THE AUSTRALIAN NAVAL ARCHITECT

Volume 24 Number 2
May 2020

HMAS *Arunta* fires an Evolved Sea Sparrow Missile off the coast of Western Australia to test its missile systems after undergoing the Anzac Midlife Capability Assurance Program upgrade
(RAN photograph)

THE AUSTRALIAN NAVAL ARCHITECT

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(Australian Division)

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Cover Photo:

Nairana, a double-ended ro-pax ferry for operation between Kettering and Roberts Point on Bruny Island in Tasmania, recently completed by by Richardson Devine Marine Constructions in Hobart
Photo courtesy Incat Crowther

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on the
World Wide Web
www.rina.org.uk/aust

From the Division President

Welcome to the May edition of *The Australian Naval Architect*. I would like to have taken over the position under less bleak and uncertain times, however, that is the hand we are dealt.

I must, of course, start my duties by thanking, both personally and on behalf of the Council, the outgoing President, Martin Renilson, who has demonstrated enormous drive and commitment to the Institution and will continue to provide us all with his guidance in the future.

For those who do not know me, I qualified as a Naval Architect from Strathclyde University in Scotland in 1985 following four years as a marine engineer in the merchant navy. I have worked primarily in the Defence sector over the subsequent 35 years. As a consequence, my understanding of the other key maritime sectors, civil, offshore and recreational are somewhat limited, and I therefore reach out to representatives in our sections for your support to keep the Council informed of your issues so that we may assist you.

The RINA London AGM will be held in May, at which the new President will be appointed, replacing Prof. Richard Birmingham who has held the position since 2018. During Richard's tenure the RINA Board embarked upon a Strategic Review of the Institution, focused on what we need to look like by 2050. The Review commenced by reiterating the four Objectives of the Institution:

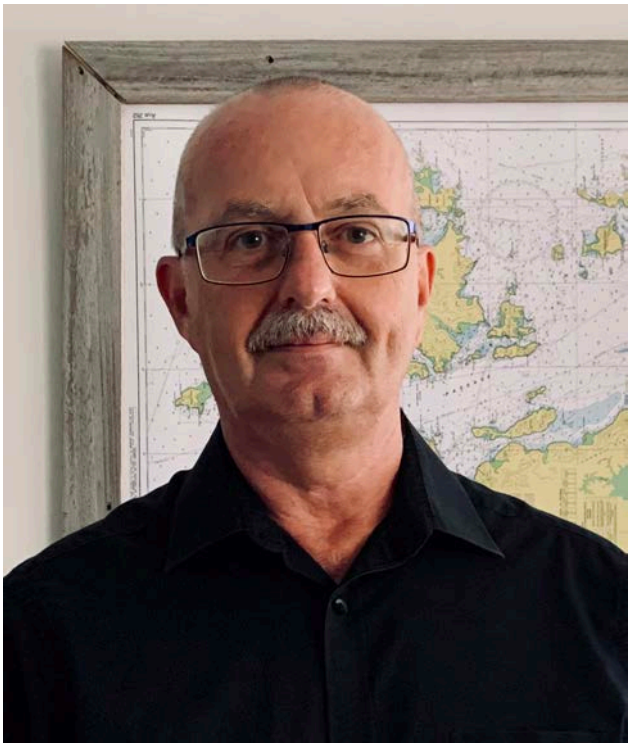
- Setting standards of professional competence and integrity.
- Encouraging membership at all levels.
- Enabling the exchange of technical information.
- Contributing its collective expertise for the benefit of society.

The review has been conducted over four phases, with the final phase to implement the endorsed recommendations under way. Full details of the recommendations will be published in due course, but can already be seen in the shift towards election of the Institution's Council on a regional basis. As your Division President, I am an ex-officio member of that Council, charged with bringing the Division's views to the Council independent of our location in the Pacific Region.

Aligned with the fourth dot point above, the IMO Green House Gas Study (2014) estimated that, for the period 2007–12, shipping emitted about 1000 Mt CO_2 per year, equalling approximately 3.1% of annual global CO_2 emissions. As a consequence, Council has been considering the Institution's policy on global warming through the Maritime Environment Committee.

The Australian Division Council continues to progress a number of initiatives which we believe to be for the long-term good of the membership. We have been actively engaging with the Naval Shipbuilding College's (NSC) CEO with a view to formal participation. The NSC remit is to ensure that a suitably skilled and qualified sovereign workforce is available to meet the needs of shipbuilders who will deliver our latest naval assets.

The Council also continues to support maritime-related Government initiatives such as our recent submission to the Senate inquiry into Australia's sovereign naval shipbuilding capability. Active participation in these forums raises the profile of the Institution and level of awareness of our profession.



Gordon MacDonald

The Council has also been working with Engineers Australia to consolidate our role in the evaluation and accreditation of degrees in naval architecture and maritime engineering, with some positive progress being made.

The Australian Division AGM was held by video-conference on 31 March, at which Martin Renilson delivered his final President's Report. The annual Financial Report was considered and the new Council memberships announced.

The Australian Division Council is in the process of moving to a video-conferencing format. While this has not been without its technical challenges, as evidenced by technical problems with many members' attempts to participate in the Division's Annual General Meeting, this technology may outlive the current social distancing environment by improving our communications in the longer term. It is heartening to see that, despite the current impositions from COVID-19. the sections continue to be actively embracing video-conferencing technology to keep the membership involved. Use of this technology will support the participation of members in meetings and, as such, is one potential bright spot in our current dilemma, as evidenced by the participation in the Division AGM of members from around the nation as against those in the nominated meeting location.

On a positive note, as you will be aware, Defence has embarked on the massive strategic challenge of bringing together the private and public sectors of the economy to deliver a fundamental national objective, the implementation of continuous shipbuilding through the recapitalising of the Navy, i.e. the creation of the future fleet. The implications for the naval shipbuilding and engineering domain are immense; however, the challenges also give rise to great

opportunities — we as naval architects need to understand these opportunities and shape the future for our membership.

During my years in Defence in Australia, our naval architects and engineers have focused on the in-service phase of a ship's lifecycle; we will now need to develop the skill sets in requirements definition, design, build, configuration control, and test and acceptance. In this time of uncertainty, this prospect provides a long term future for the next generation of naval architects.

As part of this program the keel for Australia's second Arafura-class offshore patrol vessel (OPV) was laid down at Osborne Naval Shipyard in Adelaide on 9 April. The vessel, which will be in service as HMAS *Eyre* once commissioned, is part of a $3.6 billion contract for 12 vessels.

I wish I had something positive to say regarding the commercial sector, however, the impact of COVID-19 on cruise industry in Australia would have to be the current focus. The maritime industry has unfortunately been at the forefront of the Australian and, indeed, the world's, gaze as we witness so many catastrophic COVID-19 cruise ship incidents. The cruise industry contributed $5.2 billion to Australia's economy in the 2018–19 financial year so it is crucial that the industry works towards a solution to eliminate and/or control virus outbreaks onboard.

In closing, I would like to thank the retiring Division Council members Tony Armstrong, Karl Slater, Kalevi Savolainen and Ian Laverock and welcome Nathan Wallace and Yuriy Drobyshevski and, finally, commiserate with Violeta Gabrovska for having to support me as Vice President.

Gordon MacDonald

Editorial

In the business of shipbuilding and ship repair (particularly the latter) the unexpected can be, well, not unexpected. Sometimes something happens to a ship which demands rapid response with material and equipment and, above all, people with appropriate skills. I have experienced a number of such unexpected events during my career. To respond to these events one needs to hold sufficient stock of materials for immediate use, and a reserve of trained people readily available.

In times when such events are few, the pressure to reduce overheads can mean that the capacity to respond in a timely and effective manner is diminished as time passes, but the nature of shipbuilding and ship repair means that business plans must encompass a long-term perspective.

The circumstance which we now all face, with COVID-19 rapidly reshaping the world we understand, is a totally unexpected event to most people apart, perhaps, from those whose job it is to consider such possibilities and devise strategies to manage them. Of course, those to whom this event might not have been unexpected have a challenge to get policy makers and those in government to listen and make provision for a proper response. It must be a bit like persuading a board of directors that the level of steel stock, for example, must be maintained even though there has been no call on it for years.

The world we know has, within a very short time, been turned upside down. Cruise lines, airlines, the tourist industry (to name a few) are facing challenges to adapt to a different world as we emerge from what is, effectively, a global lockdown. The industries in which we work will also face unusual challenges — how to build ships whilst observing physical distancing, for example, and globalisation with its 'just in time' reliance on world-wide supply sources will be increasingly questioned.

Many years ago, when facing some apparently intractable problems, I took encouragement from my holding company's managing director (who had great experience in much more trying times) who listened to my problems and said 'John, it's a challenge.' Well, we certainly have one now — all of us. I have great confidence that the fine people who work in the world of ships will rise to those challenges and succeed in the difficult years that I fear lie ahead of us.

John Jeremy

A familiar ship on Sydney Harbour flying new colours. The Chilean frigate *Capitan Prat* (ex-HMAS *Newcastle*) was commissioned on 15 April 2020 with her sister ship *Almirante Latorre* (ex-HMAS *Melbourne*). The Australian-built guided-missile frigates were decommissioned last year after around a quarter century of service in the RAN. Their sale to Chile was completed this year
(Photo John Jeremy)

LETTER TO THE EDITOR

Dear Sir,

The purpose of this letter is to outline an investigation which may interest one or more of your readers with access to a test tank with a wave-making capacity and a suitable trials vessel. Don Jordan, with access to the facilities of the US Coastguard, developed a series drogue system to assist a yacht in severe conditions. It was intended to slow the vessel and reduce the chance of the vessel pitch-poling or rolling — a Google search will find his report [*see http://jordanseriesdrogue.com/pdf/droguecoastguardreport.pdf*—Ed.] and other comments. A rope with a mass at the end and a series of small cloth cones along its length is deployed from the stern of the yacht and acts as a mechanism to slow the progress of the yacht and keep it stern-to-wind. The report also provides guidance on the forces involved, and the length of rope and the number of cones needed — these increase with the size of the yacht.

Several notable yachtsmen speak highly of the device. For example, Roger Taylor, who gets pleasure in taking a small junk-rigged yacht to the high Arctic, swears by it. His blog can be found via a web search for "Roger Taylor simple sailor" and his Jordan drogue comment is the article for January 2010. Jeanne Socrates, a 77 year old lady who recently completed a solo nonstop circumnavigation, and Jessica Watson also used the device.

My question is: can the benefits of the device be obtained by using equipment which may be on a yacht already or carried for use as a drogue, without incurring the cost of a Jordan drogue? I assume that the main reason the Jordan device works is that the drag-inducing devices are spaced so that it still provides drag when some of the cones are in a wave front which would carry them forward. So, the essential requirement is a series of drag-inducing devices which are spaced along a rope. On my yacht, I have an anchor rope and chain and several buckets. I could deploy them and, if more drag was needed, more buckets (or other devices) could be deployed by using the anchor rope as a guideline and attaching the extra buckets to it with a large shackle and feed them out with other ropes. I would suggest fitting some of the buckets with some buoyancy and some with weights, so they would deploy above and below the anchor rope.

The perceived benefits are the use of equipment which will mainly be already carried, and so lower cost. Also, at the end of the storm it would also be easier to retrieve — some users of the Jordan system have cut theirs away when they could not recover it because of the drag generated.

If anyone is interested in testing the idea, then I am happy to discuss it with them. The Editor has my contact details.

John Pennefather
Amateur sailor and retired scientist

COMING EVENTS

NSW Technical Meetings

Technical meetings during COVID-19 restrictions will continue as webinars, hosted by Engineers Australia. Registration for each presentation is required, and details will be provided in the flyer for each meeting.

Post COVID-19 restrictions, technical meetings will generally be combined with the NSW–ACT Branch of the IMarEST and held on the first Wednesday of each month at Engineers Australia's new premises at 44 Market St, Sydney, starting at 6:00 pm for 6:30 pm and finishing by 8:00 pm.

Meetings may be subject to change at short notice so, if you are making extensive arrangements to attend, then please confirm the venue, date and time with the Secretary of the Section.

The program of meetings for 2020 (with exceptions noted) is as follows:

20 May	Levi Catton, Managing Director/ SEA5000 Technical Advisor Ship Integration, Gibbs & Cox Australia *Design and Construction of the RAN's New Hunter-class Frigates*
3 Jun	Christelle Auguste, PhD Candidate, Australian Maritime College *Investigation of Sediment Transport Processes near Tidal Energy Devices*
1 Jul	Clive Evans, Maritime Systems Lead—Research Supply Icebreaker Project, Australian Antarctic Division *RSV* Nuyina: *Australia's New Icebreaking Research and Supply Vessel*
29 Jul	IMarEST at Sydney Mechanics School of Arts, 280 Pitt St, Sydney
2 Sep	Sean Langman, Managing Director, Noakes Group *Restoration of the Heritage-listed Rosman Ferry* Radar
1 Oct	IMarEST
3 Dec	SMIX Bash 2020

NEWS FROM THE SECTIONS

ACT

Technical Presentations

The ACT Section took the opportunity to have presentations on the final-year thesis work of two engineers currently in the Defence Civilian Engineer Development Program with the Naval Technical Bureau. The meeting was held at Campbell Park Offices in Canberra on 3 March 2020.

Reducing the Drag of an Aerial Drone through the Implementation of Folding Propellers — a CFD Study

Alan Tate graduated from Monash University in 2019 with a Bachelor of Engineering degree in Aerospace Engineering and a Bachelor of Science. He then took up a position in the Hydrodynamics Cell of the Naval Technical Bureau in Canberra as part of the Civilian Engineering Development Program.

Alan's presentation discussed the idea of implementing folding propellers on Monash University's Unmanned Aerial System's drone. A computational fluid dynamics (CFD) study was implemented to observe whether these folding propellers would allow the drone to cruise at a higher efficiency, which would increase its capability. These propellers would initially be used for vertical take-offs and landings, and then fold inwards during cruising where they are dormant, as the drone uses fixed-wing flight. CFD simulations displayed a decrease in skin friction drag, but a significant increase in pressure drag as a result of the frontal area being greater, hence the folding propellers would have decreased the efficiency of the drone.

An Experimental Investigation on the Performance of Double-interceptor Systems

James Loram graduated from the Australian Maritime College in 2018 with a Bachelor of Engineering degree in Naval Architecture. He then took up a position in the Structures Cell of the Naval Technical Bureau in Canberra as part of the Civilian Engineering Development Program.

James' presentation looked at the application of double-interceptor systems in an effort to determine the variations in effectiveness of interceptor depths and forward interceptor position. Through the use of model-scale tests in calm water, the combined effects on hull resistance and running trim were investigated. The limitation of fixed interceptors is that there will be changing requirements at different speeds due

to the strong relationship between drag and trim. Resistance reductions were observed for aft-only interceptor conditions, but lack of forward interceptor ventilation led to noticeable increases in drag for double-interceptor conditions. The ability of the system to correct non-optimal LCG positions, both forward and aft, was also shown. The findings highlighted the importance of balancing the increased drag resulting from the forward interceptors with the amount of lift produced, limiting the capacity of the system outside of the tailored speed. The effect of turbulence from the interceptors on vessel propulsive efficiency will also need to be examined in future.

Summary

Both presentations were well received, given the novel and experimental nature of the investigations undertaken, and were aided by the presenters being very happy to engage in clarifying and entertaining discussions regarding their thesis work experiences.

Ray Duggan

Queensland

Annual General Meeting

The Queensland Section held its AGM on the evening of 18 February 2020 at the AusShips facilities in Brisbane. Both the AGM and the following technical presentation were well attended.

The AGM saw the outgoing committee standing down and a new committee being elected. A number of long-serving committee members, including Tommy Ericson, Peter Holmes and Hamish Lyons, stepped down from the more active roles. We thank them for their hard work and contributions over the years. As a result, the Queensland Section Committee is now as follows:

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

Sail Training Ships

Rick James, naval architect and industry stalwart, gave a presentation on *Sail Training Ships* to a meeting of the Queensland Section on the evening of 18 February 2020 at the AusShips facilities in Brisbane, following the AGM of the Queensland Section.

Rick's presentation gave insights on some of the sail-training ships which are currently in operation throughout Australia and the world. He focused on the differences between these designs and some of the issues (predominantly financial) which the vessels face operationally. One of the highlights was his discussion of how he designed the sail-training ship *South Passage* and some of the sailing adventures he has had on her. We thank Rick for giving up his time and showing us some unique designs.

Australian Division AGM

The Queensland Section was due to host the Annual General Meeting of the Australian Division on 31 March. However, due to the COVD-19 restrictions, the AGM was re-scheduled as a video conference on 31 March (see report in the *Membership* column in this issue of *The ANA*).

Ashley Weir

Western Australia

RINA at AOG 2020

The Australasian Oil and Gas (AOG) Exhibition and Conference 2020 took place in Perth on 11–13 March 2020. The AOG is a major annual event organised by Diversified Communications Australia (see http://aogexpo.com.au/). The Royal Institution of Naval Architects was an exhibitor and a conference partner by hosting the stream *Offshore Marine Technology* within its Knowledge Forum.

The RINA stand was prominent with a number of publications and a LEGO model of the new Antarctic research and supply vessel RSV *Nuyina* demonstrating the contribution of the naval architecture profession in Australia. The RINA conference stream featured eight presentations arranged in four sessions to cover a range of topics:

Floating Solutions—Fixed and floating offshore structures

- Stuart Wales (AMOG) — *Digital Twin Reconstruction: from Donor Hull to FPSO*
- Yuriy Drobyshevski (NavTec) and Michael Morris Thomas (IntecSea) — *Response-based Design and Classification Society Rules: Evolution Towards a Common Basis*

Offshore Operations—Ships for Offshore Operations and Offshore Installation

- Jeff Baker (Lloyds Register): *Purpose Designed LNG Bunkering Vessels: a 2020 Update on Characteristics and Features*
- Holger Kelle (INSITIAS) — *Reeled Floating-hose Systems as a Cost-effective Alternative to Traditional Jetties for Liquid Terminal Operation*

Marine Renewable Energy—Renewable energy Offshore Structures and Systems

- Tim Sawyer (Floatation Energy) — *Development of Offshore Floating Windfarms*
- Daniel Veen (Bentley Systems) — *OpenWindPower: Validation of a Structural Analysis and Design Solution for Floating Offshore Wind Turbines*

Offshore Marine Digitalization — Application of Digital Technology to Offshore and Marine Industries

- Ken Goh (Knud E. Hansen) — *Collaboration with Virtual Reality Tools for Offshore Operations*
- Jeff Baker (Lloyds Register) — *The Role of Digital Twins in Oil and Gas Compliance*

The AOG event took place in difficult circumstances. Due to the COVID-19 situation deteriorating progressively, the event was challenged by last-minute presenter cancellations. Attendance at the RINA stream was also impacted by the restrictions which some companies in Perth had put in place just before the event. In spite of this, the stream attracted

attention, feedback from the audience was positive, and the Section had already been asked by those who could not attend for copies of the presentations.

Jeff Baker of Lloyd's Register speaking on
The Role of Digital Twins in Oil and Gas Compliance
at the RINA Knowledge Forum of AOG 2020
(Photo courtesy Tim Gourlay)

The RINA participation in the AOG 2020 event was possible due to the efforts of a dedicated sub-committee of the WA Section who worked collectively throughout the year: Tim Gourlay, Technical Chair of the RINA stream, and Piotr Sujkowski, Ken Gogh, Zeerak Mehdi, and Nathan Chappell, who organised the RINA stand. A number of section members volunteered to crew the stand during the exhibition. The RINA Chief Executive, Trevor Blakeley, attended the event and paid visits to maritime companies and universities in Perth, facilitated by Sammar Abbas, Cheslav Balash and Piotr Sujkowski.

RINA's participation in the AOG Exhibition and Conference in Perth has become a regular yearly event, highlighting the significant role which our profession plays in the Australian offshore industry, both in its petroleum and renewable sectors. The sponsorship support provided to the WA Section by Lloyds Register is gratefully acknowledged.

Yuriy Drobyshevski

The RINA Stand at AOG 2020 with the
LEGO model of RSV *Nuyina*
(Photo courtesy Ken Goh)

Tasmania

Visit by Trevor Blakeley, Chief Executive, RINA

Trevor visited Tasmania on 16 and 17 March 2020 on his way across Australia. The Tasmanian Section organised a busy schedule of meetings in the north of the state in Launceston with students, presenting prizes, talking to students about joining RINA, and talking to students about taking the final steps to chartered status. On the second day we had five industry visits planned for the south of the state in Hobart and environs.

You may be able to tell from the dates that this whole visit was marked by social distancing and travel restrictions. Rather than travel to Hobart, we quickly reorganised to conduct a series of virtual visits to key industry players in Hobart. We look forward to even more members from southern Tasmania as the local maritime industry goes from strength to strength.

Presentation of the 2019 Rat Trap Boat Race Prize by Trevor Blakeley (RINA) and Dr Nick Johnson (AMC). First Prize went to Tom Hoare, Sophie Roberts and Mostafa Mohseni
(Photo courtesy AMC)

Annual General Meeting

The Tasmanian Section AGM was held on 11 March 2020, during which the operation of the section was discussed. Traditionally the Tasmanian Section has had one of the largest memberships due to the large student cohort (now the only) in Australia. Tasmania is also the home of a strong and growing maritime sector. As can be seen from the new committee below, joining these two groups of members is the main aim for 2020 for the Section.

The elected members from this AGM were:

Chair	Jonathan Binns
Deputy Chair/Technical Meeting Coordinator	Dan Clayton
Honorary Secretary	Gregor Macfarlane
Honorary Treasurer	Nick Johnson
Southern Tasmania Representative	Chris Davies
The Australian Naval Architect/e-News Co-ordinator	Tom Mitchell Fergusson
Community Engagement Officer	Callum Finney
Junior Representative	Jack Davison
Undergraduate Student Representative	Tom Davenport
Members	Alan Muir
	Michael O'Connor
	Chance Ong
	Hossein (Behrooz) Enshaei
	Nirman Sembukutti Vidanelage

Gregor MacFarlane

New South Wales

Annual General Meeting

The NSW Section held its twenty-second AGM on the evening of 4 March, following the March technical presentation in the Boardroom at Engineers Australia, Chatswood, attended by 14 with Deputy Chair, Phil Helmore, in the chair.

Phil presented Valerio Corniani's third Chair's Report, touching on some of the highlights of 2020, which included nine joint technical meetings with the IMarEST (NSW–ACT Branch), with attendances varying between 17 for Michael Uberti's presentation on *Domestic Commercial Vessel Survey in Australia*, and 59 for Jim Galanos' presentation on *Corrosion and Mitigation*. SMIX Bash 2020 was successful and was attended by 200, including a number of national and international guests.

Adrian Broadbent presented the Treasurer's Report. The EA venue at Chatswood had, as usual, been our major cost for the year. However, with a close watch on the outgoings, we had managed to operate within our budget, we had a total of $1493 in the Section account at 31 December 2019, and the 2019 accounts have been audited. SMIX Bash is funded separately through the Social account and, despite a modest loss for SMIX Bash 2019, projections are for a sufficient balance to enable preliminary arrangements for SMIX Bash 2020.

There are two changes to the NSW Committee for 2020. Nominations were received from Belinda Tayler and Molly McManus, and both were elected to the committee. As a result, the committee for 2020 is as follows:

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

The NSW Section is also represented on the Australian Division Council by Craig Boulton as Treasurer.

Committee Meetings

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

- SMIX Bash 2019: All sponsorships have been received and all expenses paid, and projections are for a modest loss, which will be shared with IMarEST.
- Technical Meeting Program: RINA presentations arranged for March and May, with others being sought for July and September; IMarEST to advise their presentations for April, June, late July and October.
- Technical Meeting Venue: The move by Engineers Australia from Chatswood to Sydney CBD has been delayed by rain damage from 2 March to (probably) mid-March; with luck, our April meeting will be in the new venue at 44 Market St. We have eight meetings per year at EA, so we have booked the Sydney Mechanics School of Arts, 280 Pitt St, Sydney, for one meeting on 29 July in lieu of the usual August meeting.
- Recording of Technical Presentations: The *Screen Recorder Pro* software has successfully been used to record two presentations, and these are now up on the RINA YouTube channel.

The NSW Section Committee also met by video conference on 14 April and, other than routine matters, discussed:

- Engineers Australia Update: Greg Ewing and Natalia Kontsevaya from EA attended the video conference and gave updates. EA has moved into their new premises at 44 Market St, Sydney, but cannot yet use them for members' events due to COVID-19 restrictions. Technical presentations and committee meetings can be made as webinars and recorded using their WebEx software.
- SMIX Bash 2019 accounts completed and recorded a modest loss, which will be shared with IMarEST.
- SMIX Bash 2020: There is a question mark about whether this will go ahead due under COVID-19 restrictions but, at this stage, we should plan on going ahead. Committee members were confirmed, and talks with sponsors to commence.
- Technical Meeting Program: We have our three remaining presentations for the year signed up, and it is expected that these will go ahead as webinars while COVID-19 restrictions remain in place. IMarEST presentations to be advised.

The next meeting of the NSW Section Committee is scheduled for 9 June.

Structural Integrity of Ships

Bruce Cartwright, Research Associate, University of Newcastle, and Senior Simulation Engineer, Pacific ESI, gave a presentation on *Structural Integrity of* Ships to a joint meeting with the IMarEST attended by 28 on 4 May in the Boardroom at Engineers Australia, Chatswood.

Introduction

Bruce began his presentation by saying that it would be in two parts: some of the initial work in smoothed-particle hydrodynamics (SPH), and then an example using a typical frigate, as presented at Pacific 2019 IMC. The software used is Virtual Performance Systems (VPS) from ESI Group in Paris. The motivation was to use commercial-off-the-shelf software to provide unprecedented engineering results for the maritime industry, based on tried-and-proven techniques in use in the automotive and aerospace industries.

The overall aim of the project was to develop a tool to give asset owners and operators a more confident method to predict the likelihood of a given asset surviving a given service load. The perceived applications were life extension of existing assets, and/or survivability of aged assets.

More specifically, the aim was to reveal the non-linear stress response of a ship as it traverses a wave in order to understand, from an engineering perspective, the response of:

- a vessel to limit-state incidents;
- a damaged or compromised vessel to a given sea-state; and
- a vessel that is not able to be analysed by conventional tools — i.e. not a "ship" shape.

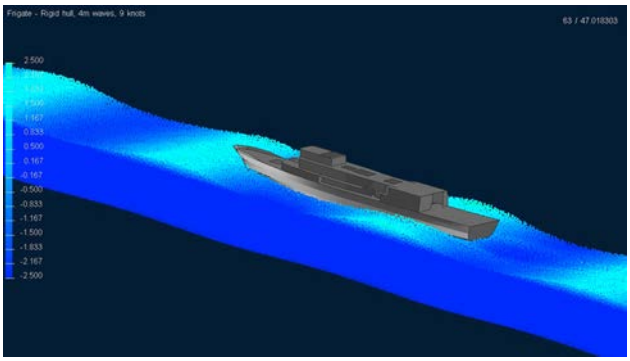
The results may be used for risk assessment, survivability assessment or life predictions by way of fatigue assessment.

The technique *can* be used for linear responses, but is not efficient compared to other tools for this purpose.

VPS Software

The VPS software is used for virtual prototyping of manufacture, testing and real-life. The largest user-base is the automotive industry, and the interface reflects this. It has explicit and implicit solvers, and the explicit solver has inbuilt controls for determining stable timesteps. There are numerous material models for most material types, including composites. Advanced material failure laws are included for the prediction of progress of non-linear failures.

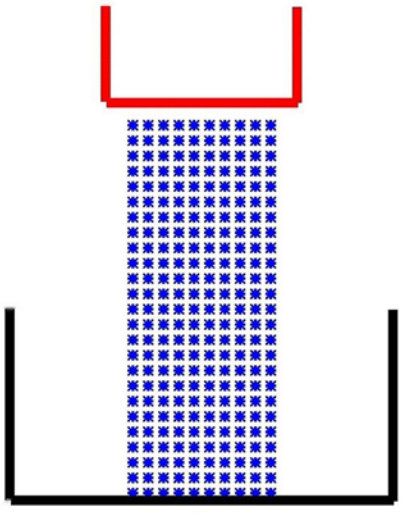
Here Bruce showed an example of the results, an animation of a typical frigate proceeding at 9 kn into a regular head sea of 4 m wave height.



Animation of typical frigate at 9 kn into 4 m head sea
(Image courtesy Pacific ESI)

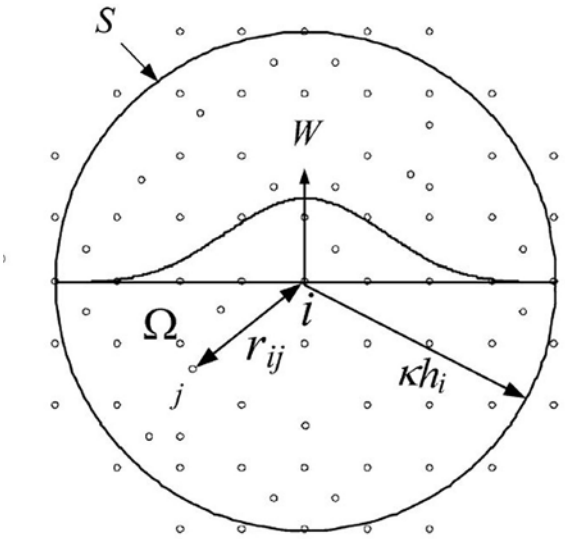
How does Smoothed Particle Hydrodynamics Work?

You need to define physical things, such as a boat, water and a tank, give each of them properties and loads, define how they interact with each other, and then see what happens.



How SPH works
(Image courtesy Bruce Cartwright)

In general, everything falls under gravity, the water stays in the tank (mostly), the boat floats on the water, and the boat deflects under the hydrostatic and hydrodynamic loads. Where does the smoothing come in? The properties of particle *i* are determined by the properties of its neighbours, weighted by a "smoothing" function. Those particles closer have greater effect, and those further away have less effect. This also implies that each particle influences its neighbours to a degree, and within a 'sphere of influence'.



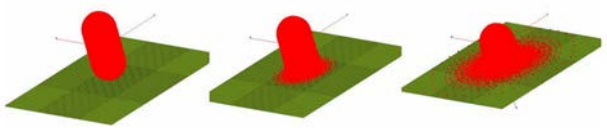
Smoothing in SPH
(Image courtesy Bruce Cartwright)

Early Days

The first uses of SPH were in astrophysics for studying the formation of galaxies from large volumes of gas.

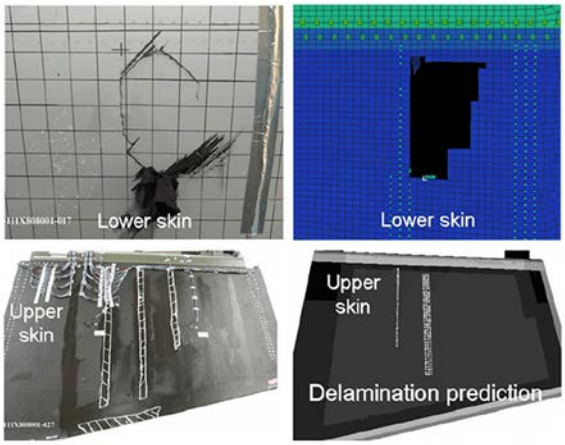
Some of the first commercial applications of SPH to fluids (in the early 2000s) were in Europe to analyse the ditching of commercial aircraft; where SPH was used for the water together with a deformable fuselage.

At about the same time, bird strike on aircraft was also being considered; SPH was used for the bird, impacting a flat plate with pressure sensors. The break-up of the bird, and the distribution of pressure with time, enabled the SPH material to be calibrated against real bird impacts.



Modelling of bird strike on aircraft
(Image courtesy Bruce Cartwright)

In 2006, Boeing in Australia, with assistance from Pacific ESI and the Cooperative Research Centre for Advanced Composite Structures, combined the SPH bird model with composite materials. The main focus of the numerical simulation was damage prediction. Simulation provided failure prediction of the composite skins and composite structural members. After rigorous evaluation, the Boeing 787 was the first commercial aircraft in the world to use numerical simulation of bird strike for certification with the FAA.

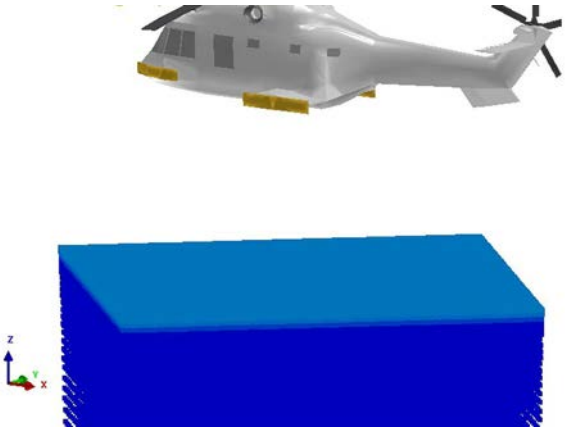


Bird strike penetration of lower skin and delamination of upper skin, test panel (L), SPH simulation (R)
(Image courtesy Pacific ESI)

Other Examples

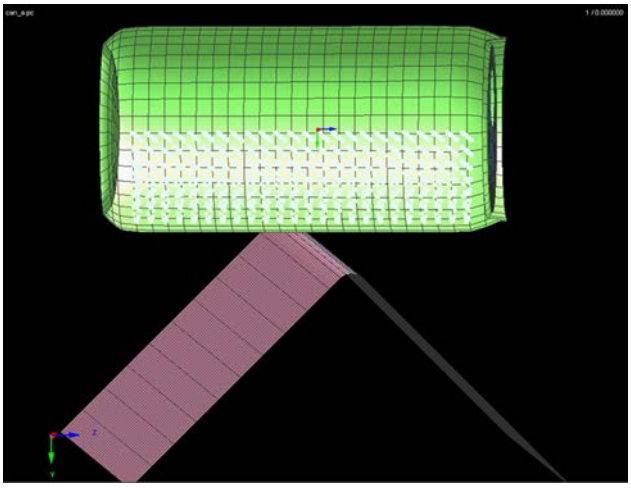
Bruce then showed a series of fluid-structure interaction (FSI) problems to which SPH had been applied. All came up with physically-realistic results, inspiring confidence in the method and the outcomes. These included:

- Helicopter ditching in water: Helicopters have a high centre of gravity, and tend to roll over and sink very quickly on impact with the water. Survivability is low without emergency flotation devices. The VPS software contains an airbag facility for automotive use, so this was employed to make super-sized airbags for upright helicopter flotation. The airbags commence in the folded position and inflate just prior to impact.



Helicopter ditching with airbags to be deployed
(Image courtesy Pacific ESI)

- Dropped soda can: This involved dropping a soda can (with its axis horizontal) half-full with fluid onto a vee-shaped metal edge. They were interested in the material deformation, the slosh/splash inside the can, and the impact forces.
- Water in a falling bottle: A rigid soft-drink bottle was modelled with a rubber end-cap like a half tennis ball, part filled with water, and dropped. This showed the sloshing of the water, with interesting transfer-of-momentum effects depending on the initial conditions of the water.
- Interaction with waves: A Volvo 70 hull was modelled, with a force on the mast to represent the sails, balanced for the yacht to be upright and driving forward into waves.

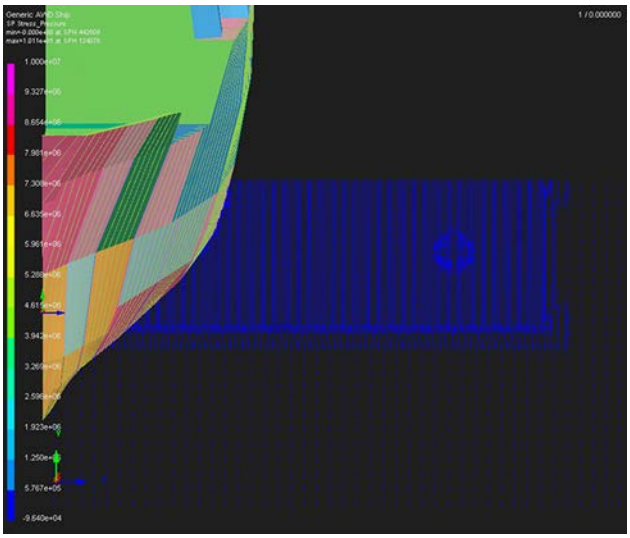


Soda can dropped onto vee-shaped edge
(Image courtesy Pacific ESI)

- Planing hull: A planing hull was accelerated from rest, and found that the pitch and heave changed realistically with velocity. There was an indication of dynamic lift, so the planing response was generically correct. However, no validation was performed on this.
- Disabled submarine on surface: Here a typical submarine was modelled at zero forward speed on the surface of the water, with motion in six degrees of freedom induced by waves only. Here they could explore passive devices for damping of motions.

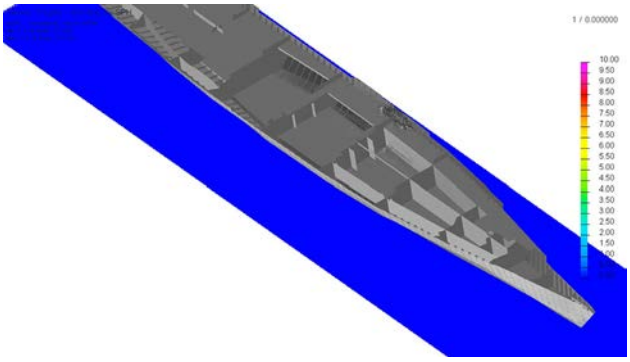
Underwater Explosion and Flooding

Here a typical frigate hullform was used, with an explosive charge placed in the water some distance away. The water was modelled with SPH and the ship hull was elastic-plastic with strain-rate dependent failure. The explosion took place in 10 ms, and the pressure wave was transmitted through the water (SPH) and interacted with the hull, with element elimination on failure.



Model of underwater explosion close to typical frigate
(Image courtesy Pacific ESI)

SPH prediction of damage sustained by typical frigate in underwater explosion
(Image courtesy Pacific ESI)

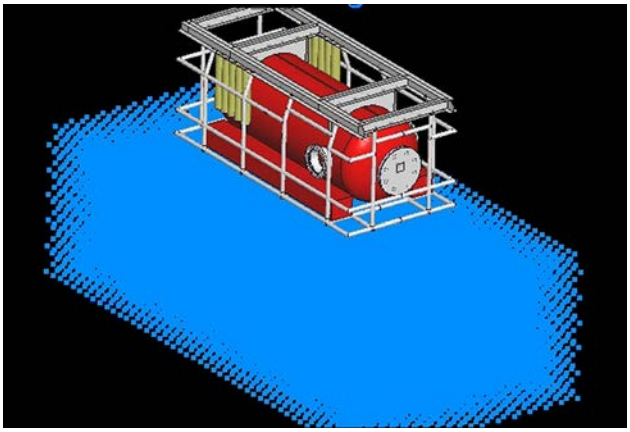


SPH prediction of flooding of typical frigate following underwater explosion
(Image courtesy Pacific ESI)

Flotation of Unconventional Vessels

SPH is particularly useful for the flotation of unconventional vessels, as there is no restriction on the type or shape of the vessel, and/or if it is in the water or not. Contact interfaces define the interaction of water and the structure, to produce momentum/impact forces when at speed, and hydrostatic/buoyancy forces when at rest.

Bruce used the example of a hyperbaric chamber on board a vessel where, if a fire or other emergency necessitates evacuation of the ship, then the chamber with its occupant(s) needs to be jettisoned overboard. Issues such as acceleration of occupant(s), and the flotation of the chamber, needed to be confirmed for certification for use on board a ship.

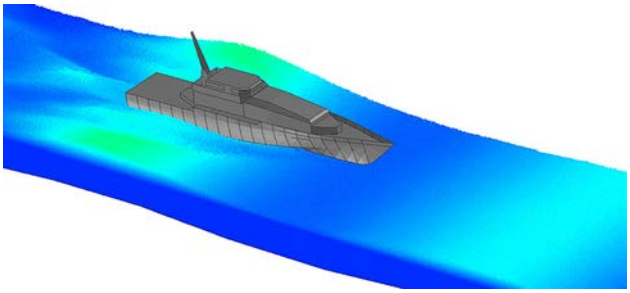


Model of hyperbaric chamber about to be jettisoned
(Image courtesy Pacific ESI)

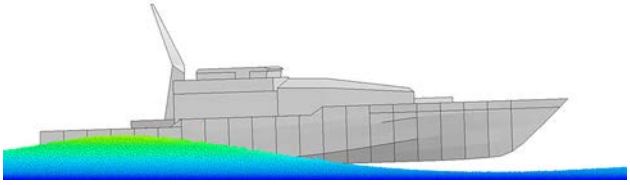
Another example was of a SWATH (small-waterplane-area twin-hull) vessel, with six degrees of freedom proceeding obliquely at 20° to the oncoming waves. Thrust was provided by a constant force acting normal to the transom at all times (like a waterjet); if the boat changed direction, so did the thrust. The result is visible corkscrew motion over the waves, with variations in forward speed with waves, and coupled pitch/roll/yaw behaviour.

Hydrodynamic Loads

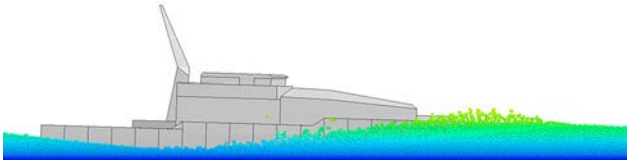
Bruce then used the example of a typical patrol boat. By dividing the hull into equi-spaced strips, we can extract the force acting between the hull and the water on that strip and, hence, the forces acting on the ship to generate motions. He showed eight separate predictions of the motions as the vessel progressed through the waves (only Positions 1 and 4 are shown here).



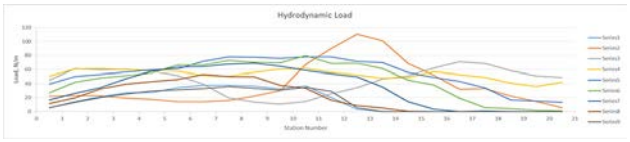
Model of typical patrol boat in waves
(Image courtesy Pacific ESI)



SPH motion prediction of typical patrol boat in waves — Position 1
(Image courtesy Pacific ESI)



SPH motion prediction of typical patrol boat in waves — Position 4
(Image courtesy Pacific ESI)



SPH prediction of hydrodynamic loads on typical patrol boat in waves
(Image courtesy Pacific ESI)

Seaway Loads Applied to a Frigate

Bruce then turned to the second part of the presentation, the application of seaway loads to a typical frigate, as presented at Pacific 2019 IMC. This is an ARC-funded project, involving collaboration between the University of Newcastle, Pacific ESI, Defence Science and Technology, and UNSW Sydney, and is due for completion in June 2020.

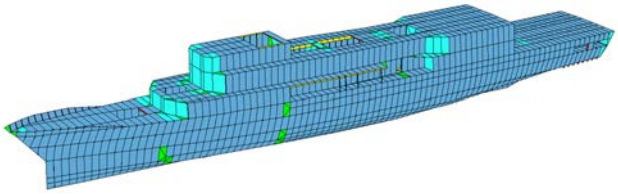
The project aims to deliver a tool to give asset owners and operators a more confident method to predict the likelihood

of a given asset surviving a given service-load. It aims to achieve this by having a detailed knowledge of the state of the specific asset at a given time, being able to induce loads in that asset as a consequence of a specific sea state or wave loading (now or in the future), and performing a structural assessment of the asset under those loads. The structural assessment can be used to assess the likelihood of surviving a specific incident now or, in combination with conventional structural deterioration theories, for fatigue or corrosion, to assess the expected life of the vessel.

Project Methodology

The model was set up to accommodate time-varying hydrodynamic loads through fluid-structure interaction using mesh-free methods, i.e. with the fluid modelled using SPH. The fluid and structure are modelled simultaneously in the commercial software package VPS.

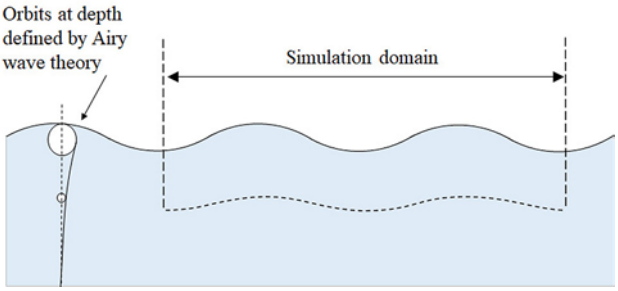
A finite-element structural model of a typical frigate with no appendages was provided, incorporating non-linear finite elements, with local refinement for failure modelling. Distributed nodal loads were used in order to represent maximum displacement. The model initially represented the ship as built, i.e. with no defects. Only the areas of the ship of known high stress will be modelled in detail in order to reveal stresses around cracks which appeared in the real ships.



Structural finite-element model of typical frigate
(Image courtesy Pacific ESI)

The finite-element model will be refined by the provision of approximately 600 documents describing various defects. These were reviewed to identify strength-degrading defects, and only the defects in high-stress regions of the ship will be accounted for in the FE model. Loss of material by corrosion will be modelled by local thinning of structural members, and cracks will be modelled directly as fissures in the material.

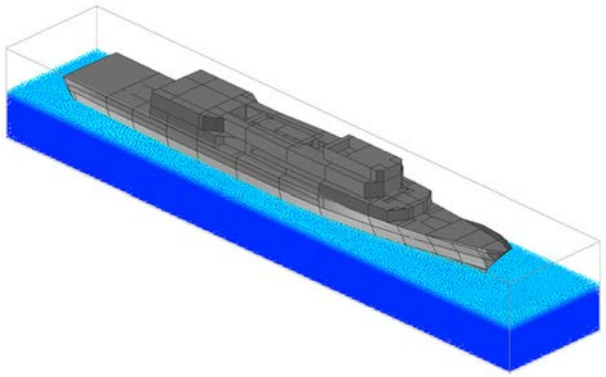
The sea state was modelled using SPH, with waves generated by the moving-floor concept, i.e. using the FE technique of a sub-domain, the lower boundary of the domain of interest is assigned boundary conditions (motions or velocities) identical to the behaviour of the full domain at that point. This has the advantages of reduced computational domain due to the reduced depth, and there is no wave maker on the surface.



Modelling of the sea state
(Image courtesy Pacific ESI)

The model was initially set up for hydrostatic and still-water bending moment checks, and comprised:

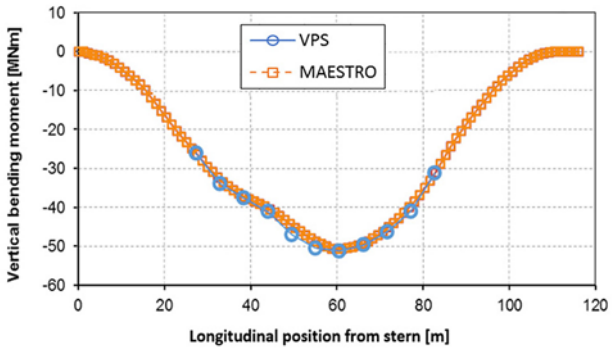
- A tank for containment of SPH.
- The FE model, free to pitch, heave and roll.
- Gravity acting on the water (SPH) and the ship.
- Interaction of the underwater shape of the ship, where the mass distribution and the displacement of the water (SPH) determined the final resting position of the ship.
- Time duration to allow the ship to settle.



Model for hydrostatic and SWBM checks
(Image courtesy Pacific ESI)

Simulation Results

The model achieved hydrostatic equilibrium, floating at the datum waterline and with the correct trim. Shear forces and bending moments were extracted at ten central locations on the FE model and compared with the results from MAESTRO [*Owen Hughes' ship structural analysis software* —Ed.] The correlation between the VPS results and MESTRO were good, with a maximum of 4% difference.



SPH simulation results for SWBM
(Image courtesy Pacific ESI)

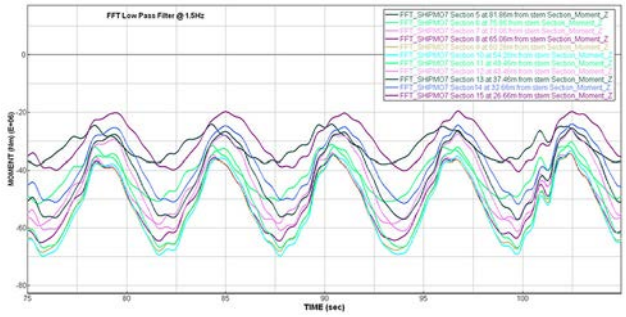
With successful results for still water, the attention turned to the vessel moving with forward speed into head seas. This was modelled with the moving floor for the lower domain boundary, periodic boundary conditions up- and down-stream, the vessel velocity provided by a boundary condition and with either a rigid-body or fully-flexible ship model.

A parameter sensitivity study was performed, as there were many variables in the simulation setup: the size of the SPH particles, i.e. discrete particles of water, the tank parameters of width and depth, the wave length, wave height and ship speed. The output parameters were normalised (non-dimensional) pitch and heave. It was found that the tank width and depth had some effect on the ship response , but also that the SPH particle diameter had a significant effect. Smaller SPH particles approach a continuum, and so give

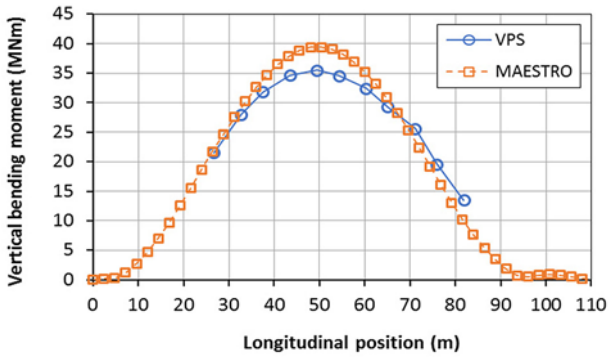
better results and less-noisy interface reactions, but also mean more particles requiring more CPU effort. Present computers (36 cores) are limited to about 500 000 particles for reasonable (24 h) solution time.

The conclusion of the sensitivity study was that a reasonable compromise between CPU effort and accuracy for an engineering solution would be achieved for the case of 109 m wavelength and 9 kn into a head sea with a tank width of 50 m, depth of 20 m, and particle diameter of 1.2 m.

When run with these parameters, the SPH simulation result is a bending moment which varies with time as the ship passes over the waves.



Total bending moment results at λ/L_{WL} = 1.0, v = 9 kn, h = 1 m in head seas
(Image courtesy Pacific ESI)



BM comparison with MAESTRO at λ/L_{WL} = 1.0, v = 9 kn, h = 1 m in head seas
(Image courtesy Pacific ESI)

Stresses in Waves

Stresses in plates can be visualised as a wave passes a ship. In this case, with zero forward velocity, high stresses are noted where the aft deck meets the superstructure. Work is underway to develop similar stress states for a ship with forward velocity

Animations of Ships in Motion by VPS

Visualisation is a valuable tool to aid understanding of wave-induced stresses. The output from VPS can produce animations which show the motion of the vessel. An important aspect to consider is that the simulation results account for non-linear interactions between the vessel and the water. In addition, totally un-realistic behaviours can be observed, such as specifying impractical speed through high sea states, or realistic behaviours such as flooding through water ingress.

Here Bruce showed some animations of the frigate proceeding at 9 kn into head seas of varying heights of 1, 2 and 4 m, and then at 27 kn into an 11 m head sea [*possibly unrealistic* — Ed.]!

Conclusion

Results to date using smoothed-particle hydrodynamics are promising. Ship motions and bending moments show good correlation to MAESTRO results. Current work to complete the project involves refining the mesh to provide 'as-built' detail, which can then be 'degraded' to represent real 'aged' defects, and developing the stress state in a ship with forward velocity.

Questions

Question time was lengthy and elicited some further interesting points.

As in FE calculations, when using SPH the size of the particles can be varied as required to home in on areas of interest, e.g. away from the vessel the particle diameter could be large, while in an area of interest the particle diameter could be one-tenth that size; both would generate the same sized waves.

Class societies require structural design assessment (SDA) using detailed FE models with still-water bending moments specified by IACS. However, this project is looking for an independent way to specify the loads on the vessel, and to be verified by experiments.

SPH can handle the air-water interaction at the free surface and, in particular, can handle the slamming effects of the air cushion in an air-cushion vehicle.

The vote of thanks was proposed, and the certificate and "thank you" bottle of wine presented, by the President of the Australian Division of RINA, Martin Renilson. The vote was carried with acclamation.

Bruce Cartwright (L) accepting his certificate and "thank you" bottle of wine from Martin Renilson
(Photo Phil Helmore)

April Technical Presentation

The technical presentation scheduled for April was cancelled due recommendations on social-distancing restrictions associated with COVID-19.

Phil Helmore

CLASSIFICATION SOCIETY NEWS

ABS, RCN and DRDC Take Part in Digital Pilot Program

ABS announced in mid-February that it is engaged in a pilot program with the Royal Canadian Navy (RCN) and Defence Research and Development Canada (DRDC) to deliver the ABS Digital Asset Framework for the RCN's Maritime Coastal Defence Vessels. The ABS Digital Asset Framework forms the foundation of a broader condition-based class program which transforms ship classification from a calendar-based schedule to a condition-based model. The project, which will start with HMCS *Saskatoon* [*a Kingston-class coastal-defence vessel* — Ed.], will support the RCN's larger Digital Navy Initiative.

"ABS is a leader in delivering condition-based maintenance data services in maritime and offshore applications, and we are proud that the RCN has chosen to work with us on this landmark project," said Christopher Wiernicki, ABS Chairman, President and CEO. "Through our digital programs for commercial and government clients, we are seeing first-hand the power of these technologies to drive improved asset performance and operational safety."

In the pilot program, a network of data models will be generated from a suite of ABS digital solutions which include advanced condition-analysis tools. This network of data models will support the execution of an integrity-management program developed specifically for the RCN.

The multi-year pilot program will enable the RCN to monitor the condition of the vessel throughout its remaining service life using digital-twin technology and advanced ABS analytics to identify anomalies, guiding inspection and maintenance planning.

ABS digital solutions which will be applied during this pilot program include:

- A vessel-specific structural sensor plan designed for measurement of global hull response.
- Hull sensor pre-processing and data quality checks.
- Hull and operational data dashboard visualisations.
- Full structural digital twin creation and analytics.
- RAM Analysis.

HMCS *Saskatoon*
(Photo from ABS website)

Together, the digital solutions offer greater access to vessel-wide intelligence, providing a more holistic view of structural health and the condition of on-board equipment. This allows the RCN to plan future maintenance actions based on the actual condition of the vessel.

ABS *Press Release,* 13 February 2020

DNV GL's Remote Surveys

The impact of the global COVID-19 crisis has reinforced the value of DNV GL's industry-first remote survey services. With some 15 000 surveys and inspections undertaken since the launch in October 2018, customers have benefited from greater flexibility and efficiency through the continued digitalization and integration of DNV GL's class services. At DNV GL it is vital that our customers continue to operate and deliver without disruptions to class services and, at the same time, it is essential not to compromise the safety of crews and surveyors. While our offices, surveyors and experts remain in operation, remote surveys have provided the flexibility which customers need, with global round-the-clock coverage, and improved efficiency through reduced travel times and increased availability.

"In these challenging times we are seeing the benefits of the full scope of the digitalisation initiatives which we have been building up over the past few years," said Knut Ørbeck-Nilssen, CEO, DNV GL Maritime. "The use of remote surveys has meant that we have been able to limit disruptions to customer operations resulting from travel bans or quarantines involving our surveyors. Ship operators are able to receive immediately updated and verified electronic certificates, which make their business dealing with class, authorities and vendors much more efficient. This has all been backed by expert teams in the regions and through our DATE (Direct Access to Technical Experts) hubs, which cover technical and survey requests around the globe 24/7 and have solved 500 000 cases since the launch of the service five years ago."

Remote surveys were first rolled out by DNV GL in October 2018 and have been gaining in popularity ever since. In 2019, for some survey types, up to 25% of all surveys were conducted remotely, with more than one third of customers having utilised the service at least once.

Customers are able to request remote surveys around the clock, independent of port calls, location, and time zone. Remote surveys are being offered both through DNV GL's global DATE service, delivered through expert teams from Høvik, Singapore, Hamburg, Houston and Piraeus, and via regional offices.

Remote surveys and inspections mean that, for a range of surveys, a DNV GL surveyor will not be required to travel to the vessel. Instead, by using an online connection or video streaming link, a dedicated team of remote surveyors can provide support to vessels anywhere in the world with documentation, images, video (streaming or recordings), and input provided by the customer and crew onboard. Some periodical survey items can also be handled remotely, subject to flag acceptance, where required.

DNV GL *News,* 26 March 2020

LR to Class New Multi-role Ships for Federal German Government

Shipbuilders, in agreement with Bundesanstalt für Wasserbau BAW, appointed LR as the classification society for two new 95 m multi-role ships.

The German Federal Waterways and Shipping Administration awarded the contract for two new 95 m multi-role ships to Abeking & Rasmussen Schiffs und Yachtwerft. The shipbuilder, in agreement with Bundesanstalt für Wasserbau BAW, appointed LR as the classification society for the vessels. These next-generation vessels will be capable of performing a number of tasks, such as emergency towing, fire-fighting and buoy tendering as well as oil-recovery and chemical-recovery operations. One of the many innovations is the ship's propulsion concept with LNG as a single fuel.

LR Hamburg office provides dedicated technical support relating to the complex regulatory framework for these multi-functional ships. Early design screening of the LNG fuel gas system layout, together with many more independent verifications of the initial design concept, were performed prior to the final award of the classification contract to LR.

Due to the ship's variety of special duties, the system design and on-board integration is complex. For chemical-recovery operations the ships are designed for a gas-safe operation using a citadel concept to protect the crew from hazardous substances. The combination of LNG as the single-fuel propulsion concept, with the special operational duties listed above, makes these ships novel with unique features.

95 m multi-role vessel for Federal German Government
(Image from LR website)

Markus Büsig, LR's M&O President for North Europe, said "LR welcomes the opportunity to support Abeking & Rasmussen and their client with these two next-generation vessels. This is a significant achievement for the LR team as these ships will push the boundaries of flexibility and innovation."

The design and engineering phase is underway and construction is scheduled to begin in 2021 with the ships due to be delivered in 2023.

LR *News,* 21 April 2020

FROM THE CROWS NEST

Vale Daniel Savitsky

It is with sadness that *The ANA* records the passing of Em/Prof. Daniel Savitsky on 23 March 2020, aged 98. After a career spanning over 70 years, he passed away peacefully.

Daniel Savitsky was born in New York City on 26 September 1921 on the Lower East Side. He attended Stuyvesant High School, and the City University of New York (CUNY) where he earned his undergraduate degree in Civil Engineering. He served in the Army from 1944 to 1947 as an aeronautical research scientist, and later earned his Master of Science degree in Fluid Mechanics/Naval Architecture from Stevens Institute of Technology. He earned his PhD from New York University in Oceanography.

Daniel's professional contributions to the fields of naval architecture and marine engineering are vast. He retired as Professor Emeritus from Stevens Institute of Technology where he taught graduate classes in marine engineering while also directing research on high-speed marine craft in the Davidson Laboratory. It was there that he devised the mathematical model which became the Savitsky Method, still widely used across the world. A research vessel was christened in his honour and named RV *Savitsky*. The vessel is used for the study of hydrodynamics in the New York Harbour.

Daniel truly enjoyed sharing his knowledge with students and colleagues, and accepted opportunities to further the study of marine engineering and naval architecture through his research, in the classroom, and with professional organisations. Aged 94, he travelled to Annapolis, Maryland, to deliver a follow-up paper to his seminal work from 1964,

Em/Prof. Daniel Savitsky
(Photo courtesy Davidson Laboratory, Stevens Institute of Technology)

and at 95 published his last professional paper.

He was proud of his Ukrainian heritage and enjoyed sharing stories of growing up on the Lower East Side. He loved sailing at the Niantic Bay Yacht Club with his family, as well as reading, travelling, and watching Yankees baseball. For all of his professional achievements, the most important thing in his life was his family, and he couldn't do enough for them.

He is survived by his wife of 57 years, Mary, his sister Emily, his three children, granddaughter, and two sons-in-law. Funeral arrangements were by Robert Spearing Funeral Home, Park Ridge, NJ.

[*Aficionados can read details of Daniel Savitsky's career and contributions to naval architecture in Hoyt, J.G. III (2010), Dr Daniel Savitsky,* Proceedings, Chesapeake Power Boat Symposium, *Annapolis, MD, March; copy available from Lawry Doctors or Phil Helmore* — Ed.]

The New York Times, 29 March 2020

WWSR *Spirit 2*

Dave Warby of Warby Motorsport is attempting to break his father Ken's World Water Speed Record in *Spirit of Australia* of 317 mph (511 km/h), in their latest vessel, *Spirit of Australia 2*.

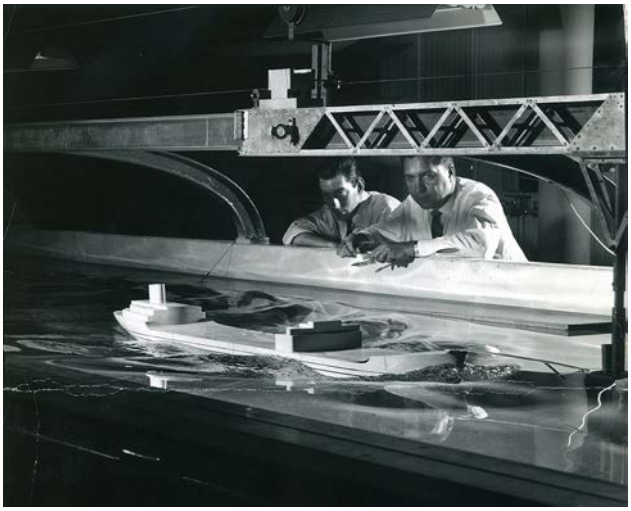
The University of Newcastle has been doing computational fluid dynamics analysis on *Spirit of Australia 2* and this, in conjunction with their data logging of previous runs of the boat, means that she is currently having a revised tailfin built for her. Of note, this is being done by NP Aviation at Bankstown airport, the same airport where Dave's father, Ken Warby MBE, had his tailfin built for *Spirit of Australia* to achieve both of its records of 288 mph (463 km/h) in 1977 and then the current record of 317 mph (511 km/h) in the following year.

This new T-tail follows the previous successful testing of *Spirit of Australia II* up to 250 mph and is well under construction.

New T-tail for *Spirit of Australia 2* under construction
(Photo from Longbow website)

Further testing was due to be undertaken towards the end of May, but that has been postponed due to the COVID-19 pandemic restrictions. Warby Motorsport expects to auction off the old tail fin to raise money for an animal shelter in Tumut which was wiped out by the recent fires there.

Longbow website



Daniel Savitsky (R) and Pierre deSaix
during 1965 tests of a 550 ft (168 m) tanker in the Davidson Laboratory (Photo courtesy Davidson Laboratory, Stevens Institute of Technology)

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.

Construction of the jet hydroplane *Longbow* took a break over Christmas and the new year, but is again proceeding, the next phase being construction and installation of the side-skirts/fences for the air trap beneath the hull.

Longbow's side skirts installed completed
(Photo from Longbow website)

Hydroplane enthusiasts know that a large amount of lift can be generated on the lower surface of a ramp with side skirts, oriented at some angle of attack and placed very close to the water surface. This effect, known as the "ram effect" or "surface effect", generates its lift on the lower surface

rather than the upper surface like a conventional airplane wing. Further, it generates much more lift than the increase due to what is known as "ground effect" which can increase the effectiveness of the wings on aircraft when close to the ground" [*as in ekranoplans*—Ed.]

The side skirts to form the air trap beneath the hull of *Longbow* are made of long lengths of laminated timber running on the bottom of the hull, commencing towards the bow and tapering off towards the transom. These were constructed and installed in February.

The COVID-19 pandemic slowed construction significantly from March onwards, but they have cut the patterns for the sponson frames, laminated the frames themselves, and have most of them installed, as they (along with everyone else) settle to being in lockdown 24/7.

Longbow's sponson frames being installed
(Photo from Longbow website)

For more information and photos, visit the Longbow website at https://www.jet-hydroplane.uk and click on the News tab.

Longbow website

Ocius and UNSW to Research GNSS Situational Awareness at Sea

The Defence Innovation Network has awarded a Seed Project grant to Ocius Technology and UNSW as part of the NSW Government's initiative to support defence innovation. Through the Defence Innovation Network, the NSW Government provides companies with matched funding to fast-track the development of early-stage technology concepts which can bring innovative solutions to Defence.

This project aims to detect and geolocate GNSS* jammers and spoofers in a GNSS-denied environment at sea using low-cost unmanned sea vehicles (USV) which bear extremely low radar cross-section. The project addresses the defence need to be situationally aware of its electromagnetic environment, which falls under the integrated intelligence surveillance and reconnaissance theme. This is especially true as more and more devices onboard mobile platforms (e.g. navy ships, aircraft and land vehicles) depend on GNSS for communications, position authentication and/or navigation.

The ability to navigate is critical for many applications, but even military encrypted GPS/GNSS signals are disabled by jamming. This is a highly-integrated miniaturised system mounted on a USV being useful as part of reconnaissance of regions suspected of malicious activity. It will inform where GPS coverage is available or unavailable. This could then help inform decision making and route planning to avoid an accurately determined GPS-denied region.

This project provides a straightforward path to develop anti-jamming technologies for Bluebottle USVs for their operation in GPS-denied environments, and could be applicable to other applications including unmanned aerial vehicles.

[* *Global Navigation Satellite System (GNSS) refers to a constellation of satellites providing signals from space which transmit positioning and timing data to GNSS receivers.*

The receivers then use this data to determine location. By definition, GNSS provides global coverage. Examples of GNSS include Europe's Galileo, the USA's NAVSTAR Global Positioning System (GPS), Russia's Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS) and China's BeiDou Navigation Satellite System — Ed.]

Ocius Technology *News,* 12 February 2020

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 was born from the encounter of three young engineering students from the Swiss engineering school École Polytechnique Fédérale de Lausanne (EPFL) who are passionate about sailing, kitesurfing and speed. They have decided to design a vessel 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

This project is supported by EPFL and follows in the steps of the famous *Hydroptère*, the record holder prior to *Vestas Sailrocket 2*, which was also developed in collaboration with EPFL. Numerous teachers previously involved in either *Hydroptère*'s or *Alinghi*'s adventures are also giving their support to *SP80*, gathering all the resources needed to create great innovation and to develop new technologies.

SP80
(Photo from Sail-World website)

The project was officially launched in Neuchâtel on 25 October 2019 during the celebration of the 20-year anniversary of their first partner, P&TS SA. Since then, *SP80* continues to be present at different events, and was presented with *Foiling Week*'s 2019 Design Foiling Award on 20 February 2020 at the prize-giving ceremony held in Milan, Italy.

For an overall view of the project, visit https://sp80.ch/.

Sail-World website

HMAS *Gascoyne* undergoing refit in the Captain Cook Graving Dock at Garden Island, Sydney on 25 March following a recent deployment. HMAS *Brisbane* is in the inner dock during her post-delivery availablility. The Captain Cook Graving Dock was 75 years old on 24 March this year and continues to be a major national strategic asset
(RAN photograph)

More Patrol Boats for the RAN

The Commonwealth Government announced on 1 May that it will spend around $350 million to build six new Cape-class patrol boats for the Royal Australian Navy.

The vessels will be built by Austal in Western Australia, securing Australian shipbuilding jobs and maintaining strong border protection.

The Australian Border Force currently operates eight Cape-class patrol boats, while the Navy operates two leased vessels.

The six new Cape-class patrol boats will grow the patrol boat force to 16 vessels, while the new, larger Arafura-class offshore patrol vessels are introduced into service.

The Minister for Defence, Senator the Hon. Linda Reynolds CSC, said that the new vessels will play an important role in keeping Australia's borders safe, while Navy's new capability is brought online.

"These vessels will not only enhance national security, but will provide important economic stimulus and employment continuity during the COVID-19 pandemic," Minister Reynolds said.

"The ability to build more of these vessels in Australia will deliver Australian industry content of more than 65 per cent, providing significant opportunities for Australian industry and Defence, as well as more than 1200 workers in the broader Australian supply chain."

Austal Chief Executive Officer, David Singleton, said that the new contract both reaffirmed the Cape class as Australia's pre-eminent patrol-boat platform and represented a clear commitment by the Australian Government to strengthen Australia's sovereign shipbuilding industry during a challenging global environment, brought on by the COVID-19 pandemic.

"Since its introduction by the Australian Border Force (ABF) in 2013, the Cape class has proven to be a high-performing, reliable and effective maritime asset, utilised for a wide variety of constabulary and naval missions, playing a critical role in Australia's national security," Mr Singleton said. "With ten Capes currently in operation with the ABF and RAN, it is a smart, logical step to build upon the existing fleet with additional vessels which will enhance the nation's ability to protect and secure our maritime borders.

"These new, evolved Capes add even greater national security at this critical time during the COVID-19 pandemic, by ensuring that at least 700 jobs are maintained at Austal, and supply chain opportunities continue for Australia's shipbuilding industry."

Based on Austal's proven 58 m aluminium monohull design, the new RAN evolved Capes will include a number of enhancements which further extend the capability of the vessel and the fleet. These evolved Cape-class patrol boats include modifications determined through the extensive in-service experience of the RAN and ABF Capes currently operating throughout Northern Australia.

Crew capacity has been increased by 10 people, to now total 32, and quality-of-life provisions have been enhanced, ensuring that those who operate the new Capes have connectivity to the outside world regardless of the operating environment. Further improvements have been incorporated into the new RAN Cape-class design, developed during the design and construction of two Cape-class patrol boats for the Trinidad and Tobago Coast Guard, an export contract awarded on 16 August 2019 and won with the strong support of the Australian Government and Export Finance Australia.

The Trinidad and Tobago Coast Guard Capes are currently in an advanced state of construction and are scheduled for delivery later in 2020. Construction of the six Capes for the RAN will commence immediately at Austal's Henderson shipyard, with deliveries scheduled from September 2021, then successively through to mid-2023.

Austal is to build six evolved Cape-class patrol boats for the Royal Australian Navy
(Image courtesy Austal)

Progress with the Offshore Patrol Vessel Program

On 9 April the National Shipbuilding Program reached another milestone with the ceremonial keel laying of the second Arafura-class offshore patrol vessel (OPV) in Adelaide.

The Minister for Defence, Senator the Hon. Linda Reynolds CSC, said that the keel laying reinforced the continued progress and ongoing success story of Government's continuous shipbuilding endeavour in Australia.

"The Arafura-class offshore patrol vessels are larger than the Armidale-class patrol boats currently in service with the Royal Australian Navy, and will offer greater endurance and capability for patrolling Australia's maritime borders," Minister Reynolds said.

"Over the past 10 months, Luerssen Australia and ASC Shipbuilding have contributed an enormous effort to build and commence consolidation of the keel blocks which, when complete, will be part of a 1600 t ship.

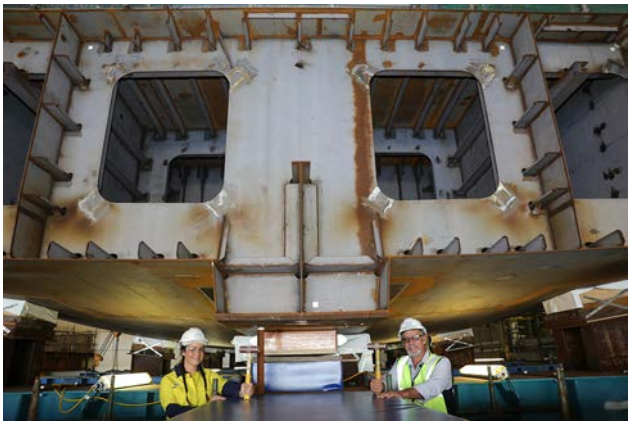
"Defence and industry are working closely together to support our sovereign shipbuilding programs and Australian jobs in these challenging times, in a way which is safe for employees and the community."

The Minister for Defence Industry, the Hon. Melissa Price MP, said that the OPV program is creating jobs right across the supply chain.

"This project is estimated to create around 600 jobs involving more than 300 small and medium businesses, reinforcing the Morrison Government's commitment to maximising Australian industry involvement in our $90 billion shipbuilding program," Minister Price said.

"The project also highlights Australian industry's ability to deliver on schedule, with construction on the first offshore patrol vessel to be built in Western Australia commencing ahead of schedule.

The Chief of Navy, VADM Michael Noonan AO RAN, announced that the second OPV will be commissioned as HMAS *Eyre* when it comes into operational service in early 2023.



Evyenia Kontakos, fourth-year apprentice welder and boilermaker and Larry Lavallee, Offshore Patrol Vessel Block Construction Manager, ASC Shipbuilding, after hammering in wedges to secure the Chief of Navy's ceremonial coin in place during the keel laying ceremony of Offshore Patrol Vessel 2, NUSHIP *Eyre*
(RAN photograph)

"The next four OPVs will be named HMAS *Pilbara*, HMAS *Gippsland*, HMAS *Illawarra* and HMAS *Carpentaria*," VADM Noonan said.

The OPVs being built by ASC Shipbuilding at Osborne Naval Shipyard are setting the foundation of continuous shipbuilding prior to prototyping commencing on the Hunter-class frigate program this year.

Construction of the first offshore patrol vessel (OPV) to be built in Western Australia began at the end of March. The future HMAS *Pilbara* will be the first to be built at the Civmec shipyard in Henderson, Western Australia.

After the first two vessels built by Luerssen Australia and ASC in Adelaide, the remaining ten vessels will be constructed by Luerssen Australia and Civmec at Henderson.

Luerssen Australia is the prime contractor working with key shipbuilding partners Civmec in Western Australia and ASC OPV Shipbuilder in South Australia to deliver the OPV capability for the Royal Australian Navy.

The forward and aft hull modules of NUSHIP *Arafura* coming together at Osborne recently
(Defence photograph)

New Contract for Incat Tasmania

On 25 March Incat Tasmania and leading South Korean coastal passenger transport company Seaworld Express Ferry announced an order for a new generation fast ferry. The 76 m high-speed wave-piercing catamaran ferry will accommodate up to 700 passengers and 79 cars when it enters service on the new route between Jindo and Jeju early 2022.

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

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

"As the leading ferry operator in South Korea, it is this world-class expertise that led us to select Incat Tasmania for our new high-speed service, and it was an important aspect of our winning tender submission" he says.

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

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

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

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

An impression of the new Incat ferry for Korea
(Image courtesy Incat Tasmania)

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

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

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

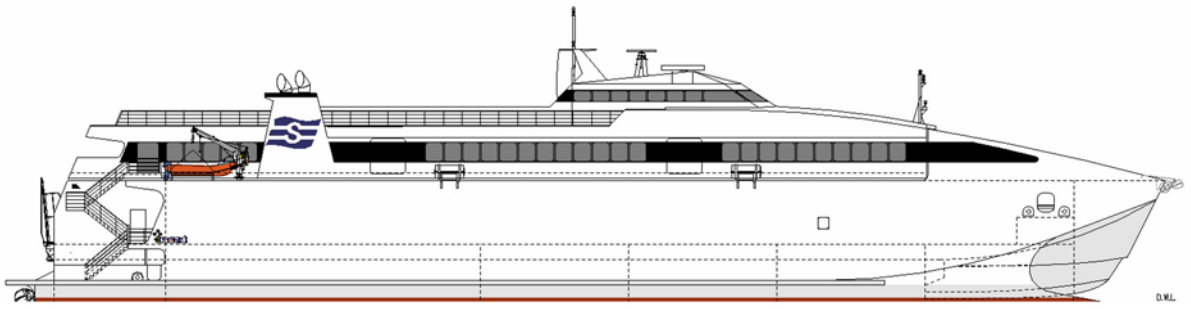
"At Incat Tasmania we are fortunate to have the best quality, most highly-experienced workforce in the global fast-ferry industry, and we are pleased to add this new vessel to the three already under construction for customers around the world."

Principal Particulars

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

Ship of the Year 2020

Virtu Ferries' Incat-built 110 m high-speed ferry, *Saint John Paul II*, has won the coveted High-speed Ferry award in *Cruise and Ferry Review's* first-ever Ship of the Year awards. *Cruise and Ferry* is a trusted and reliable source for news of the passenger shipping industry. The Ship of the Year award was created to recognise passenger ships which showcase innovative green technologies, impressive interior and exterior designs, and unique onboard amenities and guest experiences.



Profile of Incat Tasmania's 76 m catamaran ferry
(Drawing courtesy Incat Tasmania)

Saint John Paul II
(Photo courtesy Incat Tasmania)

Saint John Paul II scooped the award from a short list of nominations, including high-speed *Express 4* from Molslinjen, *Rikulau* from Brave Lines, *Venus Clipper* from Thames Clippers, and fellow Incat catamaran *Volcán de Tagoro* from Naviera Armas.

Saint John Paul II, operating between Malta and Sicily, is the largest vessel of its kind operating in the Mediterranean and the second-largest in the world. Onboard facilities include five lounges, gift shops, gaming lounge bars and shops. She offers a total of 1134 VIP, business and economy class seats on two decks, including 996 inside and 138 outside, as well as a designated truckers' lounge with additional facilities. The vehicle deck is designed to carry 23 heavy commercial trucks or 167 cars.

Incat Tasmania's CEO, Tim Burnell, said "It is a huge honour for Incat to be associated with this award, and a fantastic endorsement of our dedicated workforce at Incat. We warmly congratulate Virtu Ferries; they were a committed partner in this project and, without their commitment to detail and perfection, *Saint John Paul II* would not be the ship she is. We wish her every success in the future."

Virtu Ferries' Francis Portelli thanked those who voted *Saint John Paul II* Ship of the Year 2020 in the High-speed Ferry category. "*Saint John Paul II* is a magnificent ship. She has surpassed our expectations and, after 30 years of operating fast ferries on international routes, our expectations are extremely high," he said.

Last Air-warfare Destroyer Delivered

In a ceremony in Adelaide on 28 February, the Royal Australian Navy's third air-warfare destroyer, NUSHIP *Sydney*, was officially handed over to Defence.

NUSHIP *Sydney* is the last of the three ships being delivered by the Air Warfare Destroyer Alliance which includes the Department of Defence, Raytheon Australia, and ASC Shipbuilding supported by Navantia Australia.

The Minister for Defence, Senator the Hon. Linda Reynolds CSC, attended the acceptance ceremony at the Osborne Naval Shipyard in Adelaide.

"Today's milestone demonstrates the success of the Government's Naval Shipbuilding Plan," Minister Reynolds said.

"While the delivery of NUSHIP *Sydney* marks the end of this program, it represents an exciting time for the National

Chief of Navy, VADM Michael Noonan, AO, RAN, Minister for Defence Senator the Hon. Linda Reynolds CSC, and CMDR Edward (Ted) Seymour, Commanding Officer of *Sydney*, on the bridge of the third air-warfare destroyer which was delivered in a ceremony at Osborne in South Australia on 28 February
(RAN photograph)

Naval Shipbuilding Enterprise, as we continue to build upon the unique skills developed at this precinct and transfer them across the whole shipbuilding ecosystem.

"I congratulate the 5000 workers who have worked directly on this program over the past decade, from the design phase through to the construction, integration and delivery of these magnificent ships.

"The significance of this success cannot be understated and is reflected in the truly world-class capability of these warships, and the naval shipbuilding and combat system integration skills that have been developed at Osborne."

NUSHIP *Sydney* arrived at her home port at Fleet Base East in Sydney on 27 March 2020.

Austal USA Delivers Eleventh LCS to the US Navy

Austal USA has delivered its 11th littoral combat ship (LCS) to the US Navy at the company's shipyard in Mobile, Alabama.

The future USS *Kansas City* (LCS 22) is the first Independence-class LCS to be delivered by Austal USA in 2020.

Austal's Chief Executive Officer, David Singleton, said that the latest LCS delivery from Austal's USA shipyard builds upon the company's strong record in recent years.

"Austal USA's delivery of the Independence-class LCS program continues to impress, with quality, cost and productivity improvements being achieved with each new vessel.

"We have now delivered 11 of the 19 Independence-class LCS currently contracted, and it's very pleasing to see more and more of these ships deployed around the world, adding great capability to the US Navy," Mr Singleton said.

Upgrades to the LCS program continue to take shape, both in production and post-delivery. Austal USA and General Dynamics Mission Systems teams recently integrated a new over-the-horizon missile system into USS *Gabrielle Giffords* (LCS 10) prior to her deployment. *Gabrielle Giffords* and her sister ship, USS *Montgomery* (LCS 8), are currently deployed and meeting US Navy operational requirements in South East Asia.

Five Independence-class littoral combat ships are in various

NUSHIP *Sydney* entering Sydney Heads on 27 March at the end of her delivery voyage from South Australia
(RAN photograph)

Austal USA has delivered LCS22, the future USS *Kansas City* to the US Navy
(Photo courtesy Austal USA)

stages of construction at Austal USA including the future USS *Oakland* (LCS 24) and USS *Mobile* (LCS 26) which are preparing for sea trials. Assembly is underway on the future USS *Savannah* (LCS 28) and USS *Canberra* (LCS 30), and modules for the future USS *Santa Barbara* (LCS 32) are under construction in Austal's module manufacturing facility. Three more LCS are under contract and scheduled for production, through to LCS 38.

Patrol Boat for Fiji Delivered

On 6 March Australia handed over the latest Guardian-class patrol boat to Fiji in a ceremony at Austal's shipyard in Henderson, Western Australia — the latest milestone for the Pacific Maritime Security Program.

The Republic of Fiji Military Forces' RFNS *Savenaca* was received by the Prime Minister of the Republic of Fiji, the Hon. Josaia Voreqe Bainimarama, the Minister for Defence, National Security and Foreign Affairs, the Hon. Inia Seruiratu, and Commander Republic of Fiji Military Forces, RADM Viliame Naupoto.

The Minister for Defence, Senator the Hon. Linda Reynolds CSC, said that the replacement of the Pacific patrol boats is an important part of Australia's $2 billion 30-year commitment to the Pacific region under the Pacific Maritime Security Program.

"Australia and Fiji have a long history of warm and productive relations and have worked closely in pursuit of

common goals and values for decades," Minister Reynolds said.

"Under the Vuvale Partnership signed between Prime Minister Bainimarama and Prime Minister Morrison, we agreed to take our cooperation to next level.

"It is in the spirit of this partnership which we hand over RFNS *Savenaca* to one of our closest regional partners.

"We will continue to work with Fiji on our shared commitment to a support a region that is strategically secure, economically stable and politically sovereign."

RFNS *Savenaca* is named after Fijian Navy sailor, Ordinary Seaman Savenaca Naulumatua, who served in World War II and gave his life in defence of freedom in the Pacific.

"I'm confident that the new Guardian-class vessels will significantly enhance Fiji's capability to patrol and protect its exclusive economic zone, support humanitarian assistance and disaster-relief tasks, and combat illegal activities in its maritime domain," Minister Reynolds said.

The Minister for Defence Industry, the Hon. Melissa Price MP, said that the Pacific Maritime Security Program demonstrates the Government's commitment to delivering more jobs and opportunities in Australia's defence industry.

RFNS *Savenaca* is the first of two Guardian-class patrol boats which will be gifted to Fiji under the Pacific Maritime Security Program. The second boat will be delivered in 2023.

The Commanding Officer HMAS *Stirling*, CAPT Ainsley Morthorpe CSC RAN, salutes the Prime Minister of Fiji, RADM (Ret.) the Hon. Josaia Voreqe Bainimarama MP, as he crosses the gangway of their newly-acquired Guardian-class patrol boat, RFNS *Savenaca*, at Fleet Base West in Western Australia (RAN photograph)

Launched by Austal in April, the eighth Guardian-class patrol boat, *Teanoai II*, will be given by Australia to Kiribati on completion (Photo courtesy Austal)

New Plan for Australian Antarctic Shipping

The Australian Antarctic Division (AAD) announced on 30 March that it will use the MPV *Everest* to resupply its Antarctic stations and sub-Antarctic Macquarie Island next summer.

The ice-class multi-purpose vessel is operated by the Dutch company Maritime Construction Services, and is capable of navigating in ice up to 1 m thick.

AAD General Manager of Operations and Safety, Charlton Clark, said that the end of the *Aurora Australis*' contract and the delayed arrival of Australia's new icebreaker RSV *Nuyina* means that an alternative ship had to be contracted.

"MPV *Everest* was selected after a call for proposals and was identified as providing the best value for money," Mr Clark said.

"The 140 m long ship was built in 2017 and will be used for a minimum of 90 days next Antarctic summer season."

"The vessel can accommodate up to 100 expeditioners, has large fuel storage tanks and space for up to 96 twenty-foot cargo containers on its decks.

"It also has a helipad above the bridge which will be used for ship-to-shore resupply operations," he said.

Australia's new icebreaker RSV *Nuyina* was due to arrive in Hobart at the end of the year, but the current COVID-19 pandemic will delay its arrival.

RSV *Nuyina* during final stages of fitting our at her building yard in Romania
(Photo courtesy Australian Antarctic Division)

"The fit-out and testing schedule for the vessel is being severely impacted by travel restrictions around the world, with specialist teams unable to get to the shipyard in Romania," Mr Clark said.

"Due to the uncertainty around the coronavirus situation, we don't know when the ship will be finished and ready to undergo the required sea-trials before being handed over to the Australian Antarctic Division."

It's not expected that the delay will have any impact on the cost of the long-term contract.

Everest will provide re-supply services to Antarctica until RSV *Nuyina* is available for service
(Photo courtesy Australian Antarctic Division)

New Passenger Ferry for Perth

A new passenger ferry built by Dongara Marine has been introduced to the public transport system in Perth, Western Australia. MV *Tricia* is the third ferry in the Transperth fleet, joining two other low-wash catamarans introduced in 1997 and 2009.

Operating across the Swan River between Elizabeth Quay and South Perth, the 23.7 m aluminium catamaran can carry up to 148 passengers and has a loaded top speed in excess of 16 kn.

With two catamaran ferries each providing departures every 15 minutes in peak periods, the route carried more than 648 000 passengers in 2018. The clientele mixes commuters and leisure travellers, including the many locals and tourists of all ages who use the ferries to reach Perth Zoo from the city's CBD. The operation of the service is contracted to Captain Cook Cruises.

While currently operating solely on that route, the ferry has been designed and equipped to be suitable for longer journeys should Transperth's operation expand in the future. This includes being faster and longer than the previous vessels, and the addition of a toilet.

In addition to meeting disabled access and National Standard for Commercial Vessels (NSCV) Class 1E survey requirements, Dongara Marine's design partner, Southerly Designs, developed the catamaran within strict constraints. Operational needs dictated low air draft, compatibility with existing shore infrastructure, and being able to operate with only a Master. The Public Transport Authority further required that the vessel's appearance and layout be in keeping with the existing ferries.

Dongara Marine also met client requirements and preferences through, for example, enabling integration of Transperth's electronic ticketing, public address, and networked CCTV systems; incorporation of Side-Power bow thrusters for enhanced manoeuvring, and fitout selections such as providing seating commonality with its existing

MV *Tricia* underway on the Swan River
(Photo courtesy Dongara Marine)

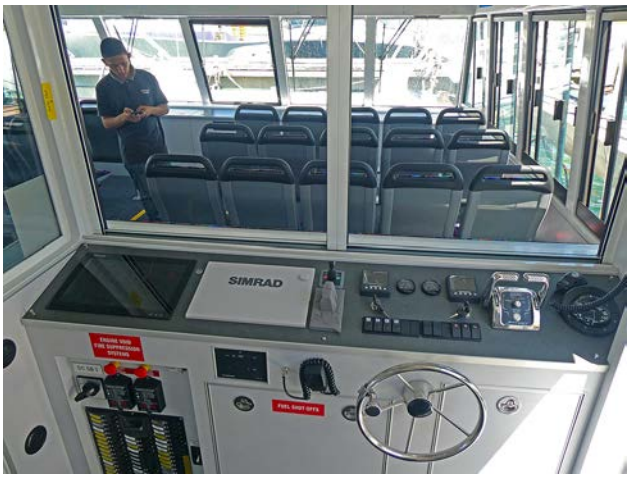
ferries, buses, and trains. Roof-mounted panels provide solar power for charging the ferry's batteries and CCTV system. Building the passenger ferry demonstrated the Western Australian boatbuilder's extensive capability including aluminium fabrication, all of which was undertaken in-house, as well as engineering, fitout, and painting.

After completing a trade study considering technical, commercial, fuel consumption, and through-life support considerations, Dongara Marine opted to power the ferry with a pair of Cummins QSB6.7 diesel engines at the heavy-duty rating of 184 kW. These spin Veem propellers via Twin Disc MGX5065 gearboxes.

MV *Tricia* achieved a speed of 18.5 kn on trials, easily exceeding the 16 kn contractual requirement.

All controls are centralised in a compact wheelhouse on the starboard side, an arrangement which enables the master to dock the ferry singlehandedly and monitor passenger flows without leaving the control station.

Principal navigation tools include a Simrad NSS touch screen multifunction display that incorporates GPS, electronics charts, and CHIRP-enabled broadband sounder and interfaces with the Simrad Halo pulse compression radar. A Poseidon system from Oceanic Systems enables alarm, monitoring and control of the ferry's various systems.



The wheelhouse in *Tricia*
(Photo courtesy Dongara Marine)

Austal Trimaran for Ferry Service in Japan

On 27 February Austal celebrated the company's latest development in high-speed trimaran technology with the revealing of an 83 m trimaran ferry, under construction for JR Kyushu Jet Ferry of Japan, at the company's Henderson shipyard in Western Australia.

Austal Hull 396, to be known as *Queen Beetle*, was designed and constructed by Austal Australia and is due to be handed over to JR Kyushu Jet Ferry in June 2020, and will commence services between Busan, South Korea, and Fukuoka, Japan, in July 2020.

A reveal ceremony for *Queen Beetle*, an 83 m high-speed trimaran ferry designed and constructed by Austal for JR Kyushu Jet Ferry of Japan
(Photo courtesy Austal)

Speaking at the reveal ceremony, which was attended by more than 100 guests, including the Governor of Western Australia, The Hon. Kim Beazley AC, and West Australian Premier, The Hon. Mark McGowan MLA, Austal's Chief Executive, David Singleton, said that the company was proud to be introducing the new trimaran to Japan while offering outstanding value to a new customer, JR Kyushu Jet Ferry.

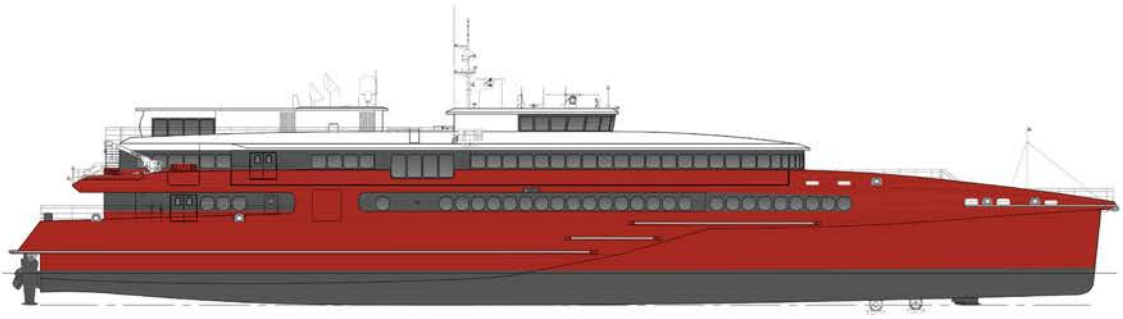
"We're very proud to be introducing this new Austal trimaran to one of the most technologically advanced and mature markets in the world. In fact, *Queen Beetle* will be the first high-speed trimaran ferry to be delivered to, and operate in, Japan.

"This stunning new ship will truly transform the fast-ferry journey between Japan and South Korea, offering significantly improved seakeeping and an exceptional on-board experience for passengers and crew.

"With a capacity to carry 502 passengers in greater comfort, with previously unavailable amenities such as a shop and café, this new trimaran represents outstanding value to our customer, JR Kyushu Jet Ferry," he said.

Since 2005, Austal has delivered 14 high-speed aluminium trimarans worldwide, including 11 for the United States Navy. Austal has a further 11 trimarans under construction or scheduled for construction at the company's shipyards around the world, and remains the only shipbuilder designing, constructing and sustaining large high-speed trimaran ferries, globally.

More than 200 Western Australians were employed in the design and construction of the vessel, spending a combined 450 000 hours to get the vessel to the current point in its construction program.



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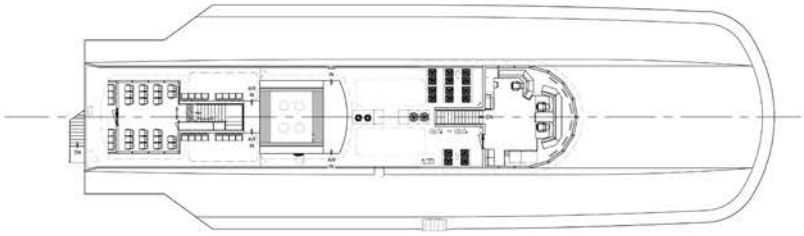
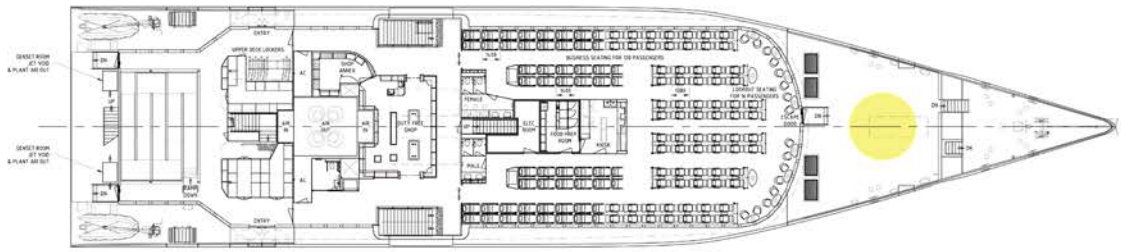


BRIDGE DECK



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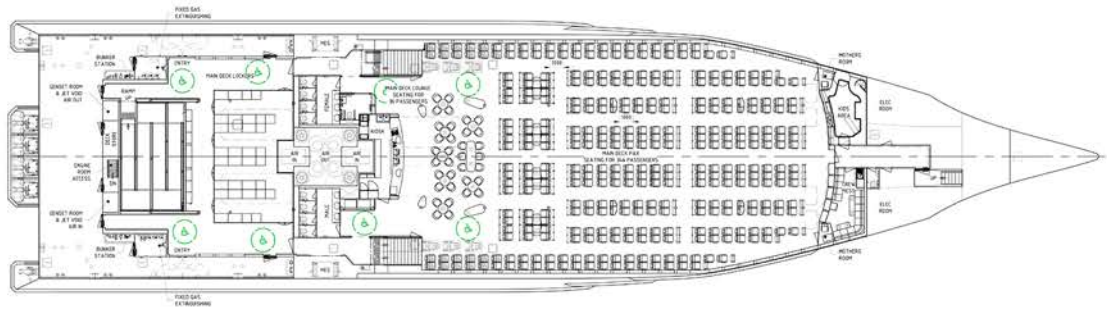
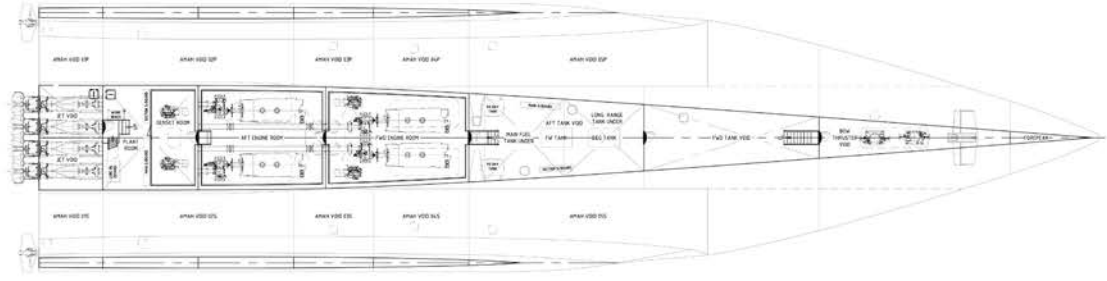


MAIN DECK



HULL

The general arrangement of *Queen Beetle*
(Drawing courtesy Austal)

WA Premier, Mark McGowan, said that it was particularly pleasing that a range of local suppliers and subcontractors had also contributed to the construction of the vessel, in addition to those directly employed by Austal.

"The extent of the local content in this vessel is proof of both a vibrant shipbuilding industry in Western Australia as well as a testament to the quality of the work and products which Western Australian companies can contribute to the maritime sector, whether in civil or defence areas," Mr McGowan said.

JR Kyushu Railway Company President, Mr Toshihiko Aoyagi, and JR Kyushu Jet Ferry President, Mr Masayuki Mizuno, who both travelled from Japan to attend the ceremony, congratulated the Austal project team on the progress of the vessel and remarked on the growing anticipation for the new ship in Japan.

"JR Kyushu Jet Ferry is very excited about the imminent launch, completion and delivery of *Queen Beetle* and we look forward to commencing services in Japan, in July. The reveal ceremony has assured us that *Queen Beetle* will be the most impressive ship in our fleet," Mr Aoyagi said.
The distinctively red-painted *Queen Beetle* will be able to transport 502 passengers (and 20 crew) across two passenger decks, at speeds up to 37 kn on the 115 n mile route.

Featuring a customised interior designed by Eiji Mitooka of Don Design Associates, *Queen Beetle* includes two classes of seating plus compartments for groups and families, a children's play area and nursing room, a café and bar, duty-free shop, lockers for luggage and all-access spaces for wheelchairs and prams. An outdoor viewing deck will further enhance the on-board experience for passengers.

Principal Particulars

Length OA	83.5 m
Length (WL)	79.6 m
Beam (mld)	20.2 m
Hull depth (mld)	6.3 m
Hull draft (max)	3.6 m
Passengers	502
Crew	20 (Subject to Flag)
Deadweight (Max)	115 t
Fuel	55 000 L
Main engines	4 × MTU 16V1163 M74 (IMO Tier II)
Gearboxes	4 × ZF 40060 NR2H
Waterjets	4 × KaMeWa 90 S4
Speed	36.9 kn at 85% MCR
Class Society	DNV GL
Class Notation	✠ 1A HSLC R2 Passenger EO HSC Category B
Flag State	Panama

Captain Ben Moore from Incat Crowther

Incat Crowther has announced the launch of *Captain Ben Moore*, a hybrid-propulsion Incat Crowther 19. Built to serve produce company Harbor Harvest, the vessel will deliver farm-to-table produce, eliminating lengthy truck routes. Harbor Harvest has a store front in Norwalk, Connecticut, USA, distributing fresh produce to restaurants and consumers. With a focus on sustainability, owner Robert Kunkel had the vision to link the farms of Long Island Sound with the retail outlet in Norwalk in an efficient, sustainable way. *Captain Ben Moore* is the realisation of that vision. As a hybrid vessel, based on proven technology, it is fitted with lithium batteries connected to a BAE Systems HybriDrive. The vessel's batteries will be charged at either their Norwalk or Huntington (Long Island) locations, allowing the vessel to run emissions free. As a backup, a pair of diesel generators is fitted for onboard power generation. A cross-sound trip will take around 45 minutes, instead of upwards of 9 hours by road. The vessel can carry the equivalent of between three and five full trucks. As well as being cleaner than trucks and reducing the travelling distance, the vessel also seeks to remove trucks from one of the most congested highways in North America.

The vessel has capacity for 28 pallets, of which 10 are in a fully-refrigerated space. A stern folding access ramp and a deck crane lend flexibility to loading and unloading. The vessel's low draft also allows entry to areas with little or no established infrastructure.

Captain Ben Moore is the third in a series of 19 m hybrid-propulsion vessels built in the USA, after RV *Spirit of the Sound* and RV *CUNY I*. *Spirit of the Sound* is a classroom and research vessel operated by the Maritime Aquarium at Norwalk. Operating on Long Island Sound, the vessel has been a game changer for the aquarium, allowing them to operate classroom tours quietly at slow speeds. *CUNY I* is a hybrid-propulsion Incat Crowther 19 operated by the Science and Resilience Institute at Jamaica Bay, Long Island. *CUNY I* operates full- and half-day scientific excursions, in addition to being available to private enterprise for charter.

Colin Thom, Associate Director of Vessel Operations for the Maritime Aquarium at Norwalk, said that RV *Spirit of the Sound*'s hybrid-electric system saves the Aquarium significant fuel costs with the majority of its cruise programs.

"Most of our vessel programs—which we present to school groups and to the public on Long Island Sound year-round—can be performed over their 2.5 hours with little need to engage the diesel engine," Thom said. "Her quiet operation, and her steadiness and stability, are ideal for these educational presentations at sea."

Captain Ben Moore
(Photo courtesy Incat Crowther)

In Australia, Incat Crowther's fourth hybrid vessel, *Spirit of the Wild*, has been in operation for over a year. The Incat Crowther 33 uses hybrid technology to revolutionize the

service which it offers. Operating in Tasmania's World Heritage-listed wilderness, *Spirit of the Wild* offers silent cruising on the Gordon River.

"The hybrid-electric mode has proven to be very reliable in operation and has not required any significant increase in maintenance compared with our previous conventional vessel. We also use less hours on the main engines which increases our maintenance intervals." said Geoff Eyers, General Manager of Gordon River Cruises. "We have been able to offer our customers an immersive experience in the local environment by using the quiet drive hybrid-electric mode. The feeling on board has exceeded all of our expectations—it is very smooth and comfortable. We are very pleased with the solution Incat Crowther has delivered to meet our requirements."

Incat Crowther's growing range of hybrid vessels demonstrates a wide range of applications and the breadth of expertise to apply this technology effectively. From world-heritage wilderness to highly-developed and congested regions, hybrid research, passenger and cargo transport has been proven in marine operations.

Principal particulars of *Captain Ben Moore* are

Length OA	19.2 m
Length WL	18.7 m
Beam OA	6.50 m
Depth	2.10 m
Draft (hull)	0.90 m
Draft (propellers)	1.40 m
Passengers	49
Crew	3
Fuel oil	1200 L
Fresh water	1000 L
Sullage	1000 L
Prime generators	2×Cummins QSB6.7
Propulsion	2×propellers
Speed (service)	12 kn
(maximum)	15 kn
Construction	Marine-grade aluminium
Flag	USA
Class/Survey	USCG Subchapter T

Nairana from Incat Crowther

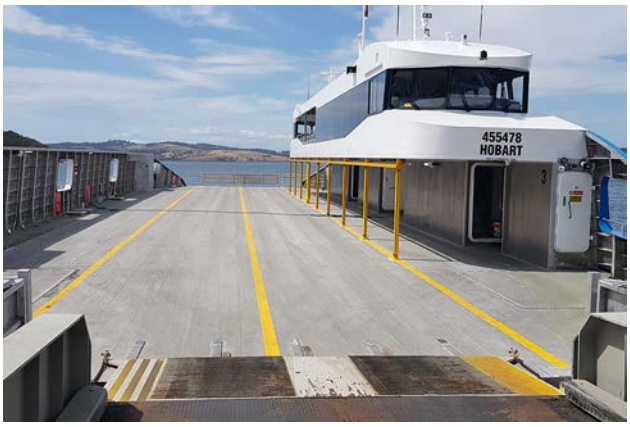
Incat Crowther has announced the launch of *Nairana*, a double-ended ro-pax ferry for operation between Kettering and Roberts Point on Bruny Island in Tasmania. The Incat Crowther 44 was commissioned by Sealink Travel Group and built by Richardson Devine Marine Constructions in Hobart.

Nairana breaks new ground by combining robust aluminium structure, double-ended functionality and a catamaran platform. The catamaran hull platform with its generous beam offers significant fuel savings compared with a monohull. The vessel will bring improvements in both transit and turn-around times. In addition to improved performance, *Nairana* brings modern vessel technology, including the latest in fit-out and convenience.

The vessel is configured to carry 36 cars and 192 passengers. Three of the vehicle lanes are unrestricted in height, with the two central lanes carrying a total of 90 lane-metres of trucks. The vessel is certified to carry dangerous goods.

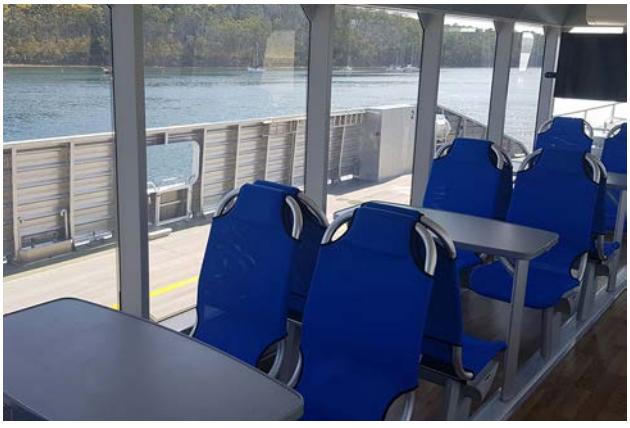
The elevated superstructure, located on one side of the vessel, has both interior and exterior spaces. The indoor space seats 32 passengers in booth seats with tables, whist the outdoor space features café style seating for 30 passengers.

Incat Crowther worked with Sealink to customise the vessel to the operator's docks, as part of a wholistic approach to the operation, including design and on-site fitment. This approach targets long-term value and minimises risk for the operator. *Nairana* performed well on recent performance and docking trials, exceeding her contract speed and successfully interacting with shore-based infrastructure.



Main deck and superstructure on *Nairana*
(Photo courtesy Incat Crowther)

Nairana passing Sealink's other Bruny Island ferry *Mirambeena*
(Photo courtesy Incat Crowther)



Main deck seating on *Nairana*
(Photo courtesy Incat Crowther)

Nairana is powered by four Scania DI13 070M main engines, each producing 200 kW. Positioned in each of the four corners of the vessel, these engines are directly coupled to Schottel SRP 100 azimuthing drives. As well as offering

exceptional manoeuvrability, the azimuthing drives provide propulsion efficiency with all four delivering thrust in the direction of vessel travel. If required, the vessel can operate on two pods during off-peak periods, further reducing operating costs.

A second vessel is under construction at Richardson Devine Marine Constructions.

Principal particulars of *Nairana* are

Length OA	44.99 m
Length WL	44.99 m
Beam OA	13.40 m
Depth	3.50 m
Draft (hull)	1.55 m
Passengers	192
Cars	36
Fuel oil	10 000 L
Fresh water	5000 L
Sullage	5000 L
Main engines	4×Scania DI13 080M each 200 kW @ 1800 rpm
Propulsion	4×Schottel SRP 100 FP
Generators	2×Izuzu 40 ekW
Speed (service)	12 kn
(maximum)	15 kn
Construction	Marine-grade aluminium
Flag	Australia
Class/Survey	NSCV Class 1E

17 m Patrol Vessel from Incat Crowther

Incat Crowther has been chosen to design an aluminium patrol vessel for Queensland's Department of Environment and Science. The Incat Crowther 17 was developed in a conceptual design process specifically to meet multiple operational requirements and roles. The design was put to construction tender and Norman R. Wright and Sons has been selected to build the vessel.

Incat Crowther was selected for the project based on specific criteria to deliver a high service-delivery capacity for the operation. This requires excellent seakeeping, reliable cruise speed, low fuel consumption, reliability, ease of maintenance, good product support, aesthetics and value for money.

The new vessel for the Great Barrier Reef Field Management Program will perform a range of tasks, including marine protected-area management, island national park management, compliance operations, incident response, diving operations, mooring maintenance, and research. The vessel will operate throughout the Queensland coast and Great Barrier Reef waters to the extent of the Exclusive Economic Zone. Much of this vessel's work will be in remote areas of the Great Barrier Reef.

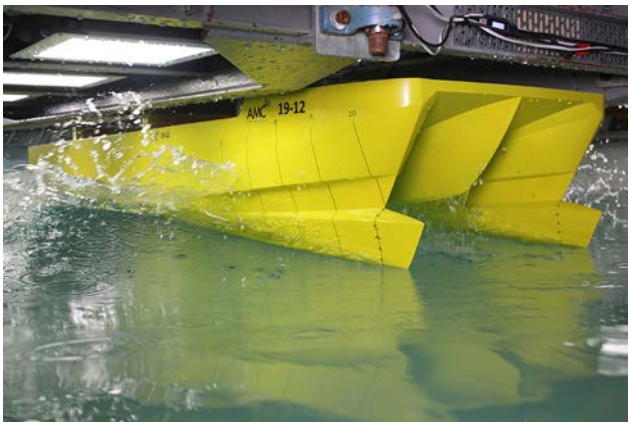
The hull has been specifically designed for the demanding operation. The hullform features a new-generation Z-bow, large reserve buoyancy, and a nacelle to combat rough seas from south-east trade winds. The development process included operational experience from the existing fleet and computational fluid dynamics (CFD) to optimise the new solution. The performance was independently verified by rigorous speed and seakeeping tests at the Australian Maritime College's facilities.

The vessel makes the most of the platform size, which is specific to fit its home-port berth. The main deck is dominated by an aft working deck with a quick launch-and-recovery system for a 3.4 m RHIB, dive racks, deck winches, BBQ area, a sink and multiple deck lashing points.

Inside the main deck cabin is a wet room, mess, full-size galley and chest freezer. The elevated wheelhouse accommodates the captain's bunk, whilst side doors provide direct access to the foredeck. Under the wheelhouse is a pair of twin cabins. Under the main deck cabin is a pair of single cabins.

The roof includes ample cargo area suitable for up to two 4.5 m RHIBs, a deck crane and multiple storage boxes, topping off a highly-flexible and functional vessel. A deck crane allows the loading of cargo onto the roof, as well as answering the call for both onboard RHIBs to be launched and recovered easily and safely.

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



Tank testing the Queensland patrol vessel
(Image courtesy AMC)

Starboard bow of the Queensland patrol vessel
(Image courtesy Incat Crowther)

The construction of the vessel by Norman R. Wright and Sons will include high-quality materials which minimise mass, whilst ensuring high strength, robustness, and low maintenance. This allows the Incat Crowther 17 to maintain good efficiency whilst packing a high level of capability for the size.

The vessel will be powered by twin MAN i6-850 main engines driving fixed-pitch propellers through ZF V-drive gearboxes. She will have a service speed of 20 kn. The vessel is designed to be autonomous for up to 10 days at sea with a 500 n mile range.

Incat Crowther's holistic approach to the design solution, and Norman R. Wright and Sons quality of construction will deliver a safe, reliable, effective and efficient vessel to serve the Great Barrier Reef World Heritage Area.

Principal particulars of the Incat Crowther 17 are

Length OA		18.60 m
Length WL		17.90 m
Beam OA		6.50 m
Depth		2.60 m
Draft	(hull)	1.10 m
	(propellers)	1.50 m
Personnel		12/24
Fuel oil		6600 L
Fresh water		1000 L
Sullage		400 L
Main engines		2×MAN i6-850 EPA Tier III each 625 kW @ 2300 rpm
Propulsion		2×838 mm diameter fixed-pitch propellers
Gearboxes		2×ZF 510V
Reduction ratio		2.222:1
Speed	(service)	20 kn
	(maximum)	28 kn
Construction		Marine-grade aluminium
Flag		Australia
Class/Survey		AMSA DCV Classes 1C and 2C

H401 and *Curiosity* from Incat Crowther

Incat Crowther has announced the successful delivery of the first two low-emission EPA Tier 4-compliant 29 m passenger ferries, named *H401* and *Curiosity*, for the still-expanding NYC Ferry by Hornblower. The Incat Crowther digital ship design package allowed identical vessel to be constructed at independent shipyards, Halimar Shipyard of Morgan City, LA, and Breaux Brothers Enterprises of Loreauville, LA.

Although the vessels were commissioned prior to the current tragic circumstances caused by the COVID-19 emergency, it is expected that the high passenger demand which NYC Ferry has experienced since commencing operations in 2017, will return. The new vessels complement the 17 Incat Crowther-designed 26 m vessels and 14 29 m vessels which have already been delivered to NYC Ferry. Four additional 26 m vessels are currently under construction at Gulf Craft and Metal Shark, both of Franklin, LA, along with one additional 29 m vessel under construction at St John's Shipbuilding in Palatka, FL. Upon completion of these additional vessels, the NYC Ferry fleet will have grown to an amazing 38 vessels in just over three years.

The new vessels include seats for 354 passengers, dedicated bicycle storage, disability access, mobile device-charging stations, wi-fi connectivity and a well-equipped on-board convenience store by The New Stand. All the vessels are equipped with main engines from Baudouin but, unlike any of the existing vessels in operation, the new vessels are equipped with EPA Tier 4-compliant engines which further reduce emissions. In order to bring the engines into compliance with Tier 4, Incat Crowther integrated a Baudouin-supplied SCR system into the vessel design along with the necessary urea tanks and dosing-system components.

H401
(Photo courtesy Incat Crowther)

The innovative NYC Ferry fleet has been developed in close co-operation with Hornblower, leveraging Incat Crowther's comprehensive digital design package and expertise in the US ferry industry to satisfy challenging operational and regulatory requirements.

The growing NYC Ferry fleet continues to form the backbone of a modern, comfortable and efficient urban ferry fleet which is offering New York city commuters the ability to access more parts of metropolitan area than ever before.

Principal particulars of *H401* and *Curiosity* are

Length OA		29.6 m
Length WL		28.1 m
Beam OA		8.50 m
Depth		3.50 m
Draft	(hull)	1.30 m
	(propellers)	2.20 m
Passengers		354
Crew		8
Fuel oil		7750 L
Urea		1515 L
Fresh water		1987 L
Sullage		1987 L
Main engines		2×Baudouin 12M26.3 each 1029 kW @ 2100 rpm
Propulsion		2×5-bladed propellers
Generators		2×RA Mitchell custom built
Speed	(service)	26.5 kn
Construction		Marine-grade aluminium
Flag		USA
Class/Survey		USCG Subchapter K

Stewart Marler

JBD Conducts Inclining Experiment on HMAS *Canberra*

John Butler Design was awarded the contract to undertake an inclining experiment on HMAS *Canberra*, one of the Navy's LHD ships, during its scheduled maintenance period. An inclining experiment using traditional solid mass movement would have required approximately 260 t of masses and a team of forklifts on the deck, not to mention the logistics of sourcing and transporting these masses to the flight deck of the LHD.

It was decided to undertake the inclining experiment using transfer of ballast water instead. To assist the loading and unloading of the LLC landing craft there are several large

water-ballast tanks, and the largest pair was chosen for the water transfer to generate the heel required during the experiment.

To ensure the accuracy of the experiment, the chosen ballast tanks were 3D laser scanned internally along with the well-dock void in between the tanks. This scan included the tank boundaries and the structure, sounding tubes and pipes running through the tanks. A 3D model of the tanks was generated, allowing the volume in each tank and, hence, the applied heeling moment, to be accurately derived using tank dips after each water-ballast transfer evolution.

Prior to the inclining experiment, a solid-state survey was conducted on the entire ship. With a team of four, each space within the ship was inspected to identify equipment or stores that were missing or that needed to be removed or moved.

The complex inclining experiment was undertaken overnight and relied on communication between the ship's crew on the bridge and in the control room, the tug skippers holding the ship off the wharf, and the John Butler Design team working the three pendulums and recording tank dips.

The inclining experiment was conducted successfully, and the resulting lightship parameters were accepted for use in the ongoing certification of the LHD class of ship.

JBD Refits STS *Young Endeavour*

After over 30 years sailing the world, the bowsprit and boat deck of STS *Young Endeavour* were due for replacement. John Butler Design designed a new boat deck and bowsprit for the vessel, maintaining the same proportions and appearance, but improving the construction methodology, the ability to monitor the condition of the components, and provide better access for future maintenance activities. The safety rails on the bowsprit were also redesigned to provide improved safety for those accessing the bowsprit.

A detailed ship check was undertaken, and the new design was prepared for AMSA and Lloyd's Register review and approval.

New bowsprit and bobstay on STS *Young Endeavour*
(Photo courtesy John Butler Design)

Prior to the dry-docking period in September 2019, work commenced on fabricating the new bowsprit and boat deck, so that they would be ready to install when the old ones were removed. In dock, the vessel was de-rigged and the bowsprit and boat deck were removed. The removed components were overlayed on the new to ensure that they would suit the vessel. After minor adjustments, they were offered up to the vessel and installed in place.

The mass impact of the new bowsprit and boat deck design was assessed by conducting an inclining experiment on the vessel. STS *Young Endeavour* passed the sea trials, and the new bowsprit, boat deck and lightship parameters were accepted by AMSA.

John Butler Design was also tasked with designing a new composite gangway for STS *Young Endeavour*. The new gangway was fabricated from carbon fibre, and designed to support a loading of 200 kg/m^2, so that heavy items can be taken onboard easily. The gangway was designed with the option of fitting a 1.2 m extension piece to suit wharves where a longer gangway is required.

New boat deck on STS *Young Endeavour*
(Photo courtesy John Butler Design)

JBD Conducts Lightship Survey on *Pacific Explorer*

Every five years, as part of ongoing certification, a lightship survey is required on each ship to ensure that the displacement and centre of gravity location are sufficiently close to those determined at the previous inclining experiment, thereby indicating that the current stability booklet is still valid and operations can proceed for another five years.

Pacific Explorer
(Photo courtesy John Butler Design)

The John Butler Design team undertook a lightship survey on *Pacific Explorer* whilst the vessel was on a voyage from Sydney to Melbourne and return. This lightship survey consisted of a solid-state survey of all compartments on each of the 15 decks, manual dipping of the 64 fuel, fresh water, ballast and waste tanks, and measuring the depth of water in the ship's pools and spas.

On arrival in Sydney, John was lowered to the water in the fast craft, and undertook the draft measurements and water density readings whilst the ship was stationary (with tug support) in White Bay.

Measuring draft marks on *Pacific Explorer*
(Photo courtesy John Butler Design)

JBD Analyses Australia Day Display Screen on Barge in Circular Quay

The City of Sydney wanted a large outdoor movie screen to act as a backdrop for the Australia Day celebrations in the middle of Circular Quay. In conjunction with Australian Barge Hire, John Butler Design provided a solution in the form of a jack-up barge, on which a large scaffold and movie screen was installed.

John Butler Design was responsible for determining the environmental operating limits (wind, current and waves) for the jack-up barge whilst jacked up in Circular Quay. A plate Strand7 model was developed for the modular jack-up barge, including the pontoons, jacking towers and two-piece spud legs. Beam elements were used to simulate the scaffold design. The environmental and equipment loads, along with dynamic acceleration factors were applied to the model in two directions, and solvers run to simulate the load path from the movie screens down though the scaffold to the deck of the barge, and then down the spud legs to their foundation on the seabed of the harbour.

The resulting stresses and deflections within the model were assessed, along with the stability of the jack-up barge.

The floating stability was also assessed to ensure safe passage along the harbour to Circular Quay, with the full complement of the scaffold, screens, and the large spud legs. The maximum height of these spud legs was specified to ensure satisfactory stability during the tow of *Sealift 1* to the site.

Australia Day barge and movie screen at Circular Quay
(Photo courtesy Australia Day Council of NSW)

JBD Assists *Mischief 1* AMSA Survey

In partnership with Australian Superyachts and Slipstream Marine, John Butler Design assisted with the commercial survey approval of *Mischief 1*. The vessel has an overall hull length of 52.45 m, making it the largest luxury yacht in Australian commercial survey, and can carry up to 200 passengers.

Mischief 1 on board the Biglift ship
(Photo courtesy John Butler Design)

Mischief 1 afloat on Sydney Harbour
(Photo courtesy John Butler Design)

The John Butler Design team undertook a gap analysis to determine changes required to the vessel and additional documentation required for plan approval by AMSA. John Butler Design prepared a number of required safety drawings

as well as the general arrangement drawing of the vessel, and obtained approval of these drawings in accordance with the requirements of the NSCV.

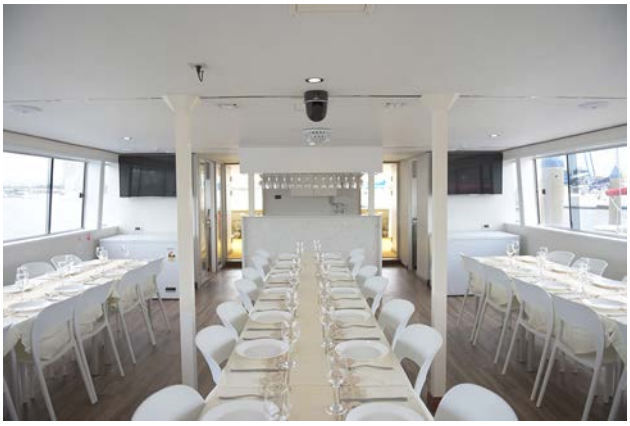
John Butler Design undertook a draft mark survey on the vessel to confirm the location and accuracy of the draft marks prior to the vessel being lifted off the Biglift ship. A lightship survey was also undertaken, the results of which were used to update the vessel's stability book for the required increase in passenger numbers to suit the charter operations on Sydney Harbour.

John Butler

Easeland from Oceanic Design & Survey

Oceanic Design & Survey has welcomed the arrival of their 21 m aluminium catamaran *Easeland* on the Gold Coast. With a shallow draft to allow beach access from the bow ramp, and powered by twin 149 kW (200 hp) Mercury outboards, Oceanic Design & Survey has designed this vessel especially for their local conditions on the Broadwater estuary system on the Gold Coast. The client, Bayman Coast Touring Australia, can cruise with up to 140 guests and 5 crew, hosting both tours and events with a flexible internal layout, well-equipped catering facilities, and state-of-the-art digital entertainment and karaoke systems across both decks.

Port bow of *Easeland*
(Photo courtesy Oceanic Design & Survey)



Main-deck cabin on *Easeland* looking forward
(Photo courtesy Oceanic Design & Survey)

Uniquely, whilst ultimately intended to be in survey in Australia as an NSCV-compliant Class1E vessel, *Easeland* was constructed in China and underwent class approval by China Classification Society (CCS). "An aluminium catamaran, much smaller than most of their steel ships, was a first for CCS and presented some unique design, communication and legislative challenges. Despite this, we're proud to say that the desired outcome was achieved without significant issue or delay", said Chris Hutchings, Managing Director at Oceanic Design & Survey.

Oceanic Design & Survey is pleased to have been able to design a solution to meet the requirements of not only CCS and AMSA but, most importantly, our client at Bayman Coast Touring Australia, with the delivery of this vessel.

Hamish Lyons

John Oxley Restoration

Restoration of Sydney Heritage Fleet's *John Oxley* is proceeding, with the hull re-plating complete, and now being caulked — yes; rivetted ships require caulking! — and fitting out of all spaces is proceeding, with the forecastle the last to be started.

The news of progress on the website went quiet for a couple of years, but a recent effort has brought it back nearly up to date. For all the details and photographs of progress, visit http://johnoxley.org.au/latest-update/previous-news-items/2019-updates/#.

John Oxley Project Coordinator, Andy Munns (L) with engineering stalwarts Ian Bird and Malcolm Pilcher in the Engine Room
(Photo courtesy Heather Kirk)

SHF Operations Manager, Tim Drinkwater (L), and Chief Fabricator and Boilermaker, Steve Stylianou, erecting scaffolding at the bow of *John Oxley* to allow restoration of the forecastle
(Photo courtesy Andy Munns)

Progress of caulking on the re-plated port bow
(completed caulking shown in black)
(Photo courtesy Andy Munns)

Aft deck with stern bulwarks awaiting fitting of cap rail and steering gear in position
(Photo courtesy Andy Munns)

Cruising in NSW

The summer season continued through late February with visits by *Maasdam, Queen Elizabeth, Albatros, Silver Muse, Carnival Splendor, Voyager of the Seas, Pacific Princess, Arcadia, Viking Orion, The World, Ovation of the Seas, Azamara Journey, Astor, Ruby Princess, Columbus, Noordam, Celebrity Solstice, Seven Seas Navigator* and *Seven Seas Mariner.*

The season continued into early March with return visits by some of these vessels plus visits by *Crystal Serenity, Queen Mary 2, Costa Deliziosa, Amsterdam, Seabourn Encore, Queen Elizabeth, Sea Princess, Artania, Pacific Explorer,* and *Radiance of the Seas* up to mid-March,

However, the COVID-19 restrictions placed a ban on cruises, and vessels were subsequently only allowed to berth for disembarkation of passengers. Most cruise vessels have now returned to their home ports. Winter cruising is currently in abeyance.

The scheduled arrivals of *Sun Princess* on 1 September and *Majestic Princess* on 28 September *may* signal the start of the next summer season.

Queen Elizabeth berthed at the Eden cruise-ship wharf on 10 March
(Photo courtesy Robert Whiter)

Cruise vessels continued visiting Eden in late February and early March, including *Explorer Dream*, *Noordam, Seven Seas Navigator, Seabourn Encore*, *Queen Elizabeth*, and *Pacific Explorer*, berthing at the new cruise-ship wharf. However, the COVID-19 restrictions forestalled further visits.

Phil Helmore

One of a number of cruise ships caught up in the COVID-19 crisis, the Royal Caribbean Cruises' *Spectrum of the Seas* became a familiar sight in Sydney Harbour during March. Completed in April 2019, this large ship would normally be based in China but was repositioned to Sydney as the pandemic developed. During her time here she conducted three complimentary cruises for bushfire first responders and their families. She has now left Australia
(Photo John Jeremy)

Characterising the Southern Ocean and Ross Sea Wave Climate

Sally Garrett, Defence Technology Agency, New Zealand Defence Force
and Tom Durrant, Oceanum Limited

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

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

In this paper, this previously unpublished wave atlas for the Southern Ocean and Ross Sea will be presented. A limited comparison will also be made between the wave statistics from both wave buoy observations and the wave atlas in these regions with the bivariate frequency wave height-period occurrence tables recommended for the North Atlantic by the International Association of Class Societies (International Association of Classification Societies, 2001).

INTRODUCTION

The New Zealand Defence Force (NZDF) routinely operates in the Southern Ocean and Ross Sea and is engaged in a shipbuilding programme which requires a detailed understanding of the wave climate for sea-keeping analysis and ice-belt design. This characterisation of the Southern Ocean and Ross Sea waves is required for all sea areas from 31°S to 78°S year round.

Knowledge of the wave climate of an area is a critical element for the design of vessels and offshore structures. Several studies have attempted to quantify the effect on design of uncertainties caused by a lack of knowledge in the wave climate (Bitner-Gregersen and Guedes Soares, 2007) and have found differences in long-term ship responses of up to 150 % of a nominal value, e.g. Guedes Soares and Travoa, (1991). This high uncertainty may lead to over-design or under-design of ships, with significant economic and risk-related consequences.

The need to improve the availability, quality and reliability of wave databases has been identified by several professional organisations (Bitner-Gregersen et al., 2009). In addition, the evolution of design processes has increased the detail required of not only the characteristic wave statistics and bivariate frequency wave height-period occurrence tables (scatter diagrams), but also of the full directional wave spectrum (Cardone et al., 2015).

Scatter diagrams based on the historical visual observations of sea state by merchant vessels participating in the Voluntary Observing Ships (VOS) form the basis of the Global Wave Statistics (GWS) atlas (BMT Group, 1986). Products derived from the GWS atlas include the International Association of Class Societies recommended wave data (International Association of Classification Societies, 2001). The atlas divides the globe in 104 regions, as illustrated in Figure 1, each with a scatter diagram of historical observations. This data is still employed for ship motion and design studies. However, while this database has been used for many years its accuracy has been questioned by researchers, especially concerning wave period and steepness (Bitner-Gregersen and Guedes Soares, 2007).

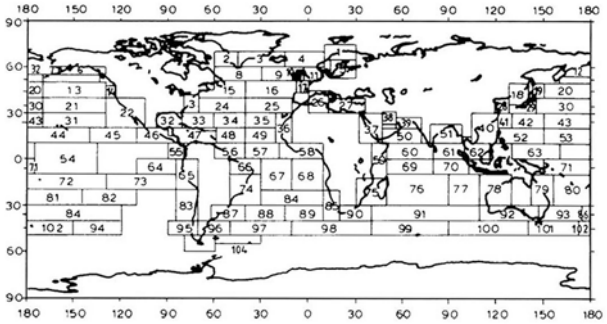


Figure 1: Map of the GWS sea areas
(BMT Group, 1986)

Another shortcoming of the GWS atlas is that it does not have global coverage and does not define the wave climate for the Southern Ocean area. The southernmost latitude of the available GWS data is 50°S (except for the Drake Passage sea area 104); well short of the 77°S ships are able to navigate to in the summer. Professional practise currently recommends the use of a refined GWS scatter diagram for the entire North Atlantic to be used for designing ships operating globally, including those operating in the Southern Ocean (International Association of Classification Societies, 2001).

To test whether this practice adequately describes the conditions of the Southern Ocean, Cannon, Guzsvany, and Turner (2004) compared the ship motions modelled for an Anzac-class frigate for both the Southern Indian Ocean (GWS sea areas 91, 92, 99, 100 and 101) and North Atlantic (GWS sea areas 3, 4, 8 and 9). Southern Indian Ocean data from 30°S – 50°S was used due to the absence of data in the Southern Ocean. Overall, the global bending moment of a frigate operating in the Southern Indian Ocean was 10% greater than for the same vessel in the North Atlantic.

Slamming calculations were made for a frigate travelling at 7.5 kn in all sea states for head seas only. The number of slams for the same length of simulation was 1.5–3 times greater for the Southern Indian Ocean sea areas compared to the North Atlantic sea areas. The greatest number of slams was modelled for Southern Indian Ocean sea area 100. The pressures generated by these slams was also modelled, with sea area 100 having the greatest slamming pressures and the average Southern Indian Ocean slamming pressure being 1.2 times higher than when operating in the North Atlantic.

A limitation of this study which was identified was the

lack of winter Southern Indian Ocean data due to a lack of shipping in the area, making the results a conservative estimate. However, even considering this limitation, the larger global bending moment estimated for the Southern Hemisphere brought doubt to the assumption that North Atlantic sea areas expose ships to the worst sea conditions.

Moreover, a comparison of the GWS data with available satellite altimeter data showed that the Southern Indian Ocean sea areas had a greater peak significant wave height than any area described in the GWS database. For North Atlantic sea areas the peak significant wave height was similar for GWS and satellite databases, highlighting the GWS data for that Southern Indian Ocean was underestimating the conditions that would be experienced at sea.

At the time of the study, wave period data was unable to be collected by satellite and therefore no comparison between satellite wave period and the GWS datasets was made. The inability to accurately sense wave period from space continues today. Synthetic aperture radar (SAR) is the only direct source of wave period estimates available from space. High errors have been identified in this data due to the SAR only capturing the long-wave part of ocean wave fields. Violante-Carvalho (2005) noted that the high-frequency cut-off is sea-state dependent but, in general, waves shorter than 10 seconds propagating parallel to the satellite track are not mapped.

The New Zealand Defence Force operates in the Southern Ocean annually. Ship's staff have reported high sea states on all voyages. This study aims to measure and then model the sea conditions in the Southern Ocean and compare these with the International Association of Classification Societies (2001) scatter diagram for the North Atlantic. This paper provides the initial findings of this new wave characterisation by measurement and modelling, with papers presented by Marsland and Ballard providing details of the implications for ship design.

WAVE CLIMATE MEASUREMENT AND MODELLING

The Southern Ocean is the southernmost part of the global ocean and represents around 22% of the sea surface area. The combination of persistent westerly winds, and the largely unbroken expanse of sea, produces potentially enormous fetches, resulting in the Southern Ocean experiencing higher wave heights for longer periods than any other body of water (Young, 1999). Due to the harsh ocean environment and remote location it is also the least observed of any ocean body.

The NZDF shipbuilding program requires characterisation of the wave conditions year-round in the Southern Ocean and Ross Sea to 78°S. Initial studies of waves in the area to support this requirement focussed on three main data sources; ship observations from the Volunteering Observing Ships (VOS) program (Kent et al., 2011), ship motion measurements from Royal New Zealand Navy (RNZN) vessels to enable estimation wave characteristics using the techniques of Nielsen and Stredulinsky (2012) and satellite observations using the Globwav database (Ash and Buswell, 2010). Each of these data sources was unable to provide year-round characteristics for the required spatial extent.

Ship voyages in the Southern Ocean and Ross Sea are currently limited both temporally and spatially (Summerhayes et al., 2007). Unlike similar latitudes in the Northern Hemisphere, ship-based observations, both visual and using ship motion sensors in the Southern Ocean, currently do not provide year-round wide-area coverage of wave conditions.

An example of these spatial and temporal limitations are the cruises completed by the fleet of New Zealand registered ships which operate in the Southern Ocean and Ross Sea routinely. The fleet includes the RNZN offshore patrol vessels, the National Institute of Wave and Atmospheric research (NIWA) research vessel RV *Tangaroa,* and the fishing vessels conducting toothfish fishing in the Ross Sea. The vessels from each of these groups operate in the Southern Ocean and Ross Sea between November and March, returning to similar areas on each voyage, and all routinely make observations. However, no observations are made by the New Zealand fleet in the winter months and locations where these vessels do not routinely operate.

Tedeschi, Rizzo, and Carrera's (2001) study of the route between New Zealand and Terra Nova Bay in the Ross Sea highlights the low number of observations in the winter months. Only 88 observations south of 60° S exist between 160°E and 180°E for wind speed or wave height or period summed across the period of April to September for all years from 1960–2000. For the same 40-year period and longitudes, 5778 observations were made between 50°S and 60°S.

These very low numbers of observations have been associated with high sampling biases (between ship-based measurements and models) in the Southern Ocean, where wave height may be underestimated by the VOS fleet by as much as 1–1.5 m because of poor sampling, primarily associated with a fair weather bias of ship routing and observation (Gulev et al., 2003) . Ship-based observations were therefore deemed unsuitable as a sole source of data for developing a shipbuilding wave climatology.

Satellite observations in open water provide a year-round unbiased method of characterising wave height. However altimeters, the most common sensor used, cannot estimate wave height in the presence of sea ice or other non-Gaussian surfaces within the sensor footprint (Ardhuin et al., 2019). For SAR-collected images, ocean waves are clearly visible in the imagery of ice-covered waters; however their quantitative analysis is presently limited to the estimation of a dominant wavelength and direction (Liu et al., 1991; Schulz-Stellenfleth and Lehner, 2002) for wave periods less than 10 seconds (Violante-Carvalho, 2005). As this study required wave characteristics within areas with sea-ice coverage, and required detailed understanding of wave period, these limitations meant that the use of satellite data was limited to open-water areas for the validation of the wave model outputs.

To enable a year-round understanding of wave conditions in all locations to 78°S, a three-part approach was used: in-situ measurements of waves were completed using wave buoys; the data from these buoys, along with satellite altimeter measurements, was then used to validate a Southern Ocean and Ross Sea optimised setup of the WaveWatch III wave model; this model was then used to create a 24-year hindcast for the area.

The first long-term wave buoy deployment was Southern Ocean Flux Station (SOFS), established as part of the Southern Ocean Time Series project (Trull et al., 2010). Five deployments have been performed since March 2010, providing measurements of wave characteristics and spectra spanning a period of over 700 days. The approximate coordinates of the mooring location were 47°S and 142°E. SOFS was the southernmost directional measurement of waves in the South Pacific sector of the Southern Ocean.

To enable measurements of waves throughout the South Pacific sector of the Southern Ocean, an array of free-floating and moored wave buoys was deployed from 53°S to 67°S. A combination of free-floating and moored wave buoys was used due to the cost and difficulties associated with the deployment of moored wave buoys.

Wave buoys provide point measurements of waves for a short time period. The second part of this study was to hindcast the wave conditions in the Southern Ocean for a 24-year period. The model outputs were then validated against both the collected wave buoy data and intercalibrated altimeter data.

Observation — Wave Buoy Array

Moored and free-floating wave buoys were used to measure waves from 42°S to 67°S between February 2017 and present. A time series of the latitude of the deployed buoys is shown in Figure 2.

The wave buoy array consisted of the following buoys:

- Two TRIAXS Directional Wave Buoys, the first of which was deployed 11 n miles south of Campbell Island (52°45.71′S, 169°02.54′E) in February 2017. This buoy broke free in July 2017 and was replaced by the present buoy in March 2018.
- Nineteen Miniature Wave Buoys, developed by Scripps Institution of Oceanography (SIO) (Coastal Observing Research and Development Centre, 2016), deployed from Royal New Zealand Navy ships and the RV *Tangaroa* across the Southern Ocean and in the Ross Sea.
- Four Spoondrift buoys deployed in the Southern Ocean from RV *Tangaroa* during the 2018 Ross Sea cruise.

The moored TRIAXYS buoys were deployed within New Zealand territorial seas, with the location decided upon due to the relatively shallow water depth (~140 m) in an area with limited other sea-bed features that would cause shoaling of waves.

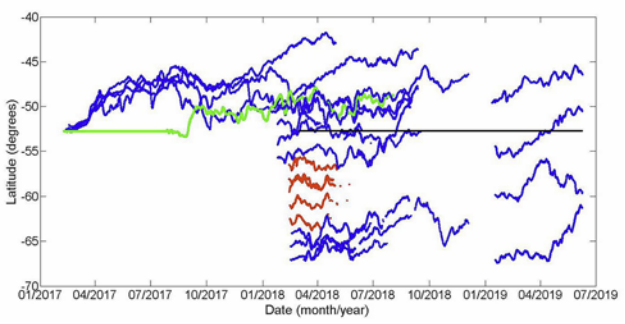


Figure 2: Time series of the latitudes of wave measurements made by SCRIPPS (blue), Spoondrift (red), TRIAXYS 2017 (green) and TRIAXYS 2018 (black) wave buoy deployments

The latitude of the free-floating buoys was able to be planned with the deploying ships; however, the longitude of deployment was decided by the ship.

Wave measurements for all buoys were completed using a standard ocean wave measuring regime of sampling at 2 Hz for a sampling burst of 20 minutes. For the TRIAYXS and Spoondrift buoys these sampling bursts occur three-hourly with hourly sampling for all the SIO buoys. Onboard processing is then completed and wave characteristics, including significant wave height, wave peak period, wave peak direction as well as directional spectra, are telemetered to shore by satellite.

The TRIAXYS and Spoondrift buoys measure waves using accelerometers (Raghukumar et al., 2017) while the SIO buoys measure waves using GPS (Coastal Observing Reserach and Development Centre, 2016).

The data collected from the TIAXYS and Spoondrift buoys are available from https://www.metocean.co.nz/southern-ocean.

Modelling — Southern Ocean Wave Atlas

In order to enable a greater spatial and temporal characterisation of waves, a 24-year hindcast was completed for all ice-free areas south of 31°S. This hindcast was modelled using WaveWatch III version 5.16 (Tolman, 1991). The details of the setup of the model is detailed in Southern Ocean Wave Atlas report (MetOcean Solutions Limited, 2019) and are summarised in Table 1.

Table 1: Setup parameters for WaveWatch III Southern Ocean hind-cast.

Parameter	Hind-cast Setup
Resolution	0.25 deg × 0.2 deg
Extent	31°S – 77.5°S
Period	January 1993 – December 2017
Wind field	ERA5 reanalysis from the European Centre for Medium-Range Weather Forecasts
Current input	GLORYS reanalysis from Mercato Ocean European Copernicus Marine Environment Monitoring Service

The validation of the wave hind-cast was based on intercalibrated altimeter data from 1993 to 2016 from the Globwav multi-altimeter dataset (Ash et al., 2010). The average bias in wave height was less than 0.05 m with a slight overestimation of the smallest waves and a slight underestimation of the largest waves. The root-mean-square deviation was also relatively low with overall values of ~ 0.4 m. Regions covered by ice during part of the year had the largest errors, including the coastal areas near Antarctica between 60°E and 120°E and between 180°E and 240°E.

Seasonal bias was calculated for the 1993–2016 period. These biases were generally positive, especially south of 50°S. The largest positive bias was found in the summer season from December to February, with values of ~0.2 m throughout the domain and up to 0.4 m in some areas. During the March to May period there was a smaller positive bias around 0.15 m on average, with fewer areas of higher bias compared to summer months. Winter (June to August) had the smallest bias on average, with few regions showing positive bias around 0.05 m, but with surprisingly high negative bias in the ice marginal zone. Spring biases were like those in the March to May period.

Full details of the validation are provided in the Southern Ocean Wave Atlas report (MetOcean Solutions Limited, 2019) and, as this hindcast was only recently completed (June 2019), further analysis will be presented in a series of forthcoming papers.

The data from the 24-year hindcast is available from https://metoceanview.com/.

The GWS atlas divides the area covered by the atlas into 104 sea areas. These sea areas (shown in Figure 1) are rectangular in shape and, in some cases, cover locations where bivariate frequency wave height-period occurrence may have different distributions. For example, Area 104 covers both the western and eastern approaches to Cape Horn.

The intent for the newly-developed wave atlas was to divide the hindcast modelled area in to a series of regions with a similar distribution of wave heights and periods. This was completed by calculating the mean significant wave height, the standard deviation of the significant wave height, the mean wave period and the standard deviation of the wave period for each of the 300 months in the hindcast and then clustering using a K-means algorithm to find areas of similar wave characteristics (MetOcean Solutions Limited, 2019). The resulting clustering is shown in Figure 3. To increase the usability of the data the grid was divided in to 5° × 5° regions and the cluster for each region applied from the K-means analysis as shown in Figure 4.

SOUTHERN OCEAN AND ROSS SEA WAVE CLIMATE

Wave Measurements

In total 5622 buoy days (at 1 June 2019) of wave data has been collected at latitudes between 42° S and 67° S in the South Pacific sector of the Southern Ocean. The only buoy to have collected data for a 12-month period south of 50° S (the area outside the GWS sea areas) is the TRIAXYS buoy deployed in March 2018. This dataset will be used for comparison against the IACS North Atlantic data.

In the Ross Sea only free-floating buoys were deployed. The longest wave buoy record south of 60° S is currently 142 days in duration; after this time the buoy drifted into the Southern Ocean. 30-day records from each of four wave buoys were used in addition to the 142-day time series to develop an understanding of waves in the area.

Figure 5 shows the occurrence of significant wave heights for each of the three regions. For measured wave data in both the Southern Ocean and the Ross Sea, the largest number of observations was between 4–5 m. For the IACS North Atlantic data, this peak is for waves with a significant wave height between 3–4 m. However, the occurrence of higher sea states in the IACS table was greater than the Ross Sea observations for all wave heights greater than 5 m and greater than the Campbell Island buoy for all wave heights greater than 7 m.

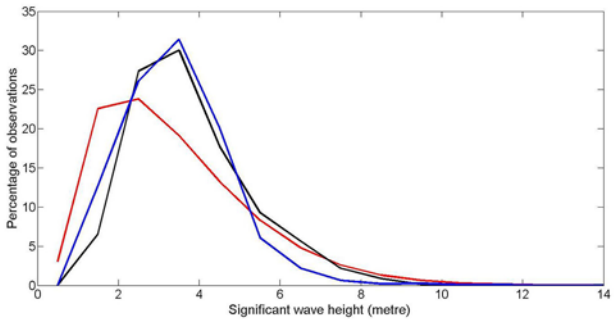


Figure 5: Distribution of significant wave heights for International Association of Class Society North Atlantic sea area (red), Campbell Island TRIAXYS wave buoy (black) and Ross Sea SIO wave buoys (blue)

Figure 6 shows the occurrence of peak wave period for each of the three regions. Wave period was greater for the observational datasets, with the Ross Sea data having the greatest peak wave period. The Ross Sea dataset was collected with free-floating GPS buoys; however, the ability of these buoys to measure long-period waves has not been extensively researched and it is possible that the variations between the two observed datasets is associated with sensor limitations. The Campbell Island wave buoy shows a peak wave period at 8.5 seconds. Further analysis is required to determine the reason for this peak; however, the majority of the waves at that period come from a north-west direction where the fetch is affected by Campbell Island.

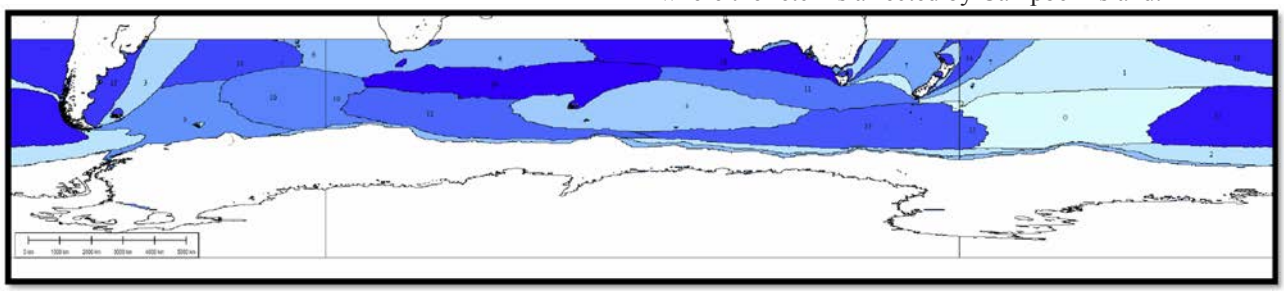


Figure 3: Classification of Southern Ocean zones obtained from K-means clustering

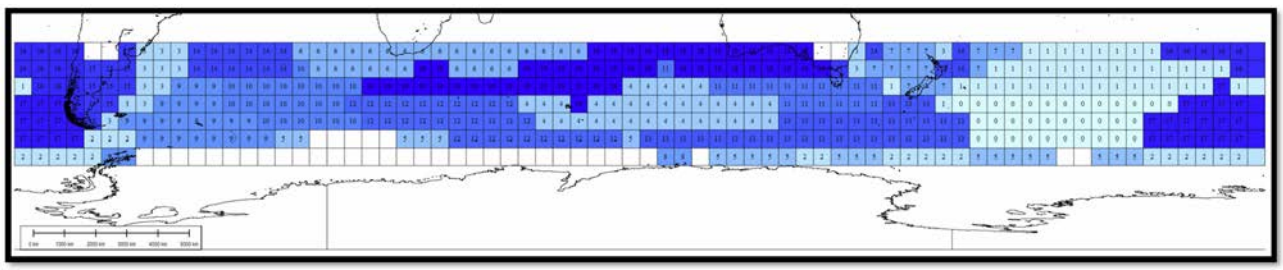


Figure 4: Simplified classification of Southern Ocean zones.

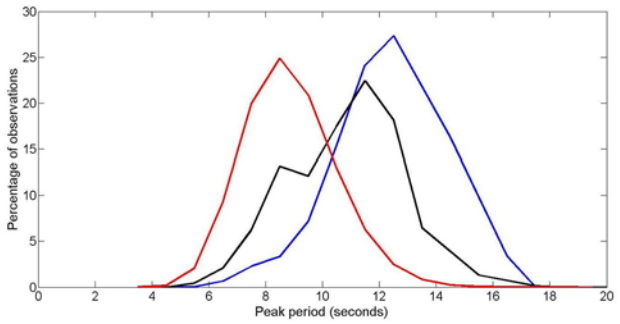


Figure 6: Distribution of peak period for International Association of Class Society North Atlantic sea area (red), Campbell Island TRIAXYS wave buoy (black) and Ross Sea SIO wave buoys (blue)

The IACS table's largest wave heights were between 16–17 m with periods between 10–16 seconds. For the Campbell Island observation, they were 15–16 m at 16–17 seconds and, for the Ross Sea, the largest wave height was between 12–13 m. However, as the wave buoys are a point measurement of waves and the length of each observational time series is short, it is difficult to compare these maximum values to the long-term time series of the IACS data. For this reason, the hindcast was completed.

Wave Atlas

Wave height distributions for the 20 zones of the Southern Ocean Wave Atlas (SOWA) compared with the IACS North Atlantic dataset are shown in Figure 7. The significant wave height distributions for the SOWA zones vary in terms of peak significant wave height and in distribution of wave height greater than 6 m. Twelve of the SOWA zones have a peak significant wave height greater than the peak of between 3–4 m of the IACS. Moreover, eight zones have a higher proportion of waves greater than 6 m than the IACS, and two zones have a higher proportion of waves greater than 8 m.

At high sea states the largest wave height for the 20 zones is between 15–16 m, while for the IACS data it is between 18–19 m. However, only 0.00198% in the IACS data set is greater than 16 m. Additional understanding of the distribution of extreme sea states in the Southern Ocean is required, in particular whether the SOWA zones should include calculated wave height extremes or remain only distributions of significant wave height.

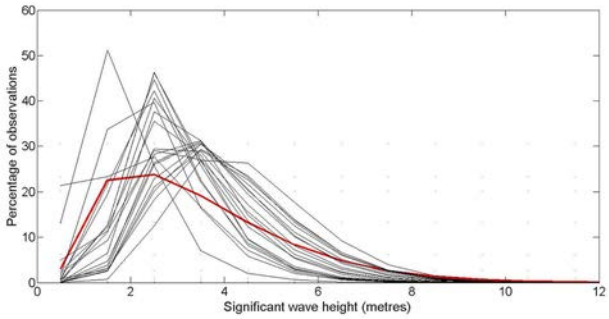


Figure 7: Distribution of significant wave heights for International Association of Class Societies North Atlantic sea area (red), wave hindcast zones 0–19 (black)

Wave peak period distributions for the 20 zones of the SOWA compared to the IACS North Atlantic dataset are shown in Figure 8. For 18 of the 20 SOWA sea areas, the peak of the peak period distribution is greater than that of the IACS, with all SOWA sea areas having a greater percentage of wave periods than the IACS for periods greater than 12 seconds. This is consistent with the observational data presented above and also with the work by Bitner-Gregersen and Guedes Soares (2007).

A bimodal distribution in wave peak period is shown for SOWA Area 9 located to the east of the Drake Passage and the Antarctic Peninsula. This sea area also has a large percentage of lower significant wave height in its distribution, indicating the effects of land on the seas in the area.

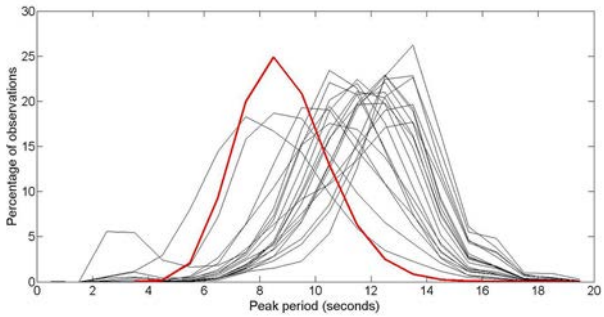


Figure 8: Distribution of peak wave period for International Association of Class Society North Atlantic sea area (red), wave hind-cast zones 0-19 (black)

CONCLUSIONS

In this study a series of short-term wave buoy deployments have been used to characterise the waves across the Southern Ocean south of New Zealand and the northern Ross Sea, to enable comparison with the IACS wave data for the North Atlantic. The aim of this comparison was to gain an understanding of whether the IACS Recommendation 34, to use the North Atlantic data for worst-case conditions for design, is appropriate for Southern Ocean ships. The observational datasets indicate that the average wave conditions experienced in this area represent greater significant wave heights and longer periods than those specified by IACS. However, higher sea states occur at greater frequency in the IACS tables.

The collected wave data has several limitations, including the short length of each deployment and the limited spatial coverage. The TRIAYXS wave buoy data from Campbell Island included 12 months of data, while the Ross Sea collection period was 262 days. Spatially, all buoy deployments occurred in the Southern Ocean Pacific Ocean sector.

To address these limitations, a 24 year hindcast for all ice-free sea areas south of 30°S globally was developed. These data were then divided into sea areas based on similar significant wave height and peak period. As with the observational datasets, the modelled datasets indicate that the average wave conditions experienced in the Southern Ocean have a higher significant wave height and longer period than those specified by IACS. However, they also indicate once again that higher sea states occur at greater frequency in the IACS tables. This is an area for further research.

The findings of this study conclude that bivariate frequency wave height-period occurrence tables for the Southern Ocean and Ross Sea differ from the recommend IACS tables. These differences of a greater average significant wave height and period are the same as those noted from the Southern Indian Ocean by Cannon et al. (2004), who found that the greater average significant wave height and wave period caused

a 10% greater global bending moment in an Anzac-class frigate.

This programme of work continues with the characterisation of wave spectra using the observations and hindcast in this paper to compare to industry standard spectra and, if appropriate, the development of specialised spectra for the Southern Ocean.

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SailGP Hydrofoil Sailing Catamaran Races on Sydney Harbour

Martin Grimm, Naval Technical Bureau, Department of Defence
Em/Prof. Lawrence Doctors, UNSW Sydney

Background

SailGP is an organisation which encourages the development and racing of very efficient sailing hydrofoil craft. Their website provides much material on these boats. The development encompasses all aspects of the design, which includes the hulls, the foils, the sails, the control systems, and the navigation aspects.

One of the outstanding achievements is the running of competitive races around the world. This year, for the second year running, the first races in the series were run on Sydney Harbour on 27 and 28 February 2020. Being in Australia meant that the races would be of interest to readers of *The Australian Naval Architect*. Unfortunately, due to COVID-19, further races planned for San Francisco, New York, Cowes and Copenhagen have been suspended for now.

Design

The F50 is a one-design foiling catamaran used in the SailGP race series. The boats are based on America's Cup AC50 boats and technology previously used in the 2017 America's Cup, and are the culmination of ten years of development work. They are the fastest sail racing class in history, with speeds now exceeding 50 kn. The outright sailing speed record of 65.45 kn over 500 m still rests with the Australian Paul Larsen in *Vestas SailRocket 2*, which was purpose designed to achieve that record rather than for racing.

The boats use a flapped wing-sail and jib for propulsion. The first season of SailGP adopted the original AC50 wing-sails with a 24 m wing height and a 100 m^2 planform. However, with new sails progressively being manufactured, in the future height and area variations will become possible to suit foilborne sailing in a wider range of wind conditions. Apart from the wing-sail incidence, which is controlled by two grinders, wing-sail flap twist, the jib sheet, both main and rudder foil trimming or pitch control, and raising and lowering the main foil is hydraulically operated using an accumulator pressurised by electric pumps powered by Lithium-ion batteries. The main foils can also be canted while on the water. Foil toe-in or toe-out is also adjustable, but only on shore.

The boats have a crew of five: helmsman, wing trimmer, flight controller and two grinders. A dedicated crew member relieves the helmsman of flight controls so that the helmsman can focus on tactics. This is similar to Team New Zealand's unique crew arrangement in the 2017 America's Cup. While racing, the crew stay in the windward hull in order to assist in correcting the wind-overturning moment.

The boats comprise a one-design development class. However, unlike most one-design sail classes which have fixed rules, F50 boats are constantly developed, with changes generally being implemented on all boats simultaneously. This prevents technological arms races, while allowing performance improvements.

Table 1 Particulars of the 2020 Version of the F50 Catamaran

Inaugural Year	2019
Number built	7
Builders	Core Builders Composites, New Zealand
Crew	5
Crew mass limit	438 kg (average 87.6 kg per sailor)
Hull type	Foiling catamaran
Length overall	15 m
Beam over foils	8.8 m
Rig type	Wing-mainsail and jib
Mast length	24 m (option for 18 m and 29 m in future)
Sail area	100 m^2 (for 24 m high mainsail)
Sail flap area	Approx. 50% of sail area
Total mass	Approx. 2500 kg
Mainsail mass:	Approx. 450 kg
Top speed	52+ kn
On-board cameras	3
On-board microphones	3

While the F50 boats originate from the AC50 design, with some having previously been AC50 boats, the entire fleet has been extensively modified with new main foils and board cases, new rudders and aft foils, new hydraulics and electronics, a new cockpit layout for five rather than six crew, a new steering system, and a new flight-control system operated by a combination of joy sticks, twist grips and push buttons. The beam fairings and systems have also been refined to allow more efficient pack-up and assembly.

The main foils are constructed with higher-modulus carbon fibre, and the geometry has been modified to provide more righting moment and increase the boat speed prior to the onset of cavitation. With the new foil arrangement, the 8.80 m beam across the main foils is larger than that on the AC50 boats.

While the rudders themselves are also carbon fibre, the horizontal foils at the base of the rudders are manufactured in high-strength stainless steel to permit a geometry with reduced drag.

To support the frequent transportation of the F50s between events, they can be disassembled and shipped in standard 40 ft containers. To that end, the forward sections of the demihulls can be detached via a flanged joint. The boats can be re-assembled and readied for racing at each venue within 48 h of arrival at the event village.

Geometry

A general understanding of the F50 design can be gained by a study of Figure 1 and Figure 2. It is a remarkable characteristic of these boats that, while the hydrodynamic forces on the foil act below the water surface and the aerodynamic forces act on the sails well above the water surface, the boat travels at near level trim and with very little heel.

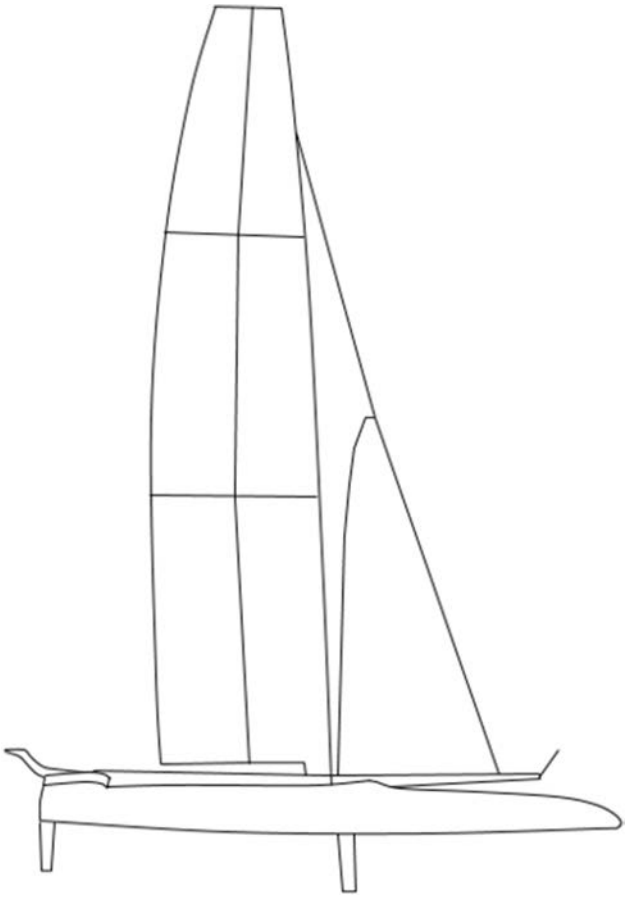

Figure 1: Profile of foils, demihulls and sails
(Image courtesy SailGP)

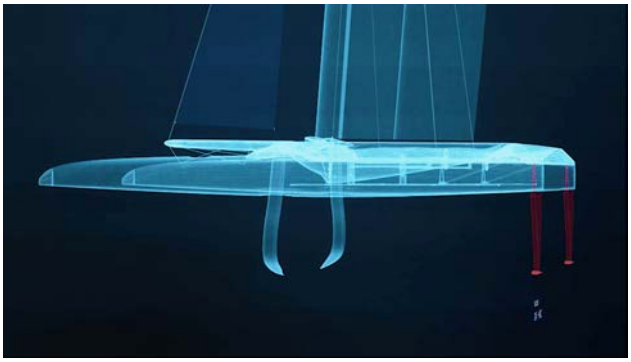

Figure 2: Perspective view of boat
(Image courtesy SailGP)

The ability to maintain a near-horizontal attitude can be explained by reference to Figure 2. The two main lifting foils are located near midships. During sailing on a leg of the race, the windward foil is typically retracted free of the water. Hence the horizontal portion of the leeward foil primarily supports the mass of the boat while the predominantly vertical portion or strut of the foil generates a lateral resistance to the sail force as a result of the sideslip (yaw angle) that is generated when the boat is under way. The off-centre lift forces combined with the off-centre crew mass on the windward hull produce a heel-correcting moment to counter the heel-disturbing moment created by the two sails.

The pair of stern rudder-foils serve several purposes: steering, pitch stability and an additional heel-correcting moment as teams have become proficient in employing a downforce on the windward rudder foil since the Cowes race last year.

It should be stated that, traditionally, hydrofoil craft fall into two general types: the earliest type was the surface-piercing foil in which the foils were either in a ladder arrangement or possessed a dihedral angle of 35 to 45 degrees. The stability of such craft relative to the water surface is achieved naturally due to the fact that increased submersion of the foil (for whatever reason) will generate increased lift, thus restoring the boat to the desired equilibrium condition. Most of the earliest sailing hydrofoils from the 1950s onwards adopted surface-piercing foils.

The second and more sophisticated hydrofoil type is fitted with fully-submerged foils, as in the F50 class being discussed here. Such foils provide only a weak natural vertical stability. This weak stability is due to the fact that the lift does drop off (to a small extent) should the foil approach the water surface. This free-surface phenomenon depends essentially on the ratio of the depth of submergence of the foil relative to the chord of the foil. This form of stabilisation has been successfully employed on former Soviet passenger hydrofoils intended for river and lake use, but is not viable for offshore operation.

The F50 foils have a very thin section which has less resistance at high boat speeds and reduces the risk of cavitation. Unlike the AC50 boats which were constrained by class rules, the geometry of the F50 main foils has been extended outside the maximum beam of the boat which provides more righting moment, and they now also have a smoother transition between the vertical and horizontal sections of the foil. All of this translates into significantly-higher ultimate boat speeds, where the onset of cavitation on the foils occurs at a much higher speed as compared to a foil designed under the AC50 class rule. Two main and rudder foil configurations can be fitted to the boats, one set for lighter wind conditions with greater foil area and another with less area for stronger winds and, hence, faster sailing speeds. It is understood, that during the races on Sydney Harbour, the smaller foils were installed on the first day of races and the larger foils were selected on the second day based on wind forecasts.

Flight Control

Without effective passive stability, fully-submerged foil systems must be supplemented by an active control system in order to maintain the desired condition of level flight at the design height above the water surface.

The precise details of how the flight-control system functions is not made clear in the technical material available on the official website of SailGP. It is, however, understood that boat handling is still largely controlled directly by the crew. SailGP indicate that iXblue Quadrans gyrocompasses and inertial navigation systems are fitted to the boats to provide highly-accurate and reliable heading and attitude data for precise control of the aero-hydrodynamic performance of the craft, and that “crews need the highest-grade roll, pitch and heading inputs in order to have very precise control of their boat and to be able to react quickly at great speeds”. Both the main foils and the rudder T-foils are able to be adjusted in rake (or pitch attitude) and are controlled by the flight-control system. This control applies to both the trim correction and steering of the boats.

The helmsman can control the flight of the boat through

twist grips on the steering wheel while ride height, the jib sheet, and the rudder foil differential are adjusted with push buttons on the steering wheel. The helmsman can also adjust the rate of these adjustments through a dial in the centre of the steering wheel. The flight of the boat is also controlled through a joystick managed by the flight controller. The ride height of the boat can be adjusted independently of the trim of the boat. Once again, this is understood to be managed by the crew and there was no obvious evidence of any radar or ultrasonic flight height-sensing system.

With these multiple configurations to manage, teamwork and communication remain key to achieving speed and efficiency.

Behind-the-scenes Tours

Aside from arranging for spectator boats and spectator transfers to Shark Island, SailGP also organised a series of behind-the-scenes tours of the pit-lane garages on Cockatoo Island. These tours, with a duration of about 30 min and consisting of small groups of visitors, were held in the days prior to the races. Tours were hosted by experienced sailors, even if not specifically F50 sailors. They commenced with an informative verbal and video introduction to the SailGP series. This was followed by a walk past the team hangar tents allowing reasonably close inspection of the hulls, foils (Figure 3) and wing-sails. Explanations were given of what could be seen, and questions were fielded by the guides during the tour.

Figure 3: A main foil removed from a boat showing its complex geometry and a temporary protective strip applied to its trailing edge
(Photo courtesy Martin Grimm)

It was also possible to view boats being lifted from the water (Figure 4) followed by removal of the wing-sail and rudder foils (Figure 5). Boats are stored in tent hangars with a pair of 40 ft shipping containers making up each side wall of the team tent (Figure 6) while wing-sails were all stored together in one tent. The technical support teams that prepare, maintain and repair the boats are a shared resource between all teams.

The visit to Cockatoo Island also provided an ideal opportunity to wander around the former shipbuilding and maintenance precinct which is supported by signage and self-guided audio tours.

Figure 4: The Danish team boat being lifted from the water showing new wing-sail with flaps and four spanwise segments
(Photo courtesy Martin Grimm)

Figure 5: Technical support crew removing a rudder foil to allow the boat to be lowered onto its transport dollies
(Photo courtesy Martin Grimm)

Figure 6: The French team boat stored in the tent hangar constructed in part from the 40-ft containers used to transport the boats between events
(Photo courtesy Martin Grimm)

Races

The Sydney races this year spanned two days, namely 28 and 29 February. Three races were scheduled each day with the final day involving a match race between the top two teams. There were also practice races on February 27.

There were seven competitors in 2020. These represented Australia, Denmark, France, Great Britain, Japan, Spain, and the USA. The Spanish and Danish teams joined the series this year while the Chinese team which competed in 2019 has discontinued this year. The aim in the longer term is that teams will consist of nationals from each country. However, for the near term, teams may include experienced hydrofoil sailors from other countries, an example being the Australian Nathan Outteridge as helmsman of the Japanese team.

One nominal track of the course is reproduced in Figure 7. However, the arrangement of the course is decided on the day depending on the prevailing wind conditions. Indeed, on 28 February, the course was adjusted between races as winds shifted.

Figure 7: Typical course configuration of SailGP races in February 2020
(Image courtesy SailGP)

All data recorded from the boats are transmitted to the team coaches via the Oracle Cloud, giving them the ability to analyse performance and communicate with their crews at pre-determined times during a race. These communications are broadcast, giving spectators a greater appreciation for the reasons why one crew may be outperforming another.

The recorded data are also being used to create a unique second-screen experience via the SailGP App where fans are able to select up to two teams to follow and receive key performance insights from their boats. The information is all integrated into an informative race broadcast.

The Great Britain team, with helmsman Sir Ben Ainslie, performed consistently well on both days, finally winning the match race against the Australian team with Tom Slingsby at the helm.

Close-up photographs of the boats in action are shown in Figure 8 and Figure 9. These two pictures clearly show the boats travelling on just three foils; that is, the windward main foil has been retracted. While risky, there is potential to lower the windward foil to generate an additional downforce for additional heel-correcting moment and allow a greater sail driving force and, in turn, higher boat speeds.

Figure 8: Australian contender supported on three foils
(Photo courtesy SailGP)

Figure 9: Great Britain contender supported on three foils
(Photo courtesy SailGP)

A field of fully foilborne boats, with the exception of the French team (which suffered damage from a collision and had to withdraw for the first day) is shown in Figure 10. At high foilborne speeds, the F50 boats sailed with a characteristic slight bow-down trim attitude as seen in Figure 11. This is their equilibrium attitude when the windward rudder foil is driven to a maximum negative incidence while the leeward rudder foil is driven to maximum positive incidence.

Future Developments

Despite its record-breaking debut last year, SailGP is constantly looking to improve the world's fastest sail racing and for Season 2, a new modular wing-sail has been developed which was intended to be used throughout the class from the San Francisco SailGP onwards, but which already featured on the Danish and Spanish team boats in Sydney. There had been insufficient time to complete the manufacture of the new wing-mainsail for all the boats. However, the height and area of the sails were reported

Figure 10: Majority of the field of boats
(Photo courtesy SailGP)

Figure 11: Australian and US boats foilborne,
displaying characteristic bow-down trim
(Photo courtesy John Jeremy)

to remain the same. The new sail is constructed of four spanwise sections which can be assembled together in varying lengths (Figure 12). Initially a section of constant chord length can be removed to reduce the sail height from the normal 24 m all-purpose rig to an 18 m heavy-air rig. The design has been developed with the ability to also configure the sail for a 29 m height for light-air conditions. This will enable the F50 catamarans to compete in a wider range of weather conditions to appeal to spectators on all occasions. Vital mass savings have also been achieved through a more advanced wing structure and the removal of rigging and cables inside it, replaced by hydraulic lines and actuators.

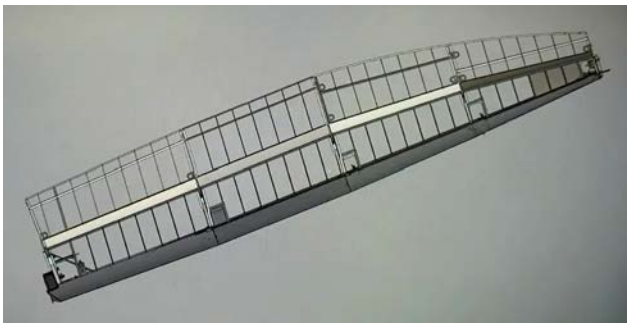

Figure 12: CAD Image of the new wing-sail structure
(Image courtesy SailGP)

The new wing-sail design is also reported to provide for greater available wing twist through its series of flap elements. This is a favourable feature because the natural wind is characterised by a thick boundary layer with some metres of height above the water. Because of the forward speed of the boat (which is generally at some angle relative to the prevailing wind), the relative angle of attack of the wing-sail varies in the spanwise direction. Thus it is advantageous to be able to aerodynamically match the sail angle properly at each spanwise location. The design allows for a continuous twist profile from sail foot to head to avoid gaps between segments, thereby reducing vortex shedding and induced drag at the segment joints.

Acknowledgement

The authors extend their thanks to Tom Speer, who has been associated with the development of the AC50 and F50 boats, for clarification of aspects of the design and performance of the boats, and to Sacha Kemp from SailGP media for additional advice.

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EDUCATION NEWS

Australian Maritime College

AMC is Number One

The University of Tasmania's Australian Maritime College (AMC) has been ranked No. 1 of all member universities, for global engagement and research, in the latest International Association of Maritime Universities (IAMU) benchmarks.

The IAMU is the governing body for global maritime training organisations and collects data from its member universities annually.

AMC Principal, Michael van Balen, said that the results gave a strong endorsement of the quality of the AMC as an institution, its research and education endeavours, and its engagement program.

"The AMC provides quality specialist education, training, research and consultancy, which enable graduates and clients to succeed in the maritime domain," Mr van Balen said.

"Along with other members of the IAMU, we seek to inspire and educate a new cohort of maritime students by leveraging our unique expertise, skills and partnerships in the maritime sector.

"The IAMU recognition helps increase awareness of the AMC as a national Australian establishment and a globally-recognised training, education and research institution. It will also promote visibility of our student and staff achievements and highlights the unique expertise offered through the AMC."

The latest rankings are part of the IAMU's benchmarking project PIMET (Performance Indicators in Maritime Education and Training), which was started in 2016 and involved data collection on a voluntary basis from IAMU member universities in 2017, 2018 and 2019.

The IAMU has 65 universities/academies/faculties of the world's maritime education and training institutions, and the Nippon Foundation, as its members.

AMC Design Project

The 2020 AMC Design Project has again been structured to simulate a large concept design development. This year it focusses on concepts provided by the Blue Economy CRC (see https://blueeconomycrc.com.au/). Here teams are required to design either a multi-use platform, a general purpose offshore base ship, or a large offshore base ship. The system, though, must produce 30 000 tonnes per annum of salmon as well as be in a position to produce excess energy from the platform, all done whilst minimising environmental impact.

How is this done? With a lot of coordination, firstly by AMC lecturers, but soon this will be taken over by the students. As design coordinator, Jonathan Binns would like to thank some of our industry collaborators for 2020, the Blue Economy CRC, Revolution Design, Lloyd's Register, Dr Alex Robbins, Mr Greg Cox and Dr Brett Morris.

Gregor MacFarlane

UNSW Sydney

Undergraduate News

Graduation

The graduation ceremony for the School of Mechanical and Manufacturing Engineering was due to be held on 6 May, but, due to COVID-19 social-distancing restrictions, UNSW Sydney made the decision to not hold the May graduation ceremonies.

However, the following degrees in naval architecture have ben conferred:

Max McCann	BE (Hons) Honours Class 2 Division 2
Gianluca Viluce Correa	BE (Hons) Honours Class 2 Division 1
Isabella Yan	BE(Hons) H1 and University Medal

Isabella's University Medal deserves special mention, as this is the highest undergraduate honour. She is the fourteenth to be awarded the University Medal of our 405 graduates so far in naval architecture at UNSW Sydney, and the first since 2011.

UNSW has three more naval architecture students to graduate when they complete all non-naval architecture courses and industrial training for their degrees.

Prize-giving

The School's prize-giving ceremony is usually held on the same day as the graduation ceremony but, due to COVID-19 social-distancing restrictions, the School made the decision to not hold the May prize-giving ceremony.

However, the following prize has been awarded in naval architecture:

The David Carment Memorial Prize and Medal for the best overall performance by a student in the final year went to Isabella Yan.

Congratulations, Isabella!

Phil Helmore

Isabella Yan, University Medallist and winner of the David Carment Memorial Prize
(Photo courtesy Stef Salamanca Clavijo)

Training Australia's Research Engineers

Dr Elizabeth Vagg, Senior Administrator, Australian Maritime College and
Prof. Jonathan Binns, Director, Research Training Centre for Naval Design and Manufacturing

The Design of Marine Structures

The design of a marine structure — whether a ship, a submarine, an autonomous underwater vehicle or some form of floating or fixed platform — is a complex process if the resulting structure is to be operational, functional and efficient. The factors to be considered include the overall shape and size of the structure, the materials used, the processes in its manufacture and maintenance, the in-built systems, their placement and interconnectivity.

However, there is another aspect which is vitally important. The design, build, maintenance and sustainment of maritime structures requires the development of teams of highly-skilled personnel who can work together collaboratively across a range of areas, people who understand the systems and processes, can identify problems, suggest solutions, design appropriate modifications and implement them, and share their findings more widely for the benefit of the wider industry.

ARC RTCNDM

An example of a project which encompassed not only research on various aspects of marine structures but also the development of a cohort of skilled engineers was presented at a showcase event in Canberra on 10 March 2020. In 2014, a consortium of three Universities, two Defence organisations and the six partner organisations received a grant from the Australian Research Council (ARC) under the Industrial Transformation Research Program to train a group of research engineers for the maritime defence industry. The main objective of the consortium, known as the ARC Research Training Centre for Naval Design and Manufacturing (RTCNDM), was to develop a cohort of engineers and researchers who were broadly skilled, industry focussed, and aligned to the requirements for naval shipbuilding and design. This cohort would be part of a collaborative network of engineering researchers across industry, universities and government which could enable more rapid and efficient innovation and evolution in the design, construction and sustainment of naval vessels and platforms.

The RTCNDM commenced operations in 2015, the partner organisations being the Australian Maritime College (University of Tasmania), Flinders University, University of Wollongong, the Defence, Science and Technology Group (DST Group), Defence Materials Technology Centre (DMTC), ASC, Austal, Babcock, PMB Defence, Serco and Thales. Since then, it has enabled the training and development of nine doctors of philosophy (PhDs) and four post-doctoral fellows while, at the same time, advancing collaborative research in nine key areas of relevance: lithium-ion batteries, inspection robots, anti-fouling acoustic sensors, multiple welds on submarine hulls, corrosion of aluminium, underwater shock and submarine structures, ship survivability: hardening vs defensive systems, unsteady loading of hydrofoils and maritime asset management.

Prof. Jonathan Binns, RTCNDM Director, explains the focus of the ARC Training Centres
(Photo courtesy AMC)

Contribution to Research

As the Training Centre draws to a close, the individual research projects have each produced outcomes useful to the efficient design, construction and sustainment of naval vessels or platforms. While there are some restrictions on the release of the details of the research, the following results were obtained:

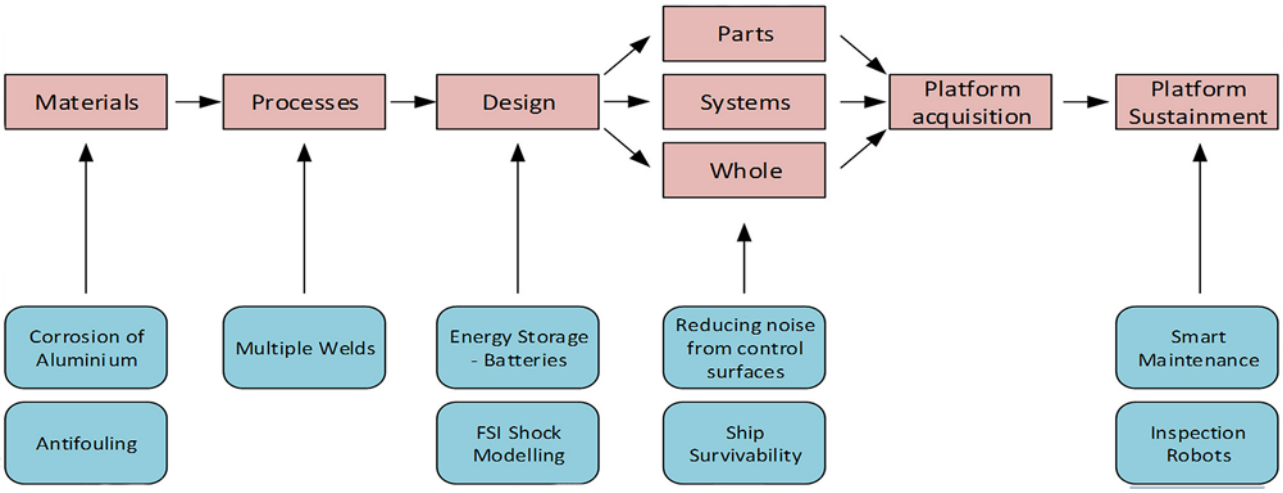


Figure 1: Research topics

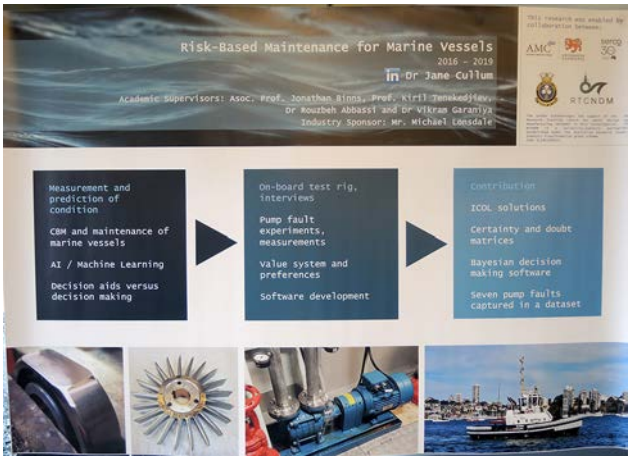
- New, safer separator materials for use in lithium-ion batteries were designed and implemented.
- The response of underwater platforms to explosive loads was modelled, resulting in information pertinent to the design and placement of equipment.
- A method to establish acoustic response estimations was validated and used to test various anti-fouling coatings.
- A method of condition-based in-service monitoring and sustainment was validated and tested in a RAN Field Support Unit. The findings have applicability across a range of operations.
- Automated processes for two identified issues, namely 3D coverage planning and improved efficiency for specialised tasks, were developed and demonstrated using a robot. These automated processes have applicability in tasks such as the inspection of confined spaces. Motion-planning software has been released under open-source licence.
- Investigation of control surfaces and the effect of turbulence on the hydrodynamic performance of a hydrofoil led to the comparison of numerical and experimental data and the design and calibration of equipment for more detailed measurements and, hence, better control of flow-induced noise.
- A method to quantify the corrosion performance of aluminium was validated; the causes of pitting of aluminium in marine environments were established and appropriate maintenance methods proposed.
- New information was found regarding the changes to metal during welding and the effect on the metallic properties, especially in the case of multiple welds. Guidelines were proposed for improved repair processes.
- Design measures were modelled and assessed to determine the optimum design for the survivability of a vessel.

Pragathi Dissanayake (University of Wollongong) and Rowan Pivetta (Flinders University) prepare to present their research on welding processes and the use of robots in confined spaces (Photo courtesy AMC)

Key Feature of the Program

A key feature of this program was the inclusion of practical training. In addition to their research on a specific topic, each researcher spent a total of 12 months as an intern with an industry partner organisation. Together with their mentors, they were able to explore issues important to the organisation, while at the same time gaining important practical skills which would be of use in the workforce. For their part, the engineers with whom they worked raised issues that contributed to the research aspect. In some cases, additional organisations (e.g. CSIRO, ANSTO, TnE) contributed to the project, providing valuable access to programs, facilities, equipment or expertise.

The practical training included attendance at annual workshops on practical topics, such as academic writing, speaking and presentation skills, employment applications, interview techniques and preparation of CVs. Training in specific technical skills was available on an individual basis as required. Opportunities were provided for the researchers to present their work at an annual student conference, which included researchers from RTCNDM, DMTC and DSI, thus extending the peer cohort beyond the RTCNDM members. Individual researchers also presented their work at national and international conferences as the opportunities arose and submitted articles for publication in high-quality peer-reviewed journals.



Risk-based Maintenance for Marine Vessels — one of the topics investigated (Photo courtesy AMC)

Value of the Program

So, where are these young researchers now?

The four post-doctoral fellows have ongoing employment in Universities as researchers and mentors in relevant fields; three PhD students have graduated and one has been accepted for graduation; two others have submitted their theses for examination and the last three are in the process of finalising their reports prior to submission. All are currently employed in relevant naval engineering positions.

Beside the obvious benefits of their research to specific issues, was the project worthwhile?

Certainly, for the organisations involved, there is a greater collaboration between industry and research. This collaboration is valuable: industry recognises that researching an issue generates new ideas which, in turn, lead to innovative solutions which can then be tested for their suitability; at the same time, researchers see the relevance and applicability of their work and learn the practical skills involved in the implementation process. The collaboration has facilitated wider access to expertise and facilities and a sharing of resources, thus avoiding duplication and extending research translation.

John Jeremy AM (Chair of the RTCNDM Advisory Committee), discusses the Training Centre with Gerry Bluett (CAE) and Peter Davie (ASC, member of the Steering Committee and Chair, Australian Maritime Defence Centre, AMDC)
(Photo courtesy AMC)

Prof. Sue Thomas, CEO Australian Research Council, talks with researchers, Sam Smith (AMC), Dr Stephen de Candia (AMC) and Bradley Donnelly (Flinders University) about their work at DST. In the background is Dr Ian Sare, a member of the RTCNDM Advisory Committee
(Photo courtesy AMC)

The researchers themselves are part of a new cohort of engineer-researchers already in the workforce. One thing which has become clearer during the current COVID-19 pandemic is the importance of social interaction for our mental health, for work productivity and for personal support. The researchers involved in this project have developed a network of peers which extends beyond their own university into industry and defence. The interaction during the showcase event was an indication of the relationships which have been forged. It has also highlighted the value of mentors, especially in the early career years.

The Authors acknowledge the support of the ARC Research Training Centre for Naval Design and Manufacturing in this project. The RTCNDM is a university-industry partnership established under the Australian Research Council Industry Transformation Grant Scheme (ARC IC140100003).

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>.

Items included in the February 2020 e-Newsletter included:

- The role of an AMSA-accredited surveyor
- Get on My Boat (a simple guide to standards for new vessels, including standard tools such as the safety equipment list generator, navigation lights generator and propeller-shaft calculator)
- The details on NSCV level flotation (with examples)
- Use of previous state-accepted arrangements or approaches
- Recommendation for certificate of survey with conditions (including examples of acceptable and non-acceptable conditions)
- Documenting non-conformances
- AMSA's approach to modular barges

Items included in the March 2020 e-Newsletter included

- Large file transfer
- Re-accreditation matters
- Radio matters
- Gear survey comments
- Tips for conducting a load line renewal survey
- DCV welding quality control
- Simple exemptions

As examples, items on the role of an AMSA-accredited surveyor, and re-accreditation matters, are reproduced below.

Phil Helmore

The Role of an AMSA-accredited Surveyor

It has come to the attention of AMSA that an Accredited Marine Surveyor may have made representation to a foreign vessel operator that the surveyor was accredited by AMSA to assist in preparing vessels for port state control (PSC) inspections.

AMSA only accredits marine surveyors to carry out surveys of Australian domestic commercial vessels (DCVs) under the National Law.

While AMSA accepts that some accredited marine surveyors have the appropriate training, qualifications and experience to assist the operator of a vessel with preparing for a PSC or flag State control (FSC) inspection, it is misleading for a surveyor to make representations that they are accredited by AMSA to do so. Similarly, it is misleading for a surveyor to allow a vessel operator to assume that the surveyor's AMSA accreditation was with respect to the survey or inspection of RAVs or foreign vessels.

This type of misleading practice is inappropriate and future instances will be referred to the Australian Competition and Consumer Commission (ACCC) and surveyor professional associations for investigation.

In addition, towards the end of last year we received two incident reports of verbal abuse being directed at AMSA staff by an accredited surveyor. This type of behaviour is unacceptable and AMSA takes these reports seriously.

Survey Matters, February 2020

Re-accreditation Matters

Part of the process to renew your accreditation is to supply supporting documentation regarding continued professional development undertaken within the last five years. Examples of continued professional development include, but are not limited to, certificates of attendance or statements of:

- Additional qualifications
- Short courses
- Technical meetings
- Safety training
- Conferences
- Workshops
- Mentoring
- Writing publications
- Private study
- Subscriptions

[*These align closely with the continuing professional development requirements of RINA* — Ed.]

Please note that you are required to submit your application for renewal of accreditation and pay the fee no less than three months prior to the expiry of your accreditation, given that processing of an application and undertaking the associated tasks can take a number of weeks.

If you do not wish to renew your accreditation, then please advise AMSA by email.

Survey Matters, March 2020

INDUSTRY NEWS

Saab Partnership with Defence

Saab has signed an enterprise partnering agreement with the Australian Department of Defence to provide combat-management systems across all the Royal Australian Navy's major surface ships.As previously announced by Saab and the Australian Department of Defence, Saab will deliver the tactical interface to the Royal Australian Navy's fleet of Hunter-class frigates. The tactical interface will be based on Saab's next-generation combat-management system (CMS), which will become part of all the Navy's major surface ships.

"This agreement is an important milestone in our long-standing relationship with Australia and we look forward to continue building our partnership and supporting the Royal Australian Navy's capability with our combat management system" Anders Carp, head of Saab's Surveillance business area, commented.

Saab will deliver the next-generation CMS to Australia's new Arafura-class offshore patrol vessels and the Supply-class auxiliary oiler replenishment ships. Saab will also modernise the 9LV CMS currently in use in the Anzac-class frigates, and will provide the software for the future tactical interface for the Hobart-class destroyer when their current CMS is modernised.

PropCad 2020 Released

PropCad 2020 is industry-leading software for the geometric design of marine propellers. PropCad automatically prepares 2D drawings, 3D CAD models, and much more.

Improved Program Stability and Speed

All HydroComp 2020 products have been upgraded with a new internal code-and-control set. This has increased the speed and stability of the program across existing Windows platforms. These changes are largely behind the scenes, but keen users will notice some visual changes in PropCad and HydroComp's other programs.

CAD Import

The Propeller CAD Import utility includes algorithm revisions to greatly increase the supported file-size, import, and feature-extraction speeds.

Updated 2019 Classification Society Rules

PropCad 2020 includes the latest updates to the classification society rules, which determine blade thickness requirements. The American Bureau of Shipping (ABS) has introduced a consolidated rule set — the Marine Vessel Rules — which supersedes many of the previous rule sets. The Indian Registry of Shipping (IRS) Ice Class HA rule set is now included for fixed-pitch and controllable-pitch propellers.

Improved 3D Rendering Speed and Visuals

Many of the existing propeller materials have been adjusted to improve the visualisation of curvature and edge details on the blade surface. Additional rendering options have been introduced, including "hard edges" and texture options. The 3D render loops have been optimised for increased speed and stability, particularly for older graphics cards.

VEEM launches World's Largest Gyrostabiliser

On 6 March, VEEM launched the world's most powerful gyrostabiliser, the VG1000 SD. The launch function was held at their new gyrostabiliser facility, which was officially opened by the Minister for Defence, Senator the Hon. Linda Reynolds CSC.

VEEM's new 4000 m² facility has been constructed to meet the rise in demand for VEEM's gyro products, including the VG1000 SD, and will have the capacity to produce over $100 million worth of gyros annually.

VEEM's managing director, Mark Miocevich, said: "The new facility allows us to significantly ramp up the commercialisation phase of our gyro products, enhancing our ability to capitalise on the rise in customer take-up of this disruptive technology."

In addition to its gyrostabiliser range (which has significant defence applications), VEEM has developed a substantial defence business, servicing both surface and sub-surface combatants.

The VG1000 SD, with a mass of 20 t, will be delivered to the European shipbuilding giant, Damen, and installed on the revolutionary new fast crew suppliers, FCS 7011, which is expected to be launched later this year.

The VG1000 SD, generating 1000 kNm of torque, easily eclipses the second-largest gyro product which VEEM produces, the VG260, which is approximately one quarter of the size of the VG1000 SD.

Damen representative, Camiel Curfs, and event attendees were given the opportunity to witness the VG1000 SD in

action under induced precession.

VEEM's managing director, Mark Miocevich, said: "The successful completion of the VG1000 SD is the culmination of significant research and development investment into the product.

"I would like to congratulate the entire talented VEEM team, who, after years of hard work, has delivered a gyro product which is unrivalled anywhere in the world in terms of scale and quality.

"The VG1000 SD has a broad potential market, with the product best suited to vessels 60 m to 90 m in length, which encompasses luxury and superyachts, defence and civil vessels, and has further commercial applications including windfarm services, oilfield services, crew transfer and ferries.

"We are delighted to have such an internationally-esteemed shipbuilder as Damen as the first customer for the VG1000 SD, and we anticipate that the successful delivery of the VG1000 SD will substantially increase interest in the product, which will help propel long-term value for our shareholders."

The VG1000 SD will now be delivered to Damen to undergo extensive sea trials. The trials will involve fitting two model VG260 SD VEEM gyrostabilisers to a 50 m test vessel in the Netherlands, which will be subsequently evaluated by Damen management and current and potential purchasers of Damen ships.

US Navy Researching New Class of Medium Amphibious Ship

The US Navy's research and development portfolio is planned to include some $US30 million for the development of a next-generation medium amphibious ship design which will likely be based on an Australian ship designer's stern-landing vessel.

The US Marine Corps needs a ship which could move Marines around some distances, but also able to beach itself like a landing craft to offload gear and vehicles. Studies have led to a new focus on the stern-landing vessel designed by Australian company Sea Transport Solutions, which could serve as the inspiration for the medium amphibious vehicle as requirements develop and EABO wargaming and simulations take place.

Stern-landing vessel concept design
(Sea Transport Solutions image)

The Sea Transport Solutions website advertises that its stern-landing vessel design is "similar to conventional landing craft; however, the SLV design has overcome the primary problems associated with conventional landing craft, including poor head-sea capability due to the bluff bow ramp dramatically reducing speed, poor visibility due to the bow ramp, crew discomfort and fatigue due to location of accommodation directly above machinery spaces; inadequate power available when de-beaching due to propellers working inefficiently astern, and the need to overcome the forefoot suction effect," and more.

Nauti-Craft and OFFCON enter into a Development and License Agreement

Western Australian company Nauti-Craft Pty Ltd, winner of the 2018 Royal Institution of Naval Architects/QinetiQ Maritime Innovation Award for its development of the Nauti-Craft Marine Suspension System, has entered into a development and license agreement with OFFCON GmbH with the purpose of introducing a novel range of multi-purpose daughter craft to the offshore wind industry.

The first of this range of boats incorporating Nauti-Craft technology, an 18 m design, is well advanced in its development, having been supported with design assistance from Nauti-Craft over the last six months.

OFFCON has secured exclusive rights to manufacture the multi-purpose daughter craft vessels incorporating Nauti-Craft technology in Germany, with the right to sell them worldwide. This exclusivity is for a finite period and is subject to meeting certain sales performance criteria.

In a nod to the Australian DNA in this new range of boats, OFFCON has established a company to build them called Wallaby Boats GmbH. Three types planned currently are the Wallaby-18, Wallaby-16 and the Wallaby-14. The smaller boats are designed to be daughter craft with an OFFCON-patented single-point hoist which adjusts for variable centre of gravity, and the bigger boats can be large daughter craft or small crew transfer vessels.

In January this year, Yanmar and Nauti-Craft announced that both companies have entered into a technology-transfer agreement with the purpose of commercialising Yanmar's boats by utilising Nauti-Craft's patented marine suspension technology.

Cooperation between Yanmar and Nauti-Craft began in 2016 with Yanmar evaluating the technology by constructing a 10 m suspension-boat concept. Yanmar showcased the concept boat at the Japan International Boat Show in Yokohama in March 2018, where it was widely appreciated and confirmed the marketability of the technology.

Nauti-Craft will explore global market applications supported by the Yanmar group's worldwide network.

The Yanmar concept boat using Nauti-Craft technology
(Photo courtesy Nauti-Craft)

VALE

Neil Cormack

It is with sadness that *The ANA* records the passing of Neil William Cormack on 25 June 2015.

Neil was the son of William Roy (Bill) and Alice Cormack, and first lived in the house built by his father on Lot 42 in the Hundred of Port Adelaide (now 42 Roslyn St, Largs, SA), the first house in the street. He was born into a family of mariners, shipwrights and sailmakers.

He became a shipwright himself, then a naval architect, and rose to be the Senior Shipwright Surveyor with the SA Department of Marine and Harbours. His career positions included Shipwright Foreman for J.P. Clausen and Sons, former Commanding Officer RANRC at HMAS *Encounter*, the Official Measurer for South Australian Royal Yachting Association in the UK, and the Official Measurer for the 5.5-metre class at the Melbourne Olympics in 1956.

In the course of his career, Neil designed at least 17 fishing vessels ranging in length from 28 ft. (8.53 m) to 85 ft (25.91 m), including five tuna vessels, *Sirenia Pearl, Glen Morry, Hermay, Cape Baron* and *Southern Bluefin,* the crayboats *Carolyn Star* and *Nereus*, and the lineboat *Joymay*. Three of the tuna vessels were built in timber, the 85 ft (25.91 m) *Sirenia Pearl*, which was built by W.G. Porter and Sons at their Birkenhead slipway for Fairwell Fisheries of Port Lincoln, the 57 ft 6 in (17.53 m) *Glen Morry,* which was built by Culhoy Engineering for a subsidiary company, Culhoy Fisheries, of Kirkaldy, SA, and the 59 ft 10 in (18.24 m) *Hermay,* which was built by W.G. Porter and Sons at their Birkenhead slipway for Hermay Ltd of Port Lincoln. He presented a written paper on the design and construction of the first two of these vessels, *On the Building of Two Wooden Tuna Vessels in South Australia,* to a meeting of the Australian Branch (as it was then) of RINA in Sydney in the late 1960s.

His interest in square-rigged sailing ships began at an early age, when he saw them coming and going from the Largs anchorage at the end of Roslyn Street, and it resulted in an abiding love of the tall ships. He analysed the stability of a number of them, including *Herzogin Cecilie* (about which he also wrote a book) [*for a review of the book, see* The ANA, *May 2000* —Ed.], *Admiral Karpfanger* ex *L'Avenir* which was lost at sea with all hands in the vicinity of Cape Horn in March 1938 with a cargo of wheat in bags en route from Port Germein, South Australia, to Falmouth, UK, for orders under the Hamburg-Amerika flag (a report, and then a paper with Captain Roger Ghys which was published in *Marine Technology*), and *Garthneill* ex *Inverneill* (another book!) He was a Member of the International Association of Cape Horners [*membership is open to sailors who have rounded Cape Horn under sail* —Ed.], and attended their last international congress in 2003 in St Malo, France (where the first congress was held in 1937), when it became more difficult for the ageing members to travel internationally. He was awarded the St Malo Medal by the International Association of Cape Horners for his contribution to the history of the square riggers.

He also had an abiding interest in half models of ships, most built at a scale of 1/8 inch to the foot (1:96 for those who like it that way). These include *Herzogin Cecilie, Hougomont, Pommern*, and *Lawhill*. These were all made showing both the waterlines and the buttock lines, using alternating lifts of light and dark timber. He learned this method from his father who, in turn, was taught by the master tradesman, Bob Lambie, the foreman shipwright and senior loftsman at Poole and Steele's yard at Osborne. The models of *Herzogin Cecilie* and *Hougomont* lived on Neil's lounge-room wall [*for photographs, see* The ANA, *May 2003* —Ed.]

Neil Cormack presenting his *Nautical Notes* at the SSCA
(Photo courtesy Rob Smedley)

In all, Neil wrote at least twenty books, with subjects including the tall ships, the shipbuilders of South Australia, sailing clubs, and fishing vessels, and wrote many more papers on these subjects. Many of his books are in the National Library of Australia and in other libraries around the world [*for a list, see https://trove.nla.gov.au/book/result?q=exact_creator%3A%22Cormack+Neil+W+1923%22* — Ed.] He received an *Industry Stalwart* award for service to the industry from the Boating Industry Association.

Neil was a Fellow of the Royal Institution of Naval Architects, Member of the Society of Naval Architects and Marine Engineers, and a long-time member, Past President (1987) and Life Member of the Seven Seas Club of Australia. When he was able to attend SSCA meetings he would present his *Nautical Notes* which became an important part of the club's dinner format. His encyclopedic knowledge of ships, especially sailing ships, was unsurpassed.

Neil was the husband of Beth (who pre-deceased him), father and father-in law of Kathryn and Allan, Margaret and John, grandfather of five and great-grandfather of eleven. He was privately interred on 1 July 2015.

Phil Helmore

Lindsay Emmett

It is with sadness that *The ANA* records the passing of Lindsay Victor Emmett on 26 May 2020.

Lindsay was the son of Albert Victor and Joy Emmett and brother of Jo-Ann, and was born on 6 December 1944 in Newcastle, where his father, who had been gunner in the Royal Australian Navy and served in WWII, was the lighthouse keeper at Nobby's at the time and, subsequently, at Yamba. Lindsay grew up in Newcastle and Yamba, and attended Newcastle Junior Boys' High School from 1957 to 1960.

Following his father's maritime background, he commenced work with the State Dockyard in Newcastle in 1961 as an apprentice shipwright, undertaking hands-on work on a variety of craft from lifeboats to international trading vessels. He was promoted to the general drawing office and then into the design office, where he became involved in preliminary design for hull, structure, accommodation arrangements and outfitting under the guidance of the Dockyard's Technical Manager, the late Michael Pearson, a former President of the Australian Division of RINA. This work included the design of the four Freshwater-class Manly ferries which were built at State Dockyard, and preparation of the stability data for the State Dockyard's last large commercial ships, the Lake class for the Australian National Line.

A former State Dockyard colleague recalls Lindsay as one of the gentle souls of the world, softly spoken and always ready to help a greenhorn. Although the yard was in desperate need of new orders at that time, the drawing office was flat out, and they even worked some Saturdays and evenings. In the end these efforts did not bear fruit and the yard went into progressive shut down. Many staff were let go in January 1977 in one of the waves of retrenchments which saw over 2000 workers lose their jobs. It is a testament to Lindsay that he was asked to stay on as one of a number of staff to keep things ticking over [*The yard finally closed on 3 March 1987* — Ed.]

While working at the dockyard, he completed his Shipbuilding Certificate at Newcastle TAFE in 1966 and his Certificate of Naval Architecture in 1970. He then enrolled part-time in the University of Newcastle's Bachelor of Science (Engineering) degree in Naval Architecture from 1971 to 1978, graduating in 1979.

On the closure of State Dockyard, he started his own naval architecture consulting business, working with the shipbuilders, repairers and operators in Newcastle, but the income proved inconsistent and he considered alternative options. At Carrington Slipways during this period, while HMAS *Tobruk* was under construction, a colleague recalls meeting Lindsay during his undergraduate dockyard placement. He says that Lindsay welcomed questions and gave freely of his experience, clearly demonstrating that he knew what he was doing without mentioning his background and training; "He was a quiet, competent, encouraging work colleague, always with the time to help".

He moved to Canberra in 1986 to take up a position as a naval architect in the Directorate of Naval Ship Design in the Department of Defence. This position was initially in the small-craft section, undertaking safety assessments and the suitability of the small craft which the Navy wished to use. He then became the Design Manager for survey motor launches and then the Deputy Production Manager for the Navy's Anzac-class frigate project.

Lindsay Emmett
(Photo courtesy Megan Mouradian)

Lindsay moved on from Defence to the Australian Maritime Safety Authority when it was established in January 1991, sensing the opportunity to return to Newcastle with the proposed movement of AMSA Head Office. He took up the position of Deputy Chief Naval Architect in Canberra before moving into the Survey Operations area in Newcastle as part of a re-structuring in 1993. In Survey Operations, he managed the statutory plan approval aspects of Australian-flag newbuildings and coordinated the port-state control (PSC) program. He was particularly active in the activities of the Indian Ocean Memorandum of Understanding (IOMoU) on PSC. Projects which he undertook included:

- AMSA representative on the Parliamentary Joint Standing Committee on Treaties in 1996. Attending numerous annual meetings of the IOMoU's governing body, the PSC Committee, from about 2003 onwards. Lead presenter for IOMoU ISM Code training course at Pune, India, in 2005.Australian representative at the IOMOU Seminar in India in 2007.
- Evaluation of the first fellowship training course to enhance port-state inspection skills in Russia in 2008.
- Organisation of the 11th IOMoU Committee meeting hosted by AMSA in 2008.
- Technical expert for the Non-convention Vessels Standard project in Indonesia in 2009.

His knowledge of naval architecture was extensive and, apart from port-state control, he was the guru on tonnage measurement and load lines.

He retired from AMSA as Principal Marine Surveyor in May 2011 and, moving to Toronto on Lake Macquarie with his wife Aleice, became what he described as a "naval architect of leisure". He proudly retained his RINA membership in his retirement, occasionally participating in NSW Section technical meetings. He kept in touch with some of his close associates from AMSA and State Dockyard, joining both the

Australian Men's Shed Association and the State Emergency Service while also caravanning with his wife. When meeting him, either during his working life or in retirement, he never failed to express his pride in his three daughters, and the joy he shared with his four grandchildren who he referred to as his "angels".

He was something of an historian, and he wrote extensively on shipbuilding in eastern Australia and his areas of expertise, with articles on the Walsh Island Dockyard, Newcastle (*see* The ANA, *May 2004)*), State Dockyard, Newcastle (*see* The ANA*, November 2012*), and Tonnage Measurement (*see* The ANA*, August 2013*). He also compiled a list of the ships built at State Dockyard, and his list is now included in the *Register of Australian and New Zealand Ships and Boats*. He also wrote the *Vale* column for Neil Fleck (*see* The ANA, *February 2018)*.

Lindsay's wife Aleice pre-deceased him, and he is survived by daughters Megan, Lyndsay and Natalie, and four grandchildren. The funeral was held on Thursday 9 April 2020 at The Chapel, Belmont, conducted by Pettigrew Family Funerals.

Megan Mouradian
Rob Gehling
Phil Helmore

[*Many others have also have contributed to this* Vale*, and* The ANA *would like to thank Mori Flapan, Werner Bundschuh, Ray Toman, Bob Mitchell, Mel Tarlinton, Len Gillespie, Abdul Hannan* and *Glen Seeley* for their memories — Ed,]

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Tuesday 24 March 2020 by video-conference under the chairmanship of our President, Prof. Martin Renilson, in Launceston with links to Airlie Beach, Gold Coast, Sydney, Canberra, Perth and another in Launceston. The meeting was conducted under COVID-19 isolation restrictions which were escalating daily at the time and served as a trial for the video-conferencing arrangements proposed to be used for the virtual AGM the following week.

This being the final meeting before the Division's Annual General Meeting, it was also the final one before Gordon MacDonald assumed the Presidency and the last for a number of members. The full agenda included a number of on-going items, some of the more significant ones being:

Election of Vice President

Council elected Ms Violeta Gabrovska as Vice President for the coming two years.

Conduct of Division's Annual General Meeting

In view of the travel and social distancing restrictions which were being introduced by the Government, Council approved amendment of the arrangements notified in the February edition of *The ANA*, so that it would be held as a video-conference meeting at the appointed time. Council thanked Queensland section for its original offer to host the meeting and instructed the Secretary to issue updated meeting information as soon as possible.

Pacific 2021 IMC

Council endorsed the proposal for our agreement with IDSAL, organisers of the Pacific 2019 and proposed Pacific 2021 Exhibitions, to cover professional conference organiser functions for the 2023 and possibly 2025 IMCs in addition to the 2021 IMC.

Senate Inquiry into the Sovereign Naval Shipbuilding Industry

Council was advised that the Division's submission had been lodged on 20 December 2019 but the Division had not yet been invited to appear before the inquiry, although a hearing had been held on 24 February.

Members might note that, subsequent to the Council meeting, a notice appeared on the inquiry's web-page that "all previously scheduled face-to-face public hearings …… have been *postponed* until further notice".

Division Representative on Committee Reviewing the Small Boats Code

Council noted the appointment of Peter Holmes to this role with Standards Australia. Any members wishing to contribute their knowledge and experience to this review should contact Peter, either directly or through the Secretary.

Chief Executive's Visit to the Division

Council received a brief report on the visit, outlined separately below.

Sections' Nominees to Council for 2020-22

Council was notified that, following a call for nominations from Sections, Adrian Broadbent (NSW), Peter Dandy (SA-NT), Cameron Whitten (Qld) and A/Prof. Michael Woodward (Tas) had been re-appointed. The WA Section had nominated Dr Yuriy Drobyshevski and the Victorian Section Nathan Wallace to respectively replace Kalevi Savolainen and Karl Slater respectively. The ACT Section's nominee has yet to be named.

COVID-19 Response Facilities for Sections

Council was advised that RINA's video-conferencing system could be used by Sections to facilitate continuation of their committee and technical meetings during the COVID-19 crisis and, if appropriate, thereafter. Other video-conferencing options such as Zoom could be used, but Council did not intend providing additional funding for this purpose. Sections which have not done so already are invited to contact the Secretary for further information.

Next Meeting of the Division Council

The next meeting of the Division Council is scheduled for the afternoon of Tuesday 16 or 23 June 2020.

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.

Chief Executive's Visit to the Division

Our Chief Executive, Trevor Blakeley, visited the Division from 11 to 20 March. Despite daily developments, both nationally and internationally, in response to COVID-19, he managed to successfully complete most of his schedule in Perth, Tasmania and Canberra.

His first stop was in Perth for the Australian Oil and Gas Exhibition and the associated Knowledge Forum conducted by our WA Section. Notwithstanding the late withdrawal of some exhibitors and some problems with the prominence of some commercial brands on the RINA stand, he reported that the Exhibition was very successful as was the knowledge forum.

Trevor's next stop was Launceston, where Prof. Jonathan Binns organised a series of meetings in and around UTas-AMC. COVID-19 problems intervened to prevent the day-trip to Hobart for a series of meetings, but these went ahead as video-conference meetings which were also very successful and bode well for increased Tasmanian Section activity in the Hobart area.

Finally, Trevor spent a day-and-a-half in Canberra. Although meetings at UNSW Canberra, Engineers Australia and with ACT Section members had to be cancelled due to social distancing, he and I had very productive meetings with the AMSA Chief Executive and the senior officers of CASG (Defence) responsible for the naval shipbuilding program. Issues discussed included:

- AMSA looking to have RINA verify competence of its members as accredited persons for domestic commercial vessels;
- CASG would like RINA to establish channels of communication with prime contractor(s) with a view to naval architects and maritime engineers working on the various new-build contracts obtaining internationally-valid chartered status;
- Recognition by CASG of chartered engineer registration obtained through RINA;
- Reinvigoration or renewal of RINA's MoU with the old DMO, and
- Defence sharing RINA concerns with regard to supply of naval architects/maritime engineers, including technical officers, to meet the requirements of the Naval Shipbuilding Program, with remedial action to be announced in the near future.

Trevor had to bring forward his departure from Canberra to avoid flight cancellations and successfully returned to the UK just before travel restrictions tightened. He has since advised me that he has received a number of membership applications resulting from his visit which, in difficult circumstances, was an unqualified success.

Rob Gehling
Secretary

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 Division	rina.austdiv@gmail.com
Section	
ACT	rinaact@gmail.com
NSW	rinansw@gmail.com
Qld	ash@oceanicdesign.com.au
SA/NT	rinasantdiv@gmail.com
Tas	gregorm@amc.edu.au
Vic	owen.tregenza@dst.defence.gov.au
WA	rina.westaus@gmail.com

Phil Helmore

THE INTERNET

RINA Webcasts

RINA has set up a YouTube channel and all 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 Jim-Ray Semanhiya <jsemanhyia@rina.org.uk> at RINA HQ for uploading.

To find a presentation made prior to the last three months, use 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.

Victorian Section Webcasts

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

- *Domestic Commercial Vessel Survey in Australia: The Changes in Regulation and Privatisation of Survey*, presented by James Nolan, Naval Architect/Marine Surveyor, Marine Survey Australia, to the Victorian Section of RINA on 13 December 2018 at the Mission to Seafarers in Docklands, Melbourne.
- *RSV* Nuyina: *Australia's New Icebreaker,* presented by Clive Evans, Maritime Systems Lead, RSV *Nuyina* Project, Australian Antarctic Division, to the Victorian Section of RINA on 21 November 2019 in the Deloitte Building at 55 Bourke St, Melbourne.

Further recordings will be added as they occur.

Jesse Millar

NSW Section Webcasts

The NSW Section has not uploaded any new webcasts within the last three months.

Further recordings will be added as they occur.

Phil Helmore

WALTER ATKINSON AWARD

A PRIZE FOR THE BEST WRITTEN PAPER FOR THE BEST WRITTEN PAPER PRESENTED TO A RINA FORUM IN AUSTRALIA IN 2019-20

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

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

The Award comprises three components:

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

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

A nomination must be a written paper, not simply a presentation, first presented either at a RINA Section technical meeting or RINA-supported conference in Australia, or first published in a RINA-supported publication in Australia (e.g. *The ANA*). Eligible conference papers include those presented at the Pacific 2019 International Maritime Conference and the RINA Knowledge Forum at the Australian Oil and Gas Expo.

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

Visual presentations are not eligible unless they reflect the content of the presenter's written paper. Nominations of papers published in the period 1 July 2019 — 30 June 2020 must be received by the Secretary no later than 17 July 2020.

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

Mail	PO Box 462, Jamison Centre, ACT 2614
email	rinaaustraliandivision@gmail.com or ausdiv@rina.org.uk
Phone	0403 221 631

NAVAL ARCHITECTS ON THE MOVE

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

Pierre de Chateau Thierry has moved on from Lloyd's Register and has taken up the position of Business Director, Marine and Offshore, Australia, New Zealand, Papua New Guinea with Bureau Veritas Australia in Sydney.

Rob Dunbar moved on from ThyssenKrupp Marine Systems Australia in 2017 and returned to Australian Maritime Technologies to take up the position of Managing Director in Melbourne.

Tim Gates has moved on from BMT Defence and Security and has taken up the position of Head of Engineering — Defence with Serco Asia Pacific in Canberra.

Edward Hawkins has moved on within the Australian Energy Market Commission and has taken up the position of Adviser, in Sydney.

Jun Ikeda has moved on from Trident Energy in Equatorial Guinea and taken up the position of Deputy Installation Manager for the Merakes subsea tieback project with TechnipFMC Malaysia, but has now returned to Australia and is working from home due to COVID-19 restrictions.

David King moved on from Orica in 2014 and, after some time at Hanwha Corporation, has now taken up the position of Head of Strategy with Hanwha Mining Services in Sydney.

Nick Kitching has moved on within Navantia Australia and has taken up the position of AIR9000 PSD Engineering Co-ordinator in Adelaide.

Matthew Klingberg has moved on within Austal and has taken up the position of Project Manager in the Pacific Patrol Boat Replacement Program at their shipbuilding facility at Naval Base, WA.

Steve Kretschmer continues as Director of SK Marine, moving on from Chevron in 2018 and, after some time at EDG and Sapura Energy Berhad, has taken up the position of Removals and Disposals Manager with ConocoPhillips in Perth.

Tony Laubreaux continues consulting as Laubreaux Marine in Noumea, New Caledonia.

Ian Laverock has recently retired from the Australian Border Force and is now getting used to life as a retiree, but keeping his hand in as a member of the ACT Section and nominee to the Australian Division Council of RINA, and Engineers Australia committees in Canberra.

Matthew Laverty continues as a naval architect with Riviera Group in Coomera, Qld.

Jake Law has moved on from Clough and, after some time at Saipem, Maersk Drilling and DONG Energy, in 2018 moved to INEOS Oil and Gas where he has now taken up the position of Asset Integrity Manager in Copenhagen, Denmark.

Regina Lee completed her Bachelor of Medicine/Bachelor of Surgery (MBBS) degree at the University of Notre Dame and, in 2018, took up the position of Medical Doctor with UNSW Health in Sydney.

Holley Lees moved on from DOF Subsea in 2014 and took up the position of Engineer with Tasmanian Parks and Wildlife in Hobart.

Geoff Leggatt has moved on within INTECSEA and has taken up the position of Naval Architecture Team Lead in Perth.

John Lembke has moved on from DOF Subsea and, after some time at McDermott Australia and Silver Yachts, has returned to McDermott Australia and taken up the position of Principal Installation Engineer in Perth.

Percy Lentin has moved on within DNV GL and, having returned from postings in China, is continuing his work with newbuilds out of the Perth office.

Richard Liley has moved on within Austal and has taken up the position of Head of Production in Fremantle, WA.

Jason Steward has moved on from DNV GL and has taken up the position of General Manager Defence with Varley in Newcastle.

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

Phil Helmore

The Japanese icebreaker *Shirase* departing Sydney on 21 March 2020 after a port visit on the way home to Yokosuka after her summer resupply voyage to Antarctica.

Completed in May 2009, *Shirase* is operated by the Japanese Maritime Self-defence Force. With a displacement of about 20 000 t she is 139 m long and 28 m in beam. Diesel electric propulsion on two shafts with fixed-pitch propellers delivers 22 000 kW for a maximum speed of 19.5 kn. She can make 3 kn in 1.5 m thick ice.

Her complement is 175 and she has accommodation for 80 scientists. Cargo capacity is 1100 t and she can carry three helicopters (Photo John Jeremy)

FROM THE ARCHIVES

AURORA AUSTRALIS

John Jeremy

In March this year, Australia's icebreaker *Aurora Australis* arrived in Hobart for the final time after more than three decades of service with the Australian Antarctic Program. Known to many as the 'Orange Roughy', *Aurora Australis* carried more than 14 000 expeditioners on over 150 scientific research and resupply voyages to Australia's Antarctic and sub-Antarctic stations.

From 1947 to this year, eighteen ships have provided resupply services to Australia's Antarctic stations, including well-known vessels like HMAS *Wyatt Earp* (1947–48), four Lauritzen 'Dan' ships (1953–87) and even HMAS *Stalwart* (1985). One of the best known of these ships was Lauritzen's *Nella Dan*, named after Nel Law, wife of the Antarctic Division's Director, Phillip Law.

Completed in 1961, *Nella Dan* set a new standard for polar vessels. She was 75.5 m long, had a maximum speed of 12.5 knots and could carry 34 passengers originally, later increased to 42. In December 1987, during a visit to Macquarie Island, bad weather caused the ship to drag her anchor and she ran aground just metres from the island. Although salvage was initially planned, the decision was finally made to scuttle the vessel in deep water.

Despite her many years of service, *Nella Dan* was not ideal for the resupply task as work in Antarctica increased. In 1977 studies began into the requirements for and design of a new specialised ship equipped with long-range helicopters capable of station resupply and service as a platform for marine research and surveillance activities. Design studies continued through 1983, with interest being sought world-wide for the design of a suitable ship for Australia's needs. The requirements were soon varied as air transport of personnel to Antarctica became practicable.

Finally, in 1986, the decision was made to call tenders for a new ship to be built in Australia and chartered to the Antarctic Division. In December 1987, a contract was awarded to P&O Polar Australia. The construction contract for the new Research Survey Vessel (RSV) was awarded to Carrington Slipways at Tomago in New South Wales and the ship was designed by Wärtsilä Marine Industries of Finland. RSV *Aurora Australis* was launched on 18 September 1989 and completed on 30 March 1990.

The new ship was a considerable improvement on the ships which had preceded her. She is 94.91 m long with a beam of 20.35 m. Her deadweight capacity was 3991 t and she is propelled by two medium-speed diesel engines driving a single controllable-pitch propeller for a maximum speed of 16 knots. She could accommodate 140 persons — 24 crew and 116 passengers.

Aurora Australis served Australia well and has earned her place in the history of Australia's Antarctic and Southern Ocean research.

Progress with the construction of Australia's new Antarctic research and supply vessel at Carrington Slipways on 29 May 1989
(Photo courtesy Martin Grimm)

Aurora Australis making a splash at her launching on 18 September 1989
(Photo courtesy Martin Grimm)

Aurora Australis at work in Antarctica
(Photo by Doug Thost, courtesy Australian Antarctic Division)

The third and last of the RAN's new air-warfare destroyers, NUSHIP *Sydney*, arriving in Sydney on 27 March 2020 after her delivery voyage from Adelaide (RAN photograph)