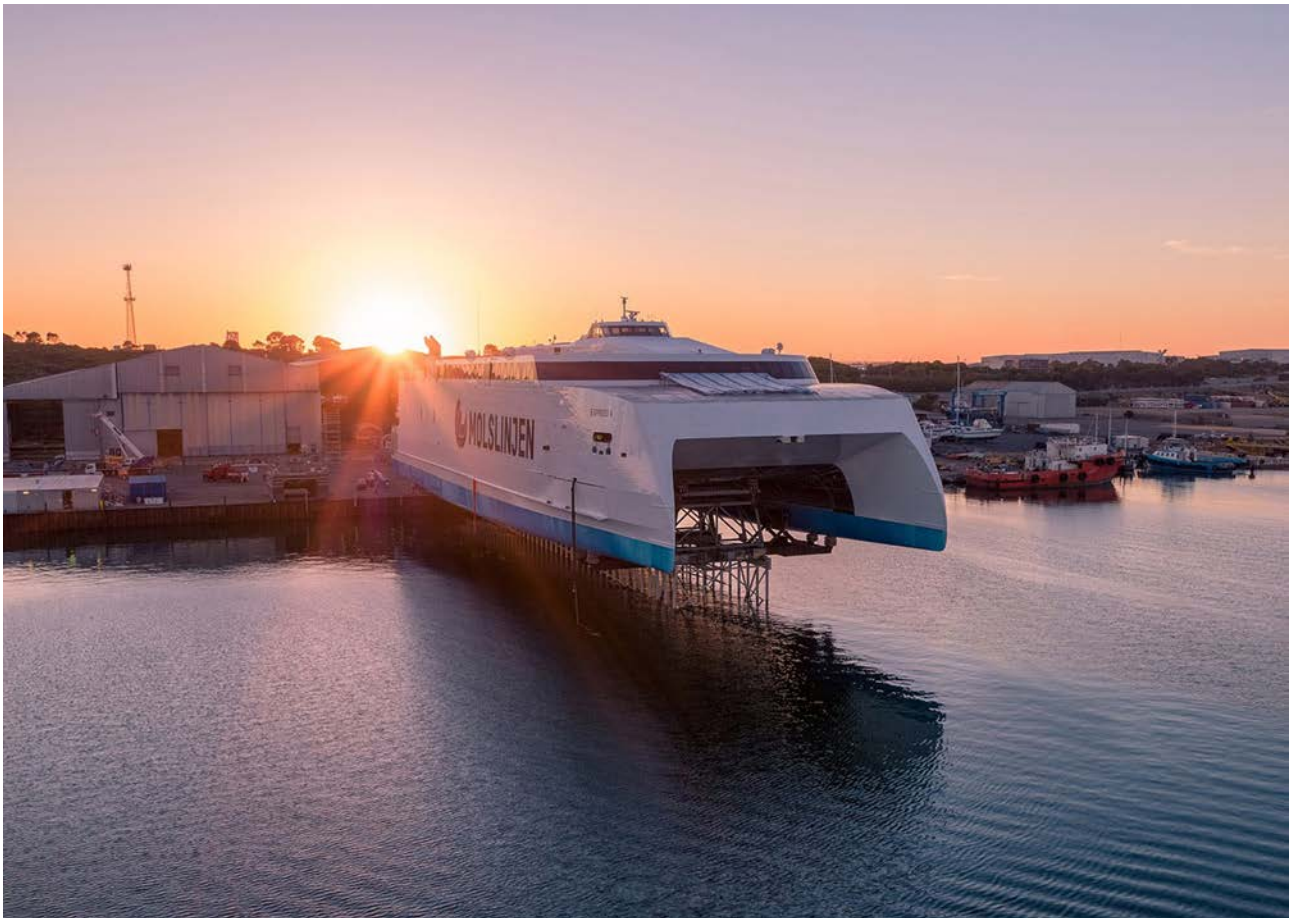
THE AUSTRALIAN NAVAL ARCHITECT



Volume 22 Number 4
November 2018

Night flying trials with F-35B Lightning fighter jets have been conducted during October off the United Kingdom's largest warship, HMS *Queen Elizabeth*.

The new carrier has been fitted out with specially-designed LED lightning on her flight deck to aid night-time landings.

During the trials, conducted off the east coast of the United States, pilots initially used only ambient light and the lights on the carrier's deck, before later conducting landings using the night-vision capability in their helmets.

HMS *Queen Elizabeth* is on track to deploy on global operations from 2021

(Photo courtesy Lockheed Martin)

THE AUSTRALIAN NAVAL ARCHITECT

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

Volume 22 Number 4
November 2018

Cover Photo:
Ready for launching — the Austal-built Auto Express 109 m high-speed vehicle/passenger ferry *Express 4* for Molslinjen of Denmark was launched on 29 October
(Photo courtesy Austal)

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

The Editor
The Australian Naval Architect
c/o RINA
PO Box No. 462
Jamison Centre, ACT 2614
AUSTRALIA
email: jcjeremy@ozemail.com.au

The deadline for the next edition of *The Australian Naval Architect* (Vol. 23 No. 1, February 2019) is Friday 25 January 2019.

The Australian Naval Architect
ISSN 1441-0125

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

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

CONTENTS

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

From the Division President

Welcome to another great edition of *The Australian Naval Architect.* As usual, it is full of very interesting information for us in the field, and we are really fortunate in Australia to have this superb publication.

I have mentioned in this column before that the Institution is conducting a strategic review, and that one of the working groups is looking at the publication policy. This is considering enabling the exchange of technical information through the Institution's publications, conferences and local meetings, including:

- scope, structure and delivery of conferences, workshops and seminars;
- scope and structure of publications; and
- how information is disseminated — printed, digital, online, social media, etc. — for future needs and expectations of the membership.

There is certainly a strong trend in general to move more and more to short snippets of information delivered electronically in a frequent manner. I personally get quite a number of such electronic newsletters, and find that I don't always have the time to read all the information that is coming to me — all for free! However, I'm not really sure that this is the sort of thing that the Institution should be moving towards.

We ought to be concentrating on more in-depth stories, including technical articles. However, there is now also quite a large number of peer-reviewed journals in our field, and it is not straightforward to see what the Institution's niche should be. Many years ago we held the Spring Meetings in London every year. These were well attended, and papers presented there were at the pinnacle of our profession. The discussions, and authors' replies, were recorded and all reproduced in the annual *Transactions* — a nice blue-covered volume. I recommend that people to read through some of these old papers, along with the discussions. Some of them are quite interesting, and one can imagine the discussions going on at the Spring Meetings — but things have moved on.

I'm very interested in any thoughts regarding the direction of the Institution's publications which members may have. This is a very fast moving field, and I'm perhaps a bit out of my depth regarding the latest electronic communication technologies,

There is also the question about the future of conferences, and how the Institution should handle these. There are so many these days, a lot of which are regular events every two or three years, often run by academics primarily designed for other academics and researchers in their field. Most of the papers at these are deep technical ones in specific areas. There also seems to be an increasing number of conferences run by commercial conference-organising companies. In these cases some of the papers are just advertorials for the presenters' companies. However, often they are useful networking events, particularly when held in conjunction with an exhibition.

Again, it is not clear to me what the Institution's role regarding conferences should be into the future, and I'd certainly appreciate your thoughts on that role.

Martin Renilson

The Institution is also conducting a strategic review of how to best increase the internationalisation of the Council. Australian Division members may not be aware that it is now possible for Council members to attend the International Council meetings without being present in London. Until recently the technology for doing this has not been wonderful; however, the Chief Executive is putting considerable effort into improving the electronic conference facilities, so this will be a lot better in the future.

As President of the Australian Division, I am an ex-officio member of the International Council, so I attend most of them by teleconference (although I do manage to get to them when I am in the UK). Our Secretary, Rob Gehling, used to be a member in his own right; however, his term has expired. I recommend that members of the Australian Division consider nominating for Council, so that we can achieve a good representation for Australia. Members who may be interested could contact either Rob Gehling or myself for further information about how to nominate, and what the role entails.

On that note, members of the Australian Division who are interested in joining the Australian Division Council should be aware that nominations will be due by 21 December — see the information about this elsewhere in this edition. Again, if you are interested in putting your name forward, please feel free to contact either me or Rob Gehling for further information. The Australian Division is only as good as those on the Council can make it!

I recently attended the Final Year Research Project Conference at AMC. There were about 90 papers arranged into six parallel sessions. I couldn't attend all of them, but those that I did were generally impressive. This is all the more so when you consider that a large number of these students are from overseas and English is not their first language.

Equally impressive was the fact that over 30 external people

from the maritime industry came to assist with the assessing. Of course, most of them were from outside Tasmania, and those that I spoke to were impressed with the quality of the students. I know that some were there touting for future staff.

Eric Gubesch was awarded the prize for best presentation which was sponsored by the RINA Tasmanian Section and AMSA. There is more information about this elsewhere in this edition. Students and graduates are the future of our profession and it was really great to see such enthusiasm.

Readers will be aware that the decision regarding the design of the future frigate for Australia, SEA 5000, has been made and that the Commonwealth Government has chosen the British BAE design over its competitors. The Australian version is to be known as the Hunter Class. What is interesting is that, subsequent to the Australian decision, the Canadian Government also chose the same design for its new frigate.

Discussions continue regarding Australia's future submarine. Obviously I am not privy to the negotiations which are ongoing between the Australia and French, but I do read a lot in the press complaining about how long this is taking. However, it is important to realise that the details of the Strategic Partnership Agreement are really important if we are going to get a "regionally superior" submarine which can be maintained and upgraded throughout its lifetime. Thus, we must get it right now, and I feel that this may be what is influencing these negotiations.

Of course, there are always those in the public who criticise anything that the Government and, in particular, Defence, does. Most of this seems to be based on ignorance, such as the well-publicised criticism of the use of a pumpjet for these boats. Pumpjet technology is highly sensitive and we are very lucky that the French are prepared to share this with us. Some of the nonsense that I've read in the public domain about why we shouldn't be using pumpjets is really quite incredible. At the risk of putting in a plug for my book on *Submarine Hydrodynamics*, people should read the section on pumpjets in that before saying anything.

On a different note, I was concerned to read that Austal's computer system had been hacked. Of course, I have no idea what this means, but it doesn't sound good. Hacking technology seems to be improving rapidly, and the "arms race" may now be between those that hack and those that try to stop it occurring. Unfortunately, many of us don't understand what is going on and we don't comprehend the sophistication of what is possible for hackers to do. I've been involved in different defence-related organisations, and each seems to have its own protocols. Perhaps there needs to be a lot more awareness for those of us that don't understand.

The Institution is organising a stream again at the Australasian Oil and Gas Conference (AOG) in Perth, 13–15 March 2019. The stream topic is *Offshore Marine Technology* and it will provide a forum for interaction of all professionals in the area of offshore structures, naval architecture and marine operations. Presentations from industry experts will reflect on the current and future technologies and will focus on engineering innovation in the changing industry conditions. This is being run again by the WA Section, which has formed a dedicated AOG Sub-committee. Please contact Yuriy Drobyshevski on yuriy@bigpond.com if you would like any further details, or are able to assist.

There has been a lot of criticism in the press recently about foreign students coming to Australia and learning our technologies which they can adapt to improve their country's defence capabilities when they return home. I wonder whether the negative aspect of this is really somewhat over exaggerated. I'd like to think that the very sensitive technologies are kept well and truly under lock and key (including from Australian students with no security clearance), and presumably this is being monitored by DST Group when it is partnering with a university.

Of course, the universities argue that they need to have these foreign students to generate the income necessary to run their program. I don't want to get into arguments about funding levels at Australian universities, but I see a far more important benefit to Australia by allowing these students to come and study here. Whilst here, they'll learn about our values and how our democracy works. Hopefully, they'll appreciate our form of government, and our lifestyle, which will influence them when they return home.

The Institution is one of only four non-governmental organisations participating in the IMO correspondence group which is finalising the Second Generation Intact Stability Criteria. The guidelines being prepared provide specifications for direct stability assessment procedures for the following stability failure modes: pure loss of stability; parametric roll; surf-riding/broaching; dead-ship condition; and excessive accelerations. These will be submitted to the next meeting of the Sub-Committee on Ship Design and Construction. Please contact me if you would like to know more about this important new development for ship safety.

Finally, I want to mention that I am planning to attend the Queensland Section's social event on the Gold Coast on 30 November. Although I've been to Queensland a few times over the last couple of years, this will actually be my first visit to a Queensland Section meeting since becoming President. Of course, I will also be attending the SMIX Bash in Sydney on 6 December. I hope to see as many members at these two events as I can.

Martin Renilson

Editorial

In the May 2018 edition of *The Australian Naval Architect* we reported on the second visit to the wreck of Australia's first submarine, HMAS *AE1*, where she lies over 300 m down on the sea floor off the Duke of York Islands in Papua New Guinea. The visit, in April, was made possible by the provision of the research vessel *Petrel* by Microsoft co-founder Paul Allen, who sadly died on 15 October at the age of 65. The expedition returned with around 25 hours of high-definition video and 8367 still images of wreck.

Over the following months a very detailed analysis was undertaken of the submarine which provided more clues as to the possible reason for her loss. This study has been summarised in a 180-page report, *Research Vessel* Petrel *Baseline Survey of HMAS* AE1, which was released by Find AE1 Limited and the Australian National Maritime Museum on 14 September 2018, the 104th anniversary of the submarine's loss.

Examination of the very high quality images of the wreck revealed that the ship's ventilation valve in the pressure hull is about 60% open, confirming earlier views that the submarine was probably lost due to a diving accident. The open valve could have caused rapid flooding of the engine room, resulting in loss of control and causing the submarine to sink below crush depth. The implosion of the submarine forward of the engine room would have resulted in the instantaneous death of the crew. We will never know why the ventilation valve was not shut.

The ocean is a very unforgiving environment.

Australia's first submarines, *AE1* and *AE2*, were completed only 12 years after the Royal Navy commissioned its own first submarine. The submarine service had expanded very quickly in the years prior to World War I, and accidents were not uncommon. The E-class submarines were very advanced for their time and were the backbone of the RN submarine service during the war years. Of the 56 built, 21 were lost.

As I write this on Remembrance Day 2018, I am reminded of the responsibility which falls upon those who design, build and maintain submarines, to ensure that they are not only fit for purpose, but safe. Those of us who were involved in the maintenance and refit of Australia's Oberon-class submarines were very aware of this responsibility. That program began in the aftermath of the loss of USS *Thresher*. *Thresher* was a new submarine which was lost on 10 April 1963 during her test deep dive after her post-delivery availability. The submarine passed below collapse depth (about 725 m) and imploded, with the hull fragmenting into six major sections.

The official inquiry into the loss of the submarine favoured the theory that a water pipe subject to full diving pressure failed, which caused loss of electric power and the reactor to scram (shut down) at a depth at which propulsive power was necessary for the submarine to surface. An alternative theory suggests that short-period line-frequency instability of the main electrical bus caused the main reactor coolant pumps to shut down resulting in an immediate scram of the reactor.

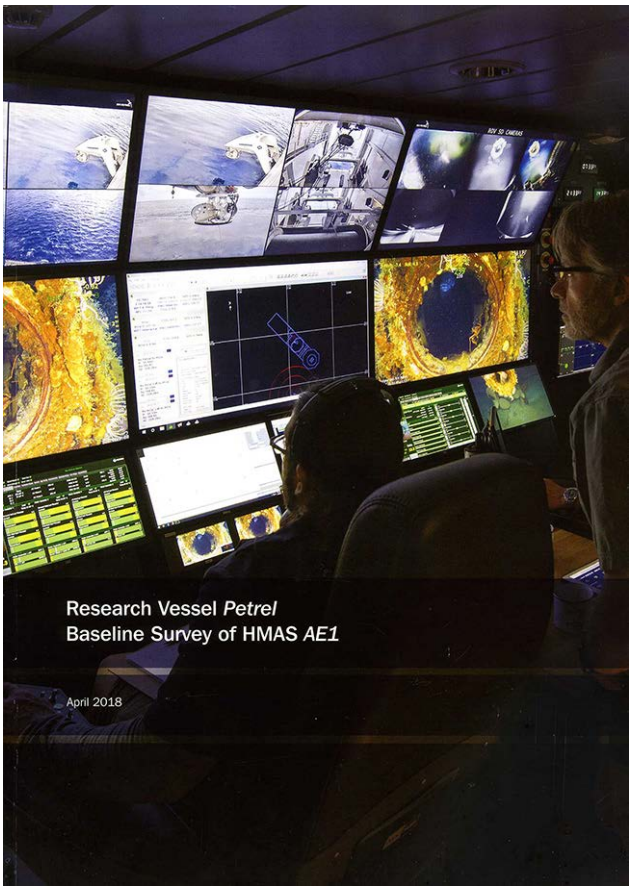
Whatever actually caused the loss of *Thresher*, the subsequent examination of systems in other submarines revealed disturbing defects and the initiation of the Submarine Safety Program (SUBSAFE). SUBSAFE was a quality assurance program intended to ensure that submarine systems were defect free and that the submarines were safe to operate as designed. From 1915 to 1963 the US Navy had lost 16 submarines from non-combat related causes but, after the SUBSAFE program began, lost only one, USS *Scorpion,* in 1968.

In Australia a formal quality assurance system and rigorous testing program was introduced for the Oberon-class submarines which borrowed much from the practices adopted for the construction of nuclear submarines in Britain in the post-*Thresher* period.

Modern submarines are much more complex than *AE1*, yet the environment in which they work is just as demanding, if not more so. I feel sure that those involved in the construction and maintenance of the RAN's submarines today are also very conscious of the responsibility they bear for the safety of those who go to sea in them.

The operation of a successful submarine service demands teamwork between those who take the submarines to sea and those who, through their essential work ashore, enable them to do so. It is a relationship fostered through close cooperation and detailed knowledge of the submarines acquired during design and construction. The importance of this relationship is sometimes overlooked by those who are critical of Australia's future submarine construction plans.

John Jeremy



The latest report on the submarine *AE1* can be downloaded from the Australian National Maritime Museum's website www.anmm.gov.au

imc 2019

PACIFIC INTERNATIONAL MARITIME CONFERENCE

INTERNATIONAL CONVENTION CENTRE SYDNEY, AUSTRALIA

8 - 10 OCTOBER 2019

PRELIMINARY ANNOUNCEMENT AND CALL FOR ABSTRACTS

KEY DATES

- Abstract Submissions Open & Call for Papers
  19 November 2018
- Abstract Submission Deadline
  15 March 2019
- Author Acceptance Notification
  12 April 2019
- Registrations Open
  13 May 2019
- Refereed Paper Submission
  14 June 2019
- Full Paper Submission Deadline
  26 July 2019
- Early Bird and Presenter Deadline
  9 August 2019

The **IMC 2019** Pacific International Maritime Conference, to be held in conjunction with the ***PACIFIC 2019*** International Maritime Exposition, will offer insightful presentation in to all facets of ship and submarine technologies, including:

- Commercial Ship Technology
- Naval Ship Technology
- Submarine Technology
- Commercial Ship Operations
- Shipbuilding and Sustainment
- Maritime Safety
- Maritime Environment Protection
- Offshore Resource Industry

Organised by The Royal Institution of Naval Architects, Institute of Marine Engineering, Science & Technology and Engineers Australia, **IMC 2019** will coincide with the prestigious Royal Australian Navy Sea Power Conference and the ***PACIFIC 2019*** International Maritime Exposition which is organised by Industry Defence and Security Australia Limited.

Abstract submissions open from 19 November 2018 and prospective authors are invited to submit an abstract relating to the conference program topics in accordance with the instructions on abstract format and guidelines available on the conference website menu.

Abstracts are to be submitted online at
www.pacificexpo.com.au/imc2019

For further information contact the
PACIFIC 2019 International Maritime Conference Secretariat at:
PO Box 4095, Geelong VIC AUSTRALIA 3220 **P**: +61 (0)3 5282 0543 **F**: +61 (0)3 5282 4455 **E**: imc@amda.com.au
www.pacificexpo.com.au/imc2019

COMING EVENTS

NSW Section

The nineteenth SMIX (Sydney Marine Industry Christmas) Bash will be held on Thursday 6 December aboard the beautifully-restored *James Craig* alongside Wharf 7, Darling Harbour, from 1730 to 2130. This party for the whole marine industry is organised jointly by RINA (NSW Section) and IMarEST (NSW–ACT Branch). Join your colleagues in the maritime industry and their partners for drinks and a delicious buffet meal on board the unique 19th century iron barque. Dress is smart casual, but absolutely no stiletto heels! Cost is $60 per head.

Those wishing to attend this Sydney Marine Industry Christmas Party should purchase their tickets through www.trybooking.com. Search for SMIX and follow the prompts. Payment only accepted by Visa and Mastercard.

Alternatively, you may mail your details (including names of guests and your email address for confirmation of booking), together with your cheque, to the RINA (NSW Section) Treasurer, Adrian Broadbent, at 27 Manning St, Queens Park NSW 2022.

There is a maximum limit of 225 attendees on the James Craig and we have had to turn away members and friends in previous years; so you are urged to book early.

AOG2019

Australasian Oil & Gas Exhibition (AOG) is a three-day event being held from 13 to 15 March 2019 at the Perth Convention & Exhibition Centre in Perth.

Following its successful participation in AOG in previous years, the Royal Institution of Naval Architects will again be organising a conference stream at AOG 2019. Expressions of interests and submissions of abstracts were sought from members of the international maritime industry, and closed on 30 September.

The RINA conference stream *Offshore Marine Technology* will cover offshore structures, naval architecture and marine operations, and provide a forum for the interaction of all professionals in the area of offshore structures and vessels. Submissions which reflect the current oil and gas market, and focus on its economic implications and engineering innovation in the offshore industry have been targeted.

Attendance at the conference stream will be complimentary for the AOG Exhibition delegates.

For more information about AOG Events and the 2019 conference, visit http://aogexpo.com.au/conference/overview/, or for details of the RINA conference stream, contact the WA Section Committee at wa@rina.org.

Pacific 2019 International Maritime Conference

The Pacific 2019 IMC, organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia, will be held in conjunction with the Pacific 2019 International Maritime Exposition at the International Convention Centre in Sydney from 8–10 October 2019.

Abstract submission is now open, see details on Page 5.

HPYD7

HPYD is the series of conferences on high-performance yacht design organised by the Royal Institution of Naval Architects NZ and the University of Auckland. The first conference was held in December 2002. Since then, the conferences in 2006, 2008, 2012, 2015 and 2018 have showcased the latest developments in yacht research from around the globe. The conference enables naval architects, engineers, designers and researchers to present and hear papers on the current state of high performance yacht and power craft technology.

The High Performance Yacht Design Conference HPYD6 took place in Auckland, NZ, on 10–13 March 2018 during the stopover of the Volvo Ocean Race. Due to a lack of high-quality technical abstracts submitted, the HPYD committee made the decision to change the format of the HPYD6 conference. As such, there was no publication of papers and no formal conference presentations. Instead, there was a focus on providing a range of exciting, publicly-accessible presentations and keynote addresses delivered by some of the top designers and engineers involved in the America's Cup and Volvo Ocean Race.

Planning for HPYD7 has already begun. It will coincide with the America's Cup in Auckland in 2021, and will return to the more traditional format with a full complement of papers and speakers.

You can follow HPYD on Facebook, LinkedIn or sign up for their mailing list to receive the latest news.

See www.hpyd.org.nz for more details or, for general information, email info@hpyd.org.nz; or for sponsorship opportunities: sponsorship@hpyd.org.nz

The RAN at work — HMAS *Melbourne* (foreground) on standby to conduct a replenishment at sea with USNS *Carl Brashear* (centre) (RAN photograph)

NEWS FROM THE SECTIONS

Western Australia

The Western Australian Section is proud to announce our involvement in next year's AOG 2019. We will have a booth at the event and will be organising a stream of presenters as part of the Technical Forum. Invited speakers will present across the disciplines of Renewable Energy, Offshore Installation, Marine Operations and Floating Systems. Organisation of the event is supported by Trevor Blakeley, the RINA Chief Executive, who will also be attending the event.

To date the line-up of confirmed speakers and subject areas include:

David Field of Icon Engineering (Perth), will be talking about new subsea technology in the form of the innovative CAN-Ductor which inserts a drilling conductor into the sea floor using suction pile technology thereby reducing drill rig time in the field and offering reduced costs and lower operational risks. The technology is deployed from conventional anchor handlers.

Ian Sherrington of Waves Group (London) will be talking about the European offshore wind energy market. Waves Group over the past twenty years have been a leader in establishing the technical design and installation requirements for fixed and floating wind farms. Ian will share his learnings and offer insights into the offshore development of renewable energy in Australia.

Jan Flynn of Woodside Energy (Perth) will offer insights into the synthetic storm approaches to modelling and evaluating planning criteria at specific sites. This includes the variation in storm scenarios, such as cyclones in North Western Australia, which offer significant challenges in predicting characteristics such as intensity, frequency, scale and track.

Captain Walter Purio is the CEO of the LNG Marine Fuel Institute (Perth) which is seeking to realise environmental benefits and energy security across Australia. Walter has been instrumental in raising the profile of LNG as a future ship fuel and solution to Australia's energy security. Walter will share progress of the adoption of LNG-fuelled bulk carriers in Australia.

Jeff Baker of Lloyd's Register (Perth) will discuss the challenges involved with bunkering LNG-fuelled ocean-going vessels, through truck-to-ship, shore-to-ship or ship-to-ship LNG transfer. Jeff is the business development manager for Lloyd's Register Australasia.

Abstracts and speaker biographies will be available as we get closer to the event.

To embrace local expertise and developments in naval architecture, RINA WA Section is seeking expressions of interest for short electronic poster presentations in the form of an e-poster, run from the RINA booth.

Electronic posters will be delivered on a flat-screen monitor and allow for animation, audio, and video to enhance interactions between the presenter and the audience. The e-posters will be scheduled during the AOG session breaks and held at RINA's booth. Each presenter will be allocated 15 minutes with an additional five minutes allowed for discussion. The content of each e-poster will be required to be technically sound, follow the stream guidance areas noted, and be non-commercial, for consideration and acceptance by the RINA WA Sub-Committee.

Expressions of interest in the form of an abstract should be submitted to RINA for consideration to wa@rina.org.uk .

Over the past couple of months, a committee has been working together with AOG and RINA London to ensure that RINA puts its best foot forward. This is an exciting step for RINA here in Australia and in the West as the energy and mining industries re-emerge from a few quiet years.

Tim Gourlay

New South Wales

Committee Meetings

The NSW Section Committee met on 4 September and, other than routine matters, discussed:

- SMIX Bash 2018: Committee has met and arrangements are progressing; bookings to open soon.
- TM Program 2019: Proposals for presentations at technical meetings in 2019 were canvassed, and half a dozen to be followed up.
- Emails: Process for sending emails from Australian Division to section members to be checked.
- Professional Affairs Committee: Jason Steward has accepted an invitation to re-join the Professional Affairs Committee of RINA in London.

The NSW Section Committee also met on 30 October and, other than routine matters, discussed:

- SMIX Bash 2018: Registrations have started slowly, and we need the booking information to be disseminated more widely; sponsorships are being sought to reach our target.
- TM Program 2019: Proposals for presentations at technical meetings in 2019 have been checked, with more to be followed up; a CBD venue to be trialled.
- Recording of Technical Presentations: Ways and means of recording presentations to be checked.
- RINA Logo: Use of the RINA logo on shirts, etc., to be checked.
- Discount for members for registration at Pacific 2019 IMC to be checked.

The next meeting of the NSW Section Committee is scheduled for 12 February 2019.

Environmental Solutions for Ships

Daniel Bellagamba, Account Manager Australia East Coast and New Zealand with Wärtsilä Australia, gave a presentation on *Environmental Solutions for Ships* to a joint meeting with the IMarEST attended by 24 on 4 September in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Daniel began his presentation with a brief introduction to Wärtsilä Corporation, which currently employs nearly 19 000 professionals at 110 locations in 70 countries around the world. The company's annual turnover is of the order of

€5 billion, providing marine solutions, energy solutions and services. Marine solutions (34% of total business) comprises the five segments merchant, offshore, cruise and ferry, navy and special vessels (such as fishing vessels, dredgers, etc.), and provides a comprehensive solutions portfolio. Daniel focussed his presentation on three areas: propulsion efficiency, exhaust gas cleaning systems, and ballast water management.

Propulsion Energy Efficiency

The aim here is to lower the environmental footprint through propulsion efficiency solutions. Key drivers for energy efficiency include the need to cut costs and improve operational efficiency, maritime regulation, and technological advancements.

The target of energy efficiency is to minimise the energy consumed during the whole lifecycle of a vessel. Fuel is the major contributor to the operating cost of the ship. Benefits include:

- Direct cost savings: Savings increase and investment payback time shortens as fuel costs increase.
- Increased competitiveness: Better profitability, offering a possibility to invest in further differentiation and increased revenues.
- Positive effect on brand image: Minimising the environmental footprint with compliance to current and upcoming regulations.

Propulsion efficiency plays an important role in the reduction of fuel consumption and the operational costs of vessels. Wärtsilä has decades of in-house experience of hydrodynamics, extensive knowledge and experience of the entire ship system which helps to develop efficient propulsion systems, can optimise solutions to specific customer requirements, utilises the latest numerical methods for calculations such as computational fluid dynamics (CFD) and model testing, and so can help improve a vessel's energy efficiency.

Here Daniel showed a video on propulsion energy efficiency and some of the improvements which can be made by way of propeller design, wake-improvement devices, propeller boss cap fins, Costa propulsion bulbs, nozzles and two-speed gearboxes [*This video is available at https://www.youtube.com/watch?v=zlxugrT0Zx4&t=14s* — Ed.]

Propeller Optimisation

For a typical propeller, the engine power is distributed as follows:

Rotational losses	5%
Frictional losses	15%
Axial losses	20%
Efficiency	60%
Total	100%

If a vessel changes its operating profile, then there is often a change in operating speed, new powering requirements, different optimal propeller characteristics, and the existing propeller design may not be suitable for the actual vessel operation. For an optimal solution, the requirements must be determined: Is it fuel savings? An increase in bollard pull? Solution of noise and vibration issues? Solution of cavitation erosion analysis? Wärtsilä can investigate the optimal propulsion system by way of a fixed-pitch or controllable-pitch propeller, and any of the devices shown in the video above.

Here Daniel gave an example of a fixed-pitch propeller optimisation:

Item	Original	New Design
Propeller dia. (m)	8.900	9.000
No. of blades	6	5
Blade area ratio	0.95	0.70
Mass (t)	101	65
Efficiency gain		3.6%

The larger diameter increased the propeller efficiency, and the reduction in number of blades and blade area ratio reduced the frictional losses.

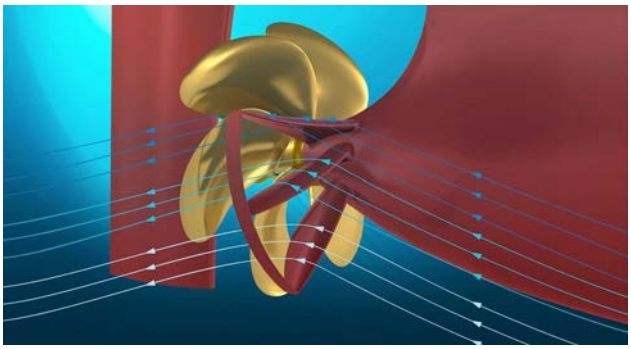
And an example of a controllable-pitch propeller optimisation:

Item	Original	New Design
Propeller dia. (m)	7.000	7.000
No. of blades	4	4
Blade area ratio	0.68	0.55
Blade mass (t)	5.5	4.5
Efficiency gain		4.5%

The reduction in blade area ratio reduced the frictional losses.

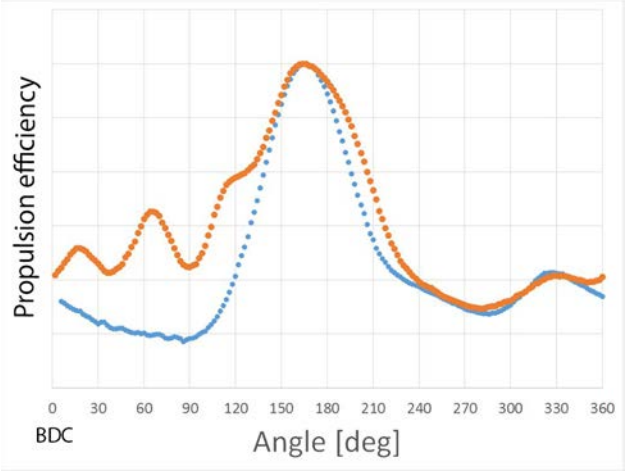
Wake Improvement Devices

Wake improvement devices aim to improve the inflow to the propeller by guiding one side of the stern flow in the opposite direction to the propeller rotation, generating pre-swirl. Devices such as Wärtsilä's EnergoFlow consist of multiple curved fins and a ring attached to the ship's hull to prevent the power losses which typically occur in a propeller's slipstream. The curved fins enhance the propeller's efficiency while keeping resistance at acceptable levels. The ring reduces the tip vortex and levels out the peak stresses which occur in severe loading conditions such as slamming.



Wärtsilä's EnergoFlow wake improvement device
(Image courtesy Wärtsilä)

The propeller blade efficiency varies during one revolution depending on the local inflow due to the wake field. The blue curve in the accompanying diagram shows the variation in blade efficiency over one rotation for a four-bladed propeller. After applying Wärtsilä's EnergoFlow, efficiency increases mostly between 0° and 120°, which is the zone of the upward-moving blade, as shown by the orange curve.



Efficiency gain due to Wärtsilä's EnergoFlow wake improvement device
(Image courtesy Wärtsilä)

Propeller Boss Cap Fins

Propeller boss cap fins aim to reduce rotational losses. The cap fins reduce the boss vortex strength significantly and recover kinetic energy from induced rotation. They are applicable to all vessel types, and provide an average energy saving of 2%. The EnergoProFin is Wärtsilä's device.

The vortex coming from the propeller can cause cavitation damage on the rudder. Installing cap fins can reduce rudder damage due to reduced boss vortex, and installation of the cap fins does not affect the manoeuvrability of the vessel.

Installation of the cap fins can be performed by a shipyard during dry-docking, or afloat with the help of divers, typically taking one day.

Wärtsilä has had more than 190 EnergoProFins installed since their introduction, and can provide service engineers for local installation support.

Nozzles

Nozzles, or the application of ducted propellers, are suitable for vessels with high propeller loads, such as tugs, trawlers, seismic vessels, dredgers, and the like. Typical benefits include an increase in bollard pull, and a reduction in noise and/or vibration.

Process

A typical process for a Wärtsilä propulsion optimisation takes place in three stages:

1. Quick Scan

This involves an investigation of the operating profile, propeller diameter, number of blades and optimal RPM, with rudimentary calculations and a rough estimation of savings. This results in a one-page report which is free of charge.

2. Detailed Study

This involves a propeller pre-design and an accurate calculation of savings, and results in a full report.

3. Engineering Project

This involves model testing, and all documentation required for manufacturing and installation, production and testing.

Propulsion Examples

Here Daniel gave a number of examples of vessels which Wärtsilä had investigated and for which they had provided propulsion energy efficiency improvements, including a large fishing vessel, a fleet of twelve 9000 TEU container vessels, a twin-screw ferry, a fleet of six 6700 TEU container vessels, a ro-ro container vessel and a coaster.

Exhaust Gas Cleaning Systems

Daniel next turned the focus onto exhaust gas cleaning systems, and began with a world map of the existing and future emission control areas (ECAs). Existing areas include the east and west coasts of the USA and, in Europe, the North and Baltic Seas. Future areas include the coasts of Mexico and the remaining coasts of Europe, the coasts of Japan, and some coasts of China.

The International Maritime Organization (IMO) is standing its ground on the enforcement of the 2020 sulphur cap which means that, as of 1 January 2020, ships will be banned from burning any marine fuel with a sulphur content above 0.5%. IMO's Sub-Committee on Pollution Prevention and Response (PPR) has approved draft amendments to the MARPOL convention on the prevention of pollution from ships (MARPOL Annex VI) to prohibit the carriage of non-compliant fuel oil. The exception would be ships fitted with an approved "equivalent arrangement" to meet the sulphur limit—such as an exhaust gas cleaning system or so-called "scrubber"—which are already permitted under Regulation 4.1 of MARPOL Annex VI. More than 70 000 ships will be affected by the regulation.

In a recent report, Clarkson Research stated that more than 25% of the global orderbook is confirmed with a scrubber. However, this only translates to 3% of the entire fleet. Clarkson data suggests that come 1 January 2020, when the sulphur cap kicks in, up to 90% of the global merchant fleet will be relying on more-expensive compliant fuel to power their ships.

Alternatives for Reducing SOx

For the 2020 deadline, there are essentially four choices available:

- Using very-low-sulphur fuel oil or compliant fuel blends (0.50% sulphur). This requires only a small investment and is flexible, but has a high operating cost based on present fuel prices, and there is a question mark about availability of such fuel.
- Switching from high-sulphur fuel oil to marine gas oil or distillates. This requires only a small investment and is convenient, but has a high operating cost and there is a question mark about future availability.
- Retrofitting vessels to use alternative fuels such as LNG or other sulphur-free fuels. This solution also reduces NOx and particulates, but has a high investment cost, and LNG is not yet widely available.
- Installing exhaust gas cleaning systems (scrubbers), which allow operation on regular high-sulphur fuel oil. This works with high-sulphur fuel oil, has the lowest total life-cycle cost, is used everywhere and is easy to operate, but the payback period depends heavily on the fuel price difference between low-sulphur and high-sulphur fuel oils.

Considerations

The global demand for distillates is likely to increase, so the price of MGO is expected to increase while the price of HFO is expected to stay the same or even decrease.

Scrubbers have been demonstrated to work in the marine environment, and allow for the same bunkering and same engine operation as before. European and North American sulphur ECAs are already in force, and more are expected. Wärtsilä has a large portfolio of marine scrubber solutions which are fit for new buildings and retrofits, and for any engine and boiler brands.

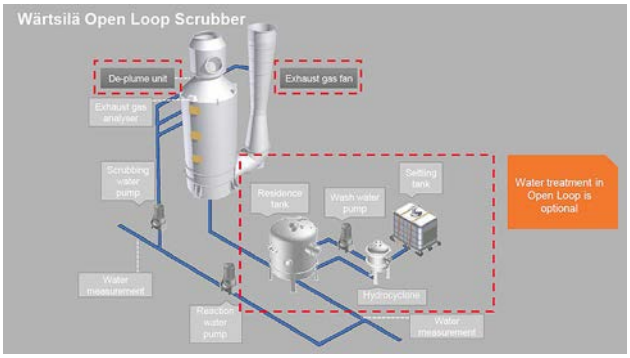
Wärtsilä Scrubber Systems

Wärtsilä has three types of scrubber systems:

Open-loop Scrubber

This system operates in an open loop utilising seawater to remove SOx from the exhaust. Exhaust gas enters the scrubber and is sprayed with seawater in three different stages. The sulphur oxide in the exhaust reacts with water and forms sulphuric acid. Chemicals are not required since the natural alkalinity of seawater neutralises the acid. Wash water from the scrubber is treated and monitored at the inlet and outlet to ensure that it conforms with the IMO discharge criteria. It can then be discharged into the sea with no risk of harm to the environment.

This is the main alternative for ocean-going ships and an easy solution.



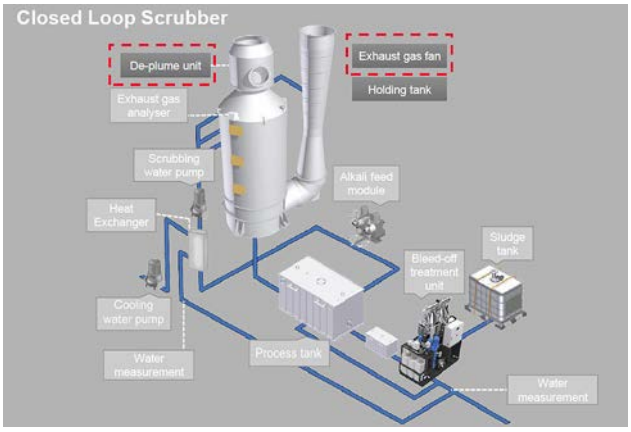
Wärtsilä's open-loop scrubber system
(Image courtesy Wärtsilä)

Closed-loop Scrubber

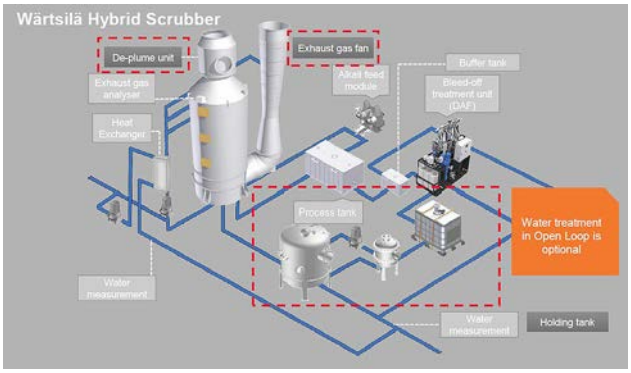
In this system, the exhaust gas enters the scrubber and is sprayed with sea water which has been mixed with caustic soda (NaOH). The sulphur oxides in the exhaust react with this mixture and are neutralised. A small bleed-off is extracted from the closed loop and treated to fulfil IMO requirements. Cleaned effluents can be safely discharged overboard with no harm to the environment. If operation in zero-discharge mode is requested, then the effluent can be led to a holding tank for scheduled and periodical discharge. This would be the choice for seas with extremely low alkalinity and for operators looking for continued closed-loop operation.

Hybrid Scrubber

Hybrid solutions have the flexibility to operate in both open- and closed-loop modes. This provides a flexibility of operation in low-alkaline waters as well as the open ocean. The hybrid approach enables operation in closed loop mode when required, for instance whilst in port and during manoeuvring, using NaOH as a buffer. The system can be operated in zero-discharge mode for a limited period. When at sea the switch can be made to open-loop using only seawater.



Wärtsilä's closed-loop scrubber system
(Image courtesy Wärtsilä)



Wärtsilä's hybrid scrubber system
(Image courtesy Wärtsilä)

This would be the choice for ships requiring full flexibility of operations.

Scrubber Examples

Here Daniel gave a number of examples of vessels which Wärtsilä had investigated and for which they had provided scrubber solutions, including a 70 000 dwt product tanker, *Harmony of the Seas* (the biggest cruise vessel with the biggest scrubbers!), *Clipper Quito* and *Clipper Posh* (the first of a series of very large gas carriers), and *Thalata* (car carrier). To date, Wärtsilä has supplied over 310 scrubbers, mainly to container vessels (30%), but including VLCCs, tankers, ro-ro vessels, bulk carriers, cruise vessels, ro-pax vessels and trawlers.

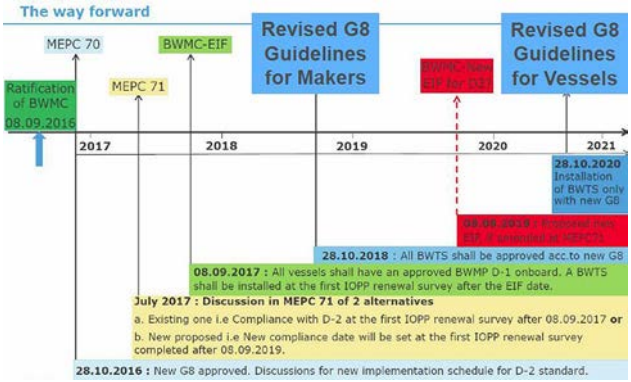
The lead times for a project are typically 8–10 weeks for feasibility and budgeting up to the award of a contract, and then 9–10 months for engineering, procurement, construction, installation, testing and trials.

Ballast Water Management Systems

Daniel next turned the focus onto ballast water management systems, and began with a video of the threat posed by ballast water transport and Wärtsilä's systems [*This video is available at https://www.youtube.com/watch?v=M2oAol_dxPY* — Ed.], followed by details of the implementation schedule required by IMO's *Guidelines for Approval of Ballast Water Management Systems (G8)*, adopted on 28 October 2016.

Ballast water treatment systems which will be installed (i.e. delivered on board a vessel) prior to 28 October 2020 should be certified either with the existing G8 (2016) guidelines or the revised version. The latter allows early movers to use

their installed systems as long as they maintain and operate them properly. The revised guidelines will be applied on BWTS which start their Type Approval process from 28 October 2018 onwards. Installations from 28 October 2020 onwards should be with BWTS certified with the revised guidelines.



Ballast water treatment system implementation schedule
(Image courtesy DNV GL)

Treatment Systems

There are two main types of ballast water treatment systems: one using electro-chlorination which can treat more than 1500 m^3/h and is suitable for tankers and bulk carriers, and one using ultra-violet light which can treat up to 1000 m^3/h and is suitable for containerships and most other vessels. Both are type approved and USCG compliant.

For an electro-chlorination system, the typical scope of supply includes the main control panel, EC power supply, side-stream pumps, electrolysis cells, dosing/degassing unit, neutralisation unit, static mixer and filter.

For an ultra-violet system, the typical scope of supply includes the main control panel, UV power supply, filter and UV treatment unit.

Retrofitting options can include supply only, engineering, site advisory, and complete installation.

Steps to Compliance

The following are the usual six steps to compliance:

Initial Phase

This phase covers collection of data on the vessel and its operating profile, preliminary price indications based on similar previous projects and estimates, and choice of technology and loose, modular or bespoke systems.

Concept

An onboard technical survey of the vessel is carried out, and an equipment configuration developed based on the survey and proposed BWMS setup. Capital expenditure and operating expenditure estimates are made, and a technical feasibility report prepared.

Basic Engineering

The proposed installation site of the vessel is 3D laser scanned in order to produce full mechanical and engineering drawings and documents for the installation. Dialogue is opened with the classification society for preliminary approvals, sub-contractors are selected and a firm offer and contract for supply made.

Detailed Engineering

This includes detailed mechanical and electrical engineering, production drawings, including steelwork detailed drawings, welding details, and foundation drawings, capacity calculations and diagrams, equipment and valve lists, class approvals for drawings, and procurement.

Installation

Equipment is delivered for prefabrication and installation, with system delivery as loose kit or pre-assembled modules, including all components mounted on skids and internal cabling connected, followed by installation at the yard during docking, and installation onboard before and after docking.

Commissioning

Testing and commissioning includes crew training in operating the system, flag and class approvals, and handing over and start of life-cycle support

Warranty

The warranty period is typically one year. Life-cycle support includes guaranteed availability of spare parts and services throughout the life of the system, and guaranteed service network and availability.

Wärtsilä's BWMS

Wärtsilä has 11 000 service professionals with leading technology know-how in many countries of the world. They have ballast trained personnel in the UK, Korea, China, Netherlands, Singapore, USA, Italy, Finland, India, Greece, France, Germany, Norway, Japan, Turkey and UAE, and more are coming!

The Wärtsilä Land & Sea Academy also runs courses in Ballast Training [*The Wärtsilä Land & Sea Academy has operations in 12 countries, and runs a huge number of courses (listed in the Training Program Catalogue) intended for personnel of any Wärtsilä equipment owner, see https://www.wartsila.com/wlsa* —Ed.]

The vote of thanks was proposed, and the certificate and "thank you" bottle of wine presented, by George Curran.

Daniel Bellagamba (L) accepting the "thank you" bottle of wine and certificate from George Curran
(Photo Phil Helmore)

Wild Oats XI Bow Extension Project

Warren Miller, Senior Design Engineer with Composites Consulting Group (a Diab Group company), gave a presentation on the Wild Oats XI *Bow Extension Project* to a joint meeting with the IMarEST attended by 19 on 3 October in the auditorium at the Royal Prince Edward Yacht Club, Point Piper.

Introduction

Warren began his presentation with an introduction to Composites Consulting Group (CCG), which is an independent branch of the Diab Group providing businesses with the required competence in the design and manufacture of composite materials. CCG has extensive engineering and manufacturing experience from various industries giving them insight into their customers' needs. They provide structural engineering, process and mould design, manufacturing inspections and consulting, and training.

Their team of more than 30 engineers in seven countries offers 24/7 fast worldwide support. Various projects in Australia have included

- The *All Eyes on Us* sculpture, 7 m high, for the Commonwealth Games on the Gold Coast in April 2018.
- *Ocius,* the 6 m Bluebottle autonomous sailing drone from Ocius Technology (hull and deck, internal structure, mast base, etc.)
- Kenwick (Perth, WA) railway station monocoque composite canopy.

Why Modify the *Wild Oats XI* Hull?

Over the years, *Wild Oats XI* has become more powerful, with the addition of water ballast and more sail area. This means that she can be driven harder, and driving into the back of a wave slows the boat for a start, and can even become dangerous.

Three years ago side lifting foils were fitted which could be extended on the leeward side to provide righting moment. In addition, they were forward of the centre of gravity, and so provided lift for the bow.

However, they really needed the whole rig to be moved further aft, or the hull to be moved forward under the rig, to provide more buoyancy forward and so reduce pitching. This is not easy to do .....

Wild Oats XI punching into the back of a wave
(Photo courtesy Diab Group)

The Rules

The International Sailing Federation (ISAF) is the world governing body for the sport of sailing. Their Offshore Special Regulations (OSR) of 2015 in Section 3.03.3(b) states:

"A yacht of 24 m in hull length and over ….. shall have: The repair or modification designed and built in accordance with the requirements of a classification society recognised by the ISAF."

The original engineering of *Wild Oats XI* by SP Technologies was to ABS' *Guide for Building and Classing Offshore Racing Yachts,* 1994. However, the *Guide* is no longer updated or supported by ABS. It turns out that DNV GL is now the only classification society with rules applying to racing yachts, so the structural engineering of the bow extension was done in accordance with GL's *Guidelines for the Structural Design of Racing Yachts ≥ 24 m*.

This is important, because they were wanting to move the keel and mast, which could easily be done on, say, a TP52. However, the keel is not fixed on *Wild Oats XI,* but is a canting keel, and the current rules require that the vessel must be able to ground with the keel fully canted. This has not been allowed for, so the keel could not be moved.

The Plan

A team of local experts was formed to design the modifications, including Wild Oats Racing, One2three Naval Architects, McConaghy Boats, and CCG performing the structural engineering tasks.

Instead of moving the mast and keel on the original hull, they had to make decisions about what to do. The plan they came up with was to

- remove 2 m from the stern;
- remove 11.2 m from the bow; and
- replace the bow with a 13.2 m extension.

The easy part was removing the bow and stern sections, although they had to be careful where they cut, and what they cut. One goal was to lighten the vessel by removing material, one example being the removal of a large watertight bulkhead. They decided to cut the vessel forward of the daggerboard cases, and to leave the forestay attachments in the same place. The rocker profile of the hull did not change much, as the vessel is very flat from the keel aft.

Wild Oats XI with the 11.2 m bow section cut away
(Photo John Jeremy)

Major Considerations

Hull Curvature

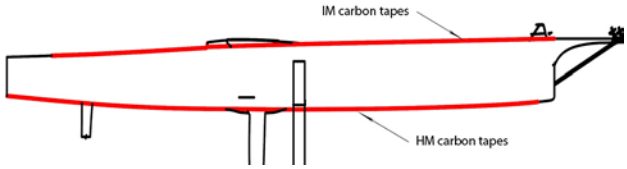
It was difficult to keep the sheer line of the vessel, and this was a major factor in deciding on the location of the bow cut.

Global Stiffness

Analysis showed that, with the forestay, backstay and mast

loads, they had to allow for a total bending moment on the hull of 3600 kN-m! That meant that, for global strength and stiffness, they had to have Intermediate Modulus carbon tapes on the deck, and High Modulus carbon tapes on the hull bottom.

Carbon Type	Young's modulus	Ultimate strains	
	GPa	%	%
High-strength carbon fibres	130	1.1	–0.82
Intermediate modulus fibres	163	1.0	–0.71
High modulus fibres	208	0.75	–0.45



Carbon tapes on deck and hull for global strength and stiffness
(Image courtesy Diab Group)

The old deck was therefore cut away from the deck "planks" of carbon tapes, and the planks reinstated on the new deck.

Hull under tow showing deck planks
(Photo courtesy Diab Group)

Joining

There were a number of considerations in joining the bow extension onto the main hull:

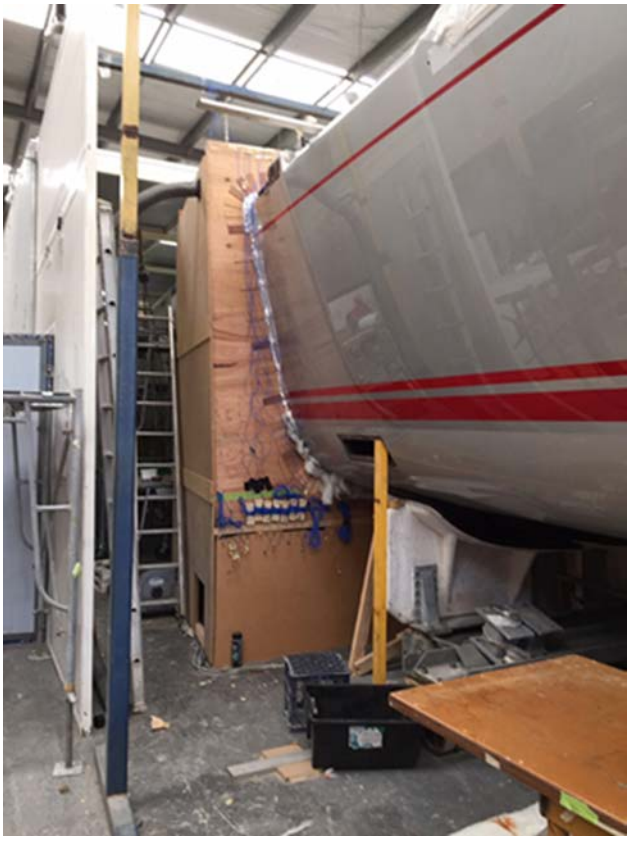
- Cutout geometry: they had to avoid the daggerboard inboard webs and tapes.
- They had to join as far aft on the topsides as possible to fair into the existing topsides.
- Longer laps for global tapes meant that it was advantageous to step forward on the hull bottom.
- Due to lack of availability of wet-laid HM fibre they used the equivalent strength of IM fibres for both hull and deck global tape joins.

The bow extension was joined to the main hull at the deck level with five plies inside and five plies outside the sandwich laminate construction.

The bow extension was joined to the main hull sides and bottom with five plies inside and eight plies outside the sandwich laminate construction.

Hull ready for joining
(Photo courtesy Diab Group)

McConaghy Boats did all the work, and they were amazing. They had done previous cut-and-join work, and so were familiar with the type of work required. A specialist, Peter



Hull join being vacuum bagged
(Photo courtesy Diab Group)

Britt from Forster, was brought in to oversee the join of the new bow to the hull. The join fit perfectly.

Mass Savings

A secondary aim of the project was to save as much mass as possible.

Interestingly, the ABS 1994 *Rules* required a minimum skin thickness. whereas DNV GL do not. This means, for example, that *Comanche* has laminate skins which are about half the thickness of *Wild Oats XI*'s originals. As a result, the bow extension has lower skin thicknesses than the original, and the nomex honeycomb was replaced with aramid honeycomb, allowing for further mass savings.

The original estimated bow with structure was 5954 kg. The original topside mass was 8.4 kg/m², and the modified mass is 7.4 kg/m². The original bottom mass was 17.62 kg/m², and the modified mass is 10.96 kg/m².

In addition, there was removal of old supporting structure and implementation of simpler structure.

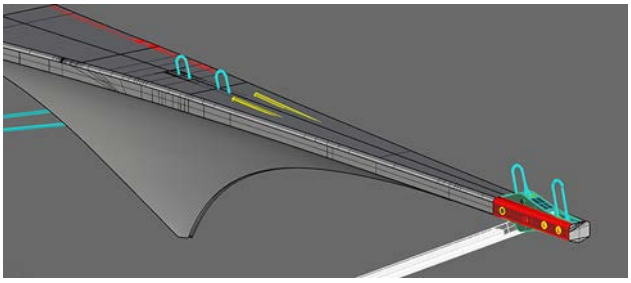
All of this gave rise to a total saving of 725 kg (including the modified bowsprit), or 12% of the hull mass.

Side Benefits

A side benefit of the bow extension project was the longer bowsprit. When the bow extension project was first planned, they thought that they would get away with a shorter (1.5 m) bowsprit. However, when the sailmakers became involved, they ended up with a longer (4 m) bowsprit than original! The benefit comes when handling headsails.

Older vessels (like *Loyal*) have hank-on headsails and, in heavy weather at night, it can take hours to change headsails. The new bowsprit on *Wild Oats XI* allowed the use of top-down furling headsails, which are easier to manage between sail locker and deck as a roll, and one can be hooked on before the other comes off, so that the vessel is never without a headsail.

However, the tip of the new bowsprit was a real structural challenge, including a solid carbon bobstay. They spent almost as much time on the bowsprit engineering as on the hull!



Wild Oats XI new bowsprit
(Image courtesy Diab Group)

Results

The hull modifications have changed the yacht's performance, and the crew is now much happier with how she handles.

Downwind, *Wild Oats XI* can make a better VMG [*velocity made good; i.e. towards a given waypoint* — Ed.] by sailing 15° lower but at a slightly lower speed than, say, *Comanche.* One reason for this is that she has a lower wetted surface area and so less frictional resistance.

Conclusion

The bow extension project for *Wild Oats XI* has involved removing 2 m from the stern and 11.2 m from eth bow of the vessel, and replacing the bow with a 13.2 m extension. The structural analysis was complex, and involved many decisions. The work was carried out by McConaghy Boats who did a wonderful job. The result has been the desired improvement in performance, which has kept the vessel competitive with contemporary modern designs, and the crew are very happy with what has been achieved.

The vote of thanks was proposed, and the certificate and "thank you" bottle of wine presented, by Jason Steward.

Phil Helmore

Warren Miller (R) accepting the "thank you" bottle of wine and certificate from Jason Steward
(Photo John Jeremy)

CLASSIFICATION SOCIETY NEWS

Common Structural Rules Software Updated

Common Structural Rules Software LLC, a joint venture company formed by LR and ABS, has released a software update which simplifies compliance with current and pending IACS Common Structural Rules CSR).

"The Common Structural Rules provide the only industry route to compliance with IMO's Goal-Based Standards for tanker and bulk carrier structures," said LR Marine and Offshore Business Director, Nick Brown. "By working together, LR and ABS have provided fully up-to-date straightforward and accessible tools for the whole industry to use when applying CSR."

"As requirements change, it is imperative for classification societies to provide services and solutions which keep pace," says ABS Senior Vice President, Engineering and Technology, Derek Novak. "By updating this software, we ensure that our tools are effective and provide the best possible guidance to end users."

Improvements to this leading software facilitate compliance with existing and future IACS Common Structural Rules, providing users with an easy way to evaluate designs. Developed from the technical strengths of LR and ABS, Version 2.5 of the CSR Prescriptive Analysis and CSR Finite Element (FE) Analysis software allows assessment of whole vessel structures — including new bulk carrier and oil tanker designs — using compliance information for the current CSR, which entered into force on 1 July 2015, as well as for the rule changes that come into force on 1 July 2018. Both class societies will use these tools to evaluate new designs against the CSR.

The updated CSR Prescriptive Analysis software can be used on both Windows 7 and Windows 10. A summary report provides required and offered scantlings with graphic representation of deficiencies. Reports summarise dominant criteria for each structure as well as data for every parameter value. Used with CSR FE aAalysis, this complete tool makes verifying CSR compliance possible with minimal effort. A new user interface for CSR FE Analysis software enables automatic picking or manual selection to display the stress readout points for Cruciform Flange, Cruciform Web and Bracket Toe hotspots. Results are added to verification results for Fatigue Assessment.

The software is now employed by over 1600 users. Regular updates for additional structural coverage and functionality will address ongoing CSR changes.

Detailed information on structural areas and functionality covered by this release are found in the Release Notes and User Guide bundled with the software installation. The updated CSR Prescriptive Analysis and CSR FE Analysis is available for download from the Common Structural Rules Software LLC website, www.commonstructuralrulessoftware.com.

Lloyd's Register website, *News,* 15 August 2018

FROM THE CROWS NEST

Bluebird K7 Restoration

Bill Smith, the man who restored Donald Campbell's *Bluebird* has said that he does not want it to be locked away in a museum. Campbell died when *Bluebird* flipped and crashed during his attempt to break his own water speed record of 444 km/h in 1967. Bill Smith recovered the wreckage of the hydroplane in 2001 from Coniston Water in Cumbria and rebuilt it at a workshop on the Tyneside.

Following successful test runs on Loch Fad in Scotland, where the restored hydroplane reached 100 mph (161 km/h) there have been offers for him to take it around the world. But there are also calls for it to be housed in a specially-built extension in the Ruskin Museum in Coniston.

The hydroplane is effectively co-owned by the Ruskin Museum Trust — which was gifted the wreckage in 2006 — and the man who restored it, Bill Smith.

He said that negotiations to bring it back to Coniston had stalled, leading him to carry out the test runs on the Isle of Bute in Scotland. Mr Smith said "The boat performed beautifully and there was a phenomenal amount of interest. It demonstrated very forcibly that this is not the sort of object that should be put in a museum." He said that, while it could be stored and displayed at the premises in Coniston, it needed regular maintenance and would have to "run on water".

"We've had offers coming in from all over and all sorts of places, including Australia and America. And if they want it, we can do it", he said. "It would be very sad if it was put in a museum and the doors shut. People really need to see the power of it."

But Anne Hall, Chairwoman of the Ruskin Museum Trust and a parish councillor for Coniston, said that there was no reason why it could not run on Coniston Water. :The reason it went to Bute is because a quiet, shallow lake is needed", she said. "Coniston is different, it's a public highway."

But she said Coniston had "everything" needed to showcase the boat. "Once we've got a date we can all agree on, we can get a safety plan, then it can happen", she added.

BBC News website, 15 August 2018

Restored *Bluebird* undergoing tests on Lake Fad in Scotland
(Photo courtesy The Bluebird Project)

Watch this space!

Lots of photos for those interested on the *Bluebird* Restoration Project Twitter page, https://twitter.com/bluebirdk7?lang=en

Team Britannia

Team Britannia is a multi-million-pound British bid led by ocean adventurer, Alan Priddy, to design and build *Excalibur,* the fastest and most fuel-efficient wave-slicing powerboat to circumnavigate the globe for the much-coveted Union Internationale Motonautique world record, currently held by New Zealander Pete Bethune at 60 days 23 h 49 min.

Excalibur was removed from her shed at ABC Marine on Hayling Island, UK, in early September and turned round through 180 degrees so that the wheelhouse and stern were in the more-spacious permanent building, rather than the temporary structure, for work to concentrate.

There does not now appear to be an expected launch date, but it is expected that, following trials, the vessel will be moved to Gibraltar by the end of the year and, when the weather window is right, they will commence their round-the-world record attempt.

Excalibur being turned around
(Photo from Team Britannia Facebook website)

For more details and photos, visit the Team Britannia Facebook page, https://www.facebook.com/teambritannia/.

Phil Helmore

GENERAL NEWS

BAE Systems Signs AWA for Hunter-class Frigates

BAE Systems Australia has signed an Advanced Work Arrangement (AWA) with the Australian Government for the Hunter-class Frigate Program.

The Australian Government announced in June that BAE Systems was selected as the preferred tenderer for the program to deliver nine future frigates for the Royal Australian Navy.

The AWA will allow BAE Systems to continue to mobilise the program including maturing design and engineering plans, establishing a skilled workforce and setting up the required infrastructure necessary to commence prototyping in 2020.

BAE Systems' Managing Director for the Hunter-class Frigate Program, Nigel Stewart, said "This is a very important and early milestone in the development of an enduring world-class naval shipbuilding industry in Australia. The AWA demonstrates a commitment by both BAE Systems and the Australian Government to ensure timely progress on this critical defence program."

BAE Systems continues to progress negotiations with the Australian Government for the Head Contract for the Hunter-class Frigate Program and the acquisition of ASC Shipbuilding.

Major Milestones for Civmec

On 3 October two major milestones were achieved at Civmec's Henderson facility in Western Australia — the erection of the first steel for one of the world's largest undercover ship-assembly halls and the preparation of the first steel for delivery to South Australia for Australia's new fleet of Offshore Patrol Vessels (OPVs).

Construction of Civmec's new facility is on track to meet the scheduled completion date of late 2019. The 53 000 m^2 (gross floor area), 70 m high, purpose-built facility will be one of the largest single under-cover modularisation, repair and maintenance facilities in Australia.

Large enough to house complete destroyers, frigates and OPVs, the facility will enhance Civmec's existing facilities on its 200 000 m^2 land holding at the Australian Marine Complex (AMC) at Henderson.

Designed to be one of the most efficient and innovative in the world, the new facility will be a significant piece of industrial infrastructure, adding a new world-class resource to the Australian maritime landscape and considerably enhancing the capability available in Western Australia.

Since the first sod-turning ceremony in December 2009, Civmec has continued to develop the site and after ten years, when fully operational, the Civmec complex will be capable of handling any of Australia's major projects for either the resource, infrastructure or defence sectors.

The facility will provide employment opportunities for up to an additional 1000 Australians, including 100 new apprentices and trainees, as capacity increases. Presently the company employs over 2500 people across Australia.

Civmec's Executive Chairman, James Fitzgerald, said "At times like this, it's important to stop and reflect on the company's achievements. I would like to take this opportunity to thank everyone who has contributed to the company for their support and encouragement which has helped to get us to this significant moment. This facility will create employment for numerous generations to come. It will be a hub for training and innovation and will be a home-grown leader in the future of modern heavy engineering. It's a facility that West Australians and, indeed, all Australians, can be proud of."

The other milestone was the preparation and profile cutting of Australian steel plate for the first of 12 OPVs to be constructed for the Royal Australian Navy.

In April 2018, Lürssen Australia awarded Civmec a significant contract for the new build program for the Royal Australian Navy's SEA 1180 OPVs. The contract includes the supply and processing of steel for 12 vessels. The first two vessels will be built in South Australia by ASC, and Civmec will undertake the fabrication, construction and consolidation for the following 10 vessels in Western Australia.

This work program will be a key element underpinning Civmec's Henderson operations for the years to come.

"We are extremely pleased to be involved in the OPV program. Today represents an important step in our long-term commitment to further support the establishment of a competitive Australian shipbuilding industry and supply chain which can export to the global market," said Pat Tallon, Civmec's Chief Executive Officer.

Present at the event were the Hon. Scott Morrison MP, Prime Minister of Australia; Senator the Hon. Mathias Cormann, Minister for Finance; Commodore Stephen Hughes, Director-General Littoral, Royal Australian Navy; and Peter Croser, Assistant Secretary Ships Acquisition — Specialist Ships at CASG, Department of Defence.

HMAS *Anzac* arrives in Henderson for AMCAP upgrade

HMAS *Anzac* has arrived at BAE Systems Australia's Henderson facility in Western Australia for her AMCAP upgrade.

The Mid-life Capability Assurance Program (AMCAP) upgrade is being undertaken at Henderson by the Warship Asset Management Agreement (WAMA) Alliance.

HMAS *Anzac's* docking marks a milestone for BAE Systems, where she joins her sister ships *Perth* and *Arunta*. This will be the first time that three warships have been on the hard stand at the Henderson facility.

HMAS *Arunta*, the first-of-class AMCAP ship, most recently had her old mast removed to make way for the installation of a newly-developed air-search radar system. The new mast was manufactured by BAE Systems and was scheduled to be installed at the end of October.

HMAS *Arunta* will undock before the end of the year after having spent more than 12 months on the hard stand. She will then undertake sea trials ahead of a planned return to service in 2019.

The remaining seven ships will be back in service after upgrade by 2023.

Tasmania Turns Down *Darwin*

The former Royal Australian Navy frigate *Darwin* will not be turned into a dive wreck off the coast of Tasmania (as reported in *The ANA* August 2018 p. 49) as the island state's government decided not to accept the Commonwealth's gift. While the frigate was offered for scuttling off the East Coast for free, the Tasmanian government estimated that it would have to pay over $12 million to prepare and establish *Darwin* as a dive wreck.

The Department of State Growth further found that it would cost approximately $600 000 per annum to monitor and manage the dive wreck site that would not be covered by dive permit receipts.

"We thank the Commonwealth for their offer; however, the costs associated with the project have rendered it financially unfeasible," the Tasmanian government said.

HMAS *Darwin* was commissioned in July 1984, the last of four guided missile frigates (FFG) built in the US for the RAN. Of the other three ships, *Adelaide* and *Canberra* are dive wrecks, and *Sydney* was broken up in Western Australia.

HMAS *Darwin* was decommissioned in December 2017 and offered as a gift to the Tasmanian government in August 2018.

Cooperative Engagement Capability Tested

In a first for both navies, in early November HMAS *Hobart* successfully tested a communications capability, proving her ability to share sensor information and real-time combat system data with the United States Navy.

HMA Ships *Arunta*, *Anzac* and *Perth* ashore together at Henderson, Western Australia
(Photo courtesy Hugh Hyland)

During training and testing near Hawaii, HMAS *Hobart* established secure data links with the US Navy Arleigh Burke-class destroyer USS *John Finn* and shared tracking and fire-control data across the two ships.

The Minister for Defence, the Hon. Christopher Pyne MP, said that the trials were a significant milestone in the testing and qualifying of *Hobart's* combat and weapons systems.

"These trials are the culmination of 12 months of preparations and demonstrate *Hobart's* formidable capability," Minister Pyne said.

"Australia is the first country outside the United States with cooperative engagement capability, and so this demonstration marked the first time this capability was proven between two navies".

The Commanding Officer of HMAS *Hobart*, CAPT John Stavridis RAN, said that the visit to the US had proven how closely the Australian and US navies can work together.

"Connecting and sharing data with the US Navy like this is an important step in increasing our interoperability with them, especially during linked task group operations at sea," CAPT Stavridis said.

"Sharing information like this between ships at sea means that ships in a task group can know and respond to what is going on, including sharing tracking and targeting data."

"It means that a ship can detect and, if needed, engage a threat identified by another ship or aircraft, creating greater flexibility and better protection for all the ships involved".

Defence Support Services

In August Australian companies were invited to have their say on how marine support services for the Department of Defence should be delivered in the future. The then Minister for Defence Industry, the Hon. Christopher Pyne MP, announced the release of a Request for Information for the Defence Marine Support Services (DMSS) Program.

The program includes services such as tugs for port movements, harbour refuelling, transport services between ships, stores and personnel transfer and aviation training.

The program is initially valued at $83 million annually over the next five years but is expected to increase over time as further services across Defence, and potentially other government agencies, are considered for inclusion.

It is expected that more than 287 jobs will be created across Australia in major ports and Defence establishments such as Sydney, Darwin, Cairns and Perth.

Minister Pyne said that this innovative approach will allow Australian defence industry to work together to develop creative contracting options to enable capability delivery at sea.

"This is about thinking outside the square to deliver a long-term and flexible solution for Defence and industry."

"Instead of just contracting one large prime to do all the work, perhaps the best option is engaging multiple smaller companies."

"It will also provide a sustainable ongoing business model for industry and provide taxpayers with value for money."

"We know from experience that contracts entered into now may not be fit-for-service in the future."

Once options have been received, Defence will work with industry to develop a contracting model which ensures that support services remain up-to-date.

"This approach will shape a new way of doing business to ensure that marine support services are adaptive to evolving requirements."

The DMSS Program will commence in 2021 and will initially deliver marine support to Navy's fleet in ports across Australia, including supporting exercises, operations and workforce training.

HMAS *Hobart* (DDG 39), foreground, and the Arleigh Burke-class guided-missile destroyer USS *John Finn* (DDG 113), during cooperative engagement capability trials in September
(US Marine Corps photo)

Austal Delivers High-speed Catamaran to VS Grand Ferries

Austal has completed a 30 m high-speed aluminum catamaran for VS Grand Ferries of the Philippines. The Incat Crowther-designed vessel was built at Austal's shipyard in Balamban, Cebu. The new MV *Seacat* provides capacity for 300 passengers at speeds up to 25 kn.

This $A5.5millon contract was awarded to Austal in August 2017 with construction commencing in September 2017. The *Seacat* project met every milestone on time and on budget and is the first locally-operated vessel to be built to achieve Pioneer status, the prestigious enhanced safety standard rating in the Philippines with the Maritime Industry Authority (MARINA).

"Austal Philippines has developed into an established and very successful shipyard which has produced high-quality vessels for the worldwide market since 2012. Austal has been proud to be leading this sovereign industrial capability development for the Philippines", Austal CEO, David Singleton, said.

"Our Philippines facilities employ more than 500 highly-skilled local employees in a broad range of professional, technical and trade roles. Austal Philippines has been responsible for developing the local SME industry and supply chain whilst also collaborating with local universities and educational establishments to truly develop a sovereign industrial capability for the Philippines."

In the last two years Austal Philippines has delivered six high-speed commercial vessels at increasing rates of efficiency whilst maintaining Austal's standard for excellence. Austal Philippines is currently constructing modules for a 109 m next-generation high-speed catamaran for Fjord Line of Norway, the largest aluminium passenger ferry to be built in the Philippines. The vessel will be completed in a brand-new purpose-built 120 m long assembly facility which is Austal's largest outside of the USA. The new facilities are under construction and on track to be completed in early 2019.

Austal Delivers LCS 18 to the US Navy

In September Austal USA delivered its ninth Independence-variant Littoral Combat Ship (LCS) to the US Navy. The future USS *Charleston* (LCS 18) is the third Austal-designed and built LCS delivered to the USN this year and she will be the fourteenth to enter the fleet.

The 30 m high-speed catamaran *Seacat* delivered to VS Grand Ferries of the Philippines by Austal
(Photo courtesy Austal)

"The Austal team is excited to deliver another of these incredible ships to the US Navy. We are very proud to be delivering this program with efficiency and reliability," Austal CEO, David Singleton, said.

"The maturity and success of the LCS program is a direct result of the dedication and skill of the Austal employees, and the technology invested in our Mobile, Alabama, next-generation shipbuilding facility."

"The advanced production process developed at Mobile is allowing us to roll out ships from the assembly bays one after the other in quick succession, offering a huge competitive advantage for Austal to be able to support the US Navy's fleet expansion to 355 ships," Mr Singleton said.

Five LCS remain under construction at Austal's Alabama shipyard. *Cincinnati* (LCS 20) is preparing for sea trials. Assembly is underway on *Kansas City* (LCS 22) and *Oakland* (LCS 24) with modules under construction for *Mobile* (LCS 26) and *Savannah* (LCS 28). The future USS *Canberra* (LCS 30) is in pre-production and will begin construction early in 2019.

Austal is also under contract to build 12 Expeditionary Fast Transport vessels (EPF) for the US Navy. The company has delivered nine EPFs while an additional three are in various stages of construction.

The future USS *Charleston* (LCS18) was delivered to the US Navy by Austal USA in September
(Photo courtesy Austal)

Austal USA Contracts for LCS 32 and 34

On 19 September Austal announced that it had been awarded construction contracts by the US Navy to build two additional Independence-class Littoral Combat Ships, the sixteenth and seventeenth ships in the class, at its Austal USA facility.

The specific value of each contract is under the congressional cost cap of $US584 million per ship (about $A1.6 billion for both vessels).

The 127 m LCS was originally designed in the Austal Centre for Excellence in Maritime Design, based in Henderson, Western Australia. The vessel design has been transferred to Austal USA and construction is undertaken in Austal's purpose-built shipyard in Mobile, Alabama.

"This latest order from the US Navy is a tremendous endorsement of the Austal LCS and further evidence of the important role which Austal plays in building the United States Navy", Austal CEO, David Singleton, said

Austal continues to reduce cost and deliver on schedule, handing over three LCS to the Navy this year, all under the congressional cost cap. Construction of LCS 32 is scheduled to begin in 2019 with delivery of LCS 34 expected to occur in mid fiscal year 2023.

Long Lead Order for Austal

It was announced on 19 October that Austal USA has been awarded a $US57 854 366 million order to fund the procurement of long-lead-time materials for the construction of a 103 m Expeditionary Fast Transport (EPF), the thirteenth vessel of this type ordered by the US Navy from Austal.

Long-lead-time materials for the additional vessel will include diesel engines, waterjets and reduction gears.

Austal was awarded the initial contract to design and build the first EPF in November 2008. The EPF is a high-speed shallow-draft catamaran, designed for rapid intra-theatre transport of troops and cargo. Reaching speeds of over 35 kn allows the EPF to be used for rapid deployment of conventional and special forces with their equipment and supplies.

Since 2008, nine Spearhead-class EPFs have been delivered and are serving as an affordable solution to fulfilling the Military Sealift Command's requirements worldwide. Three additional EPFs are under construction at Austal USA.

Austal Starts Work on 117 m Trimaran for Fred. Olsen

On 21 September Austal announced that construction had begun on the first of two 117 m high-speed passenger trimaran ferries for Fred. Olsen. Developed in Henderson, Western Australia, at Austal's Centre of Excellence in Maritime Design, these technologically advanced, next-generation vessels will be used by Fred. Olsen Express in the Canary Islands, joining their sister ship, *Benchijigua Express*.

Capable of transferring over 1100 passengers and 276 cars at speeds up to 38 kn, these vessels will feature the latest in Austal's optimised hullform and vessel design and will be fitted with Austal's industry-leading ride-control technology.

"*Benchijigua Express* is the benchmark for blue-water commercial ferry operations, exceeding expectations for performance, speed and customer experience in the Canary Islands. This new vessel will be a game-changer in the international high-speed ferry market and we are proud to be building it for Fred Olsen", Austal CEO, David Singleton, said.

"The trimaran vessel's design provides advanced seakeeping whilst maintaining the carrying capacity of a catamaran. This uniquely Austal design provides a more comfortable ride for passengers while maintaining the carrying capacity of a traditional catamaran."

Ivan Fernandez Martinez, technical manager at Fred. Olsen said, "After the signing of the contract, the project spiral was

launched which, in several iterations, has improved the different details of the vessel, avoiding interferences and seeking appropriate solutions based on the current experience of years' operating in the Canary Islands. After these months of engineering, the metal-cutting ceremony symbolises the start of this exciting phase of production".

The contract with Fred. Olsen for the two 117 m trimarans is worth $190 million and was awarded to Austal in October 2017.

Austal Launches 109 m High-speed Ferry

On 29 October Austal launched the Auto Express 109 m high-speed vehicle/passenger ferry *Express 4* for Molslinjen of Denmark.

This launching at the Austal yard in Western Australia followed the roll out and joining of the hull and superstructure in August. The vessel is now undergoing final preparations to begin sea trials as part of the acceptance and handover process.

This next-generation catamaran commenced construction in April 2017, and remains on schedule to meet contract handover date in January 2019. *Express 4* features an advanced optimised hullform designed to minimise fuel consumption. Also built into the vessel is Austal's industry-leading ride-control system, which will result in superior seakeeping and comfort for over 1000 passengers traveling at speeds up to 40 kn.

"The technology and efficiency of this vessel truly places it in a class of its own — it has really redefined what is possible in high-speed aluminium vessel design", Austal CEO, David Singleton, said.

"The international demand for Austal vessels in both commercial and defence markets is testament to the Austal team continually developing the world's most advanced vessel designs and then building them to the highest possible standard", he said.

"The commercial ferry market has further strengthened over the last 18 months, with the Austal Auto Express 109 setting the benchmark for large, technologically-advanced, super-efficient, high-speed ferries", Austal Vice President of Sales and Marketing, Ben Marland, said.

"This is a record sales period for international high-speed ferries and Austal is clearly leading the market with our highly-differentiated and unique designs." he said.

Shipping the superstructure of *Express 4* after roll out
(Photo courtesy Austal)

Express 4 alongside after launching. Two Cape-class patrol boats and the first Pacific Patrol Boat *Ted Diro* are dwarfed by the large catamaran
(Photo courtesy Austal)

Austal Ferry for Trinidad and Tobago

Austal has commented on the announcement by the Prime Minister of Trinidad and Tobago in that country's press that the Trinidad and Tobago Cabinet has authorised the purchase of a fast ferry from Austal.

Until a contract is finalised, this initial announcement was expected to trigger the release of a down payment which will allow design of the vessel to commence and for initial long-lead-time materials to be procured.

The vessel will be a 94 m high-speed catamaran for operation on the sea bridge between Trinidad and Tobago. This vessel is a variant of the two 109 m high-speed catamaran's currently in production at Austal.

The 94 m catamaran to be designed and constructed by Austal for the Government of Trinidad and Tobago
(Image courtesy Austal)

HMAS *Brisbane* joins the Fleet

The Royal Australian Navy welcomed a new ship into the fleet on Saturday 27 October, with the commissioning of the guided-missile destroyer, HMAS *Brisbane*.

In the ceremony at the Fleet Base East in Sydney, *Brisbane* officially became one of Her Majesty's Australian Ships.

Before an audience of dignitaries, family and friends, the Commander of the Australian Fleet, RADM Jonathan Mead AM RAN, welcomed *Brisbane* to the fleet.

During the ceremony the Governor-General of Australia inspected *Brisbane's* crew and HMAS *Brisbane* received a blessing. The Australian White Ensign was hoisted, signifying completion of the commissioning. The crew marched onboard for the first time, where they cheered ship, as a mark of honour.

The Prime Minister of Australia, the Hon. Scott Morrison MP, and the Minister for Defence, the Hon. Christopher Pyne MP, attended the ceremony, and noted the importance of the occasion for both Australia's national security and domestic shipbuilding capability. The commissioning marks a major milestone in the life of the ship, and the Government's multi-decade commitment to enhance the Navy's capabilities to protect our maritime interests.

The second of three Hobart-class guided-missile destroyers, *Brisbane* is the third ship to carry the name. Her Commanding Officer, CMDR Josh Wilson RAN, is proud to lead the ship's company as she joins the Australian Navy surface fleet.

"My crew and I are honoured to continue the name and proud history of *Brisbane* in the Royal Australian Navy, and excited to be given the opportunity to realise the incredible capability she represents," CMDR Wilson said.

Brisbane will now undergo her test and evaluation period where she will integrate into the fleet and Navy personnel will train to operate the warship.

The ship's company of HMAS *Brisbane* cheer ship during her commissioning ceremony
(RAN photograph)

HMAS *Brisbane* arriving in Sydney for the first time
(RAN photograph)

HMPNGS *Rabaul* Completes Final Voyage

October marked the end of an era for HMPNGS *Rabaul*, which has completed her final voyage to Port Macquarie from Lombrum Naval Base on Manus Island, after 31 years of service with the Papua New Guinea Defence Force.

The patrol boat was given to Papua New Guinea in May 1987 under the Pacific Patrol Boat Program, which ultimately delivered 22 vessels to Pacific Island nations.

Papua New Guinea received four Pacific Patrol Boats, which have been the bedrock of successful Australia-Papua New Guinea maritime security cooperation for over 30 years.

The Commanding Officer of the Pacific Patrol Boat handed the keys to the Commonwealth in Port Macquarie, to enable environmentally-responsible disposal of the vessel. The crew will travel to the Defence International Training Centre and then to Western Australia for training before receiving the first of their four Guardian-class replacement vessels in late November 2018. The new patrol boat will be named after Brigadier General Ted Diro (retired), the first Commander of the Papua New Guinea Defence Force.

The replacement vessels are being delivered under the Pacific Maritime Security Program, which builds upon the success of the Pacific Patrol Boat Program and continues Australia's enduring security commitment to the South Pacific.

Under the Program, Australia will give 19 Guardian-class patrol boats to 12 Pacific Island nations. The program also includes a region-wide aerial maritime surveillance capability, enhancements to regional coordination, sustainment and training support, and the continuation of Australia's in-country maritime adviser network. Timor-Leste will also receive two Guardian-class vessels.

The new Guardian-class patrol boats, being built in Western Australia by Austal, will offer enhanced capability to broaden and strengthen the region's maritime security, fisheries protection and response to transnational crime.

The Papua New Guinea Pacific Patrol Boat, HMPNGS *Rabaul*, arrives at her last berth
(RAN photograph)

RNZN Acquiring Norwegian OSV

The New Zealand government has approved $NZ103 million for the purchase and refit of a second-hand multi-role offshore support vessel which will be used as a dive and hydrographic support vessel by the Royal New Zealand Navy.

Following purchase, the 85 m Norwegian-built survey vessel MV *Edda Fonn* will be outfitted with the dive and hydrographic systems required by the defence force.

MV *Edda Fonn* will replace the hydrographic ship HMNZS *Resolution* and the dive support ship HMNZS *Manawanui*. The two vessels were decommissioned from the RNZN in 2012 and 2018 respectively, following several decades of service.

"This vessel will ensure that the current capability gaps for diving and hydrography are filled as quickly as possible, with a proven, well-tested platform," said the Minister of Defence, Ron Mark.

The ship is scheduled to be delivered to Devonport Naval Base in May 2019. It will feature a 100 t salvage crane, a remotely-operated vehicle and a contemporary dynamic positioning system, which will allow Navy's specialist divers to achieve greater levels of effectiveness and safety, in a greater range of conditions.

The Royal New Zealand Navy was initially scheduled to receive a custom new-build vessel, but an $NZ148 million cost blowout in the country's frigate upgrade project forced the government to consider a used vessel.

Defence officials identified *Edda Fonn*, owned and operated by Norwegian company Østensjø Rederi, as the most suitable option from an initial list of over 150 candidate offshore and subsea support vessels.

"Defence officials have subjected *Edda Fonn* to considerable scrutiny ahead of purchase," said Ron Mark. "We have been assured by independent experts that it is in excellent condition, and will handle well in the operations the Defence Force will use it for," he said.

The vessel generally operates in the North Sea, and is under lease until the end of 2018, following which the modification process will begin.

Once delivered, final modifications will be undertaken in New Zealand. It is expected that New Zealand industry will be involved in this part of the project. The ship is expected to be in service with the Navy by November 2019.

Edda Fonn
(Photo courtesy RNZN)

Red Jet 7 from One2three NavalArchitects

Red Funnels' *Red Jet 7* was built in East Cowes, UK, by Wight Shipyard and represents a £7 million (AU$12.6 million) investment in its Southampton–West Cowes route. Like her near-sisters, *Red Jet 7* uses waterjets rather than propellers to

Red Jet 7
(Photo courtesy Justin Merrigan)

aid manoeuvrability and provide impressive stopping power. An advanced hull design and computer-controlled interceptors also help keep the wash to an absolute minimum, which is good news for nearby leisure craft.

The One2three-designed vessel is fitted with four MTU 10V 2000 M72 main engines powering quad Hamilton HM571 waterjet units connected via ZF 3050D gearboxes.

This configuration was chosen to ensure high levels of in-service availability as she can operate on two or three engines if any waterjet intakes become obstructed by debris in the Solent. Exhaust emissions fully comply with the IMO Tier II regulations.

Other technical innovations to help reduce fuel consumption include the use of specialist marine-grade vinyl instead of paint for the superstructure to reduce weight, and the application of the latest Teflon hull coatings to minimise drag through the water. Such technology helped *Red Jet 7* achieve a top speed of 39 kn on trials, which is in excess of her required in-service speed of 36 to 38 kn.

Internally, *Red Jet 7* offers a premium experience with 275 comfortable high-back leather seats with cup-holders, space for four wheelchairs and ample amounts of luggage. USB charging points for phones and tablets have been fitted to all window seats. In common with the rest of the fleet, free wi-fi is available, offering customers a fast and stable ship-to-shore connection.

LED lighting is provided throughout and the cabin air temperature and humidity are controlled automatically thanks to a sophisticated air-handling system which puts a stop to internal condensation on the windows, all of which are tinted to prevent glare.

Six LED HD TV screens offer a wealth of information in real time, including local and national news headlines, the latest weather and Jive travel connections for buses, coaches and trains. The screens also show the vessel's GPS position along the route and can display a live video feed from external cameras facing forward and aft.

Principal particulars of *Red Jet 7* are

Length OA	41.12 m
Length WL	37.94 m
Beam moulded	10.87 m
Draft	1.30 m
Crew	4
Passengers	275 + 2 wheelchairs
Fuel oil	5000 L
Fresh water	1000 L
Lube oil	50 L
Sullage	500 L
Oily bilge	400 L
Main engines	4×MTU 1OV 2000 M72 each 900 kW @ 2250 rpm
Gearboxes	4×ZF 3050D
Propulsion	4×Hamilton HM571 waterjets
Generators	2×55 kW 415 V 3 phase 50 Hz
Trim Control	Humphree interceptors
Service speed	38 kn @ 85% MCR
Range	200 n miles @ 38 kn

Acadia Explorer and *Schoodic Explorer* from Incat Crowther

Incat Crowther has announced the delivery of a pair of multi-functional 29 m catamaran passenger vessels, *Acadia Explorer* and *Schoodic Explorer*. Built to a high standard by Gulf Craft in Franklin, Louisiana, for Bar Harbor Whale Watch Co., the USCG Subchapter T-certified vessels will be used for whale-watching excursions, nature cruises and lighthouse tours in the Acadia National Park and surrounding areas, as well for providing tender services to cruise ships which frequent picturesque Bar Harbor, Maine, during the spring and summer months.

The practical vessels feature three boarding areas on each side of the vessel to facilitate efficient loading and unloading, and a pair of stairs leading to the upper deck enhances passenger flow.

The ADA-compliant main-deck cabin has seating for 114 passengers in a climate-controlled interior. In addition, the forward doors provide access to the exterior foredeck seating for 16 passengers. The comfort of passengers is addressed with ergonomic seating fitted with tables, a large kiosk serving various snacks and refreshments, and five televisions for entertainment. The aft end of the accommodation includes two heads, one of which is ADA compliant.

The upper deck provides a spacious and open view of the

environment with seating for 65 passengers, with 36 of these under cover. Entertainment is provided by a large-screen centreline television.

The large wheelhouse is equipped with wing stations and the latest electronics for safe navigation.

The roof above the wheelhouse is fitted with a station for a naturalist who is tasked with disseminating information to passengers about landmarks and wildlife which are within viewing distance.

Propulsion is provided by two Caterpillar C32 ACERT engines rated at 970 kW @ 2100 rpm driving two Hamilton HM571 waterjets for a service speed of 25 kn. Ride control for passenger ride comfort is provided by a complement of Humphee interceptors. Electrical power is provided by a pair of Caterpillar C4.4 generating sets.

Principal particulars of *Acadia Explorer* and *Schoodic Explorer* are

Length OA	30.0 m
Length WL	29.7 m
Beam OA	8.50 m
Draft (hull)	1.30 m
Depth	3.00 m
Passengers	150
Crew	4
Fuel oil	4480 L
Fresh water	757 L
Sullage	757 L
Main engines	2×Caterpillar C32 ACERT each 970 kW @ 2100 rpm
Propulsion	2×Hamilton HM571 waterjets
Generators	2×Caterpillar C4.4 each 75 ekW
Speed (service)	25 kn
(maximum)	30 kn
Construction	Marine-grade aluminium
Flag	USA
Class/Survey	USCG Subchapter T

Acadian Explorer
(Photo courtesy Incat Crowther)

20 m Workboat from Incat Crowther

Incat Crowther has announced a design contract with Cape Town-based shipbuilder Veecraft Marine for the supply of a 20 m monohull workboat for the South African National Defence Force. The vessel will be tasked with the transportation of personnel and equipment and support training activities in coastal areas up to 10 n miles off the coast under the inclement weather conditions often experienced in the area. The vessel is designed in accordance with BV requirements and in compliance with flag-state rules as defined by South African Maritime Authority (SAMSA) for Category C vessels.

Starboard bow of 20 m workboat for South African National Defence Force
(Image courtesy Incat Crowther)

The main deck features a forward deckhouse with wheelhouse above and a generous 25 m^2 aft cargo deck. The modestly-sized deckhouse is fitted with galley and mess areas along with two bathrooms and a deck locker accessible from the cargo deck. The wheelhouse is arranged for 360° visibility, including an unobstructed view of the cargo deck.

The cargo deck of the aluminum vessel is able to accommodate a 6 m ISO container and is also fitted with a 5 t marine crane. A foldable dive platform is fitted aft of the transom, along with stairs integrated into the main deck to provide safe access.

Below deck includes two 7.5 m^3 cargo holds with access hatches above, engine room, fuel and water tanks, and a crew accommodation space. The crew accommodation features three staterooms, each with three bunks for a total capacity of nine crew members.

Other notable features include a robust fendering system and heavy towing bollards on each end of the vessel.

With a modest service speed of 16 kn at a healthy deadweight load of 20 t, the vessel will be powered by two MAN D2862 LE431 marine engines rated, each at 551 kW @ 1800 rpm driving Teignbridge fixed-pitch propellers through ZF 2050 gearboxes.

Port quarter of 20 m workboat for South African National Defence Force
(Image courtesy Incat Crowther)

The vessel will be the sixteenth Incat Crowther vessel built by Veecraft in less than a decade, and further demonstrates the versatility of both organisations in delivering custom solutions tailored to unique and demanding requirements.

Principal particulars of the new vessel are

Length OA		20.0 m
Length WL		19.4 m
Beam OA		5.50 m
Depth		2.80 m
Draft	(hull)	1.20 m
	(propellers)	1.70 m
Passengers		16
Crew		4
Fuel oil		9000 L
Fresh water		2000 L
Sullage		500 L
Main engines		2×MAN D2862 LE431 each 551 kW @ 1800 rpm
Propulsion		2×fixed-pitch propellers
Generators		1×Kohler 10 kVA @ 1800 rpm
Speed	(service)	16 kn
	(maximum)	19 kn
Construction		Marine-grade aluminium
Flag		South Africa
Class/Survey		BV/SAMSA

Jiang Men from Incat Crowther

Incat Crowther has announced the launch of the 40 m catamaran passenger ferry, *Jiang Men*, built by Wang Tak. *Jiang Men* is the third in a series which started with *Shi Zi Yang 7* in 2016. In the constantly-evolving highly-competitive Chinese marketplace, Incat Crowther has continued to improve the design, realising an 8% reduction in fuel burn. The vessel is engineered for robust structure and performance.

Jiang Men accommodates 199 passengers with 162 economy-class passengers seated on the main deck and 37 business-class and VIP passengers seated on the upper deck.

A large crew area is located at the aft end of the main deck, including sleeping quarters, mess room and pantry. Forward of this are stairs to the business-class cabin, three toilets, luggage racks and a kiosk. The economy seats on this deck are arranged in a 2-3-3-2 layout which affords excellent access and wide aisles.

The upper deck consists of 28 comfortable business-class seats at a relaxed pitch with wide aisles. Two VIP rooms are located aft, in addition to an oversize bathroom. The aft upper deck features a dedicated area for luggage containers to be lifted on and secured to the deck.

Jiang Men is powered by a pair of MTU 16V2000 M72 main engines, each delivering 1080 kW at 2250 rpm. She is propelled by MJP 650 CSU waterjets for a top speed of 31 kn.

The vessel's operational efficiency is mirrored by its maintenance simplicity, with design features such as clear overhead removal paths for the main engines and large switchboard/utility spaces adjacent to the engine rooms.

The vessel meets CCS's latest rules for sea-going high-speed craft.

Jiang Men's improved efficiency heads the class and cements Incat Crowther's premier standing in the market, leading the way in the competitive Pearl River Delta market.

Principal particulars of *Jiang Men* are

Length OA	41.9 m
Length WL	40.0 m
Beam OA	9.50 m
Depth	3.20 m
Draft (hull)	1.10 m
Passengers	199
Crew	11
Fuel oil	7000 L
Fresh water	1000 L
Sullage	2000 L
Main engines	2×MTU 12V2000 M72 each 1080 kW @ 2250 rpm
Propulsion	2×MJP 650 CSU waterjets
Generators	2×Cat C4.4
Speed (service)	28 kn
(maximum)	31 kn
Construction	Marine-grade aluminium
Flag	China
Class/Survey	CCS CSA Catamaran HSC, Passenger A, Coastal Service Restriction: Pearl River Area — Hong Kong and Macao

Port bow of *Jiang Men*
(Image courtesy Incat Crowther)

Xin Hai Bin from Incat Crowther

Incat Crowther has announced the launch of *Xin Hai Bin*, a 40 m catamaran passenger ferry built by Afai for Zhuhai Fast Ferry Company. Incat Crowther's relationship with Afai dates back to 1982, when the yard built the first Incat Crowther ferries to enter service in China. In 2018, *Xin Hai Bin* is the 50th Incat Crowther-designed vessel for operation in China.

Xin Hai Bin is based on the proven unique Incat Crowther Z-bow hull form used on *Hai Ju* and *Hai Yao* in 2012. The hull was lengthened and a new modernised superstructure built on this platform, with two passenger decks and a raised wheelhouse. The modular approach, collaboratively developed between the yard and the designer, gave Afai a competitive advantage in both cost and delivery.

Passengers board via aft gates and enter the main deck cabin. This deck seats 190 economy-class passengers along with bathrooms, luggage racks, pantry, service counter and crew room.

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

Central stairs lead to the upper deck, with seats for 59 business-class passengers and 12 VIP passengers, as well as a dedicated service counter.

Xin Hai Bin is powered by a pair of MTU 16V2000 M70 main engines, each delivering 1050 kW and driving fixed-pitch propellers. The vessel's Z-bow hull form exhibits excellent characteristics in rough water, whilst giving the vessel class-leading efficiency.

Xin Hai Bin is a sound demonstration of the strong relationship between Incat Crowther and Afai, and the value which such a relationship brings to the Chinese market.

Principal particulars of *Xin Hai Bin* are

Length OA		40.5 m
Length WL		37.9 m
Beam OA		9.00 m
Depth		3.50 m
Draft	(hull)	1.30 m
	(propellers)	2.00 m
Passengers		260
Crew		9
Fuel oil		6020 L
Fresh water		1090 L
Sullage		1730 L
Main engines		2×MTU 16V2000 M70 each 1050 kW @ 2100 rpm
Propulsion		2×fixed-pitch propellers
Speed	(service)	3 kn
	(maximum)	27.6 kn
Construction		Marine-grade aluminium
Flag		China
Class/Survey		CCS CSA Catamaran HSC, Passenger A, Coastal Service Restriction

Stewart Marler

Progress on Australia's New Icebreaker

The Australian Antarctic Division reports that, since RSV *Nuyina* was moved to a wet dock in late September, construction of the superstructure (area above the watertight hull) and internal fit-out has progressed rapidly.

Some of the expeditioner and crew spaces are now being fitted out, with ensuites installed in cabins, while the galley and dining area, and a theatre with raked seating and a raised stage, are under construction.

RSV *Nuyina* floating in the dry dock before being moved to a wet berth in September
(Photo Damen courtesy AAD)

A superstructure block being erected
(Photo Michiel Jordaan courtesy AAD)

On the science front, the CTD (conductivity, temperature and depth) hangar, which includes a moon pool, is taking shape. The CTD equipment will be deployed from the ship through the moon pool or with an overhead crane through a door in the side of the ship. The CTD is a critical piece of scientific equipment used to measure ocean salinity (conductivity) and temperature at different depths.

The moon pool is a 13 m vertical shaft, 4 m square, which runs through the ship's hull to the open ocean. When its top and bottom hatches are opened, the moon pool will allow the deployment of CTDs, nets, underwater vehicles and other oceanographic instruments, from within the relative comfort and protection of the ship.

The CTD hangar, which includes a moon pool (at right)
(Photo Michiel Jordaan courtesy AAD)

Sea-ice scientists will be able to deploy on to the sea ice via a specially-designed ramp. The scientists will also have access to an adjacent cargo hold area to store their equipment and mobile laboratories (in modules similar to shipping containers), when the area is not in use for resupply.

The scientific winch room on deck three (below the level of the aft science deck) is also being kitted out with six main

Expeditioner and crew cabins will have ensuites with shower, toilet and basin, shown here with green protective covers being installed on Deck 6, below the helicopter hangar
(Photo Michiel Jordaan courtesy AAD)

The ship's aft science deck (Deck 4) with the starboard aft mooring station in the foreground
(Photo Michiel Jordaan courtesy AAD)

One of two switchboards which will take power from the ship's four diesel generators and two shaft-driven electric-motor generators
(Photo Michiel Jordaan courtesy AAD)

winches — two trawl winches, one deep-sea corer winch, one deep sea towing winch with electro-optical capability for connecting cameras and other powered equipment, a towed-body winch, and a general-purpose winch with dynex fibre rope. These winches collectively have over 40 km of cable length spooled on their storage drums.

On the operational side, the switchboards have been installed. These will take power from the ship's four diesel generators and two shaft-driven electric-motor generators and redirect it to run all the electrical components on the ship, including computers, lights and laboratory equipment.

In the engine rooms, insulation, cables and pipework are being installed. The forward mooring deck is also being fitted out with windlasses (anchor winches) and bollards.

In the dry dock a range of superstructure blocks is currently being assembled, including the helicopter hangar and the bridge with its 32 m beam. These will be added to the ship before she next turns in the wet dock in November.

www.antarctica.gov.au

This forward cargo hold area will house up to 48 20-foot shipping containers over three decks
(Photo Michiel Jordaan courtesy AAD)

The navigation bridge, crow's nest and main mast taking shape in the dry dock, with the windows for the crows nest already installed. The bridge wings either side span about 32 m
(Photo Michiel Jordaan courtesy AAD)

Cruising in NSW

The winter quiet saw *Carnival Spirit, Pacific Eden, Pacific Explorer, Pacific Jewel, Sea Princess,* and *Sun Princess,* working out of Sydney, the increasing number of six vessels (up from two a couple of years ago) being indicative of the increasing demand for winter cruises.

The arrival of *Majestic Princess* on 15 September signalled the start of the next summer season. She was followed by *Radiance of the Seas, Carnival Legend, Celebrity Solstice, Golden Princess, Noordam,* and *Explorer of the Seas* in October.

November moved into a higher gear, with many return visits by these vessels plus *Ovation of the Seas.*

Vessels berthing regularly at the Overseas Passenger Terminal at Circular Quay is a sure sign that the summer cruise season is under way.

Phil Helmore

Trials of *Spirit of Australia 2*

Martin Grimm

The weekend of 1–2 September 2018 was another opportunity for David Warby and his team to test *Spirit of Australia 2* (or *Spirit 2* for short) on Blowering Reservoir, in southern NSW.

The intention of the team is to exceed the outright world water-speed record of 317.6 mph (511.1 km/h or 276 kn) currently held by David's father, Ken Warby, in *Spirit of Australia* set on Blowering Reservoir on 8 October 1978, just over 40 years ago.

David completed a series of runs on Saturday morning 1 September and again in the afternoon reportedly achieving 206 mph (331 km/h or 179 kn) that day. On Sunday morning, after a delay while awaiting wake from a support boat to dissipate, further trial runs were performed with the boat achieving 218 mph (351 km/h or 189 kn). However, on both days, David experienced steering issues and, on lifting the boat from the water following the Sunday morning runs, it was discovered that stainless steel backing plates, which are used as part of the attachment of a pair of fins to keel strakes on the boat, had been bent back by the dynamic pressure of the water acting on their leading edge. As it wasn't possible to repair or replace these plates at short notice, a decision was made to end further trials for the weekend.

The speed achieved on 2 September, while not official and/or a two-way average, still exceeds one of Ken Warby's initial records from 17 September 1977 (when he had achieved 214.8 mph) as he too progressively increased his speed. The Warby team are quite intentionally making incremental advances while monitoring the performance of the boat.

Observing a watercraft travelling at this speed is quite remarkable and the sound of the jet engine winding up and then echoing across the reservoir adds to the experience.

At this stage, further trials are proposed for the weekend of 1–2 December 2018 with NSW Roads and Maritime Services declaring an exclusion zone daily for these trials. Aside from replacing the fin backing plates with a stronger set, cockpit modifications have been made and steering control is being revised with a new profile rudder also being fitted.

A damaged fin backing plate marks the end of trials in September (Photo Martin Grimm)

Underside of *Spirit of Australia 2* being lifted from water showing fins forward (Photo Martin Grimm)

Spirit 2 shows a clear pedigree from the original *Spirit of Australia*. However a key difference is the powerplant. Whereas *Spirit of Australia* was fitted with a Westinghouse J34-WE-34 turbojet with 3400 lbs (15.12 kN, 1542 kg) static thrust, *Spirit 2* is equipped with a Rolls Royce/Bristol Siddeley Orpheus 803 turbojet of 5000 lbs (22.24 kN, 2268 kg) static thrust. For his original record boat, Ken had purchased three of the J-34s at an RAAF surplus auction. They had been used in pairs on the RAAF Lockheed P2V-7 (later SP-2H) Neptune maritime-patrol aircraft to augment thrust from its radial engines during take-off. David's Orpheus 803 has been removed from an ex-Italian Air Force Fiat (later Aeritalia) G.91 jet fighter. With around 50% more thrust available, and assuming at these high speeds that resistance varies approximately with the square of speed, this suggests a speed of around 385 mph (620 km'hr or 319 kn) might technically be possible; however, the team has a target speed of 348 mph (560 km/h) which, if achieved, would push the craft over the 300 kn mark. As a comparison, the G.91 fighter in which the Orpheus 803 was installed had a maximum speed at sea level of 668 mph (1075 km/h).

Externally, the main visual difference is that *Spirit of Australia* was fitted with a combined vertical and horizontal "T" stabiliser aft, while *Spirit 2* is only fitted with a vertical stabiliser. However *Spirit 2* has small spoilers on the upper rear fuselage either side of the stabiliser. The cockpit construction on *Spirit 2* is also more robust than its predecessor, consistent with the stringent safety rules now in place.

The underside of the craft appears very similar to *Spirit of Australia,* as is apparent when comparing photos of both craft.

The team and its considerable support network from groups such as the local SES and VRA along with NSW RMS, base their operations from The Pines campground on the eastern shore of Blowering Reservoir just off the Snowy Mountains Highway when heading south towards Talbingo.

The boat is lifted in and out of the water using a mobile crane. Periods between racing therefore afford a good opportunity to take a closer look at the boat. A visit to Blowering to witness the trials is well worthwhile.

Spirit of Australia 2 stern quarter while being lowered onto its trailer
(Photo Martin Grimm)

Underside view of *Spirit of Australia 2* being lifted into the water
(Photo Martin Grimm)

Underside of *Spirit of Australia* at the Australian National Maritime Museum showing some of the heritage of *Spirit 2*
(Photo Martin Grimm)

An overall view of *Spirit of Australia* on display at the Australian National Maritime Museum
(Photo Martin Grimm)

Should Nuclear-powered Submarines be part of Australia's Future?

Peter Briggs

Australia's rapidly deteriorating strategic circumstances have caused me to review my earlier stance on the navy's future submarine requirements and the case for nuclear propulsion.

As Hugh White wrote in response to Paul Dibb and Richard Brabin-Smith's 2017 paper on strategic risk in a new era:

If we decide that Australia should be able independently to resist a direct attack from a major Asian power like China, then we need to start building the forces to do that right now, not wait for some further warning sign.

The time has come for early consideration of all aspects of a transition to nuclear propulsion for Australia's submarines based on compelling strategic and submarine capability arguments.

While acknowledging the strategic and operational advantages that a nuclear-powered submarine force would provide, it must be recognised that there would be some formidable challenges to overcome to add such a force to the RAN.

Quite apart from the political sensitivity of such a decision, it would be a protracted process requiring a lead time of 15 to 20 years, driven largely by the technical, training and educational preparations and a very significant increase in qualified personnel required to operate and maintain the force.

The current program to acquire 12 conventional future submarines (FSMs) is an essential starting point for a successful transition which will take significant time and a national focus to achieve. The RAN must first achieve the critical mass of submarine personnel and be able to sustain the manpower required for this challenging transition.

Attempting a transition before the Australian submarine arm has achieved sufficient size in platforms and personnel risks a capability gap even if there are no delays during the transition.

In the face of a deteriorating strategic outlook, the consequent need to transition to nuclear submarines (SSNs) expeditiously and the reality that growth of the submarine arm via FSM is essential to starting that transition, that program must be accelerated, with a national priority allocated for funds, personnel and a fast track for facilities.

A force of modern SSNs offers significant sea-denial and force-projection capabilities, providing at least twice the number of more capable submarines deployed at long range compared with an equivalent number of conventional submarines, assuring the ability to sustain a high level of deterrence and operational capability. A fleet of 12 double-crewed SSNs would allow four submarines to be on task at long range and constitute a formidable deterrent force. Such a fleet would also facilitate a rolling construction program.

A force of at least ten nuclear submarines with ten crews is the minimum required to maintain a critical mass of trained personnel and to generate the experience needed to crew the senior supervisory and policy staff needed for a globally-credible nuclear-safety organisation.

A force of at least 12 conventional future submarines, each with a crew of at least 60 and a total submarine arm of at least 2100, is judged to be a conservative, safe and viable starting point for a transition to a force of ten SSNs.

The options for Australia to develop an SSN capability would be limited to building the boats offshore or to consolidating the vessels in Australia incorporating a reactor purchased offshore. Leasing SSNs is not a practical option.

A supporting nuclear power industry is desirable as it would provide Australia with a broader regulatory, technical and educational base. However, provided that the costs of not having that support are clearly identified, the absence of an Australian nuclear-power industry should not preclude a transition to nuclear propulsion for Australia's submarines.

The timing of any transition should be one of the study's findings. Two time-lines may serve to illustrate the long lead times required:

- The initiation of a training program to prepare the policymakers and senior technical management personnel will be necessary six to eight years prior to ordering the first SSN.
- Over 250 experienced RAN submariners (approximately 12% of the submarine arm operating 12 FSMs) would enter nuclear education and training pipelines approximately eight years prior to the commissioning of the first SSN.

Given the lead time, unfolding strategic situation and benefits of nuclear propulsion, an immediate decision is recommended to commit to a feasibility study into a transition to nuclear propulsion to be delivered by 2020. It's time we understood the benefits, costs, risk and timescales of this option fully.

Finally, a reminder for cabinet's national security committee. We need to accelerate the FSM project, with national priority for resources without reducing the sovereignty of our new subs. It would also be a good idea to stock up on the high-tech/costly/long-lead-time weapons to go in those torpedo tubes.

Will someone heed the warning bells?

Author

RADM Peter Briggs AO CSC RAN (Rtd) is a retired submariner and a past president of the Submarine Institute of Australia.

First published by The Australian Strategic Policy Institute (ASPI) at www.aspistrategist.org.au. The ASPI Special Report SR129, Can Australia afford Nuclear Propelled Submarines? Can we afford not to? *by Peter Briggs was published in October 2018 and is available from www.aspi.org.au.*

Sailing Catamaran Performance Metrics

Kim Klaka

Introduction

Cruising sailing catamarans are not the high-speed, easy-capsize racing foilers which capture the sailing public's attention. They are relatively heavy, sedate and stable live-aboard platforms. They are increasingly popular in the yacht-charter market. In terms of design there are two main variants: those with retractable dagger boards and those with fixed stub keels. Their cruising role notwithstanding, performance is still an important attribute, and the usual optimisitic claims play an important part in their marketing. How can the average sailor cut through the sales spin and assess the relative performance of different models?

Here a set of five metrics is proposed for assessing the relative performance of cruising sailing catamarans, by using just six published design characteristics.

It is with some trepidation that this proposal is submitted: whilst it attempts to provide something useful, it also flies in the face of good science or engineering. Almost since the beginnings of our profession, naval architects have tried to describe the complex shape of a vessel by reducing it to a few simple parameters — length, displacement, block coefficient, and the like. We have also attempted the same with performance — resistance coefficient, Froude number, advance coefficient, etc. Sometimes these efforts are underpinned by sound analytical processes such as dimensional analysis; at other times they are driven by pragmatism. The approach described here most definitely sits in the latter camp.

Nomenclature

A	profile area (m^2)
A_b	profile area of dagger board (m^2)
AR_e	effective aspect ratio
A_s	area of stub keel (m^2)
B_{OA}	beam overall (m)
B_{WL}	waterline beam of one hull (m)
C_L	lift coefficient lift curve slope (1/rad)
e	non-dimensional lift
e_b	non-dimensional lift of dagger board
e_s	non-dimensional lift of stub keel
Fn	Froude number
g	acceleration due to gravity (m/s^2)
geosim	geometrically similar shapes of different sizes
GZ	righting arm (m)
h	heeling lever (from VCB to VCE) (m)
k, k'	arbitrary constants, sometimes dimensionless
L	lift (sideforce) (N)
L_b	lift of dagger board (N)
L_s	lift of stub keel (N)
L_{OA}	length overall (m)
L_{WL}	length on waterline (m)
R_{low}	resistance at low speed (low Froude number) (N)
R_{high}	resistance at high speed (high Froude number) (N)
RM	righting moment (Nm)
SA	sail area (m^2)
T	draft (m)
T_h	draft of hull excluding dagger boards (m)
V	boat speed (m/s)
VCB	vertical centre of buoyancy (m)
VCE	vertical centre of effort of sails (m)
VCG	vertical centre of gravity (m)
V_{ld}	downwind light airs speed metric
V_{hd}	downwind fresh breeze speed metric
V_{lu}	upwind light airs speed metric
V_{hu}	upwind fresh breeze speed metric
WSA	wetted surface area (m^2)
α	leeway angle (rad)
Δ	mass displacement (kg)
ρ	density of water (kg/m^3)

Assumptions

In order to make this issue tractable, a number of assumptions have been made:

1. Rigs are geosims, so $VCE = k\sqrt{SA}$
2. Overhang lengths are small and similar, so $L_{WL} = k \times L_{OA}$.
3. Hulls are approximately semi-circular in section underwater, so $B_{WL} = 2 \times T_h$. This equation is not used directly; it merely supports the approximation that $WSA = k \times T_h \times L_{OA}$.
4. At low Froude number, friction dominates drag, so $R_{low} = k \times WSA$.
5. At high Froude number, wavemaking dominates drag, so $R_{high} = k \times \Delta$.
6. With wind forward of the beam, the sailing efficiency is governed by the underwater shape rather than the rig (most cruising cats have much lower hydrodynamic efficiency than aerodynamic efficiency) (Palmer, 1990).
7. We only have to consider one hull for lift, drag, etc. provided that it is done consistently.
8. In the absence of a published chord length for a dagger board, it is assumed to be half the span of the board.
9. Longitudinal stability is not taken into account; in practice this often sets an upper limit on downwind boat speed in a fresh breeze.

Equations

Fundamental Relationship

The full velocity prediction process is simplified as

speed = f(stability, sail area, hull drag, foil efficiency)

For comparison of boats of different sizes, dimensionless numbers should be used for each of the above factors, with speed being non-dimensionalised using Froude number:

$$F_n = \frac{V}{\sqrt{g \times L_{OA}}}$$

Strictly speaking, waterline length should be used in this equation. However, for geosims, it is acceptable to use the more-often published overall length.

The aim is to estimate comparative speed, i.e. speed of one boat compared with speed of another, regardless of any size difference. Therefore, once a dimensionless performance factor has been established, Froude's law of comparison can be used to obtain a measure for absolute speed.

Power to Carry Sail (Tippiness Factor)

We shall only concern ourselves here with small-angle transverse stability. Small-angle stability of a catamaran is easy to formulate because the centre of buoyancy shifts from the centreline to the outer hull as soon as the windward hull starts to lift. Furthermore, the VCG of a catamaran has very little influence on small-angle stability because the righting arm is so large. Also, the width of the hulls is small compared to the overall beam. Provided that the analysis is limited to similar types of catamaran, it can be assumed that the righting lever GZ is linearly proportional to the overall beam:

$$GZ = k \times B_{OA}$$

and the righting moment becomes

$$RM = k \times \Delta \times B_{OA}$$

The heeling moment from the rig is the product of the sail force and the lever arm:

$$HM = k \times h \times SA$$

As a first approximation,

$$h = k\sqrt{SA}$$

so the heeling moment becomes

$$HM = k \times k\sqrt{SA} \times SA = k' SA^{1.5}$$

The effort required to lift a hull (the "tippiness") is linearly proportional to the ratio of heeling moment to righting moment, i.e.

$$Tippiness\ metric = \frac{HM}{RM} = \frac{k' \times SA^{1.5}}{k \times \Delta \times B_{OA}} = \frac{100 \times SA^{1.5}}{\Delta \times B_{OA}}$$

The factor of 100 has been introduced to make the resulting metric easy to read and write. However, note that this metric is not dimensionless (m^{-1}).

Downwind Speed in Light Winds

Two simplifying assumptions are made:

1. There is no leeway when sailing downwind, so the efficiency of the foils plays no part in performance.
2. There is also no heeling moment, so stability plays no part either.

Drag in light airs is mostly from friction, and the thrust is proportional to sail area. Therefore boat speed is governed by the ratio of sail area to wetted surface area. The wetted surface area is linearly proportional to length, waterline beam and hull draft. Given the assumption of a circular cross section, a light airs downwind speed number can be written as:

$$V_{ld} = \frac{SA}{L_{OA} T_h} \times \sqrt{L_{OA}}$$

This assumes that a catamaran with boards will retract them when sailing downwind.

Downwind in Fresh Winds

As was the case in light airs, the same two simplifying assumptions can be made:

1. There is no leeway when sailing downwind so the efficiency of the foils plays no part in performance.
2. There is also no heeling moment so stability plays no part either.

Drag is mostly from wave-making, and the thrust is proportional to sail area. Froude's law of comparison states that wave-making drag is linearly proportional to mass displacement for geosims. Therefore, dimensionless boat speed is governed by the dimensionless ratio of sail area to displacement. Note that, because catamaran hulls are relatively slender, friction does make up a significant proportion of hull drag at high speeds and ought to be taken into account too. Perhaps that will be included in the next iteration of this work; simplicity is paramount for this first attempt.

$$V_{hd} = \frac{1000 \times SA^3}{\Delta^2} \times \sqrt{L_{OA}}$$

The factor 1000 has been introduced to make the resulting number easy to read and write.

Upwind Hull Efficiency

Now that the basic drag and stability characteristics have been identified, the remaining and most-complex task is to determine the other factors affecting windward performance. This can be reduced to estimating the lift-drag ratio of the underwater hull shape. There are two main types of catamaran underwater hull shape: those with retractable dagger boards and those with fixed stub keels. It is assumed that the hull drag is the same for both configurations, so the difference in efficiency is attributable only to their ability to generate lift (side force).

The basic lift equation is:

$$L = C_L \frac{1}{2} \rho A V^2$$

This immediately creates a problem — the solution is iterative, requiring an estimate of boat speed V before we can calculate the lift, which determines boat speed. As a first approximation, it is assumed that boat speed is the same for all boats. On that basis, the two determining factors for producing lift are lifting area A and lift coefficient C_L. It is at this point that each underwater configuration must be examined separately.

Hull with Stub Keels

From slender body theory (Newman, 1977) for typical very low aspect ratio stub keels:

$$\frac{dC_L}{d\alpha} = \frac{\pi}{2}$$

Therefore

$$L_s = k' A_s \frac{\pi}{2}$$

Estimating the area of the stub keel from published data might at first seem problematic. However, for slender bodies

such as catamaran hulls, the hull itself contributes a useful amount of lift, as well as the stub keel. Therefore the entire underwater shape can be treated as one big slender body (or, if you prefer, one big stub keel). Provided that hulls with similarly-proportioned stub keels are being compared, the lifting area can be considered directly proportional to both the hull length and the total draft (including the stub keel). Therefore:

$$L_s = k' L_{OA} \times T \times \frac{\pi}{2}$$

If we assume that the stub keel is half the length of the boat and half the draft, then

$$L_s = k' \frac{L_{OA}}{2} \times \frac{T}{2} \times \frac{\pi}{2}$$

This is not a dimensionless quantity. In order to non-dimensionalise, it must be divided either by displacement or length cubed (we can ignore the *g* and ρ). The amount of lift generated has arguably less to do with mass than length, so length is chosen:

$$e_s = \frac{L_s}{{L_{OA}}^3} = k' \frac{1}{{L_{OA}}^2} \times \frac{T}{8} \times \pi$$

It is again assumed that the induced drag from the stub keels is small relative to the other drag components of the hull. That is not a very good assumption; it needs to be improved in the next iteration of this work.

Hull with Retractable Dagger Boards

For aspect ratios typical of dagger boards, low aspect ratio foil theory and empirical data (Lewis, 1988) show that

$$\frac{dC_L}{d\alpha} = \frac{2\pi}{\left(1 + \frac{3}{AR_e}\right)}$$

For most board configurations at moderate boat speeds, the effective aspect ratio is consistently about twice the geometric aspect ratio so, for this type of analysis, geometric aspect ratio can be used. Furthermore, to a very crude first approximation for typical board aspect ratios, the lift curve slope is directly proportional to aspect ratio (try for yourself by calculating it for effective aspect ratios of 1.5 and 3).

For a typical board of geometric aspect ratio 1.5 (effective aspect ratio about 3):

$$\frac{dC_L}{d\alpha} = \pi$$

so the lift equation for the board becomes

$$L_b = k' A_b \pi$$

It is assumed that the induced drag from the board is small relative to all the other drag components of the hull. This is probably a reasonable assumption, given the high efficiency (hence high lift-drag ratio) of a board.

The hull of a boat with retractable boards also contributes to lift, just as it does for a boat with stub keels. The total lift is therefore

$$L_{tot=} k' A_b \pi + k' \frac{L_{OA}}{2} \times \frac{T_h}{2} \times \frac{\pi}{2}$$

and the non-dimensional lift is:

$$e_b = \frac{L_b}{{L_{OA}}^3} = \frac{\left(k' A_b \pi + k' L_{OA} \times T_h \times \frac{\pi}{8}\right)}{{L_{OA}}^3}$$

Readers who are still awake at this point may realise that I have committed the unforgivable sin of adding two quantities which are dimensionally consistent but arithmetically unrelated — the constants of proportionality contain different parameters. The two weak defences offered for doing this are:

1. it seems to yield believable results; and
2. I have not yet found a better way of dealing with it.

Upwind in Light Winds

In light winds, power to carry sail is not relevant, and drag is mostly due to friction. Therefore the important parameters for upwind sailing are sail area, wetted surface area and foil lift:

$$V_{lu} = k \times \left(\frac{SA}{WSA}\right)^a \times (e)^b \times \sqrt{L_{OA}}$$

where *a* and *b* are power indices, and *e* is taken as e_s for the stub keel and e_b for the retractable board.

Upwind in Fresh Winds

In a fresh breeze two things change:

1. the power to carry sail becomes important, and
2. drag is mainly from wave-making, with not much contribution from friction.

Therefore:

$$V_{hu} = 10 \times k \times \left(\frac{SA^3}{\Delta^2}\right)^a \times (e)^b \times \left(\frac{\Delta \times B_{OA}}{SA^2}\right)^c \times \sqrt{L_{OA}}$$

where *a, b* and *c* are power indicesand *e* is taken as e_s for the stub keel and e_b for the retractable board.

The factor 10 has been introduced to make the resulting number easy to read and write.

The Upwind Equation Power Indices

The values of the indices *a, b* and *c* in both of the two upwind metrics are not known. It is quite possible that the indices *a* and *b* are different in each equation; however, for this first attempt, it is assumed that they are the same.

Their values were determined empirically by comparing the output numbers for an idealised test boat both with and without boards, and both in lightship and at full load. All three indices were initially set to unity, but this resulted in performance differences that were unrealistic. Trial-and-error was then used to obtain plausible results on the test boat. This was achieved by changing index *a* to 0.5, with indices *b* and *c* remaining at 1.0.

Error Sources

There is a number of possible sources of error in the use of these equations.

1. The biggest uncertainty is probably the estimation of displacement. Most published figures do not state whether they are for the lightship or full load; the difference is typically 30%. If both load conditions are known, then they can be treated as separate boats.

2. The second-biggest uncertainty is the estimation of sail area. Whilst it would be reasonable to assume that the published data is for upwind sail area, some data uses the area of a non-overlapping jib, whereas other data appears to use an overlapping genoa. The difference is typically 15–20% of total sail area.
3. The importance of foil efficiency and transverse stability decrease as apparent wind angle (AWA) increases because leeway decreases as AWA increases. The decrease is dealt with as a step function: one metric for upwind sailing, and another for downwind sailing. Clearly, this is a poor way of dealing with beam-reaching performance, but a weighted average of the two might offer a useful indication.

Results

The performance metrics for a dozen production catamarans have been calculated and the results seem plausible. However, there is insufficient confidence in them to publish the results just yet. Nevertheless, to give some indication of what might be, the results for three idealised boats are in the following table.

Conclusions

It would be foolish to offer conclusions from such tentative work as this. The reason for publishing this paper is to canvass views as to whether, despite the numerous assumptions and approximations, the approach taken has merit; or is it too far removed from reliable naval architecture?

Design	Test 1 lightship	Test 1 full load	Test 1 light + boards
Δ (kg)	3000	4000	3000
L_{OA} (m)	10	10	10
B_{OA} (m)	5	5	5
T (m)	1	1	0.7
SA (m^2)	50	50	50
Board span (m)	—	—	1.5
Board chord (m)	—	—	0.75
Tippiness metric *	2.4	1.8	2.4
V_{ld} **	16	16	23
V_{lu} **	9	9	17
V_{hd} **	44	25	44
V_{hu} **	28	28	44

* A high value of the tippiness metric means that the boat is tippy.
** A high value of the speed metric means that the boat is fast.

Please let me know your thoughts at kimklaka@gmail.com. I look forward to your responses!

References

Palmer, C. (1990) Sail and Hull Performance, *Wooden Boat,* No. 92, Wooden Boat, Brooklin, Maine, USA, January/February 1990.

Newman, J.N. (1977) *Marine Hydrodynamics*, MIT Press, Cambridge, Massachusetts, USA.

Lewis, E.V. (Ed.) (1988) *Principles of Naval Architecture,* v.3, Society of Naval Architects and Marine Engineers, New York.

EDUCATION NEWS

Australian Maritime College
AMC Maritime Engineering Student Research Projects

Final-year Bachelor and Master of Engineering students have honed their presentation skills and gained invaluable industry feedback on their thesis projects at the Australian Maritime College's Maritime Engineering Research Conference in early November.

The annual conference marks the culmination of countless hours of hard work during the last year of their maritime engineering degrees, with students required to deliver a 15-minute presentation and 5-minute Q&A session which is judged by industry assessors.

A total of 85 presentations were delivered to the panel of external assessors, the majority of whom travelled from interstate to attend the conference.

Bachelor of Engineering (Ocean Engineering) student Eric Gubesch was awarded the best-presentation prize for his research integrating multiple wave-energy converters into a multi-purpose floating platform.

"The concept involved developing a floating structure which could be used for a variety of purposes and uses the motions of the platform to generate energy," Mr Gubesch said.

"The platform integrated four wave-energy converters (called oscillating water columns) into a rectangular structure and could potentially be used in the offshore aquaculture industry or in applications where an isolated floating structure requires a source of energy.

"I chose this topic because I am very interested in marine renewables and think that there is a very useful application for this technology in the future."

Mr Gubesch won a trophy from the Royal Institution of Naval Architects (Tasmanian Section) and $250 from the Australian Maritime Safety Authority (AMSA) for his efforts.

Runners-up Samuel Smith and Yew Kee Goh each received $125 from AMSA for their research on strength analysis of corroded aluminium structures and analysing AUV area coverage planning respectively.

Nick Johnson and Eric Gubesch
(Photo courtesy AMC)

Upon graduation, Mr Gubesch plans to build a career contributing to the development and application of marine renewable energy. His aspirations include completing a PhD in the field and sharing this knowledge with students and the global research community.

"I enjoy the pursuit of solving challenging problems with innovative solutions and the marine renewable industry requires exactly that," he said.

A/Prof. Gregor Macfarlane said that the quality of the presentations was a testament to the students' efforts throughout the course of their degrees.

AMC students together for the Maritime Engineering Research Conference
(Photo courtesy AMC)

"The Maritime Engineering Research Conference was an excellent experience for both students and staff. It provides students with the opportunity to build their presentation skills in front of a relevant audience, as well as highlighting some of AMC's current research focus," he said.

"We had a terrific turnout with a record number of 32 external assessors in attendance from all corners of the country. In fact, 75 per cent travelled from outside Tasmania for the event, highlighting the truly national reach of our maritime engineering degree programs."

For Mr Gubesch, the conference capped off a rewarding study experience at AMC, the highlight of which has been conducting experiments in hands-on facilities such as the model test basin.

"I have learned so much from applying theoretical concepts learned in the classroom to the real world in the model test basin and other AMC facilities," he said.

"I have had the opportunity to design a range of floating (and other) structures from first principles, construct them in the build studio, conduct scale model experiments, and then evaluate and compare the performance to my initial design. This learning cycle has been invaluable.

"I would like to thank all the AMC lecturers and support staff who have influenced me over the past four years. Their help and guidance has been excellent."

AMC Researcher Making Waves in Renewable Energy

Chasing waves is a lifelong passion for Australian Maritime College PhD candidate Jarrah Orphin, and he's harnessed this love of the ocean to dive into research in the marine renewable energy field.

In September Mr Orphin was awarded the Laurie Prandolini Research Fellowship through the Institute of Marine Engineering, Science and Technology (IMarEST) and will use the $14 000 grant to replicate the same scale model tests he is conducting at the University of Tasmania's Australian Maritime College at another international university.

The fellowship was established to honour Laurie Prandolini, who made an outstanding contribution to the maritime community in the Australia, New Zealand, and South Pacific region. It provides an annual grant to a doctoral candidate or postdoctoral researcher in the marine engineering, marine science or marine technology domains.

Mr Orphin, 26, grew up on the beach in Milton on NSW's South Coast and wanted to pursue tertiary studies which combined his love of the ocean with his interest in building things.

He relocated to Tasmania in 2012 to undertake a Bachelor of Engineering (Ocean Engineering) degree at AMC. After graduating in 2015, he took a year off to travel and gain some industry experience at Bombora Wave Power, a wave energy development company based in Western Australia.

This work further cemented his interest in the field of marine renewable energy, so Mr Orphin returned to AMC to start a PhD in Maritime Engineering in 2016.

His three-year project aims to mitigate the uncertainty which currently exists in the hydrodynamic modelling of wave energy

PhD candidate Jarrah Orphin conducts tests on a model wave energy converter in the model test basin at the Australian Maritime College (Photo courtesy AMC)

converters — machines which extract power from ocean waves and convert it to renewable energy.

"The primary objective of this research is, firstly, to try and understand where these uncertainties in the modelling are coming from and, secondly, to develop procedures to analyse them," Mr Orphin said.

"We're looking to replicate the experiments that we're doing here (at AMC) in another facility to gain an insight into how the laboratory influences the test results, and that will help set the benchmark for how certain each facility is in producing that data.

"Effectively what we're trying to do is to make the data which we collect in physical scale experiments more reliable, so that when engineers take this data they can design these big machines which cost millions of dollars with more confidence."

Ultimately, Mr Orphin's research findings will be used to improve international best practice for physical modelling of wave energy converters. He will propose a new set of guidelines for use by developers to allow them to collect more accurate data.

The results will be shared with the international research community through first-quartile journals and the International Towing Tank Conference — a voluntary association of organisations which conduct hydrodynamic testing to predict the performance of ships and marine installations around the world.

AMC Search Partnership to Deliver Drone Training

AMC Search, the commercial arm of the Australian Maritime College, and The Institute for Drone Technology™ have signed a memorandum of understanding to bring drone technology training into the maritime training environment. The partnership was launched at the MIAL SEA18 conference in Canberra on Tuesday 16 October with the first three courses offered in Sydney from November 2018.

Drone technology has unprecedented capacity to provide improvements in safety, efficiency and innovation in the maritime environment.

By partnering to deliver contextualised drone technology

training to AMC Search course participants, the two organisations aim to make Australia a leader in the integration of drone technology and maritime activities and help build a highly-skilled workforce to drive the future of the maritime industry.

The agreement will see relevant training products delivered from beginner to advanced levels, and include a variety of delivery methods so workers from across the maritime industry can access world-class training and obtain the skills they need to make the most of this revolutionary technology.

The first three courses, Remote Pilot's Licence, Safe Drone Operation for Managers, and Flight Basics: Hazards, Batteries and the Law, were to be offered out of the Australian Maritime College's Sydney Study Centre in Darling Harbour in November.

Dr Joel Spencer, CEO of The Institute for Drone Technology, said that the organisation was excited to work with AMC Search to extend the training offering into drone technology for the maritime industry.

"The potential for drone technology in the maritime industry is enormous and centrally concerns improving safety for workers. This is the first time a drone technology organisation has teamed with a maritime training organisation to provide contextualised drone training in a marine environment," Dr Spencer said.

Emilie Donovan, Manager – Training at AMC Search, explained that the new drone training courses are being offered in response to industry demand.

"AMC Search prides itself on offering training that the industry needs, adapting and supplementing our training program year-on-year in response to feedback from our stakeholders and customers," Ms Donovan said.

"As the applications of drones in the maritime industry become better understood, and drone usage increases in our sector, the need for specialised maritime drone training became apparent."

Dr Spencer added that the partnership is expected to develop to help create industry leaders in the use and integration of drones.

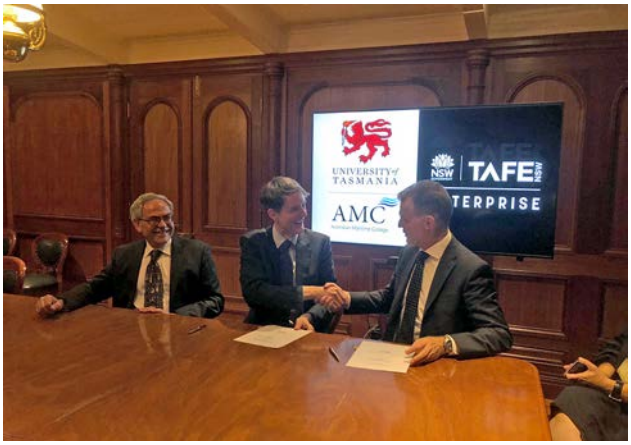
"It is envisioned, that by working together into the future, this project could be expanded in a number of ways to further and more effectively embed drone technology training into maritime training programs," he said.

"This will ensure that AMC Search course participants not only have the skills demanded by employers in the near future, but can also become leaders in the integration of drone technology into the maritime industry in their own right."

AMC and TAFE NSW Partner on Shipbuilding Pathways

The University of Tasmania's Australian Maritime College and TAFE NSW have strengthened their joint capability to supply skilled workers for Australia's naval shipbuilding program with an agreement to collaborate on education and skills development.

The two organisations have signed a memorandum of understanding to develop direct study pathways from TAFE NSW vocational education and training programs to the Australian Maritime College specialist undergraduate degrees,



College of Sciences and Engineering Executive Dean, Prof. Brian Yates, University of Tasmania Vice-Chancellor Prof. Rufus Black and TAFE NSW Chief Operating Officer Glen Babington sign the memorandum of understanding
(Photo courtesy AMC)

particularly in the areas of maritime engineering and global logistics management.

AMC students are also set to benefit with opportunities for reverse articulation to TAFE NSW's vocational courses, allowing them to upskill and engage in ongoing professional development.

University of Tasmania Vice-Chancellor, Prof. Rufus Black, said that the partnership was an important step towards building a pipeline of skilled workers for the naval shipbuilding projects in Australia.

"The Federal Government's investment in the continuous naval shipbuilding program has led to significant career opportunities for the next generation of engineers, project managers and logisticians," Prof. Black said.

"As the national institute for maritime education, training and research, the Australian Maritime College has the expertise and infrastructure required to help build this capacity and support the goals of the naval shipbuilding program.

"We are very much looking forward to collaborating with TAFE NSW to create a study continuum so that more students in New South Wales can participate in the growth of the shipbuilding industry.

"The collaboration is a good strategic fit for both of our operations, with New South Wales set to be a key location for Defence sustainment activities as well as already supporting a large maritime industry sector through the major ports of Sydney, Botany Bay, Newcastle and Port Kembla."

This new memorandum of understanding builds on a longstanding partnership between TAFE NSW and AMC for articulation from their seafaring courses.

TAFE NSW Chief Operating Officer, Glen Babington, said that the new partnership would provide a valuable opportunity to bring more young people through the doors eager to study in the areas of maritime engineering and global logistics management.

"As Australia's largest education and training provider, TAFE NSW prides itself on providing the practical training and relevant skills that students need to get a job. We also recognise the changing nature of work and the rise of new technologies, which is why we're designing state-of-the-art training to skill the workforce of the future," Mr Babington said.

"By liaising with industry to develop, teach, and maintain course curriculum, we can that ensure our students finish their studies with precisely the skills which they need to be job ready."

The collaboration with TAFE NSW follows similar agreements that AMC has forged with TAFE SA and South Metropolitan TAFE.

UNSW Sydney

Undergraduate News

Thesis Topics

Among the interesting undergraduate thesis projects recently completed is the following:

Prediction of Ship Squat in Shallow Water

There are empirical methods around for the prediction of ship squat, which is the loss of under-keel clearance when a ship is under way in shallow water or a channel. However, CFD offers the possibility of improved results with modelling of the actual hull shape.

Seyit Sarioglu investigated the application of computational fluid dynamics to the prediction of ship squat and compared the results to experimental data, numerical prediction methods, and to the results of a slender-body prediction program written by Em/Prof. Lawry Doctors. CFD gives good results and has the advantage that it can take into account all the factors which affect the squat, but is considerably more complex to model and apply and, hence, more labour intensive and time consuming.

MechSoc Annual Ball

The Mechanical Engineering Students' Society Annual Ball was held on the evening of Monday 29 October in the James Cook Ballroom at the Intercontinental Hotel in Sydney, with the theme of *The Last Voyage* paying respect to the sinking of the naval architecture degree program at UNSW Sydney. The ball was attended by most of the naval architecture students (and some partners), and Phil Helmore who was invited to make the after-dinner speech. Phil gave some of the history of naval architecture at UNSW, the achievements of some of the graduates, and some of the things which have happened along the way.

Naval architects at the MechSoc Ball (L to R):
Isabella Yan, Yun Wang, Patrick McManus, Phil Helmore, Gianluca Viluce Correa, Max McCann, Tamasin Welch, Patrick Doherty and Nelson Tsang
(Photo courtesy Helen Wortham)

Thesis Conference

The School has moved to having a Thesis Conference in each Semester, due to the increasing number of mid-year starts. At the undergraduate Thesis Conference on 1 November at the end of Semester 2 in 2018, the following presentations by naval architecture students were made:

Patrick Doherty	*Parametric Analysis of Ice-breaker Bow Geometry*
Billy Gosper	*Fashion or Function: A VPP Investigation of Yacht Bow Geometries*
Patrick McManus	*Validation Study of Blohm+Voss Type S Fin Stabiliser*
Seyit Sarioglu	*CFD Analysis of Ship Squat*
Yun Wang	*Analysis of the Naples Warped Hard Chine Hull Systematic Series*

RINA–DST Group Award

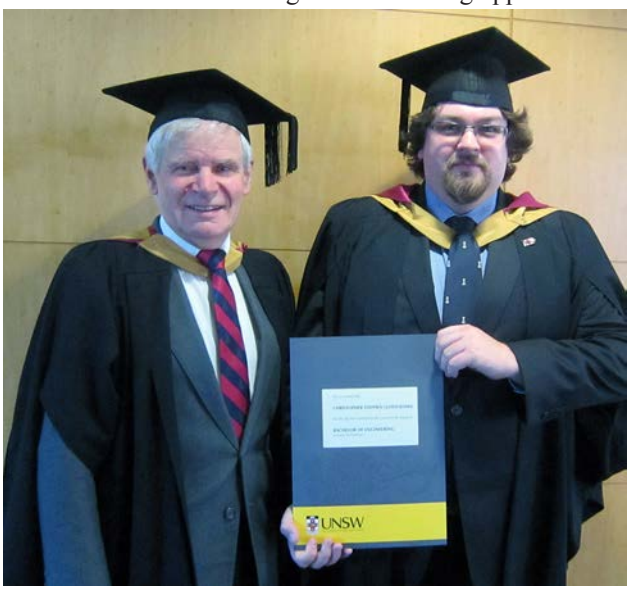
RINA and the Defence Science and Technology Group jointly offered an award of $125 and a certificate for the best presentation at the Semester 2 Thesis Conference by a student member of RINA on a naval architectural project. Assessment was made on the basis of marks awarded by School staff. The award went to Patrick Doherty for his presentation on *Parametric Analysis of Ice-breaker Bow Geometry.* Patrick's certificate and cheque are under way.

Graduation Ceremony

At the graduation ceremony on 8 November, the following graduated with degrees in naval architecture:

Christopher Lloyd-Jones

Christopher is Assistant Maintenance Manager at the Fernbank Retirement Village and evaluating opportunities.



Phil Helmore and Christopher Lloyd-Jones
at the UNSW Graduation Ceremony on 8 November
(Photo courtesy Carolyn Lloyd-Jones)

Naval Architects' Annual Dinner

With the passing into history of the School's annual undergraduate Thesis Conference Dinner, the seventh and second-last Naval Architects' Annual Dinner was held on 20 November at Giovanna Italian Restaurant in Kingsford, and was attended by most of the final-year naval architects, along with staff David Lyons and Phil Helmore.

Closure of Naval Architecture at UNSW

NAVL3620 Ship Hydrodynamics (Rozetta Payne) and NAVL4130 Ship Design Project B (Phil Helmore) have been taught in Semester 2at UNSW Sydney for the last time, and are the last courses in naval architecture to be taught at UNSW. Six naval architecture students expect to graduate in May next year, with the remainder completing MMAN and MECH courses next year to graduate in August next year or May 2020. Then naval architecture at UNSW Sydney will be no more.

Phil Helmore will go on long-service leave in January and retire fully in mid-December next year — his UNSW email address will work until full retirement.

David Lyons will continue at UNSW Sydney, teaching MMAN2130 Engineering Design 2, MECH4100 Mechanical Design 2, MMAN410 Thesis A, MMAN4020 Thesis B, MECH9420 Composite Materials and Mechanics, and coordinating Industrial Training for the School.

Phil Helmore

Naval Shipbuilding College Opened

Australia's Naval Shipbuilding College was officially opened on 1 November. The College will deliver a coordinated, national approach to workforce development and skilling for Australia's naval shipbuilding enterprise.

The Minister for Defence, the Hon. Christopher Pyne MP officially opened the College at Osborne in South Australia.

Minister Pyne said that it's an integral interface with the shipbuilding industry to identify workforce requirements throughout all phases of construction and sustainment.

"Today is exciting day for the future of shipbuilding in this country," Minister Pyne said.

Under the management of the Naval Shipbuilding Institute, the College will also link up with education providers, as part of a hub-and-spoke model, to that ensure courses are offered across Australia which produce workers who are job-ready.

"The College is a critical enabler of the continuous naval shipbuilding program which will build and sustain Australia's naval capabilities, create economic growth and secure Australian jobs for decades to come."

"I'm particularly excited to launch the naval shipbuilding workforce register."

"It enables Australians who are interested in long-term shipbuilding career opportunities to express their interest and receive assistance through the skilling and employment process."

"The workforce register will help connect people with potential employers or education providers."

"I encourage anyone interested in working on some of the most technologically-advanced cutting-edge projects anywhere in the world to register."

Defence Industry Internship Program

It was announced on 1 November 2018 that the Defence Industry Internship Program is now taking applications.

The program supports small-to-medium enterprises (SMEs) in the defence industry to harness the highly-skilled Australians needed to support the Australian Defence Force.

The program matches third- and fourth-year engineering students, 30 in total, with defence industry SMEs for a 12-week placement, to provide real-world experience in pursuing a career in the defence industry.

The Government is investing $200 billion in Defence capability over the next decade and the program is one way the Government plans to help defence industry develop and retain people critical to Australia building a world-leading defence industry sector.

The program will be delivered by the Queensland Tertiary Admissions Centre, leveraging off its 40 years of experience in delivery of internship programs across Australia. Further information can be found at www.diip.com.au.

INDUSTRY NEWS

BAE Systems Bid for LHD Sustainment Contract

BAE Systems has submitted its bid to the Australian Government to provide ongoing sustainment and support for the Canberra-class Landing Helicopter Dock ships (LHD), LHD Landing Craft (LLC) and associated shore-support facilities.

BAE Systems has partnered with Atlantic & Peninsula Australia, Saab Australia and Navantia Australia to offer an experienced program team to maintain the capabilities of the LHD assets, optimise the sustainment and support system and deliver the best outcome for the Commonwealth.

BAE Systems Australia was the prime contractor for the Canberra -class LHDs and has provided the initial five-year in-service support for the ships.

The company has supported HMA Ships *Canberra* and *Adelaide* from their base at the Royal Australian Navy's Garden Island facility, providing the sustainment necessary to ensure that the ships are capable and available to undertake a range of operational requirements.

Atlantic & Peninsula Australia has delivered exemplary support to HMAS *Choules,* built on inherent platform knowledge and extensive amphibious ship support experience.

Saab has unique knowledge of the LHD Combat System and proven collaboration within the ANZAC Enterprise.

Navantia is the LHD platform designer and constructed the hulls for the Canberra class. Navantia is also the platform designer and prime contractor for the twelve LLCs. The

LLCs were designed and built to specifically operate with the RAN's two LHDs.

BAE Systems Australia Chief Executive, Gabby Costigan, said "BAE Systems is proud to have submitted its response to the Australian Government for the LHD Asset Class Prime Contractor (ACPC) program. We have a long history of supporting the LHD and maritime sustainment for the RAN that not only includes the LHD but also four other classes of ships.

"Through our role in the LHDs acquisition and transition to service, we have developed a deep understanding of them and we have a strong Australian supply chain in place to support their sustainment.

"We have partnered with the right companies to ensure that we provide the best customer offering. Our commitment to maritime sustainment as well as our role in shipbuilding supports the Government's plans for a future naval shipbuilding industry which delivers comprehensive Australian industrial capability and supports local jobs and the wider economy."

Iridium and Rolls-Royce Marine to Expand the Reach and Capabilities of Autonomous Vessels

Iridium Communications Inc. has announced the signing of a Letter of Intent with smart-shipping pioneer Rolls-Royce Marine (RRM), in support of their autonomous vessel development program.

Through this arrangement, RRM and Iridium will work together to explore incorporating Iridium's next-generation L-band satellite broadband service, Iridium CertusSM, into the RRM suite of Ship Intelligence solutions. By doing so, RRM will have a resilient and reliable broadband capability which can serve as a stand-alone option or high-throughput backup, while expanding the reach of autonomous vessels to all the world's waterways. As a leader in the autonomous vessel movement, RRM's solutions deliver multi-faceted enhancements to ships, enabling remote diagnostics, operations and performance-monitoring capabilities. Among many offerings, these solutions provide remote access to onshore operators and control centres, delivering real-time connectivity and automation.

By automating processes such as navigation, crew are able to focus on more valuable areas of vessel operations helping to streamline overall functionality, ushering in a new digital era of shipping. A strategic part of the maritime industry's future, autonomous ships are being examined by the International Maritime Organisation (IMO), where they are defining the regulatory environment and degrees of autonomy for Maritime Autonomous Surface Ships. The capabilities offered by Iridium Certus will help streamline management of vessel operations, whether for command and control, engine diagnostics, tracking information and other onboard processes for a simple, secure and reliable experience. Iridium operates the world's largest, and only pole-to-pole, mobile commercial satellite constellation. The network comprises 66 crosslinked LEO [*low earth orbit* — Ed.] satellites which blanket the entire planet with reliable satellite connectivity.

The Iridium network enables a portfolio of maritime applications, including voice and data communications, and is poised to supercharge these capabilities with Iridium Certus. Enabled by Iridium NEXT, the Company's next-generation, $3 billion satellite constellation, Iridium Certus will provide high-quality voice capabilities, alongside enterprise-grade broadband functionality, for the entire planet, whether on land, in the air or at sea. The service, planned for commercial availability in 2018, will soon after deliver the fastest L-band satellite broadband speeds on the market, through small-form-factor cost-effective terminals. Initial service offering speeds will debut at 352 kbps and will later be upgradable to 704 kbps with a firmware upgrade.

Iridium NEXT is the Company's next-generation satellite constellation currently being launched by SpaceX. To date, there have been seven successful Iridium NEXT launches, deploying 65 new satellites. One launch remains before completion of the company's historic constellation refresh. In total, 75 new satellites are being launched to LEO, of which 66 will be in the active constellation, with nine on-orbit spares. Iridium is the only mobile voice and data satellite communications network which spans the entire globe. Iridium enables connections between people, organisations and assets to and from anywhere, in real time. Together with its ecosystem of partner companies, Iridium delivers an innovative and rich portfolio of reliable solutions for markets which require truly global communications. The company has a major development program underway for its next-generation network — Iridium NEXT. Iridium Communications Inc. is headquartered in McLean, VA.

Naval Group and Fincantieri Joint Venture Plans

Italy's Fincantieri and France's Naval Group have outlined plans for a possible future joint venture.

The latest agreement is the result of a year's work during which the two sides looked at ways of creating "a more efficient and competitive" European shipbuilding industry and to reinforce their military naval cooperation.

The French and Italian governments announced their intention to establish an industrial alliance between Fincantieri and Naval Group at the 34th Franco-Italian Summit held in Lyon on 27 September 2017.

Fincantieri and Naval Group have cooperated since this date and submitted their proposal for such an alliance in July 2018 to the competent French and Italian Ministers, encompassing an industrial project and its envisaged roadmap, along with a description of the key initiatives.

Acknowledging the declaration of support by the French and Italian governments, and subject to each company's board of directors' approval, Fincantieri and Naval Group are ready to concretely launch the alliance in particular with the aim of setting forth the terms and conditions for the incorporation of a 50/50 joint venture.

Through this JV, Fincantieri and Naval Group will jointly prepare winning offers for bi-national programs and for the export market. The two companies will also look to foster a more efficient supply policy, to jointly conduct selected research and innovation activities and to encourage cross-fertilisation between the two companies, with sharing of testing facilities/tools and expertise networks.

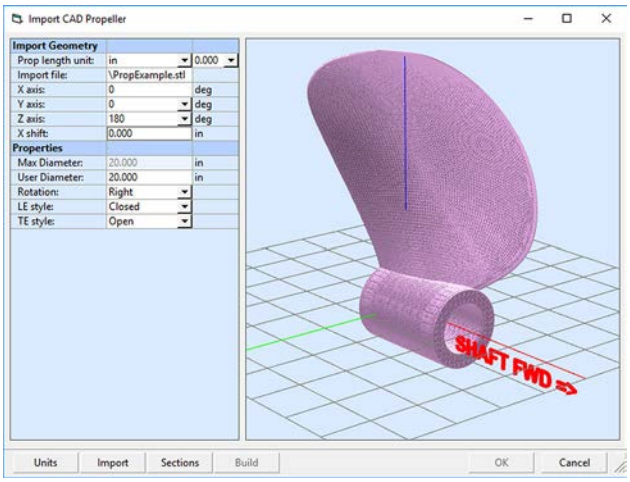
So far, Naval Group and Fincantieri have already engaged in a common industrial collaboration to provide the French Navy with four logistic support ships (LSS), based on the design of the Italian Vulcano LSS. The Flotte Logistique (FLOTLOG) program is expected to start in 2019 with the first two double-hull tankers delivered in 2025.

Furthermore, as of 2019 and with the support of both Ministries of Defence, Naval Group and Fincantieri contemplate presenting a common offer for the first studies for the Mid-Life Upgrade of the French and Italian Horizon-class destroyers with a common combat management system.

A government-to-government agreement would be needed to ensure the protection of sovereign assets, a fluid collaboration between the French and Italian teams, and encourage further coherence of the national assistance programs which provide a framework and support export sales.

HydroComp Automates Import of 3D CAD Files

HydroComp Inc. has included a new utility in the latest release of PropCad 2018 Premium Edition to simplify the extraction of propeller features from full 3D CAD files. This new feature drastically reduces the time and effort needed to recreate an existing propeller or product model — a critical task for propeller designers and manufacturers. A process which previously took several hours can now be completed in just a few minutes.



A screen shot from the import utility
(Image courtesy HydroComp)

The Import CAD File utility can be used to automatically extract geometric data from a CAD file. The user selects a CAD file in either STL or OBJ formats. The CAD models require the shaft axis to be positioned at the origin, but there are tools in the utility to rotate and translate the CAD data into the proper position with the integrated 3D preview window.

After selecting which radial sections to sample from the CAD data, the 3D intersections are calculated. PropCad's mathematics calculate the 2D section shapes and the associated parameters for chord length, thickness, pitch, rake, and skew from the intersections.

The user has an opportunity to review the derived distributions within the utility. The reference line representing the pitch plane can be manipulated to yield the proper frame of reference for the propeller's design data. The face and back offsets will automatically be calculated from the extents of the 2D section.

More information can be found at www.hydrocompinc.com.

ASC Teams up with Asset Management Council

ASC has launched a new partnership with Australian Asset Management Council (AM Council) to strengthen its life-cycle management execution of the Collins-class submarine fleet.

The move follows ASC becoming the first Australian defence company recognised with international certification for asset management for defence assets — awarded by BSI International in April 2018.

"This partnership with the AM Council will drive continuous improvement in ASC's submarine sustainment, upgrade and life-of-type extension for the entire fleet, using life-cycle management principles," Stuart Whiley, ASC Chief Executive Officer, said.

"Defence has endorsed asset management as best practice in maximising value from its critical assets. With this partnership, ASC and the Asset Management Council are showing the way for others in the Australian defence industry. We are excited at what the future brings, both for this partnership and the improvements which we can bring to bear for the Collins-class fleet in coming years," he added.

The partnership will initially see 40 specifically-selected key ASC submarine experts undergo targeted training, seminars and joint events focused on asset management and life-cycle management.

This initiative is expected to generate a broader and deeper understanding of asset management in general and will result in the adoption of relevant methodologies and alignment across ASC's submarine business.

"The objective is to maximise the value of the submarine to Australia's submarine enterprise by optimising submarine capability, availability and affordability throughout its service life," Mr Whiley explained.

ASC and DST Group to Collaborate in Submarine Technologies

The Australian shipbuilder ASC has signed a strategic cooperation agreement with the Defence Science and Technology Group (DST Group) to further collaborate in the submarine-related technologies.

Commenting on the new agreement, ASC CEO, Stuart Whiley, said "I'm delighted to secure ASC's continued collaboration with DST Group and look forward to further benefits for Australia's operational submarine fleet, the Collins class, across ASC's responsibilities in submarine maintenance, sustainment, upgrades and life-of-type extension."

He further said that the collaboration with Australia's leading government-sector defence research organisation was important for the company's commitment to continuous improvement.

"As the builder, design authority and maintainer of the

Collins-class fleet, which will be in service into the 2040s, ASC's partnerships with subject-matter experts and research organisations are a high priority," Mr Whiley added.

Since ASC and DST Group last formalised the collaboration in 2013, the organisations have delivered positive outcomes for Australia's submarine enterprise in submarine structures, materials, hydrodynamics, signatures and diesel engines.

ASC and Saab to Work Together on A26 Submarine Program

Saab has entered into an agreement with Australian submarine specialist ASC for the provision of a range of services which include engineering services for the A26 submarine program.

Saab is building two A26 submarines for the Royal Swedish Navy and is offering three export variants of the A26 design on the international market.

ASC and Saab will launch a pilot program which will see ASC's submarine designers delivering specialist detailed design services in Adelaide for Saab's A26 program.

Upon successful completion, ASC will provide ongoing services to Saab across various projects.

"The Saab-ASC engagement recognises ASC's long-standing relationship with Saab on the Collins-class submarine," ASC Chief Executive, Stuart Whiley, said. "It also recognises ASC's up-to-date design-to-build capability first developed on the Collins project in partnership with Kockums in the 1980s and 1990s."

Managing Director of Saab Australia, Andy Keough, said "This agreement with ASC is another example of Saab's commitment to the Australian Submarine enterprise and will facilitate engineering knowledge and experience transfer between Australia and Sweden. We are pleased to engage ASC in the Saab supply chain."

ASC CEO Stuart Whiley (R) and Saab Australia Managing Director Andy Keough signing the agreement
(Photo courtesy ASC)

Mr Whiley said that the program would have a positive impact on ASC's submarine workforce, provide additional opportunities and professional rewards for ASC's engineers and designers, along with ASC's core responsibility of the platform sustainment of the Collins Class fleet.

"This work will strengthen ASC's capability to deliver submarine engineering and design services in coming years and to be able to support Australia's growing submarine sector," Mr Whiley concluded.

Naval Group Unveils new Li-ion Battery System

The French defense technology company Naval Group has unveiled a new lithium-ion (Li-ion) battery system which will provide conventional submarines with improved operational capabilities, as well as an optimised diving period and recharging time.

The system was developed in close technical partnership

with the French Defence Procurement Agency (DGA) and in close cooperation with Saft, CEA Tech and EDF R&D.

Naval Group is the system provider and integrator, Saft was responsible for the conception and production of Li-ion batteries, CEA Tech provided Naval Group with its research capacities in the fields of chemistry, structure and electronics and, finally, EDF R&D provided its testing facilities for energy production systems requiring high levels of safety, reliability and security.

Naval Group says that the system, named LIBRT, offers double the available energy while reducing significantly the recharging time when compared with current battery technology.

"The successful development of the LIBRT Li-ion batteries systems is a huge technological stride for the new generation of submarines developed by Naval Group," Alain Guillou, Senior Executive Vice-President said.

Collaboration Agreements for ASC

FIVA, suppliers of engineering services to the naval defence, energy and environment sectors, has announced a collaboration agreement with Australian submarine builder and maintainer ASC Pty Ltd.

Together, FIVA and ASC intend to develop a joint submarine design workforce in Australia with the capability of satisfying Naval Group's demands for design services in support of the Australian Future Submarine Program. This proposed alliance seeks to exploit the capabilities resulting from the collaboration between a European long-term partner of Naval Group and an experienced Australian submarine company.

"We are proud to partner with ASC, who constructed and now maintains the Australian Collins-class submarine fleet," said Yannick Vergez, CEO of Groupe FIVA.

"The 30 years of experience and the current capability of ASC make it a natural ally of FIVA and the services we provide to Naval Group. This agreement will lay the foundations for FIVA and ASC to add value to our clients, especially Naval Group.'

ASC's Chief Executive, Stuart Whiley, welcomed the agreement. "ASC is Australia's foremost submarine platform company, with significant current design-and-build expertise developed over thirty years working in the heart of the Australian submarine sector."

"This collaboration between ASC and FIVA creates mutual benefits, with FIVA's experience providing submarine design services to Naval Group in France and ASC's experience in submarine platforms in Australia."

As the sustainer and in-service platform designer for the Collins-class fleet, ASC offers current submarine design expertise which is able to deliver solutions which comply with Australian Standards and the requirements of the Commonwealth of Australia.

"This is an alliance between a European company and long-term partner of Naval Group and an experienced Australian submarine company," said Mr Vergez.

The collaboration agreement will allow the development of a design workforce for submarines in Australia which is familiar with the design processes, techniques and tools required by Naval Group.

ASC has also entered into a long-term collaboration agreement with French submarine motor manufacturer Jeumont Electric, opening the way for joint initiatives in support of the Collins-class submarines and future submarine programs.

Under the agreement, Jeumont Electric and ASC will exploit synergies in the delivery of services supporting the ongoing sustainment and upgrade of the Collins-class submarines in preparation for support of the design, build and test of the main motors for the future submarine program. The agreement builds upon the long standing relationship developed between Jeumont Electric and ASC during ASC's construction and sustainment of the Collins class.

Not only is Jeumont Electric the supplier of the main motors for the Collins-class fleet, it is also the preferred supplier of new-generation permanent-magnet motors for the Australian future submarine program.

ASC and Endel Engie have also signed a collaboration agreement. The collaboration brings together ASC and Endel Engie, an established supplier of construction and assembly services for Naval Group's submarine programs in Cherbourg, France.

For more than 20 years, Endel Engie has been a major subcontractor to Naval Group, in the construction and the maintenance of frigates and submarines to a high level of technical sophistication. Endel Engie is involved in the construction and assembly of several submarines in Cherbourg, working in its areas of expertise, which are mechanics, sheet metal work, piping, welding and handling.

The collaboration is aimed at providing additional submarine-building capacity in Australia for Australia's future submarine program prime contractor, Naval Group. Emeric Burin des Roziers, Chief Executive Officer of Endel Engie, said "With the support of our colleagues from Engie Services Australia, our presence in Adelaide alongside ASC will enable us to offer Naval Group in Australia our well-known expertise and experience. Our teams will be trained in France and Australia to meet the stringent demands of submarine construction."

ASC Chief Executive Officer, Stuart Whiley, said "ASC welcomes this collaboration as it leverages ASC's significant submarine expertise, developed over 30 years working in the heart of the Australian submarine sector."

ASC receives International Procurement Excellence Award

In September ASC received the international corporate certification for excellence in procurement from the Chartered Institute of Procurement and Supply (CIPS), the first Australian defence company to be so recognised.

ASC Chief Executive Officer, Stuart Whiley, said that the CIPS Corporate Standard certification, which followed an in-depth examination by CIPS, was critical in enhancing ASC's role as Australia's largest sovereign-controlled defence prime contractor.

"The award is independent recognition by the global professional body of the quality and robustness of our

procurement policies, processes and procedures," said Mr Whiley.

"This achievement will guide our future work in procurement — a critical role as Australia's largest locally-owned defence prime contractor, supporting the Government's Naval Shipbuilding Plan."

Over several months, ASC underwent an in-depth examination of its purchasing policies, processes and procedures to ensure alignment with the CIPS corporate benchmarks. As a result of this in-depth review, ASC was awarded CIPS Corporate Standard certification and was provided with a detailed report which included assessors' commentary on the outcomes and as recommendations for further improvement.

Wärtsilä LNG Solutions for Environmentally-advanced Cruise Ship

Wärtsilä's 31DF dual-fuel engine, which emphasises outstanding efficiency, extremely economical fuel consumption, and minimal emissions, has been selected to power a new and highly-advanced pioneering cruise vessel. The polar ice-class luxury cruise vessel is being built for the France-based operator Ponant at Vard Søviknes, a part of VARD shipbuilding group in Norway. The order with Wärtsilä was placed in the second quarter of 2018.

Because the 150 m long ship will operate in environmentally-sensitive Arctic and Antarctic waters, it will operate primarily on LNG. Wärtsilä's advanced technologies and experience in LNG solutions were cited as key reasons for the selection of the 31DF engines and other Wärtsilä solutions.

In addition to four 14-cylinder and two 10-cylinder Wärtsilä 31DF engines, Wärtsilä will also supply the fuel-gas supply system, chosen because of the company's outstanding experience and references in gas containment and gas fuel systems. Also included in the scope is Wärtsilä's Nacos Platinum advanced navigation equipment, which can later be integrated with an Eniram proactive energy-management system delivering predictive insights and mobile alerts. Eniram is a Wärtsilä company.

The company's Smart Marine Ecosystem vision is to use high levels of connectivity and digitalisation in enabling the efficient use of resources, the highest levels of safety, and the least possible impact on the environment.

"We have ordered the building of a clean ship featuring technologies which go beyond current industry-standard environmental regulations. This is why we have chosen a propulsion format with Wärtsilä's highly-efficient 31DF engine running on LNG," said Charles Gravatte, Ponant General Secretary.

"Wärtsilä's cutting-edge technologies are making a huge contribution to creating cleaner, more efficient, and more environmentally sustainable shipping. This valuable contract is a clear example of this. We are delighted to be supporting Ponant in enabling this cruise ship to meet the highest standards of sustainability," said Glenn Mattas, Regional Sales Director, South Europe & Africa, Wärtsilä Marine Solutions.

The Wärtsilä equipment is scheduled to be delivered in 2020, one year before delivery of Ponant's polar ice-class luxury cruise vessel. This will be the twelfth ship in Ponant's fleet of cruise vessels. The previous eleven ships are all powered by Wärtsilä engines.

Wärtsilä Chosen for LNG-fuelled High-speed Catamaran

The Spanish shipping company Baleària has announced construction of the world's first fast ferry for passengers and cargo powered by dual-fuel LNG engines. The Incat Crowther 125 design is a new class of ferry, being the first to use dual-fuel reciprocating engines and will also be one of the largest fast catamarans in service when it is delivered in 2020.

The ship will feature a fully integrated scope of supply

Ponant's new cruise vessel will feature advanced environmental performance with Wärtsilä LNG solutions
(Image courtesy Ponant)

Baleària's new high-speed catamaran
(Image courtesy Incat Crowther)

from the technology group Wärtsilä. The 125 m long vessel is being built at the Armon Gijón shipyard in Spain. The ability of Wärtsilä to deliver a fully integrated scope, including the engines, the waterjets, and the LNG fuel storage and supply system, together with all the related auxiliary systems, was an important option for both the owner and shipyard.

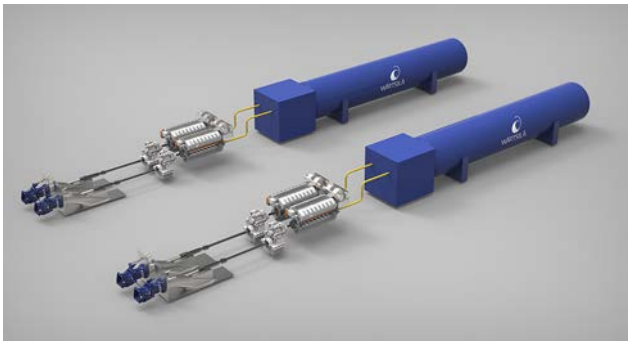
"High efficiency, reduced operating costs, and environmental sustainability were the key values in the design of this exciting new high-speed ferry. Wärtsilä has a strong focus and excellent track record in all these areas, as well as unique integration capabilities. This project redefines the conventional standard for this type of vessel, enabling 'greener' operations and lower life-cycle operating costs. We have worked closely in the past with both the yard and the owners, and we are proud to be once again their vessel solutions provider," said Stefan Wiik, Vice President, Marine Power Solutions, Wärtsilä.

"This ferry will very much shape the future for high-speed gas-powered catamarans and trimarans. This completely new design, which optimises the performance of the ship, not only in terms of speed but also in seakeeping, and which utilises Wärtsilä's LNG technology, makes this a breakthrough vessel. The use of LNG allows us to fulfil our commitment to the environment and to energy efficiency, while also keeping us one step ahead of the new pollutant gas reduction regulations scheduled for 2020," said Juan Paino, CTO of Armón.

"Baleària's strategic commitment to LNG responds to criteria of social responsibility and economic profitability. The axiom, less pollution and greater economic profitability, works fully with liquefied natural gas," said the CEO of Baleària, Adolfo Utor,

The vessel will operate on four highly-efficient Wärtsilä 31DF dual-fuel engines, four Wärtsilä waterjets, and the Wärtsilä LNGPac fuel gas storage and supply system. It will have a service speed of 35 kn, and a top speed of more than 40 kn. The storage tanks will give the ferry a range of 400 n miles. The equipment is scheduled for delivery to the yard in the latter half of 2019.

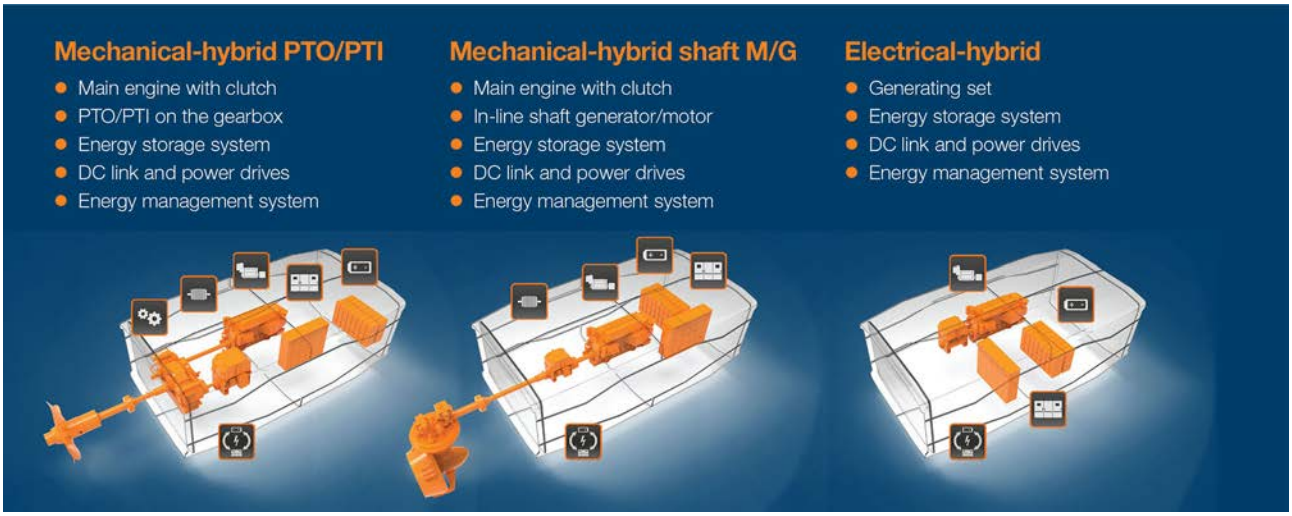
When delivered, the ferry will be capable of carrying 1200 passengers and 500 cars, or trucks covering a length of 500 m plus 250 cars. Baleària will invest €90 million in the construction of this fast ferry, which is scheduled to start the aluminium cut in December 2018 and to enter into service in the northern summer of 2020.



The Wärtsilä propulsion system for the LNG catamaran
(Image courtesy Wärtsilä)

Wärtsilä HY Hybrid Power Module receives AIP from ABS

Wärtsilä's hybrid power module, the innovative Wärtsilä HY, has been granted Approval in Principle (AIP) by ABS. This AIP follows another issued by ABS in 2017 for Wärtsilä's hybrid-propulsion tug designs.



The Wärtsilä HY is available in different configurations
(Image courtesy Wärtsilä)

The Wärtsilä HY was developed by leveraging Wärtsilä's technical strengths in both engine design and electrical and automation systems. The fully-integrated hybrid-power module combines engines, an energy storage system, and power electronics optimised to work together through a newly-developed energy management system. It is the marine sector's first hybrid-power module of this type produced, thereby establishing a new industry benchmark in marine hybrid propulsion.

"This AIP is an important step in the development of our eco-friendly hybrid propulsion system, which can be applied to a variety of vessel types. By working with ABS, we are demonstrating the viability of hybrid vessels in a range of applications and highlighting the capability to the US market and further afield," said Giulio Tirelli, Director, Sales & Business Intelligence, Wärtsilä Marine Solutions.

"This is the latest example of how ABS is collaborating globally with innovative companies like Wärtsilä to expand approval of hybrid designs for power and propulsion options. We recognise the significant economic and environmental benefits of hybrid-powered vessels and are committed to supporting the development of alternative power applications which optimise efficiencies," said Demetri Stroubakis, ABS Director Equipment and Materials.

With the increased industry focus on environmental compliance and operational performance, many ship owners and operators are shifting their attention to electric propulsion and non-conventional sources of power. The ABS Advisory on Hybrid Electric Power Systems has been published to provide guidance in the development of new concepts.

Wärtsilä Design for New Factory Fishing Trawler

Wärtsilä has been contracted to provide the ship design for a state-of-the-art factory fishing trawler. The vessel will be unique in having the combined capabilities of twin trawling for many different fish species, having both conventional winching as well as pumping systems for bringing the catch onboard, and being able to process fish from other vessels. The ship is to be built in Kaliningrad at the Yantar shipyard for RK named after V.I. Lenin (RK Lenina), the owner. The order with Wärtsilä was placed through its Russian entity Wärtsilä Vostok LLC and was booked in October 2018.

The 121 m long vessel will feature a unique bow design which has undergone testing following computerised fluid dynamics calculations and simulations. The design offers enhanced performance. The ship will be part of the Russian Government's investment programme for fleet renewal. Under a separate agreement, Wärtsilä has developed a concept which will enable the owner to apply for an extended quota for fishing in Far East waters. The ship will have more than 5000 m^3 of storage capacity.

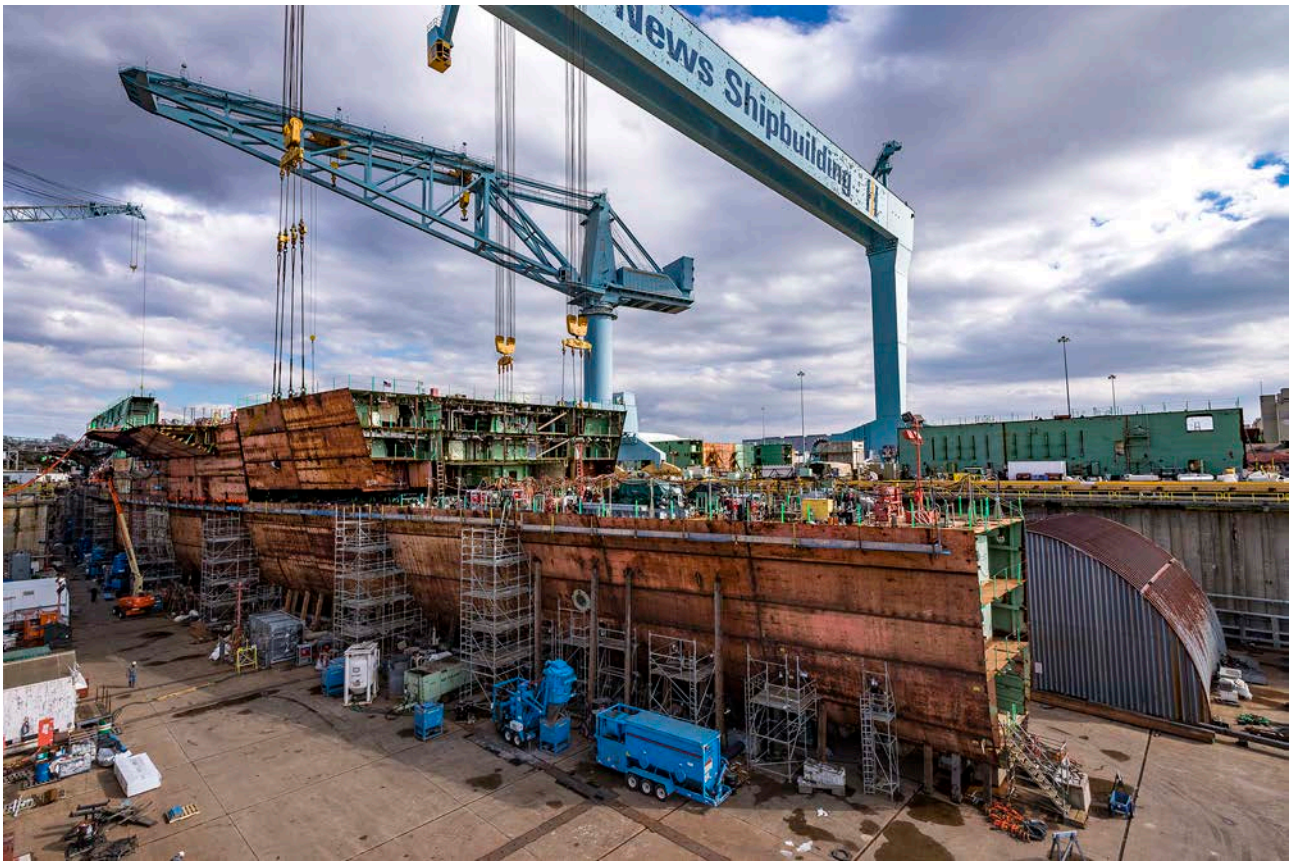
The unique bow design of the Wärtsilä-designed 121 m trawler is intended to enhance efficiency
(Image courtesy Wärtsilä)

"Wärtsilä has a very successful track record in designing highly efficient and sustainable fishing vessels, and an impressive reference list to back it up. We have worked closely with the yard and owner to deliver a very extensive design package which meets the specific operational requirements," said Dmitry Firsov, Managing Director of Wärtsilä Vostok.

"We have had positive collaboration with Wärtsilä during the concept-development phase of the project, and we appreciate their support and technical know-how in designing this very modern fishing vessel. It demonstrates innovative thinking and will help in upgrading fishing methods, processing and logistics," said Sergey B. Tarusov, Chairman of RK Lenina.

The vessel is scheduled for delivery in 2023 and will operate in Russia's Asian fishing grounds in the Okhots Sea.

The Minister for Defence, the Hon. Christopher Pyne MP, inspecting a model of Australia's new OPVs whilst attending a ceremony at ASC Shipbuilding in Adelaide on 15 November to mark the formal commencement of construction of the first ship, the future HMAS *Arafura*. *Arafura* is expected to enter service in 2022
(RAN photograph)



Progress on the new US Navy aircraft carrier *John F. Kennedy* (CVN-79) early this year. The ship is now about 84 percent structurally complete and 53 percent complete overall and is expected to be launched by the end of 2019. CVN 79 is the second carrier built for the USN to a new design — the first new design for some 40 years. Fewer manhours are being used to build this ship — about 15% less than USS *Gerald R Ford* (CVN 78), the lead ship of the class. *John F. Kennedy* is expected to cost around $US11.4 billion (about $A16 billion) by the time she is completed
(Photo by John Whalen courtesy Huntington Ingalls Industries)

Amendment of EEDI Reference Line for Ro-ro Cargo and Passenger Vessels

The International Maritime Organisation (IMO) has adopted the amendments to Regulation 21, Chapter 4 of MARPOL Annex VI** regarding the Energy Efficiency Design Index (EEDI) requirements for ro-ro cargo and ro-ro passenger ships. The amendments concerning the new parameters from Phase 2 increase the reference line by 20% and introduce a DWT threshold value for larger ro-ro cargo ships of 17 000 DWT and ro-pax ships of 10 000 DWT.

In Table 2 (Parameters for Determination of Reference Values for the Different Ship Types), Paragraph 3, Rows 2.34 and 2.35 for ro-ro cargo ships and ro-ro passenger ships are replaced by the table below.

The amendments will enter into force on 1 September 2019 and will apply for Phase 2 and onwards, i.e.

- the building contract is placed on or after 1 January 2020; or
- the building contract is placed before 1 January 2020, and the delivery is on or after 1 January 2024; or

in the absence of a building contract,

- the keel is laid, or the ship is at a similar stage of construction, on or after 1 July 2020; or
- the keel is laid, or the ship is at a similar stage of construction, before 1 July 2020, and the delivery is on or after 1 January 2024.

The IMO encourages early application of the aforesaid amendments to ro-ro cargo ships and ro-ro passenger ships (as soon as possible), prior to entry into force, with the agreement of the flag administration.

**The amendments to MARPOL Annex VI, Chapter 4 are detailed in Resolution MEPC.301(72).

Lloyd's Register, *Class News 18/2018,* 10 August 2018

Ship type defined in Regulation 2	a	b	c
2.34 Ro-ro cargo ship	1405.15	DWT of the ship	0.498
	1686.17*	DWT of the ship where DWT≤17 000* 17 000 where DWT≥17 000*	
2.35 Ro-ro passenger ship	752.16	DWT of the ship	0.381
	902.59*	DWT of the ship where DWT≤10 000* 17 000 where DWT≥10 000*	

* To be used from Phase 2 and thereafter.

HMAS Gascoyne at sea off Korea. After the longest transit ever completed by Australian Minehunters, HMA Ships Gascoyne and Huon have recently contributed to the Multi-National Navy Mine Warfare Exercise 2018 in the Republic of Korea. This is the furthest north that RAN Minehunters have deployed and the first time units of this type have visited the Republic of Korea
(RAN photograph)

TIME AND TIDE

The Division would like to recognise the passing of a number of long-standing RINA members and naval architects of whom I have recently become aware, namely Alan Lloyd, Peter McBride and Lance (Bill) McMillan, a couple of whom were founding members of the Australian Branch (now Division). Their brief details are as follows;

W.R.A. (Alan) Lloyd

Alan was trained as a naval architect in the UK and emigrated to work at the shipyard of Walkers Limited at Maryborough, Queensland. Walkers was a general engineering company which had been building ships since the late 1800s. Their shipbuilding activities gathered pace under the World War II Australian minesweeper building programme and carried through to the construction of the eight Balikpapan-class landing craft heavy (LCH) in the early 1970s, during which time they were a member of the Australian Shipbuilders Association which represented the major steel shipbuilders of Australia. The shipyard closed in 1974 at the end of that program.

In 1982 Alan joined the then Department of Transport to work with me in Canberra, largely on the approval of stability books. In 1995 he transferred to Fremantle as a Senior Marine Surveyor. He retired to Hervey Bay in Queensland in about 2003, where he lived until he passed away in February 2018 at age 85. He is survived by his wife Muriel and sons Alan and Graham.

Peter McBride

I first came across Peter when I was a new vacation student preparing stability books and conducting inclining experiments at the Whyalla Shipyard. Peter was the naval architect in the Department of Shipping and Transport in Melbourne who had to be satisfied with the format and content of the stability data before a Load Line certificate could be issued to the ship.

Peter undertook this work with Bob Herd and Doug Janes, with whom he had trained as a naval architect at the University of Glasgow. As a team at the Department, Bob, Doug and Peter were responsible for upgrading stability standards and their implementation in response to a series of stability-related casualties the most prominent of which was *Blyth Star*.

Our paths intersected more closely when I joined the DST team in Melbourne from 1978 and worked in parallel with him following the closure of the Whyalla Shipyard. I recall that his Sundays were generally spent sailing his boat from the St Kilda marina to Williamstown for lunch.

In 1981 Peter declined to move to Canberra with the Department and elected to retire to Adelaide to look after his elderly parents and take a more active role in the family pastoral company. His father was a Federal parliamentarian from 1931 to 1958, serving as a Cabinet Minister in both Menzies Governments, including as Defence Minister, and is recognised as one of those involved in formation of the Liberal Party in the early 1940s.

An intensely private person, Peter remained single all his life, and his executors did not respond to my request for further information about his career. However, he maintained his RINA membership from 1951 until he passed away in July 2018, aged 92.

Lance (Bill) McMillan

Bill was one of those members whose name came up year after year on my membership lists but who was unknown to me on a personal basis. He has been a Member since 1950 and so, like Peter McBride, was already a RINA member when the Australian Branch (now Division) was formed in 1954.

It was only after I was advised earlier this year that he was a missing member that I learned that he had passed away in May 2016, aged 91. In response to my further inquiries, Ross Hawke advised that Bill was a "good mate" with whom he had worked and studied in the Whyalla Shipyard and the School of Mines (now University of SA), at Whyalla. Bill left Whyalla after completing the course and worked "all around Australia" during his career.

Bill remained single and lived in retirement at Myrtlebank, SA.

Rob Gehling

THE AUSTRALIAN NAVAL ARCHITECT

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

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

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

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the evening of Wednesday 12 September 2018 by teleconference under the chairmanship of the President, Prof. Martin Renilson, in Launceston. The President welcomed new Council member Violeta Gabrovska who had been appointed to a casual vacancy following the resignations of Gerard Engel and Matthew Williamson.

The meeting had a full agenda and some of the more significant matters raised or discussed are outlined as follows:

Casual Council Vacancies

Council agreed to a process for filling the remaining vacancy.

Not-for-profit Status of the Division

Council confirmed its earlier decision to lodge an application with ACNC.

Naval Architecture Career Flyer

This document is being finalised by a group led by A/Prof. Woodward.

Walter Atkinson Award 2018

Council endorsed the recommendations of the selection panel. The outcome to be advised to the authors of candidate papers and the presentation arranged with the winning author(s).

Council Elections 2019

Council noted that, in accordance with the Division By-Laws, a notice calling for nominations would appear in the current issue of *The ANA*.

Next Meeting of Council

Council tentatively agreed to its next meeting being held on the afternoon of Tuesday 11 December 2018.

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

Rob Gehling
Secretary

Changed Contact Details?

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

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

RINA London	hq@rina.org.uk
Australian Div.	ausdiv@rina.org.uk

Section

ACT	rinaact@gmail.com
NSW	rinansw@gmail.com
Qld	hamish@oceanicdesign.com.au
SA&NT	peter.dandy@asc.com.au
Tas	brian.winship@utas.edu.au
Vic	owen.tregenza@dst.defence.gov.au
WA	wa@rina.org.uk

Phil Helmore

NOMINATIONS FOR DIVISION COUNCIL

Nominations are invited from Corporate Members (MRINA or FRINA) and Associate Members (AMRINA) for election to Division Council for a term of two years from March 2019. The majority of these elected members must be Corporate Members. Nominations, which must be in writing and include the signatures of the proposer, seconder and nominee, should be received by the Secretary no later than Friday 21 December 2018.

Rob Gehling
Secretary, Australian Division
Mail: PO Box 462, Jamison Centre, ACT 2614
email: ausdiv@rina.org.uk
Phone: 0403 221 631

NAVAL ARCHITECTS ON THE MOVE

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

Tony Armstrong (the younger) has moved on within Teekay Shipping and has taken up the position of Vice President in Vancouver, Canada.

Jonathan Branch has moved on from Lloyd's Register and is now consulting as Invicta Maritime Solutions in Sydney, providing services on safety and environmental assurance, regulation and governance.

Angus Bratter, a graduand of UNSW Sydney, has moved on from Svitzer Australasia and has taken up a position as a naval architect with Thales Australia at Garden Island in Sydney.

Hamish Bush has completed his Bachelor of Medicine/ Bachelor of Surgery degrees at Griffith University, and after some time at Westmead Hospital, has taken up a position as Orthopaedic Senior Resident Medical Officer (better described as junior surgical trainee!) at Blacktown Hospital in Sydney.

Dan Curtis has moved on from Fincantieri Australia and is now consulting as DRJ Consulting Capricornia in Yeppoon, Queensland.

Tom Dearling continues as a Senior Naval Architect with Qinetiq Australia, but has re-located from Canberra to their South Melbourne Office.

Mark Devereaux has moved on within Marine Safety Queensland and has taken up the position of Naval Architect in the Operations Section in Brisbane.

Lina Diaz has moved on from Shearforce Marine and has taken up a part-time position in Customer Service with Petbarn in Sydney.

Alan Dowd continues consulting as Sirius Design and Marine at Oxenford on the Gold Coast, Queensland.

Richard Dreverman continues as Sales Manager with Rolls-Royce Marine in Perth.

Yuriy Drobyshevski continues as Technical Advisor and Lead Naval Architect with INTECSEA in Perth.

Yang Du completed his Master of Business Administration degree at the University of Newcastle in 2016 and took up the position of Sales Engineer with Nantong Sifang Tank Storage Equipment Manufacturing Co. in Nantong, China.

Matt Duff continues consulting with Craig Boulton as ASO Martine Consultants in Sydney.

Peter Edmonds continues consulting as Peter Edmonds Marine Design in Perth.

Bill Edwards has moved on in the Royal Australian Navy and has taken up the position of Marine Engineer Officer on board HMAS *Success*.

Brenden Egan continues as Senior Naval Architect with Composites Consulting Group, Diab Group, telecommuting from Pearce's Creek, NSW.

Peter Gawan-Taylor has moved on from Braemar Falcon and has taken up the position of Design Manager with Austal in their Philippines office in Cebu.

Michale Halkes, in addition to his positions as Managing Director of daiyat.com (a product R&D company), Chief Operating Officer of Shnug Design (a modern designer furniture company), and co-founder of diyi Limited (a start-up mobile services application), in 2017 also co-founded Tableworks Limited (an app for a live mapped "hot desk" network and food-and-beverage platform), in Hong Kong.

Frank Jarosek has retired from the Marine Safety Division of the WA Department of Transport, and is enjoying life in Fremantle.

Chia How Khee has moved on from DNV GL and has taken up the position of Sales and Application Specialist with Henry Schein, a leader in digital dentistry, in Singapore.

Kim Klaka moved on from Sea Gyro in 2009 when company operations moved to Malaysia, moved on from CMST at Curtin University in 2012, and is now fully retired and enjoying life.

Mark Korsten moved on from Pacific Operations in 2013 and, after some time with the Royal Australian Navy, took up a position with Jacobs Australia where he is now the Business Development Manager in Canberra, and is also consulting to Pacific Operations again as Maritime Security Adviser.

Anthony Kovacevic moved on from Ensign Ship Brokers in 2014 and has taken up the position of Sales Executive at Multihull Solutions Australia in Mooloolaba, Qld.

Alex Law has moved on within Incat Crowther, and has taken up the position of Project Manager with Incat Crowther Europe in Winchester, UK.

Christopher Lloyd Jones, a recent graduate of UNSW Sydney, has taken up the position of Assistant Maintenance Manager at the Fernbank Retirement Village in Sydney.

Shinsuke Matsubara has moved on from the Australian Maritime College and has taken up the position of Senior Customer Success Engineer with MathWorks (MATLAB/ Simulink), visiting universities in Victoria to support academics and students in their use of MATLAB/Simulink for research, teaching and learning, curriculum development, problem-based learning, online assignments and marking.

Adam Solomons continues as Managing Director of London Offshore Consultants (Australia), but has shifted from Perth to the office in Sydney.

Carl Vlazny continues consulting as Black Swan in Perth and, as well as Vesco Foods' Innovation Products Manager, now includes Fortescue Metals among his clients as Operational Readiness Manager for the introduction of Fortescue's new tugs in Port Hedland, WA.

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

FROM THE ARCHIVES

Launching day for the first ship built at the BHP Whyalla shipyard. HMAS *Whyalla* was launched on 12 May 1941 by Lady Muriel Barclay-Harvey (wife of the Governor of South Australia) and was completed on 8 January 1942,

The small ship was one of 60 Australian minesweepers of the Bathurst class built in Australia in th early years of the war, a program which helped restart the Australian shipbuilding industry which had languished during the 1930s. Four more of the class were built at the Whyalla shipyard, *Kalgourlie*, *Gawler* and *Pirie*, all completed by October 1942.

The first merchant ship built at Whyalla was the BHP ore carrier *Iron Monarch* which was laid down on 1 July 1941 and completed on 12 April 1943
(Photo John Jeremy collection)

Still racing after 118 years, the yacht *Caprice* was built in Tasmania by shipwright Charles Lucas at his Battery Point yard in 1900 to a design by William Fife modified by Hobart designer Alf Blore. The 32 ft (9.7 m) yacht was first raced in Hobart before being shipped to Sydney where she has been sailed since at least 1908. Recently restored, *Caprice* has been owned by the same family since 1926 (Photo John Jeremy)