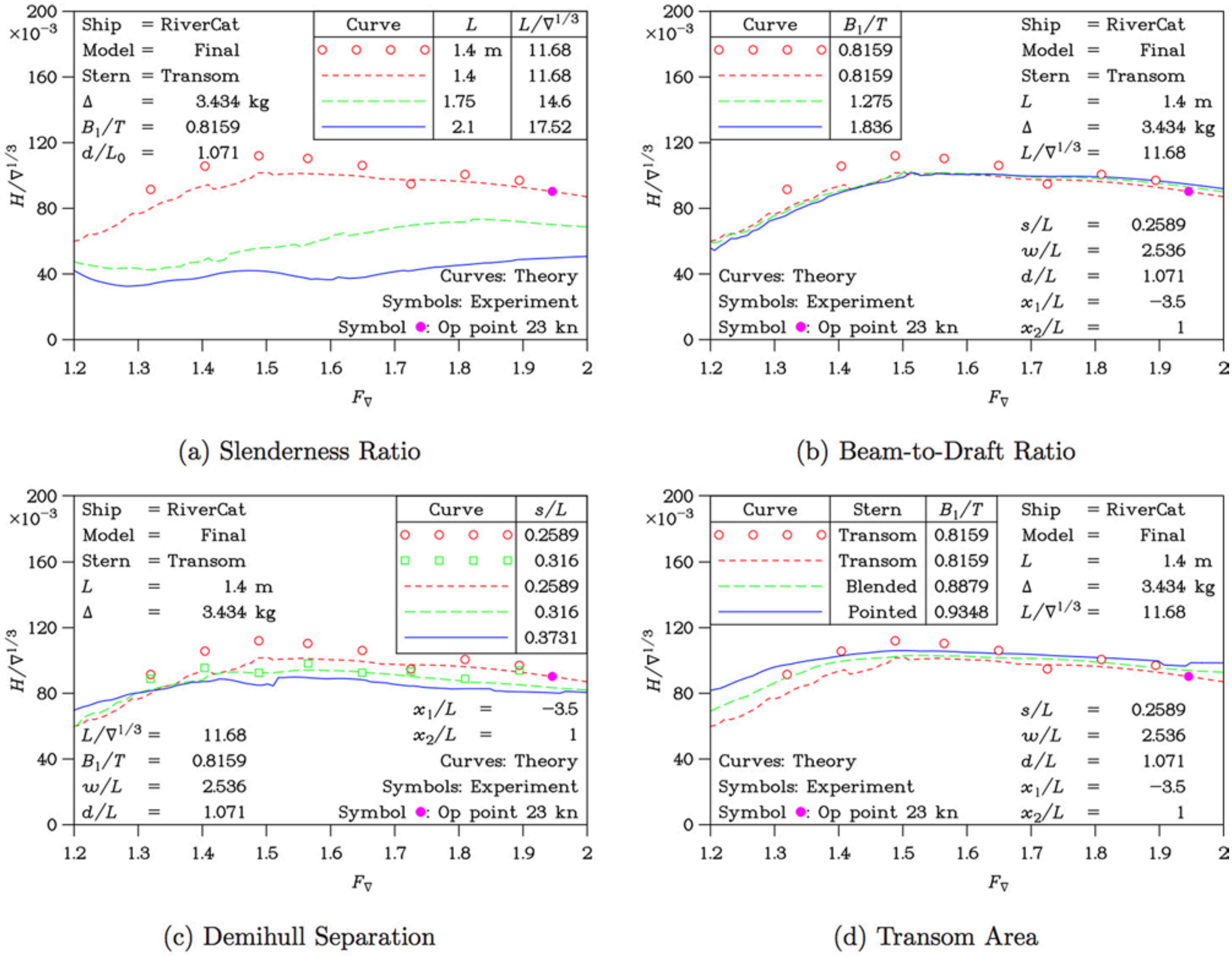


Figure 8: Influence of Affine Transformations on Wave Generation
(Graphs courtesy Lawrence Doctors)

For each depth, we have plotted three sets of data. There are the towing-tank experimental data (shown as symbols) for the catamaran, and there is the theoretical prediction shown as a dashed curve. Lastly there is the theoretical prediction for our equivalent monohull.

We firstly focus our interest on the operating condition, namely the nominal speed of 23 kn, which is marked by a solid circle in the plots. There is a substantially lower wave height for the catamaran for all of the considered three depths.

For the shallowest case in Figure 9(b), the catamaran retains its superiority at all speeds covered by the experiments. However, for the intermediate depth in Figure 9(c) and for the greatest depth in Figure 9(d), the advantageous lower wave making of the catamaran is greatly diminished. at the lower speeds.

5 Conclusions

5.1 Current Investigation

The current study has demonstrated that the linearised wave-resistance theory, used in conjunction with physical models of the transom-ventilation process and the generation of the accompanying transom hollow, provides excellent predictions of the resistance of efficient river catamarans. It is important at the same time to have good estimates of the frictional-resistance form factor. For the Sydney RiverCat, this was determined to be 1.09.

This work has also shown that it is difficult to further improve the hull design if one wishes to reduce the total resistance. At a design operating speed of 23 kn, the only affine transformation in Figure 5 that showed promise was to increase the sectional beam-to-draft ratio B_1/L. This modification makes the sections closely semicircular, thereby reducing the wetted-surface area and, hence, the frictional resistance.

A principal aim in the design of this river vessel was to reduce the wave generation. Let us consider a nominal vessel speed of 23 kn, corresponding to $F_\nabla = 1.946$. In this respect, Figure 8(a) demonstrates that increasing the slenderness ratio by 50% will result in a reduction of mean wave height of approximately 45%. To achieve this outcome, the length of the RiverCat would need to be increased from 35 m to 52.5 m.

5.2 Future Studies

Further studies should include modifying the demihulls in various ways. Suitable modifications include embracing the concept of pure semicircular sections. These will reduce the frictional resistance to the minimum. Secondly, it is possible that modifying the sectional-area curve (defining the longitudinal distribution of volume) may lead to a further reduction in wave generation.

It is understood that the consequential very long hulls might lead to some practical operational difficulties. These difficulties include manoeuvrability in confined waterways

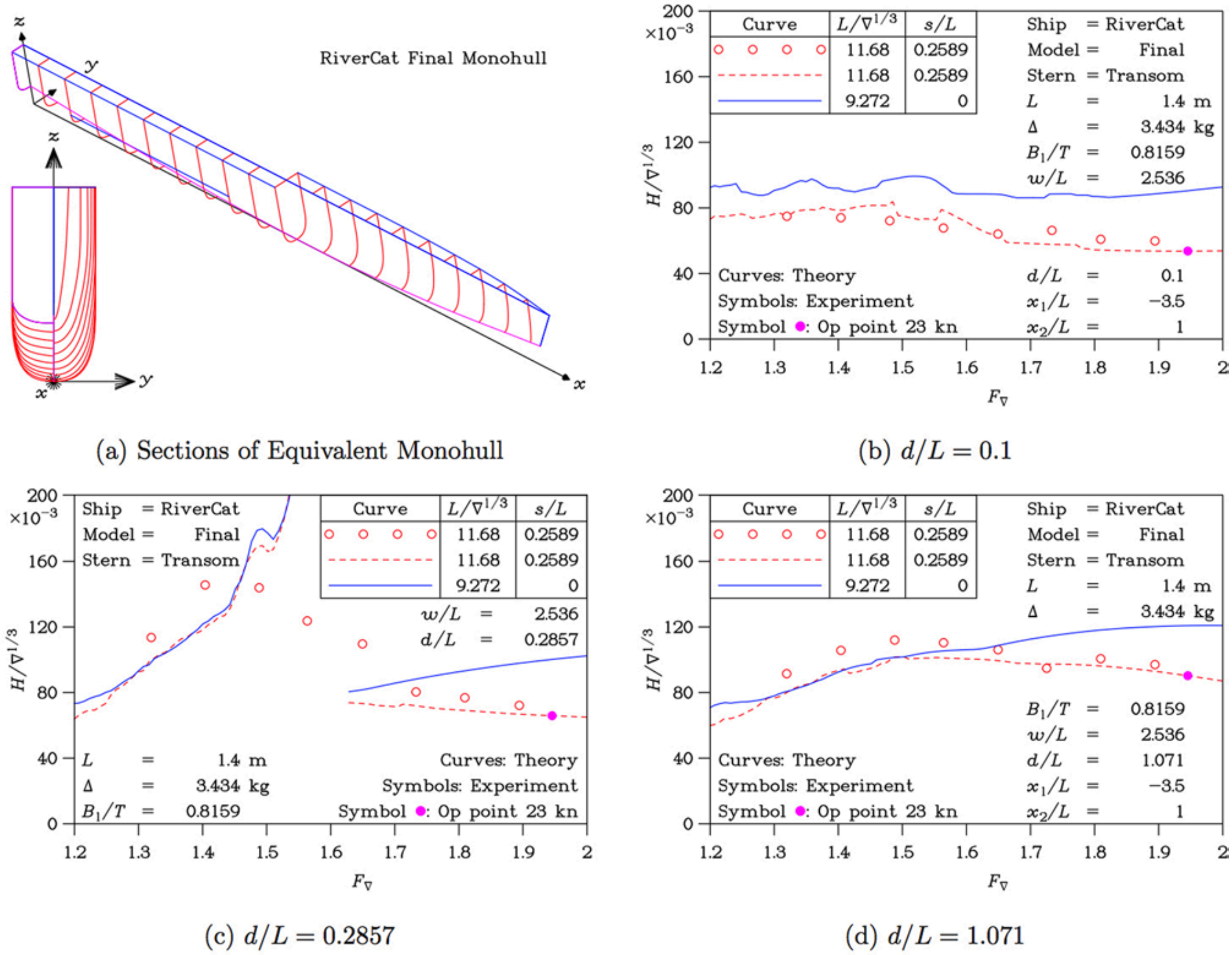


Figure 9: Wave generation of monohull version RiverCat
(Graphs courtesy Lawrence Doctors)

and manning regulations. The latter might impose an increased cost for salaries for a larger crew.

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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 are now also available online at

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

Items included in the May 2021 e-Newsletter included:

- Renewing your accreditation
- Changes to identity cards
- Updates coming to MARS
- AMSA application review process
- Completing the AMSA 638 shaft survey report
- Load line survey frequency for vessels operating under Exemption 2 Division 5
- Working with the Fire Protection Industry Board to protect the environment, property and lives
- The importance of terminal covers
- Ultrasonic thickness measurements
- Upcoming certificate of survey renewals
- Simplified equipment lists for small fishing vessel operations

The article on *Changes to Identity Cards* is reproduced below.

Phil Helmore

Changes to Identity Cards

Accredited marine surveyor identity cards underwent a change in December 2020. Cards no longer list a surveyor identification number; instead, they list your unique AMSA ID number which will never change. This change effects all cards issued after December 2020.

I already have a Surveyor ID, can I continue to use it?

Yes, you can use your existing Surveyor ID number; however, we recommend that you transition to the AMSA ID.

My existing Surveyor ID card does not have an AMSA ID, can I continue to use it?

Yes, your card is valid until you submit a new or renewal application and receive an updated card.

The AMSA form is asking for a Surveyor ID, what do I use?

Existing AMSA forms require you to fill in the 'Surveyor ID' field. You can use either your Surveyor ID or AMSA ID in this field.

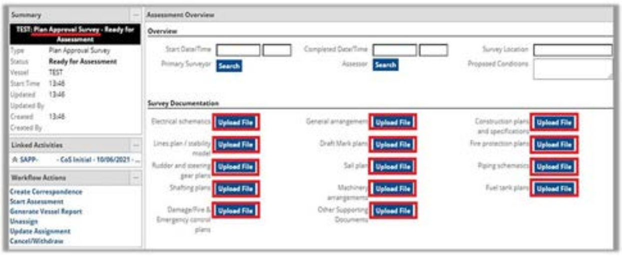
Survey Matters, May 2021

MARS Updates

The latest updates to MARS (AMSA's MARitime Safety system) were released in mid-June. The updates are focussed on increasing the efficiency of the certification process. They include a change to the supporting-document upload function and changes to the way some survey code letters are generated.

Supporting Document Upload

Each survey activity has its own specific survey documentation upload buttons. For example, a plan approval activity will have a specific place to upload the expected plans.



MARS document upload screen
(Image courtesy AMSA)

If a user chooses not to upload an expected document, a warning message will appear when the recommendation is submitted in MARS. A user may still proceed without uploading the expected document, but this will cause delay or may ultimately result in refusal of the application. This change aims to improve submission quality, allowing AMSA to complete applications with less manual checks, and provide faster outcomes for you and your clients.

Survey Code Letters

This update lets AMSA check and customise survey codes on the letters before they are sent to the applicant. This will allow AMSA to communicate survey requirements to applicants more clearly and reduce the administrative burden for survey. The changes to the survey code letter will only affect applications for vessels being modified or undergoing operation changes.

Survey code letters have also been updated to provide applicants with clearer guidance about survey requirements and the process to complete their application.

The MARS user guide available from the AMSA website will be updated to reflect these changes.

Ewen McCarroll
Advisor Technical
Vessel Safety Unit | Operations
Australian Maritime Safety Authority

Fees for Domestic Commercial Vessel Safety Services Changed

Fees for domestic commercial vessel certificate services increased by 1.1 per cent on 1 July 2021. The increase is a mandatory requirement under the National Law and was calculated using the March 2021 quarterly consumer price index numbers.

The updated fees apply from 1 July 2021 for domestic commercial services, including certificates of survey and operation, permits, exemptions, unique vessel identifiers and seafarer certificates of competency. Updates to fees for services under the surveyor accreditation scheme also apply.

Details of the new fees may be found at

https://www.amsa.gov.au/about/fees-levies-and-payments/fees-services-certificates-competency-and-vessel-safety

AMSA is aware of the impact which COVID-19 has had on the domestic commercial industry, and is providing assistance to those operators and seafarers who have been impacted by way of exemptions and extensions of time for certificate renewals.

Details of exemptions and extensions of time may be found at

https://www.amsa.gov.au/news-community/campaigns/exemptions-we-may-use-during-covid-19-period

AMSA News, 18 June 2021

Guidelines for Shafting System Design

SNAME has released their new T&R Bulletin 3-53 (2021) *Guidelines for the Development of a Propulsion Shafting System Design for Commercial Vessels*.

T&R Panel M-16 Propulsion Shafting Systems, felt that a commercial guideline was needed for personnel involved in the design and selection of commercial marine propulsion shafting systems. Therefore, this Bulletin is on shafting systems for commercial vessels over 20 m in length. This bulletin provides a series of commercial shafting systems applicable to most commercial ships being designed today. Included in this bulletin is an appraisal of commonly-used shaft line components.

This bulletin provides the propulsion engineer with the necessary technical background and knowledge to develop a commercial shafting design which meets all design considerations. Guidance is provided so that a design can be transformed into a comprehensive shaft arrangement drawing which allows a shipyard to incorporate the shafting system into the constraints of the build strategy and shipbuilding practice. While specific details of prime movers, gearing, and propulsors are not covered, certain aspects of these components, as they apply to shafting design and details, are presented. Finally, the bulletin provides guidance for maintenance of the shafting system after the vessel enters service.

To purchase, head to the website https://www.sname.org/publications/T-and-R-technical-research (where you can see all available T&R Bulletins) and add "3-53" in the search bar. You must be signed in as a SNAME member to receive the member pricing (50% discount).

SNAME *Press Release*, 31 July 2021

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

EDUCATION NEWS

UNSW Canberra

With each passing week we are getting closer to teaching the first cohort of students in the newly-established Naval Architecture program in Semester 1 2022. There is some ability for us as academic staff to relate to Kevin Costners *Field of Dreams*, as we have built the program and are now waiting for the students to transfer and enrol.

As described previously, at UNSW Canberra the naval architecture program runs in parallel with mechanical engineering for the first two years. Thus, the specialist naval architecture courses reside in Years 3 and 4 of our program. This leads to an arrangement whereby students who satisfy the requirements of the first two years of a four-year mechanical engineering degree program at any Australian tertiary institution may be admitted into Years 3 and 4 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".

Since my last report in May, major developments have included the programs being publicly listed on the UNSW website (see https://www.handbook.unsw.edu.au/undergraduate/programs/2021/4484) and by the Universities Admissions Centre (see https://www.uac.edu.au/undergraduate/courses/unsw/451300.shtml). We are particularly working with the Navy to inform future Marine Engineering Officers that they have the option of pursuing naval architecture qualifications as an optional academic pathway to becoming an MEO. While the roles at sea for an MEO will be traditional, when coming ashore, the postings of the naval architecture-trained officers will take advantage of their education.

Two other major activities are currently taking place. As one of the School's five engineering disciplines, we are seeking provisional accreditation for the naval architecture program from Engineers Australia in August alongside the other disciplines which are seeking accreditation renewal. Full accreditation for the naval architecture program cannot be achieved until graduates have been produced, so that is expected in the next accreditation cycle in five years' time, i.e. in 2026.

Finally, we are in the process of recruiting a new academic staff member to join our team, so I expect that I will be able to announce the successful candidate in the next issue of *The ANA*.

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

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

Attack-class Submarine Project to Provide Training for Women in Welding

Naval Group Australia has developed a new program which aims to boost female participation in the Attack-class submarine project, through offering the entry-level training needed to begin a career as a submarine welder. Partnering with the South Australian government's Skilling South Australia initiative and Adelaide Training and Employment Centre, Naval Group's 10-day program will be provided at no cost to ten successful applicants.

It will provide them with 60 hours of accredited training and familiarise them with equipment and tasks via hands-on experience with power tools and the performance of metal arc welding. It will also assist with introductions to employers in Naval Group Australia's host business network.

The pre-work skills training will be provided in September 2021. Participants who choose to pursue a welding career can be considered for a new intake of Naval Group Australia apprentices later this year. This will create a pathway to a long-term career working on the Attack Class.

"The Attack-class program will require hundreds of new workers in the next few years, as we get ready to start cutting steel at the new and modern shipyard being built at Osborne," Naval Group Australia's Chief Executive Officer, John Davis, said.

"We want to maximise the talent in our Attack-class team. A key part of that plan is supporting more women to identify and achieve their potential in secure trade pathways like welding.

"It's important for Naval Group Australia, and our staff, that there's a diversity in our growing team which accurately reflects the local community we are embedded in and working for," he said.

"But we also need to inspire people from non-traditional backgrounds to take up trades like welding so that we achieve the number of skilled workers needed for submarine construction."

Naval Group Australia currently employs 21 trade apprentices, who receive on-the-job training with South Australian host businesses. Those placements allow apprentices to gain experience in skills including welding and boilermaking and prepare for future work on Attack-class submarines.

INDUSTRY NEWS

Wärtsilä's Multi-fuel Engine Technology for the new Australian RoPax Ferries

Wärtsilä is to supply the engines and fuel gas supply systems for the two new Ro-Pax ferries which are being built at the Rauma Marine Constructions (RMC) yard in Finland for TT-Line of Tasmania The order with Wärtsilä was placed in June 2021.

TT-Line currently operates two ferries, *Spirit of Tasmania I* and *Spirit of Tasmania II*, both of which operate with Wärtsilä engines. The two new 212 m long vessels will adopt the latest technology and be powered with LNG fuel to lessen the environmental impact.

"Since 2002 when the current vessels were introduced into our fleet, the Wärtsilä engines have delivered both performance and reliability backed by strong service and technical support. Keeping in mind the IMO's stringent emission targets for the future, TT Line has opted for LNG fuelled ferries. Wärtsilä's depth of experience and broad portfolio of LNG fuel solutions for marine applications were prime considerations for us," said Bernard Dwyer, Chief Executive Officer of TT-Line.

"We have worked closely with TT-Line for a number of years and are pleased and proud to continue this long-standing relationship via this latest newbuild project. We will extend our best technical and operational support to TT-Lines' new ferries. Wärtsilä has played a major role in enabling LNG to become a viable and increasingly-popular marine fuel, and its adoption by global operators continues to grow. This order is a clear reflection of that trend," said Mikko Mannerkorpi, General Manager, Sales, Wärtsilä Marine Power.

"Our goal is to be a pioneer in environmentally-sustainable technology in shipbuilding, and we want to provide vessels to our customers accordingly. The LNG-powered engines play an important part in building two new eco-efficient and future-proof vessels for TT-Line," said Jyrki Heinimaa, President & CEO of Rauma Marine Constructions.

The scope of supply includes, for each ship, four Wärtsilä 46DF dual-fuel main engines, three Wärtsilä 20DF dual-fuel auxiliary engines, and two Wärtsilä LNGPac fuel storage, supply, and control systems. The engines are future-proofed to operate on alternative green fuels as and when the availability evolves.

The new ferries will have a capacity of 1800 passengers and approximately 2500 lane metres on two freight decks. The first vessel is scheduled for delivery by the end of 2023, with the second one due a year later.

Austal Australia announces Collaboration with Australian Missile Corporation

Austal Australia has joined a consortium of Australian defence industry partners, academia and government organisations to support a new collaboration platform, the Australian Missile Corporation (AMC), which has the aim of establishing a sovereign guided missile manufacturing enterprise in Australia.

In March 2021 the Prime Minister, Scott Morrison, announced that the Australian Government's intention to create a new enterprise to support missile and guided weapons manufacturing in Australia for use across the Australian Defence Force. In July 2021, a Request for Information (RFI) was issued by the Australian Government calling for expressions of interest to support a $1 billion sovereign Guided Weapons and Explosive Ordnance Enterprise (GWEOE).

AMC is a wholly owned subsidiary of NIOA, the largest Australian-owned supplier of weapons and munitions to the Australian Defence Force. Austal Australia joins a number of companies collaborating with the AMC, including Quickstep, Moog Australia, Black Sky Aerospace and Thomas Global Systems.

Austal's Chief Executive Officer, Paddy Gregg, said that the collaboration with AMC was yet another example of how Austal is working with defence industry partners to build sovereign capability in Australia.

"Austal has a proven track record of effective collaboration with not only Australian industry, but academia and government, to deliver effective defence capability, such as the current Guardian and Evolved Cape-class patrol boat programs, and we're proud to support the Australian Missile Corporation's bid to establish a sovereign missile manufacturing enterprise here in Australia," Mr Gregg said.

NIOA and AMC's Chief Executive Officer, Robert Nioa, welcomed the support of Austal and highlighted the company's success in helping to develop Australia's sovereign defence capability.

"The expertise of a great Australian business such as Austal, with its world-leading insights, skills and enthusiasm, will be critical to the AMC in this formative stage," Mr Nioa said.

"As a trusted part of the defence industry for more than 30 years, they share our goal of strengthening the nation's sovereign capability while supporting the ADF."

The sovereign Guided Weapons and Explosive Ordnance Enterprise (GWEOE) aims to enhance Australia's self-reliance and supply-chain resilience, with a longer-term aim of developing a sovereign guided weapons manufacturing capability, comprising the following elements;

- manufacturing;
- research and development;
- education and training;
- test and evaluation;
- maintenance and repair;
- storage and distribution; and
- disposal.

VEEM Order from ASC

VEEM, the marine propulsion and stabilisation systems designer and manufacturer, has announced a $3 million order for the next full-cycle docking for the Collins-class maintenance program from ASC in South Australia.

This initial order for the next submarine refit highlights VEEM'S long history of work for ASC and its ability to consistently deliver highly-specialised engineering capability for Defence contracts.

It also reflects a sophisticated scheduling approach to the next full-cycle docking, considering long-lead-time items and forecasted changes in metals pricing due to COVID-19.

This allows VEEM to plan future production and supply-chain commitments and provides assurance to ASC for future timing and pricing. Orders on suppliers will be placed immediately by VEEM.

"The new order from ASC is further demonstration of our reputation for precision engineering to the exacting defence standards of the Royal Australian Navy," VEEM's Managing Director, Mark Miocevich, said.

"This order will provide certainty to our planning and positively impact our profitability in the 2022 and 2023 financial years."

The full contract is anticipated to be worth $9 million with delivery to commence in the next financial year, around July 2022.

Alfa Laval and Wallenius to Develop Modern Wind Propulsion

With the aim of radically reducing the marine industry's carbon footprint and overall emissions, Alfa Laval and Wallenius have announced their intent to form a new 50/50 joint venture. AlfaWall Oceanbird will focus on the development and realisation of technology for fully wind-powered vessel propulsion.

Alfa Laval and Wallenius are familiar partners in developing ground-breaking technology. The companies have collaborated previously on PureBallast, which is one of today's leading solutions for ballast water treatment. Through AlfaWall Oceanbird, they will pursue an innovative means of wind propulsion based on telescopic wing sails. This solution could reduce emissions by 90% on the largest ocean-going vessels.

"Wind has a key role to play in decarbonising the marine industry," said Peter Nielsen, Business Unit President, Alfa Laval Marine Division. "Together with Wallenius, we will harness this abundant natural force to meet both climate needs and those of maritime business."

"Oceanbird wing sail technology will be not only an elegant solution, but also a powerful driver of positive change," said Per Tunell, COO of Wallenius Marine and future Managing Director of AlfaWall Oceanbird. "Our vision at Wallenius is to lead the way towards truly sustainable shipping, and we are proud to partner with Alfa Laval in reaching it."

Though designed for wind propulsion, the Oceanbird technology has more in common with modern planes than traditional sailing vessels. It comprises an array of rigid wing sails, built from steel and composite materials which generate forward movement instead of vertical lift. These wing sails will be able to turn 360° to make optimal use of the wind.

The technology will be valid for any vessel type, but it will be implemented first on a transatlantic car carrier. Able to carry 7000 cars, the vessel will be 200 m long and will cross the Atlantic in 12 days when sailing at an average speed of 10 kn. AlfaWall Oceanbird will focus primarily on the vessel's technical sailing aspects, such as the vessel control system which will steer the wing sail operation.

"The wing sails are up to 80 m tall and have a telescopic construction," said Nielsen. "Besides adjusting to catch the wind, they can be lowered to pass under bridges, to handle harsh weather conditions or for maintenance. Because they will interact with the hull in a sophisticated way, they will also require intelligent control."

The AlfaWall Oceanbird joint venture comes at a critical point for the marine industry, which is responsible for around 2–3% of global greenhouse gas emissions. With the intent of reducing greenhouse gases related to shipping by at least 50% by 2050 compared to 2008 levels, IMO has set a goal to cut CO_2 emissions from international shipping by 40% by 2030. Alfa Laval and Wallenius are committing to decarbonisation targets beyond these levels, as are many other companies and a range of countries.

"We cannot wait until the end of the century to phase out fossil fuels," said Tunell. "We must create realistic alternatives, including the infrastructure for delivering and supporting them. Wallenius is committed to wind propulsion, and we know from the experience with PureBallast that Alfa Laval can help us make it a global reality."

"Alfa Laval has supported the marine industry's evolution for more than 100 years, but today there is new urgency," said Nielsen. "Wallenius shares our environmental momentum and the determination to find immediate, workable solutions. Having once helped us explore our planet, wind can now help us rescue it."

To learn more about the wing sail technology and AlfaWall Oceanbird's approach to wind propulsion, visit www.theoceanbird.com.

An impression of the Oceanbird car carrier design
(Image courtesy Alfa Laval)

NavCad for Yacht Designers

NavCad is a powerful tool which can be leveraged by designers of sailing yachts to ensure that performance under auxiliary power isn't an afterthought. It can be used to refine the vessel-propulsor-drive system and create a sophisticated prediction of performance under power — information useful to both owners and designers.

NavCad's built-in sailing-craft resistance prediction models for monohulls or catamarans (with or without appendages) may be employed directly or to lend context to performance predictions from other sources. Even trimaran resistance can be estimated using a hybrid technique. The speed at which performance predictions can be developed with NavCad allows it to be a vital tool for comparing hullform options during early design iterations. Using CFD? Leverage CFD or model test assets to create aligned predictions with NavCad — just like the major international model tanks.

NavCad's propulsion system modelling is used to ensure that rules and standards are met. Many racing rules require a vessel to reach a particular speed under power for a specified minimum duration. For example, the rule for Category 3 Monohulls requires a vessel to maintain 70% of hull speed for at least eight hours. The ability to precisely compute not only basic powering requirements, but propeller sizing and fuel consumption, is critical to appropriate selection of engines, gearboxes, propellers and even fuel tank volumes. Design studies with NavCad lead to weight savings relating to the engine and fuel, often two of the heaviest components onboard.

Special features for yacht designers include:

- Sailboat-specific upright vessel resistance
- Appendage models for various keel and rudder styles
- Suitable methods for folding and feathering propellers based on in-house R&D
- Workflow efficiency by launching directly from Rhino/Orca3D

NavCad is not just for patrol craft, workboats, and large ships. Yacht designers can also leverage a variety of tools to develop accurate simulations of the vessel-propulsor-drive system. Prediction of sailing vessel performance under auxiliary power is key to robust design and is critical information for future owners.

Serco tests Landing Craft Design at AMC

Serco Australia has completed an extensive round of tank testing for its provisional landing craft design, proposed to deliver next-generation amphibious capabilities for the Australian Defence Force (ADF) under its LAND 8710 Phase 1 program.

LAND 8710 Phase 1 is the project to design, build and maintain landing craft to enhance ADF's amphibious capabilities in littoral waters and to enable independent deployment throughout the region.

The tank testing was completed at the Australian Maritime College (AMC) in Launceston and involved the construction of a 1:16 scale model of Serco's design.

Named *Oboe 1,* in recognition of the unique heritage of amphibious operations undertaken by the Australian Army during the Second World War, the design utilises both local skills and international expertise developed over a long heritage of ongoing design, manufacture and support tasks undertaken by Serco for the United States Navy and Army.

The Oboe model then underwent a rigorous series of speed and performance trials utilising the impressive capabilities of the towing tank at the AMC, a specialist institute of the University of Tasmania.

The AMC tank is the largest facility of its kind in Australia and gives valuable data as to how the vessel will behave under differing load conditions and how it will dynamically perform at sea at various speeds and sea states.

The results of the AMC trials will be fed back into Serco's design and further refine performance specifications to address ADF requirements.

The model of *Oboe 1* at the AMC test tank
(Photo courtesy AMC)

The staff at AMC is fully independent of Serco's industry team, allowing the LAND 8710 design team to benefit from unbiased empirical data and feedback.

While the current Serco design reflects a mature set of operational criteria, it offers inherent flexibility and is scalable to meet specific ADF requirements tailored to meet Australia's unique operational circumstances.

Over the last decade, Serco has delivered more than a dozen large vessels for naval service under the Fleet Marine Services Contract, with this commitment to excellence to continue with Serco's approach to the LAND 8710 program.

Serco's preparations ahead of the LAND 8710 RFT are concurrent with the upcoming delivery of Australia's new state-of-the-art Antarctic icebreaker, RSV *Nuyina*. As the prime contractor for this 30-year partnership with the Australian Antarctic Division (AAD), Serco has continued its focus and deep involvement in delivering Commonwealth shipbuilding and maintenance programs.

Wärtsilä Launches Major Carbon-free Test Program

Wärtsilä is pioneering the adoption of hydrogen and ammonia as viable engine fuels through advanced testing in Wärtsilä's fuel-flexible combustion engines.

Full-scale engine tests have been recently carried out in Wärtsilä's engine laboratory in Vaasa, Finland, to assess the optimum engine parameters for running on these fuels. The test results are very encouraging, with one test engine performing very well when running on a fuel with 70% ammonia content at a typical marine load range. Tests were also completed successfully on another engine in pure hydrogen operation.

Testing will continue throughout the coming years with the aim of defining the most feasible internal combustion engine-based solutions for power plant and marine applications, thereby enabling the transition to a decarbonised future with green fuels.

The company's engines can currently run on natural gas, biogas, synthetic methane or hydrogen blends of up to 25% hydrogen. Wärtsilä engines will be capable of transitioning to future fuels, including pure hydrogen and ammonia.

Tony Armstrong

It is with sadness that *The ANA* records the passing of Dr Neville Anthony (Tony) Armstrong on 18 May 2021.

Tony was born on 24 February 1947 in the family home at Waterfoot, Rossendale, Lancashire, UK, to Richard and Winifred (nee Stephenson) Armstrong. His love of engineering and architecture started early, with childhood memories of building bricks and making 'roads' out of books and paper that ran through the downstairs rooms of the home, to 'race' cars with his father. In 1952 the family moved to Marampa, Sierra Leone, where Tony was home schooled for two years, and then in 1954 he moved to Winterdyne boarding school in Southport, UK. In 1960, he sat for his Common Entrance exam for Wrekin College in Shropshire, and passed Math's with 100%.

Tony's father may well be held responsible for starting what became a lifelong passion for open-top fast cars. On a visit to England in 1964, Richard bought Tony an MG PB Midget which was held in store until Tony acquired a driver's licence. Later, his early pay packets found room to include his growing love of fast cars, as he acquired a Lotus Super Seven, followed by a Lotus Elan.

Tony graduated in June 1971 from the University of Newcastle-upon-Tyne with a Bachelor of Science (Naval Architecture) degree. His first job was at the Vickers shipyard in Barrow-in-Furness, which he started at about the same time as he commenced his university education in 1965. After graduating, he worked as an R&D engineer on various projects involving nuclear submarines and surface warships before moving on to the test-and-commissioning organisation and taking on responsibility for the hull integrity of the first of a new class of destroyer, the Type 42 HMS *Sheffield*.

In 1974, he was offered a job as a design naval architect with the independent marine consultancy company Eken and Doherty in Sydney, and emigrated to Australia with a wife and new child on Christmas Day 1974. For the next three years, he was involved in the design of several tugs and offshore supply vessels.

Desiring some experience of regulations and legislation relating to ships, in 1977 he moved to Hong Kong for two years and worked as a ship surveyor for the Hong Kong Government, mainly involved with new building ships in Hong Kong and overseas.

He returned to Sydney in 1980 and re-joined the old firm, now called MJ Doherty and Company. During the next six years, he was the principal designer for the innovative self-discharging bulk limestone carrier MV *Accolade*, bulk cement carrier MV *Goliath*, and many tugs and offshore supply vessels, as MJ Doherty and Co. were one of the largest and busiest ship-design consultancies in the southern hemisphere.

In 1986 Tony set up his own business in Sydney, working on various national and international design and shipbuilding projects. He also worked for Carrington Slipways as Manager of the Sydney Marketing Office throughout much of 1988, assisting with the preparation of a bid for the Anzac frigate project and, later, a bid to build Australia's Antarctic research vessel *Aurora Australis*. Because of the multiple functions of the vessel, the design had to incorporate all the international legislative requirements for a fishing vessel, a passenger ship, and a special-purpose ship. Through 1989 there were also several other projects including the structural design of a 140 m ro-ro vessel for Bass Strait.

Tony Armstrong
(Photo courtesy Laura Armstrong)

In late 1989 Tony joined International Catamaran Designs (ICD) in Sydney, originally for a six-week secondment but which turned into six years working as Director of Design.

These were turbulent and exciting times, designing many novel high-speed craft for which the designs were well outside the limits of international regulations. The world's first large high-speed catamarans were designed, and then built in Hobart, and a whole new Australian industry developed — the aluminium shipbuilding industry which is now one of the mainstays of shipbuilding in Australia, and one which other countries have not been able to replicate. In 1990 alone, ICD designed the 35 kn 35 m Sydney Harbour Jetcats, the 40 kn 74 m wave-piercing car ferries (five built), a 120 m wave-piercing catamaran car ferry for P&O, and a 49 m wave-piercing passenger ferry built in the UK. All of these designs were "cutting edge" in that the dynamics of the aluminium structure were not fully understood, there were limited international safety regulations, and the classification society regulations governing structural design were only preliminary and applied only to ships up to 50 m in length!

Through involvement with the Australian Maritime Engineering Cooperative Research Centre, the opportunity arose to return to university in 1995 and, with financial support from Incat Australia, the aluminium shipbuilder in Hobart, Tony obtained a PhD at the University of New South Wales for his thesis titled *On the Viscous Resistance and Form Factor of High-Speed Catamaran Ferry Hull Forms*.

However, it was at Austal Ships in Perth, which Tony joined in 1998 as Manager R&D and Chief Scientist, that his most prominent achievement was the research and development of several large high-speed trimarans including the trimaran LCS for the US Navy and development of a range of commercial fast ferries.

There is no argument within Austal that Tony's greatest legacy is the design and development of the Austal trimaran; in fact, one customer described Tony as the father of the trimaran. The development of the trimaran as a high-speed surface vessel is the single most successful and unique platform within the Austal stable. Tasked with expanding the R&D function within the Austal business to support a growing world-wide market for fast craft, it was Tony's insight into the conundrum of how to make fast ferries not only more efficient but also more comfortable for the passengers, that led to the development of the trimaran. It was within just a few short years of Tony joining Austal, and after some intensive research and tank testing, that Austal announced a contract for what was to be not only the largest aluminium vessel in the world but also the first large high-speed trimaran.

The vessel, named *Benchijigua Express* by her owner, Fred Olsen SA, was launched in September 2004 and entered service during early 2005. With an overall length of 127 m and the capacity to carry 1291 passengers and 341 cars, or 450 truck lane metres and 123 cars, at speeds in excess of 40 kn, the achievement is testament to the belief of both Austal and Fred Olsen SA in Tony's vision and capability.

Following the success of this ground-breaking vessel, dubbed "the most significant vessel to arrive on the fast ferry stage", Austal has subsequently built and delivered a further five commercial and 12 defence variants of this revolutionary concept.

During his time at Austal, Tony's R&D group also developed a suite of tools to assist Austal Sales present complex technical and novel concepts to potential customers. Tony also authored and co-authored a wide range of technical papers which reflect the broad scope of activities to which he applied his vast range of innovative and inventive skills. His extensive body of research remains a key source of information and is still referenced regularly by the technical staff. Amongst colleagues who were lucky enough to work with him and within senior management who endure, Tony remains a key figure and influencer for what was a highly successful and ground-breaking period for the company.

Ever since early 1990s, Tony worked with the international regulators to develop the regulations into the current safety standard of the 2000 High Speed Craft Code (HSC 2000), published by the International Maritime Organisation (IMO). Also, as an adviser to AMSA, and Chairman of the Technical Committee of the Australian Shipbuilders Association from 1994 through 2010, he contributed significantly to the development of the national rules and regulations for ships in the National Standard for Commercial Vessels.

Tony's huge body of work includes 37 patents, 2 books, 3 journals, 23 conference papers, 265 technical reports, 11 organisations of conferences and 16 invited presentations including keynote speaker at a RINA Annual Dinner in 2006 and an Eminent Speaker tour of Australia for Engineers Australia in 2009.

In 2009, the College of Mechanical Engineers of Engineers Australia awarded him the AGM Michell Medal for his outstanding contribution to engineering including a balance of ingenuity, theoretical knowledge, and applications of them, along with devoting time to RINA and other industry organisations and nurturing young minds.

Upon retirement from Austal Ships in 2012, he continued to be active with the Australian Research Council, Curtin University and RINA, serving as President of the Australian Division from 2014 through 2016.

Tony passed away on 18 May 2021 at the age of 74, after an 18-month battle with cancer. He was one of the most remarkable naval architects of our time and known world-wide for his research in ship hydrodynamics and high-speed craft. He is survived by his wife Laura, four children and two grandchildren.

Vesna Lampalov Moretti

Benchijigua Express — the world's first large high-speed trimaran ferry
(Photo courtesy Austal)

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Tuesday 15 June 2021 by Zoom video-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. As this was the first Council meeting following the Division's Annual General Meeting, the President welcomed new members Sammar Abbas and Ken Goh from WA and Andy Harris from SA&NT, and re-appointed members Walid Amin and Jason Steward.

Among the items discussed were:

Council Membership and Registration as Not-for-profit

The Secretary reported that, as the remaining Council vacancies had only been filled shortly before the meeting, the not-for-profit application would be resubmitted in the near future including all current Council members in the Division's governance structure.

RINA and the Naval Shipbuilding Program

Council considered the comprehensive report of the working group led by Past President, Jim Black, which examined and reported on the role that the Division could and should play in the NSP. The resulting report will be considered by Council at its September meeting. Council agreed to seek further guidance from the group as to specific actions which should be taken to follow up on the report with a view to initiating those actions at the next Council meeting.

Replacement of Bass Strait Passenger Ferries

In response to a paper submitted by the Tasmanian Section, Council agreed to write to the Tasmanian Government noting the Task Force recommendations and supporting the feasibility study into a large multihull as recommended as part of Option 2.

UNSW Canberra Program Accreditation

The Division will nominate a "discipline expert" to participate in the accreditation panel for the new Naval Architecture degree program, which is due to commence teaching Year 3 students in 2022.

Section Funding

Noting that minimal expenditure had been made by sections in conducting largely virtual technical meetings during the COVID-19 pandemic, Council agreed to consider a proposal at its September meeting for a change to *Guidelines for Section Treasurers and Procedure for Allocation of Section Funds* to reflect this principle. In the meantime, sections would be provided with funding as necessary to facilitate their continued operations.

Payment of Subscriptions

Council instructed the Secretary to raise with RINA HQ the possibility of members' annual subscriptions being paid to an account within Australia to avoid multiple foreign exchange costs.

Next Meeting of Division Council

The next meeting is tentatively scheduled for the afternoon of Tuesday 14 September 2021, subject to Council members being canvassed for the day of the week and time of day which best suits most members.

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.

Finally, in recent days I attended the funeral of Past President Bryan Chapman. I have known Bryan since my early days at Whyalla Shipyard and it was he as Division President who invited me to join the Division Council soon after it was re-constituted in 1998. Noting his pivotal role in establishing the Division as we know it today, I have sent the Division's deepest condolences to Bryan's wife and family.

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

60-year Membership Certificate

Noel Riley has received a certificate from RINA HQ for his sixty years of membership of RINA.

Noel Riley with his 60 year membership certificate
(Photo courtesy Donela Riley)

Noel served his time as a shipwright at Cockatoo Dockyard and was working for Eken & Doherty (legends in naval architecture in Australia) when he joined RINA in 1961. At the time he was also in Stage 4 of the five-stage Naval Architecture Diploma program at Sydney Technical College, from which he graduated with honours. He moved to Whyalla, and taught the Naval Architecture Diploma program there for several years, moved back to Sydney and worked for Alan Payne (another legend in naval architecture in Australia), formed the partnership Boulton, Riley and Hercus, and then his own company, Commercial Marine Design. He also taught two courses part-time in the Naval Architecture degree stream at UNSW Sydney, and is a former President of the Australian Division of RINA.

Membership certificates commence at 45 years, are given more rarely at 50, and even more rarely at 55 and 60 years. Noel is now a member of a very select club — congratulations, Noel!

Continuing Professional Development

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

Continuing Professional Development will therefore enable the member to:

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

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

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

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

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

RINA Council and Committee Members

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

Australian Division Council

President	Gordon MacDonald
Vice-president	Violeta Grabovska
Secretary	Rob Gehling
Treasurer	Craig Boulton
Members nominated by Sections	
	Alistair Smith (ACT)
	Cameron Whitten (Qld)
	Adrian Broadbent (NSW)
	Yuriy Drobyshevski (WA)
	Nathan Wallace (Vic)
	Peter Dandy (SA&NT)
	Michael Woodward (Tas)
Members elected or appointed by Council	
	Walid Amin
	Jonathan Binns
	Sammar Abbas
	Violeta Gabrovska
	Ken Goh
	Andrew Harris
	Jason Steward

ACT Section

Chair	Warren Smith
Deputy Chair	Peter Hayes
Secretary	Lily Webster
Assistant Secretary	Alistair Smith
Treasurer	Lachlan Clarke
Nominee to ADC	Alistair Smith
Members	Ray Duggan
	Martin Grimm
	James Loram
	Ahmed Swidan

NSW Section

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

Queensland Section

Chair	Cameron Whitten
Deputy Chair	Tom Pipon
Secretary	Ashley Weir
Treasurer	James Stephen
Nominee to ADC	Cameron Whitten
Members	Mark Devereaux
	Sasha Harrison
	Hamish Lyons
	Tom Ryan
	Timothy Vaughan

South Australia and Northern Territory Section

Chair	Peter Dandy
Deputy Chair	Nathan Doyle
Secretary	Christopher Carl
Treasurer	Giang Ngo
Nominee to ADC	Peter Dandy
Members	Andrew Harris
	Peter Samarzia
	Cameron Wilkinson

Tasmanian Section

Chair	Jonathan Binns
Deputy Chair	Chris Davies

Secretary	Gregor Macfarlane
Treasurer	Nick Johnson
Nominee to ADC	Michael Woodward
TM Coordinator	Chris Davies
Members	Doupadi Bandara
	Conor Dalton
	Callum Finney
	Alan Muir
	Michael O'Connor
	Chance Ong

Victorian Section

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

Western Australian Section

Chair	Piotr Sujkowski
Deputy Chair	Kenneth Goh
Secretary	Nathan Chappell
Treasurer	Cheslav Balash
Nominee to ADC	Yuriy Drobyshevski
Members	Sammar Abbas
	Hadiqa Khan
	Ian Milne
	Gino Parisella

International Journal of Maritime Engineering

Editorial Board Member	Martin Renilson

The Australian Naval Architect

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

Walter Atkinson Award Panel

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

RINA London

Board of Trustees	Rob Gehling
Council Members	Gordon MacDonald (*ex officio*)
	Rob Gehling
Maritime Safety Committee	
	Rob Gehling
	Doug Matchett
IMO Committee	John Manning
Digital Review Working Group	
	Jesse Millar

RINA/Engineers Australia Joint Board of Naval Architecture

Chair	Gordon MacDonald
Member	Rob Gehling

AMSA DCV Liaison Working Group

Joint Chairs	Violeta Grabowska and Rob Gehling
Members	10 (names confidential)

Standards Australia Committee CS114 (Small Pleasure Boats)

Member	Peter Holmes

Standards Australia Committee ME059 (Shipbuilding)

Member	David Gonzalez Pastor

Indo-Pacific 2022 Organising Committee

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

Indo-Pacific 2022 IMC Papers Committee

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

Changed contact Details?

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

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

RINA London		hq@rina.org.uk
Australian Div.		rinaaustraliandivision@iinet.net.au
Section		
	ACT	rinaact@gmail.com
	NSW	rinansw@gmail.com
	Qld	rinaqlddiv@gmail.com
	SA/NT	rinasantdiv@gmail.com
	Tas	gregorm@amc.edu.au
	Vic	vic@rina.global
	WA	wa@rina.org.uk

Phil Helmore

NAVAL ARCHITECTS ON THE MOVE

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

Bradley Abdilla moved on within Thales Group in early 2018 and took up the position of Platform Lead Engineer, supporting the Armidale-class patrol boats, in Darwin.

Stuart Cannon has moved on within Defence Science and Technology Group and has taken up the position of Chief Technology Officer for Innovation and Strategic Research in Melbourne.

Peter Dandy has recently moved on within ASC to take up the position of Principal Naval Architect in Adelaide, and continues as Chair of the South Australian and Northern Territory Section.

Patrick Doherty has moved on from One2three Naval Architects and has taken up a position as a naval architect with the Ship Structures Cell in the Directorate of Navy Engineering, Department of Defence, in Sydney.

Yang Du has moved on within Nantong Sifang Tank Storage Equipment Manufacturing Co. and has taken up the position of Sales Manager, in Nantong, China.

Edward Hawkins has moved on from the Australian Energy Market Commission and has taken up the position of Manager Energy and Carbon with Engevity in Sydney.

Geoff Leggatt has resigned from Intecsea, and is spending some quality time with family and on home renovations and building projects while evaluating opportunities.

Adam Podlezanski continues as Managing Director and Principal Design Consultant with Apcon in Brisbane.

Christopher Polis completed his PhD at the Australian Maritime College in 2016, then set up his own naval architecture consultancy and has also taken up the position of Research Director for cryptocurrency GTCoin with Game Tester in Launceston.

Neil Pollock has moved on from consulting and has taken up the position of LNG and Shipping Consultant with Poten & Partners in Brisbane.

John Polmear moved on from Viking Seatech in 2015 to take up the position of Design Manager with Liferaft Systems Australia in Hobart.

Kevin Porter continues as Principal Marine Surveyor, Flag State Control, with the Australian Maritime Safety Authority in Canberra.

David Purser continues as Executive Branch Manager, Goods and Services with the ACT Government in Canberra.

Trevor Rabey continues as the Director of Perfect Project Planning in Perth.

Dimitrije Radukanovic continues consulting as Raducan, mainly in the marine heavy lift area, but has moved from Perth to Zurich, Switzerland.

Tauhid Rahman has moved on within DNV Australia and has taken up the position of Principal Surveyor, concentrating on the offshore industry and ship surveys/audits, based in Sydney.

Peter Randhawa continues as Senior Structural Engineer with BAE Systems in Melbourne.

Kristofer Rettke has moved on within the Capability Acquisition and Sustainment Group, Department of Defence and has taken up the position of Chief Engineer in Sydney.

Andrew Richards continues as Naval Architect with Aurora Marine Design in Coomera, Qld.

Shaun Ritson moved on from Naval Architecture and Marine Solutions in 2017 to take up the position of Senior Naval Architect with MMD Naval Architects in Melbourne.

Robert Rostron has moved on within DNV in Oslo, and has taken up the position of Diving Group Leader/Principal Surveyor in the Offshore Equipment, Mooring and Diving Section.

Brett Ryall has moved on from Ocius Technology and, after a return voyage to Hobart on *James Craig* and across the North Atlantic and through the North Sea on USCGC *Eagle*, recently completed a Certificate 3 to qualify as master of vessels up to 24 m in length, and is now evaluating opportunities.

Brendan Thornton has moved on from Australian Maritime Technologies and has taken up the position of Structural Engineer with Naval Group in Adelaide.

Drew van Ryn moved on from One2three Naval Architects in 2019 to concentrate on his own business, Wet Tech Rigging, in Sydney.

Zohlupuii has recently joined Oceanic Design and Survey, taking up a position as a naval architect, in Coomera, Qld.

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

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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

The Victoria Jubilee Floating Dock, named in honour of Queen Victoria, was located in Cameron's Cove, in the Sydney suburb of Balmain. The dock was designed and built by James Anderson of Anderson, Goodall & Co. of Balmain. It was 97 m long, 17.3 m wide and 8.2 m deep with displacement of 14 763 t. The dock received its first ship, *Royal Tar*, on 1 October 1887
(Photo Australian National Maritime Museum Collection)

Camerons Cove today is home for the NSW Water Police. The Cove has changed in the last 130 years and the city skyline is unimaginably different
(Photo John Jeremy)

HMAS *Canberra* sailing from Sydney Harbour on the afternoon of 15 July for a four-month deployment (RAN photograph)