THE AUSTRALIAN NAVAL ARCHITECT

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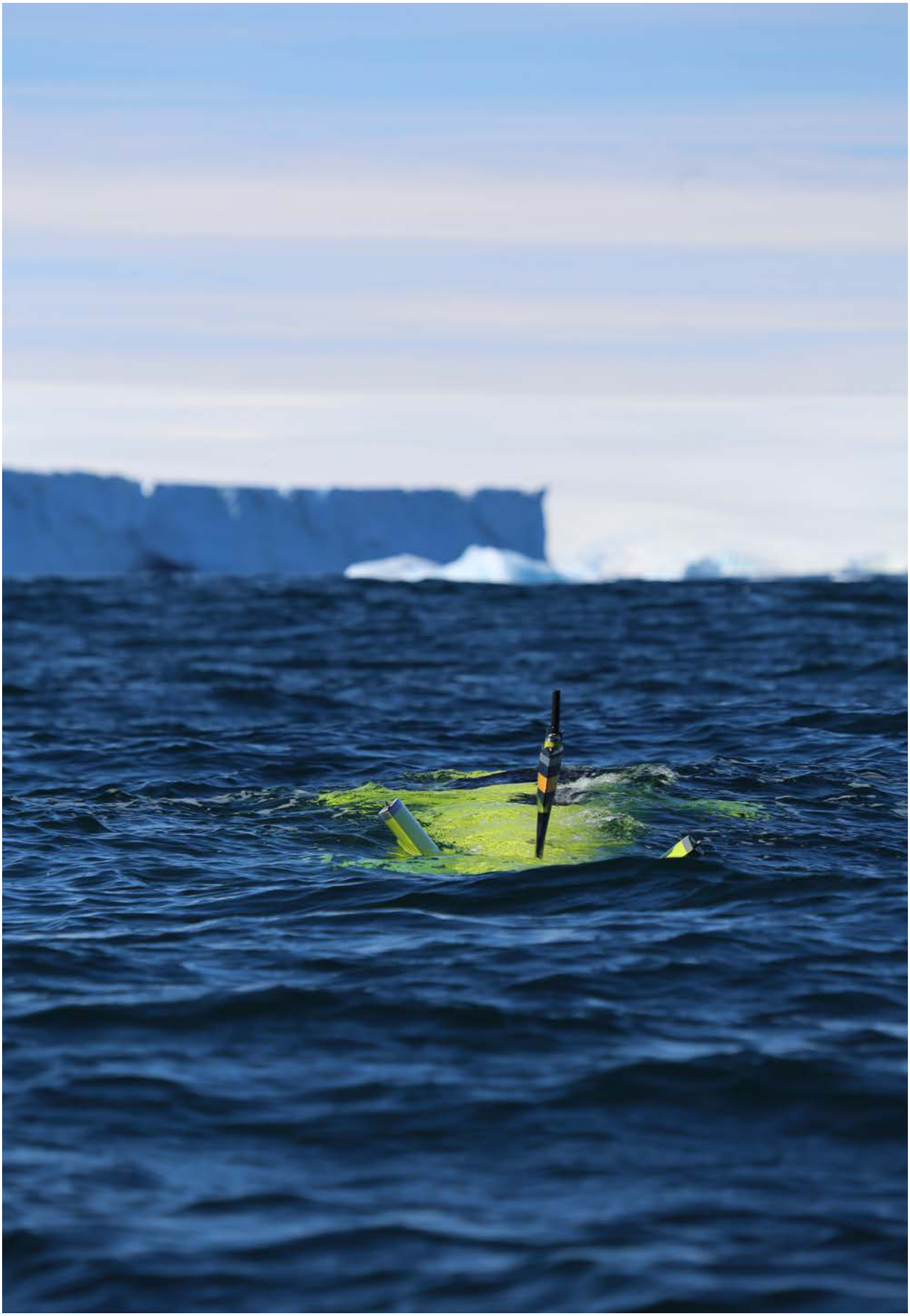

The University of Tasmania's world-leading polar Autonomous Underwater Vehicle (AUV), , named nupiri muka, is the first untethered Australian AUV to dive under an ice shelf and joins those from the UK and Sweden as the only AUVs in the world with this capability (Photo courtesy Australian Antarctic Division)

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

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Cover Photo:

Freya, built by Richardson Devine Marine Constructions and completed in December 2018, adds colour to Hobart waters whilst servicing Hobart's Museum of Old and New Art (MONA)
(Photo courtesy RDM)

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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.*

First, I'd like to thank the NSW Section for hosting our Annual General Meeting in Sydney on 3 April. As members will be aware, we rotate the Division AGMs through the different sections. Last year it was Victoria, and the year before it was Western Australia. I would also like to thank the only retiring member of the Australian Division Council, Jesse Millar, for his service to Council. He has stepped down from Council to take up the role of Chair of the Victorian Section. All the other members of Council have continued, and I look forward to another good year. From my perspective as President, it is great to have such a supportive and active Council.

Following on from our Division Council AGM in Sydney, I travelled to London for the Institution's AGM there on 11 April. This is always held at the Institution's headquarters in London; however, I look forward to the time when the Institution is truly international and hosts its AGM outside the UK, as I gather is done by other international organisations such as the Nautical Institute.

A Special General Meeting was also held in conjunction with the Institution's AGM, where the following resolution was passed:

"To make such amendments to the By Laws as are necessary to change the composition of the Council of the Institution to enable it to become more representative of the world-wide membership by reflecting geographic location as well as membership class and experience."

I believe that this is a good step towards further internationalisation of the Institution.

One of the activities at the AGM is the presentation of awards and prizes, presented by the President. Many of the recipients attend and I was very pleased to see that Nick Eutick (Austal) and Angus Cameron (Norman Wright & Sons) were able to travel to London to receive the Wakeham Prize, which is awarded annually for the best general paper published in the *Transactions* by an author aged 35 or under. It was great chatting with them, and good to see other Australians in London for this event. Thanks to their employers for supporting their attendance. There were quite a few other award recipients from outside the UK, and this helps to raise the international status of the Institution.

Nick Eutick and Angus Cameron with the Institution's President, Prof. Richard Brimingham
(Photo courtesy Martin Renilson)

Martin Renilson

This year the general presentation given at the close of the AGM was a very interesting one by Dr Jo Stanley entitled *Women Pioneers in Naval Architecture,* in which she described the early female engineers and naval architects involved with ship design and construction. This was particularly relevant as, one hundred years ago almost to the day, members at the 1919 AGM voted to admit women as members of the Institution on the same terms as men. Dr Stanley explained the background to this change, and the difficulties which women had been having in being accepted previously. It was interesting to note that the motion to admit women was won 491 votes for, and 220 against.

One of the first women members was Eily Keary, and she was also the first woman to have a paper published in the *Transactions*. Accordingly, it has been decided that the Institution will establish the Eily Keary Award, to be presented annually to an individual or organisation which has made a significant contribution to promoting equality, diversity and inclusion in the maritime community.

The Institution's Annual Dinner is always held in the evening following the AGM. This was a most enjoyable occasion, and we were treated to a wonderful after-dinner address by the President of the World Maritime University, Dr Cleopatra Doumbia-Henry, on today's maritime challenges and opportunities.

I met many members, largely from the UK, who I have known for a while, and many others. I also met with Suzanne Beckstoffer, the President of SNAME. As I was sitting next to her at the dinner I had the opportunity for a lengthy discussion with her about SNAME, compared to RINA. We were also joined in this discussion by Bruce Rosenblatt, who has been President of both organisations!

The new governance arrangements for the Institution, with

a small Board of Trustees and a much wider Council, seem to be working very well. Although I am not on the Board I did manage to speak with a number of Board members, who are generally very happy with the current system.

Much of the recent Board discussion has been focused on the outcomes of the Strategic Working Groups, and the Board reported on progress at the Council meeting. Most of the recommendations from the Working Groups have been accepted, although some of these will not be implemented immediately. There are four key "directions" which have been identified:

- internationalisation of Council;
- review of the structure and operations of the secretariat;
- web/IT issues, and the "digital strategy"; and
- diversity/inclusion.

I made the point at the Council meeting in London that the Australian Division Council is also discussing the future digital strategy for the Division as a result of feedback from our members in our recent survey. I am very pleased to say that Jesse Millar has agreed to join the group looking at this issue, and I hope that he will be able to pass on what we have been doing in Australia (which he has been instrumental in leading), as well as to learn from developments in the UK. Whilst I'm personally not exactly sure what direction the Institution should be heading in this regard, I am sure that we do need to take this seriously and that we need to determine a strategy for the way ahead. What do other members think?

Since the last edition of *The ANA,* the Institution has submitted its response to the Naval Shipbuilding Strategic Workforce discussion paper issued by the National Naval Shipbuilding Office. The turn-around time for submission was very tight, and I would like to thank all the Council members who contributed to the Institution's response. Our response can be obtained from the Secretary on request. At this stage we have not had any feedback.

On a related issue, Skills for Australia, part of the Federal Government's Department of Education and Training, issued a draft report on *Industry Skills Forecast and Proposed Schedule of Work — Naval Shipbuilding* on 9 April, with the request for feedback by 18 April! Following public consultation, this group plans to submit the outcomes to the Australian Industry and Skills Committee for approval. As the preeminent learned body in the maritime engineering field in Australia and internationally, I am hoping that our comments will be taken seriously and that we will have the opportunity to make a more detailed submission in due course. Personally, I feel that it is somewhat unfortunate that the Government is working away in this direction without discussions with the Institution.

Many thanks to Prof. Jonathan Binns for noticing this (a copy of the request for feedback was not sent to RINA) and for initiating the response which we managed to submit by the deadline.

Some recent very good news was the announcement of the success of the bid for the largest-ever Cooperative Research Centre, which will be for the Blue Economy. This is led by A/Prof. Irene Penesis and Prof. Stewart Frusher, and is a $329 million investment over 10 years by the Federal Government and 45 national and international partners. Irene has promised a number of future articles in *The ANA* describing the activities of this research centre, which range from maritime renewable energies to aquaculture, and includes a substantial development across a wide range of maritime engineering.

I am pleased to report that the Institution again participated actively in the Australian Oil and Gas Exhibition and Conference (AOG 2019) this year. The RINA Conference stream on *Offshore Martine Technology* featured six speakers who presented on a range of topics relevant to our profession. Poster sessions were held at the RINA stand, giving an opportunity for local maritime professionals to share their technological developments.

The AOG event was attended by the RINA Chief Executive, Trevor Blakeley, who also visited several maritime companies and universities in Western Australia. The feedback was very positive, with the issues of *The ANA* claimed to be the most popular material among the RINA stand visitors!

The success of the event was only possible due to efforts of the WA Section led by Sammar Abbas and members Cheslav Balash, Gino Parisella, Ian Milne, Jinzhu Xia, Mike Priestly, Tim Gourlay and Yuriy Drobyshevski, supported by the WA Section Secretary, Matthew White.

In conjunction with his visit for AOG, Trevor also made valuable visits to our Victorian and SA-NT Sections.

Activities are now ramping up for the 2019 International Maritime Conference to be held in Sydney at Pacific 2019 in October. We were inundated with proposed abstracts from a range of authors from around the world. The Program Committee has since met and selected a number of those for the conference. We've needed to turn down quite a number of very good ones due to lack of space in the program. As usual, a number of the authors of the accepted papers have requested that they be independently peer reviewed. So, if you receive a request soon from a Program Committee member to agree to peer review a paper, then I hope that you'll agree to do this. The timeline will be very tight from the submission of the paper to the feedback to the authors.

The Pacific 2019 event looks like being the largest yet and attendance at IMC2019 and the exposition will be rewarding. Registration for IMC2019 will be available by the time you read this.

I have often commented on how the sections operate their technical meetings in different ways. Personally, I think that it is very important for each Section to do what suits its members best. I have enjoyed visiting the different section technical meetings and comparing the way that they do things and, of course, when I was living in the UK and subsequently in the UAE, I learned how things are done there. Recently I was invited to make a presentation to a technical meeting at the Japan Society of Naval Architects and Ocean Engineers (JSNAOE) in Osaka. It was only *after* accepting this invitation that I was told that the meetings last for two hours, and that my presentation was to be for an hour and a half! This was held at 2 pm on a Thursday at the University of Osaka. Despite it being during the day, most of the audience was from industry.

I explained to committee members of the JSNAOE that we record many of our section technical meetings to enable them to be viewed by members who are unable to attend. The

Martin Renilson making his presentation to the JSNOE in Osaka
(Photo courtesy Martin Renilson)

JSNAOE is also interested in some sort of collaboration with us, and we discussed how it may be possible in the future to have "joint" technical meetings using video conferencing as we operate at almost the same time zone. I'm not sure of the practicalities, but certainly if it is possible it would be quite exciting.

The development of our Naval Architecture career flyer is now almost complete and is looking very good. A/Prof. Michael Woodward has been leading this task and I would like to thank him for coordinating all the various inputs which he has been receiving from Council Members. I think that this is an important initiative, as we certainly do need to raise the profile of the profession. There are plenty of opportunities in the maritime field and we need to encourage the most able students to enter our profession.

Finally, the Council has decided to establish a liaison committee to coordinate inputs to AMSA on the Domestic Commercial Vessel issues. Although this will be led by Council, we are very keen to have members from outside Council on the committee. Ms Violeta Gabrovska and the Secretary will jointly convene the committee and any members who are interested in serving on it, or providing input to it, should contact the Secretary as soon as possible.

Martin Renilson

Editorial

Many years ago, at a social event in a city building overlooking Sydney Harbour, the chief executive of a major consumer electronics manufacturer said to me "John, we just build television sets and the like — thrown out after five years or so and soon forgotten — but you build icons."

A slight exaggeration perhaps, although engineers do produce icons well known to us all, like the Sydney Harbour Bridge, the Opera House and the Snowy Mountains Scheme. There are many more. Not all civil or mechanical engineering projects might be regarded as iconic. Some simply allow our society to live in safety and comfort and go about our normal business, barely aware of the engineering behind the services we now take for granted.

In the same way, not all the ships we build could be described as iconic. Many are humble craft providing service on our waterways, ferrying us or maintaining our ports. Others become well known, even internationally, through their public profile during their service lives. Warships write their own pages in history, hopefully by never having to be used in anger, but by maintaining the peace and representing us throughout the world as parts of sovereign Australia.

The ships we build are different from other engineering achievements in a very important way. They move. All ships, but especially those which go to sea, must keep those who sail in them safe, rested and fed whilst carrying out their intended duties in, sometimes, extreme conditions. The sea is an unforgiving master. The design, construction and maintenance of these creations are the responsibility of a particular kind of engineer, the naval architect. To many people, unfortunately, the naval architect is simply the specialist who designs a hull which floats, upright, can be propelled economically, and is strong enough to withstand the loads placed on the hull at sea. The naval architect is much more than that. A naval architect is a systems engineer who must ensure that the input of other engineering disciplines is coordinated and integrated into a complete working whole. A naval architect has responsibility for the whole vessel, through design, build, operation and maintenance. This needs to be more widely understood — a task for which we all bear some responsibility.

The design and construction of a ship can be an all-consuming task. I am sure that there must be some who regard them simply as products, to be churned out with a financial bottom line which is, hopefully, in the black rather than the red. There are others of us (and I confess that I am one) who regard them almost as children, to be part of us in some way throughout their lives. To us, at least, they are icons.

John Jeremy

COMING EVENTS

NSW Technical Meetings

Technical meetings are generally combined with the NSW-ACT Branch of the IMarEST and held on the first Wednesday of each month at Engineers Australia, 8 Thomas St, Chatswood, starting at 6:00 pm for 6:30 pm and finishing by 8:00 pm.

The program of meetings remaining for 2019 (with exceptions noted) is as follows:

29 May	Steve Quigley, Managing Director, and Rob Tulk, Principal Naval Architect, One2three Naval Architects *Design and Construction of* White Rabbit: *the World's Largest Trimaran Superyacht* NB Date fifth (not first) Wednesday of the month, and venue Mitchell Theatre, Sydney Mechanics School of Arts, 280 Pitt St, Sydney
3 Jul	Bert Ritscher, Business Dev. Manager, Europe, Africa and the Middle East Caterpillar Asset Intelligence *Age of Smart Iron: How Technology Innovation is Driving Change in the Marine Industry*
7 Aug	Adam Williams, Plan Approval Engineer, DNV GL *The Australian Specialisation in Classification of High Speed Craft*
4 Sep	Jarrah Orphin, PhD candidate, AMC *Mitigating Uncertainty in Oscillating-water-column Wave-energy Converters*
2 Oct	Alistair Smith, Naval Architect, Capability Acquisitions and Sustainment Group, Department of Defence *Design and Construction of the RAN's New Arafura-class Offshore Patrol Vessels*
5 Dec	SMIX Bash 2019

Pacific 2019 — IMC2019

The next Pacific International Maritime Conference, held in conjunction with the Pacific International Maritime Exposition and the Royal Australian Navy's Sea Power Conference, will be held in Sydney on Tuesday 8 to Thursday 10 October.

Pacific 2019 is the only comprehensive international exhibition of its kind in the Indo-Asia-Pacific region. It will again provide the essential showcase for commercial maritime and naval defence industries to promote their capabilities to decision-makers from around the world. Held in the heart of Sydney and on the shores of one of the world's most beautiful harbours, Pacific 2019 will be the tenth in the series and builds on the highly successful biennial events since 2000.

Specifically developed to satisfy the needs of industry, government and defence professionals across the broad spectrum of maritime affairs, Pacific 2019 is not open to the general public.

The Pacific 2019 website is up and running at www.pacificexpo.com.au, with further details being added as they come to hand. The preliminary programme and registration for IMC 2019 is now available at www.pacificexpo.com.au/imc2019. For further details, contact imc@amda.com.au.

ASRG Dockmaster Courses 2019

DM Consulting's dockmaster course is a four-day course which covers the fundamentals and calculations of dry docking. The next courses in Australia will be held on

Tuesday 15 to Friday 18 October, Sydney; venue TBA
Tuesday 22 to Friday 25 October, Darwin; venue TBA

The course begins with the basics and safety concerns, and progresses through all phases of dry docking: preparation, docking, lay period, and undocking. The course ends with a discussion of accidents and incidents.

It is designed to be relevant to dock masters, docking officers, engineers, naval architects, port engineers and others involved in the dry docking of ships and vessels. The course is presented through classroom lectures, student participation in projects, and practical application exercises. The course addresses the deck-plate level of practical operation needed by the dock operator and the universally-accepted mathematical calculations required to carry out operations in accordance with established sound engineering practices.

Topics to be covered include:

- Basic dry docking community terminology
- Calculations
- Safe dry docking procedures
- Lay period
- Undocking evolutions
- Docking Plans
- Docking and undocking conferences
- Hull boards
- Vessel stability
- Incidents/accidents

Joe Stiglich, the course leader, is a retired naval officer, qualified NAVSEA docking officer and holds a master's degree from MIT in naval architecture and marine engineering. Responsible for over 250 safe docking and undocking operations, he currently runs a series of conference and training courses for personnel involved in all phases of the dry docking industry and acts as a consultant for ship repair companies.

For further information, please see www.drydocktraining.com/.

This training will be held in conjunction with the Australian Shipbuilding and Repair Group (ASRG). Registration and payment may be made directly to ASRG. Contact Liz Hay at liz.hay@asrg.asn.au or call (07) 5597 3550.

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.

imc2019

PACIFIC INTERNATIONAL MARITIME CONFERENCE

INTERNATIONAL CONVENTION CENTRE SYDNEY, AUSTRALIA

8 - 10 OCTOBER 2019

ENGINEERS AUSTRALIA

Connect with eminent leading speakers, new technical research and leading-edge maritime technologies at the region's premier maritime technical conference, IMC2019.

Organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia, ***IMC2019*** will be held in conjunction with the prestigious Australian Navy Sea Power Conference and the PACIFIC 2019 International Maritime Exposition.

Two conference streams will highlight new advances, research and technologies across:

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

IMC2019 Registration will include free access to the PACIFIC 2019 exposition.

Eminent Keynote Speakers include:

Professor Tanya Monro
Chief Defence Scientist
Defence Science and Technology

Sheryl Lutz
First Assistant Secretary Ships
Capability Acquisition and Sustainment Group

Kerry Lunney
Country Engineering Director and Chief Engineer
Thales Australia

Professor Hugh Durrant-Whyte
NSW Chief Scientist & Engineer
NSW Department of Industry

www.pacificexpo.com.au/imc2019

***IMC2019* registration will be opening soon.**

For further information

Email: imc@amda.com.au or PO Box 4095, Geelong VIC AUSTRALIA 3220

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

NEWS FROM THE SECTIONS

New South Wales

Annual General Meeting

The NSW Section held its twenty-first AGM on the evening of 6 March, immediately following the March technical presentation in the Harricks Auditorium at Engineers Australia, Chatswood, attended by 11 with Phil Helmore in the chair, standing in for the Chair of the NSW Section, Valerio Corniani.

Valerio, in his Chair's Report (which Phil presented), touched on some of the highlights of 2018, which included nine joint technical meetings with the IMarEST (NSW–ACT Branch), with attendances varying between 13 and 60 (for Sean Langman and Belinda Tayler's presentation on *A New Lease of Life for Sydney's Iconic Floating Dock*), with an average of 28. This average is close to our long-term average of 27 at the Engineers Australia Chatswood venue.

Webcasting of presentations has come to something of a standstill. However, the Victorian Section has been conducting trial recordings of technical meetings, and these are now available on the Victorian Section's YouTube channel. We are investigating options with Engineers Australia.

SMIX Bash 2018 was successful and was attended by about 200, including a number of interstate guests. Many thanks to the organising committee of Adrian Broadbent, John Butler, Graham Taylor, Craig Boulton, Len Michaels and Alan Taylor, and to the sponsors who supported the event because, without them, the "Bash" could not happen.

Adrian Broadbent presented the Treasurer's Report. The EA venue at Chatswood had, as usual, been our major cost for the year. However, with a close watch on the outgoings, we had managed to operate within our budget and have a grand total of $1595 in the Section account at 31 December 2018. SMIX Bash is funded separately through the SMIX account which currently has a healthy balance and, although there are accounts still to be paid, projections are for a small surplus to be shared with IMarEST and enable preliminary arrangements for SMIX Bash 2019.

There is a number of changes to the NSW Committee for 2019. Anne Simpson and Noel Riley have recently resigned from the Committee due to the pressure of other things. Jason Steward has been nominated for the position of Secretary of the Section, and has been elected unopposed. The NSW Section is also represented on the Australian Division Council by Craig Boulton as Treasurer.

As a result, the committee for 2019 is as follows:

Chair and SMIX Bash Committee Chair	Valerio Corniani
Deputy Chair and TM Program and Website Coord	Phil Helmore
Secretary	Jason Steward
Treasurer and AD Council Nominee	Adrian Broadbent
Assistant Secretary	TBA
Auditor	David Wong
Members	Craig Boulton John Butler Alan Taylor Rob Tulk

Committee Meetings

The NSW Section Committee met on 16 April and, other than routine matters, discussed:

- SMIX Bash 2018: All sponsorships have been received, all expenses paid and the proceeds of the raffle donated to the Sydney Heritage Fleet, resulting in a small surplus which will be shared with the IMarEST.
- SMIX Bash 2019: *James Craig* has been booked for Thursday 5 December; the Organising Committee is forming up and the letter to sponsors is to be updated for this year; means of reducing queues at the registration desk at the gangway were discussed.
- Technical Meeting Program: RINA and IMarEST presentations have been arranged for this year.
- Recording of Technical Presentations: Consideration of options is continuing.
- New RINA Banner Stand: Has not been sent from RINA HQ; they are waiting for other sections to supply delivery addresses to enable one order and save on cost of delivery.

The next meeting of the NSW Section Committee is scheduled for 28 May.

Recent Studies of the Hydrodynamics of River Vessels

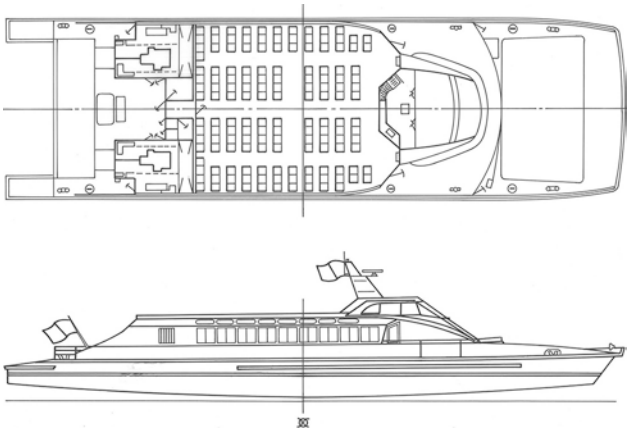
Lawry Doctors, Professor Emeritus at UNSW Sydney, gave a presentation on *Recent Studies of the Hydrodynamics of River Vessels* to a joint meeting with the IMarEST attended by 31 on 13 February in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

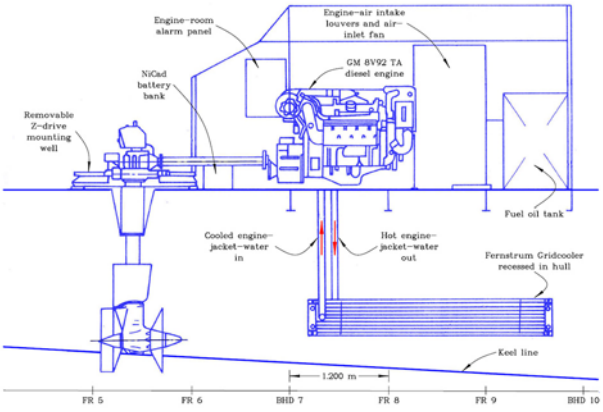
Lawry began his presentation by noting that in 1991 he had been asked to do some hydrodynamic analysis work on the RiverCats, which were then being designed by Grahame Parker. He then showed some photographs and drawings of the vessels.

RiverCat *Dawn Fraser* on Sydney Harbour
(Photo courtesy Lawry Doctors)

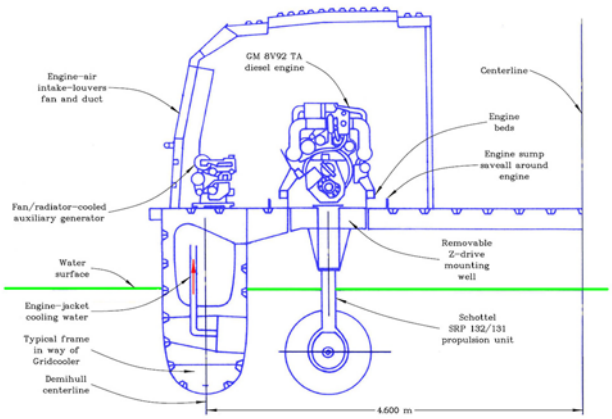
RiverCat *Shane Gould* in operation on the Parramatta River
(Photo courtesy Lawry Doctors)



General arrangement of the RiverCats
(Drawing courtesy Grahame Parker)



Machinery profile of the RiverCats
(Drawing courtesy Grahame Parker)



Machinery section of the RiverCats
(Drawing courtesy Grahame Parker)

Grahame Parker wanted the demihulls as slender as possible, and achieved this by placing the propulsion machinery on the main deck and driving through Z-drives into clear water. The demihulls are extremely slender, with a length/beam ratio of 30, and so they have very low wave-making resistance; in fact, the lowest Lawry has seen on any vessel of this type.

Theory

Lawry then said that he would give some theoretical equations for everyone to understand the practical implications. He was very proud of the fact that the theoretical equations for ship resistance were first developed by the Australian, John Henry Michell, a professor of mathematics at the University of Melbourne. Michell's paper *The Wave Resistance of a Ship*, was published in the *Transactions of the Royal Society* in 1898. What is astonishing is that all his numerical calculations were done without the benefit of any sort of calculator, but with pencil and paper!

The final result is that the wave resistance of the ship is given by:

$$R_W = \frac{\rho g}{\pi} \sum_{i=0}^{\infty} \in \Delta k_y k k_x^2 (u^2 + v^2) / \frac{df}{dk}$$

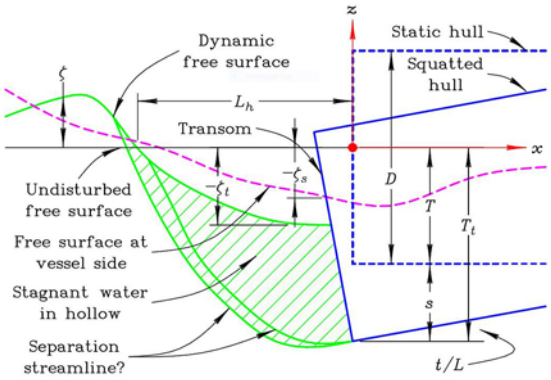
where R_W is the resistance related to the waves generated by the vessel, and which we want to minimise. In 1991 there was great interest in the minimisation of wave generation, saving fuel and minimising damage to riverbanks. The summation means that we need to add all the wave components in the spectrum, and the i refers to the transverse waves behind the vessel.

The Kochin functions in the above equation for R_W are given by

$$u + iv = \int_S b(x,z)e^{ik_x x}\frac{\cosh[k(z+d)]}{\cosh(kd)}dS$$

It can be seen that this involves the local breadth, *b,* of the demihull. Michell's theory only considered the case of deep water, and it was left for Sretensky to extend this to the case of finite depth of water in 1937, and this is accounted for in this equation by *d.* So the theory now takes everything into account, including the separation of the demihiulls.

A feature of these vessels is the transom stern. The first specific work on the resistance due to transom sterns was done by Oving in 1985, who came up with a formula for the way in which a transom stern ventilates.



Idealisation of transom ventilation
(Diagram courtesy Lawry Doctors)

As the vessel starts from rest, the lowering of pressure at the aft end means that the water level at the transom drops. As the speed increases, the water level drops further until, at sufficiently high speed, the water flow separates from the underside of the transom and breaks clear. At intermediate speeds there is partial separation. This gives additional drag due to the deletion of the water pressure acting forward on the transom. So the hydrostatic drag due to the transom is the integral of the lack of pressure on the transom:

$$R_{H1} = \rho g \int_{-T_t}^{\zeta_t} b(x_t, z)(z - \zeta_t)dz$$

There is, in fact, also a contribution from the bow:

$$R_{H2} = -\rho g \int_{-T_t}^{0} b(x_t, z)zdz$$

and so the total hydrodynamic resistance is given by:

$$R_H = R_{H1} + R_{H2}$$

The total resistance of the vessel R_T is then given by:

$$R_T = R_W + R_H + f_F R_F + R_A + R_a + R_M$$

where

f_F = frictional form factor (due to Hughes)
R_F = frictional resistance
R_A = correlation resistance
R_a = air resistance (very small on the RiverCats)
R_M = momentum resistance (only applicable to air-cushion-type vessels)

and we ignore any interactions between terms.

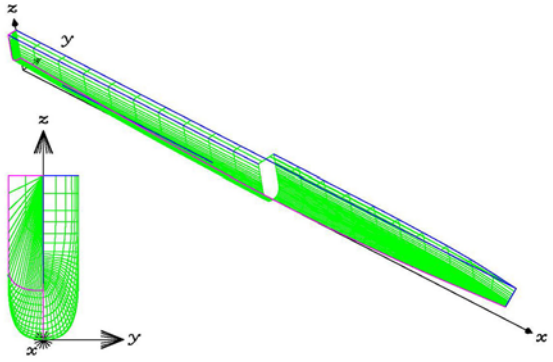
Some consider a good measure of a vessel's efficiency to be the Transport Factor, defined as:

$$\text{TF} = \frac{WV}{P}$$

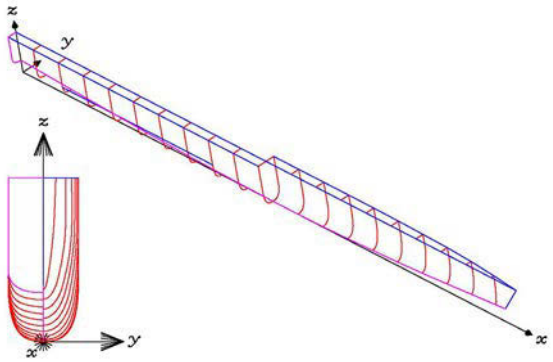
where W is the weight of the vessel (as a force, rather than the displacement, to keep the transport factor non-dimensional), V is the speed, and P the power. Depending on the application, we could take W as the total weight or the cargo deadweight, V as the maximum or service speed, and P as the maximum power, MCR power, or even the effective power (i.e. at the propeller).

Analysis

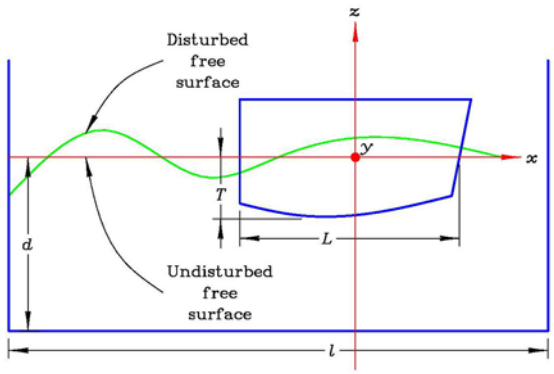
Here Lawry showed some diagrams of his modelling of the RiverCats. The extreme slenderness of the hulls can be seen in the mesh diagrams.



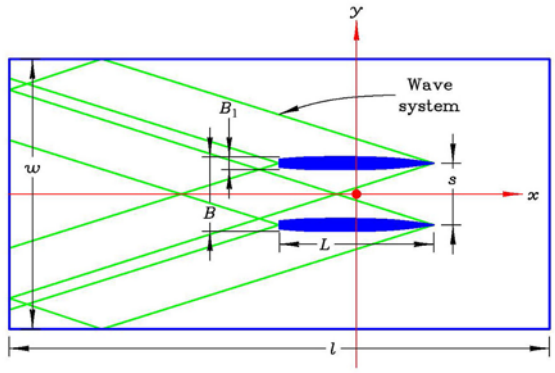
Input mesh for RiverCat demihull
(Diagram courtesy Lawry Doctors)



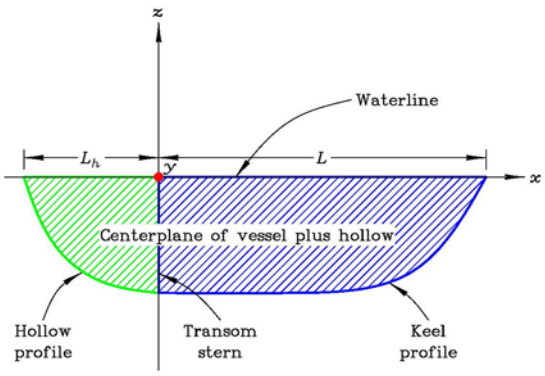
Input sections for RiverCat demihull
(Diagram courtesy Lawry Doctors)



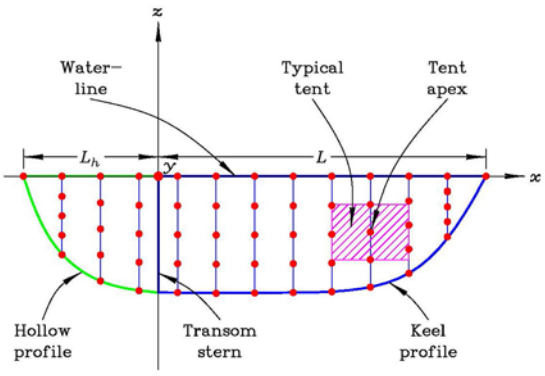
Notation profile for a catamaran in a towing tank
(Diagram courtesy Lawry Doctors)



Notation plan for a catamaran in a towing tank
(Diagram courtesy Lawry Doctors)



Centreplane source distribution for computer
(Diagram courtesy Lawry Doctors)



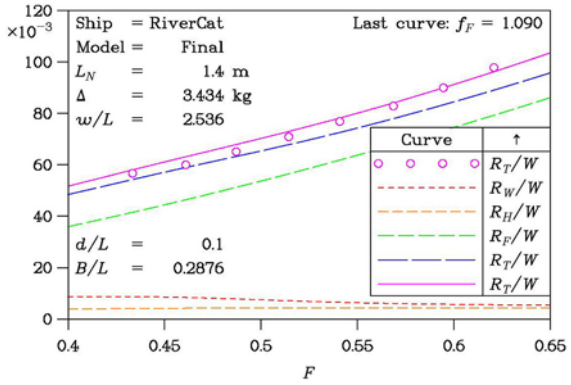
Discretisation of centreplane source distribution
(Diagram courtesy Lawry Doctors)

It can be seen in the towing-tank notation diagrams that all of the principal factors affecting resistance are taken into account: *B, b, s, w* and *d*. It is fascinating that the towing tank has finite width and depth, and that these both affect the results. The wave system comes off both demihulls, and these waves reflect off the sides of the tank and provide interesting interaction effects. This is similar to the Parramatta River, which is limited in both width and depth. The flaw in the Parramatta River is that the cross section is not rectangular!

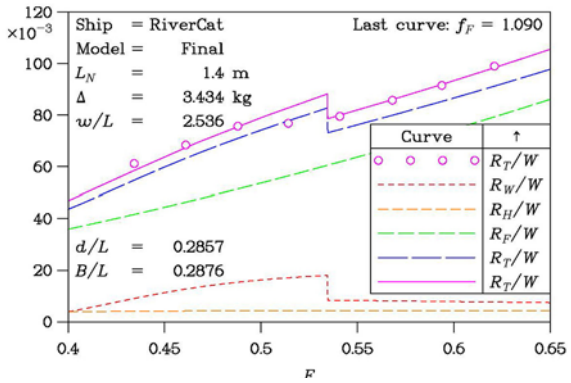
The computer models the hull of the vessel and the wave hollow behind the hull in order to generate the wave system. The source panels are distributed over the centreplane of the hull.

Experimental Results

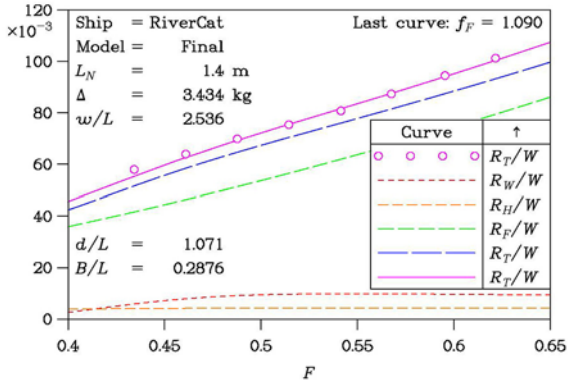
Lawry then showed a series of graphs of the comparison between the towing-tank results and his latest computer predictions, noting that his current program has been refined since his analysis for Grahame Parker in 1991. The abscissas of all graphs are the length Froude number, $F = vL/v$, and the ordinates are the scale for non-dimensionalised resistances, R/W. The symbols represent the experimental points, and the curves represent the computer predictions. The blue R_T/W curve is with a frictional form factor of 1.0, and the purple R_T/W curve is with a frictional form factor of 1.09.



Experiments on RiverCats at d/L = 0.1
(Graph courtesy Lawry Doctors)



Experiments on RiverCats at d/L = 0.2857
(Graph courtesy Lawry Doctors)

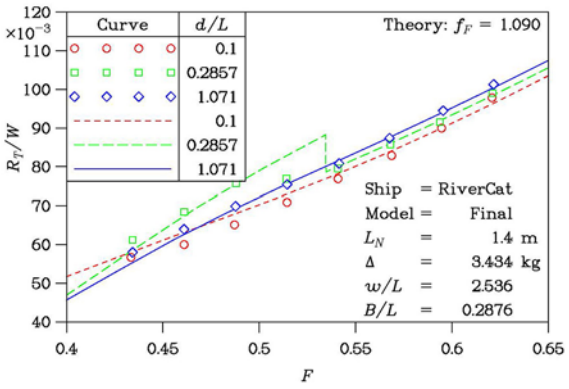


Experiments on RiverCats at d/L = 1.071
(Graph courtesy Lawry Doctors)

The graphs show that, in general, the resistance of the RiverCats increases monotonically with speed. The wave-making component and the hydrodynamic component (due to the transom) are both small, and the principal contributor to the total resistance is the frictional component.

The case of d/L = 0.1 corresponds to a water depth of 3.5 m for the RiverCats.

For d/L = 0.2857, a jump decrease occurs in the wave-making resistance at a depth Froude number F_d = 1.0, due to the loss of the transverse component of the wave pattern



Experiments on RiverCats at all *d/L* ratios
(Graph courtesy Lawry Doctors)

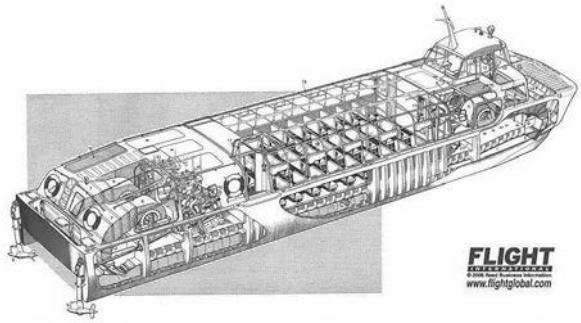
at that speed. The experimental points do not "jump" as do the predictions, *due to the unsteady effects,* which occur in a practical towing-tank test.

For d/L = 1.071, there is close agreement between the experimental results and predictions over the whole range of speeds.

This last graph shows that, overall, the latest computer predictions agree well with the experimental results.

Other Marine Concepts

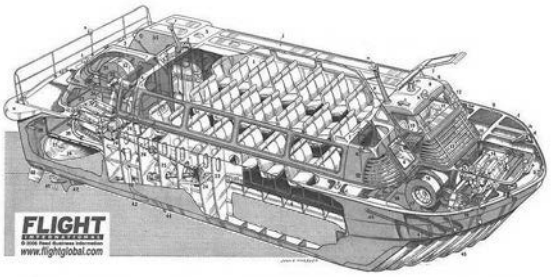
Lawry then said that there are other possibilities for reducing the resistance of vessels. One of these is the sidewall hovercraft.



Cutaway drawing of sidewall hovercraft Denny D2 Hoverbus
(Drawing from Flightglobal Cutaways website)

Sidewall hovercraft Denny D2 Hoverbus on trials
(Photo Scottish Maritime Museum)

The sidewall hovercraft also has very slender demihulls (i.e. the side hulls), a cushion of air in between, and skirts fore and aft to seal and maintain the air pressure. Newton's Law tells us that the whole of the vessel's displacement must be supported by the water, and so waves will be generated. The slender demihulls and the low cushion pressure mean that the wave-making resistance will be low. However,



Cutaway drawing of sidewall Hovermarine HM2 Hoverbus
(Drawing from Flightglobal Cutaways website)

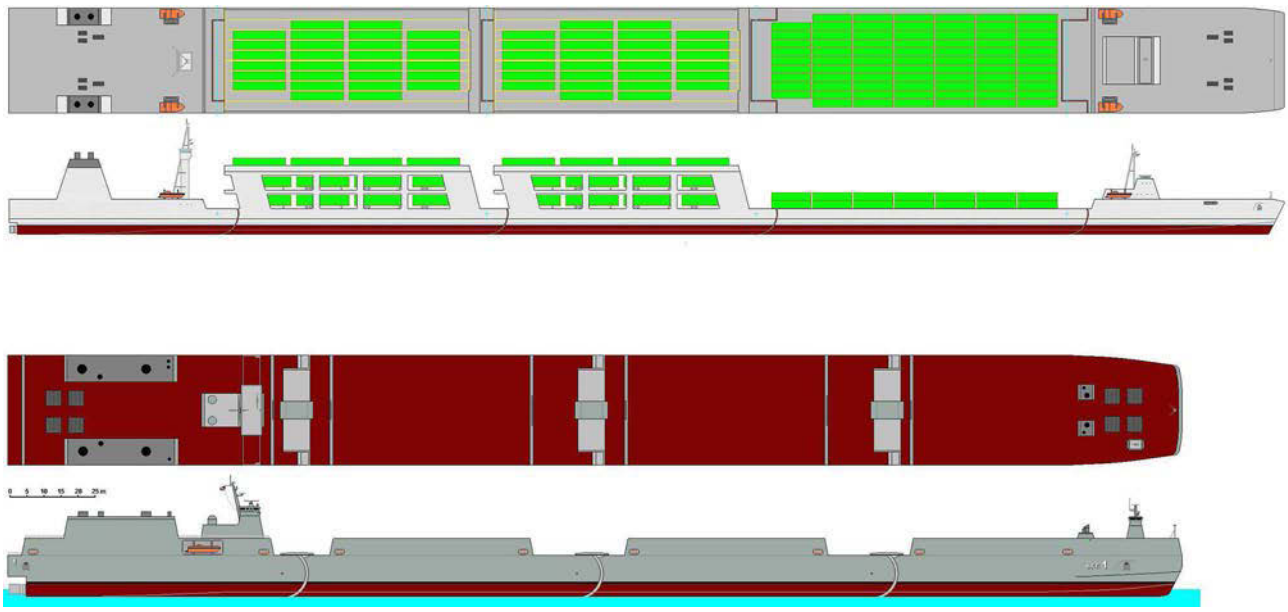
Sidewall hovercraft Hovermarine HM2 Hoverbus in operation
(Photo courtesy Lawry Doctors)

the distribution of support will be different from that of a catamaran. If we can lift the hulls out of the water (or partly so), then the frictional resistance will decrease, and maybe the wave-making resistance too, but we cannot eliminate it. Like the RiverCats, there is no room in the side hulls for the propulsion engines, so they are placed on deck. These vessels often have trouble with the drive shafts and propulsion train.

The photograph of the HM2 Hoverbus shows that the vessel had one poor operating condition, with quite a large wave generated at this low speed.

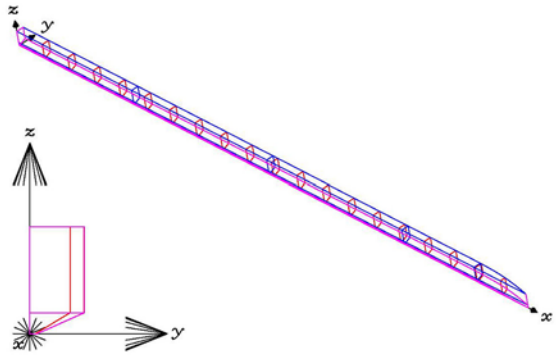
The High-Speed-Sealift SeaTrain surface-effect-ship concept was developed by Alion Science and Technology Corporation in the USA. A long vessel with high length/depth ratio tends to develop high stresses in a seaway. Alion's solution was to articulate the vessel by providing hinged joints to reduce the bending loads. The vessel could also operate into smaller ports by disconnecting at the joints, and they proposed both commercial and military versions.

1:20 scale model of the HSS SeaTrain surface-effect ship being tested on the Severn River near Annapolis, MD, USA
(Photo courtesy Alion Science and Technology Corp.)

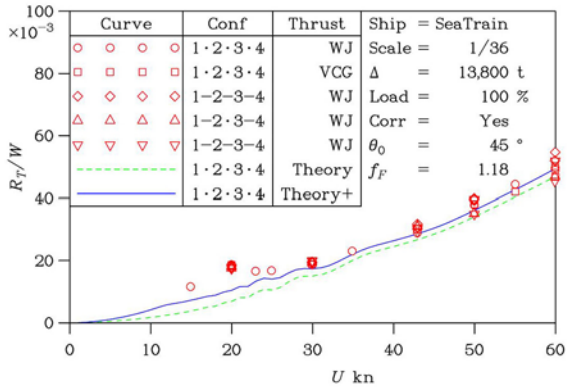


Alion's High-Speed-Sealift SeaTrain surface-effect-ship concept
commercial (top) and military (bottom) versions
(Diagram courtesy Alion Science and Technology Corp.)

Lawry had modelled this vessel and provided resistance predictions using his computer program.



Computer model of four-car HSS SeaTrain
surface-effect-ship side hull
(Diagram courtesy Lawry Doctors)



Results of model tests and computer predictions
for HSS SeaTrain surface-effect ship
(Graph courtesy Lawry Doctors)

In the graphs the symbols represent the results of model tests, while the curves represent the theoretical predictions. In the configuration column, a bar between hulls indicates hulls locked together, while a dot indicates hulls free to articulate. For example, the configuration 1–2·3–4 indicates that Hulls 1 and 2 were locked together, as were Hulls 3 and 4, but that Hulls 2 and 3 were free to articulate.

The symbols show that there is little difference in resistance depending on the degree of locking or articulation.

The results also show that the theoretical predictions agree well with the results of model tests.

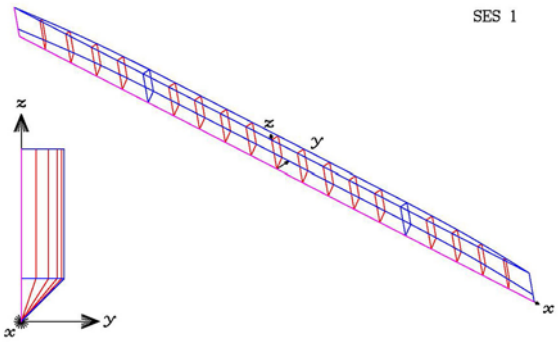
Parametric Studies

Lawry then said that it would be interesting to see what happened if we changed the dimensions of the RiverCat and a surface-effect ship, and whether we could reduce the resistance and improve the transport efficiency. He had tried varying the demihull beam and draft of both the RiverCat and an equivalent surface-effect ship for a length $L = 35$ m, displacement $\Delta = 55$ t and demihull spacing $s = 10$ m.

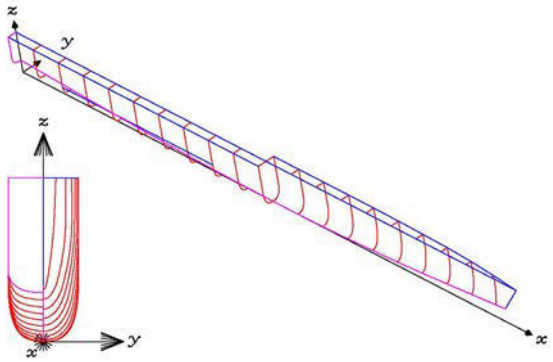
Table of candidate vessels
(Table courtesy Lawry Doctors)

Vessel	Demibeam B_1 (m)	Draft T (m)	Cushion Lift r_C
RiverCat 1	1.000	1.220	
RiverCat 2	1.414	0.866	
RiverCat 3	2.000	0.612	
SES 1	0.400	0.400	0.9136
SES 1	0.200	0.200	0.9784
SES 2	0.400	0.400	0.8845
SES 2	0.307	0.200	0.9641

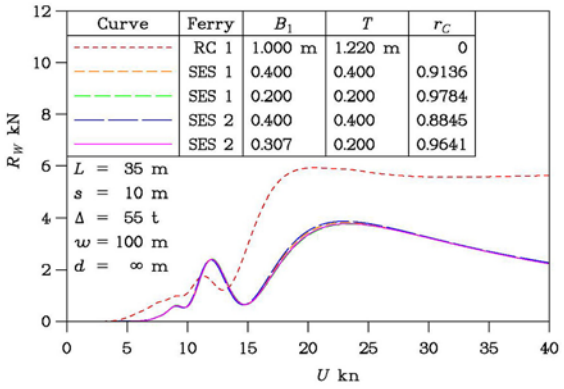
*Common values: Displacement $\Delta = 55$ t
Length $L = 35$ m, Demihull spacing $s = 10$ m



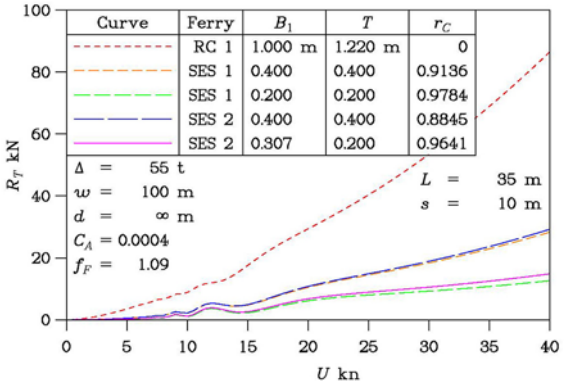
Computer model of hard-chine SES side hull
(Diagram courtesy Lawry Doctors)



Computer model of round-bilge SES side hull
(Diagram courtesy Lawry Doctors)



Comparison of wave resistance of vessels
(Graph courtesy Lawry Doctors)



Comparison of total resistance of vessels
(Graph courtesy Lawry Doctors)

The graphs show that the wave-making resistance of the SES vessels is about 60% of that of the RiverCats at the operating speed of 23 kn, and that there is little difference between the hard-chine and round-bilge versions of the SES. Reducing the draft of the SES vessels produces a worthwhile reduction in resistance. It is unfortunate that, in the real world, there are many constraints on a design, and one cannot reduce the draft of a vessel too much—if the draft is too low on an SES vessel, then air leaks out from the cushion!

Table of comparative transport factors
(Table courtesy Lawry Doctors)

Vessel name	Method of Analysis	Displacement Δ (t)	Propulsive Power P (kW)	Speed U (kn)	Transport Factor (TF)
Denny D.1	Proto†	4.16	52	17.6	7.08
Denny D.2	Proto†	29.4	328	23	10.4
Hovermarine HM.2	Proto†	17.5	477	35	6.46
SES SeaTrain	Model†*	13,800	74,930	43	40.0
RiverCat 1	Proto	55	670	23	9.52
RiverCat 1	Theory*	55	671	23	9.51
SES 1 at T = 0.4 m	Theory*	55	244	23	26.2
SES 1 at T = 0.2 m	Theory*	55	139	23	45.8

*Assumed overall propulsive efficiency of 0.63 to match prototype RiverCat
†First four vessels do not travel at equivalent Froude number

It is also interesting to compare the transport factors for these different vessels. The figures in the table are based on the total installed power (which does not include the power for the air cushion for the SES). The RiverCats show up well compared to the sidewall hovercraft, with about the same TF of about 10 as the D2 Hoverbus. However, the SES vessels all do much better, with the HSS SeaTrain operating with TF = 40. Boeing and Airbus aeroplanes operate with a TF of about 25 at 500 kn; i.e. they operate at 20 times the speed of the RiverCats and at twice the transport factor. But they do have it easy: they have only air to contend with, and air has a density of about 1/800 of that of water where we operate!

Conclusions

The RiverCats have shown themselves to be a marvellous design, with their slender hulls and extremely low wave-making resistance. There are other marine concepts, which also have low wave-making resistance, including sidewall hovercraft and surface-effect ships. In addition, calculations based on the theory are now able to make resistance predictions which are close to the experimental results.

Question time was lengthy, and elicited some further interesting points.

Lawry Doctors (L) accepting the “thank you” bottle of wine and certificate from Adrian Broadbent
(Photo Phil Helmore)

The vote of thanks was proposed, and the certificate and “thank you” bottle of wine presented, by Adrian Broadbent. The vote was carried with acclamation.

Domestic Commercial Vessel Survey in Australia

Michael Uberti, AMSA Accredited Surveyor with Maritime Survey Australia, gave a presentation on *Domestic Commercial Vessel Survey in Australia: the Changes in Regulation and Survey* to a joint meeting with the IMarEST attended by 17 on 6 March in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Michael began his presentation by saying that Marine Survey Australia was formed in 2016 when he went into partnership with Thom Magnuson and Isi Lyons. The company now employs nine full-time marine surveyors around Australia, with a focus on domestic commercial vessels, although they do some work overseas including a recent job in Saudi Arabia.

In general, owners like to talk to surveyors with seagoing experience, but they have found that naval architects are also ideally suited to the role of surveyor, due to their knowledge of the rules and their experience.

AMSA has made significant changes to how domestic commercial vessels are regulated and surveyed. For example, for periodic surveys, some states used to survey every vessel, every year. AMSA has introduced a new risk-based approach, and now no vessel has to be surveyed every year. A passenger vessel will be surveyed four times in a five-year period.

What is a Domestic Commercial Vessel?

From the *Marine Safety (Domestic Commercial Vessel National Law Act* 2012 (the National Law):

7 Definition of *domestic commercial vessel*

(1) In this law

domestic commercial vessel means a vessel that is for use in connection with a commercial, governmental or research activity.

(2) The use of a vessel in connection with an activity that is not a commercial, governmental or research activity at the same time as the vessel is used in connection with a commercial, governmental or research activity does not prevent the vessel from being a domestic commercial vessel.

(3) Despite Subsection (1), a vessel is not a ***domestic commercial vessel*** if the vessel:

(a) is a regulated Australian vessel; or

(b) is a foreign vessel; or

(c) is a defence vessel; or

(d) is owned by:

(i) a primary or secondary school; or

(ii) a community group of a kind prescribed by the regulations.

By way of example, prior to the National Law, police boats and emergency services vessels were not classified as domestic commercial vessels; now, according to the definition above, they are.

State and Territory Agencies

Individual states and territories had their own interpretations of the *Uniform Shipping Laws Code* (USL Code) and the *National Standard for Commercial Vessels* (NSCV), and there was scope for discretion. Now, under the National Law, administered by the Australian Maritime Safety Authority, there is little scope for discretion in applying the regulations. Certificates of Survey and Certificates of Operation were previously combined into one certificate in NSW, while all other states and territories had separate certificates; these are now separate everywhere. Previously, Certificates of Survey and Certificates of Operation were specifically for operation within the home state, and it was often difficult to transfer a vessel from one state to another, due to local (state) interpretations and survey. Now, AMSA certificates apply Australia-wide and, on them, a vessel can be operated in any state.

The USL Code was a prescriptive code. In order to make it work for the varying conditions encountered Australia-wide, there were equivalent solutions, state interpretations, and local rules.

The National Marine Safety Committee was formed in 1998 in an effort to coordinate the marine safety activities of the various states and territories. The NMSC comprised representatives from each state and territory, meeting approximately monthly, and they came up with the NSCV which was implemented in 2008 as a performance-based standard. The intent was for it to be more flexible, and that has, for the most part, been achieved. Michael noted that the NSCV is not yet complete, and that the USL Code is still referred to for load lines, watertight integrity, damaged stability and, of course, "grandfathering" of vessels built in accordance with it.

The National Law

The *Marine Safety (Domestic Commercial Vessel) National Law Act* (the National Law) was introduced by AMSA in 2012 and replaced all equivalent state and territory legislation. This provided for national certificates for five years of operation. The Certificate of Survey applies to the vessel itself, and the Certificate of Operations applies to the operations which the vessel undertakes.

The role of the states and territories has now been replaced by AMSA as the single authority, and AMSA has agreements in place with the state and territory authorities regarding compliance. However, the survey function is now carried out by private surveyors who have been accredited by AMSA for specific survey functions.

The cost of survey has now changed: the survey company sets the price and, as a general rule, overall it is cheaper than it was under the previous system. In NSW, Roads and Maritime Services had a policy of full cost recovery for survey, and so costs for survey there have reduced. In Victoria, Marine Safety Victoria had an arrangement whereby survey costs were about 7% of the actual cost, and so costs for survey there have increased dramatically.

Where are we Now?

On 1 July 2018, AMSA became the single national regulator, and private surveyors must be accredited by AMSA to carry out surveys of domestic commercial vessels.

AMSA monitors the dates required for periodic survey of each vessel, and sends reminder notices to owners that a vessel is coming up for a particular survey.

Surveyors are accredited across a wide range of categories, and each surveyor is not often accredited for all types of survey. In a large organisation, there is usually expertise to cover the full range of survey categories but, for the lone operator, it can be quite difficult and require additional expertise. For example, a naval architect could not usually expect accreditation to carry out electrical surveys, nor could a marine engineer expect accreditation to carry out load line surveys.

Surveyor accreditation categories are as follows:

Initial Survey	**Periodic Survey**
Plan approval	Survey
Stability approval	Electrical
Load line	Load line
Electrical	Safety equipment
Construction or alteration	Communications equipment

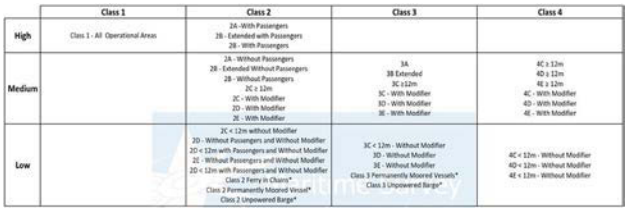
Accreditation is granted by AMSA for a period of five years. For renewal of accreditation, an application for renewal must be submitted at least three months before the current accreditation expires.

The system is in its infancy, but a vessel with a Certificate of Survey now is likely to be at a better standard of seaworthiness and safety than previously.

Risk-based Survey

AMSA has implemented a risk-based approach to survey and the frequency of periodic surveys. Risks are categorised as high, medium or low and, as the risk decreases, the frequency of periodic surveys also decreases.

Categories of risk
(Table courtesy Marine Survey Australia)



Class 1	Passenger vessels
Class 2	Workboats
Class 3	Fishing vessels
Class 4	Hire-and-drive vessels
Area A	Unlimited
Area B	Within 200 n miles of coast
Area C	Within 30 n miles of coast
Area D	Partially-smooth waters
Area E	Smooth waters

Survey Frequency Category	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
High	Initial Survey	In Water Periodic	In Water Periodic	Out of Water Periodic		Renewal Survey (In and Out of Water)
Medium				In Water Periodic		
Low						

Frequency of survey depending on category of risk
(Table courtesy Marine Survey Australia)

It can be seen from the table that no vessels have to be surveyed every year. Class 1 vessels, and Class 2 vessels operating in Areas A or B, i.e. those presenting the highest risk, are surveyed in all years except Year 4. Low-risk vessels are only surveyed every five years. However, some owners of high-risk vessels see the benefit of surveying in every year, and some do it as a requirement of their insurance company.

If a vessel is not on the list, e.g. a non-survey (NS) vessel of less than 12 m in measured length operating on Sydney Harbour, then the owner can apply to forego the need for a surveyor to say that the vessel meets the requirements of a non-survey vessel. This would mean that the construction, buoyancy, engineering, flotation and all other requirements do not have to undergo any initial survey by an accredited surveyor. However, that is quite a brave thing for an owner to do! The biggest danger is from these vessels, having no construction survey and allowed to carry up to four passengers.

As AMSA set the survey schedule, by virtue many owners tend to use this as their maintenance schedule. Michael said that he often fields questions like "How do I keep my vessel in the water for five years, and what do I need to do regarding maintenance, etc.?"

If a vessel is behaving well and is obviously being kept up to scratch, then it can move up in the table and the frequency of periodic surveys can decrease. Similarly, if a vessel is behaving poorly and is obviously not being kept up to scratch, then it can move down in the table and the frequency of periodic surveys can increase.

Naval Architects

Naval architects are particularly suited to carrying out plan-approval surveys, initial surveys, stability surveys and preparing stability books, five-yearly renewal surveys and lightship checks.

However, if a naval architect designs a vessel, then he/she cannot conduct the initial survey on that vessel.

The naval architect preparing the stability book for a vessel can also conduct the inclining experiment on which the book will be based.

A naval architect can self-certify his/her own drawings, but many design companies contract another company to certify their drawings or stability books as a further check.

Conclusion

The *National Standard for Commercial Vessels* and the new National Law have changed the face of domestic commercial vessel survey in Australia; the NSCV by changing to a performance-based standard in place of the prescriptive *Uniform Shipping Laws Code*, and the National Law by creating a single national jurisdiction, and putting the survey of vessels into private hands (with oversight by AMSA), and introducing a risk-based approach to the frequency of periodic surveys.

Questions

Question time was lengthy, and elicited some further interesting points.

A vessel owned by the Royal Australian Navy but operated by civilians is a domestic commercial vessel. Vessels owned and operated by the Australian Border Force may be domestic commercial vessels, but are operated primarily as regulated Australian vessels because DCVs cannot exit Australia's exclusive economic zone.

To become an AMSA-accredited surveyor, you need to apply to AMSA and have all your documentation to meet the requirements. As a minimum, you need to have a degree

in naval architecture or a certificate as a Class 3 Marine Engineer, or a Diploma in Marine Surveying. You then need to sit for the AMSA exam.

There are more AMSA DCV employees around Australia now than there were state/territory-based DCV employees by all the states and territories combined prior to 1 July 2018.

Michael Uberti (L) accepting the "thank you" bottle of wine and certificate from Graham Taylor
(Photo Phil Helmore)

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

Design of Car Decks with Composite Panels on a Car Carrier

Valerio Corniani, Global Marine Segment Manager, Diab Group, gave a presentation on *Design of Car Decks with Composite Panels on a Car Carrier* to a joint meeting with the IMarEST attended by 47 on 3 April in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Valerio began his presentation by saying that his own background was in composites, mainly in the marine field and, especially, in small pleasure boats. However, in 2017 Diab received a request for the first case of a SOLAS-approved vessel, a car carrier. These vessels are basically big boxes with pointy ends, with lots of decks for transporting new cars from manufacturers to all parts of the world.

The Uljanik shipyard is in Pula, Croatia, was founded in 1856, and is one of the oldest operating shipyards in the world. The city has since grown around the yard, and the yard is now being squeezed for space. It is also facing stiff competition from overseas yards.

The Project

The project actually started ten years before the first vessel was launched, with a European grant for research into how to save mass in the construction of ships. A bright young engineer on the research team came up with the concept of upper car decks constructed of composites. The first

The Uljanik shipyard in Pula, Croatia
(Photo courtesy Diab Group)

modelling on a ro-ro vessel predicted a deck structure mass reduction of up to 35%, a fuel-consumption reduction of 2% and consequent reduction of CO_2, stability benefits, and production and life-cycle cost reductions.

However, there was a question mark about the durability of composites under continuous car traffic. So they made up composite panels and placed them at the entrance to the yard main carpark and subjected them to year of use without problems. With that question answered, the project continued to evolve.

Composite panel under test in carpark entrance
(Photo courtesy Diab Group)

Siem Car Carriers eventually placed an order for three car carriers from Uljanik, each to have the three top decks constructed in composites. Principal particulars of the vessels are:

Length OA		200.0 m
Length BP		188.7 m
Beam		32.26 m
Depth	(upper deck)	32.12 m
Draft	(design)	8.00 m
	(scantling)	8.80 m
Dwt	(design)	13 370 t
	(scantling)	17 170 t
Capacity		7000 cars
Main engine		MAN-B&W 7 S 50 ME-B9.5 11 200 kW @ 117 rpm
Propulsion		Single screw
Speed		19.7 kn at 85% MCR and design draft
Flag		Liberia
Class		Bureau Veritas

The first vessel, *Siem Cicero,* was launched on 12 November 2016 and delivered for Volkswagen in July 2017 [*There is a video of the launch at https://www.siemcarcarriers.com/content_news/siem-cicero-launch-12th-november-2016/*—Ed.]

Siem Cicero
(Photo courtesy Diab Group)

Deck Design

Diab became involved in the supply of materials for the composite panels as they knew more than anyone else about sandwich composites. The view on a car deck looks similar to other car carriers, but with some differences: The decks have sandwich composite panels, supported by a steel grillage structure of girders and beams, with two rows of tie-down points in each panel.

Car deck showing composite panels, steel grillage and tie-down points
(Photo courtesy Diab Group)

The panels were designed with carbon and glass fibres either side of the 40 mm PVC core material, wetted out with resin. The fibres carry the tensile and compressive loads, and the core carries the shear load. The sandwich construction means that the structure can have thinner skins and be stronger and lighter than a single-skin layup.

Uljanik had good welders who handled the grillage structure, but they had no expertise in composites, so they sub-contracted the construction of the panels to the Croatian company Brzoglass. They constructed the panels by laying up the dry skins on a vacuum table, interleaved the foam core, applied the vacuum bag, connected the feed lines and pump. When the resin was fed in, it wet out the skins and provided high consolidation with no air bubbles. The process is called vacuum infusion. The edges were then trimmed to give the finished panel. Each deck has 2500 m^2 of 40 mm H80 core, and 1000 m^2 of 40 mm H100 core.. Each ship requires 1043 panels for the three decks; at 155 kg per panel, that's a total of 162 t per ship, a saving of 230 t over steel construction of those three decks.

However, the mass saving is not the only benefit. Since the mass saved is high up, the stability performance is improved by lowering the vertical centre of gravity, and so 575 t less ballast has to be carried, a total mass saving of 230 + 575 = 805 t. In addition, the fuel consumption has been reduced by 4.5% with a consequent reduction in CO_2 emissions for the same cargo capacity.

Panel Design

The panels had to be designed to meet the requirements of SOLAS, class, and the owner.

For SOLAS, there were the strength and fire-safety regulations to consider. Longitudinal and ultimate strength analysis was done without participation of composite panels, only the steel part was considered; i.e. the composite panels do not contribute to strength in any way and the steel beams and girders ensure the integrity of the structure. Local structural design of beams was done to prevent any type of car from falling through the grillage to the next deck and thereby overloading. In summary, structural integrity is fully ensured by the steel members and the structure is therefore SOLAS compliant and equivalent to a conventional design. For SOLAS fire safety, the composite decks are all within the same fire zone bounded by steel gas-tight structure, so there are no extra fire-protection requirements by SOLAS. The vessel is therefore SOLAS-compliant and conventional design procedures apply. There are no fire-retardant additives to the resin.

Bureau Veritas, the classification society, had no fire-safety requirements additional to SOLAS, and the structural requirements were according to BV rules. The composite panels were optimised by way of the number of glass fibre layers and fibre direction, and core type according to location (H80 and H100 were both used). Finite-element analysis according to BV rules was completed.

Owner's Fire Safety

The owner came and said that the SOLAS fire-safety compliance was fine, but what about when loading cars alongside a berth—how good was the design? Uljanik therefore went to an independent company, the Technical Research Institute of Sweden (RISE) and asked them for a fire-safety assessment. The procedure of the analysis was based on the MSC/Circ.1002 *Guidelines on Alternative Design and Arrangements for Fire Safety*, even though all prescriptive requirements were considered achieved. Hence, the scope was not to achieve fire-safety requirements in an alternative way but the methodology presented in SOLAS II-2/17 was used to demonstrate safety equivalent to that of a conventional steel design. The team conducted a preliminary analysis in qualitative terms, then did large-scale fire tests (on both steel and composite deck structures), conducted a quantitative analysis (18 FDS simulations were performed, varying fire growth rate, ventilation conditions, land/sea scenario, time to close vents, fire origin deck, and time for vertical fire spread for both steel and composites. They then analysed egress analysis and load-carrying capacity of the steel structure, and the risk of containment loss was evaluated based on these simulations.

They compared the spread of fire from one deck to another for steel and composite structures. They realised that the fire was able to spread between decks through the tie-down holes in the panels. They used the tests to model the rate of spread of smoke and fire, to determine how long people had to escape from the deck, and the last moment to activate the fire-suppression system. One benefit of the composite panels was that people struggle to walk on a steel deck which has a fire underneath because of the heat but, with composite panels with a 40 mm core, people can walk on the deck for a lot longer. The overall result that the first composite design was not as good as steel.

In the next iteration, they closed the underside of the tie-down holes in the panels which prolonged vertical fire spread, fire spread to the deck below was eliminated, and cargo lashing was functional for a longer time in a fire scenario. Automatic/remote-controlled dampers were provided, which gave fast closing (immediately after alarm) and faster CO_2 activation. Position feedback was given on doors and dampers which allows crew to focus on failing doors and dampers, reduces risk of CO_2 activation despite failing doors and dampers. A30 insulation was provided below lifeboat embarkation stations, allowing safe lifeboat embarkation in case of uncontrolled fire in Gastight Zone C. The resultant comparison of the composite panels with the all-steel structure showed that the parameters for the composite panels were all better than steel except for the expected safety margin, which was above requirements in all cases. The owner was satisfied with that.

Criteria	Prescriptive design	Base design	TAD2*
PLL	0	0	0
Expected safety margin	20.5 min	13.5 min	13.5 min
Probability of structural integrity failure	12 %	51 %	3 %
Probability of loss of containment	10 %	10 %	1 %
Weighted average time to structural integrity failure	418 min	31 min	552 min
Weighted average time to containment failure	706 min	597 min	5973 min

Fire safety assessment results
(Table courtesy Diab Group)

In general, the composite structure delayed the spread of fire through decks, and allowed escape routes over the deck in case of a fire below deck compared to steel. However, there was increased fire growth rate, increased fire load, and toxicity from the burning resins and core.

Composite construction would not be easy to implement in cruise ships, which have the most strict fire, smoke and toxicity requirements. However, possible applications include bulk carrier hatches, and other commercial vessels.

Conclusion

In this innovative application of composites to the decks of a car carrier design, the deck structure mass was reduced by 230 t or 25%. Overall there was an 805 t mass reduction due also to the reduced amount of ballast required. Fuel consumption was reduced by 4.5% (2.1 t/day HFO) for the same cargo capacity. Production cost and lead time were reduced. There was improved safety of crew in case of fire below deck with respect to escape routes.

The end result was a SOLAS-compliant vessel with respect to fire safety, according to the SOLAS Conventional and Alternative Design Procedure. This was therefore the first extensive application of composites in a SOLAS-compliant vessel.

Questions

Question time was lengthy and elicited some further interesting points.

The composite panels were bolted in place.

If there is such a mass saving from three decks, why not apply composites to all 14 decks? Further down, there is less benefit from mass saving, so more decks is not necessarily better. The design team considered that three decks was the optimum to start with.

The European grant justified the research at the start of the project to see whether the business case would stack up, and was done on the basis of the cargo decks of a Delight Transport ro-ro vessel. The research was based on four decks and predicted a 20% mass saving, so the business case was good.

The life expectancy of the vessel is unknown, but the life of the composite panels is expected to be at least that of the ship. Recycling the panels is a problem, because all are thermosetting and not thermoplastic. Being a mix of different materials, composites are by nature very hard to recycle

Valerio Corniani (L) accepting the “thank you” bottle of wine and certificate from Martin Renilson
(Photo Phil Helmore)

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

Corrosion and Mitigation

Jim Galanos, Engineering Manager NSW & ACT, Corrosion Control Engineering, gave a presentation on *Corrosion and Mitigation: Truths, Lies, and Everything in Between* to a joint meeting with the IMarEST attended by 59 on 1 May in the Harricks Auditorium at Engineers Australia, Chatswood. This was the third-highest attendance of our 114 meetings at the Chatswood venue since Engineers Australia moved there in June 2006.

Introduction

Jim began his presentation by saying that corrosion is a massive problem in general, but is particularly so in the marine environment as the conditions are conducive to corrosion, and mitigating corrosion in these environments is challenging. The presentation provided a lot of experiences from years in the game to help designers and maintainers of vessels, as well as giving some facts about corrosion and dispelling myths.

Corrosion Basics

There are four essential requirements for a corrosion reaction:

- a cathode: the metal which is protected against corrosion;
- an anode: the metal which corrodes;
- an electrolyte: the conductive environment which sustains the corrosion process; and
- a conductive bond: the electrical bond between metals, but can be internal within the metal

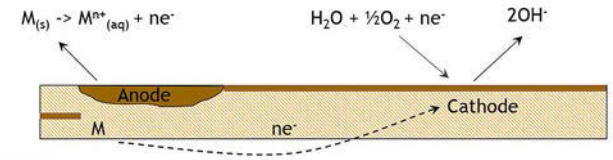
Removal of any of these will stop corrosion.

As a matter of interest, a direct current of 1 amp discharging off steel for a year will cause a loss of steel by corrosion of 9 kg in that year. Oil and gas pipelines typically have wall thicknesses of 6–10 mm, and that rate of corrosion can put a hole in a pipeline in a year.

Structures are now being asked to last longer, often past the original design life and, if there has been loss of metal due to corrosion, then we may have to reduce the operating pressure in a pipeline, or reduce the allowable loads on wharves and jetties, etc.

However, corrosion can be beneficial and the electron flow can be useful: batteries are just corrosion cells, and we rely on batteries for many things. So it is not all bad, just mostly!

In a basic cell, corrosion occurs when a metal "is dissolved" in an aqueous solution. Slight differences in the potential within a metal creates corrosion cells. The anode decomposes into metal ions in solution and electrons. The cathode absorbs the electrons and forms hydroxyl (OH) ions. A potential difference of millivolts will cause corrosion.



Basic corrosion cell
(Diagram courtesy Corrosion Control Engineering)

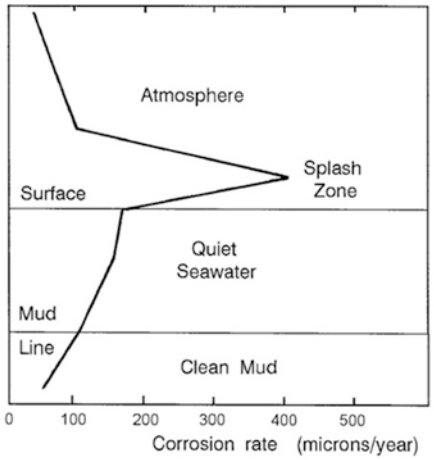
The Hard Truth

The hard truth is that all metals commonly used in the marine industry corrode, with the rate of corrosion depending on the metal and its environment.

- Mild steel immersed in seawater corrodes at an approximate rate of 0.1 mm (100 microns) per year.
- Grade 316 stainless steel immersed in seawater corrodes at an approximate rate of 0.0025 mm (2.5 microns) per year.
- Marine copper alloys (including bronzes) immersed in seawater corrode at an approximate rate of 0.01 mm (10 microns) per year.

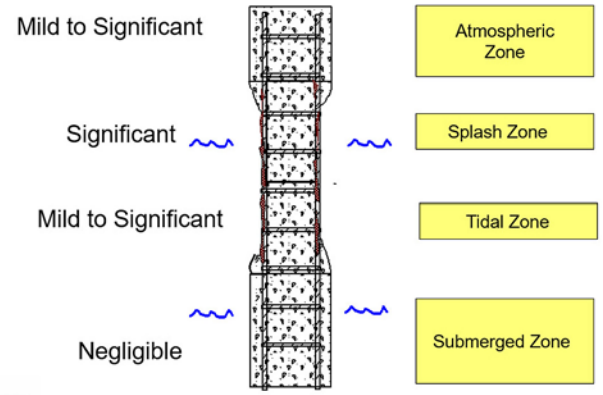
Factors which may influence these rates include temperature, flow rates, microbial activity and oxygen levels. Corrosion rates in tidal and splash zones can be 3–5 times higher. Pitting corrosion and microbial-induced corrosion can be up to several millimetres per year.

The corrosion of steel in seawater depends on the location relative to the water surface, the rate being highest in the splash zone just above the surface.



Corrosion of steel in seawater
(Diagram courtesy Corrosion Control Engineering)

The corrosion of concrete-embedded steel in seawater also depends on the location relative to the water surface, the rate being highest in the atmospheric and tidal/splash zones.



Corrosion of concrete in seawater
(Diagram courtesy Corrosion Control Engineering)

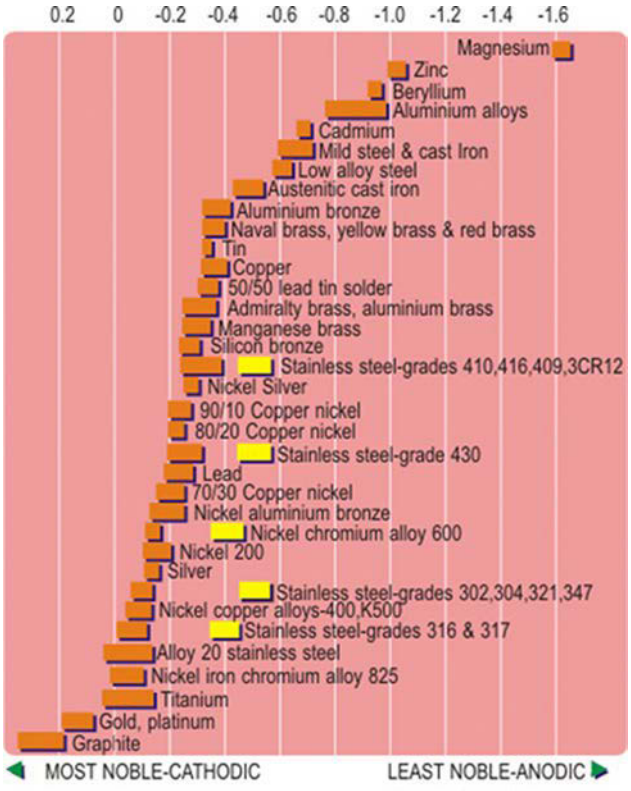
The problem with reinforced concrete in seawater is that the product of the steel corrosion (rust) mostly does not go into solution, but expands (up to 6–8 times the original volume) and cracks the concrete, allowing the access of chlorides which decreases the pH of the concrete and accelerates the whole process.

Pitting corrosion in steel plates can be a real problem. If there is no hole, then the problem is manageable; a hole is not manageable! Some codes and regulations assume uniform corrosion and provide for a corrosion margin on the required thickness of plates; however, it is impossible to design for non-uniform corrosion, i.e. pitting.

The Galvanic Series

Here Jim showed a diagram of the galvanic series and how the electrode potentials of the various metals relate to each other.

Bonding dissimilar metals increases corrosion rates, and the further apart they are on the galvanic scale, the greater the driving voltage, the higher the current flow between the metals, and the higher the rate of corrosion on the more-active metal. What can we do about it?



The galvanic series (units of volts)
(Diagram courtesy Corrosion Control Engineering)

In Australia, corrosion mitigation is a multi-billion-dollar industry, and it is a multi-trillion-dollar industry in the USA and world-wide. We are interested in arresting corrosion and in extending the service life of structures.

Corrosion Mitigation via Coatings

Coatings are often used as the main corrosion-protection barrier. Coatings provide protection by isolating the metal (usually steel) from the surrounding environment.

The coating manufacturers market their products as perfect and defect free. However, a perfect (100%) coating cannot be applied or maintained. Coating breakdown occurs with day-to-day operation and with age. Having a coating 99% intact means that the coating is not perfect, and corrosion can take place at the 1% which is *not* protected. If the corrosion products expand (e.g. rust), then the affected area becomes larger and the problem becomes bigger.

New epoxy coatings are good, and limit water ingress. However, some of the older coatings, such as coal tar, are now more like sponges!

Coatings are never perfect, and will never be. They break down with age, or damage from impacts, or from abrasion. Given enough time, and this could be many decades, coatings will absorb moisture and will disbond.

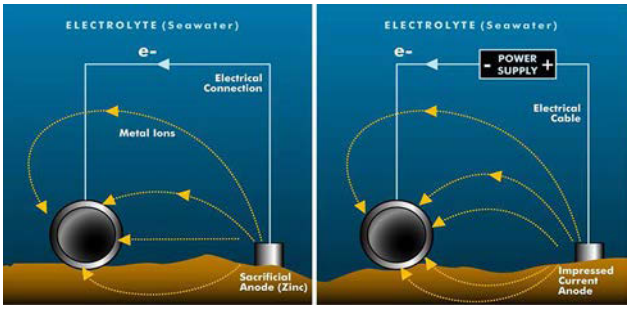
Corrosion Mitigation via Cathodic Protection

Cathodic protection is an electrochemical process and involves a direct current being forced to flow from an external source (the anode) to the buried/immersed structure being protected (the cathode). There are two types of cathodic protection:

- Sacrificial anode, typically zinc or aluminium in seawater and brackish environments.
- Impressed current, with a DC power supply; the anode

is inert, typically of titanium, platinum or graphite. Titanium and platinum anodes have a metal oxide coating which is the active part of the anode.

Both of these systems do exactly the same thing, although the sacrificial anode has a fixed driving voltage, where the impressed current system can vary the driving voltage (and hence current) as required.



Sacrificial anode and impressed current cathodic protection
(Diagrams courtesy Corrosion Control Engineering)

Cathodic protection (either sacrificial anode or impressed current) is widely used to complement coating systems, with the coating system being the main corrosion barrier. As coatings break down, the cathodic protection system provides protection at coating defects. The formation of calcareous deposits on the surface show that a passive (protective) film is being established, even to previously-corroded steel, and that no more corrosion is taking place.

Note that no *cathodic protection* means *no* protection!

Cathodic Protection of Structures

The following structures *can* be protected from corrosion by cathodic protection:

- Buried, immersed and steel-reinforced concrete structures.
- Berths, wharves, jetties, dolphins, moorings and navigation aids (up to mid tide).
- Sheet piling and driven piles (up to mid tide).
- Structures with existing corrosion (retrofit).

The following structures *cannot* be protected from corrosion by cathodic protection:

- Above-ground structures (this includes land-based vehicles!)
- Above-mid-tide structures.
- Timber structures.

Anyone telling you otherwise is lying!

Wharf piles are often mild steel, can be 30 m long and 1 m diameter, driven into the sea bed and so have buried, water, splash and atmospheric zones to protect. It is expensive to coat the whole length of pipe, so they are often coated down to 1 m below the low-water mark, with cathodic protection underwater and up to the mid-tide mark, so that some areas have double protection.

Internally protecting pipework against corrosion is difficult. Isolation and material selection is the best for pipes.

Interpretation of Corrosion Potentials

The measurement of the potential of a metal (measured relative to a $Cu/CuSO_4$ reference electrode) can be used to indicate its corrosion state in a particular environment. This is detailed in local and overseas standards.

Buried/Immersed Structures

–500 mV	Typical unprotected potential
–850 mV or more -ve	Protected against corrosion

Concrete Structures

–200 mV	> 90% Probability of no corrosion
–200 mV to –350 mV	Uncertain corrosion activity
–350 mV or more -ve	> 90% Probability of corrosion

Protection Criteria

For buried and immersed structures as per AS2832 Parts1–4

Reference	Protection Potential in Volts	
	Steel	Aluminium
Cu/CuS04	-0.85	-0.95
Ag/AgC1	-0.80	-0.90
Zinc	+0.25	+0.15

*1

Reference	Maximum Potential in Volts
Cu/CuS04	-1.20
Ag/AgC1	-1.15
Zinc	-0.10

Protection criteria according to AS2832 Parts1–4
(Diagram courtesy Corrosion Control Engineering)

Note:

1. All potentials are free of significant voltage-gradient error.

2. Where MIC/SRB/ALWC [*Microbiologically-influenced corrosion/Sulphate-reducing bacteria/accelerated low-water corrosion*—Ed.] is present, a minimum potential of 100 mV more negative than shown in the table should be maintained.

Galvanic (Sacrificial) Cathodic Protection Systems

A sacrificial anode cathodic protection system involves connecting the structure to a sacrificial anode. The anode must be more active (as per the galvanic series) than the metal being protected.

The most common sacrificial anodes are:

Magnesium	Fresh water and non-chloride contaminated soils only and for tank de-scaling
Zinc	Fresh water, salt water and all soil types
Aluminium	Salt water applications and some low-resistivity soil environments

Zinc is limited by temperature, as it passivates at temperatures of about 50°C and higher.

Advantages of sacrificial anode cathodic protection systems include no external power source being required, typically lower supply and installation costs, less maintenance, minimal/no adverse effect on other structure, and minimal/no chance of coating disbondment.

Disadvantages of sacrificial cathodic protection systems include limited driving potential and hence current output, typically shorter design life than impressed current systems, and limited flexibility in controlling output.

Impressed Current Systems

Impressed current cathodic protection systems involve the use of an external direct-current power supply. The structure is connected to the negative terminal of the power supply whilst the positive terminal is connected to an inert anode (typically mixed-metal-oxide-coated titanium or platinum-coated titanium). Anodes installed in high-resistivity ground environments will have a have a calcined coke backfill which increases output and life.

Advantages of impressed current cathodic protection systems include larger driving voltages and, hence, greater current output, good output control, and typically longer design life than sacrificial anode cathodic protection systems.

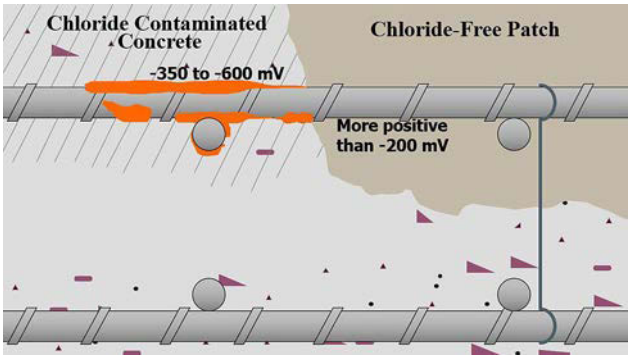
Disadvantages of impressed current cathodic protection systems include typically higher supply and installation costs, higher running and maintenance costs, potential to cause adverse effects on other structures, and may cause coating disbonding under certain conditions.

Concrete Patch Repair

Patching concrete can lead to corrosion problems.

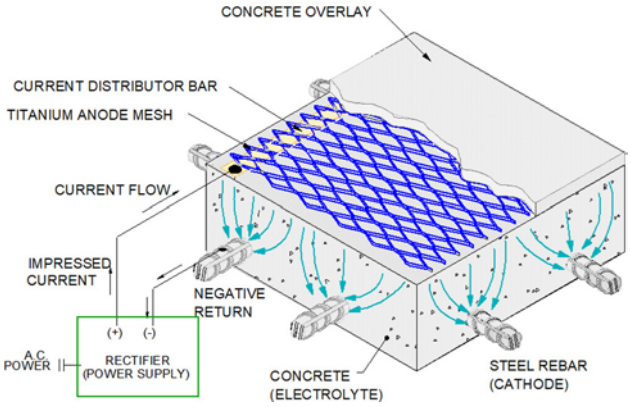
In the diagram, the new concrete patch is chloride free, and has a potential more positive than –200 mV. The old concrete is chloride contaminated and has a potential of between –300 and –600 mV. This naturally sets up a galvanic cell, and causes corrosion (rust, coloured orange) on reinforcing steel bars of the old concrete rebar.

One means of obviating this problem is to use a titanium anode mesh with concrete overlay and an impressed current



Corrosion caused by patching concrete
(Diagram courtesy Corrosion Control Engineering)

system between the steel reinforcing and the titanium mesh, with the moisture in the concrete as the electrolyte. The same effect can be achieved using ribbon anodes in lieu of mesh. That is, a cathodic protection system is installed to mitigate rebar corrosion.



Concrete overlay titanium mesh system
(Diagram courtesy Corrosion Control Engineering)

Frequently-asked Questions

These new (piles, sheet piling, rebar, etc.) are corroding faster than the existing ones which are 50 years old!

This is not uncommon. Bonding new steel to old steel results in a potential difference in the order of 200–300 mV, with the new steel acting as the anode.

These anodes don't work, the boat's propeller and shaft are still corroding!

You would need to check:

- Whether the anodes are AS2239 compliant; if they are not, then there may be too many or too much impurity which can passivate the anodes which will then not be as efficient as required. In some cases, the anodes will completely passivate and fail.
- Whether all structures are electrically bonded; for example, a propeller-shaft slip-ring assembly ensures good electrical contact between the propeller, propeller shaft and the ship's hull. The assembly comprises a silver-inlaid copper band, clamped to the shaft, and a brush assembly. High silver content brushes running on the silver strip provide electrical continuity.
- Whether there are enough anodes to provide uniform current distribution; distribution of anodes is difficult to teach—it depends very much on experience.

These anodes disbonded my coating.

Sacrificial (zinc or aluminium) anodes in seawater do not

have the capacity to shift a structure to over-protected potentials. Coating loss would most likely be due to other factors, such as poor surface preparation and/or application.

However, note that impressed current cathodic protection *can* shift a structure to over-protected potentials and, hence, disbond coatings, for example.

The marina upgraded the on-shore AC power and now my boat is corroding at twice the previous rate.

It is common for marinas and vessels to have insufficient isolation between the marina's electrical earth and adjacent vessels (bonding via the earth). This results in accelerated corrosion of the hull. The marina needs to have sufficient electrical isolation, and this can be provided by a decoupler.

The wharf's cathodic protection system is causing electrolytic corrosion on my vessel.

It is common for a vessel to switch its own cathodic protection system off and connect to the wharf's cathodic protection system. However, if the wharf's cathodic protection system is not operating satisfactorily, then vessel corrosion can occur. In this case, do not bond to the wharf!

Conclusion

Corrosion is a big problem in the marine environment, as the conditions are ideal and conducive to corrosion. However, there are systems available to mitigate corrosion, and these include materials selection, coatings, sacrificial anodes, and impressed current systems. Each has advantages and disadvantages, and corrosion engineers are kept employed by having to treat each new case on its merits.

Questions

Question time was lengthy and elicited some further interesting points.

Steel marine piles often have an HDPE sleeve and cap, and you get aerobic corrosion. If you can keep moisture out from between the sleeve and the pile, then the sleeve will do a good job. However, if you get a split in the sleeve, or the sleeve itself is not a tight fit and moisture is able to penetrate, then corrosion will result.

In some areas the waterway can be acidic due to engine exhausts exiting underwater, so what effect does this have on corrosion? If you use cathodic protection in that scenario, then you would need two or three times the usual current in order to mitigate the corrosion. In this situation a water analysis will be beneficial.

Wrought iron sometimes corrodes less than mild steel but not always. Some old wrought iron was a high-quality product, and formed its own crusty layer to protect, whereas steel doesn't. The old railway bridge at Ryde (now a walk-and-cycle way) is wrought iron which was totally imported and is still in business.

Some ships alongside a wharf switch off their own impressed current system and bond to the wharf. Many vessels are set to maintain a certain potential, either in seagoing or harbour mode, and the smarts in the system will try to maintain that potential. However, alongside the wharf, you want the wharf to provide most of the protective cathodic protection current, so that the wharf is protecting the ship, and you don't have the ship trying to protect the wharf!

Metal spray can be used to build up corroded surfaces in the tidal and splash zones, subject to careful surface preparation. Many bridges have had metal spray applied.

"Tea staining" is discolouration of the surface of stainless steel by corrosion. It is a cosmetic issue which does not affect the structural integrity or the lifetime of the material. Tea staining is a problem because it keeps recurring. It can usually be removed with warm soapy water, but you need to get to it early and keep at it.

Hinges and pins in the marine environment are often the subject of crevice corrosion, so what is the best material to use for these? Probably 316 stainless steel, although if graphite grease is used then the graphite will likely eat into the stainless steel!

The cutting edge in cathodic protection is on the side of smarts for control of impressed current systems. There is much regulation in the standards for testing several times per year. On the sacrificial anode side, it is purely a refinement of the standards; the Australian standard is 20 years old, but the DNV GL standard is much more recent. Impressed current anode materials mostly use a titanium substrate, and coatings are being asked to last longer and cost less. Changes are really more on the monitoring and hardware sides. Ceramic anodes for protection of concrete were tried a few years ago, but were not effective.

A lot of different polymers have been added to concrete to limit the ingress of moisture and block the electrolytic path. Many repair grouts are heavily polymer modified, but this makes them too resistive for subsequent cathodic protection, and their longevity is still unknown.

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

Phil Helmore

Jim Galanos (L) accepting the "thank you" bottle of wine and certificate from Geoffrey Fawcett
(Photo Phil Helmore)

Western Australia

Walk-to-work Systems for Accessing Offshore Platforms

David McCarthy from Granherne's Perth office will present this topic at the 2019 APPEA conference in Brisbane from 27–30 May. Recent advances for walk-to-work systems have opened opportunities for new and existing facilities to move toward minimum-manning operating philosophies, using vessel transfers and vessel-based accommodation in place of the traditional helicopter transfers and platform-based accommodation. At the same time, advances in remote-operation technology and shifts in design and redundancy philosophies have allowed reductions in required attended hours. Assessments can be made of each operating change in isolation: reduced equipment, remote operations, personnel transfers and accommodation; however, a holistic approach to assessment can reveal a greater impact than the sum of each change. This increased combined benefit can enable a step-change in operating and manning philosophies to one of "not normally manned" with vessel-based accommodation.

International Conference on Ship Manoeuvring in Shallow and Confined Water

This conference will be held in Ostend, Belgium, from 19–23 May. Tim Gourlay from Perth Hydro will present the paper *Benchmarking of DIFFRAC, FATIMA, HydroSTAR, MOSES, NEMOH, OCTOPUS, PDStrip, RAPID, SEAWAY, SlenderFlow and WAMIT Against Measured Vertical Motions of the Duisburg Test Case Container Ship in Shallow Water.* This paper is the result of a joint research project between Perth Hydro, MARIN, the University of Ghent, and Flanders Hydraulics Research.

Tim Gourlay

Victoria

Over the past quarter, we have been working to consolidate the committee and have recruited one additional member with another two expected to join at the next committee meeting. Alex Conway has been appointed as Deputy Secretary, to jointly support Owen and Nathan in their roles as Secretary and Social Media Manager respectively. Alex joins us with a bucket load of practical naval architecture experience, having been on the 470 sailing circuit for the past couple of years, and is now entrenched in research at DST Group at Fisherman's Bend.

In March, the Chief Executive of RINA, Trevor Blakeley, was our guest, spending a day travelling around to five organisations which deliver services to the local maritime industry. He then backed it up with a professional development session in the evening which, although not well attended due to Trevor's earlier coverage, was insightful for those attending. During his time in Melbourne, Trevor visited DST Group, AMT, AMSA, OMC International and Navantia.

A massive thanks to Trevor for covering the miles in a very compressed timeframe, where I'm led to believe he attracted many new potential members.

Regrettably, our editing of technical presentations has slipped, with no new additions to our YouTube channel. We have, however, enjoyed three great presentations — one being the professional development session hosted by RINA. The other two were hosted by IMarEST, *Defence (Navy) Asset Management*, which was presented by John West of BAE Systems and *Autonomous Underwater Vehicle Operation Planning*, presented by Fletcher Thompson, a PhD candidate at the Australian Maritime College.

Both presentations were thoroughly engaging, and synopsises can be found at https://www.imarest.org/local-communities/asia-pacific/victoria.

Jesse Millar

CLASSIFICATION SOCIETY NEWS

LR Insight Report on Safety in the Passenger Ferry Industry

The Lloyd's Register Foundation recently published an *Insight* report on safety of passengers in the ferry industry, with the following Executive Summary:

The global passenger ferry industry has averaged more than 1000 fatalities per year since the 1960s, with the great majority occurring on domestic voyages in Asia and Africa.

From 1966 to 2015 there were 750 recorded fatal accidents involving passenger vessels, resulting in 59 600 fatalities. 93% of ferry accidents occurred during domestic voyages, with 90% of fatalities occurring in just 20 countries and 76% in 10.

The Lloyd's Register Foundation identified passenger ferry safety as a challenge in its *Insigh*t report on global safety challenges, in 2017. Since then, The Foundation has investigated further to better understand the issue. It has drawn on expert knowledge and opinion to determine what activity is already underway to improve safety, what is further needed, and to explore whether there is a unique role for The Foundation in line with its charitable mission.

The investigation has focused on establishing or confirming:

- the countries or locations where the most fatalities are occurring;
- the predominant causes of accidents in these countries; and
- the practical measure(s) which could save the most lives.

This *Insight* report on safety in the passenger ferry industry presents the following key findings:

- The highest numbers of fatalities have occurred in the Philippines, Bangladesh, and Indonesia.
- Globally, the causes of ferry accidents are related to the economic status, value placed on life and social outlook of the operators and passengers in the countries where the incidents occurred.

  In countries enjoying relatively favourable economies, causes include:

- failure to enforce existing regulations;
- suboptimal vessel design (including bridge, and other location, ergonomics);
- suboptimal technology informing captains and crews of real-time vessel status;
- incomplete or less than best-practice safety training;
- suboptimal emergency equipment, for example lack of equipment making it possible to pinpoint vessel location at any time; and
- suboptimal safety culture producing dangerous behaviours and decisions.

In countries with less favourable economies, the causes are different, including:

- lack of any form of enforceable regulation or complete failure to enforce existing regulations;
- very poor vessel design and/or construction, leading to small vessels which are unseaworthy;
- inadequate or totally absent vessel maintenance;
- inadequate weather information or, more often, failure to heed weather warnings; and
- absence of crew training.

- A non-profit, ferry-operator-funded organisation dedicated to improving ferry safety should be established. The initial operational area will be the three countries experiencing the most fatalities, but the long-term intention is to offer safety services globally. The initial step in each location where the organisation operates will be to identify the specific local situation and scope of activity.
- Partnerships with like-minded organisations and local representation will be crucial to success. Connections will be made with key stakeholders such as owners, governments, the International Maritime Organization (IMO), International Labour Organization (ILO), flag authorities, IACS (International Association of Classification Societies), crew unions and the general public.
- The network of safety experts who contributed to the work should be supported and expanded. This will be facilitated by the establishment of a platform from which they can share expertise, experience, knowledge and good practice and engage with policy makers, industry and the wider public on safety issues in the industry.

The full report can be downloaded from https://www.lrfoundation.org.uk/en/publications/insight-report-on-safety-in-the-passenger-ferry-industry/

Pierre de Chateau Thierry

Developing the First Ocean-going Autonomous Navigation System

LR announced on 10 April — during Singapore Maritime Week — a Memorandum of Understanding (MoU) with ST Engineering Electronics Ltd (STEE), a leading information communications technologies (ICT) provider, and Mitsui & Co., Ltd (Mitsui), the second-largest trading house in Japan. The partners will collaborate on the 'Development of Ocean-going Autonomous Navigation System on a Marine Asset', and the MoU forms the foundation of the MPA-funded 'World's Largest Ocean-Going Autonomous Vessel Program', which was also announced on the same day.

"LR's involvement in this project builds on the capability and experience already gained from our partnership in other industry-leading and world-first autonomous projects," said Andy McKeran, LR's Commercial Director Marine & Offshore. "However, this project, a world first for the deployment of autonomous navigational technology to an ocean-going vessel for commercial operations, pushes the boundaries of autonomous technology and moves the industry towards deployment of autonomous navigation systems onboard vessels for enhanced performance and, critically, safety."

"Increasing interest in maritime autonomy and remote access/control technologies is a specific example of larger technological changes which we are currently seeing in the maritime industry. Essential to the successful and safe adoption of these technologies is that robust use cases are established, for example to improve navigational safety, supply-chain efficiency or operational costs of marine assets. Autonomous systems will also provide opportunities for skilled seafarers to focus on what they do best, and the safe and sustainable integration of autonomous systems relies on the appropriate engagement with seafaring professionals."

He continued, "Working with STEE, who have already developed and proven this capability and are now looking to work to scale in the commercial marine market, is what sets this project apart; STEE provide world-class technical expertise, technology and advanced learnings on autonomous systems in the marine environment. We will support with expertise on assurance, certification and regulation for the application of autonomy in the maritime environment as well as approval of systems where appropriate."

https://www.lr.org/496dec/contentassets/7ff4f83a50b84b3ba5fcf18671607951/web-lr-announces-collaboration-to-develop-industry-first-ocean-going-autonomous-navigation-system.jpg.

LR News, 10 April 2019

LR Launches Industry First Airborne Noise Notation for Ships in Ports

LR has released a new airborne noise emission notation (ABN) and ShipRight procedure to meet increasing demand for a standard and methodology to control airborne noise emissions from ships.

The new notation defines a set of limit levels for airborne noise emission from ships. This enables ports to better monitor overall noise levels from ship calls. It will assist ports in determining which and how many ships can access the most noise-sensitive areas of the port. It will also allow ports to specify that ships require a certain ABN notation to stay in a noise sensitive area of the port, for example those locations close to residential areas.

Similarly, the new ABN notation enables ship owners to demonstrate that their vessels have controlled airborne noise emissions to gain access to noise-sensitive areas, such as ports in city centres or natural sanctuaries.

Per Trøjgård Andersen, LR's Principal Consultant — Noise & Vibration, commented "LR is the first class society to have a notation on this subject. It will assist ports and shipowners in controlling and verifying airborne noise emissions, a field in which LR is at the forefront of technical development. Several industry partners have helped with the development of the notation, including yard representatives and port operators, and LR would like to thank them all for their valuable contributions and support."

Airborne noise levels present similar challenges for inland waterways. Directive EU 2016/1629 specifies the maximum noise level from a ship in the EU when sailing and at berth; however, achieving the ABN notation will ensure that the ship complies with these requirements.

The new notation defines five limit levels for the airborne noise emission:

- Super Quiet (SQ)
- Quiet (Q)
- Standard (S)
- Inland waterways (IW)
- Commercial (C)

The notation also describes how compliance can be ensured at the design stage by giving examples of how to calculate the expected noise levels.

LR News, 28 March 2019

LR Surveyor Positioned in South Island of New Zealand

LR now has a senior surveyor permanently based in Lyttelton, New Zealand, to better service local and global customers operating in this area. This initiative will provide increased levels of responsiveness, convenience and cost savings for clients requiring survey activity in the South Island of New Zealand.

LR senior surveyor, Peter Hatton, took up the post in July 2018 and has been with LR for 11 years, previously working in the Sydney and Perth offices.

LR senior surveyor, Peter Hatton
(Photo courtesy LR)

Pierre de Chateau Thierry, LR's Marine Business Development Manager for Australasia, said "LR is the only class society with a full-time surveyor based in the South Island of New Zealand, demonstrating our commitment to ensuring that we are where our customers need us to be, even in remote areas like Lyttelton. LR's combination of global reach and local presence makes a huge difference to our customers."

Lyttelton is the main port in the South Island of New Zealand and is visited by many global trade vessels, along with local vessels such as trawlers, tugs and workboats which operate in the area.

LR News, 27 March 2019

LR and UMAS Release new *Zero-Emission Vessels: Transition Pathways* Study

Lloyd's Register (LR) and University Maritime Advisory Services (UMAS) on 29 January released *Zero-Emission Vessels: Transition Pathways*, a study which aims to show what is needed to enable the transition, both at the ship and supply infrastructure level, to deliver zero-emission vessels (ZEVs) which are crucial to achieve the IMO's Greenhouse Gas (GHG) Strategy 2050 ambition. The study demonstrates to all stakeholders what action needs to be taken now.

The new *Zero-Emission Vessels: Transition Pathways* study seeks to address key questions about ZEVs such as: what needs to happen between now and in the next three decades for ship deployment? And what needs to happen within this period to develop the supply infrastructure? The study looks at the key milestones, barriers and enablers over the specified timeframe, and considers cost implications, operating profiles, and how policy measures such as carbon pricing could influence the outcomes.

The *Zero-Emission Vessels: Transition Pathways* study indicates that all pathways explored within the study will achieve the IMO's ambition of at least 50% reduction in GHG emissions by 2050 and go beyond to show that zero-carbon is possible.

2020–30

This is the most significant decade, stressing the urgency for early action.

- There is still uncertainty when choosing one fuel, one technology and one route and, therefore, this decade will need to see full-scale pilots and prototypes, the development of policy, standards and rules, and will be characterised by first adopters driven by consumer pressure.
- Batteries in short-sea markets or if used as hybrids, and on-shore power supply, will play an important role in reducing the dependency on fossil fuels. Easy-to-store zero- or low-carbon fuels (for example sustainable biofuel and methanol) may also be an attractive solution as existing infrastructure and machinery can be used to ease the transition.

The 2030s

For scaling up of zero-carbon solutions.

- The evolution of shipping's fuel mix is closely linked to the evolution of the wider energy system, so a clear signal needs to be given to the potential fuel

producers. We expect to see a consolidation of what the dominant technologies for use on board will be; and the interactions between end-fuel price, machinery costs and revenue loss will be better understood. We will start to see ships being designed to store less energy on board and changes to their operating profile to bunker more frequently.

Up to the 2050s

- Although the likelihood of any pathway is difficult to assess, we may experience more than one switch. For example, a growing share of biofuels in the 2020s with on-going efforts to develop fuels produced from renewable electricity, referred to as electro-fuels, resulting in a major shift to electro-fuels in the 2040s and 2050s. We expect that, by 2050 and beyond, consolidation of the market will take place, to see an end fuel mix dominated by one family of fuels.

Previous LR and UMAS studies, *Low Carbon Pathways* (in conjunction with *Shipping in Changing Climates*) and *Zero-Emission Vessels 2030*, have shown that, to achieve at least a 50% reduction in CO_2 by 2050 and to be on course for a CO_2 pathway consistent with the Paris Agreement, ZEVs need to be entering the fleet around 2030. What is more, a significant portion of newbuilds will have to be zero-emission compliant to compensate for the non-zero emissions of the existing fleet.

So, by investigating all key energy sources which would allow zero-carbon fuels to enter the shipping fuel market: renewable electricity, bio-energy and fossil fuels with carbon capture and storage (CCS), our *Transition Pathways* study supports those who are planning to finance, design or build a ship in the 2020s and who will need to consider how their ships can switch to non-fossil fuel later in their operational lives. And, for those not directly associated with shipbuilding or operating: the shipping industry must now establish collaborative joint ventures involving the shipping industry partners, but also fuel technology companies, equipment manufacturers and energy developers from other industry sectors so that we can develop, scale and commercialise the uptake of ZEVs.

LR's Global Sustainability Manager, Katharine Palmer, said "2020–30 is the most significant decade, and the study stresses the urgency for early action. Scaling up of zero-carbon fuels relies on clarity of the direction taken in the wider energy system. Uncertainty risks delaying important investments within the world's fleet and infrastructure."

UMAS' Principal Consultant, Carlo Raucci, said "It doesn't happen very often, to live such moments of a global transition towards a new paradigm. This study has given us the opportunity to reflect on the actions needed to achieve a desirable future with zero-emission vessels dominating the shipping industry. There are different paths to reach this goal and every turn of a path has its seduction and promises attached. A path may hold so many possibilities for shipping stakeholders but what is clear, though, is that the era of emitting fossil fuels must be left behind."

Zero-Emission Vessels: Transition Pathways is the latest in LR's series of reports in collaboration with UMAS, looking at fuel and technology trends for the marine industry, aimed at developing new knowledge and tools which can contribute to policy debate. Previous reports include *Global Marine Trends 2030, Global Marine Fuel Trends 2030, Global Marine Technology Trends 2030, Low Carbon Pathways 2050* and *Zero Emission Vessels 2030*.

Download the *Zero-Emission Vessels: Transition Pathways* study here https://www.lr.org/en/insights/global-marine-trends-2030/zero-emission-vessels-transition-pathways/

LR News, 29 January 2019

FROM THE CROWS NEST

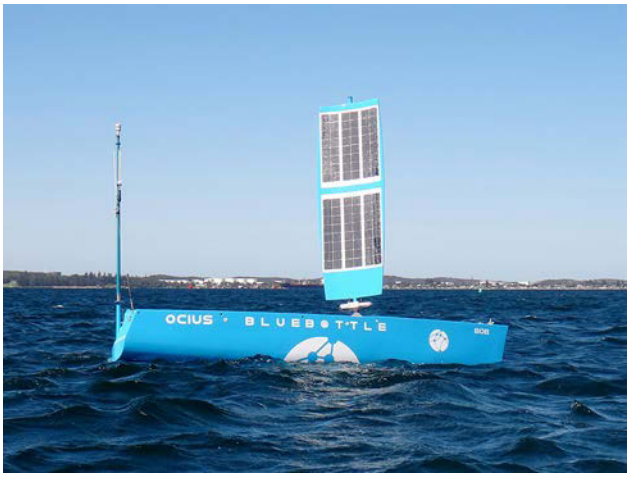
Ocius' *Bob* Sea Trials

On Tuesday 26 March, the second vessel of Ocius Technology's Bruce-class Bluebottles, christened *Bob*, [*see* The ANA, *February 2019*—Ed.] underwent initial sea trials. Design changes to *Bob*'s trim, displacement and helm immediately showed improvements in the vessel's performance.

Also, particularly pleasing was that algorithms and software functions developed and optimised over two years on the original *Bruce* copied seamlessly into *Bob*; for example, waypoint sailing, auto tacking upwind, figure-eight station-holding, etc., all operated flawlessly and autonomously.

Bruce-class Bluebottle discriminators include:

- 300 kg payload capacity for customers
- 50 W average power to customer payload 24/7 sustainably with 8 hours sun
- Keel winch to lower sensors to 100 m
- Advance in all conditions with the ability to get out of currents
- Two fit into one 20 ft shipping container
- Launch and recovery from a conventional boat ramp



Bluebottle *Bob* undergoing initial sea trials on Botany Bay (Photo courtesy Ocius Technology)

Ocius Technology has a busy schedule planned for the next quarter.

Kevin Chan
Ocius Technology website

Spirit of Australia II WWSR

In 1977 Ken Warby broke the Outright Unlimited World Water Speed Record in *Spirit of Australia* on Blowering Dam, NSW, with a speed of 464.5 km/h. Ken returned in 1978 to set his second and current record of 511.1 km/h, which to this day remains unbroken. Now, 42 years on from Ken's first world record, Warby Motorsport will again challenge for the Outright Unlimited World Water Speed Record, with a new boat and driver, *Spirit of Australia II* with Ken's son David driving.

Over the past five years the father-and-son team have been working side-by-side building the new *Spirit of Australia II*. The new boat is now completed, with successful testing undertaken in July 2017 on the 2 km course on the Manning River at Taree, NSW. This was followed by further tests in 2017 and 2018 on the Manning River and on Blowering Dam.

Another series of tests was completed over the last weekend of March 2019 on the Manning River at Taree, NSW. Despite trying different rudders, there remained a tendency for the boat to pull to one side as it ran along the course. Tracking the issue down appeared to suggest that the vertical aero fin over the rear of the jet pipe was slightly out of alignment so a new one was made and fitted.

New aero fin being fitted to *Spirit of Australia II*
(Photo from Warby website)

In mid-April a stolen car crashed into the front of the building where *Spirit II* was being stored and then the car burst into flames! Fortunately, the local fire brigade and emergency services were on the scene very quickly to bring the situation under control and saved what could have been a disaster.

The team returned to Blowering Dam over the weekend of 11–12 May, and Dave took *Spirit II* up to 378 km/h and says that the handling has improved.

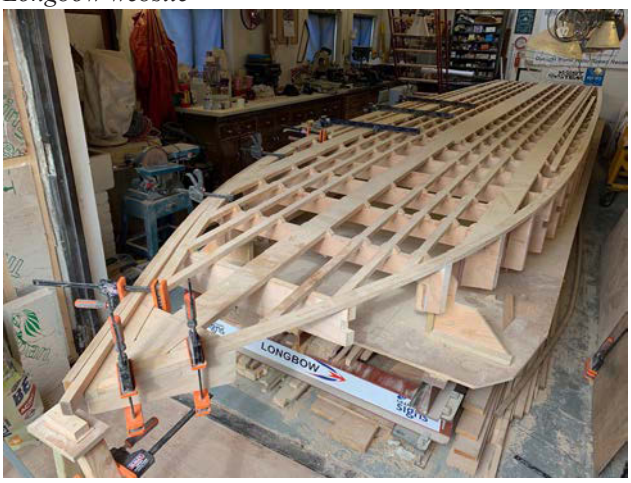
When Dave's father Ken became the fastest person on water in the world back in 1978, one of the guys on his team who helped Ken a lot with developing his boat was Bob Apathy. It is now great to see Bob's son, Rodney, helping Dave during testing for his attempt on the Outright World Water Speed Record.

Longbow WWSR

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

The hull is being built upside-down, and the battens have now been fitted to the underside of the hull. The battens run parallel to the central keel from the transom all the way to the bow of *Longbow*. They are attached to the timber frames by a combination of marine-grade screws and the West System using an epoxy bond. The chocks on either side of the battens act to increase the bond shear area and provide a mechanical stop, reducing high stress concentrations in this area.

Longbow website



Battens fitted to the underside of *Longbow*'s hull
(Photo from Longbow website)

Bluebird K7 Restoration

Donald Campbell set seven consecutive World Water Speed Records in *Bluebird K7* from 325.6 km/h on 23 July 1955 to 444.7 km/h on 31 December 1964. While trying to raise his own record on on 4 January 1967 on Coniston Water, UK, at over 480 km/h *Bluebird K7* exceeded her static pitch-up limit of 5.2°, cartwheeled across the water, and came to rest. The impact broke the vessel forward of the air intakes (where Campbell was sitting), the main hull sank shortly afterwards, and Campbell died.

The wreckage of *Blubird K7* was recovered by the Bluebird Project between October 2000, when the first sections were raised, and May 2001, when Campbell's body was recovered.

Gina Campbell, Donald's daughter, formally gifted the recovered wreckage of *Bluebird K7* to the Ruskin Museum in Coniston on behalf of the Campbell Family Heritage Trust on 7 December 2006. Now the joint property of the Ruskin Museum and The Bluebird Project, the vessel has been restored by Bill Smith and his Bluebird Project team in his Tyneside workshop.

Gina Campbell sitting in the cockpit of the restored *Bluebird K7*
(Photo from Bluebird Project Twitter website)

During a fortnight of testing in August 2018 at Loch Fad on the Isle of Bute, Scotland, her Bristol Siddley Orpheus jet engine powered the restored *Bluebird K7* to 252.7 km/h.

However, plans to return the vessel to Coniston Water in July 2018 for further runs were forestalled by the Lake District National Park Authority "due to unforeseen circumstances", which have not subsequently been revealed, although the LDNPA "remain committed to celebrating *Bluebird*'s return to Coniston".

In the meantime, The Bluebird Project Team is busy refining, adjusting and refurbishing *Bluebird K7* with a view to further outings elsewhere (other than Coniston) in 2019. They have also acquired *Jetstar,* Donald Campbell's tender for *Bluebird K7,* and are busy restoring her as well.

At the Classic Boat Awards 2019, presented on 2 April at a reception at the Royal Thames Yacht Club in Knightsbridge, London, *Bluebird K7* took out the award for the best Restored Powered Vessel under 40 ft (12.2 m).

Bluebird Project Twitter website

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.

The Team Britannia website, Facebook and Twitter pages have all gone quiet about progress on fitting out and plans for launching, trials and a start date for the record attempt. However, the Team Britannia website has opened up a prize competition for twelve people to each win a place on one of the legs of the round-the-world record attempt. Visit https://www.teambritannia.co.uk/prize-competition to check out the details and enter the competition.

Phil Helmore

GENERAL NEWS

Aus Ships Group delivers Luxury Passenger Ferry for Hayman Island Resort

Following on from the success of *Sun Symphony* and *Sun Serenity* delivered to the five-star Hayman Island luxury resort in the Whitsundays in 2015 and 2016 respectively, the Aus Ships group has recently designed and delivered a new flagship for the resort in preparation for the grand re-opening in 2019.

The new vessel incorporates the proven design and technologies of her sisters, with a modern take on the exterior styling.

Her primary role will be to transport hotel guests from the Hamilton Island Airport direct to the Hayman Island Resort in absolute luxury.

Custom lounges, bar and high-end finishes will provide for the ultimate experience for all those lucky enough to visit the Intercontinental Hayman Island.

Tom Pipon

Austal Cuts Metal on Second 118 m Trimaran for Fred. Olsen Express

In April Austal commenced construction of the second of two 118 m high-speed passenger trimaran ferries for Fred. Olsen Express at the Company's Philippines shipyard.

The vessel is due to be delivered by the end of 2020 as part of a $190 million contract with Fred. Olsen Express for two 118 m trimarans which was awarded to Austal in October 2017.

A metal-cutting ceremony for the future *Bañaderos Express* was held in the Philippines shipyard, where the names for the new vessels were officially announced by Fred. Olsen Express.

The next-generation design for *Bañaderos Express*, and her sister ship, *Bajamar Express*, were developed at Austal's centre for excellence in maritime design in Henderson, Western Australia.

"These vessels developed for Fred. Olsen are among the

Aus Ships latest delivery for Hamilton Island
(Photo courtesy Aus Ships)

most sophisticated and technologically advanced that Austal has developed," Austal CEO, David Singleton, said.

"The Austal-designed-and-built 127 m trimaran, *Benchijigua Express*, has become the benchmark for blue-water commercial ferry operations since she entered service in 2005, exceeding expectations for performance, speed and customer experience in the Canary Islands. These new 118 m trimaran vessels will continue to be a game-changer in the international high-speed ferry market when these vessels enter service for Fred. Olsen.

"In particular, the unique trimaran hull design and the stability which the design provides, delivers a more comfortable ride for passengers, crew and cargo while maintaining the carrying capacity of a traditional catamaran in the challenging sea conditions in the Atlantic."

Attack Class Design Contract Signed

On 5 March the Attack-class Submarine Design Contract was signed, less than a month after the Strategic Partnering Agreement was signed, and just days after the signing of the Framework Agreement between Naval Group Australia and ASC.

The Minister for Defence Industry, Senator the Hon. Linda Reynolds, said that the Submarine Design Contract is worth $605 million and will see design work progress through to 2021.

"The timeframe for the Submarine Design Contract takes into account the detailed design work required, ensuring that we have a mature design which avoids costly rework," Minister Reynolds said.

Keel of first OPV Laid in Adelaide

The first Arafura-class Offshore Patrol Vessel reached a significant milestone on 10 May with the ceremonial keel laying at the Osborne Naval Shipyard in Adelaide.

Chief of Navy, VADM Michael Noonan AO, RAN, positioned a coin to commemorate the laying of the keel for the first vessel to be named *Arafura*.

"The keel-laying ceremony represents a great naval tradition and I am honoured to be joined today by the two youngest shipbuilders in the Osborne shipyard in placing the commemorative coin under the keel," VADM Noonan said.

The Arafura class is named for the Arafura Sea between Australia and Indonesia, acknowledging the importance placed on the coastal regions around Australia and their significant role in the nation's security and economic prosperity. The naming of the Arafura class also honours the significance of Northern Australia's waters to Australia's maritime security and the importance of the continuing work of the Navy across the Top End.

The prime contractor, Lürssen Australia, along with shipbuilding sub-contractor ASC, commenced construction of the first vessel on 15 November 2018.

The first ship will be launched in 2021, with the second ship to be launched from the Osborne shipyard in 2022.

Construction of the third vessel will commence in 2020 at the Henderson Maritime Precinct in Western Australia, where the remaining 10 vessels will be constructed.

Austal Delivers Second Guardian-class Patrol Boat

In April Austal delivered the second Guardian-class patrol boat (GCPB) to the Australian Department of Defence. The new ship, *Te Mataili II,* was then presented to the Prime Minister of Tuvalu and his Government. The 21 GCPBs are being given by the Commonwealth to 12 Pacific Island nations and Timor-Leste under the Commonwealth's Pacific Maritime Security Program.

"Austal is pleased to deliver this program for the Commonwealth of Australia. The Guardian class has brought together the industry-leading skills of over 200 Austal employees, and is estimated to have employed an additional 200 people indirectly through the design, construction and sustainment process which will continue through the life of the program out to 2023" Austal CEO, David Singleton, said.

"This is Austal's first major defence shipbuilding program using a steel hull. It is a reflection of the skills, experience and management of the Austal team that, since May 2016, we have developed a brand new facility in Naval Base, WA, designed a production line assembly process, completed the detailed vessel design and are now delivering the second vessel less than three years later." Mr Singleton said.

The Pacific Patrol Boat contract was awarded to Austal in May 2016, with an additional contract option awarded in April 2018 taking the program to 21 vessels at a combined value of $335 million.

Tuvalu Police Force at the acceptance ceremony for *Te Mataili II* at Henderson, WA (Photo courtesy Austal)

Austal Delivers Second High-speed Catamaran to Brave Line

On 20 April Austal delivered the second of two 50 m high-speed catamarans to Brave Line, the company's first commercial contract with a Taiwan enterprise.

The Austal-designed catamaran was built at the company's Philippines shipyard in Balamban, Cebu, under a two-vessel contract awarded by Taiwan's Brave Line in September 2017. The first vessel was delivered in mid-March 2019, with both ferries capable of carrying 550 passengers and including a hullform optimised for improved fuel efficiency and passenger comfort.

"The Austal Philippines team continue to deliver these high-quality vessels, showcasing their capabilities to successfully combine Austal's industry-leading Australian-based intellectual property and efficient low-cost Asian

Blue Magpie, recently delivered by Austal to Brave Line
(Photo courtesy Austal)

construction," Austal Chief Executive Officer, David Singleton, said.

"Since its establishment in 2011, construction capacity at our Philippines shipyard has trebled, and it now employs more than 800 highly-skilled local employees in a broad range of professional, technical and trade roles."

"This shipyard is currently building the next generation technologically-advanced 109 m high-speed catamaran for Fjord Line of Norway, and a 118 m trimaran for Fred. Olsen S.A.'s operations in the Canary Islands" he said.

Upgrades to the Philippines shipyard, largely undertaken in 2018, have included construction of a brand new assembly hall measuring 120 m long, 40 m wide and 42 m high, the largest for Austal outside of the USA. This facility now enables Austal Philippines to build the largest ferries in the Austal order book.

Austal's continued investment in Asia is a direct result from the increasing efficiency and high-quality production of the vessels being delivered.

Geelong Flyer on the Way

Port Philip Ferries is on track to commence ferry services between Central Geelong and Docklands, Melbourne in early December 2019, as announced by Paul Little at the annual Chairman's Luncheon with Tourism Greater Geelong and the Bellarine in March.

Geelong Flyer will run a twice-daily service, connecting Geelong commuters and leisure travellers with Victoria Harbour, Docklands. The ferry will dock in Central Geelong, adjacent to the iconic Cunningham Pier. This new service demonstrates further confidence from Port Phillip Ferries and expands on the success of its current Portarlington service.

The team at Port Phillip Ferries has been working closely with Incat Tasmania to deliver *Geelong Flyer*, a purpose-built ferry for the Geelong service. Incat also built the existing ferry, *Bellarine Express*, which services the Portarlington-to-Docklands route. This route has seen continuous growth in passenger numbers since launching in November 2016. *Geelong Flyer* is due to be delivered prior to Christmas, which ensures it is in the market for the summer peak season.

Replacement for *Young Endeavour*

On 1 April the Government announced that the project to replace the sail training ship *Young Endeavour* is progressing and will be due for consideration by Cabinet later this year.

The Minister for Defence, the Hon. Christopher Pyne MP, said that the program is recognised internationally as a leading youth development program, with more than 500 young Australians taking part every year.

"More than 13,600 young Australians have participated in the scheme since January 1988," Minister Pyne said.

"After 31 years of dedicated service *Young Endeavour* is now approaching the end of her operational life and this project will deliver a new vessel by late 2023.

"The search for a new design is progressing and, once selected, the new vessel will be built in Australia", he said.

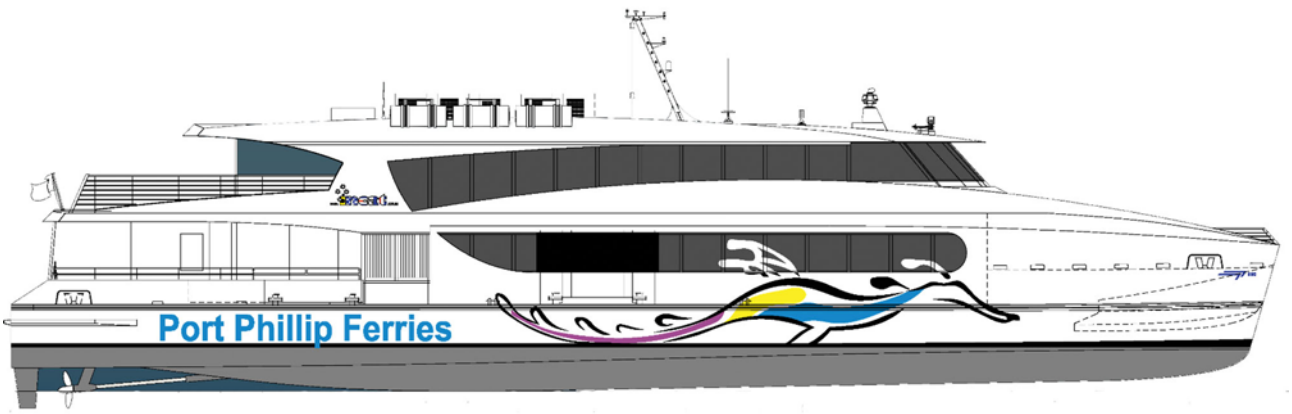
New Submarine Rescue Service

It was announced in March that the Royal Australian Navy (RAN) will receive a new sovereign air-transportable Submarine Rescue Service capability under a contract with Phoenix International (Australia).

The Minister for Defence, the Hon. Christopher Pyne MP, said that the service will be based in Western Australia and will support both the Collins-class submarine force and the Attack-class submarines for over 25 years.

"The new system is being designed and built specifically to support the capability requirements of the Navy and will be both air-and-road transportable, and capable of being deployed on a range of vessels," Minister Pyne said.

The acquisition phase of the project is valued at $255 million with Australian industry content at approximately 80 per cent, creating more than 55 jobs.



Geelong Flyer is currently under construction by Incat Tasmania
(Image courtesy Incat Tasmania)

HMAS *Arunta* prepares for an inclining experiment towards the end of her Midlife Capability Assurance Program upgrade at Henderson, Western Australia (RAN photograph)

The submarine rescue system will be accepted into operational service in 2022 and will be one of only four air-transportable systems in the world. While the primary mission is to deliver a rescue capability for Australia's submarine fleet, the system will also be capable of supporting other submarine operating nations in distress situations through the use of the NATO standard escape hatch.

TMT Contracted to Deliver ROV

Perth-based Total Marine Technology has secured its first Royal Australian Navy contract as it landed a deal to design and deliver a remotely-operated vehicle (ROV) for the service's new submarine rescue system (SRS).

TMT was selected by Phoenix International, who is in charge of delivering the new air-transportable submarine rescue service under a contract from March 2019.

TMT will also design and supply the external propulsion and non-life-support-related electrical and control systems as well as the submarine rescue bell.

Twin City Liner from Incat Crowther

Incat Crowther has announced the launch of *Twin City Liner*, a 39 m low-wash high-speed catamaran ferry for operation by Twin City Liner on the Danube River between Vienna and Bratislava. The vessel was built by Wight Shipyard, UK, with local support from Incat Crowther Europe.

The vessel meets stringent design criteria for operation on the Danube. The design features a low draft of 0.8 m, minimal wake/wash, low air draft and a hullform designed for restricted waters where high currents and debris are encountered. A retractable mast facilitates navigation and radar functions whilst fitting under low bridges.

The CFD-optimized hull is highly efficient, giving the vessel a top speed of 40 kn and a reliable service speed of 32 kn at less than 70% MCR. The hull performs at level trim, affording maximum clearance under the keel for shallow areas of the river.

Passengers board *Twin City Liner* via midship doors port and starboard, and enter a bright and airy main cabin with large windows, capable of seating up to 184 passengers. A kiosk providing a range of snacks and refreshments is provided aft on the starboard side. On the port side toilets are provided, one of which is for disabled customers.

Above, the upper deck is accessed from a centre staircase in the main cabin as well as two staircases aft on the open deck. Interior seating is available for 35 passengers, whilst external seating is provided for 29 passengers. Being a commuter ferry as well as serving tourists, there will be space for 12 bicycles on the aft deck. An extensive demisting system is fitted to windows to maintain clear views for passengers.

A specific anchoring system has been provided which may be used in very high current conditions. The anchors are stowed flush in custom pockets to prevent external contact. Special consideration was given to the design of mooring and fendering systems to allow ease of docking in the narrow canals and high currents of the Danube.

Twin City Liner's structural design uses advanced engineering to reduce mass whilst remaining robust. This is matched with durable lightweight systems and interior

Upper-deck cabin on *Twin City Liner* (Photo courtesy Incat Crowther)

Twin City Liner on Trials
(Photo courtesy Incat Crowther)

fitted by Wight Shipyard, with the vessel coming in under the target displacement.

The vessel is powered by quad Scania DI16 main engines, each producing 809 kW, driving Rolls-Royce S40-3 waterjets. The quad propulsion train was chosen for improved redundancy and reduced maintenance by allowing the engines to run at low MCR. Large hatches over the main engines and gearboxes enhance maintenance access.

Incat Crowther's global experience provides an in-depth understanding of the unique operating environment, balancing local flag state requirements, classification authority rules and EU directives.

Principal particulars of *Twin City Liner* are

Length OA	39.7 m
Length WL	38.1 m
Beam OA	10.6 m
Depth	1.95 m
Draft (hull)	0.80 m
Passengers	248
Crew	4
Fuel oil	8800 L
Fresh water	600 L
Sullage	1500 L
Main engines	4×Scania DI16 076M each 809 kW @ 2300 rpm
Propulsion	4×Rolls-Royce S40-3 waterjets
Generators	2×John Deere 4045, 63 ekW
Speed (service)	32 kn
(maximum)	40 kn
Construction	Marine-grade aluminium
Flag	Austria
Class	DNV GL ✠1A HSLC R6 Passenger craft E0
EU Regulation	EU Directive 2006/87/EC

Wight Shipyard Co. (WSC) is Europe's leading high-speed craft and aluminium shipbuilder based on Britain's Isle of Wight. WSC brings to the ferry and aluminium vessel industry the experience and dedication of a team of hand-picked craftspeople from across the world of fast ferry construction. With this fine pedigree, ferry owners and operators have the most progressive solutions and highest quality skills available. Purpose-built, fuel-efficient, and with the most comfortable passenger accommodation, WSC fast ferries deliver high performance cutting-edge designs right across the ferry world. In partnership with its customers and marine authorities, WSC passionately seeks to redefine how fast ferries are built through innovative design and quality construction.

Central Danube Region Marketing & Development GmbH has been operating successfully sincde 2006 as Twin City Liner, carrying more than 1.5 million passengers annually between Vienna and Bratislava.

Main-deck cabin on *Twin City Liner*
(Photo courtesy Incat Crowther)

Lady Megan from Incat Crowther

Incat Crowther has announced the launch of *Lady Megan*, a 19 m catamaran fisheries patrol vessel designed and built to a demanding specification. Built by Mainstay Marine Solutions in Pembroke Dock, Wales, UK, for the Welsh Government, *Lady Megan* is a robust and versatile vessel which packs immense functionality into its modest platform and is designed to operate year round in the harsh conditions of the Irish Sea.

The aft working deck of *Lady Megan* is the epicentre of this functionality, featuring a hydraulically-operated tender launch-and-recovery system, capable of launching and retrieving a 5 m RIB whilst the vessel is in motion in Sea State 3. The main deck also houses a pot hauler, deck stores, capstans and a deck crane for unloading large items such as quad bikes.

Lady Megan sleeps eight, with permanent berths for six and convertible berths for two. Each hull has toilet and shower rooms adjacent to twin cabins, whilst the captain's cabin is located on the main deck. The main cabin also features three individual forward-facing seats, a fully-kitted galley, settee, shower room and wet room/workshop.

Port quarter of *Lady Megan*
(Photo courtesy Incat Crowther)

Bridge control position on *Lady Megan*
(Photo courtesy Incat Crowther)

The upper deck wheelhouse features excellent 360° visibility.

Lady Megan has many features to combat the harsh conditions. The vessel's centre bow and active interceptors combine to improve seakeeping, whilst manoeuvrability and station-keeping are assisted by a pair of Hercules HHBT45 bow thrusters. The skeg is configured to protect the propeller from debris, while allowing the vessel to be beached. One of the generators is also air-cooled to enable systems to be powered in such a condition.

Lady Megan is powered by a pair of Caterpillar C18 main engines, each producing 651 kW @ 2200 rpm. In recent sea trials, she achieved a maximum speed of 27 kn and comfortably achieved a loaded service speed of 20 knots. The vessel is classed to BV rules.

Starboard bow of *Lady Megan*
(Photo courtesy Incat Crowther)

Lady Megan is a compact, robust and highly-versatile vessel, demonstrating Incat Crowther's expertise in designing patrol vessels for government authorities.

Length OA	19.7 m
Length W	19.5 m
Beam OA	7.50 m
Depth	2.90 m
Draft (skeg)	1.70 m
Crew	8
Fuel oil	3500 L (main) 2400 L (long range)
Fresh water	900 L
Sullage	250 L
Main engines	2×Caterpillar C18 each 651 kW @ 2200 rpm
Propulsion	2×propellers
Generators	2×Kohler 18EFKOZD
Speed (service)	20 kn
(maximum)	27 kn
Construction	Marine-grade aluminium
Flag	UK
Class	BV ✠ Hull Lightship — Fast Patrol Craft Sea Area 3
Survey	MCA Workboat Cat 1

113 m High-speed Ro-pax Ferry from Incat Crowther

Incat Crowther has announced a project to design a 1000 passenger high-speed ro-pax ferry to operate between mainland China and Taiwan. To be built by AFAI Southern Shipyard, the Incat Crowther 113 design will be operated by Fujian Strait Shipping Co. (CSF) between Pingtan Island and the Taiwanese cities of Taichung, Taipei and Kaohsiung.

The high-speed ro-pax ferry will have two vehicle decks, capable of carrying 230 cars or 42 containers.

The resiliently-mounted passenger cabin will have seating for 1000, in a mix of economy and business classes. Amenities include a duty-free store, café and mahjong room.

The vessel will be powered by four MTU 20V8000 M71L main engines, each producing 9100 kW @ 1150 rpm. Propulsion is by four Rolls-Royce waterjets, with power transmission via ZF gearboxes. Auxiliary power is provided by Caterpillar gensets.

Upper deck café and business-class seating
on 113 m high-speed ro-pax ferry
(Image courtesy Incat Crowther)

Starboard quarter view of 113 m high-speed ro-pax ferry
(Image courtesy Incat Crowther)

Incat Crowther is a proven world leader in fast ferry design and pleased to expand their cooperation with China's leading aluminium shipbuilder, AFAI Southern Shipyard. The Fujian Strait Shipping Co. (CSF) vessel will be the largest aluminium ship built in China and, when in operation, will promote the further cross Taiwanese Strait public and economic exchange.

Principal particulars of the new vessel are

Length OA	113.0 m
Length WL	106.0 m
Beam OA	30.50 m
Depth	7.80 m
Draft (hull)	3.30 m
Passengers	1000
Cars	230
Main Engines	4×MTU 20V8000 M71L
Power	4×9100kW @ 1150rpm
Propulsion	4×Rolls-Royce Waterjets
Generators	Caterpillar
Construction	Marine-grade aluminium
Flag	China
Class/Survey	BV 1 ✠HULL ✠MACH HSC CAT B RO-RO PASSENGER SHIP SEA AREA 4 ✠AUT-UMS

MHO Gurli and *MHO Esbjerg* from Incat Crowther

Incat Crowther has announced the delivery of the 39 m multipurpose crew transfer vessels *MHO Gurli* and *MHO Esbjerg*. The vessels were built by PT Bintang Timur Samudera in Indonesia and delivered to MH-O & Co. to be operated for Orsted in their Hornsea Project One offshore wind farm in the North Sea.

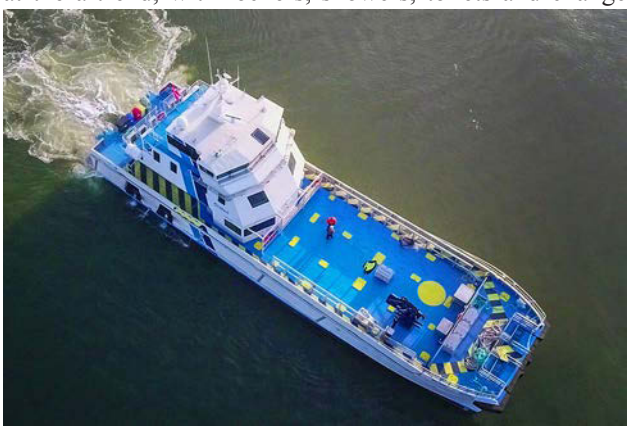
The vessels, designed by Incat Crowther, are the largest wind-farm support vessels to enter service to date anywhere in the world. They draw on Incat Crowther's experience with larger offshore fast catamarans operating in the oil and gas industry. The platform was specifically designed to deliver exceptional seakeeping, stability and comfort, whilst accommodating a highly-redundant quad-engine/quad-jet propulsion package. Unique to these vessels is the installation of continuously-rated marine diesel engines, offering increased reliability and reduced maintenance costs.

The large Incat Crowther 39 platform is maximised with an aft-mounted superstructure, affording space on the stern for a transverse 20 ft container and an extensive working deck forward. The result of a collaborative effort between MH-O & Co. and Incat Crowther, this layout offers impressive functionality and accommodates many different load conditions, including a variety of turbine maintenance operations. Among these operations is a turbine gearbox swap. With the turbine gearboxes weighing in at 32 t each, this operation requires a stable and well-designed platform.

Other equipment on the main working deck includes a deck crane, ship's boat and EU pallet tie-downs, in addition to hard points for task-specific winch installations. In total, 110 lineal feet of containers can be carried on this deck, with mounting feet spaced every 10 ft (3.05 m) allowing for flexible combinations.

MHO Gurli has already been approved for transfers in significant wave heights exceeding 2 m.

The main deck cabin is entered through the wet foyer at the aft end, with lockers, showers, toilets and change



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

facilities for technicians and crew. Forward of this is a crew lounge to port and a crew lounge to starboard. Seating for 24 technicians is provided forward of this, with excellent forward visibility and KAB suspension seats enhancing comfort.

A set of stairs each side from the main deck cabin lead to the hulls, which house large storage and workshop facilities amidships and resting areas forward.

Upstairs, the mid deck houses sleeping quarters for 6 crew members and two spare single-berth cabins. Pairs of cabins share an ensuite, while the master's and officer's cabins have their own ensuite bathrooms.

MHO Gurli and *MHO Esbjerg* are operated from the third deck, where the wheelhouse and workstations enjoy uninterrupted vision of the turbine tower and surrounding working areas.

The vessels are fitted with a quad propulsion package, made up of four Cummins KTA38 main engines coupled to four KaMeWa S50-3 waterjets. This package gives *MHO Gurli* and *MHO Esbjerg* excellent flexibility and manoeuvrability, as well as redundancy. The top speed is 30 kn and service speed 25 kn, with endurance for 14 days of 24 hour operation, and capacity for 62 000 L of fuel.

MHO Gurli and *MHO Esbjerg* are the result of a working partnership between MH-O & Co. and Incat Crowther, demonstrating the value of a collaborative process.

Principal particulars of *MHO Gurli* and *MHO Esbjerg* are

Length OA	38.6 m
Length WL	35.9 m
Beam OA	10.3 m
Depth	4.25m
Draft (hull)	1.80 m
Technicians	24
Crew	6
Deck Area	Up to 2×40 ft, 2×20 ft and 1×10 ft container 4×EU Pallets
Deck Rating	70 m^2 at 2 t/m^2 and 95 m^2 at 1 t/m^2
Crane	1.5t @ 11.9 m maximum reach
A-Frame (optional)	1 t @ 5 m reach
Mooring winches (optional)	4-point mooring compatible
Fuel oil	62 000 L
Fresh water	2500 L
Sullage	1000 L
Main Engines	4×Cummins KTA38 each 746 kW @ 1800 rpm
Propulsion	4×Kamewa S50-3/CA waterjets
Speed (service)	25 kn
(maximum)	30 kn
Generators	2×Cummins QD 50
Construction	Marine-grade aluminium
Flag	Denmark
Class/Survey	DNV GL ✠1A HSLC Crew R1 Windfarm

35 m Catamaran Passenger Ferry from Incat Crowther

Incat Crowther has announced construction of a 35 m catamaran passenger ferry for Samso Rederi in Denmark. This Incat Crowther 35 will operate between Aarhus and the island of Samso, an island of natural beauty sitting off the Jutland Peninsula. The intention of the new operation is to bolster tourism and trade between the island and the mainland.

Community planning reported that a new passenger ferry service with proper execution would bring greater economic benefit to the community. As such, Incat Crowther was charged with developing an economically-responsible solution. The vessel is optimised for high durability, low maintenance and efficient operation, whilst delivering a high level of passenger comfort and amenity.

The vessel will accommodate 296 passengers internally over two decks. Passengers will board the vessel at one of three boarding stations on each side of the main deck: aft, midships and foredeck.

The main deck features a large aft deck with double-decker racks for 60 bicycles. The main passenger cabin accommodates 180 passengers. Toilet facilities are located in the aft end of the cabin, forward of which is a fully-featured kiosk. Adjacent to the midship boarding area is a pair of luggage racks. Areas of the main-deck cabin are designated as being pet-friendly and specifically for children. An additional 11 bikes can be stowed on the foredeck.

The upper-deck cabin seats 116, with a bathroom for passengers, and a dedicated bathroom for crew located forward. The open aft upper deck has 44 seats in addition to the rated passenger capacity, offering passengers freedom to move inside and out at safely designated times.

The vessel will be powered by a pair of MAN D2862 LE463 main engines, each producing 1029 kW. She will operate at 25 kn at a modest rating to reduce load on the engines and reduce maintenance intervals. Maximum speed will be 29.5 kn. The Incat Crowther hulls have been designed specifically for high efficiency and low fuel burn.

The vessel will be built to BV rules and flagged under the Danish Maritime Authority.

Incat Crowther is proud to be part of this project, bringing experience and expertise to a project in a way that benefits the Samso community.

Starboard bow of 35 m catamaran passenger ferry
(Image courtesy Incat Crowther)

Principal particulars of the new vessel are

Length OA		36.3 m
Length WL		35.4 m
Beam OA		10.0 m
Depth		2.70 m
Draft	(hull)	1.20 m
	(propellers)	1.80 m
Passengers		296
Bicycles		71
Crew		4
Fuel oil		6000 L
Fresh water		1500 L
Sullage		1500 L
Main engines		2×MAN D2862 LE463 each 1029 kW @ 2100 rpm
Propulsion		2×propellers
Generators		2×Volvo D7A HE
Speed	(service)	25 kn
	(maximum)	29.5 kn
Construction		Marine-grade aluminium
Flag		Danish Maritime Authority
Class/Survey		BV I ✠Hull ✠Mach HSC — CAT A Sea Area 2 Greenpassport EU

Stewart Marler

Cruising in NSW

The summer season continued through late February with visits by *Norwegian Jewel, Ovation of the Seas, Explorer of the Seas, Sun Princess, Albatros, Majestic Princess, Pacific Princess, Queen Elizabeth, Celebrity Solstice, Arcadia, Pacific Explorer, Amadea, Silver Muse, Carnival Spirit, Sun Princess, Noordam, Columbus* and *Queen Victoria.*

The season wound down through autumn, with return visits in March by many of these vessels plus visits by *Regatta, Azamara Quest, Europa, Insignia, Radiance of the Seas, Amsterdam, Carnival Legend, Viking Orion, Celebrity Solstice, Sea Princess, Viking Sun, MSC Magnifica, Europa 2* and *Seabourn Encore.*

April saw return visits by some of these vessels and added visits by *Crystal Symphony* and *Golden Princess,* while May saw only return visits.

Pacific Explorer, Carnival Spirit and *Sea Princess* are scheduled for cruises over the winter months, the increasing number (up from two a few years ago) being indicative of the increasing demand for winter cruises. The arrival of *Majestic Princess* on 17 September will signal the start of the next summer season.

Pacific Princess paid an unscheduled visit to Twofold Bay, Eden, on 23 February when her planned visit to Moreton Island had to be abandoned due to the inclement weather on the Queensland coast [*better conditions further south!*—Ed.]with lots of passengers going ashore to enjoy the local sights.

The new wharf and dolphins for cruise-ship berthing in Twofold Bay are nearing completion, with equipment and construction vessels being gradually removed from the site. The first cruise ship to berth at the new wharf is expected to be *Massdam* when she arrives on 27 September.

Pacific Princess in Twofold Bay, Eden, on 23 February with the barge installing jackets on the berthing dolphins for the new cruise-ship wharf
(Photo courtesy Robert Whiter)

The new cruise-ship wharf in Twofold Bay, showing the arrangement of the two berthing dolphins and three mooring dolphins
(Photo courtesy Joanne Korner)

Many people ask "Why is the new cruise-ship wharf angled away from the breakwater and wharf?" As the breakwater extends into deeper and deeper water, its base becomes wider and wider on the sea bed, so the wharf piles and those of the inner mooring dolphin are following a line to keep them clear of the rocks comprising the base of the breakwater.

Phil Helmore

Pacific Explorer during a brief call in Sydney on 31 March, competing for space with Sunday racers and the usual traffic
(Photo John Jeremy)

Who or what sank HMS *Sirius* at Norfolk Island in 1790?

Graeme Henderson AM
President, Wreck Check Inc. and Associate Member, Western Australian Museum
and
Kim Klaka
Member, Royal Institution of Naval Architects

Introduction

Great Britain's establishment in 1788 of the New South Wales Colony in the South Pacific was arguably the most successful colonisation venture ever undertaken by any nation. However, in March 1790, less than two years after the arrival of the First Fleet on the east coast of Australia, the very existence of the colony was put in jeopardy by the wreck of HMS *Sirius*, principal consort to the First Fleet and chief protector of the colony. The vessel struggled to get off a lee shore, failed to tack, and was driven aground. Was it due to the incompetence of the master, or a performance deficiency of the vessel? The vessel's stability, power to carry sail, and ability to manoeuvre may have been compromised by the offloading of ballast. Examination of the naval architectural aspects of this event will help to explain one of the most controversial maritime incidents surrounding the British colonisation of Australia. In this project, a combination of historical and scientific method will be used to explore the reasons for the loss of HMS *Sirius*.

The wreck of *Sirius* lies on the shallow reef under the surf at Kingston, Norfolk Island
(Photo courtesy Graeme Henderson)

Traditional Arguments

Eighteenth-century observers and modern historians, commenting on the reasons for the loss of HMS *Sirius* at Norfolk Island after it became embayed, failed to tack and ran onto a reef, have pointed to sea conditions (an onshore, shifting wind and onshore current), and hinted at culpability on the part of people there at the time, namely Norfolk Island's Lieutenant Governor, Philip King, who hoisted a signal in the bay indicating that it was safe for boats to bring provisions ashore, and master of *Sirius,* Captain John Hunter. In regard to Hunter, historian Bach (1970) wrote:

> "…the master of a sailing vessel had to get a job done and usually had to strike a compromise between excessive caution and obvious rashness. To put it more bluntly, danger could always be avoided by staying hove-to at sea, or by remaining on one's moorings but, in both cases, the ship would have been rendered useless for the particular project in hand."

An Alternative Argument

Hunter was court-martialled, as was usual when a Navy ship was lost, and acquitted of all blame. So a later comment by King (1799b) is of interest. Writing to the Navy Board about the importance of correct ballasting of ships to stiffen them sufficiently to enable effective steering and to avoid going ashore, he went on to say, "*Sirius* was lost from not answering her helm", that is, from not being able to be steered through a tack. King was suggesting an unmanageable vessel, pointing the finger not at Hunter, but at some aspect of the ship or its fitout. Because King was generally negative about *Sirius*, this comment about its steering has not attracted attention. Historians have assumed that the vessel failed to tack simply because of environmental conditions—the wind turned onshore at the wrong time. King, however, was effectively saying that *Sirius* was cranky, or unstable.

Falconer (1780), defined crank as the quality of a ship which, for want of a sufficient quantity of ballast or cargo, is rendered incapable of carrying sail without being exposed to the danger of oversetting. Instability in square-rigged ships can make steering difficult.

King (1799a) had previously written to Sir Joseph Banks about HMS *Porpoise*, another Navy ship which came to grief off the east coast after failing to tack, warning that it was a bad sailer and extremely cranky, not answering its helm. He elaborated several days later:

> "…*Porpoise* would neither sail nor steer going large, and … when beating to windward … fell bodily to leeward, while every other vessel was carrying a proper sail for the weather, and getting fast to windward."

Why might *Sirius* have been in want of sufficient ballast, or cranky? Dockyard officers at Deptford knew how much iron ballast in the form of kentledge (rectangular blocks fitted snugly together) was necessary for a ship to maintain correct balance (and steerage) while sailing. Navy ships were assigned ballast plans according to rate. In 1782 the 511 ton (519 t) Navy storeship *Berwick* carried 80 tons (81 t) of iron ballast and 40 tons (41 t) of coal, which clearly suited it well during performance trials, the dockyard official noting "she soon answers her helm and is quick about and makes just little way".

During the 1786 refit which transformed *Berwick* into the 20-gun sixth-rate warship HMS *Sirius*, an upper deck or spar deck was built over the main deck, raising the centre of gravity. The hold was cleared and Captain Arthur Phillip, anxious to maximise stowage of provisions for the new colony, replaced just 28.5 tons (29.0 t) of iron ballast, later supplemented with approximately 90 tons (91 t) of the less stable, less compact, shingle ballast and coal. The Agent for Transports, Captain George Teer (1787a), explained to the Navy Board:

> "…the proportion of iron ballast warranted for *Sirius* was 80 tons (81 t), the quantity supplied her when fitted from hence in 1782, of which they have received but 28.5 tons (29.0 t), optional in her Commander, who, at the time [it] was taken on board, observed that if that was not sufficient then he would apply for more."

Two days later Teer (1787b) had more to say on the subject:

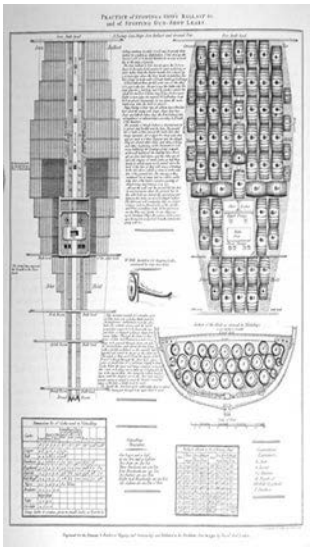
> "… she was governed by no proportion, her supply of all kinds of stores being entirely at the will of Captain Phillip and therefore we did not think it necessary to acquaint you with the ballast he thought proper to take short of what she was before supplied with as a common storeship."

Phillip then added an extra 20 tons (20 t) of kentledge, making a total of 48.5 tons (49.3 t) of iron ballast. As the Senior Captain and Governor designate of the proposed British penal colony of New South Wales, Phillip, through a desire to maximise the supply of provisions for the men and women under his command, ignored the established ballast plan for HMS *Sirius*, knowing that Second Captain Hunter, once in the antipodes, would not have been able to source kentledge. So the question arises: does the historical record and archaeological evidence support *Sirius* having been insufficiently ballasted on 19 March 1790, resulting in it failing to answer its helm?

During the on-site survey work in the 1980s, a detailed seabed count was made of the ballast blocks on the wreck, and an assessment made of their mass. Of the original 80 tons (81 t) of kentledge, just 215 pigs, having a maximum mass of 35.8 tons (36.4 t), have been accounted for on the seabed and the island, indicating that Captain Hunter removed more of the kentledge, to make room for provisions on the voyage to Norfolk Island.

Naval Architect Input Required

How great a deficiency of ballast would it take for *Sirius* to become unmanageable in circumstances such as it faced at Norfolk? Naval architects at Greenwich University (UK) have generated a digital model from the lines of *Sirius* using the Delftship software (https://www.youtube.com/watch?v=TCOmPcBZv58). Our aspiration now is to have the digital model used to show the ability or inability of *Sirius* to tack under the sea conditions at Norfolk Island on the day of the wreck. There are three components to the project:



Ballast arrangement for a 20 gun ship of the 1790s
(Diagram from Steel 1794)

1. Calculation of the Hydrostatic Stability of the Vessel

This is a relatively straightforward process of determining the righting-moment curve for the vessel from the available Delftship lines plan. However, it is complicated by the challenge of estimating the mass distribution of the vessel from limited historical records. The answers will help determine whether the vessel was operating in a catastrophic load condition, and will also provide vital input into the second stage of the project.

2. Prediction of Windward Performance

Having established the stability characteristics, the resistance, side force and sail forces have to be modelled in order to solve the quasi-steady state equations. This is usually achieved using a velocity prediction program (VPP). However, the semi-empirical algorithms found in most VPPs are for modern sailing vessels; they will need review and modification in order to work for older vessels. The resulting output of windward performance will indicate whether such a vessel could have sailed off a lee shore.

3. Prediction of Manoeuvring Performance Through a Tack

The dynamic process of tacking requires a different approach to the quasi-static VPP solution. The VPP output would assist with manoeuvring prediction, but it is possible that a manoeuvring model could be developed independently of the VPP modelling.

Are there any naval architects out there willing to help us by tackling one of these three components? Each component would make an excellent student project; indeed, the application of forensic archaeology and maritime engineering skills to the entire problem make this a very exciting postgraduate research topic. Interested? Then please contact either:

Graeme Henderson AM <ghendo47@gmail.com> or
Kim Klaka <kimklaka@gmail.com>

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EDUCATION NEWS

Australian Maritime College

Defence Pathways to AMC open for TAFE SA Graduates

TAFE SA welcomed the new education pathways for its graduates of the Associate Degree and Diploma of Engineering — Technical with the announcement in March of guaranteed entry into the Australian Maritime College's Bachelor of Engineering programs, including Naval Architecture.

It has also been announced that TAFE SA Diploma of Project Management students will receive direct entry and credit into the Bachelor of Global Logistics and Maritime Management at the AMC in Launceston.

These new higher education pathways and credit transfers open up more opportunities for TAFE SA graduates to expand their options to support Australia's Naval Shipbuilding Plan.

AMC Principal, Prof. Shuhong Chai, said that taking a national approach to training and education would help ensure the success of national endeavours such as the continuous naval shipbuilding program.

"We are delighted to partner with TAFE SA on these study pathways, providing South Australian students with new opportunities to advance their skills and broaden their career prospects. The growing maritime defence sector has led to high demand for talented naval architects, engineers, logisticians and project managers — training a steady flow of skilled graduates to fulfil these positions will be critical.

"AMC's unique role as the national institute for maritime education and training means taht we are well-positioned to partner with state-based TAFEs to help train and build that workforce. Many of our maritime engineering and logistics management graduates go on to carve out careers within Defence and the multinational organisations which serve the sector in the fields of engineering, shipbuilding, design and sustainment."

TAFE SA Director, Defence Industries, Penny Johnston, said that TAFE SA was pleased to be providing these new pathways for careers in this rapidly growing industry.

"TAFE SA has a strong track record of supporting the training needs of the naval shipbuilding industry, and we are ensuring that we play our part to ensure that a skilled workforce is available for the exciting opportunities that lie ahead," Ms Johnston said.

"Vocational education has a critical role to play in building the capacity and ability of the shipbuilding workforce, and we are pleased that our qualifications have been recognised as providing a valuable pathway to the Australian Maritime College's bachelor degrees.

"We need to build an awareness of the viable career paths available within the defence sector, while we also support existing workers in retraining and upskilling to take advantage of the opportunities that are emerging.

"The expansion of the current range of high-school-based defence industry pathway programs encouraging students into shipbuilding and advanced manufacturing careers will also lead to greater numbers of apprentices and students in TAFE SA's shipbuilding-focused qualifications.

"At TAFE SA, we will continue working closely with the defence industry and other education providers to ensure that we have the capacity and capability to accommodate the increased demand for new defence and shipbuilding skills across a wide range of jobs."

TAFE SA is working closely with the AMC and the Naval Shipbuilding College to maximise skills for the frigate and submarine programs.

The Naval Shipbuilding College's Delivery Advisory Council (L-R): Nick Howie, NSC; Tim Rawlings, PWC Skills for Australia; Phil Heggie, TAFE NSW; Mark Scott, NSC; Aaron Ingram, AMC, University of Tasmania; Penny Johnston, TAFE SA; Paul Whetstone, NSC; Julie Pisano, TAFE SA, and Brenda Micale, South Metropolitan TAFE WA.
(Photo courtesy AMC)

AMC Maritime Engineering Research Achieves Top ERA Ranking

The Australian Maritime College's maritime engineering research has been recognised as well above world standard, achieving the highest possible ranking in the latest Excellence in Research for Australia (ERA) 2018 report.

The ERA measures performance within each discipline at every Australian university and gives a detailed view of the research landscape in Australia, highlighting the quality and strengths of individual universities.

Maritime engineering was one of 21 fields of research within the University of Tasmania to achieve a rating of 5 for outstanding performance well above world standard.

AMC Principal, Prof. Shuhong Chai, said that the ranking was a testament to the dedication and innovation of the college's academic community and its support staff.

"We are extremely proud that our maritime engineering research program has been recognised through the 2018 ERA rankings, reflecting the high calibre of the work we do and the impact it has both nationally and internationally," Prof. Chai said.

"AMC's vision is to inspire and shape the maritime world, and our research aims to cut across traditional scientific and engineering boundaries to help solve industry-specific challenges.

"Our research covers topics as diverse as optimising the performance of submarines, understanding how to shape ships for humans, autonomous underwater exploration in Antarctica, and engineering devices to harness the potential of wave and tidal energy."

University of Tasmania Vice-Chancellor, Prof. Rufus Black added "This is an exceptional achievement for our University's research community. Our unique island setting enables us to produce world-class research which delivers significant social and economic benefit to Tasmania, and beyond."

Successful First Antarctic Dives for World-leading Underwater Vehicle

The University of Tasmania's world-leading polar Autonomous Underwater Vehicle (AUV) and its support crew returned home in March after a successful first deployment in Antarctica.

The $5 million AUV, named *nupiri muka*, is the first untethered Australian AUV to dive under an ice shelf and joins those from the UK and Sweden as the only AUVs in the world with this capability.

Funded by the Australian Research Council (ARC) through the Antarctic Gateway Partnership, *nupiri muka* was successfully deployed under the Sørsdal Glacier ice shelf during the summer Antarctic season with support from the Australian Antarctic Program.

Peter King from the University's Australian Maritime College, who led a support team of engineers and scientists, said that the successful first deployment under the ice opened the way for more ambitious polar research projects under ice shelves and sea ice in the future.

"This summer's deployment under the Sørsdal Glacier

Launching *nupiri muka* in Antarctica
(Photo courtesy Australian Antarctic Division)

means that Australia has joined a very select list of countries with an AUV that's capable of independently exploring under the polar ice," he said.

"The way in which ice shelves melt has a lot to do with what is happening underneath and how ocean circulation and water properties (temperature, salinity, etc.) interact with the ice.

"The only way to research certain processes on a relevant scale is with an AUV, where we can collect large amounts of data across extensive areas.

"*nupiri muka* allows us to study variables such as water temperature, salinity and current as well as the profile of both the seabed and the underside of the ice, while at the same time collecting sonar imagery and, potentially, data on the internal structure of the ice," Mr King said.

The Director of the Antarctic Gateway Partnership, Prof. Richard Coleman, congratulated the AUV team on its significant achievements, which included a rare view underneath an ice shelf in the lead-up to a calving event from the Sørsdal Glacier.

"Completing this successful first deployment is a major step forward and testament to the skill, experience and detailed planning of the support team," Prof Coleman said.

"Activities such as these require a significant investment of both time and money, and deploying equipment in extreme environments such as Antarctica always carries an element of risk.

"However, the potential scientific rewards which *nupiri muka* can deliver are enormous.

"Now that we have shown what the AUV is capable of we look forward to realising its great potential during future research projects," Prof. Coleman said.

Research Partnership to Transform Australia's Blue Economy

The University of Tasmania will lead the largest ever Cooperative Research Centre (CRC), bringing together expertise in seafood, renewable energy and offshore engineering to transform Australia's blue economy.

Announced in Launceston on 16 April by the Minister for Industry, Science and Technology, the Hon. Karen Andrews MP, the Blue Economy CRC aims to drive an evolution in marine-based industries, unlocking enormous economic, environmental and technological benefits.

The $329 million research project is a 10-year collaboration between 45 national and international partners from industry,

Blue Economy CRC Research Director, Australian Maritime College, A/Prof. Irene Penesis with the Minister for Industry, Science and Technology, Karen Andrews, and Institute for Marine and Antarctic Studies, Prof. Stewart Frusher
(Photo courtesy AMC)

research and government, underpinned by a $70 million cash investment from the Federal Government.

The Tasmanian Government is also a supporting partner, which has been a key factor in gaining local industry involvement.

Vice-Chancellor, Prof. Rufus Black, said that the Launceston-based Blue Economy CRC would build on Tasmania's and the University's distinctive strengths in aquaculture and marine ecology, offshore engineering and marine renewable energy.

"This is big blue-sky thinking fused with practical, impactful research to answer one of our planet's most critical questions: how can we sustainably feed and power ourselves from the world's oceans," Prof. Black said.

"The Blue Economy CRC imagines a future where integrated seafood and renewable-energy production systems operate offshore and where the community and industry have confidence that they are safe, reliable, efficient and environmentally responsible.

"This work will leave a compelling legacy of high-impact research, a competitive advantage for Australian industry, and innovation, collaboration and leadership on a global scale.

"And it will further solidify Northern Tasmania as an important hub for marine engineering and ocean renewable energy — a place where we can imagine new futures and chart a course to reach them."

The Blue Economy CRC head office will be hosted at the University of Tasmania's Launceston campus, supporting a research community of 50 PhD students and 50 post-doctoral research fellows throughout Tasmania, and with partner organisations nationally and internationally.

Blue Economy CRC Research Director, Australian Maritime College's A/Prof. Irene Penesis, said that the program was unique in bringing together aquaculture, renewable energy and offshore engineering.

"Australia has the world's third-largest exclusive economic zone and is positioned adjacent to the largest markets for seafood and energy," A/Prof. Penesis said.

"But with over 80 per cent classified as offshore, industries must be enabled to move from the coast zone into more exposed operating environments before we can secure this major opportunity for the nation.

"The CRC will translate new developments in science and technology into commercial activity in ways which support

An artist's impression of how the Blue Economy concept might work
(Image courtesy AMC)

our industry partners to create advantage in this evolving market."

The focus of the first five years of the program will be developing and testing new offshore aquaculture and renewable-energy technologies, which will then be brought together on a single platform to demonstrate the economic and environmental benefits of co-location.

"The offshore research platform will act as a living laboratory where we can vertically integrate renewable-energy and aquaculture technologies with other engineering activities, such as autonomous and remotely-operated vehicles, in a proof-of-concept for how we could operate in the future," A/Prof. Penesis said.

"It will be the first offshore research platform of its kind in the world and we're confident that it will deliver ground-breaking research alongside commercially viable new materials, concepts, prototypes and monitoring systems — all informed by best practice and delivered in an environmentally sustainable way."

While the solutions will be developed in the immediate term for the Tasmanian offshore environment, the involvement of international partners will help move the development of new technology to global markets.

The CRC is expected to generate more than $4 billion for the national economy.

Institute for Marine and Antarctic Studies Prof. Stewart Frusher said that the development of new environmental guidelines and policies was an integral part of the research program.

"This CRC provides a unique opportunity to simultaneously support policy development, environmental monitoring and management while securing sustainable and ethical industry expansion," Prof. Frusher said.

"Australia has a global reputation for quality, safe and sustainable seafood and management of its marine natural resources and biodiversity.

"The CRC will provide governance for the new industry capability to position Australia as the market leader in this burgeoning area."

New Principal for the Australian Maritime College

The University of Tasmania has announced the appointment of retired Australian Rear Admiral and former Deputy Chief of Navy, Michael van Balen, as the new Principal of the Australian Maritime College.

Mr van Balen brings to the role a wealth of experience from an outstanding career spanning more than 38 years in the Royal Australian Navy.

Michael van Balen, new Principal of the
Australian Maritime College
(Photo courtesy AMC)

After joining the Navy as a cadet in the late 1970s, Mr Van Balen has held several key positions including Principal Warfare Officer, Commanding Officer of HMAS *Sydney*, Chief of Defence Force Liaison Officer to United States Central Command, Deputy Chief of Navy and Head Navy Personnel, Training and Resources.

He has received a Commendation for Distinguished Service in the 2005 Australia Day Honours List and was appointed as an Officer of the Order of Australia (AO) in January 2015.

College of Sciences and Engineering Executive Dean, Prof. Brian Yates, welcomed the appointment which comes a critical time for AMC.

As the national institute for maritime education, training and research, AMC has a remit which will be of great importance as Australia seeks to achieve sovereign capability in the National Naval Shipbuilding Enterprise," Prof. Yates said.

"At the same time, AMC will work closely with the State as part of the State's Defence strategy, the development of the Defence Network and the proposal for the Maritime Defence Innovation and Design Precinct at Newnham.

"AMC will be an integral connector for Defence primes and in creating new opportunities for small-to-medium enterprises in Tasmania. Michael and the leadership team will oversee the development of a new strategic plan which captures the role of AMC nationally and internationally and defines its role and priorities in that context."

Mr Van Balen commenced as AMC Principal on Monday 13 May 2019.

UNSW Sydney

Two Semesters to Three Terms

UNSW Sydney has now moved from having two 13-week semesters to having three 10-week terms, plus an optional intensive (5-week) summer term. Course material has remained the same, with all engineering courses remaining at 6 units of credit (UoC), but a full load now being three courses per term in lieu of four courses per semester. Eight courses per year remains the normal full load, but nine courses per year (three per term) is an option which some students may choose.

For domestic students, the minimum study load required to be a full-time student (and retain the associated benefits) is six courses per year with at least one course in each of the three terms.

The flexibility of the study load means that students can free up one term for additional opportunities, such as internships, volunteering, or an overseas experience.

The UNSW website says that the new academic calendar is designed to improve the student experience and provide additional opportunities for students. It also offers more flexibility and the ability to spread workloads more evenly across the year.

However:

- the time scale for delivery of course material has been compressed from 13 weeks to 10 weeks, making it more intensive and giving students less time to assimilate and understand the same amount of information; and
- many moons ago, for very good reasons, UNSW moved from having three terms to two semesters.

The initial word on the street is that the students are not in favour of the new system. A typical student comment is "I would say that I dislike it very much. The intensity of 10 weeks' work without any mid-semester holiday (unless there's a public holiday) is exhausting. I want to enjoy studying and taking my time for it, but this term, I barely have time for myself. I went out much less than in any previous semester and, if I fall behind in the topics, then it's really hard to catch up because everything is going so fast."

Staff Changes

Em/Prof. Lawry Doctors continues at UNSW Sydney, coming in to his office a couple of times per week and continuing his research in many aspects of hydrodynamics. A recent project is comparing the results of the latest version of his resistance-prediction program with the experimental results from a large number of standard series of monohulls.

Mac Chowdhury has completed his long-service leave from UNSW, but is continuing in a part-time capacity as an Adjunct Senior Lecturer, helping in the area of solid mechanics.

David Lyons continues at UNSW, now coordinating courses MMAN2130 Design and Manufacturing, and MECH4100 Mechanical Design 2, and lecturing in MECH9420 Composite Materials and Mechanics as well as coordinating both Undergraduate Thesis and Industrial Training for the whole school.

Phil Helmore is enjoying his long-service leave from UNSW, but visits every week or two for coffee with the naval architects.

Naval Architecture Students

We have seven naval architecture students who completed their coursework and industrial training at the end of last year and are scheduled to graduate at the ceremony on 17 May.

We also have two naval architecture students now completing theses and who are expecting to graduate in August this year, three to graduate in May next year and, the last two naval architects to graduate from UNSW Sydney, to graduate in the following year.

Thesis Projects

Among the interesting undergraduate thesis projects under way are the following:

Acquisition and Maintenance Strategies for Propulsion Systems and Effects on Life-cycle Costs and System Performance

The extent of the acquisition and maintenance strategies on propulsion systems can significantly impact the life-cycle costs, ship staff's ease of operation, and maintenance and performance (in terms of reliability and ability to achieve operational aims).

Isabella Yan is conducting an investigation of the acquisition and maintenance strategies for the propulsion systems of some of the vessels of the Royal Australian Navy. The scope of the project has been limited to the FFG-, LHD- and DDG-class vessels of the RAN. A series of research questions was created and a methodology derived to answer these research questions. The methodology involves conducting interviews with relevant personnel and collecting data from vessels and

appropriate support units. The results will be collated, and recommendations for improvements made.

As a matter of interest, the first undergraduate thesis in naval architecture at UNSW, by Brian Robson, has recently been given to the university by Brian's wife, Judy. The university's own copy has long since disappeared, with the death of the School Library in about 2010. Fortunately, the School started requiring PDF submission of undergraduate theses in Semester 2 of 2005, but all previous hard copies were thrown out without scanning!

An Investigation of Some Aspects of the Dynamics of Ship Launching by the Use of Model Experiments

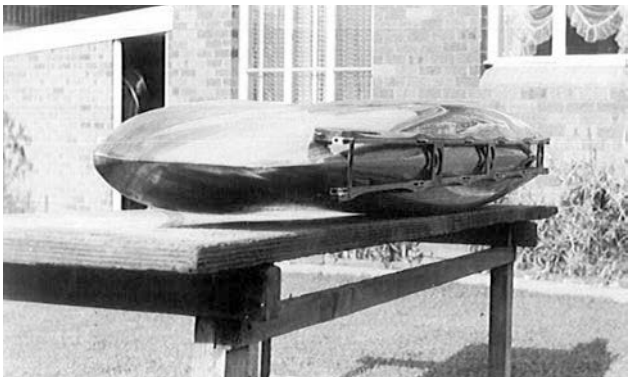
For the most practical approach to the investigation of a ship's launching motion, the motion has to be separated into three stages. The first stage represents the travel from rest to the position where the ship enters the water, and the second stage represents the motion from where the ship enters the water to where it floats free from the slipway, while the third stage represents the motion when the ship is floating free.

With this approach, Brian Robson derived the complete equations of motion for the three stages and, through these equations, examined an empirical means of predicting a ship's launching motion.

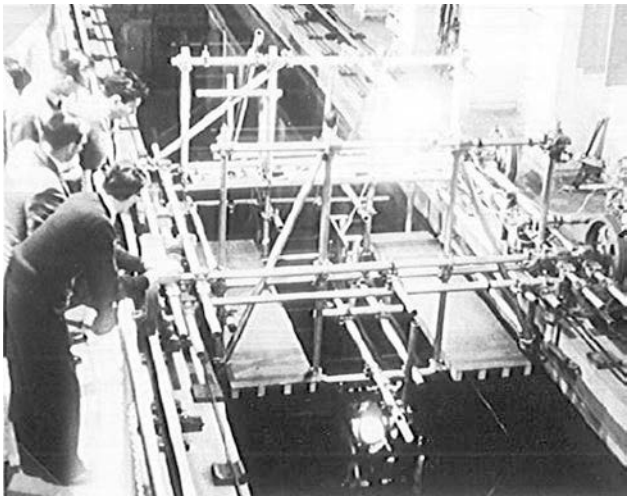
The experiments that he carried out with the model were separated into four series because of their different purposes. The first series was for the purpose of checking the validity of the dimensional analysis used for the model and this was done by comparing the motion of the model with that of the actual launching of an RAN Type 12 A/S frigate. For this reason an 8 ft (2.44 m) model was balanced and ballasted so that its mass, buoyancy, longitudinal centre of gravity and radius of gyration were the same (to scale) as those of HMAS *Stuart* which was launched at Cockatoo Docks and Engineering Co. on 8 April 1961.

The second series of experiments was carried out to determine the resistance coefficients of the model. These coefficients were calculated from the results obtained by towing the model and launching cradle stern-first in the 200 ft (61 m) towing tank at the University of Sydney under the supervision of Bob Halliday (USyd) and John Tuft (UNSW).

The third and fourth series of experiments were carried out to determine the effect of displacement and slipway inclination on launching motion and to check the validity of the empirical predictions from the equations of motion.



Brian Robson's model of the Type 12 A/S frigate
with launching cradle attached
(Photo from thesis, courtesy Judy Robson)



Tank Testing Brian Robson's model of the Type 12 A/S frigate
and launching cradle stern-first in the towing tank
at the University of Sydney
(John Tuft closest to camera)
(Photo from thesis, courtesy Judy Robson)

Post-graduate and Other News

Vale Sir Rupert Myers

Former Vice-Chancellor of the University of New South Wales, Emeritus Professor Sir Rupert Myers, KBE, AO, passed away on 21 February on his 98th birthday. Sir Rupert was UNSW's second Vice-Chancellor, following Sir Philip Baxter, and his formidable leadership paired with his warmth and down-to-earth nature garnered him deep respect from colleagues and students alike.

Sir Rupert Myers
(Photo from UNSW Records & Archives website)

Rupert Myers was born in Melbourne in 1921, educated at Melbourne High School, and then studied metallurgy at the University of Melbourne where he became the second person to be awarded a PhD from an Australian university.

After working at the Atomic Energy Research Establishment at Harwell, England, from 1948 to 1952, he returned to Australia to take up the Foundation Chair of Metallurgy at UNSW. In 1961 he became Pro-Vice-Chancellor and then in 1969 he became Vice-Chancellor, continuing in that role until 1981.

If Philip Baxter was the 'essential founder' of UNSW, then Rupert Myers was its 'essential consolidator'. With Myers as its chief executive officer and roving diplomat, the university established its character and presence in the academic world. By 1976, after only twenty-seven years, it had become Australia's largest university with a student enrolment of over 18 000.

He was instrumental in establishing UNSW's partnership with the Australian Defence Force Academy in Canberra, an achievement which gave him immense personal and professional satisfaction. Sir Rupert pushed to provide degree studies to uniformed officers because he believed in the benefits of a balanced and liberal education. Sir Rupert was also responsible for establishing the Faculty of Law, and the decision to locate Australia's first national school of business administration, the AGSM, at UNSW.

Among his honours, Sir Rupert was appointed a Knight Commander of the Order of the British Empire (KBE) in 1981. He was also appointed an Officer of the Order of Australia in the 1995 Australia Day Honours for his efforts in promoting innovation and commerce in the fields of science, technology and engineering.

Many graduates will be familiar with the Rupert Myers Building on the southern edge of the Kensington campus, which was dedicated in 1999 in honour of his leadership and his achievements.

Sir Rupert is survived by his four children (with first wife, Io), and his second wife, Nancy.

Phil Helmore

INDUSTRY NEWS

ASC Submarine Experts Recognised for Collins-class Program Achievements

The outstanding professionalism, dedication and contribution to Australia's defence capability by two senior ASC personnel have been recognised with Defence Industry Service Commendations. The awards to General Manager, Engineering, Jim Burnside, and Manager for Operational Period Maintenance, Tim Hill, were announced on 5 April by Defence Industry Minister, Senator the Hon. Lind Reynolds.

ASC Chief Executive Officer, Stuart Whiley, paid tribute to the awardees. "These awards recognise two decades of dedication, skill and sustained effort in bringing about great outcomes for our customer, the Royal Australian Navy. Jim and Tim are great representatives of our sovereign submarine workforce, numbering more than 1200 in South Australia and Western Australia. Their achievements show the exciting range of professional challenges being met by ASC's personnel and looks forward to continuing improvements in coming years, as we ramp up to meet Australia's expanding submarine capability requirements."

Addressing the awards, Mr Whiley said that Mr Burnside was a key driving force for ASC's successful innovation program following the Coles Review in 2012, which achieved international benchmarks in submarine deep maintenance, or full-cycle dockings (FCDs), in Osborne, South Australia.

"Jim has been a key driver in establishing, on a program management and engineering level, an ambitious timeline in transitioning to a two-year full-cycle docking, down from at least three years. Jim proved that a faster and more ambitious timeframe was achievable—moving to the ambitious new timeframe within a single two-year FCD.

Mr Burnside said, in response to the award "I am extremely honoured to be awarded the Defence Industry Service Commendation by Minister Reynolds. It is recognition of the work done by many people in the submarine enterprise from Navy, CASG, ASC, and industry partners, in transforming the Collins-class sustainment program to meet and exceed international performance benchmarks. Great things can be achieved if we are aligned on what's really important and continue to trust and support each other."

Mr Whiley said that Mr Hill, based at ASC's maintenance base in Henderson, Western Australia, was a key manager of ASC's response to platform issues which arise with operational Collins-class submarines.

"Tim is regarded by managers and colleagues alike as highly dedicated and skilled, with a 'can-do' approach across several decades of service that has seen him advance from the shop floor to a position which is a critical role for ASC and the RAN in keeping Australia's submarines available for operations."

Responding to the award, Mr Hill said "I am surprised but very pleased to receive this award. I am very appreciative of the teams, including the other submarine enterprise partners, which have supported me in this. I am also very grateful for the support and respect that has been shown from the Navy to my team. I get a lot of satisfaction from keeping the submarines at sea, and the camaraderie of the ships' companies in Australia and overseas."

The Defence Industry Service Commendations were announced in August last year and are "awarded to individuals or teams who demonstrate superior achievement or devotion in the application of skills, judgement, innovation or dedication to duty in the Australian defence industry for the benefit of Australia's defence capability".

Defence Industry Service Commendations

On 5 April 2019 the Minister for Defence Industry, Senator the Hon. Linda Reynolds CSC, announced seven new recipients of the Defence Industry Service Commendation.

The Defence Industry Service Commendation is an initiative launched by the Government in 2018, which recognises outstanding achievements and dedication in the application of skills, judgement and innovation in the defence industry sector.

Minister Reynolds said that, in order to continue growing

a sovereign defence industry, it was important to recognise the hard work and commitment of those in defence industry working to the benefit of Australia's defence capability while also contributing to creating Australian jobs and economic growth.

"I congratulate and thank each of today's Defence Industry Service Commendation recipients for their contributions to building an agile and resilient Australian defence industry in support of delivering capability to our defence force," Minister Reynolds said.

The following people have been awarded a Defence Industry Service Commendation:

- Kym Osley, Director, Management Consulting, Price Waterhouse Coopers.
- Jim Burnside, General Manager, Engineering, ASC Pty Ltd.
- Mark Power, Director, Power Initiatives.
- Tim Hill, Manager, Operational Period Maintenance, ASC Pty Ltd.
- Neil Matthews, Senior Manager, Advanced Technology and Engineering Solutions, RUAG Australia Pty Ltd.
- Paul Montgomery, Workshop Manager, BlueZone Group.
- The Hunter-class Frigate Program team, BAE Systems Australia Ltd.

New MD for ASC Shipbuilding

BAE Systems Australia has appointed Craig Lockhart to the position of Managing Director of ASC Shipbuilding.

As a subsidiary of BAE Systems, ASC Shipbuilding is responsible for the delivery of the Hunter-class Frigate Program which will design and build the new frigates for the Royal Australian Navy and contribute toward a sovereign naval shipbuilding capability for the nation.

Craig Lockhart
(Photo courtesy BAE Systems)

Mr Lockhart will commence in the role on 3 June 2019 and report to BAE Systems' Chief Executive Officer, Gabby Costigan. He comes to the company with extensive defence experience spanning three decades, most recently as the Managing Director of Naval Marine for Babcock in the United Kingdom.

He will take over from Nigel Stewart, who successfully led the SEA5000 campaign which saw the company selected to deliver the $35 billion program for the nine anti-submarine frigates for the Royal Australian Navy.

BAE Systems Australia's Chief Executive Officer, Gabby Costigan, said "Having held leadership positions within the surface ship, submarine and conventional- and nuclear-power sectors across a long and expansive career, Craig's depth of experience in the defence industry is exceptional.

"Craig brings a hands-on, detailed understanding of the Australian and UK defence industries and business networks. Coupled with his leadership capabilities and proven track record in leading large-scale diverse defence businesses, Craig is ideally suited to significantly grow and lead the team which will deliver the Hunter-class Frigate Program. I am truly delighted to announce Craig's appointment, and welcome him back to Australia.

"I would like to thank Nigel for his outstanding contribution to the program and for providing strong leadership of the team over the last three years. With the signing of the Hunter-class Frigate Program head contract and the acquisition of ASC Shipbuilding completed, Nigel will return to our UK maritime business, following a handover to Craig."

SeaTech Opens Australian Office in Perth

SeaTech Solutions Australia has started operations in Perth from February 2019 to better serve Australian Clients. The Singapore parent company, SeaTech Solutions International (S), is one of ASEAN's largest independent marine and offshore consultants and designers in the marine and offshore engineering and consultancy business for the past 20 years, with more than 300 unique designs.

SeaTech comprises staff of over 100 professional naval architects and engineers. Including SeaTech Solutions Australia, SeaTech now has presences in 10 countries: Singapore, China, India, Myanmar, Thailand, Japan, Vietnam, Malaysia, Korea and Australia.

SeaTech is committed to assuring optimum performance for its offshore and marine clients, through design, innovation and technology. Engineering/Consultancy Services include:

- Model tests and CFD.
- Stability and load out calculations.
- Structural analysis (FEM)
- Hydrodynamic and motion analysis.
- Powering and propeller design.
- Mooring analysis.
- Life cycle and FEED engineering.
- Pipe surge analysis.
- Shipyard evaluations and tender assistance, enquires and estimates.
- Fuel and monitoring systems.
- Shipyard layouts.
- Energy audits.
- Transportation studies.

"With the addition of this new Australian office, we will be nearer to the clients and be able to respond faster," said Mr Govinder Singh Chopra, Director of SeaTech Solutions International (S). "We are very excited about the growth opportunity in the region, and the establishment of this new office reflects SeaTech's commitment to reach out globally but deliver locally."

Mr Phil Kwon, Business Development Manager, Naval Architect (Australia), is the contact at SeaTech Solutions Australia, PO Box 1340, Booragon WA 6954, phone (08) 6255 5465, email info.australia@seatechsolutions.com.

Raytheon for Aegis Integration on Hunter-class Frigates

The Department of Defence has selected Raytheon Australia to act as the Australia's Aegis systems integration agent.

The Department issued a limited request for tender to Raytheon to establish a deed of standing offer under which Raytheon Australia will provide Aegis combat system integration support for up to six years.

The Aegis combat management system is already fitted to the Hobart-class air-warfare destroyers and will be fitted to the Hunter-class frigates as well.

Subject to successful negotiations, the contract should come into effect by mid-2019.

Aegis is an integrated missile guidance system used on US Navy and allied navies. The Australian frigates will be fitted with CEAFAR 2 phased-array radar integrated with the Lockheed Martin-developed Aegis combat system.

Congratulations for Civmec

During a visit to the site in May, the Minister for Defence, the Hon. Christopher Pyne, could not contain his genuine enthusiasm for Civmec's new shipbuilding and maintenance facility, currently under construction at Henderson, when he addressed the company's workforce.

Describing the immense structure as "magnificent", the Minister congratulated Civmec on having the foresight to invest in the future of Australia's defence capability, both in people and infrastructure.

"Civmec really took up the challenge, and decided that if there's going to be a shipbuilding industry in Australia, we want to be part of it," he said.

Minister Pyne was on site back in April 2017 to mark the first day of ground preparation works for the new facility, and wanted to return one last time to see its progression before retiring from his political career. Designed to be one of the most efficient and innovative in the world, the development will deliver a new world-class resource to the Australian maritime landscape and significantly enhance the capability available nationally.

The Minister also wanted to take the opportunity to address and thank Civmec's skilled and talented workforce, congratulating them on the important role which they are playing, not only in growing Australia's sovereign shipbuilding capability but, ultimately, in the defence of the country.

"The skilled workforce which you represent gives the Government the confidence to invest in Australia rather than building ships and submarines overseas," he said.

In partnership with Lürssen Australia, Civmec will supply and process steel for all 12 of the RAN's new Offshore Patrol Vessels, with the preparation and profile cutting of steel plates for the first two vessels currently underway at Henderson. Following the build of the first two vessels at Osborne in South Australia, Civmec will complete the fabrication and construction of the following 10 vessels in its new world-class ship assembly hall.

Wärtsilä Solutions for new State-of-the-art Wasaline Ferry

An integrated package of products, systems, and solutions from the technology group Wärtsilä will enable a new Wasaline RoPax ferry to be among the world's most efficient and environmentally sustainable ships. NLC Ferry operates the Wasaline service between Vaasa, Finland and Umeå, Sweden, and the new ferry, featuring state-of-the-art Wärtsilä technology, is scheduled for delivery in May 2021. It is being built by Rauma Marine Constructions in Finland.

Among the ship's outstanding features will be its hybrid propulsion solution. This will incorporate four highly-efficient Wärtsilä 31DF dual-fuel engines capable of operating on liquefied natural gas (LNG) and biogas. The diesel version of the Wärtsilä 31 has been recognised by Guinness World Records as being the world's most efficient 4-stroke diesel engine. Wärtsilä will also supply the LNG storage, supply and control systems, as well as the thrusters, catalysators, controls, and the integrated electrical and automation systems. The latter will incorporate an energy- and power-management system to optimise the use and operation of the hybrid power solution.

The combination of the Wärtsilä 31DF engines, hybrid propulsion, and LNG and biogas fuel will establish this ferry as a benchmark in efficiency and sustainability. The CO_2 emissions, for example, will be reduced by more than 50 percent compared to Wasaline's current ferry serving this route.

"This ferry project represents the perfect alignment of a life-cycle Wärtsilä solution with the lowest possible environmental impact. Furthermore, it is a strong endorsement of Wärtsilä's Smart Marine approach whereby connectivity and digitalisation are utilised to create greater efficiency, lower operating costs, and better environmental performance. Co-creation with partners and customers is another main element in creating a better industry ecosystem, and we have worked closely with NLC Ferry for more than five years in the development of this state-of-the-art vessel," said Henrik Wilhelms, Segment Sales Director, Wärtsilä Marine.

"We are extremely excited about our new ferry. It will be truly world class with the latest and most advanced technologies, and for this we appreciate the support which Wärtsilä has provided. We know and trust their products. For example, our existing ship is powered by a Wärtsilä Vasa 32 engine that has already accumulated an incredible 200 000 hours of operation. This outstanding reliability is an example of why we have selected Wärtsilä again," said Peter Ståhlberg CEO at Wasaline.

"Shipbuilding in Rauma has a history dating back some 600 years. During that time, all kinds of vessels have been delivered, but never has there been a ship like this new Wasaline ferry. The efficiency level is very high, and the hybrid technology employed results in minimal exhaust emissions. We are proud to be able to say that we built this ship," said Jyrki Heinimaa, President and CEO, Rauma Marine Constructions.

Wärtsilä's equipment supply is augmented by a 10-year service agreement, as well as an agreement which allows Wärtsilä to utilise the vessel as an R&D test platform and technology demonstrator. This will enable the company to further validate its latest and most innovative technologies in line with the company's Smart Marine philosophy.

The new ship will accommodate 800 passengers and will have 1500 lane metres available for trucks and passenger vehicles.

The new Wasaline ferry will be among the world's most efficient and eco-friendly vessels
(Image by Kudos Design, courtesy Wärtsilä)

Thales UK sends first Collins-class Replacement Bow to Australia

Thales UK has announced that it has recently completed the first of six new replacement bow sonar arrays for the upgrade of the Royal Australian Navy's Collins-class submarines.

The company says that the bow sonar array was delivered in time to meet the Royal Australian Navy's accelerated upgrade of HMAS *Waller* currently taking place at ASC in Osborne.

The Collins Sonar Capability Assurance Programme (CSCAP) is part of the wider SEA1439 refit program to upgrade the capabilities of the RAN's six Collins-class submarines, extending their working life until the new generation of submarine is online in the 2030s.

The boats' current sonar has been in service since the 1980s.

Thales noted that CSCAP represents the first time that the UK has exported submarine technology of this level of sophistication outside the UK.

Collins-class submarines will also receive new flank arrays from Thales France. All the upgrades will be incorporated by Raytheon Australia and Thales Australia.

Wärtsilä SceneScan, the World's First 'targetless' DP Laser Sensor

The technology group Wärtsilä has successfully completed sea trials of its SceneScan system, the world's first 'targetless' dynamic positioning (DP) laser sensor. This state-of-the-art technology requires no reflector target to be deployed, thereby increasing both safety and operational uptime. The technology has been developed by Guidance Marine, a Wärtsilä company.

The tests were carried out onboard *Topaz Citadel*, a vessel owned by Topaz Energy and Marine, a leading international offshore support vessel company providing logistics support and marine solutions to the global energy

industry. The SceneScan was connected to a Wärtsilä DP system, with which the vessel was already fitted. Following the successful 90-day tests, Topaz indicated that it will keep the system as installed on *Topaz Citadel*, and that it will begin a phased roll-out to additional vessels. The initial order includes upgrading existing DP sensor systems onboard four of the company's vessels. Wärtsilä will also provide installation and commissioning of the systems.

The Wärtsilä SceneScan provides accurate positional information for safer operations
(Photo courtesy Topaz)

"The testing and evaluation was carried out and proven under actual DP operations with offshore platforms in the Caspian Sea. The positive feedback provides further evidence of the efficiency and accuracy of the SceneScan system. This is fully in line with Wärtsilä's Smart Marine vision, for which enhanced vessel safety is a key pillar," said Andrew Stead, Head of Business Development, Guidance Marine.

"The installation onboard *Topaz Citadel* was seamless, and the technical support which was provided by Wärtsilä throughout the testing period successfully determined the system's overall effectiveness. We have no doubt that the SceneScan system will add considerable value to the DP operations of our versatile and digitised fleet." said Paul Jarkiewicz, Operations Director at Topaz Energy and Marine.

The SceneScan system is a high-accuracy rotating laser sensor which provides positional information to allow automated approach and/or station keeping relative to a structure or vessel. It is designed to be straightforward to operate, and it provides tracking information relative to natural or man-made structures within the sensor field of view. It tracks by matching its current observation of the scene against a map generated from previous observations of the scene.

Wärtsilä to Design and Equip Transport Vessel for Aker BioMarine

Wärtsilä has been awarded the contract to design a state-of-the-art multipurpose transport vessel which will operate in Antarctic waters. The ship has been ordered by Norway-based Aker BioMarine and will be constructed by CIMC Raffles at Yandai, China. The ship design order with Wärtsilä was booked in December 2018, while the order for the integrated solutions package was booked in March 2019.

The 168 m long, 20 300 dwt vessel will comply with the International Maritime Organization's Polar Code. Because it will operate in the environmentally sensitive Antarctic, Wärtsilä's sustainable technical and hybrid solutions, with high levels of safety and reliability, were considered as being the most suitable for this project.

The new vessel will be powered by Wärtsilä's award-winning Wärtsilä 31 engine. Two Wärtsilä 20 engines will provide the auxiliary power. The engines will all be fitted with Wärtsilä's NOx Reducer to prevent nitrogen oxide emissions when in diesel mode. Wärtsilä will also deliver the power distribution system, including hybrid drives and a battery package, the gearbox, controllable-pitch propeller and thrusters. A Wärtsilä Nacos Platinum Joystick system will be supplied to enhance the efficiency and safety of the ship's operations. To ensure optimal system performance and energy utilisation, the integrated solution is controlled by Wärtsilä's power and energy management system and propulsion control.

The ship will carry supply goods and liquids, as well as krill products from krill-harvesting vessels working in the Antarctic area. For this, an innovative cargo handling system has been developed.

The vessel is expected to be ready for the 2021 harvesting season.

The new state-of-the-art Aker BioMarine support vessel is designed by Wärtsilä and fitted with an integrated package of propulsion and environmental systems
(Image courtesy Wärtsilä)

The RAN's second Adelaide-built air-warfare destroyer, HMAS *Brisbane*, at anchor in Sydney harbour in March
(RAN photograph)

Chief of Navy, VADM Mike Noonan, was assisted at the ceremonial keel laying on 10 May of Australia's first OPV,
the future HMAS *Arafura* by Lauren Pitman (left) and Kane Ramsay, the youngest shipbuilders at ASC Shipbuilding in Adelaide
(Photo courtesy ASC Shipbuilding)

Changes to Shipping Registration

Changes to shipping registration laws came into effect on 1 April 2019. These changes relate to registering a ship where the full vessel history is not known and who can close a ship's registration.

Registering a Ship

There are no changes to the way that you register a ship on the Australian Registers unless you do not know the vessel's full ownership history. See https:/www.amsa.gov.au/vessels-operators/ship-registration/register-vessel/ for more information.

Registration of a ship on the Australian general shipping register provides legally and internationally recognisable nationality to your ship. When registered, you will have Australian protection on the high seas and in foreign ports.

A vessel may require certification in accordance with:

- the Navigation Act 2012, for a regulated Australian vessel; or
- the Marine safety (Domestic Commercial Vessel) National Law Act 2012, for domestic commercial vessels.

Australian-owned ships are required to be registered on the Australian general shipping register if it is one of the following:

- a commercial vessel, 24 metres or over in tonnage length, capable of navigating the high seas; or
- any vessel travelling overseas.

The following vessels are exempt from the requirement to be registered (except if they are travelling overseas):

- pleasure craft;
- fishing vessels; and
- government vessels.

These vessels are permitted to be registered and may be registered on the Australian general shipping register if the owner chooses to do so.

Australian-registered recreational vessels may also require state registration. If you need to find out whether you need state registration, contact your local state marine safety agency.

The Australian international shipping register is open to Australian owned or operated, international trading ships which meet specific criteria. Read more about which ships are eligible to register on the Australian international shipping register.

Recreational Vessels

If you intend sailing your recreational vessel overseas from:

- an Australian port to a foreign port;
- a foreign port to a foreign port; or
- a foreign port to an Australian port.

then you must register your vessel on the Australian general shipping register before you leave.

Recreational vessels on international voyages are also required to comply with certain marine orders.

Domestic Commercial Vessels

If you own a domestic commercial vessel over 24 m in tonnage length then you must register it on the Australian general shipping register. Registration of a vessel on the Australian general shipping register does not automatically permit you to undertake commercial or recreational operations. You can contact us if you have questions about certification requirements for commercial vessels.

Notice of Intention to Register a Ship

If you buy or acquire a vessel and you do not know its full ownership history, then you must lodge a notice of intention to register a ship to be published on the AMSA website. This is a change to the old requirement for a Gazette notice to be submitted to the Federal Register of Legislation.

The information in the notice of intention to register will be published on AMSA's website for 30 days. This allows any former owners to notify us of any claim they may have to the vessel.

Objections to an Intention to Register a Ship

If you have a claim to a ship for which an notice of intention to register has been received, then you can submit objections to an intention to register to AMSA.

Closure of Registration

The way you close a registration — for ships not required to be registered — has changed. It is now possible for the legal owner to make an application to close a registration if the Australian registration is no longer required. Previously this application could only be made by the registered owner. An application for closure of a ship not required to be registered needs to be completed and a statutory declaration provided. In some cases a Bill of Sale will also be required. For more information read Closing a Registration on AMSA's website.

Gerard Walsh
Media and Parliamentary
Australian Maritime Safety Authority

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.

VALE

Brian Robson

It is with sadness that *The ANA* records the passing of Brian Leslie Robson on 10 February 2019, aged 82 years.

Brian was born on 8 November 1936 to Herbert and Ivy Robson. Herb was a boatbuilder and foreman shipwright at the Green Point Naval Boatyard (later Green Point Shipbuilding and Engineering Company) at Mortlake. Herb introduced Brian to the water, and he grew up loving boats and sailing.

Brian went to Rozelle Public School, obtained his Intermediate Certificate and then, in 1953, began an apprenticeship as a boatbuilder and shipwright at Green Point, but transferred the apprenticeship to HMA Naval Dockyard Garden Island when Green Point closed in 1955. Completing his apprenticeship in 1958, Brian realised that he could go further if he altered course into drafting or naval architecture, so transferred into the Ship Drawing Office at Garden Island and went to Sydney Technical College at night to obtain his Leaving Certificate. He obtained a scholarship to enrol in the University of New South Wales' brand-new Naval Architecture degree program. For his final-year thesis project he investigated the launching of the second of the River-class destroyer escorts (HMAS *Stuart*), which was built at Cockatoo Docks and Engineering Co., by launching a 2.5 m model of the vessel on a cradle into the towing tank at the University of Sydney, supervised by John Tuft and Bob Halliday. He graduated with his Bachelor of Engineering degree in naval architecture with Honours Class 2 Division 1 on 24 April 1963, the first graduate in naval architecture from UNSW.

On graduation he was appointed as the Navy Hull Overseer at Codock but, late in 1963, transferred to Navy Office at Russell in Canberra as a naval architect. In 1966 he was appointed Small Craft Design Manager for Royal Australian Navy vessels. While in Navy Office, he noticed the attractive young lady in the drafter's smock who came around taking and delivering lunch orders, and he married Judith Mary Stephenson on 20 January 1967 at St John's in Canberra.

Later in 1967 he was appointed as Australian Construction Naval Liaison Office (ANCLO) Bath, and so it was off to Bath, UK, with Judy for two years, followed by a year as Naval Constructor at the Admiralty Experimental Works in Haslar, UK. They found that they loved travelling, bought a caravan, and spent their spare time and holidays caravanning around the UK and Europe.

Then it was back to Canberra, where Brian was appointed Senior Naval Architect in the Directorate of Forward Design. He and Judy bought a house in Weetangera, and started their family.

However, in 1975 Brian was posted overseas again, and he, Judy and two children moved to Virginia, USA, where he took up the position of RAN Technical Director on the FFG Project, in which the first four of the RAN's FFGs were constructed in the USA. While there, they also travelled widely in the USA in their spare time and holidays.

Back home in 1978, Brian was appointed Assistant Director Naval Ship Design, and became the Design Manager for both

Brian Robson
(Photo courtesy Judy Robson)

the Inshore Minehunter Project and the Oceanographic Ship Project. And, soon after, their third child arrived.

In 1982 he moved up, and was appointed Director Naval Ship Design, a position he held until 1988. During that time, he also served as International Cooperative Research Coordinator Naval Ship Structures and Hydrodynamics (1983–87), Project Director Pollution Control (Project 1160), Director Forward Design Ship Projects (1985), and Director Naval Ship Production (1987).

In 1989 he was appointed Assistant Director General Naval Engineering Services, a position he held until 1995, also serving as the Director/Manager on the Offshore Patrol Combatant Project. He was finally appointed Director General Naval Engineering Services, a position he held until he retired from the Department of Defence after a lifetime of service in November 1996. He and Judy retired to Noosa Waters, Qld.

Brian was active in the RINA, serving as the President of the Australian Division on two occasions, 1985–90 and 1993–94 and attending most meetings, not always with Judy's full approval! When they retired to Noosa, he became active in the Queensland Section, chairing the section for a time. He also became involved in Marine Rescue there, and loved going out over the Noosa Bar in one of the Marine Rescue vessels.

He was prolific in publishing and presenting work which was not classified and of interest to the naval architecture community, and authored or co-authored eight written papers. These included his own *Development of the Royal Australian Navy GRP Minehunter*, and *Systematic Series of High Speed Displacement Hull Forms for Naval Combatants* in the *Transactions* of the RINA, the first of which was awarded the RINA Bronze Medal.

Apart from his three years in the UK and three years in the USA, Brian had fourteen other work-related visits overseas to the UK, USA, Canada, The Netherlands, France, Denmark, Germany, Sweden. Norway and Thailand.

As a family man, the testimony of his children is that he was

up there with the world's best. They have memories of being taken to sports fields all over Canberra and, while Brian was not a sportsman himself, he knew a lot about each of their sports and could talk knowledgeably about them. He loved his stereo (often at high volume!), ice cream after dinner, coffee anywhere, and the occasional scotch. He loved his grandchildren when they began arriving, and they all have happy memories of holidays with their grandparents in Noosa. Ultimately, it was the grandchildren who pulled Brian and Judy back from Noosa, and they settled at Forester's Beach on the Central Coast to be nearer to them all.

The funeral service was held at Simplicity Funerals at Erina, NSW, and was attended by about 40 family and friends, including four naval architects.

Brian is survived by his wife Judy, children Ian, Gill and Catherine, and grandchildren Hayden, Jack, Tom, Indianna, Tayah, Olivia and Hugo.

Phil Helmore
Warren Smith
Roger Ramsey
Noel Riley

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Tuesday 2 April 2019 by teleconference under the chairmanship of our President, Prof. Martin Renilson, in Launceston with links to Airlie Beach, Gold Coast, Sydney, Canberra, Melbourne, Adelaide and Perth.

The meeting had a full agenda, including many on-going items. Some of the more significant matters raised or discussed were:

Visibility of RINA to Maritime Industry Companies

The Division is circulating to sections copies of two PowerPoint presentations respectively slanted towards prospective new members and recognition of the Institution by employers.

In this regard, Council continues to seek input from members for a list of management-level contacts in companies and other industry organisations.

Submission on Naval Shipbuilding Workforce Discussion Paper

Council noted that the Division's submission responding to the discussion paper had been developed and lodged inter-sessionally. A significant theme conveyed in the submission was a lack of understanding within the industry players of the knowledge, skills and potential roles of naval architects/maritime engineers in the broad shipbuilding process, particularly in their ability to apply those skills in areas of the shipbuilding process beyond design. The submission also outlined the roles of the Institution and Division as the leading learned society serving Australian naval architects/maritime engineers and thus the shipbuilding industry, making the case for the Division to be included in the Industry Reference Committee for the Naval Shipbuilding College.

Liaison on Domestic Commercial Vessels

Council agreed to form a working group of interested members to advise it in relation to these matters. Members with an interest in participating should contact the Secretary.

Elections and Appointments to Council

Following the re-election of Walid Amin and Jim Black, Council appointed Violeta Gabrovska, Jonathan Binns, David Gonzalez Pastor and Gordon MacDonald to vacant positions. Any Division members interested in filling the one remaining vacancy are invited to contact the Secretary.

Division Annual General Meeting

Council approved documents to be presented to the AGM in Sydney on the following day.

Next Meeting of Division Council

The next meeting of Council has been tentatively scheduled for the afternoon of Tuesday 18 June 2019.

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.

Annual General Meeting

As mentioned above, the Division's Annual General Meeting was successfully held at the Harricks Auditorium, Engineers Australia, Chatswood, NSW on Wednesday 3 April.

Walter Atkinson Award

Although not discussed at the Council meeting, members are advised that nominations for this year's Walter Atkinson Award, for the best written paper presented to Division or Section meetings in the year to 30 June 2019, should be submitted to the Secretary no later than Friday 19 July 2019.

Rob Gehling
Secretary

Changed Contact Details?

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

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

RINA London	hq@rina.org.uk
Australian Division	austdiv@rina.org.uk
Section	
ACT	rinaact@gmail.com
NSW	rinansw@gmail.com
Qld	hamish@oceanicdesign.com.au
SA/NT	RINASANTdiv@gmail.com
Tas	brian.winship@utas.edu.au
Vic	owen.tregenza@dst.defence.gov.au
WA	wa@rina.org.uk

Phil Helmore

NAVAL ARCHITECTS ON THE MOVE

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

George Constas-Inglis, a recent graduate of the Australian Maritime College, has taken up the position of naval architect in the Hydromechanics Cell within the Naval Technical Bureau of the Department of Defence in Canberra.

Richard Dreverman has moved on from Rolls-Royce Marine and has taken up the position of Sales Manager Oceania with Kongsberg Maritime in Fremantle.

Yuriy Drobyshevski has moved on from INTECSEA and has established his own independent consultancy, NavTec, in Perth.

Richard Dunworth has retired from his position as Stability Technology Manager in the Naval Technical Bureau and is settling into a retiree's pace of life. Richard originally joined Navy Office in 1966 and, prior to re-joining Defence later in his career, he spent 15 years at Murray, Cormack Associates in UK and another 15 years as half of Baron and Dunworth in private practice, performing commercial and naval stability work including development and supply of onboard stability software. More recently, Richard is the father of the new method of analysing inclining experiments which eschews the wall-sided assumption and is documented in his two papers, *Up Against the Wall* and *Back Against the Wall*. The method has now been taken up by much of the naval architecture world, witness Dracos Vassalos and Kristian Karolius' recent paper *Tearing Down the Wall — The Inclining Experiment* [*see https://strathprints.strath.ac.uk/62846/* — Ed.]

Kristian Fet has moved on from Rolls-Royce Marine and has taken up the position of Senior Structural Engineer with Kongsberg Maritime in Ålesund, Norway.

Mark Gairey retired from his position as Director on the Future Submarines Project with the Department of Defence back in 2014 and is enjoying the retiree's pace of life in Bungendore, NSW.

Craig Gardiner moved on from the Defence Science and Technology Group in 2011 and is now teaching mathematics at the Newcastle Waldorf School in Newcastle, NSW.

Tim Gates has moved on from the Department of Defence and has taken up the position of Senior Naval Architect with BMT Defence and Security Australia in Melbourne. He is currently subcontracted to Serco as the Engineering Manager on the Antarctic Research and Supply Vessel RSV *Nuyina* for the Australian Antarctic Division.

Ben Gilkes moved on from Technip in 2008 and, after some time at Subsea 7 and Zamil Mermaid Offshore Services, took up the position of Director with Edwell Energy in New York.

Derek Gill moved on from ASC in 2016 and, after a gap year, took up the position of Director with IRS Solutions Australia in Canberra, providing holistic solutions to industry.

Lucy Gilligan moved on from Fred Barrett Yacht Design in 2016 and, after some time at Kimberley Alpine Resort, Lorna Jane, and Chris Potter Engineering, has taken up a position as a naval architect with Austal Ships in Fremantle.

Jordan Glanville has moved on from Chevron and has taken up the position of General Manager with TEK-Ocean Energy Services in Melbourne.

Peter Goodin moved on from Australian Maritime Technologies in 2017 and joined Navantia Australia in Melbourne, where he has now taken up the position of LHD Design Manager.

David Gosling has moved on from DNV GL and has taken up the position of Port Marine Surveyor with the Australian Maritime Safety Authority in Sydney.

Andrew Graham has moved on within ASC West and has taken up the position of Specialist Mechanical Engineer in Henderson, WA.

Keegan Graham-Parker has moved on from ASC West and has taken up the position of Naval Architect with Thrust Maritime in Melbourne.

Sasha Harrison has moved on from Oceanic Design and Survey and has taken up the position of Naval Architect with Sea Transport Solutions in Runaway Bay, Qld.

Peter Hatton has moved on within Lloyd's Register and has taken up the position of Senior Surveyor in Lyttelton, New Zealand.

Peter Hayes has moved on within the Naval Technical Bureau of the Department of Defence and has been promotesdto Hydromechanics Cell Lead in Canberra.

James Heydon has moved on from HMAS *Cresswell* in his Marine Engineering Officer training, and has taken up a posting to the Submarine Systems Training Centre at HMAS *Stirling* in Perth, expecting to qualify for his dolphins this year.

Chris Hughes has moved on within Lloyd's Register, and has taken up the position of General Manager, Greater China Marine & Offshore Business Development, in Shanghai, China.

Claire Johnson has moved on within the Naval Technical Bureau of the Department of Defence and has been promoted to a stability-specific naval architect role within the Hydromechanics Cell in Canberra.

Antony Krokowski is still consulting as Aquamarine, and has moved to Dunedin, New Zealand, and has taken up the position of Vessel Design and Construction Engineer with Real Journeys in Te Anau.

John Lee moved on from DNV GL in 2017 and has now taken up the position of Consultant Naval Architect with Bluewater Shipping Denmark in Farnborough, UK.

Daniel Lim, a recent graduate of the Australian Maritime College, has taken up a position as a naval architect with the Capability, Acquisitions and Sustainment Group of the Department of Defence in Canberra.

Rhys Lovering has moved on from Navantia Australia and has taken up the position of naval architect with the Capability, Acquisition and Sustainment Group of the Department of Defence in Adelaide, working on the Future Submarine Program.

Molly McManus has moved on from Incat Crowther and has taken up the position of naval architect with the Ship Structures Cell within the Naval Technical Bureau of the Department of Defence in Sydney.

Robert Maher has moved on within the Australian Maritime Safety Authority and has taken up the position of Head of Technical — Vessel Safety Unit in Hobart.

Richard Milne moved on within Navy Platform Systems of the Department of Defence in 2009 to take up the position of Technology Manager Hull which is now within the Submarines, Boats and Interfaces Cell of the Naval Technical Bureau in Canberra. However, he has currently taken three month's leave to sail north with his family to the Coral Coast.

Sri Srinivas has moved on within the Department of Infrastucture, Planning and Logistics of the Northern Territory and, in 2012, took up the position of Principal Marine Safety Officer in Darwin.

Elisa Taniputra has moved on from Incat Crowther and has taken up the position of Design Project Manager and Naval Architect for UK-based projects with One2three Naval Architects in Sydney.

Dylan van Drunen has moved on within the Naval Technical Bureau of the Department of Defence, and has commenced an industry rotation as a naval architect with Austal Ships in Fremantle.

Carl Vlazny has moved on from Fortescue Metals Group and, after some time with Vale, has taken up the position of Projects Manager with L3 MAS in Ontario, Canada.

Jiong Wang has moved on from CSL Australia and has commenced research for his doctorate at UNSW Sydney on the topic of *Investigation of the Thermal Performance in Natural Ventilation, Space Heating and Cooling using a Solar Chimney Based Integrated System*.

Zhaohui Wang has moved on from the offshore industry and has taken up the position of naval architect with the Hydromechanics Cell within the Naval Technical Bureau of the Department of Defence in Canberra, currently focussing on the management of stability of RAN ships.

Lily Webster has returned to the Naval Technical Bureau of the Department of Defence in Canberra, following completion of rotations to BMT Design & Technology and the Naval Architecture and Platform Systems Analysis area within the Defence Science and Technology Group. She has taken up the position of naval architect with the Ship Structures Cell of NTB, mainly undertaking structural assessments.

Kim Williams retired from the Department of Defence in 2007 and, since then, has coached tennis and partnered with his wife in providing a full gardening service in Jules Handyman and Gardening Service in Murrumbateman, NSW.

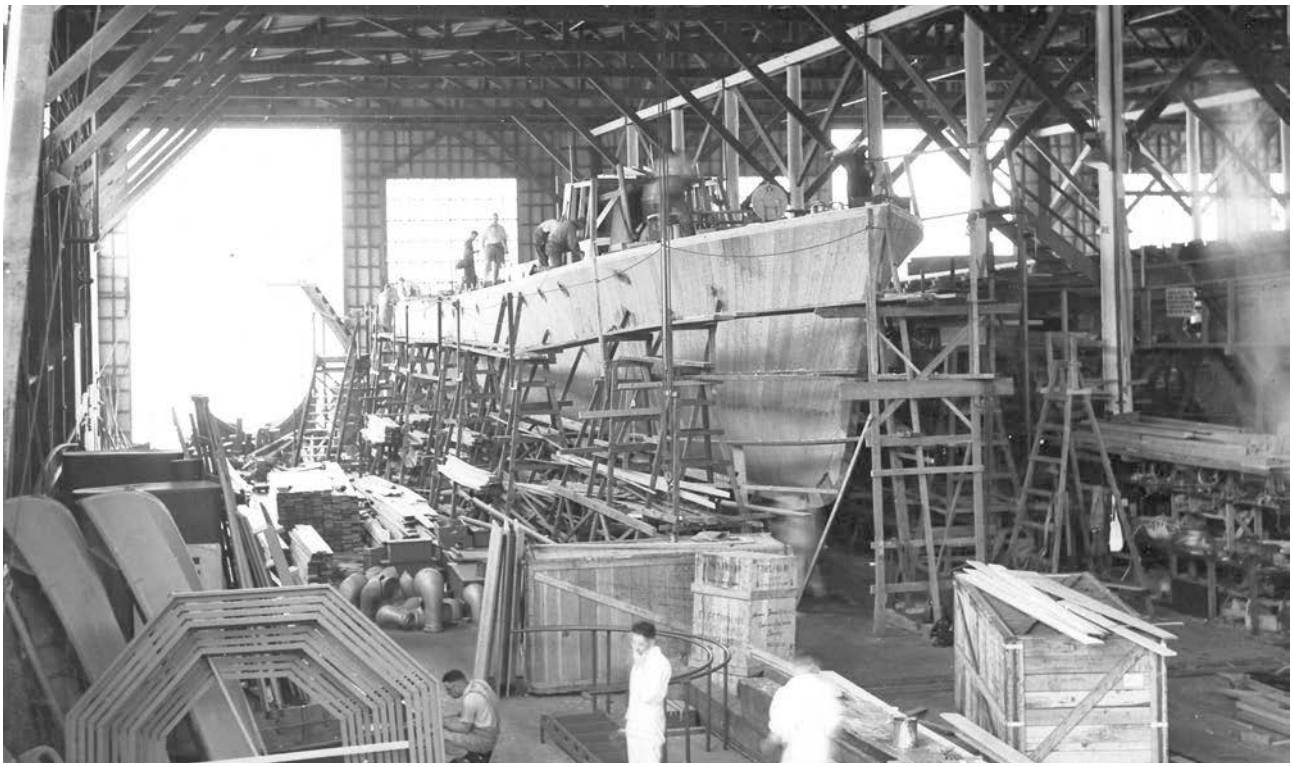
Renjie Zhou moved on in 2017 and took up a position as a naval architect with Incat Crowther in Sydney.

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.

Phil Helmore
Martin Grimm

After a busy 2018, HMAS *Hobart* has been in dockyard hands for a Post Delivery Availability for several months. Here she is in the Captain Cook Dock at Garden Island on 1April shortly before undocking. During this availability she has been completely repainted in RAN haze grey (RAN photographs)

FROM THE ARCHIVES



As part of a major program for the construction of small craft and support vessels in Australia during World War II, a number of 34 m Fairmile B type motor launches were completed during 1943 and 1944 by Norman Wright & Sons in Brisbane, Lars Halv-orsen Sons Pty Ltd at Ryde, and the Green Point Naval Boatyard at Mortlake in Sydney. This photograph shows one of the 11 Fairmiles built at Ryde between November 1942 and February 1944, nearly ready for launching in 1943
(Photo J C Jeremy Collection)

Rear Admiral G C Muirhead Gould, Naval Officer in Charge Sydney, inspecting progress on the construction of Fairmile B motor launches at Green Point in 1943. The craft were built by Concrete Constructions, initially assembled from prefabricated parts supplied from Britain, and 20 were completed between January and December 1943. The yard was managed by well-known naval architect Cecil Boden, who moved to Concrete Constructions from Cockatoo Dockyard for the task
(Photo J C Jeremy Collection)

The ship's company in HMAS *Success* gather on the flight deck to celebrate the ship's 33rd birthday during Indo-Pacific Endeavour 2019. HMAS *Success* will be deecommissioned on 29 June 2019 (RAN photograph)