

THE AUSTRALIAN NAVAL ARCHITECT



Volume 21 Number 2
May 2017



HMAS *Stuart* during undocking operations at BAE Systems at Henderson, WA, in March
after completing the Anti-ship Missile Defence Upgrade
(RAN photograph)

THE AUSTRALIAN NAVAL ARCHITECT

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

Volume 21 Number 2
May 2017

Cover Photo:

Express 3, a 109 m high-speed vehicle-passenger ferry built by Incat Tasmania for Danish operator Molslinjen on trials recently
(Photo courtesy Incat)

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

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

The deadline for the next edition of *The Australian Naval Architect* (Vol. 21 No. 3, August 2017) is Friday 28 July 2017.

Articles and reports published in *The Australian Naval Architect* reflect the views of the individuals who prepared them and, unless indicated expressly in the text, do not necessarily represent the views of the Institution. The Institution, its officers and members make no representation or warranty, expressed or implied, as to the accuracy, completeness or correctness of information in articles or reports and accept no responsibility for any loss, damage or other liability arising from any use of this publication or the information which it contains.

The Australian Naval Architect

ISSN 1441-0125

© Royal Institution of Naval Architects 2017

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

Print Post Approved PP 606811/00009

Printed by B E E Printmail
Telephone (02) 9437 6917

May 2017

CONTENTS

- 2 From the Division President
- 4 Editorial
- 4 Letter to the Editor
- 5 Coming Events
- 8 News from the Sections
- 16 From the Crows Nest
- 19 General News
- 34 Making Ferries More Useful and More Efficient — Robin Sandell
- 37 Education News
- 43 Industry News
- 47 The Internet
- 48 Membership
- 49 Vale Jock Dalziel
- 50 Naval Architects on the Move
- 51 From the Archives

RINA Australian Division

on the

World Wide Web

www.rina.org.uk/aust

From the Division President

Welcome to another edition of *The Australian Naval Architect*. I am really pleased to say that I continue to receive compliments from all sorts of people about our journal and the fact that the Australian Division produces it. For example, recently, at the Council meeting in the UK the President complimented us on this activity. Of course, we are eternally grateful to John Jeremy and Phil Helmore for all the effort which they put into each of these editions to make them so successful. I'd also like to thank all the contributors and, of course, the advertisers.

Since the last edition, we have held the Australian Division's AGM in Perth. This went smoothly and I'd like to thank the WA Section for their organisation. At that meeting the terms of Danielle Hodge, Craig Hughes and Mark Symes expired. I'd like to thank them for their input during their time on Council. Walid Amin, David Gonzales Pastor and Gordon MacDonald were subsequently elected to the Australian Division Council. I look forward to working with them.

As an aside, it was very pleasing indeed to see the level of interest shown by members in joining the Division Council. I think that this bodes well for the future of the Institution in Australia, and hope that this continues with more members nominating for Council next year.

As members may know, the Australian Division contributed to the Senate Enquiry into the Future of Australia's Naval Shipbuilding Industry. Our submission, along with all the other submissions, can be viewed at: http://www.apf.gov.au/Parliamentary_Business/Committees/Senate/Economics/Navalshipbuilding45th/Submissions.

One of the main points that we made in this submission is the need for Defence to be a "smart buyer". To achieve this, we argued that there needs to be appropriate numbers of suitably-qualified engineers in the correct positions to influence the process. In addition, there needs to be provision for engineers and other civilian staff to conduct regular exercises to maintain and enhance their capabilities.

We used the example of a ship designer who may not have been involved in the design of a ship for over 10 years. It would be very difficult for such a person to give valuable input in this field. We recognised that the exercising of such skills on a regular basis in a prescribed manner will be expensive, but noted that *not* doing this will make it difficult for Defence to be a "smart buyer". We pointed out that the need to conduct regular exercises to keep current is well recognised by the uniformed staff who carry out such exercises, at great expense! However, for some reason, the same philosophy is not widely applied to civilian engineers. I'm not sure how the Institution can influence this issue, but I do feel that it is an important one and that we should try to make this point as often as we can. I'd certainly be interested in members' thoughts on this.

We also raised the importance of incorporating lessons from previous projects and from operational experience into the design of the next generation of naval ships and submarines. In the past this was almost taken for granted; however, these days it is perhaps more difficult to achieve, with a combination of fragmentation of projects and the outsourcing of activities to the private sector. That is not to say



Martin Renilson

that the philosophy of doing either of these is bad, in itself, but it needs to be recognised that special effort needs to be put into retaining such corporate knowledge and feeding it into the new designs. Again, I'd be very interested in members' thoughts on this.

The Secretary and I were invited to give oral evidence to the Committee, which we did on 3 April. After our opening statement, covering the above points, Senator Xenophon asked us very directly how many naval architects there are, how many are needed for the \$89 billion program, and how we can make sure that there is sufficient home-grown naval architecture expertise. Of course, we were not able to answer the question of how many are needed, since this depends very much on whether he was referring to those employed by the Commonwealth, or those employed by the design authority. I'd be interested in members' thoughts on this.

Also, we were not in a position to identify how many of our members are actually working on these projects. Again, it would be really helpful for members to let us know how many are working in this area, and whether they feel that more are required, or not.

Senator Xenophon also asked whether there are any Australian naval architects working in France with DCNS. Again, it was not really possible for us to answer this question.

Personally, I found the line of questioning from Senator Xenophon quite interesting. He is clearly pushing the Government to make sure that there are adequate numbers of Australians employed on these projects and was quite focussed on this issue. It will be interesting to see how this all pans out.

Members may be aware that, subsequently, the Federal Government has announced the establishment of an Australian Maritime Technical College in South Australia. Details of this are fairly sketchy at this stage, but it seems that it is mainly focussed on vocational training of shipyard workers. It may extend to diploma-level naval architects

and I think that the Institution should continue to monitor developments with it.

The Australasian Oil and Gas Conference and Exhibition was held in Perth again in February. The Institution is a partner in the event and, this year, organised a two-session stream on the topics of *Fixed and Floating Offshore Structures* which was very successful, despite the lower number of attendees at the exhibition this year. We're extremely grateful to the WA Section for arranging this and, in particular, I would like to thank Yuriy Drobyshevski for leading the effort. This conference is run every year, so if you were not able to make it in 2017, then I hope that you'll be able to attend in 2018.

As most members are probably aware the Institution has re-structured its technical committees. The new committees are as follows:

- IMO Committee;
- Maritime Safety Committee;
- Maritime Innovation Committee; and
- Maritime Environment Committee.

The first two committees are ongoing from the previous structure; however, the latter two are new. The Chairmen and members of these committees have been appointed and they are planning their activities. Further details are available on the Institution website.

The other committees remain unchanged as follows:

- Professional Affairs Committee;
- Publications Committee;
- Membership Committee; and
- Disciplinary Committee.

I'm very pleased to report that 93 members completed the survey which we conducted recently. The Vice-President, Jesse Millar, is currently analysing the responses with Karl Slater. I think that this is going to be a very useful tool to ensure that the Division understands what it is that members want from the Institution and I'd like to thank Jesse for his initiative with this. The results will be reported in a future edition of *The Australian Naval Architect*.

Finally, arrangements for the Pacific International Maritime Conference are well underway. We received a particularly large number of very good abstracts and the Program Committee, chaired by Adrian Broadbent, was in the difficult position of having to turn down many good ones. The conference will be held in Sydney from 3 to 5 October. I look forward to seeing as many of you as possible in Sydney then.

Martin Renilson



The first of Australia's three air-warfare destroyers, *Hobart*, sailing in company with HMAS *Parramatta* and HMAS *Darwin* during acceptance sea trials. On 12 May, as this edition of *The ANA* was being prepared for press, the Commonwealth Government announced the purchase of Techport in Adelaide, the building site of *Hobart* and her sisters *Brisbane* and *Sydney*, from the South Australian Government for \$230 million. Under the Government's Naval Shipbuilding Plan, released on 16 May, the Techport site at Osborne South will become the site for the planned major surface combatant continuous build program with the RAN's new submarines to be built at Osborne North. Development of the new Osborne South surface ship construction facilities — an investment of up to \$535 million — is expected to start in the second half of this year. An investment of \$100 million in naval-related industrial infrastructure and sustainment will also be made in Western Australia from 2017 to 2020

(Photo Department of Defence)

Editorial

Since 2000 the Australian Division of the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia have organised a major international maritime conference in association with the Pacific series of maritime and defence expositions in Sydney. The Pacific 2017 International Maritime Conference, to be held in October this year, will be the tenth in this series.

This year, Pacific 2017 returns to Darling Harbour at the brand-new International Convention Centre which was opened late last year. Built in the remarkably short time of three years, the Centre has world-class facilities to complement its outstanding location.

The call for abstracts for the Pacific 2017 International Maritime Conference closed on 13 March with a record 139 abstracts submitted for consideration by the Program Committee. The quality was very high, making the Committee's task of selecting 74 papers for inclusion in the program quite a challenge. Inevitably some authors will be disappointed, but the response is very encouraging as it demonstrates how this conference has grown into an important international event.

It would not be possible for the Institutions to conduct an event of this nature without the magnificent support

of Industry Defence and Security Australia Limited, the organisers of the Pacific 2017 International Maritime Exposition of which the IMC and the RAN's Sea Power Conference are part. Some may not realise that the members of the organising and program committees give their time on a voluntary basis. Their work includes arranging the peer review of a significant proportion of the submitted papers, a task which requires considerable time to be devoted by the individuals involved.

All this support has meant that the IMC has proved to be a successful means of supporting the activities of RINA and IMarEST, in particular, in Australia. Of course, a good program and a good location are part of this success, but the attendance of as many members of the Institutions as possible is also an essential component. Conscious of the cost to attendees in coming to Sydney for the event, the program committee has been keen to keep the registration fees as reasonable as possible, and the IMC is one of the most competitively-priced conferences of its standing in the world.

Registration is available now. October will be here sooner than you think. Take advantage of the early bird rates and book in for the conference now. I look forward to seeing as many RINA members as possible at Darling Harbour in October.

John Jeremy

LETTER TO THE EDITOR

Dear Sir,

I am writing to express my concern over the future of naval architecture in Australia. My concern has developed from the fact that my university, UNSW Sydney, has suspended the intake of naval architecture students and intends closing the program. Presumably, this is due to the apparently unsustainable nature of this program, stemming from the lack of interest in naval architecture by prospective students.

My concern is that, given that a major university has decided to stop teaching naval architecture, other universities may follow suit. I believe that there is a genuine interest in the subject of naval architecture by prospective students. However, there is a lack of awareness that naval architecture exists as a career and is taught in universities in Australia.

This is especially concerning, considering the large national interest which Australia holds in naval architecture. Naval architecture in Australia should be a growing field. For a nation surrounded by water, this field is surprisingly unknown. Furthermore, Australia has large a defence interest in shipbuilding; for example, the future submarines, frigates and offshore patrol vessels to be built for the Royal Australian Navy. An interesting point in the Royal Australian Navy's procurement is that none of the future projects have been designed within Australia. The future submarine, for example, is a French design, and the future frigate will be decided from designs from Italy, Spain or the UK.

Therefore, it is justified that Australia should build its own naval architecture industry. It should follow then, that education in naval architecture should be developed as

well. I suggest that awareness of naval architecture needs to increase in the general public and even in educational institutions as well.

Isabella Yan
UNSW Student



HMA Ships *Parramatta* and *Anzac* entering Cockburn Sound after Exercise Ocean Explorer 17. These hard-worked ships will be replaced by new Australian-built frigates in the 2020s (RAN photograph)

COMING EVENTS

NSW Section Technical Meetings

Technical meetings are generally combined with the Sydney 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 2017 (with venues noted) is as follows:

- | | |
|-------|---|
| 7 Jun | Lawry Doctors, Em/Prof, UNSW Sydney
<i>Hydrodynamics of High-performance Marine Vessels</i>
UNSW Sydney, Kensington |
| 5 Jul | IMarEST TBA
Engineers Australia, Chatswood |
| 2 Aug | Steve Quigley, Managing Director, One2three
Naval Architects
<i>Innovations on Wild Oats XI</i>
Engineers Australia, Chatswood |
| 6 Sep | IMarEST TBA
Royal Prince Edward Yacht Club,
160 Wolseley Rd, Point Piper |
| 4 Oct | No meeting; Pacific 2017 events |
| 7 Dec | SMIX Bash 2017
On board <i>James Craig</i> , Wharf 7, Darling Harbour |

FAST 2017

FAST 2017, the Fourteenth International Conference on Fast Sea Transportation, will be held in France in the beautiful town of Nantes, at the Cité des Congrès on 27–29 September 2017, promoting world-wide cooperation between academia and the industry, as well as with other branches (such as aviation), with the aim of transferring knowledge and experience to sea transportation. Application of new materials, types of propulsion systems, fuel and emission are key issues for both sea and air transportation.

The technical program will focus on high-quality papers, panel discussions and invited keynote lectures from various fields. A thorough review process of both abstracts and full manuscripts will be used to select papers whose originality, relevance, timeliness, and significance meet the standards which FAST attendees have come to expect. The conference will be conducted in English.

For FAST 2017, contributions will be prioritised, and presentations in the area of propulsion, such as electrical power, batteries, hydrogen, propulsion systems and the use of new materials, will be the focus. Within the area of operations, the focus will be on safety, economy, emissions and technological innovations in equipment and decision systems.

The conference website URL is <http://fast2017.com/>

In the past, Australia has played a leading role in presenting papers to the FAST conference. Indeed, the Fourth International Conference on Fast Sea Transportation was held at UNSW Sydney in July 1997. It is therefore hoped that Australian naval architects will again be forthcoming and prepare technical papers for this important meeting.

The deadline for submission of abstracts through the website <http://fast2017.com/call-for-papers/> was 28 February 2017. An extension of time of two weeks was allowed with abstracts evaluated for selection by the technical program Committee. The list of selected abstracts was announced in April and a template provided to authors for submission of final papers by 30 June 2017. Final papers are expected to be between 3 and 5 pages including figures, in DOC, PPT, or PDF formats. The papers will be available to the conference attendees at the start of the event.

Principal themes for papers are:

- Hydromechanics and structures
- Design and new concepts
- Modelling and simulation
- Intelligent ships
- Intelligent yards
- Operations, safety and logistics
- Rules and regulations
- Economics

The conference will be held in conjunction with a separate conference on advanced materials. Therefore, please be careful to submit your abstract to the correct (first) event on the website.

Further information can be obtained from Lawry Doctors at l.doctors@unsw.edu.au

Pacific 2017 IMC

The Pacific 2017 International Maritime Conference organised by The Royal Institution of Naval Architects, Institute of Marine Engineering, Science and Technology and Engineers Australia, will coincide with the prestigious Royal Australian Navy Sea Power Conference and the Pacific 2017 International Maritime Exposition which is organised by Industry Defence and Security Australia Limited. These will be held in Sydney on 3–5 October 2017 and Pacific 2017 will be held at the brand-new International Exhibition Centre at Darling Harbour.

The IMC conference program will be conducted in two streams of parallel sessions and will cover the following topics:

- Commercial ship technology
- Naval ship technology
- Submarine technology
- Commercial ships operations
- Maritime safety
- Maritime environment protection
- Offshore resource industry

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

Keynote speakers at the conference include:

- Dr David Kershaw, Chief of Maritime Division, Defence Science and Technology Group — Department of Defence;
- Dr Margaret Law, Submarine Capability and Strategy Manager, ASC Pty Ltd; and
- Paddy Fitzpatrick, Director General Future Frigates, Capability Acquisition and Sustainment Group — Department of Defence.

Registration is now available. Full details of registration costs and entitlements are available on the conference website. For further information regarding the Pacific 2017 International Maritime Conference contact the Conference Secretariat by phone on (03) 5282 0543, fax (03) 5282 4455, email imc@amda.com.au or visit the website www.pacific2017.com.au/international-maritime-conference.

Basic Dry Dock Training Course

DM Consulting's Basic Dry Dock Training is a four-day course which covers the fundamentals and calculations of dry docking. The next course in Australia will be held on 7–10 November 2016, in Australia, with location to be advised.

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 dockmasters, 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. "The course was excellent, straight forward and comprehensive. Instruction was great, expected 'death-by-PowerPoint, but was pleasantly surprised. I am better acquainted with dry dock basics after the course and can trust the accuracy of the training based on the extensive experience of the instructors. Thank you! Very informative, very thorough."

Topics to be covered include:

- Basic dry docking 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.

HPYD6

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 and 2015 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.

Agreement has been reached between HPYD, SNAME (Chesapeake Section) and Ecole Navale (Innov'Sail) to provide a coordinated rolling three-year program of high-quality yacht technical conferences.

The High Performance Yacht Design Committee has announced that HPYD6 will take place in Auckland, NZ, on 11–14 March 2018 during the stopover of the Volvo Ocean Race.

Papers are invited on all topics relating to the design of high-performance power and sailing yachts, including:

- structural design and analysis;
- performance prediction;
- wind-tunnel and towing-tank testing;
- computational methods;
- hull and appendage design; and
- regulations and rating rules.

Abstracts were due by 22 May and final papers are due by 1 November. There may be an extension of time for abstracts so, if you would like to present a paper but have not yet submitted an abstract, then email technical@hpyd.org.nz as soon as possible.

For more information about the format of the abstract or paper, please email technical@hpyd.org.nz.

All papers are reviewed by an international technical panel; see www.hpyd.org.nz for more details.

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; for registrations: registrations@hpyd.org.nz; or for sponsorship opportunities: sponsorship@hpyd.org.nz



The Royal Institution of
Naval Architects



ENGINEERS
AUSTRALIA

PACIFIC 2017 International Maritime Conference

International Convention Centre Sydney, Australia

3-5 October 2017

REGISTRATION NOW OPEN



Organised by The Royal Institution of Naval Architects, Institute of Marine Engineering, Science & Technology and Engineers Australia, the **Pacific 2017 International Maritime Conference** will coincide with the prestigious Royal Australian Navy Sea Power Conference and the **PACIFIC 2017** International Maritime Exposition which is organised by Industry Defence and Security Australia Limited.

The conference program will be conducted in two streams of parallel sessions and will cover the following topics:

- Commercial Ship Technology
- Submarine Technology
- Maritime Safety
- Offshore Resource Industry
- Naval Ship Technology
- Commercial Ships Operations
- Maritime Environment Protection



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

An impressive list of Keynote Speakers has been assembled for the conference program:

- **Dr David Kershaw** *Chief of Maritime Division*
Defence Science and Technology Group - Department of Defence
- **Dr Margaret Law** *Submarine Capability and Strategy Manager*
ASC Pty Ltd
- **Mr Paddy Fitzpatrick** *Director General Future Frigates*
Capability Acquisition and Sustainment Group - Department of Defence

For further information and to register

<http://www.pacific2017.com.au/international-maritime-conference/>



For further information contact the **PACIFIC 2017** International Maritime Conference Secretariat:

PO Box 4095, Geelong VIC AUSTRALIA 3220 P: +61 (0)3 5282 0543 F: +61 (0)3 5282 4455 E: imc@amda.com.au

NEWS FROM THE SECTIONS

Victoria

The Victoria Section held its first committee meeting of the year on 8 March, quite aptly on the Yarra waterfront. Major topics discussed included:

RINA Victorian Jobs Network — Call for HR Contacts

Over the past year, the Victoria Section Committee has been approached by a number of both local and international RINA members looking for contacts within Victoria's maritime industry for potential naval architecture and marine engineering work. To best accommodate this growing requirement, the Victoria Section will develop and maintain the 'RINA Victorian Maritime Industry Recruitment Contact Register' which we will provide to job-seekers on request.

The RINA Victoria Recruitment Contact Register will include a list of RINA members, and/or their HR department points of contact (PoC). This list will be sent to job seekers who approach the Victoria Section in search of naval architecture and maritime engineering work, and enable them to make direct contact with appropriate members, HR departments, and/or companies operating in Victoria.

The Victoria Section will maintain this contact register at no cost, and will renew contact details annually. All RINA members and affiliated companies are eligible to join.

For those members or companies who would like to be involved, please email your company name and nominated job-seeker PoC to rina.victoria.section@gmail.com.

Mid-winter Maritime — Social Event, Call for Volunteers

The Victoria Section is calling for volunteers to join a RINA Victoria Mid-Winter Maritime event committee.

Inspired by the NSW Section's SMIX event, the Victoria Section hopes to establish an annual event where RINA members, and Victoria's wider maritime industry, can come together to network, mingle, celebrate, listen to special guest speakers, and have a generally great time all whilst fighting off the Melbourne winter cold.

Please send your details to rina.victoria.section@gmail.com if you'd like to be involved!

Call for Guest Technical and Scientific Speakers

We are always on the lookout for interesting guest speakers for our Technical Presentation Series. If you've finished an exciting project, or wish to do-in (sorry, volunteer) a colleague, please send your details to rina.victoria.section@gmail.com or contact us via our LinkedIn page.

Similarly, if you have any other exciting opportunities or ideas, to share with our members and guests, such as a tour of maritime-related facilities then we'd love to hear from you.

Technical Talks Series — CSIRO Bespoke Engineering Solutions for Ocean Science and Marine Industrial Applications

On 28 February, Mark Underwood, Research Director of CSIRO's Engineering and Technology for Oceans and Atmospheres Business Unit, presented a technical talk to the Victoria Section and IMarEST members as part of

The Australian Naval Architect

our Technical Presentation Series. The presentation was an overview of CSIRO engineering and technology — specifically, bespoke engineering solutions for ocean science and marine industry applications. The presentation was well received and prompted many questions and some interesting discussion amongst those who attended. The Victoria Section would like to thank Mark for a great presentation.

Hugh Torresan

Western Australia

The Western Australia Section had two speakers give presentations at the Northbridge Community Centre during March. The first was by Jeong Hun Ha, who gave a presentation entitled *Full-scale Measurements of Containership Wave-induced Motions and UKC at Port of Fremantle*. The second was by Dr Michael Morris-Thomas, who gave a presentation entitled *Approaches in Quantifying Wave Impact Loads on Offshore Structures*.

Troy Munro

New South Wales

Visit of the Chief Executive of RINA

The Chief Executive of RINA, Trevor Blakeley, visited Sydney on 1–3 March. In a packed program, he:

- Made a presentation to the NSW Section of RINA on *The Route to Chartered Status* on 1 March (see report below).
- Attended the RINA (NSW Section)/IMarEST(NSW and ACT Branches) presentation by Robin Sandell on 1 March (see report below);
- Attended the Annual General Meeting of RINA (NSW Section) on 1 March (see report below).
- Had dinner with the NSW Section Committee and Robin Sandell at the Shanghai Stories restaurant in Chatswood on 1 March.
- Visited UNSW Sydney, had lunch and made a presentation to the naval architecture students and staff on 3 March (see report in the *News from UNSW Sydney* column elsewhere in this issue).



Dinner at Shanghai Stories restaurant
(L to R) Craig Boulton, Alan Taylor, Adrian Broadbent, Phil Helmore, Trevor Blakeley, Robin Sandell and Valerio Corniani
(Photo courtesy Shanghai Stories restaurant)

Annual General Meeting

The NSW Section held its nineteenth AGM on the evening of 1 March, following the March technical presentation in the Harricks Auditorium at Engineers Australia, Chatswood, attended by 10 with Alan Taylor in the chair.

Alan, in his fourth and final Chair's Report, touched on some of the highlights of 2016, which included nine joint technical meetings with the IMarEST (Sydney Branch), with attendances varying between 46 for Nick Browne's presentation on *Australia's New Antarctic vessel*, and 21 for David Lyons' presentation on *Research and Development of Marine Design Rules for Curved Composites Subjected to out-of-plane Loads*. SMIX Bash 2016 was successful and was attended by about 200, including a number of interstate guests.

Adrian Broadbent presented the Treasurer's Report. The EA venue at Chatswood had, as usual, been our major cost for the year. However, with a close watch on the outgoings, we had managed to operate within our budget and have a grand total of \$1086 in the Section account at 28 February 2017. SMIX Bash is funded separately through the SMIX account which currently has a healthy balance, although there are accounts still to be paid, but projections are for a small surplus to enable preliminary arrangements for SMIX Bash 2017.

The present committee members have all agreed to serve for a further term. However, Alan Taylor has served his maximum four-year term as Chairman and has stepped down, with Valerio Corniani stepping up to the position of Chairman. Nate Gale has stepped up to the position of Deputy Chairman, and agreed to chair the SMIX Bash Committee for one further year. The NSW Section is also represented on the Australian Division Council by Craig Boulton as Treasurer.

As a result, the NSW Section Committee for 2017 is as follows:

Chair	Valerio Corniani
Deputy Chair and Assistant Secretary	Nathan Gale
Treasurer	Adrian Broadbent
Secretary	Anne Simpson
Auditor and Nominee to AD Council	Sue-Ellen Jahshan
TM Program Coordinator and Website	Phil Helmore

Members
Craig Boulton
Alan Taylor
Rob Tulk

Committee Meeting

The NSW Section Committee met on 21 March and, other than routine matters, discussed:

- SMIX Bash: Waiting on one sponsorship to arrive before closing off the accounts for 2016; booking to be made for *James Craig* for 7 December; SMIX Bash Committee to arrange a meeting.
- Australian Division Council initiatives discussed.
- Engineers Australia CPD Delivery documents discussed; meeting with EA to be arranged.

The next meeting of the NSW Section Committee is scheduled for 26 May.

The Route to Chartered Membership

Trevor Blakeley, Chief Executive of RINA, gave a presentation on *The Route to Chartered Membership* to a meeting attended by 14 on 1 March in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Trevor began his presentation by saying that becoming a Chartered Member is a two-stage process: becoming a Corporate Member (i.e. FRINA or MRINA), and then registering as a Chartered Engineer (CEng) with the Engineering Council.

Applicants for Corporate Member are required to demonstrate that they have achieved minimum standards of professional competence, are committed to maintaining that professional competence, and will act at all times with professional integrity. Registration as a Chartered Engineer provides an additional, generic qualification which applies to all engineering disciplines. Applicants for registration are required to demonstrate the same standards of professional competence, commitment, etc. as for Corporate Member.

The Engineering Council is the UK's regulatory body for the engineering profession, and maintains a register of Chartered Engineers. RINA is a Licensed and Nominated body of the Engineering Council and can therefore place Corporate Members on the CEng Register.

From the above, it should be apparent that Chartered Membership of RINA is equivalent to election as a Corporate Member plus Registration as a Chartered Engineer (e.g. MRINA CEng)

 **BMT** Design & Technology

bmttdt.com.au

Trusted. Independent. Expert Engineering.

From concept to disposal, we offer impartial advice to help you manage complex platforms and system issues with confidence.



Maritime Engineering | Risk & Safety Management | Training Courses | Vessel Surveying | Asset Management | Business Case Services

Application for registration as CEng may be made with the application for Corporate Membership, or subsequent to election. Members applying for registration after election are required to submit an updated application form and Professional Review Report.

Under a Memorandum of Understanding which RINA has with Engineers Australia (EA), Corporate Membership of Engineers Australia entitles you to immediate Corporate Membership of RINA. The MOU also recognises that registration as CEng with the Engineering Council is equivalent to registration as CPEng with Engineers Australia.

Milestones

Milestones along the route to Chartered Membership are

- Academic qualifications
- Professional review (which comprises both a report and an interview)

Academic Qualifications

The exemplifying academic qualification in Australia is a four-year accredited engineering degree (or, in the UK, an accredited integrated MEng degree or an accredited BEng degree plus an appropriate accredited master's degree). Applicants with this qualification follow the standard route to Chartered Member.

However, there are two alternative routes for those who do not meet this requirement:

- **Individual Route:** Applicants whose qualifications meet the exemplifying standards of knowledge and understanding, but were gained through academic course(s) which are not accredited by the Engineering Council, may provide documentary evidence of the content of the course(s), obtained from the university, i.e. transcript of studies, course syllabus and abstract of the final year project.
- **Extended Professional Review Report Route:** Applicants who do not have the exemplifying academic qualification for CEng in full or in part, but who can offer experience in lieu of formal academic qualification, may apply through the Extended Professional Review Report Route, by demonstrating that they have achieved the same level of underpinning knowledge and understanding as a candidate with the exemplifying academic qualification.

Professional Competence

Chartered Members must show that they are professionally competent by way of their education, training and experience to:

- use a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology;
- apply appropriate theoretical and practical methods to the analysis of engineering problems;
- provide technical and commercial leadership;
- demonstrate effective interpersonal skills; and
- demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment.

The standard of professional competence required for registration as CEng is defined by a number of generic,

high-level competencies, i.e. applicable to all engineering disciplines. It is difficult to demonstrate in the Professional Review Report that these competences have been achieved. RINA has therefore mapped these generic competences into 34 specific Professional Development Objectives relevant to the activities of naval architects, and it is easier to show competence meeting these.

The Professional Development Objectives cover activities in design, engineering practice, and management, and set the required level of ability for each Objective, i.e.

- Having knowledge or being aware of an activity's existence and the reason for it.
- Having understanding of the reason for an activity and being familiar with how it should be carried out.
- Having the skill to be able to carry out an activity competently and without further guidance.

The Professional Development Objectives are listed in the Initial Professional Development (IPD) Logbook available on the RINA website. If you record various items as you go then, when it comes time for your application, you will be able to refer to the IPD logbook to flesh out your documentation. The IPD logbook itself does not have to be submitted, but is an invaluable *aide memoire* for the application.

Application

There are four parts to the application for corporate membership and CEng:

- Application Form
- Documentary evidence of academic qualification
- Professional Review Report
- Supporting information

There are twenty members of RINA's Membership Committee, and they meet five times per year, and consider about 100 applications each time.

Professional Review

There are two parts to the Professional Review: the Report, and the Interview. The Report (only) is required for Corporate Membership, but the Interview is required by the Engineering Council for CEng registration.

Report

There is no prescribed format for the Report, but the following structure is recommended:

Part 1. *Introduction*

A summary of your career to date, i.e. dates, company/organisation, position, and nature of employment.

Part 2. *Training and Experience*

Activities which have contributed directly to your professional development, e.g.

- Nature of the activity, e.g. purpose, technical content, etc.
- Duration of the activity, e.g. start/completion, accumulated time.
- Resources involved, e.g. manpower, financial, etc.
- Personal involvement and level of responsibility, e.g. who you were accountable to, number of staff responsible to you.

- How the activity contributed to achieving your professional development objectives, e.g. the knowledge, understanding and skills gained, etc.

Part 3. Professional Activities

Activities which have contributed indirectly to your professional development, e.g.

- Attendance at training courses and conferences.
- Preparation and development, e.g. CPD Plan.

Interview

The interview will be by a panel of two or three Chartered Members who have been trained and qualified to conduct interviews. The venue will be as close to your work or home as possible, depending on who is on the interview panel. It may require to be conducted via Skype. The duration may vary significantly from, say, 10 minutes to 45 minutes – do not read anything into the time!

The interview will assess the following:

- Competence.
- Level of responsibility.
- Professional judgement.
- Communication and presentation skills.
- Role and responsibility of the engineer in society.
- Commitment to CPD

Outcome

The outcome of the interview will be either a Successful or Unsuccessful report by the panel to the Membership Committee, i.e. Recommended/Not Recommended for registration. If the Panel does recommend registration, then you are home and hosed, and will be informed by the Membership Committee that you are entitled to use the post-nominals MRINA (or FRINA if that is what you applied for) and CEng.

If the Panel does not recommend registration, then you will be informed and advised of the areas where the requirement for professional competence was not demonstrated. The Membership Committee will not set a time for re-application, since that will depend on how long it takes to fill in the professional competence gap(s).

An applicant has the right of appeal against the decision of the Interview Panel, but such an appeal will normally only be heard where additional information not previously available to the Membership Committee can be provided, or where the applicant can demonstrate that he/she did not receive a fair hearing at the interview.

However, where the Membership Committee does not accept the decision of the Panel, it will ask the applicant to undertake another Interview.

Further Information

Further information on election as a Corporate Member and registration as CEng can be found in the *Guidance Notes on Corporate/Chartered Membership* on the RINA website at <https://www.rina.org.uk/membership.html>. You may also find useful the Chartered Membership in the Australian Division — Q&A available on the Australian Division's page on the website. If the documents there cannot answer your queries, then please contact RINA's Professional Affairs Manager, Lisa Staples, by phone +44-20-7235 4622 or email proaffairs@rina.org.uk.

May 2017

Questions

The Chief Executive fielded a number of interesting questions.

A resume is not a replacement for the Professional Review Report, although it may form the basis of the Report. You may include your resume as supporting documentation, but the Professional Review Report is required.

There is no minimum (or maximum) time before you may apply for Chartered Member, but experience shows that four or more years' experience after (first) graduation is the norm. If you have achieved the required professional competence, then you can apply.

The vote of thanks was proposed by Alan Taylor.

Making Ferries More Useful and More Efficient

Robin Sandell, Principal of Sandell Consulting, gave a presentation on *Making Ferries More Useful and more Efficient* to a joint meeting with the IMarEST attended by 34 on 1 March in the Harricks Auditorium at Engineers Australia, Chatswood.

Robin's presentation is written up elsewhere in this issue of *The ANA*.

The vote of thanks was proposed, and the certificate and "thank you" bottle of wine presented, by the Chief Executive of RINA, Trevor Blakeley.



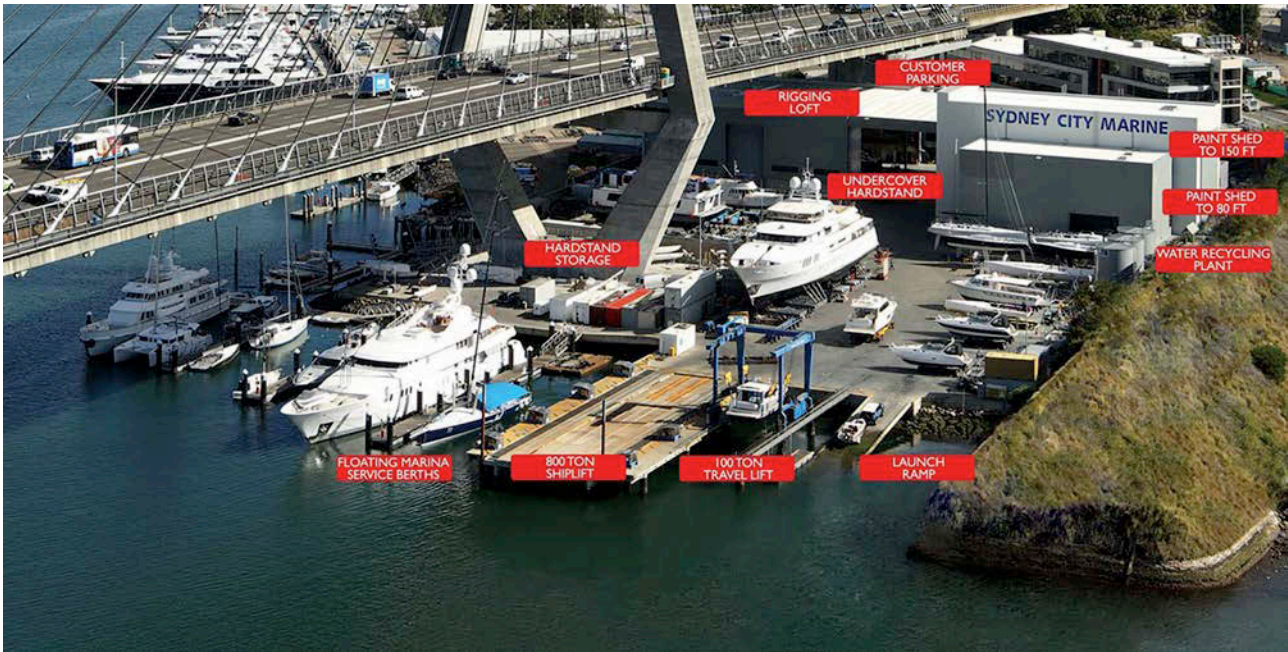
Robin Sandell (L) with his Certificate of Appreciation presented by Trevor Blakeley
(Photo Phil Helmore)

Shipyards Adapting to Changing Markets

Brenton Fischer, Director and General Manager at Sydney City Marine, gave a presentation on *Shipyards Adapting to Changing Markets* to a joint meeting with the IMarEST attended by 19 on 3 May in the auditorium at Royal Prince Edward Yacht Club, 160 Wolseley Rd, Point Piper.

Introduction

Brenton began his presentation by giving a brief summary of his career to date, with a background in computer engineering and construction project management, and a



Aerial view of Sydney City Marine
(Photo courtesy SCM)

degree in business, not to mention his grandfather, well-known yachtsman, Syd Fischer.

Sydney City Marine (SCM) was purpose built under the western end of the Anzac Bridge in Sydney, completed in 2009, and subsequently purchased by the Fischer Group in 2011. The site comprises 24 000 m² of leased waterfront land/water area. It has floating marina berths for vessels of up to 800 t, an 800 t shiplift, a 600 t ship transporter, a 100 t Travelift, a 47 t submersible trailer, a 45 t boat transporter, an open-air hardstand, an undercover hardstand, a 27×9 m painting shed and a 40×12 m painting shed. The heaviest lift to date on the shiplift has been 768 t!

Here Brenton said that there are many challenges faced by a shipyard in the modern (read changing) environment. However, he would concentrate on half a dozen of the most-important challenges.

Challenge 1

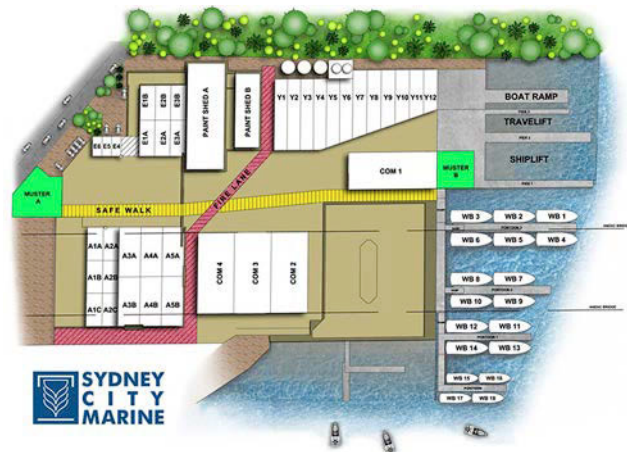
The yard services sailing yachts (including catamarans), power boats, commercial vessels and superyachts. Here Brenton asked the question “Can they all fit under one roof?” The answer is yes, but only under special circumstances, and those circumstances involve separation. You have to keep the black vessels (read commercial) away from the white (read recreational) craft. Separation can be achieved with careful planning and layout. It is difficult but not impossible, and works best with separate areas for each type of vessel.

Challenge 2

Understanding the motivations and competing demands of the various types of customers.

Yacht owners are *extremely* cost conscious, demand a quick turn-around, consider that cost generally outweighs time, and demand a high level of quality and a *very high* level of communication.

Power-boat owners are less cost conscious, happy to pay more for quality, more flexible with timeframes, and demand a good level of communication



Layout of Sydney City Marine
(Drawing courtesy SCM)

Commercial operators are *much less* cost conscious, happy to pay more for quality, consider that timeframes are imperative and that time matters more than cost, and demand a high level of communication and reporting.

Superyacht owners are a mix of all the above; they are cost conscious, happy to pay more for quality, consider that timeframes are imperative, and demand a *very high* level of communication and reporting.

Challenge 3

How do you structure the business to deal with these competing demands?

At SCM, the General Manager answers direct to the Board. The General Manager has four managers answering to him; The Shipwright manager, the Recreational Manager, the Commercial Manager, and the Engineering Manager.

Challenge 4

How do you identify and exploit new opportunities?

This can be done using a combination of

- listening to the market;
- forming strategic alliances with key suppliers;

- investing in and adapting facilities to cater for a new market;
- recruiting appropriate staff;
- conducting a complete process review; and
- raising your standards to a level that matches the new market.

Listening to the Market

SCM was contacted in late 2013 and asked if they were capable of docking a Damen 2411 tug. After conducting a feasibility study, it was found that the localised loading on the shiplift platform exceeded the certified limit of 24.5 t/m MDL (maximum design load).

SCM then contacted Damen in the Netherlands and asked for their opinion and advice on whether anything could be done to overcome the issue.

Forming Partnerships

In 2014, the Damen regional service manager contacted SCM and organised to inspect the facility. Damen were already looking at new docking options in Australia, particularly on the lower east coast, given the limited availability at that time. They identified SCM as an excellent opportunity to dock this type of vessel.

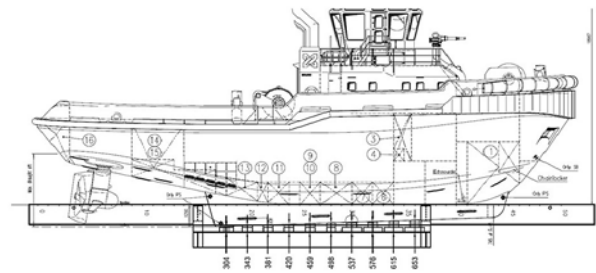
Damen proposed that SCM investigate the feasibility of constructing a purpose-built cradle for tugs to overcome the limitations of the shiplift's per-meter load limit. They put SCM in contact with Damen's research-and-development engineers in the Netherlands to come up with a solution.

In June 2016, SCM and Damen signed a Memorandum of Understanding (MoU) which detailed how they would work together. The basis of the MoU is for SCM to provide the facilities and workforce to undertake the dockings, and Damen to provide parts and specialist assistance for the dockings.

Adapting the Facilities

Under the MoU, Damen proposed a special cradle which would pick up the highly-concentrated load from the tug's keel line and spread the load over the length of the shiplift platform via long support rails.

Damen completed the design calculations and conducted a finite-element analysis to ensure that the von Mises stresses were kept below allowable levels in all parts of the cradle and supporting structure.



Tug on cradle
(Drawing courtesy SCM)

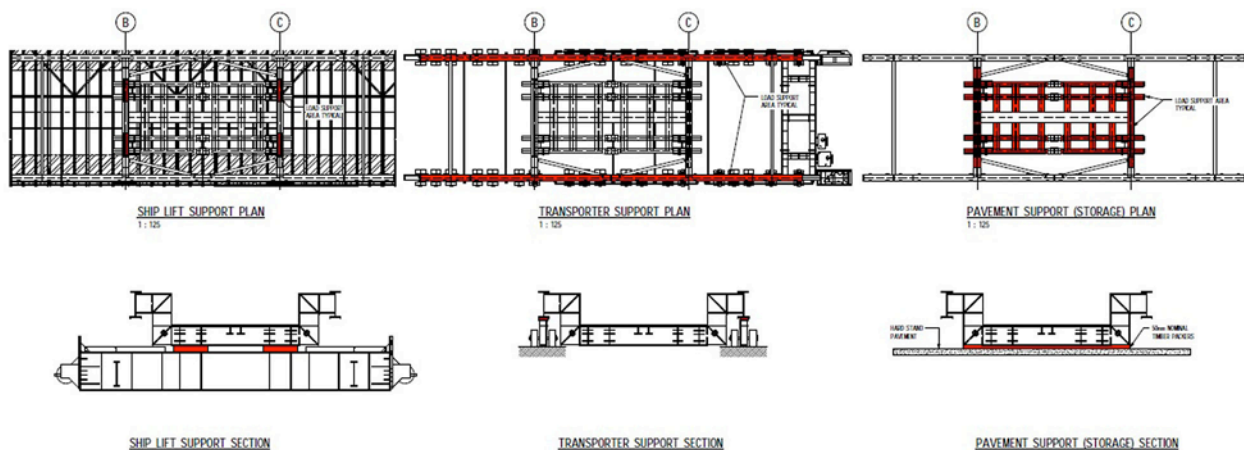
The cradle was built in Brisbane. However, the design was modified part-way through construction so that it could accommodate a wider variety of vessels. The completed cradle was trucked to Sydney under police escort, as it was 6 m wide and required two traffic lanes.



SCM's completed cradle
(Photo courtesy SCM)

Conducting a Process Review

In early 2016 a contractor-approval audit process was commenced, and quickly identified gaps between what SCM did and what the contractors expected. SCM currently had ISO 9001:2008 accreditation but, by mid-2016, obtained accreditation to ISO 9001:2016, ISO 14001:2015 and AS 4801:2001 by Lloyds Register Quality Assurance. In late 2016 the contractor-approval audit was finalised and approval granted.



How it all works
(Drawing courtesy SCM)

Raising Standards

As part of the process review, significant changes were made to the day-to-day operations of the business. Principally, construction rules were imposed on site with a requirement for personal protective equipment to be worn by visitors, contractors and staff.

The Result

The result of all of this activity was the first docking of a large tug, *Svitzer Warang*, at SCM in early 2017.



Svitzer Warang on the shiplift
(Photo courtesy SCM)



Svitzer Warang on the transporter
(Photo courtesy SCM)



Svitzer Warang in the main paint shop
(Photo courtesy SCM)



Svitzer Warang back in the water
(Photo courtesy SCM)

Challenge 6

Brenton's final challenge was a combination of items:

- re-educating existing customers to the new access requirements of the facility;
- retaining and training staff throughout the process;
- filling a shortage of skilled labour;
- managing the peaks and troughs of work flow;
- managing variations and associated spikes in labour demand; and
- overcoming an apparent reputation for price gouging in the marine industry.

A Winning Formula?

There really isn't one. Every vessel is different. Every owner or operator is different. Every scope is different and variable. Each customer and vessel has to be treated on an individual basis.

However, there has been a definite shift in SCM's overall revenue break-up, as can be seen in the accompanying table.

Revenue %	2014	2015	2016	2017**
Yachts	35%	34%	20%	16%
Power	30%	31%	44%	39%
Commercial	35%	35%	36%	45%
Total	100%	100%	100%	100%

SCM revenue break-up
(Table courtesy SCM)

Yachting

Having a well-known yachting grandfather, it is unsurprising that Brenton has inherited a love of yachting. In 2014 he skippered the Trans-Pacific 52, *Ragamuffin 52*, in the Sydney–Coffs Harbour Yacht Race, and crewed on the super-maxi, *Ragamuffin 100*, in the Sydney–Hobart Yacht Race. In 2015 he skippered *Ragamuffin 52* in the Sydney–Hobart Yacht Race, and in 2016 skippered her in the Sydney–Gold Coast Yacht race and the Sydney–Hobart Yacht Race.

Here Brenton showed a video of *Ragamuffin 100* hitting 38 kn in the 2016 Sydney–Hobart Yacht Race. For aficionados, the video is available on YouTube at <https://www.youtube.com/watch?v=TsJewTrY5v0>.

Summary

The presentation covered the facilities which are available at Sydney City Marine, and gave insights into how a modern shipyard has to adapt to cater for the changing marketplace.



Ragamuffin 52 and crew
(Photo courtesy SCM)



Ragamuffin 100 and Ragamuffin 52 at Sydney City Marine
(Photo courtesy SCM)

Questions

Question time was lengthy and elicited some further interesting points.

Looking back at the revenue break-up, the proportion of the yard's work on yachts is decreasing, but is that just because the proportion of commercial work is increasing but the amount of yacht work is steady? An interesting thought. Smaller yards tend to be emotional about their business, but they run SCM professionally and try to remove the emotion. However, they are finding it difficult to attract yachts to the yard, and yacht work has actually declined.

The original design of the cradle was just for Damen vessels. However, the re-design mid-way through construction has enabled them to subsequently dock an older Barnes and Fleck design which was built at Carrington Slipways in Newcastle as well as a 100 ft (30 m) super-maxi yacht.

The process review involved a big culture change at the yard. They have a database of circa 4000 visitors, contractors, owners, etc., and everyone was kept informed of the changes on the way; i.e. progressively, they did not come as shocks.

It can be difficult to hire skilled tradespeople. However, they have a structured training program in place for engineering, shipwrights and painters. They tend to have about six or seven qualified tradespeople permanently, and they can manage the peaks and troughs of workload.

They handle a range of materials of construction: steel, aluminium, composite, carbon fibre and timber, and their shipwrights have (and *have* to have) a wide range of skills. Their foreman knows a lot about carbon fibre and managing "lamination engineers", but their apprentices gain experience in all materials.

SCM can handle catamaran beams of up to 14 m. The widest catamaran which they have docked on the shiplift is *Magistic*, and her sponsons hang out over the winches. On the Travelift, the widest beam they can handle is 6.9 m. SCM is interested in Defence work, and is in the process of obtaining approval for the facility.

SCM experienced a lot of resistance from their contractors to the new rules for entry to the yard, wearing PPE, etc.

Noise from the facility is an issue. SCM actually has EPA approval to work 24/7. However, they have a concern for their neighbours and try not to annoy them and so attract the attention of the authorities. They *could* sand or water blast on Sundays, but would never do that; i.e. they have self-imposed restrictions.

The vote of thanks was proposed, and the certificate and "thank you" bottle of wine presented, by Bill Bixley, who said that he has been to SCM both as an owner's representative and as a paying customer, can vouch for the high quality of the work they do there, and asked Brenton to keep it up! The vote was carried with acclamation.

ASO Marine Consultants Pty Ltd

<p>Naval Architecture Structural Design Finite Element Analysis Classification Submission</p>	<p>Loadouts Full Production Drawings Plan Approval Design Verification</p>
---	--

ASO Marine Consultants Pty Ltd 79 Victoria Ave, Chatswood NSW 2067 ph: +612 9882 3844 fax: +612 9882 3284
www.asomarine.com.au

Venues for Technical Presentations

Due to some wires crossed with Engineers Australia, they did not make bookings for our technical presentations in the Harricks Auditorium past March. As a result, when we rocked up for the April presentation, the Geotechnical Society was already ensconced in the Harricks Auditorium, and we had to postpone our meeting.

The April meeting was subsequently re-scheduled for May, and we used the auditorium at the Royal Prince Edward Yacht Club (RPEYC) at Point Piper as the venue.

RPEYC has a number of advantages; the catering was similar to that at Engineers Australia, with sandwiches, party pies and sausage rolls, but included pastizzi and a cheese plate (a nice touch!), and there is a bar opening onto the auditorium.

Traffic on New South Head Rd at 1730–1800 is slow, but most people were able to park cars closer to the venue at Point Piper than they could at Chatswood.

Due to the crossed wires, our subsequent technical presentations for this year will use a number of venues, as follows:

7 June	UNSW Sydney, Kensington
5 July	Engineers Australia, Chatswood
2 August	Engineers Australia, Chatswood
6 September	RPEYC, Point Piper
4 October	No meeting; Pacific 2017 events

For authors and titles of presentations, see the *Coming Events* section.

Phil Helmore

FROM THE CROWS NEST

LNG Bunkering Commences in Australia

The first Australian commercial LNG bunkering was completed in WA's north-west on 23 January 2017 by EVOL LNG for Woodside.

Under an agreement with Woodside, EVOL LNG refuelled the platform supply vessel, *Siem Thiima*, on 23 January at King Bay Supply Base near Dampier. Business Manager, Nick Rea, sees it as just the beginning. "Our decision to enter the LNG bunkering market is part of a long-term strategy which recognizes environmental and economic sustainability of LNG as a transport fuel", he said. "It also recognises that the LNG marine fuel market is still in development, so the fact that EVOL has over 15 years' experience in distributing LNG means that we saw an opportunity to provide a suite of services that perhaps others can't.

"EVOL can safely manage the bunkering process and provide key services, such as training in the safe handling of LNG, enabling our customers to confidently adopt LNG as a marine fuel. With growing demand for lower-emission fuels over the past decade, we've seen the number of LNG-fuelled ships in operation worldwide increase steadily from a handful to more than 75, with an additional 80 expected to be built in the next three years."

Growth had largely been driven by International Maritime Organisation (IMO) regulations and the introduction of emission-control areas in Europe and North America, said Rea. In addition, China has introduced emission-control areas around its three major ports.

"Interest in LNG as a marine fuel is growing, especially since the IMO announced that it would introduce a global marine fuel sulphur limit of 0.5 per cent from 2020," he said. It's certainly an offering that we'd like to expand, particularly as truck-to-ship LNG bunkering can be achieved relatively inexpensively with existing logistics assets. If the interest is there, then EVOL LNG will obtain licences from other major Australian and regional WA ports to conduct LNG bunkering operations, and look at investing in infrastructure to meet the market's needs."

Mr Rea said that EVOL LNG would be able to supply Fremantle customers with LNG at a price competitive with low-sulphur marine diesel and would be able to refuel ships at up to 45 t/h, which is comparable to traditional bunker fuels.

The Australian Naval Architect

EVOL LNG secured its second major Australian port bunkering license from Pilbara Ports Authority, permitting LNG bunkering at King Bay Supply Base and transport through the Port of Dampier. This followed its first license from Fremantle Ports in July last year.

Maritime Global News, 21 February 2017

Rahola's Doctoral Thesis

Jaakko Rahola's thesis for the degree of Doctor of Technology, *The Judging of the Stability of Ships and the Determination of the Minimum Amount of Stability — Especially Considering the Vessels Navigating Finnish Waters*, was accepted on 26 May 1939, by the Technical University of Finland, later known as Helsinki University of Technology (HUT, or TKK in Finnish), and finally merged to Aalto University since 2010.

The objective for this doctoral dissertation was to find a method of estimating the stability of ships with sufficient accuracy and for determining the minimum stability values, especially in Finnish waters. While working on his dissertation, Rahola conducted research both in Finland and abroad, in Vienna, in Berlin and in Hamburg, and finally in London. At that time there was no internet so, in addition to some experimental research, a considerable part of this work took place by collecting details of capsizing disasters from both official and private sources, including libraries abroad.

The choice of the topic of his dissertation was prompted by the disasters that had taken place in Finnish waters. The waters navigated by Finnish ships are classified as open sea, waters sheltered by the archipelago, and inland waters. Since stability theory did at that time not yet make sufficient allowance for swell, oceangoing ships were examined by means of statistics. The stability of ships that had capsized was analysed and compared to the data with those of ships with a long accident-free history.

The practical finding of this doctoral dissertation: the minimum amount of stability sufficient for a ship expressed as curves. Upper curve: the static stability curve, i.e. the righting moment as a function of the angle of heel. Lower curve: the dynamic stability curve obtained by integration from the above. Note that the values for the lever of ships of different sizes are the same, as a result of which the

values of the righting moment are in direct proportion to the displacement. Rahola applied his theoretical perspective to ships in inland and coastal waters, where the swell is much smaller. He had heeling and yawing tests made using a heeling plotter of his own design.

The doctoral dissertation came off the press in April 1939. After the war, Rahola's method for judging the stability of ships soon spread around the world and the edition quickly sold out. A separate edition was made in the Soviet Union for which, in according to local custom, no royalties were paid.

The strength of the dissertation lies in the fact that, although its argumentation is founded on a sound command of theory, the result is presented in such a way that a ship's officer, for example, can apply it in practice. This method, known as "The Rahola Criterion", was the first of its kind to be widely adopted internationally. Shipbuilding engineers the world over became familiar with the name of Rahola. He himself was surprised that his method remained in widespread use for so long, that it has been so frequently quoted by theoreticians and used in practical shipbuilding and seafaring right up to the present day. Subsequent advances on it do not conflict with it; they are mere supplements and further developments. The vast improvements in the knowledge and theory of weather and swell conditions at sea have, in particular, meant that the theory for judging stability can now be applied even in extreme conditions.

When the stability regulations were being honed by the predecessor of the International Maritime Organisation (IMO), formerly known as the Inter-Governmental Maritime Consultative Organization (IMCO), in 1966, the name of Rahola kept cropping up, and the German engineers, among others, had told the Finnish delegate they were amazed that Rahola had arrived at such a successful criterion with the material available to him at the time. With far more extensive data at their disposal, they had tried to come up with a better criterion, but they had always arrived at one the same as Rahola's.

These IMO regulations, the wording — but not the content — of which was also influenced by a friend of Rahola's, Professor C.W. Prohaska from Denmark, are still in force. To mark the 40th anniversary of the Rahola Criterion in 1979, the Australian Branch [*as it was then* — Ed.] of the Royal Institution of Naval Architects published a 60-page article by Robert Herd on the development of the stability criterion for ships. The name of the publication was *Rahola — 40 Years*

On, and at the end, Herd sums up by saying:

"The world of ship design owes a great deal to the work of Jaakko Rahola. Much work had been done prior to Rahola, but I feel that if he achieved nothing else, he drew together the threads of earlier work, examined various ways of setting up criteria and concluded that the study of sufficiency of stability based on causality analysis held out most promise of success."

An article published in the RINA yearbook for 1998, and especially the discussion it provoked, still underlined the significance of the ground-breaking work done by Jaakko Rahola. The stability criterion of Rahola made him internationally renowned. Although it has not been able to prevent all disasters at sea, it has, in the space of over 70 years, saved many lives and much property.

Aalto University website

[For many years, the only known copies of Rahola's thesis in Australia were those held by Bob Herd at the Australian Department of Transport (now AMSA), Bill Armstead at the Maritime Services Board of NSW (now RMS), and Noel Riley at Commercial Marine Design. However, it has recently been found to be freely available for download in PDF format on the Aalto University website, see

<https://aaltodoc.aalto.fi/handle/123456789/15149>.

All naval architects should get hold of it, read, mark, learn and inwardly digest its contents for their lasting influence on today's stability criteria.

For those interested, Bob Herd's paper, Rahola — 40 Years On, may be downloaded from the Australian Division's Technical Library at www.rina.org.uk or obtained by contacting The ANA's Technical Editor — Ed.]

Ocius Bluebottle

Ocius has developed a new generation of drone vessels known as unmanned surface vessels (USVs) for industrial, defence and scientific organisations to survey and protect the world's oceans. Called "Bluebottles", after the Australian marine animal which lives at sea and uses its body as a 'sail' to get out of currents, Ocius USVs harvest the energy available at sea; from the sun, the wind and the waves. The result is an autonomous data gathering and communications platform which can remain at sea for weeks or months at a time.

Ocius aims to assist friendly governments and offshore



RUBICON
associates

**LOCAL PRESENCE
GLOBAL DELIVERY**

RENEWABLE ENERGY OIL & GAS COMMERCIAL SHIPBUILDING DEFENCE

ENGINEERING PROJECT MANAGEMENT ASSET INTEGRITY MANAGEMENT ADVISORY

WWW.RUBICONASSOCIATES.BIZ

operators make large efficiency gains — to do more with less — at the same time as removing people from harm's way. Ocius Bluebottle USVs offer multiple economic and operational advantages over conventional manned craft:

- continuous coverage;
- wide coverage;
- greatly-reduced capital costs;
- greatly-reduced operational costs (no fuel, food or crew);
- elimination of errors due to human fatigue; and
- removing people and expensive assets from harm's way.

Applications for USVs are myriad and measured in the billions of dollars. Major entities in offshore energy, defence and science are investing heavily in unmanned systems for “dull, dirty or dangerous” operations. Independent industry research estimates the USV market for defence alone to be a staggering US\$3.8 billion by 2020.

Bluebottle USVs have greater power, payload and performance when compared to known competitors and are able to navigate freely and indefinitely across the world's oceans. Already Ocius is working with two major private-sector partners to develop USVs capable of undertaking specific high-value applications in hydrography and defence.

The team at Ocius, under the direction of Robert Dane (of *Solar Sailor* fame) has been working patiently and intensely at UNSW Sydney on this product for the past five years. They are focusing all of their experience, networks and love of the sea to create revolutionary Australian technology fit for the world's oceans.

The video of trials of *Bruce*, the latest version of the Bluebottle, is available at <http://ocius.com.au/usvs/bluebottle/>

For further details, see the Ocius website, <http://ocius.com.au/usvs/>.

Ocius website

Team Britannia

Team Britannia is a multi-million pound British bid to design and build the fastest and most fuel-efficient semi-wave-slicing powerboat to circumnavigate the globe for the much-coveted Union Internationale motonautique (UIM) world record, currently held by the New Zealander Pete Bethune in *Earthrace* at 60 days 23 hours 49 minutes. Team Britannia expects to cut about seven days from this record. The UIM requires that, for a recognised circumnavigation, the craft must pass through the Suez and Panama Canals, cross the Tropic of Cancer and the Equator and must start and finish the journey in the same place. Team Britannia's proposed route, which has been approved by the UIM, starts and ends at Gibraltar, and calls at Puerto Rico, Manzanillo, Honolulu, Guam, Singapore, Oman and Malta for fuel.

The boat is a completely new design from Professor Bob Cripps, former Technical Director of VT Halmatic. It has been designed in the UK and is being constructed by the Aluminium Boatbuilding Company on Hayling Island, Portsmouth, in marine-grade aluminium. The vessel will be powered by a revolutionary fuel emulsion, a mixture of diesel, water and emulsifying agent from Clean Fuel Ltd. This will reduce harmful emissions such as particulate matter

and nitrogen dioxide. The boat will also showcase nearly a dozen leading marine companies, which are supporting the project with their expertise and equipment.

Principal particulars of the vessel are

Length OA	80 ft (24.32 m)
Beam	19 ft (5.79 m)
Draft	2.50 ft (0.762 m)
Displacement	20 t
Crew	20 (12 onboard with 5 rotating on and off the boat plus 3 shore based)
Engines	2×customised Fiat Power Train C13 500, 6 cylinders each 373 kW @ 2000 rpm
Propulsion	2×Castoldi turbo-drive 490 HC waterjets
Fuel	Emulsified diesel
Range	4000 n miles
Construction	Marine-grade aluminium
Hull thickness	8–10 mm

The vessel was due to be launched at the end of March 2017, but there appears to be no announcement of this happening on the Team Britannia website. However, the website still states that the record bid will commence in October 2017 from Europa Point, Gibraltar.

For further details, see the Team Britannia website, www.teambritannia.co.uk.

Team Britannia website



Team Britannia
(Image from Team Britannia website)

GENERAL NEWS

NUSHIP *Hobart* completes sea acceptance trials

The RAN's first air-warfare destroyer, *Hobart*, returned to port in Adelaide on 6 March after the successful completion of sea acceptance trials.

Minister for Defence Industry, the Hon Christopher Pyne MP, congratulated the Air Warfare Destroyer Alliance partners for their combined efforts.

"The success of *Hobart*'s sea acceptance trials can be attributed to the joint efforts of the Commonwealth, ASC Shipbuilding, Raytheon Australia, Navantia, and 200 plus crew on board," Minister Pyne said.

"During the 21 days at sea, *Hobart*'s combat system and platform systems were put to the test, proving they can perform the expected functions they were designed for in the maritime environment.

"Assisting in the testing of *Hobart*'s sensors and communications systems, the Royal Australian Air Force Hornet and P-8A Poseidon aircraft conducted low-level, fast-flying operations over the Gulf of St Vincent.

"*Hobart*'s sea acceptance trials were also supported by Royal Australian Navy ships and helicopters in various simulated scenarios, demonstrating the capability of the ship and its ability to collaborate with other military assets.

"This achievement is testament to the Commonwealth's commitment to delivering ships to the standard which the Navy requires," he said.

Austal-built Patrol Boat Delivered to RAN

The first of two Cape-class patrol boats for the Royal Australian Navy, the Australian Defence Vessel (ADV) *Cape Fourcroy*, was delivered from Austal's Henderson shipyard in Western Australia on 24 April.

The two 58 m patrol vessels are to be chartered by the Commonwealth of Australia on behalf of the Royal Australian Navy, which awarded the \$63 million contract to Austal in December 2015.

Austal's Chief Executive Officer, David Singleton, said that the delivery highlights Austal's proven capability to design and build defence vessels — a record which has seen the company build 72 patrol boats for domestic and international markets before this delivery.

"This latest Cape-class ship, for the Royal Australian Navy, further strengthens Austal's position as the only patrol boat designer and builder in Australia and a major world-class exporter of this type of vessel. The delivery of the Cape-class vessel clearly shows Austal's unrivalled ability to design and construct defence vessels on-time and on-budget," Mr Singleton said.

"Austal has been building patrol boats for over 20 years and we look forward to more work in the future. This includes the opportunity to design and build 12 new offshore patrol vessels for the Royal Australian Navy with our design partner Fassmer in a continuous shipbuilding initiative being driven by the Government," he said.

Austal currently has an order book of 20 patrol vessels to be delivered over the next four years, and has successfully competed in a number of overseas markets. Austal is currently proposing variations of its Bay-class, Cape-class and Guardian-class patrol boats for customers in the Middle East and Asia, and expects this activity to bring further construction work to Australia. Mr Singleton said "Exports derived from national defence programs show the multiplier effect on creating jobs out of Austal's strong and hard-won reputation in overseas markets".



NUSHIP *Hobart* returning to Adelaide on 6 March on completion of sea acceptance trials
(Photo courtesy AWD Alliance)



ADV *Cape Fourcroy* delivery ceremony
(RAN photograph)

Austal Delivers USNS *Yuma*

On 24 April Austal announced that the United States Navy had accepted delivery of USNS *Yuma* (EPF 8) during a ceremony held on board the ship at Austal USA's shipyard in Mobile, Alabama.

USNS *Yuma*, named after the City of Yuma, Arizona, is the eighth Expeditionary Fast Transport (EPF) vessel designed and constructed by Austal for the USN, under a contract for twelve vessels worth in excess of \$US1.9 billion.

Announcing the vessel's delivery, Austal's Chief Executive Officer, David Singleton, said that the EPF program is a clear demonstration of Austal's ability to design, construct and support innovative defence vessels.

"The EPF platform continues to impress both operators and end-users with its unique, multi-mission capabilities and is now leading US Navy and other humanitarian missions, traditionally led by single-purpose logistics vessels," Singleton said.

"USNS *Yuma* is the latest addition to a growing fleet of 'smart ships' that Austal is delivering globally, on-time and on-budget," Singleton added.

The EPF platform provides the USN with a high-speed, intra-theatre transport capability. The 103 m long *Yuma* is an all-aluminium military catamaran capable of transporting troops, vehicles and cargo up to 1200 n miles at an average speed of 35 kn. With a shallow draft, the vessel is designed to operate in austere ports and waterways, providing added flexibility to the USN. The EPF's flight deck can also support flight operations for a wide variety of aircraft, including a CH-53 Super Stallion.

Three Spearhead-class EPF vessels remain under construction at Austal USA, including the future USNS *City of Bismarck* (EPF 9), to be christened in May 2017. Modules for *Burlington* (EPF 10) and *Puerto Rico* (EPF 11) are under construction in Austal's module manufacturing facility.

Cristobal Colon arrives in Sydney

HMA Ships *Darwin*, *Melbourne* and *Parramatta* escorted the Spanish Armada's frigate *Cristobal Colon* into Sydney Harbour on 24 March as part of her role in providing platform and familiarisation training for Australian personnel.

Over the next three months the ship will assist in enabling Royal Australian Navy people to have advance training for Australia's first Aegis-equipped guided missile destroyer, *Hobart*.

The commanding officer designate of *Hobart*, CAPT John Stavridis, said that the opportunity to embark in *Cristobal Colon* presented an opportunity for the Royal Australian Navy to prepare *Hobart* and the navy for the swift effective operation of the destroyers.

"Being able to train with the men and women of *Cristobal Colon* is invaluable, as it will provide knowledge and insights which will complement the extensive training provided as part of the introduction-into-service process," CAPT Stavridis said.

Hobart will be commissioned into service in September this year.



USNS *Yuma* (EPF 8)
(Photo courtesy Austal)



The Spanish frigate *Cristobal Colon* arriving in Sydney on 24 March
(RAN photograph)

muir

SINCE 1968

High quality products, for exceptional projects

Muir offers a comprehensive range of commercial equipment for work boats, including fast ferries, fishing, charter, defence and offshore vessels.

Our range includes anchoring and mooring systems, manufactured in aluminium, bronze, cast steel and stainless steel, and we'll also happily custom design equipment to suit your requirements.

Muir is accredited to Det Norske Veritas Certification and our equipment is tested to all classification societies. **There's so much more to a Muir.**



Muir Australia Head Office:
Tel +61 (0) 3 6229 0600
E sales@muir.com.au

muir.com.au



BUILDING WINCHES FOR OVER 45 YEARS...PROUDLY SUPPORTING AUSTRALIAN NAVAL ARCHITECTS



The Italian FREMM frigate *Carabiniere* recently visited Australia to participate in exercises with the RAN. This type of frigate is one of the contenders for the RAN's future class of nine frigates to be built after 2020 (RAN photograph)

The destroyers are based on the Navantia-designed F-100 frigate and share significant platform similarities with *Cristobal Colon*. The Armada has been operating the class since 2002.

The RAN will embark 40 sailors in *Cristobal Colon* for the duration of her deployment.

During her stay on the east coast, *Cristobal Colon* will take part in two major exercises led by Australia — Sea Explorer and Sea Raider.

The exercises are designed to develop the Navy's joint littoral combat capabilities across the full spectrum of maritime operations and provide realistic scenarios for the crews.

Cristobal Colon initially arrived in Australia in February to take part in Exercise Ocean Explorer off Western Australia.

The exercise was designed to train the fleet in high-end war fighting and involved 13 warships and five aircraft from Australia, Italy, Spain and New Zealand, including HMAS *Darwin*.

The commanding officer of *Darwin*, CMDR Phillip Henry, said that Ocean Explorer had achieved its aim of combining separate naval units into effective fighting task groups.

"Throughout the operation all units were identifying new ways to increase the task group's efficiencies and effectiveness, resulting in a battlefield effect that allowed the task group to punch well above its weight," CMDR Henry said.

Todd Fitzgerald

Future Frigate RFT Released

The \$35 billion Future Frigate project reached a significant milestone on 31 March with the release of the Request for Tender (RFT) to the three shortlisted designers: BAE Systems, Fincantieri and Navantia.

The Minister for Defence Industry, the Hon. Christopher Pyne MP, said that the Future Frigate project is currently the largest frigate shipbuilding program of its kind in the world.

"Today's announcement shows that the Government is on track to begin construction of the Future Frigates in 2020 in Adelaide," Minister Pyne said.

"The release of the RFT is an important part of the Competitive Evaluation Process which will lead to the Government announcing the successful designer for the Future Frigates in 2018."

Minister Pyne said that evaluation of the responses to the Future Frigate RFT would commence later this year.

"Three designers — BAE Systems with the Type 26 Frigate, Fincantieri with the FREMM Frigate, and Navantia with a redesigned F100, have been working with Defence since August 2015 to refine their designs.

"The three shortlisted designers must demonstrate and develop an Australian supply chain to support Australia's future shipbuilding industry, and how they will leverage their local suppliers into global supply chains.

"The Government is committed to maximising Australian industry opportunities and participation, and this project will contribute to building a sustainable Australian shipbuilding workforce."

The Future Frigates are the next generation of naval surface combatants and would conduct more challenging maritime warfare operations in our region including delivering a greater impact on anti-submarine operations.

The frigates will also be equipped with a range of offensive and self-protection systems.

ANAO Report into Future Submarine Program Competitive Evaluation Process

On 28 April the Government welcomed the findings of the Australian National Audit Office (ANAO) report on the Future Submarine Competitive Evaluation Process.

The Minister for Defence Industry said that the ANAO Report has independently verified that Defence effectively designed and implemented a competitive evaluation process to select an international partner for the Future Submarine Program.

“The ANAO’s findings clearly demonstrate that the Competitive Evaluation Process was a fit-for-purpose process and was effectively implemented by Defence,” Minister Pyne said.

“Sovereignty over the operation and sustainment of the Future Submarine was a key consideration, as was the requirement to maximise Australian industry involvement without compromising capability, cost or schedule.”

The ANAO report can be downloaded from www.anao.gov.au/pubs.

Austal Cuts Steel on First Pacific Patrol Boat

On 26 April Austal welcomed the Minister for Defence Industries, the Hon. Christopher Pyne MP, to cut the first steel plate for the first of nineteen Pacific Patrol Boat

Replacement (PPB-R) vessels for the Commonwealth of Australia.

Austal’s CEO, David Singleton, said that the plate-cutting was not only the start of construction for the \$306 million Pacific Patrol Boat Replacement project, but also the Australian Government’s \$89 billion Continuous Naval Shipbuilding Program.

“Austal is incredibly proud to be delivering the Commonwealth’s Pacific Patrol Boat Replacement Project. Austal is Australia’s only design, build and sustainment shipbuilding company.”

“Austal has already delivered the Commonwealth’s entire border patrol capability for over 18 years. The PPB-R project is the largest fleet of steel vessels to be constructed by Austal. This project demonstrates our ability to manage and deliver complex shipbuilding projects for the Australian Government,” Mr Singleton added.

“The Pacific Patrol Boat Replacement project will also provide opportunities for some of the 100 new apprentices to be recruited by Austal over the coming seven months — and ultimately employ up to 207 Austal employees directly.”

“Upwards of 300 more are expected to be employed across our Australian supply chain, meaning that more than 500 people will be engaged with the PPB-R project. We’re building Australia’s sovereign shipbuilding capability, today,” he concluded.

With the project’s Detailed Design Review and plate-cutting both delivered on-schedule, Austal is on track to deliver the first steel PPB-R vessel in late 2018.



MARITIME

**PUT THE FUTURE OF
YOUR FLEET IN SAFE
HANDS**

As your classification partner, our extensive maritime expertise, technical knowledge and regulatory foresight will help to ensure that your fleet meets the demands of the future. Our aim is safety, compliance and optimal operational performance throughout the lifetime of your vessels, benefitting your business and the maritime industry as a whole. With DNV GL your fleet is in safe hands. Can you afford anything else?

[Learn more at \[dnvgl.com/maritime\]\(http://dnvgl.com/maritime\)](http://dnvgl.com/maritime)

SAFER, SMARTER, GREENER

DNV-GL

MATV Completes Sea Trials

Damen has announced that the Royal Australian Navy's new Multi-role Aviation Training Vessel (MATV), MV *Sycamore*, has completed sea trials.

MV *Sycamore* was built at Damen's Vietnam shipyard and she is expected to arrive at her home port of Sydney at the end of May.

In addition to the more traditional elements of sea trials, such as maneuvering and speed tests, *Sycamore* underwent an extensive testing program of all on-board military systems. This included testing of the air-traffic radar, flight-deck lighting and firefighting, flight-deck communication systems and helicopter traverse installation procedures.

Damen said that the results of the sea trials were successful and all systems and processes on the vessel were accepted by representatives of the Commonwealth of Australia.

MV *Sycamore* will be a civilian-registered aviation-capable, ocean-going vessel used for military training and a range of other tasks with the Royal Australian Navy.

Sycamore's chief role will be to provide a training platform for all possible helicopter-related operations, such as helicopter deck landings and take off, helicopter (in-flight) refueling operations and air-traffic control.

MV *Sycamore* will additionally be able to undertake torpedo- and mine-recovery operations, navigation training, dive support, officer sea familiarisation, target towing and consort duties as well as unmanned aerial vehicle support.

Furthermore, the 94 m vessel has a large storage capacity, which gives her the potential to be mobilised in humanitarian relief operations.

Talking about the future of Damen's activities in Australia, Damen Sales Director Asia Pacific, Roland Briene,

commented "We are making headway towards our ambitions of building further vessels for the Royal Australian Navy, having recently submitted out tender for the SEA 1180 Program. It is our intention to work in close concert with local industry for the project, building not only the required vessels, but a sustainable shipbuilding industry for Australia with strong export potential."

Damen Tugs for WA

Mackenzie Marine & Towage of Esperance, Western Australia, has purchased two twin-fin Azimuth Tractor Drive (ATD) Tugs 2412 for operations in Bunbury Port, on the south-west coast of Western Australia. The two vessels, named *Cape Naturaliste* and *Cape Leeuwin* after local landmarks, have arrived and were officially inaugurated on 5 April. These compact, heavy-duty tugs have a bollard pull of over 70 t. That, combined with a top speed of over 12 kn both ahead and astern and a powerful aft winch, makes them ideal for continuous and effective harbour towage activities.

Mackenzie Marine & Towage (MMT) is a fourth-generation, family-owned company and has been the harbour towage operator in the nearby port of Esperance since the 1970s. The company bought its first Damen tug, the ASD 2411 *Shoal Cape*, in 2006 and a second of the same class in 2013, named the *Hellfire Bay*.

In 2014 the merger of the Esperance Port Authority, the Albany Port Authority, and the Bunbury Port Authority led to the establishment of the Southern Ports Authority. In 2016 it put out a tender for towage operations in the ports of Esperance and Bunbury. With MMT already well established in Esperance with the two ASD Tugs 2411, it consulted with users of Bunbury Port regarding their needs. The feedback was that tractor tugs would be preferred and so, by offering two state-of-the-art ATD 2412 twin fin tugs, MMT was able



The new multi-role aviation training vessel *Sycamore* during sea trials
(Photo courtesy Damen)

to secure the combined licence for Esperance and Bunbury. The ability to meet the short delivery time for this latest order was a key part of the contract. The towage license was announced in September 2016 and operations were required to start just two months later. The very tight time frame meant that MMT was not able to inspect the yard or the vessels that Damen had ready in stock before placing the orders. However, Managing Director, Sean Mackenzie, trusted Damen to deliver to their required standards and went ahead and placed the order. Damen also arranged the required financing for the vessels in time for delivery.

Forty guests attended the naming ceremony, at which champagne was carefully poured over the bows of each vessel and Southern Ports Authority CEO, Nicholas Fertin, was among the attendees who made a short speech. At the event, Southern Ports Harbour Master, Captain Gary Wilson, added that the tugs will be kept busy with more than 450 big ships requiring berthing assistance every year. "These tugs are new and modern — the design is unparalleled," he was quoted as saying.

Sean Mackenzie commented "Mackenzie Marine & Towage is extremely happy with the delivery and performance of the new 2412 tractor tugs which we have received from Damen. MMT has built a wonderful relationship with Damen over the last ten years, so we know we can trust them to have the very best tugs and back-up support in Australia. We are looking forward to being able to build this relationship further into the future."

Anzac-class Frigates Complete ASMD Upgrade Program

The Royal Australian Navy's Anzac-class frigate HMAS *Stuart* recently completed her anti-ship missile defense (ASMD) upgrade, marking the completion of a Royal Australian Navy capability upgrade program which spanned seven years.

Completion of the work on HMAS *Stuart* was announced by BAE Systems which spent the last twelve months working on the final of the eight frigates in the class to undergo the upgrade.

The frigate will spend the next few months completing sea trials before she returns to the fleet later this year.

During work on the ASMD upgrade, the frigates received a new 'cupola' mast to house the CEA phased-array radar, underwent engineering changes and received a coat of the new Royal Australian Navy 'haze grey' paint.

Saab Australia and BAE Systems are the main contractors responsible for upgrading the frigates. HMAS *Perth* was the first frigate to complete the upgrade in 2011 and HMAS *Towoomba*, the seventh ASMD-ready frigate undocked on 13 September 2016.

BAE Systems has also started preparatory works on HMS *Perth* for the Anzac Midlife Capability Upgrade Program which will take several months. She will return at a future date for the remainder of the upgrades to be implemented, the company said.

The Midlife Capability Upgrade Program is part of a \$2 billion, six-year contract which includes improvements to the Anzac fleet including engines, propulsion, lighting, heating, cooling and communications systems, torpedo self-defence, and Nulka enhancements.

HMAS *Arunta* is scheduled for docking at Henderson in September this year. She will be the first ship to receive all of her upgrades during her 12 months on the hard stand at BAE Systems Henderson

New-generation Ferry Delivered by Incat Tasmania

A new generation fast ferry left Tasmania in April on her delivery voyage to Denmark via the Panama Canal.

Express 3 is a 109 m high-speed vehicle-passenger ferry from Incat Tasmania for Danish operator Molslinjen — the



HMAS *Stuart* ready for undocking on completion of her ASMD upgrade refit by BAE Systems in Western Australia (RAN photograph)

fourth Hobart-built catamaran in the company's current fleet. An entirely new-generation fast ferry, the 109 m wave-piercing catamaran *Express 3* has evolved from Incat's well proven 112 m catamaran range which first entered commercial service in mid-2007.

Incat's Tim Burnell commented "The design brief was simple. Ensure a consistent passenger experience and fleet commonality for Molslinjen, which already successfully operates two Incat 112 m catamarans, whilst delivering a minimum 10 per cent fuel and emissions saving, plus faster vehicle deck turnaround times."

Building on the extensive in-service experience of the Incat 112 m design, the concept was redesigned from the keel up by Incat's in-house naval architects, Revolution Design. The result is the 109 m catamaran with a lightship displacement saving of just over 100 t.

The design refinement has also produced a marked improvement to vessel trim. Fuel, domestic fresh water and sullage tanks have all been moved forward but, significantly, by repositioning the engine rooms six frames further forward, the vessel benefits from vastly improved speed and fuel-consumption performance. Adding a skeg to the keel has enhanced directional stability.

On sea trials, *Express 3* achieved a speed of 43 kn with 600 t deadweight on board, easily exceeding the contractual speed and fuel consumption expectations.

"Incat's suppliers played their part in the quest to redefine vessel design. LifeRaft Systems Australia for example, designed and gained regulatory approval for longer Marine Evacuation Systems (MES). This allows the MES bays to be moved one deck up into the passenger space, rather than

on the tween (upper car) deck on earlier vessels, resulting in a reduction in weight as well as more overall space on the tween deck," Tim Burnell said.

"Additionally, the vehicle deck layout has been enhanced with a new two-pillar line arrangement, offering an overall gain of 600 mm width in workable vehicle deck space, greatly assisting loading and discharge which, in turn, has a positive effect on turnaround times in port," he said.

The vehicle deck has space for up to 411 cars, or up to 227 cars and 610 m of truck space. Aside from the many proactive design and operating measures to reduce SO_x, CO₂, NO_x and particulate-matter emissions, another important consideration was to install charging stations for electric vehicles, allowing motorists to charge their electric car as they travel across the Kattegat.

Accommodation on board *Express 3* is provided for 1000 persons with varied seating configurations in the aft, midship and forward lounges. To service both tourist- and business-class sections, close attention has been paid to the dining areas to cater for passengers on the busy fast routes between Odden, Aarhus and Ebeltoft. In addition to a large free-flow restaurant, there is also an American-style diner, a walk-through kiosk and an espresso coffee shop.

Tim Burnell commented "The 109 m catamaran is Incat's response to increasing demand for quality high-speed craft which will provide reliable year-round service. We pioneered this mode of high-speed transport in 1990 and our ferries have since operated over 2.5 million hours in intensive commercial service. By deconstructing already successful designs and operator experience, Incat has produced a fast ferry which truly is of a new generation."



Express 3 on trials
(Photo courtesy Incat)



The economy class servery on *Express 3*
(Photo courtesy Incat)



Business class seating on *Express 3*
(Photo courtesy Incat)

The new ferry will enter commercial service on 1 June 2017. “Molslinjen offers up to 30 sailings per day and taking the ferry typically saves customers around 400 km of driving while being faster and more relaxing,” said Vice-Chairman Søren Jespersen.

“Designed and optimised for our use, *Express 3* offers a fantastic onboard service for our customers. With the arrival of this craft, our business transformation continues, expanding our route capacity, facilitating opening up new services, and ensuring continued profitability growth for our company,” Mr Jespersen said.

Tim Burnell pointed out that, in 2017, Molslinjen is a dramatically transformed business. “Molslinjen is now making its largest profits in its 54-year corporate history, representing a significant turnaround from the recent past. Credit must go to the vision and hard work of Molslinjen’s board, management and employees, who have grown traffic on their routes between Sjealand and Jutland by 48 per cent in the past three years such that they now annually carry over 2.5 million passengers, one million cars and 350 000 freight vehicles per year,” he said.

“At Incat we are proud that we have been part of the Molslinjen transformation in that they are currently operating an Incat fleet of the 91 m *Max Mols* (delivered in 1998), the 112 m *Express 1* (ex *KatExpress 1*, delivered in 2012), the 112 m *Express 2* (ex *KatExpress 2*, delivered in 2013) and now *Express 3* delivered in April 2017.

May 2017



The bridge on *Express 3*
(Photo courtesy Incat)

“Our customers are demanding that we build vessels faster and more cost efficiently. Keel laying to delivery on *Express 3* was 491 days (16 months) and this project has allowed us to grow our skilled workforce from a core of 200 to over 550 people now with recruitment continuing” said Tim Burnell.

Principal particulars of *Express 3* are

Length overall	109.4 m
Beam	30.5 m
Draft	4.05 m
Deadweight	1000 t
Gross Tonnage	10 842
Passengers	1000
Cars	411 cars in car-only mode
Engines	4 × MAN Diesel & Turbo 20V 28/33D each 9100 kW
Waterjets	4 × Wartsila Lips LJX 1500SR
Gearboxes	4 × ZF NR2H 60000
Speed (Trials)	43 kn with 600 t deadweight
(Service)	40 kn
(Lightship)	47 kn
Classification	DNV ✕1A1 HSLC R1 Car Ferry “B” EO

Fast Ferry Contract for Incat

Incat has been awarded a significant contract for the design and construction of a large new vehicle-passenger ferry for a major European operator.

The new vessel for Naviera Armas is the second vessel in Incat’s new-generation 109 m high-speed wave-piercing catamaran range and will operate in Spanish waters when delivered in early 2019.

Born out of the extensive in-service experience of the Incat 112 m, the concept was redesigned from the keel up by Incat’s in-house naval architects, Revolution Design. The result is the 109 m catamaran which offers similar passenger and vehicle capacity to the 112 m but with substantial performance improvements, including vastly improved speed, lower fuel consumption and enhanced directional stability.

This latest refinement of Incat’s well-proven wave-piercing hullform, a design favoured by high-speed craft operators around the globe, was first introduced in Molslinjen’s 109 m wave-piercing catamaran *Express 3*, delivered in April. During sea trials *Express 3* achieved an impressive speed of 43 kn with 600 t deadweight.

Seeking to present a new concept of fast ferry service in Spain, Naviera Armas is actively investing in high-speed



An impression of the 109 m fast ferry to be built by Incat for Naviera Armas
(Image courtesy Incat)

craft. This new vessel will be the third Incat craft to join the Naviera Armas fleet in as many years, following *Volcán de Tirajana* (Incat Hull 062, 98 m) purchased in 2015 and *Volcán de Teno* (Incat Hull 056, 96 m) acquired last year.

Robert Clifford, Incat's Chairman, commented "Our vessels are well proven around the world in rough-water conditions. In wanting to offer their passengers the very best in reliability and comfort, Naviera Armas sought the qualities of the wave piercing catamaran and, compared even with their earlier Incat vessels, this new-generation craft for Armas will be a real step up in terms of passenger comfort and economies of scale."

The first two Incat vessels in the Naviera Armas fleet were purchased after completing service elsewhere in Southern Europe but, as Armas CEO Antonio Armas explains, the significant global demand for fast ferries is translating to orders for newbuild tonnage.

"It is very hard to find quality second-hand high-speed ferries in the market. Nevertheless, given the performance of the two Incat-built vessels already purchased, we are confident that the wait for the new 109 m vessel will be well worth it. This new Incat vessel will provide a service speed of 35 kn and accommodate 1200 persons, including 155 persons in business class. It will also be the first high-speed ferry in southern Europe to feature a dual vehicle deck allowing cars and freight to be transported separately. The main deck has capacity for 595 truck lane metres with a 4.6 m clear height and the upper deck will accommodate 215 cars" Mr Armas said.

The contract price is €74 million and construction of the vessel will commence in June 2017.

Incat is also building a state-of-the-art 110 m fast ferry for Mediterranean company Virtu Ferries for service between Malta and Sicily. That new ship (Incat Hull 089) is scheduled for delivery at the end of 2018.

Incat currently has a 550-strong workforce at its Hobart shipyard and the yard is geared for delivering up to two large HSC per year. In addition to the three large fast ferries mentioned, the yard has recently delivered the first of six new iconic passenger ferries for Transport for NSW to operate on Sydney Harbour.

Principal particulars of the new vessel are

Length overall	109.4 m
Beam	30.5 m
Draft	4.10 m
Deadweight	1000 t
Gross Tonnage	10 800 (approx.)
Persons	1200 (including crew)
Passengers	184 passenger seats in three lounges, including 155 business class seats
Lane Metres	595 TLM at 4.6 m clear height plus 215 cars at 2.1 m clear height
Cars	390 cars in car-only mode
Engines	4 × MAN Diesel & Turbo 28/33D STC 20V, each 9100 kW
Waterjets	4 × Wartsila Lips LJX 1500SR
Gearboxes	4 × ZF NR2H 60000
Speed (service)	35 kn with 600 t deadweight
Classification	DNV ✱1A1 HSLC R1 Car Ferry "B" EO

19 m Shark Fishing vessel from Commercial Marine Solutions

Commercial Marine Solutions has announced the completion and delivery of a 19 m shark fishing vessel. The all-steel hull and superstructure have been designed with a traditional arrangement suited to commercial fishing, whether it be for cray or shark fishing as this one is. There is a high forward sheer to provide protection to the working deck.

The wheelhouse is positioned aft, over the engine room but forward of the galley, saloon and accommodation. Forward of the wheelhouse are the 20 m³ circulating tanks, the 40 m³ ice room and the focsle.

The shark reel is located on the port side adjacent to the wheelhouse.

The galley has a fully-fitted stove and work area as well as large amount of storage. The accommodation has been arranged to provide the skipper with a separate cabin.

The boat has been designed and is compliant with the latest NSCV rules for a domestic commercial vessel of Class 3 operating up to 200 nautical miles offshore.

Principal particulars of the new vessel are

Length OA	19.4 m
Beam OA	6.00 m
Draft	2.03 m
Main engine	261 kW
Class/Survey	NSCV Class 3B



Port bow of 19 m shark fishing vessel
(Photo from CMS website)

Sailing Yacht Range from Commercial Marine Solutions

Commercial marine Solutions recently designed a new range of sailing yachts suitable for weekend and offshore racing, as well as providing a level of comfort and accommodation for the cruising market. The result is a range of sailing yachts 31, 38 and 46 ft (9.45, 11.58 and 14.02 m) in length with high performance and easily-handled rigs having moderate ratios. Significant weight savings have been made utilising infusion moulding and the latest materials. The design and construction has been completed meeting local and international regulations, making these boats suitable for charter markets or hire-and-drive operators.

Sean Johnston

Tommy Norton for Lakes Entrance

The trailing suction hopper dredge ordered by Gippsland Ports of Victoria in December 2015 has recently been launched at Damen Yichang Shipyard in China. The vessel, named *Tommy Norton*, is now alongside the yard's new quay undergoing final commissioning, after which she will sail for Shanghai to undertake sea trials. Once those are completed she will sail for Australia on her own keel for dredging trials and delivery. The official handover will take place in August and the vessel is expected to be operating by September.

The new vessel, 60 m long with two 447 kW Caterpillar engines and capable of dredging to depths of 15 m, has been built with self-emptying capabilities, with bottom doors for dumping and the choice of either a bow connection or rainbow expulsion for beach reclamation work. In order to increase the vessel's payload capacity when dredging sand with a high specific density, Damen has reduced the freeboard of the vessel and applied a dredge mark.

The new vessel is named after the paddle steamer, *Tommy Norton*, which worked as a tug at the bar of the natural entrance to the Gippsland Lakes, towing schooners and steamers through the tricky and forever-varying entrance. As home to Victoria's biggest fishing fleet and a base for substantial commercial and recreational boating activity, the maintenance of ocean access to the Gippsland Lakes is vital for the region, and the entrance has been dredged for the last 125 years.

Elders of the tribe will remember the 39 m side-casting dredge, *April Hamer*, which was built by Carrington Slipways in Newcastle, and dredged the entrance from 1979 to 2011, subsequently aided by cutter-suction dredges *Melbourne* (2006–07) and *Kalimna* (2006–present), and trailing suction hopper dredge *Pelican* (2008–present).

For further details, visit

- https://www.marinelink.com/news/gippsland-launched424614?utm_source=MT-ENews-2017-04-25&utm_medium=email&utm_campaign=MT-ENews
- www.sandandgravel.com/news/article.asp?v1=20323
- www.gippslandtimes.com.au/story/3222153/new-dredge-for-lakes-entrance
- http://www.gippslandports.vic.gov.au/pdfs/dredging_facts_sheet_120723.pdf

Phil Helmore

Martin Grimm



Trailing suction hopper dredge *Tommy Norton*
(Photo courtesy Damen)

Oceanicasub V from Incat Crowther

Incat Crowther has announced the completion and delivery of *Oceanicasub V*, the second of a pair of 43 m monohull subsea dive-support vessels (SDSV) constructed by Arpoador Shipyard in Guarujá, Brazil. The vessels are owned and operated by Oceanica of Rio de Janeiro for charter by the Brazilian oil giant, Petrobras. The innovative design is the culmination of a close collaboration by the designer, builder, and operator.

The RINA-classed vessel is efficiently equipped for a crew complement of 36 and features a wide array of dive-support equipment, including deck crane, ROV A-frame, dive-bell A-frame, hyperbaric chamber, HIPAP, rescue/workboat with associated davit, and all necessary dive operations-related spaces and equipment. Crew accommodation and operational spaces are finished to a high standard and the layout of machinery and open deck spaces are well thought out to provide safe operations. As a result, the vessels are exceeding expectations of both operator and charterer.

Four Cummins QSK-19 main engines of 492 kW brake power, coupled to Hamilton HM 521 waterjets through ZF 2000 gearboxes, provide propulsion power for the vessel. The waterjet propulsion has been selected to reduce diver risk. Electrical power is provided by three Cummins QSM 11 gensets of 300 kW plus one Cummins 6BT5.9 emergency genset of 92 kW. Three Thrustmaster 150 kW tunnel thrusters provide manoeuvring and station-keeping power. Class 2 dynamic positioning is provided via a Kongsberg system, and a quartet of Intermarine fin stabilisers are provided to reduce vessel motions and enhance crew comfort.

Principal particulars of *Oceanicasub V* are

Length OA	43.0 m
Length WL	40.8 m
Beam OA	9.30 m
Depth	4.25 m
Draft (hull)	2.10 m
Tonnage	<500 GT
Crew/dive personnel	36
Fuel oil	119 400 L
Fresh water	37 800 L
Sullage	6300 L
Main engines	4×Cummins QSK 19 each 492 kW @ 1800 rpm
Gearboxes	4×ZF 2000
Waterjets	4×Hamilton HM 521
Generators	3×Cummins QSM 11 300 kW 1×Cummins 6BT 92 kW
Bow thrusters	3×Thrustmaster 30TT200AL each 150 kW
Speed (service)	12 kn
Construction	Marine-grade aluminium
Flag	Brazil
Class/Survey	RINA C Special Service DYNAPOS-AM/AT R Diving Support AUT-CCS Unrestricted



Starboard side of *Oceanicasub V*
(Image courtesy Incat Crowther)

48 m Monohull Fast Supply Vessels from Incat Crowther

Incat Crowther has announced the recent delivery of the final six of a dozen 48 m DNV GL-classed DP-1 monohull fast supply vessels built by ETP Engenharia in Rio de Janeiro, Brazil. *Baru Serrana*, *Baru Tesoro*, *Baru Sinu*, *Baru Sirius*, *Baru Taurus*, and *Baru Vega* were all delivered over the last several months by ETP to Baru Offshore, a subsidiary of Intertug, for charter with Petrobras.

The vessel design has been optimised to comply with the Petrobras UT4000 Fast Supply Vessel specification. Liquid capacities include 42 800 L of ship's fuel, 91 400 L of cargo fuel, 10 300 L of ship's fresh water and 88 000 L of cargo fresh water.

The vessels are equipped with an expansive aft cargo deck with 225 m² of usable area rated for 3 t/m² and a total capacity of 250 t of deck cargo.

An additional 30 m² of cargo area is provided inside the main deck cabin, allowing for carriage of items out of the elements, such as food, medical supplies, small tools and similar type cargoes. This space has the ability to be reconfigured for the carriage of 60 offshore personnel. Also housed in the main deck cabin are wet-room and laundry facilities.

Six cabins accommodating 11 crew, as well as a mess, galley and bathrooms are provided below deck of each vessel.



Port bow of 48 m fast supply vessel
(Photo courtesy Incat Crowther)

The vessels are powered by four Cummins QSK 50 main engines, each rated at 1342 kW @ 1900 rpm. Propulsion is by way of fixed-pitched propellers, while two 112 kW electric tunnel bow thrusters enhance manoeuvrability for the DP-classed vessels. The vessels have a service speed of 21 kn.

Principal particulars of the vessels are

Length OA	48.0 m
Length WL	46.1 m
Beam OA	9.50 m
Depth	4.25 m
Draft (hull)	1.70 m
(propellers)	2.20 m
Crew	11
Ship's fuel oil	42 800 L
Cargo fuel oil	91 400 L
Ship's fresh water	10 300 L
Cargo fresh water	88 000 L
Black water	2710 L
Grey water	2670 L
Deck area	225 m ²
Deck load	250 t
Deck strength	3.0 t/m ²
Main engines	4×Cummins QSK 50 each 1342 kW @ 1900 rpm
Propulsion	4×propellers
Generators	2×Cummins QSM 11 each 290 kW
Speed (service)	21 kn
(maximum)	25 kn
Construction	Marine-grade aluminium
Flag	Brazil
Class/Survey	DNV GL ✕1A1 HSLC (bra) R1 Service 2 E0

Zach Dubois

Ultramar from Incat Crowther

Incat Crowther has announced the delivery of the vessel *Ultramar*, a high-capacity 48 m catamaran passenger ferry for the Mexican operator, Ultramar. Built by Midship Marine in Louisiana, *Ultramar* is specifically designed for the operator's busy Playa de Carmen–Cozumel run, offering high capacity, high durability and a world-class passenger experience.

Carrying 844 passengers on a relatively short run, turnaround is paramount. *Ultramar* is optimised for a very fast turnaround with multiple boarding areas over two decks. A pair of boarding ramps is located on the mid and main decks at amidships for passenger loading, whilst an additional pair aft gives direct access to the cargo room. This cost-effective system has been well proven on other Incat Crowther vessels where efficient turnaround of high passenger numbers and cargo volumes has been a requirement.

The aft cabin on the main deck seats 211 passengers, whilst the forward end of the vessel's main deck features a premium-class area with 64 seats. The foredeck seats 50 passengers.

The mid deck seats 203 outside and 52 inside. There is a stage at the forward end of the outdoor seating area on this deck for musicians to entertain passengers. Above, the roof deck seats 264 passengers.

May 2017



Port bow of *Ultramar*
(Photo courtesy Incat Crowther)

From the moment passengers board *Ultramar*, the emphasis on detail and passenger experience is evident. Large staircases move passengers comfortably and efficiently through the vessel and large communal spaces give a feeling of openness which belies the capacity of the vessel. Continuing *Ultramar*'s commitment to an innovative fleet, large panoramic windows are complemented by high-tech lighting and high-end finishes. Painted in *Ultramar*'s distinctive yellow-and-blue livery, the vessel is set off by the operator's signature underwater LED lighting and its remarkable level of fit-out. As a consequence, the operator's market share has jumped to almost 70% despite two other operators on the same run. A second vessel is under construction and is due later this year.



Forward end of main-deck cabin on *Ultramar*
(Photo courtesy Incat Crowther)



Mid-deck lounge on *Ultramar*
(Photo courtesy Incat Crowther)



Premium-class seating on *Ultramar*
(Photo courtesy Incat Crowther)

Ultramar is powered by a pair of Yanmar 12AYM-WGT main engines, each producing 1340 kW at 1940 rpm, offering an efficient service speed of 18 kn, and a maximum speed of 24 kn.

Ultramar is the fourth vessel delivered to the operator using an Incat Crowther design. Construction of a sister vessel is well progressed at Midship Marine, together with eight lower-capacity low-wash vessels for the same operator.

Principal particulars of *Ultramar* are

Length OA	48.8 m
Length WL	44.7 m
Beam OA	11.0 m
Depth	4.00 m
Draft (hull)	1.70 m
(propellers)	2.15 m
Passengers	844
Crew	8
Fuel oil	10 000 L (day tanks) 10 000 L (long-range tanks)
Fresh water	1500 L
Sullage	1500 L
Main engines	2×Yanmar 12AYM-WGT each 1340 kW @ 1940 rpm
Propulsion	2×propellers
Generators	2×Cummins 6C-CP
Speed (service)	20 kn
(maximum)	24 kn
Construction	Marine-grade aluminium
Flag	Mexico

***Confidence 1* and *Confidence 2* from Incat Crowther**

Incat Crowther has announced the delivery of two 20 m catamaran passenger ferries, *Confidence 1* and *Confidence 2*. The vessels are the first in a series of four vessels being built by SAM Aluminium in Singapore. Designed to support Nigeria Liquefied Natural Gas (NLNG) with operation to Bonny Island in the Gulf of Guinea, the vessels carry 50 passengers with luggage, additional hot-shot cargo and have crew accommodation.

Built to operate in Sea Area 2, with a sea state up to 2.5 m wave height, *Confidence 1* and *Confidence 2* live up to their name with a rugged hull structure, good tunnel clearance and ample bow height. This ruggedness is combined with an efficient hullform and a simple and sleek superstructure.

The Australian Naval Architect

The vessel's exterior aft deck features 25 m² of cargo space. Passengers board via the aft deck through to the main cabin. The cabin features 50 large comfortable seats with a pair of toilets located aft.

The half-height wheelhouse offers good all-round visibility and is accessed directly from the forward crew space, enhancing security. Foredeck access is also via the crew space.

Confidence 1 and *Confidence 2* are powered by twin Caterpillar C18 ACERT main engines each producing 599 kW and driving Hamilton HJ403 waterjets. Waterjets were selected for shallow-water performance and to reduce the likelihood of damage from river debris. In sea trials, the vessels exceeded 30 kn.

Designed to Bureau Veritas NR396, *Confidence 1* and *Confidence 2* have upgraded stability compliance meeting load line requirements usually required for larger vessels, including increased damaged-stability margin.

Principal particulars of *Confidence 1* and *Confidence 2* are

Length OA	20.45 m
Length WL	20.20 m
Beam OA	6.50 m
Depth	2.20 m
Draft (hull)	1.00 m
Passengers	50
Crew	4
Fuel oil	3000 L
Fresh water	500 L
Sullage	250 L
Main engines	2×Caterpillar C18 ACERT each 599 kW @ 2100 rpm
Propulsion	2×Hamilton HJ403 waterjets
Generators	1×Caterpillar C2.2
Speed (service)	28 kn
(maximum)	30 kn
Construction	Marine-grade aluminium
Flag	Nigeria
Class/Survey	BV NR 396, Stability NR 566

Stewart Marler



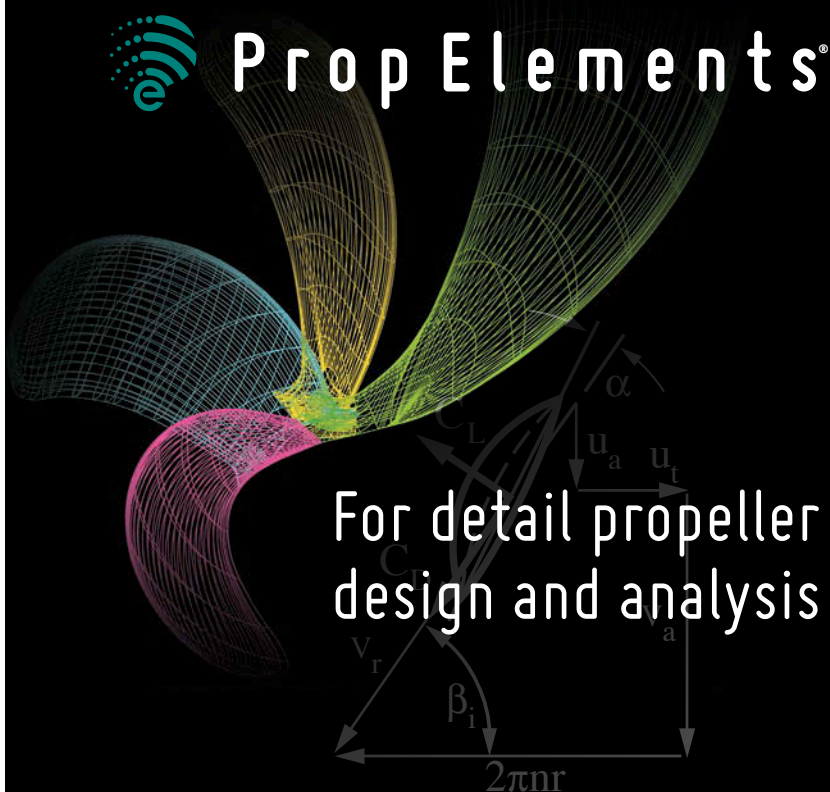
Starboard bow of *Confidence 1*
(Photo courtesy Incat Crowther)

Cruising in NSW

The summer season continued through late February with visits by *Carnival Spirit*, *Pacific Jewel*, *Ovation of the Seas*, *Dawn Princess*, *Arcadia*, *Azamara Journey*, *Voyager of the Seas*, *Explorer of the Seas*, *Carnival Legend*, *Carnival Spirit*,



PropElements®



Considering CFD for propellers?
Use PropElements to conduct preliminary design space investigations, and establish benchmarks for CFD model validation.

For detail propeller design and analysis



Durham, New Hampshire USA
E: info@hydrocompinc.com
Tel: +603.868.3344

www.hydrocompinc.com

NavCad || PropCad || PropExpert || SwiftCraft

Queen Mary 2, Queen Elizabeth, Black Watch, Seven Seas Navigator and Noordam.

The season wound down through autumn, with return visits in March by many of these vessels plus visits by *Celebrity Solstice, Aurora, MS Insignia, MS Sirena, Seabourn Encore, Emerald Princess, Sun Princess, Queen Victoria, Artana, Costa Luminosa*, and *Radiance of the Seas*.

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

Pacific Jewel, Pacific Explorer, Sun Princess, Sea Princess, Golden Princess and *Carnival Spirit* 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 *Norwegian Star* on 7 October and *Radiance of the Seas* on 8 October will signal the start of the next summer season.

Phil Helmore



Radiance of the Seas at anchor in Athol Bight with *Ovation of the Seas* at the Overseas Passenger Terminal during the peak of the cruising season in Sydney
(Photo John Jeremy)

Making Ferries More Useful and More Efficient

Robin Sandell

Principal, Sandell Consulting

Introduction

The Sydney Ferry network performs an important role in Sydney's public transport network, carrying over 40 000 passengers each day. It is also a major tourist attraction for the city. Ferries are rated in the top 2% of Sydney's attractions by the travel website Trip Advisor.

As part of Sydney's Ferry Future Plan, the NSW Government is investing in a modernisation of the fleet and network. Initiatives include new services, new vessels, construction of a terminal at Barangaroo, and a continuing program of wharf upgrades elsewhere. A redevelopment of Circular Quay is also planned.

These are valuable improvements, but important aspects of the current ferry system need more attention to make ferries more efficient and more useful for customers:

Line connectivity

With 36 ferry wharves in the current network, there is potential to connect 630 origin-destination (OD) pairs. But the current line structure, which follows a conventional radial pattern focussed on trips to and from the CBD, does not provide for timed transfers. Only 96 OD pairs have regular, convenient journey connections, limiting the range of possible journey destinations.

Passenger loading speed

Current Sydney Ferries gangway technology does not support rapid passenger loading. This adds to travel time for passengers, is not cost efficient, and affects service reliability during periods of heavy demand, especially on Sundays and during events like the Vivid Festival.

Sharing Sydney's busy waterways

Sydney ferries compete with other vessel traffic on Sydney's waterways, including cruise ships, non-regulated ferries and recreational boats. More-structured management of vessel movements is necessary, especially in Sydney Cove.

Proposed Solution

Many of us have travelled on the London Underground, Paris Metro or Tokyo Subway, where it seems easy for passengers to go from anywhere, to anywhere and at any time. These networks are designed in a grid pattern. As metro trains run every few minutes, passengers can transfer from one line to another at hubs with reasonable convenience. The traveller can rely on the connecting service arriving with just a short wait. But what about low-frequency networks like Sydney Ferries, where headways are mostly 30 minutes? How can long, annoying transfer waits be avoided at interchanges like Circular Quay?

For circumstances like this, world's best practice in public transport network design is integrated regular-interval timetabling (IRIT) (Nielsen et al. 2005). This approach is now widely followed in continental European countries including Switzerland, Germany, Austria, the Netherlands and Belgium. IRIT networks optimise connectivity between lines and between modes by ensuring that transfers at network interchanges are timed appropriately, even for headways of 30 or 60 minutes. The key to the riddle is that the cycle time of each route (i.e. time required for the train or bus to make its round trip, including layovers at either end) is a whole integer multiple of the headway.

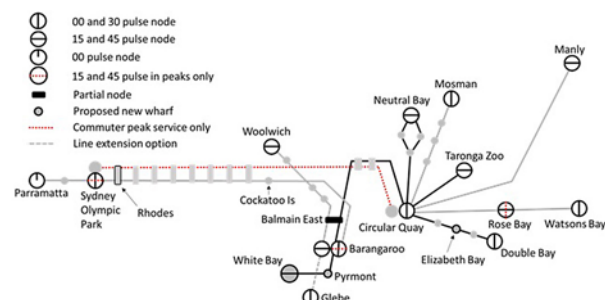
If applied to Sydney Ferries, passengers travelling on any service from Barangaroo to Circular Quay, for example,

would be able to transfer at the Quay for an onward journey to Manly, Watsons Bay, Neutral Bay or any other destination east of Circular Quay, with just a short waiting time in both the outbound and inbound directions.

To achieve this outcome, some reconfiguration is necessary to simplify the network and de-clutter Circular Quay. One option is for lines originating west of the Sydney Harbour Bridge to terminate at Barangaroo and lines from the east to terminate at Circular Quay. The Quay is linked to Barangaroo by the Darling Harbour line. Ferries would arrive at Circular Quay a few minutes before the hour and half hour, and depart a few minutes after the hour and half hour.

Then:

- The Darling Harbour route becomes a through line, starting at White Bay (to coincide with the Bays Precinct development) and terminates at Taronga Zoo, via the new Barangaroo terminal and Circular Quay. This means that passengers do not need to change vessels if travelling from White Bay to Taronga Zoo or return.
- The Woolwich line terminates at Barangaroo, but passengers can transfer to the Darling Harbour line at Balmain East in order to reach Circular Quay with a transfer wait of four minutes in both directions. There is an option to through-line this route to Glebe.
- A Parramatta River line would operate to Circular Quay, via McMahons Point and Milsons Point, in peak periods only. All other Parramatta River services terminate at Barangaroo.
- Double Bay and Watsons Bay/Rose Bay become separate lines in both peak and off-peak periods. The Double Bay line acquires an extra stop at Elizabeth Bay.
- Neutral Bay and Double Bay routes form a through line via Circular Quay.
- All routes terminating or through-lining at Circular Quay have symmetrical stopping patterns in the inbound and outbound directions.



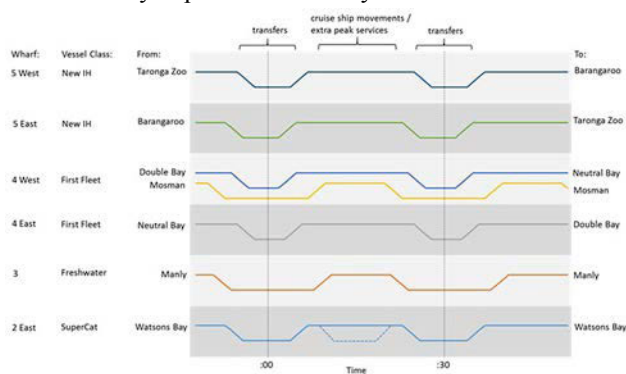
Proposed reconfiguration of the Sydney Ferry network
(Image courtesy Robin Sandell)

IRIT timetables are periodic. What happens in one period is repeated all day, seven days a week, although there is scope to slot in extra services during peak periods without changing the underlying off-peak pattern. For example, services from Sydney Olympic Park to Barangaroo move from 30 minute intervals outside peak periods to 15 minutes in the peak. The same would happen with Rose Bay.

This network reconfiguration “de-clutters” Circular Quay:

- Services to Taronga Zoo and Barangaroo depart from Wharf 5 East and West. These could be operated by the new Heritage-class vessels only, so it is possible for the pontoon deck to be aligned to the vessel freeboard to facilitate faster passenger loading.
- Services to Mosman, Neutral Bay and Double Bay depart from Wharf 4 and could all be operated by First Fleet-class vessels. The Mosman ferry arrives first on the western side of the pontoon, unloads passengers and moves into the “corner”. The ferry to Neutral Bay arrives five minutes later, also on the western side. It leaves first, allowing the Mosman ferry to move out of the corner, load passengers and depart five minutes later. The Double Bay ferry departs from the eastern side of the pontoon.
- Manly ferry services continue to operate from Wharf 3.
- Rose Bay/Watson’s Bay services, operated by SuperCats, depart from the western side of Wharf 2. The eastern side of Wharf 2 is available for either vessels out of service or non-regulated ferries.

This is a structured approach instead of the current non-regular pattern of vessel berthings. There is scope for either additional services to be slotted in during peak periods, or for cruise ship and tourist vessel movements to be scheduled between ferry departures and ferry arrivals.



Scheduling of ferry service berthings at Circular Quay
(Image courtesy Robin Sandell)

Passenger Benefits

The reconfiguration will substantially increase the usefulness of ferries for residents and tourists:

- Convenient connections occur consistently at all nodes in the network, including Circular Quay. The number of origin-destination pairs with convenient connections all day increase from 96 to 419 (maximum of one transfer; transfer wait of 5 to 11 minutes at Circular Quay and 4 to 10 minutes at other nodes).
- The timetable is strictly by the clock-face. The timetable is easily remembered because ferries always depart at the same time intervals all day and on week-ends, with additional services scheduled in peak periods as required.

- Services for a particular route always depart from the same boarding point at Circular Quay.

The transfer wait for ferries hubbing at Circular Quay is in the range of 5 to 11 minutes for all combinations except Manly–Mosman connections, which are 13 minutes. Walking distance for all transfers have been measured to ensure that all connections can be made comfortably with a 4 km/h walking speed and a two minute buffer in case of minor delays.

The proposed allocation of arrivals and departures to wharves at Circular Quay makes it possible to align pontoon decks with vessel freeboards. This allows more-advanced gangway technology to be used at Circular Quay for faster passenger loading and fewer delays.

Operational Benefits

The substantial improvement in connectivity is achieved with only 11% more service hours than the current timetable and no increase in peak vessel number requirements. The modularity of the timetable will lead to rostering efficiencies, so a future operator can deliver the ferry service at a lower cost per service hour. This means that even with modest increases in patronage and farebox revenue, the proposed timetable will require less government subsidy.

The network has a modular structure, which makes it easy to increase service frequencies or add extra services provided that they conform with integrated regular-interval timetabling rules. New lines or line extensions can be added as modules, without disturbing the existing network structure. This can include additional services for events, such as festivals at Cockatoo Island or permanent line extensions and extra peak services.

Two features of the timetable will significantly reduce safety risks:

- The time separation of arriving and departing vessels at Circular Quay avoids the risk of a reversing ferry colliding with an arriving ferry.
- The repeating pattern of the timetable makes vessel movements regular and more predictable. It allows ferry masters to anticipate possible risks and minimises the systemic causes of safety risk.

Waterway Management

The timetable proposed makes it easier for other waterway users to operate without interference by or to ferry operations. Outside of the peaks, there will be two 15 minute periods in each hour in Sydney Cove when ferries are neither arriving nor departing Circular Quay. This creates a window for cruise ships or tourist vessels to safely navigate in Sydney Cove.

Options for Future Contracting

Although there is a high level of connectivity in the proposed network, individual lines or pairs of lines operate independently so it would be possible for the NSW Government in the future to contract these out to separate operators, either individually or in “chunks”. This would be invisible to passengers if the Opal card is used on all lines. This is like the model adopted for the Singapore Mass Rapid Transit (MRT).

Conclusion

Ferries are a much-loved and iconic part of Sydney. This does not mean that they cannot be improved or made more efficient. Reconfiguring the network to provide for multi-destination travel, not just trips to and from the central business district, is a key to ferries contributing more to the public transport task in Sydney.

Adopting integrated regular-interval timetabling for Sydney Ferries, similar to what has already been demonstrated by Swiss and other European rail systems, will substantially increase the usefulness and efficiency of ferry services. The proposed version of such a timetable offers a more than four-fold increase in convenient connections between origin and destination points in the ferry network, no increase on current peak vessel number requirements and will probably require less subsidisation from Government.

The proposal also reduces safety risks, increases flexibility for extending services, reduces waterway congestion and provides an opportunity to speed up passenger loading for faster, more reliable services.

The ferry network, fleet and terminal infrastructure are interdependent. It is more efficient and better for passengers if the design of the network is the primary strategic driver. Performance specifications for the fleet and terminal infrastructure can then be developed with more clarity about what is necessary and what is not.

Reference

Nielsen, G., Nelson, J., Mulley, C., Tegner, G., Lind, G. and Lange, T. (2005) *Public Transport — Planning the Networks*, HiTrans Best Practice Guide No. 2, Interreg IIIB, European Union. Stavanger, Norway.

Robin Sandell

Robin Sandell is an independent ferry planner based in Sydney; contact email rob@sandellconsulting.com.au.

Questions

Question time at Robin's presentation to RINA/IMarEST was lengthy and elicited some further interesting points.

This proposal has been put to Transport for NSW, but has not yet gained support. The reason may be because, even though more users would benefit from the changes, some

existing passengers would incur longer journey times. For example, many people from up the Parramatta River want to go straight to Circular Quay, rather than Barangaroo and would have to change ferries to get to Circular Quay. This can, of course, be alleviated by having Parramatta River services terminate at Circular Quay in peak times, but is a distraction.

One of the implications of the proposal is a change in current crewing practices. Currently, when the crew has a break, the ferry does too, as the crew likes to go back on board the ferry that they have just come off. However, with the proposed timetable, they may well go onto a different ferry after a crib or lunch break.

If the proposed timetable were to be accepted, then it could not be introduced progressively, it would have to be introduced overnight.

At present, there are several ferry operators on Sydney Harbour; would these all be integrated? That is a separate issue. However, it does not make sense to have two separate services to Manly, for example. These ferry services should be combined, and the frequency increased in off peak periods from 30 mins to 15 mins, and 7.5 mins in peak periods..

There could be a single brand of ferries on Sydney Harbour; one colour scheme, one ticketing mechanism, etc. However, each wharf could be contracted out to different operators. This has happened on the buses, and needs integration, and the Singapore trains operate that way.

The Garden Island service is not really designed for people who work on the Island; it has been designed to coincide with the opening hours of the Navy Museum based there.

The Parramatta River service relies on backups, because the ferries on Sundays are always full. This is a problem because of the \$2.50 fare on Sundays being so cheap and generous. This is a demand management issue.

The Manly fast ferry service has not been included in this analysis, as it is not part of the official Sydney Ferry network. However, it could easily be included.

The vote of thanks was proposed, and the certificate and "thank you" bottle of wine presented, by the Chief Executive of RINA, Trevor Blakeley.

Phil Helmore

THE AUSTRALIAN NAVAL ARCHITECT

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

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

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

EDUCATION NEWS

AMC/UTAS Agreement with France

The University of Tasmania has formally joined an international consortium which will help deliver Australia's next-generation submarine fleet.

Deputy Vice-Chancellor (Global) Prof. Monique Skidmore said that an MoU signed in Nantes in March with four leading French institutions recognised the world standing of the University's Australian Maritime College (AMC) in both teaching and research, and underlined the considerable promise of defence and design to Northern Tasmania's future.

"Arrangements such as this provide a platform upon which we can expand our existing strengths, along with the development of completely new economic sectors for the region and the State," Prof. Skidmore said.

In 2016 the Federal Government announced that the nation's Future Submarine Program would deliver the next fleet of Australian submarines, to be built in Adelaide, and appointed global advanced technology and defence company DCNS as the design partner. DCNS currently works with the four French signatories to the MoU — ENSTA ParisTech, École Centrale de Nantes, CentraleSupélec and École Polytechnique — each having a particular strength in advanced defence and maritime technologies.

The universities will collaborate in the areas of research, design and knowledge-share relating to sub-sea engineering, submarines, hydraulics, hydrodynamics and wave energy; all key elements in Australia's future defence industries and energy security.

"This MoU will result in the University working with our French partners to deliver teaching and research which will inform the delivery of the next-generation submarine fleet for the country," Prof. Skidmore said.

"Universities such as the University of Tasmania, South Australian universities and the French consortia will together create the new generation of highly-skilled workers required to research, design, build and maintain the next generation submarine fleet."

Prof. Arnaud Poitou, Director of École Centrale de Nantes, said "This is more than a classical partnership — we share a common industrial partner in DCNS.

"We have decided to collaborate as both institutions have strong maritime interests and we share this in the long term. This MoU is important as it gives a long-term perspective which allows us to grow something strong and enduring."

The Australian Maritime College has multiple key defence-related strengths including:

- Workforce-reskilling opportunities through world-class facilities and expertise for the training of maritime engineers, ship designers and fleet personnel.
- The design, development and application of modern smart defence technologies, through a centre of excellence in autonomous underwater vehicles'
- Research capacity through the Australian Research Council (ARC) Research Training Centre for Naval Design and Manufacturing.

- Advanced simulation and simulator design to enhance workforce capabilities.
- With the establishment of a new inner-city campus at Inveresk, near Launceston's CBD, the University aims to consolidate and build the AMC's capability at its existing site, including the development of a defence and design precinct alongside the College.

AMC Principal, Prof. Neil Bose, said that the University would seek to work with government and industry to bring that vision to reality.



The signing of the MoU by Prof. Monique Skidmore of the University of Tasmania and Prof. Arnaud Poitou, Director of École Centrale de Nantes
(Photo courtesy École Centrale de Nantes)

RINA's Chief Executive Visits the AMC

On 28 February, the Australian Maritime College hosted Trevor Blakeley, the chief executive of RINA. Trevor presented an overview of the Institution to our first year maritime engineering students and discussed the pathways to obtain chartered status through RINA. The presentations were followed by an informal barbeque where students were able to meet Trevor and ask questions about the Institution. At the barbeque, Trevor presented a commemorative shield to Rezan Kanti-Paul, a member of the winning team for the student rat-trap boat race. Trevor's visit helped raise the profile of RINA amongst our student body and we are grateful to him for taking the time to visit us.

Lauchlan Clarke



Trevor Blakeley and Rezan Kanti-Paul at the AMC
(Photo courtesy AMC)

Power for the Future

A new wave-energy device tested at the Australian Maritime College is now heading for commercial application in Australia's Bass Strait.

AMC worked with developer Wave Swell Energy to test the performance of the device and found that it was at least 120% more efficient than a conventional device.

Wave Swell has now announced plans to build a commercial-sized plant to provide power to King Island, halfway between Tasmania and Victoria.

CEO of Wave Swell Energy, Dr Tom Denniss, said that testing in the College's shallow-water wave basin helped demonstrate that the technology was ready for commercialisation.

"Wave Swell Energy could not be happier with the results obtained by AMC during the testing of the company's wave-energy technology," Dr Denniss said.

"The results indicate that the technology is ready to assume its place as part of the world's commercial energy-generation mix, with a strong potential to be among the very lowest cost sources of power within a few years."

Wave Swell Energy's design is a concrete gravity structure which sits on the seabed in 10 m of water. It is based on the oscillating water column concept, which acts like an artificial blowhole with water rising and falling inside a chamber.

Wave Swell has introduced novel vents which allow the air to escape from the chamber as a wave enters. The vents then close and as the wave passes, it draws air through the turbine.

This has two significant advantages — the venting of the chamber as the wave enters greatly reduces damping, meaning that more water enters the chamber, resulting in an increase in efficiency.

More significantly, it means that a simpler, more robust and efficient unidirectional turbine can be used, rather than a bi-directional turbine used by conventional wave-energy converters of this type. The tests performed at AMC have provided proof-of-concept for these novel improvements.

A/Prof. Gregor Macfarlane, who led the research at AMC, explains that the research team carried out extensive testing which helped to optimise the turbine.

"With advanced measurement techniques using laser diagnostics, we looked very closely at how water flows in and out of the chamber. This allowed us to modify the geometry of the device to make further significant improvements in efficiency," A/Prof. Macfarlane said.

The AMC team also performed numerous experiments in extreme weather conditions to measure the loads experienced by the concrete structure; this information has been used by the structural engineers to ensure that the concrete device will withstand all the Southern Ocean can throw at it over a 25-year period.

Wave Swell's series of 1 MW generators will cost up to \$7 million to build and, at peak times, will provide up to half the power for King Island's 1600 residents. They expect the cost of wave power to be less than 10 c/kWh when built at scale, which is comparable with new hi-tech forms of coal power.



The wave-energy device under test at the AMC
(Photo courtesy AMC)

AMC Student Sojourn in Scotland

Gaining industry experience before you graduate is one sure-fire way to set yourself apart from the competition.

Tobias Pearce understood this well: under AMC's Co-operative Engineering Program, he had already completed two paid internships in Australia as part of his ocean engineering degree but, for his third placement, he set his sights some 17 000 km from home.

"For my final internship, I knew I wanted to go overseas for a different kind of experience and for the opportunity to travel.

"I learnt that BAE Systems in Glasgow were currently building a number of ships for the UK's Ministry of Defence. They also offer a very structured and supportive internship program and the opportunity to live in Glasgow — the third largest city in the UK — and explore Scotland and Europe was appealing."

BAE Systems provide some of the world's most advanced, technology-led defence, aerospace and security solutions. Tobias spent his time on the engineering team for their River Class Batch 2 Offshore Patrol Vessel.

In just three months, he contributed to a surprising number of stages of the craft's development.

"I was exposed to a number of different ship construction phases because one vessel was in the water being fitted out, one vessel was being prepared to be rolled out, and another was in a very early phase of construction.

"Thanks to this, I learnt a great deal about the construction process of a large ship — knowledge that will help me if I work in maritime construction in the future.



Tobias Pearce in Scotland
(Photo courtesy AMC)

“It has also been a great opportunity to make contacts within BAE Systems, including interns, graduates and other employees, and I’m sure I’ve developed skills that will interest future employers.”

Although out of a classroom environment, Tobias was happy to be able to draw connections between his work and his studies at AMC.

“A task I have particularly enjoyed is learning about Naval Authority rules (the Ministry of Defence’s internal regulatory body) and comparing them to Lloyd’s Register rules, which I recently studied in a third-year class assignment.”

He also expects that his placement will prove advantageous when it comes to writing his final-year thesis.

“I’m writing my thesis on the structural life of Navy vessels. BAE Systems builds vessels for the UK Royal Navy so there were a number of experts on this topic on site. Towards the end of my internship, I was able to meet them and ask for their advice and input, which was brilliant.”

Now back in Tasmania for the final year of his degree, he reflects on an experience which is already influencing his future direction.

“I would recommend an overseas internship to anyone, as it not only gives you industry experience while at university, but also the opportunity to travel.

“Whilst in Glasgow I met people on BAE Systems’ two-year graduate program, and they have inspired me to apply myself. It seems like a fantastic opportunity to try out working in different areas of the business at the same time as developing your skills.”

Maritime Technical College for Adelaide

On 24 March the Government announced that it will establish a Maritime Technical College to identify, train or retrain Australian workers for the naval shipbuilding program.

The Government will invest an initial \$25 million in the college which will be based in Adelaide but will deliver world-class training across the country in key areas such as steel fabrication, welding and naval engineering.

The Minister for Defence Industry, the Hon. Christopher Pyne, said that this was an important step in Australia’s future naval shipbuilding industry and would help thousands of Australians obtain the jobs created as a result of the Government’s \$90 billion commitment.

“The Government is ensuring long-term, secure employment for future naval shipbuilding and sustainment workers which will avoid the peaks and troughs the industry has previously experienced,” Minister Pyne said.

“By the late 2020s the naval shipbuilding industry will expand to more than 5200 employees in construction in South Australia, and more than double this in sustainment and through the supply chain across the country.

“The Maritime Technical College is a Government investment aimed at attracting, recruiting, training and retaining the workforce we need to successfully deliver a continuous naval shipbuilding program.”

“We fully expect workers previously employed in mining and automotive industries to be retrained through this college, ready to start work on our next generation of naval vessels,” he said.

The Minister for Education and Training, Senator the Hon. Simon Birmingham, said that Defence would work closely with educators and industry to deliver the Maritime Technical College.

AMD Marine Consulting



www.amd.com.au



“Defence capability is at the heart of our naval shipbuilding commitments. The importance of these capabilities has never been clearer, given the increasing security challenges Australia faces,” Minister Birmingham said. “A national endeavour of this magnitude requires a national approach to education and training.

“The College will deliver skills in partnership with many existing universities and training providers across Australia, ensuring that we capture the best training to help deliver the optimal naval shipbuilding skills for the future.

“The Maritime Technical College will commence operations in early 2018, with a focus on increasing key entry-level trade qualifications through contracted Registered Training Organisations across Australia,” he said.

The Maritime Technical College headquarters will be located in Adelaide and will utilise and expand on existing training courses across Australia.

A request for tender will be released in coming months. The Department of Defence is making arrangements for industry information sessions on the Maritime Technical College and its phased implementation from 2018.

SAAB-UniSA Defence Institute

On 4 May the Minister for Defence Industry, the Hon. Christopher Pyne MP, welcomed the establishment of a new academic institution aimed at developing and skilling Australia’s workforce to meet future Defence project needs.

Saab Australia will invest up to \$40 million for a purpose-built new wing of their Mawson Lakes headquarters, collaborating with the University of South Australia (UniSA) to create the Saab/UniSA Defence Institute. The Institute will educate and train the workforce required to deliver future defence industry projects during the next 20 to 30 years. Students will learn technological skills, matched with practical experience on cutting edge defence technology at Saab.

Minister Pyne said that Saab Australia and UniSA have formalised a long-term relationship with the establishment of the new Institute.

“The Defence Institute will develop a source of sustainable Science, Technology, Engineering and Maths (STEM) graduates by immersing them in real-world problems and situations to bring academia into the heart of industry,” Minister Pyne said.

“Significant Defence projects, such as the replacements for the Collins-class submarines which will be delivered in the coming years, necessitate an increase in skilled people, especially in STEM subjects. This will also build on our indigenous defence capability and provide a developing workforce for future export contracts.

“The institute will also provide opportunities for smaller companies in the defence supply chain to participate in industry based activities, contribute to science projects and access a pool of well-prepared staff to up-skill their own.”

Minister Pyne said that Defence welcomed the opportunity to work with the new Defence Institute to optimise investment in Defence research and innovation and maximise the complementary value of our respective STEM student development programs.

The Australian Naval Architect

University of New South Wales

Visit by RINA Chief Executive

The Chief Executive of the Royal Institution of Naval Architects, Trevor Blakeley, visited UNSW Sydney on 3 March. He had lunch with the naval architecture staff, and then made a presentation to the naval architecture students and staff on RINA, the aims and objects of the institution, and the benefits of becoming a member as a student and then continuing membership following graduation.

Student–Staff Get-together

The naval architecture students and staff held a get-together on Monday 13 March. This was to enable the students in early years and on study abroad to meet and get to know the later-year students and the staff on a social level, and to discuss the program and courses and matters of mutual interest. Pizza, chicken, beers and soft-drink were provided and, after a slow start, conversation was flowing pretty freely an hour later! This semester we have ten students enrolled in third-year courses and about nineteen in fourth year, including nine from NTNU in Trondheim, Norway, and one from the University of Michigan, USA, most of whom attended, as well as four staff members. A broad mix, and some wide-ranging discussions ensued. With the impending closure of naval architecture courses at UNSW, this was the last naval architects’ supper!

Student Visits to Industry

The Year 3 students in NAVL3610 Ship Hydrostatics and Practice have continued the usual industry visits accompanied by David Lyons and Phil Helmore:

On 15 March we visited Thales Australia at Garden Island. Brad Lovegrove, Dockmaster, and Murray Makin, Naval Architect Support Manager, gave the students a presentation in the Dock Office on docking procedures, calculations and details. Murray then guided them on a tour of the dock where *Searoad Mersey II* was docked, and pointed out features of the dock and the underwater hull. This was followed by a tour of the pump house, where the three main pumps for the dock are housed and dock flooding and pumping are controlled, and the galleries which surround the dock for provision of services and maintenance.

A real highlight of the visit was a guided tour of *Searoad Mersey II* by crewmember Justin, who showed us over the engine room, generator space, vehicle deck, weather deck, LPG tanker space and the bridge.



Searoad Mersey II in the Captain Cook Dock at Garden Island
(Photo courtesy Phil Helmore)



Students and staff at the last naval architects' get-together
(Photo courtesy Yun Wang)



Bow of Searoad Mersey II
(Photo Phil Helmore)



UNSW students and Searoad Mersey II
(Photo courtesy Murray Makin)



Svitzer Warang
(Photo courtesy Clyde Dickens)



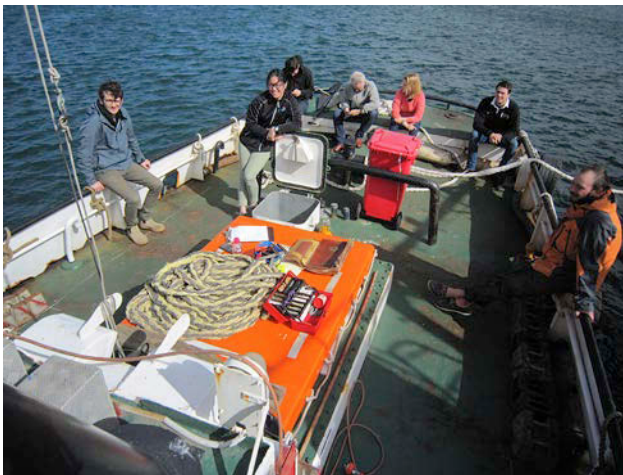
Anatoma
(Photo courtesy Clyde Dickens)

On 5 April we visited Svitzer Australasia at Port Botany, where Geoffrey Fawcett and Year 4 student Angus Bratter (who is working there while he completes the requirements for his degree) showed us over the tug *Svitzer Warang* and the bunkering vessel *Anatoma*.

On 12 April we visited Incat Crowther at Belrose, where Alex Law and Claire Ogilvie gave us a presentation on the company, the types of vessels that they design, how they go about it, the software that they use, and the details of drawings, layouts, structure, resistance, propulsion and stability.

On 3 May we visited the Sydney Heritage Fleet at Rozelle Bay to conduct an inclining experiment on their 50 ft (15.24 m) tug *Currawong*. Elders of the tribe will remember that HTS501 *Bronzewing* and HTS502 *Currawong* were designed by John Boulton and built by Stannard Bros at Berry's Bay for the Royal Australian Navy. *Bronzewing* already has her stability approved for SHF use on the basis of an inclining experiment conducted by UNSW students in 2012 and the stability book prepared by Mori Flapan. *Currawong* has been modified by fitting sullage bladders P&S in the aft compartment so that the SHF can pump out from their various vessels and this inclining experiment was in preparation for approval of the vessel's stability for entry into survey by Roads and Maritime Services.

The visits to industry bring all the theory alive for the students.



Some of the UNSW inclining experiment crew on *Currawong*
(Photo Phil Helmore)

Thesis Project

Among the interesting undergraduate thesis projects recently under way is the following:

Radius of Gyration

For any ship-motion analysis code, it is at least necessary to input the roll and pitch radii of gyration as well as the usual KG , GM , displacement and LCG (or draft and trim) data. While the latter can easily be obtained from load conditions in trim and stability booklets, roll and pitch radius of gyration are not readily available data and are usually estimated. For pitch radius of gyration (usually taken to be equal to the yaw radius of gyration), ship-motion code manuals typically suggest using $0.25 \times L_{BP}$, and for roll radius of gyration they suggest around $0.35 \times B$. A previous project has measured the yaw radius of gyration of a 1.6 m model of the Boulton, Riley and Hercus-designed vessels *Cape Arnhem* and *Cape York* (which was tank tested by Robert Halliday in the towing tank at the University of Sydney), and then modelled the vessel in Rhino and calculated the radius of gyration, finding reasonable agreement with the experimental value.



UNSW student Tamasin Welch tending the pendulum
at the inclining experiment on *Currawong*
(Photo Phil Helmore)

Angus Bratter has also measured the yaw radius of gyration of the model, and is now refining the Rhino model to reflect the internal construction of the model (which was previously estimated) to try and improve the agreement with the experimental radius of gyration. This will then be followed by a sensitivity analysis of the pitching motions of the vessel (measured by the response amplitude operator, RAO) to the value of the radius of gyration.

Naval Architecture Program Under Threat

The naval architecture program at UNSW is currently under suspension with the threat of closure at the end of 2017.

No new enrolments in naval architecture were accepted for 2017. The Dean of Engineering, Prof. Mark Hoffman, has decided to cease teaching all NAVL courses at the end of 2017.

However, UNSW is trying to ensure that all students currently enrolled in the naval architecture degree program will graduate with their degree in naval architecture from UNSW. This means that current Year 2 and 3 students will need to undertake their ship design project in 2018, and it is expected that this will be taught under MECH (rather than NAVL) course identifiers and names. Special arrangements have been offered to the two students currently completing their second semester in Year 1.

Phil Helmore

INDUSTRY NEWS

Adelaide Office for Austal

Austal announced on 5 May the establishment of a new design and project-management office in Adelaide, South Australia, to support the company's expansion into one of Australia's two major shipbuilding hubs.

The new office will initially support preparations for the Australian Government's \$3 billion Offshore Patrol Vessel (OPV) project, which will see 12 vessels constructed for the Royal Australian Navy from 2018. It will also enable Austal to prepare for the Government's Future Frigate project, comprising nine vessels to be constructed in Adelaide from 2020.

Austal has entered into a 50:50 joint-venture partnership with German designer Fassmer for the OPV project, offering a customised low-risk solution based on a proven design and build strategy which has successfully delivered seven similar vessels internationally, to date.

The effective, holistic transfer of this new OPV capability to Australian industry will enable local, high-quality support for the Royal Australian Navy, build local industry capability, and allow Austal to pursue new industry-building export opportunities.

Austal Chief Executive Officer, David Singleton, said "A clear point of difference with our (Austal Fassmer) OPV solution is that the customised, detailed design for the OPV80 will be completed by Australians in Australia, led by an internationally-competitive successful Australian shipbuilder."

Complementing experienced design and project-management team members from both Austal and Fassmer, locally-recruited designers and project managers will help establish the new Adelaide office from June 2017.

"As a key stakeholder in the delivery of the Australian Government's Continuous Naval Shipbuilding Program, which includes the 19 vessel Pacific Patrol Boat replacement project which we have just cut steel for, it is absolutely critical that we establish a strong presence in both Australian shipbuilding hubs.

"We are committed to employing, training and developing the very best talent in shipbuilding design, engineering and manufacturing in Australia for this national endeavour," Mr Singleton added.

Fassmer is one of the three shortlisted designers selected by the Australian Government to bid for the SEA1180-1 (Offshore Patrol Vessel) Project with the proven OPV80 design. Fassmer has had great success in transferring naval vessel designs and working effectively with local shipbuilders to deliver the proven OPV80 to countries including Chile and Colombia. Most recently, Fassmer won a competitive tender against both Lurssen and Damen to supply the German Coast Guard with a customised OPV80 design.

Damen Submits Tender for Australian OPVs

Damen Shipyards Group has submitted a tender for the SEA 1180 Phase 1 Project to deliver 12 Offshore Patrol Vessels to the Royal Australian Navy.

To demonstrate its commitment to on-time and within-specification delivery, Damen submitted its response early.

Damen has teamed with ASC Forgacs Shipbuilding, a joint venture established to build the initial two ships in South Australia and further 10 in Western Australia, to compete for the foundation project of Australia's continuous naval shipbuilding enterprise. The joint venture is already investing in infrastructure at the Henderson Shipbuilding Precinct in Western Australia in preparation for the OPV construction to move to WA.

Damen, with almost 100 vessels operating in Australia already, has extensive experience providing vessels which are suitable for local conditions and is fully committed to the long-term integration with Australian shipbuilding. Key tenets of the bid include maximising investment in local industries and businesses to establish a long-term capability; investment in the training of a future workforce including those transitioning from other industries; and assisting the Australian Government to prepare to build future frigates and submarines in SA. The proven Damen design being offered uses innovative technology to improve seakeeping, reduce running costs and decrease whole-of-life sustainment costs.

Damen Sales Director Asia Pacific, Roland Briene, said "We are fully committed to maximising Australian industry participation and supporting the development of a sustainable, national shipbuilding industry in Australia. This is fully in line with our standard practices where we partner with local organisations to help transform local shipbuilding industries into globally-competitive shipyards. We look forward to working with the Commonwealth to maximise opportunities for Australian industry, drawing on the existing supply chain of our Australian partners, while also providing opportunities for local industry to be involved in our global supply chain supporting more than 70 shipyards around the world."

Civmec Starts Construction of Australia's Largest Undercover Shipbuilding Facility

On 26 April, Civmec, through its wholly-owned subsidiary Forgacs Marine and Defence Pty Ltd, commenced the construction of their state-of-the-art 29 000 m², 18-storey high, purpose-built ship and module construction, ship repair and maintenance facility.

A ground-breaking ceremony was held in December 2016 to announce the commencement of development for the facility, with the then Premier, the Hon. Colin Barnett MLA, turning the first sod.

Following this announcement, Civmec has been working on the detailed design elements of the facility with the local branch of the global engineering firm, GHD Engineering, to ensure that the facilities have the best technology and will achieve the best, most efficient, project outcomes.

Civmec's Executive Chairman, James Fitzgerald, said "This is an exciting day as we look forward to further growth in our business with the announcement by the Commonwealth Government that Henderson has been identified as one of two suitable locations for the continuous build of naval ships and for vessel maintenance. This is cause for great optimism and reflects highly on Western Australia's industrial capability and capacity, to which this facility will be a significant addition. The facility will allow us to increase our Henderson workforce by an extra 1000 people, including at least 100 apprentices."

Civmec's Chief Executive Officer, Pat Tallon, said "This diversification is a natural extension of our core capabilities. The new shipbuilding and maintenance facility at Henderson will be a significant piece of industrial infrastructure, adding a new resource to the Australian maritime landscape whilst allowing Civmec to continue to service its clients in the other sectors in which it operates."

The Managing Director of Forgacs, Mike Deeks CSC, added "We are excited to commence construction of our state-of-the-art shipbuilding and maintenance facility which will be large enough to house complete air-warfare destroyers or frigates as well as offshore patrol vessels for construction or maintenance. The building has a gross floor area of 53 470 m². This facility will be a huge addition to the Australian Marine Complex and is designed to be the most efficient in the world."

"At today's event, we are honoured to have the Hon. Christopher Pyne, Minister for Defence Industry, to mark the first day of construction, as we oversee the first load of soil removed from the site. The construction plan requires 90 to 120 truck loads of earth removed each day for almost six months from the 7-hectare site."

Rebecca Schofield

DCNS Support for Australian Industry

On 24 April the Minister for Defence Industry, the Hon. Christopher Pyne MP, welcomed the signing of the DCNS Australian industry participation agreement.

Minister Pyne said that the agreement with the Defence Materials Technology Centre (DMTC) highlights DCNS's commitment to ensuring Australian industry participation in defence construction and sustainment projects.

"DCNS's support of the DMTC is another example of their commitment to maximise Australian industry involvement in military procurements and sustainment without compromising capability, cost, schedule and risk," Minister Pyne said.

The DMTC aims to develop industrial capabilities in support of defence innovation which could be made available to Defence through competitive procurement channels.

This agreement is separate to DCNS being selected as the international partner for the Future Submarine Program.

Australian industry would be directly involved in the highly technical work of designing and integration of future Defence projects, further developing Australia's own capability in these specialised areas.

Upgrade to Sydney's Garden Island Navy facilities

A \$213 million wharf upgrade project at the Navy's Garden Island facility in Sydney was referred on 2 March to the Parliamentary Standing Committee on Public Works with work expected to begin in mid-2017, subject to approval.

The Cruiser Wharf and Oil Wharf at Garden Island will be demolished and a new wharf with different alignment will be constructed. An adjoining wharf will also be extended to reduce the new wharf's protrusion into Sydney Harbour.



An impression of the upgraded wharves for Sydney's Garden Island
(Department of Defence image)

The Garden Island upgrade will provide critical capability for Navy as part of the 2016 Defence White Paper.

The project is expected to create about 300 direct jobs with flow-on benefits for the local economy.

Building a new wharf which is equipped with engineering services, including electrical, water, and fuel, along with a crane, will enable maintenance work to be conducted well away from residential areas, reducing the noise and visual impacts.

MoorMotions Software

Perth Hydro has developed a software program to calculate moored ship motions and loads. The software and example simulations were launched recently at a dedicated ship mooring session for the Nautical Institute and Company of Master Mariners Australia.

MoorMotions was developed following an extensive series of moored ship motion measurements. The software takes in external forces such as waves, wind, currents and passing ships, and calculates the moored ship motions and loads. Flags are raised when mooring line loads, fender loads or ship motions exceed threshold values. These values may be user-input or set according to PIANC guidelines.

The software employs a fully-nonlinear time-domain solver, allowing the correct treatment of fender friction and energy dissipation, as well as nonlinear mooring line and fender forces. Work is in hand to build this software into 10-day weather forecasts for ports, so that they can foresee dangerous environmental conditions for each ship class and berth, and schedule visits accordingly. This will help to increase port efficiency.

Video simulations are available at www.moormotions.com. Please contact Dr Tim Gourlay (tim@perthhydro.com) for further information.

Wärtsilä Engines to Power World's Largest Expedition Mega Yachts

Wärtsilä is to supply the main engines for a new and innovative expedition mega yacht, owned by Genting Hong Kong which also owns the MV WERFTEN yards in Germany where the vessel is to be built. There is an option for an additional two vessels in this Endeavor-class series. The order with Wärtsilä was booked in March 2017.

The new vessel will be the world's largest expedition mega yacht with ice-class certification and will be able to operate in polar region waters. Passenger comfort and operational reliability were cited as being major considerations for the equipment selected. Four 6-cylinder Wärtsilä 32 engines combined with Wärtsilä NOx Reducer (NOR) systems will provide the electrical power for the ship. The system is fully compliant with the IMO Tier III exhaust emission regulations set out in Annex VI of the MARPOL 73/78 convention. The equipment is scheduled to be delivered to the yard in 2018.

"This is an exciting newbuild project and we are proud to have been selected as a supplier. The Wärtsilä 32 engine is extremely well proven and features excellent reliability and easy maintenance, both of which were important factors in its selection," said Lars Anderson, Vice President, Engine Sales, Wärtsilä Marine Solutions.

"We have enjoyed a good relationship with Wärtsilä for a number of years and we know and trust their products. The successful development of this ship is due to good cooperation and communication between all the project partners," said Axel Rothe, Vice President, Procurement and Logistics, MV WERFTEN.

The Wärtsilä 32 engine is based on the latest achievements in combustion technology and is designed for efficient and easy maintenance with long maintenance-free operating periods. The engine is fully equipped with all essential ancillaries and a thoroughly planned interface to external systems.



The new and innovative expedition mega yacht, owned by Genting Hong Kong, which will be powered by Wärtsilä
(Image courtesy MV WERFTEN)

MY *Charley* on Show to the World

West Australian superyacht builder Echo Yachts exhibited their recently delivered 46 m Expedition/Shadow Vessel *Charley* at the Singapore Yacht Show in April.



An aerial view of MY *Charley*
(Photo courtesy Echo Yachts)

Charley was custom-designed and purpose built using the latest in 5 axis CNC and vacuum resin-infusion manufacturing technology at Echo Yacht's superyacht manufacturing facility near Fremantle in Western Australia.

Charley is the largest composite resin-infused vessel ever to be built in Australia, designed by New Zealand-based naval architects LOMOcean Design (formerly Craig Loomes Design).

The unique design of *Charley* provides extremely spacious interior and exterior accommodation entertaining areas, a very large carrying capacity for a plethora of tenders and other water toys, plus superior seakeeping and fuel-efficient performance.

Although designed primarily as a support vessel, *Charley* is still able to fully accommodate the owner and guests independently of the mothership and, as such, is expected to see use as a standalone expedition boat for fishing, diving and exploring. The vessel boasts sleeping arrangements for up to 32 guests and crew. Large living and dining spaces are supported by a full galley, with vast shaded outdoor spaces also on offer for outdoor entertaining and relaxing in the tropics.



Charley's 12 m tender on its launching platform
(Photo courtesy Echo Yachts)

One of *Charley's* most striking features is the large 12 m custom carbon-fibre tender catamaran with a specially-engineered launch and retrieval platform positioned at the stern of the vessel.

The Australian Naval Architect



Charley's wheelhouse
(Photo courtesy Echo Yachts)

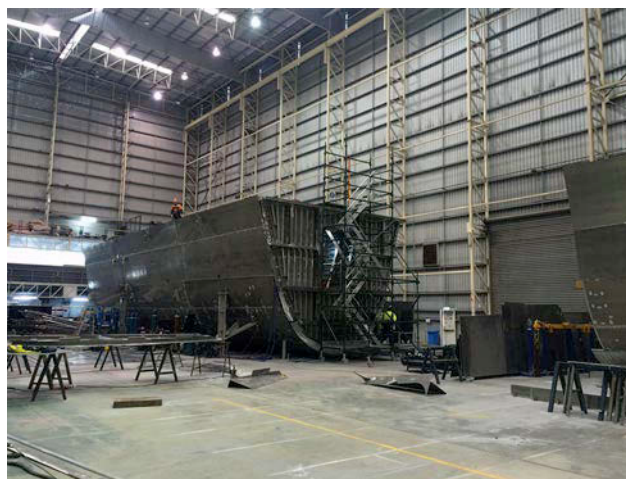
Charley also comes equipped with an emergency helicopter touch-and-go pad, dive store, decompression chamber and specialist sonar equipment for wreck finding and diving expeditions, to name but a few of her impressive features.

The team at Echo Yachts specialise in the design and manufacture of bespoke super yachts, expedition and shadow vessels, tailoring each project to match their client's exacting requirements, style, features and performance.

Echo Yachts is currently building *White Rabbit Golf*, an 84 m aluminium trimaran super yacht designed by One2three Naval Architects and styled by the renowned Sorgiovanni Design studio. The 84 m diesel-electric super yacht is to be a world first, being the largest aluminium and largest trimaran super yacht built to date.



An impression of *White Rabbit Golf*
(Image courtesy One2three)



White Rabbit Golf under construction in Western Australia
(Photo courtesy One2three)



THE WALTER ATKINSON AWARD

A PRIZE FOR THE BEST WRITTEN PAPER FOR THE BEST WRITTEN PAPER PRESENTED TO A RINA FORUM IN AUSTRALIA IN 2016–17

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

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

The Award comprises three components:

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

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

A nomination must be a written paper, not simply a presentation, first presented either at a RINA Section meeting or RINA-supported conference in Australia, or first published in a RINA-supported publication in Australia (e.g. *The ANA*). Since no Pacific International Maritime Conference was held during the year, the only conference papers that are eligible are those to the RINA AOG 2017 Conference and it is most important for Sections to nominate papers presented to their technical meetings.

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

Visual presentations are not eligible unless they reflect the content of the presenter's written paper. Nominations of papers published in the period 1 July 2016 — 30 June 2017 must be received by the Secretary no later than 21 July 2017.

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

Mail:	PO Box 462, Jamison Centre, ACT 2614
Email:	rina.austdiv@optusnet.com.au or austdiv@rina.org.uk
Phone:	0403 221 631

THE INTERNET

Webcasts of NSW Section Technical Presentations

In 2011, Engineers Australia began recording selected technical presentations made to RINA (NSW Section) and IMarEST (Sydney Branch) for webcasting using Mediavisionz. The recordings were placed on the Engineers Australia website. All of the recorded webcasts up to 30 September 2014, together with hotlinks to each one, are listed at

www.rina.org.uk/NSWwebcasts.html.

In October 2014, Engineers Australia started using a new system for recording presentations, using three cameras and a hand-held microphone, with an audio technician in attendance. Webcasts were then placed on the Engineering on Line (EoL) website at www.engineeringonline.com. Our first presentation to be recorded with this new system was Graham Taylor's presentation on *LNG — The New Marine Fuel?* on 1 October, and the presentation is up on the EoL website at www.engineeringonline.com/video/xjkrdrf/lng-the-new-marine-fuel. Details of how to access this recording were given in the February 2015 issue of *The Australian Naval Architect*.

However, in early 2015, Engineers Australia discontinued the new recording method and the EoL website for regular monthly presentations, and resumed using Mediavisionz while considering options for future recordings.

In 2015, only one recording of our presentations was made, of Warren "Skip" Miller's presentation on *Side Lifting Foils and Support Structure on Wild Oats XI* on 1 April, and the presentation is shown, with a hotlink, on the NSWwebcasts website.

In 2016, Engineers Australia discontinued recording presentations in the Harricks Auditorium. Recordings may still be made, but must be arranged/paid for by the society using the Auditorium. We are currently investigating the option of making our own recordings. We have so far made two recordings and are in the process of placing these on the web. We are learning and have ideas to improve the viewing experience.

Watch this space!

Phil Helmore

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the evening of Tuesday 21 February 2017 by teleconference from Perth under the chairmanship of the President, Prof. Martin Renilson. The Chief Executive, Trevor Blakeley, attended by invitation.

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

Division Vision Statement

This statement has been finalised but the Council was still waiting for Section responses to populate the list of members to be responsible for liaison on various subjects.

Survey of Members Expectations

Further to initial discussions at the Council's previous meeting in December, the Council noted that our Vice President, Jesse Millar, had the survey underway and looked forward to receiving the results.

Australian Naval Shipbuilding and Repair Capability

The President would prepare a draft submission to the new inquiry into naval shipbuilding by the Senate's Economic References Committee with a view to lodging it by the deadline of 3 March 2017 (since done).

AMSA Domestic Vessels

The Council invites members with concerns about the operation of the "National System" to forward details of their concerns to the Secretary. Meanwhile, the Division has invited AMSA to provide an article on developments with the system for publication in this journal.

Funding of the Division's Sections

Council agreed to a rationalised system for the distribution of funding to promote furtherance of the Institution's objectives.

Appointments to Council

As the meeting was the last prior to the AGM (held two days later), the Council appointed Dr Walid Amin, David Gonzalez Pastor and Gordon MacDonald to the vacancies remaining unfilled following the call for nominations in November 2016.

London Council Meeting on 7 February 2017

The main actions discussed by London Council related to implementation of the Institution's new technical committee structure. Council accepted the Chief Executive's offer (since implemented) to establish forums for on-line discussion of issues by members of the Council and Division respectively.

Next Meeting of Council

The Council agreed that its experiment with holding the meeting in the evening had appeared to improve attendance and the President undertook to consult with incoming members on whether to hold future meetings outside working hours.

The Council tentatively agreed to its next meeting being held on Wednesday 7 June 2017.

Annual General Meeting

The AGM was held in Perth at 2.15 pm (WST) on Thursday 23 February 2017.

The new Council for 2017–18 is:

President

Dr Martin Renilson

Immediate Past President

Dr Tony Armstrong

Vice President

Jesse Millar

Secretary

Rob Gehling

Treasurer

Craig Boulton

Members Nominated by Sections

Karl Slater (Vic)

Sue-Ellen Jahshan (NSW)

Mark Devereaux (Qld)

A/Prof. Michael Woodward (Tas)

Kalevi Savolainen (WA)

TBA (SA&NT)

Tom Dearling (ACT)

Members Elected or Appointed i.a.w. Australian Division By-Laws

Dr Walid Amin

Jim Black

Gerard Engel

David Gonzalez Pastor

Gordon MacDonald

Matthew Williamson

Walter Atkinson Award 2017

Members' attention is drawn to the notice elsewhere in this issue for nominations for this award.

Rob Gehling

(Secretary)

Changed contact Details?

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

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

RINA London hq@rina.org.uk

Australian Div. austdiv@rina.org.uk

Sections

ACT rinaact@gmail.com

NSW rinansw@gmail.com

Qld hamish@oceandesign.com.au

SA/NT danielle.hodge@defence.gov.au

Tas gregorm@amc.edu.au

Vic sgiles@bmttdt.com.au

WA wa@rina.org.au

Phil Helmore

D. J. (Jock) Dalziel

Jock's passing at the end of January was noted briefly in the February edition of *The ANA*.

As a leader in the Australian shipbuilding industry for many years and a distinguished member of RINA for 66 years, it is appropriate to reflect on his career.

Jock was born in 1925 in Armadale, Melbourne, as the fourth son of Allan and Jean Dalziel. Allan was a Scottish seagoing marine engineer who joined BHP in 1923 and moved to a shore job in Newcastle when Jock was three. Jock's childhood years included living in Scotland while Allan oversaw construction of four BHP ships in the late 1930s, but the family returned to Australia prior to the outbreak of World War II. BHP responded to the call from the British Admiralty to build warships in Australia and Allan Dalziel was charged with the role of establishing the new industry of shipbuilding in Whyalla, South Australia. The challenge was to transform a deserted, salt plain into a shipyard and to do it quickly. As shipyard superintendent, Allan and his team planned the layout of the shipyard, supervised its construction, engaged and trained a workforce of hundreds, some experienced from overseas and others recruited and trained locally. The first four vessels to be built at Whyalla in 1941 were minesweepers for RAN service, followed by merchant vessels for Australian coastal service. Allan Dalziel managed the facility until 1952.

Jock joined BHP in 1941 as a trainee technician in the shipyard drawing office. Upon completion of his part-time naval architecture studies at the South Australian School of Mines, Whyalla, he held various positions in the shipyard before embarking on a study tour of UK and European shipyards in 1956–57. On return he was appointed assistant to the shipyard superintendent in 1957.

In 1965 he led a three-man team which completed a technical co-operation agreement with Ishikawajima-Harima Heavy Industries (IHI). This agreement reflected the increasing ship size (above 20 000 dwt) and prominence of oil tankers and bulk carriers in the shipyard's orders during the 1960s. Jock was made responsible for implementation of the first stage of the agreement. In February 1967 he was appointed General Manager of the shipyard, a position he held until August 1976.

Among the notable ships constructed during Jock's tenure as General Manager were:

- The offshore drilling rig *Ocean Digger* in 1967.
- The container ships *Kanimbla* and *Manoora* in 1968–69.
- The oil tanker *Amanda Miller* in 1971, with the disruption of a severe fire while on the slipway.
- The largest ship built in Australia, the bulk carrier *Clutha Capricorn* of 83 000 dwt in 1972.
- The gas turbine powered steel-product carriers *Iron Monarch* and *Iron Duke* in 1973.
- The ro-ro bulk carrier *Zincmaster* in 1975.
- The gas turbine-electric ferries *Union Rotorua* and *Union Rotoiti* in 1976, *Seaway Prince* and *Seaway Princess* in 1976–77.



Jock Dalziel

It will be apparent to those familiar with any or all of these vessels that they embodied the quality and innovation for which Whyalla Shipyard should be remembered, all this having been overseen by Jock Dalziel who was a giant in Australian shipbuilding in the outcomes achieved. I was privileged to work under his leadership for the second half of his General Managership.

In 1976 Jock was appointed General Manager of another BHP subsidiary, the Commonwealth Aircraft Corporation (CAC) at Fishermens Bend in Victoria. He was appointed to the Board in 1983. He retired after the company was sold in 1985.

On retirement in Melbourne, Jock was not lost to shipbuilding as he was appointed a director of Cockatoo Dockyard Pty Ltd in August 1984, a position he held until August 1986. Retirement gave him the time to enjoy his family and grandchildren and to travel extensively with his wife. Jock is survived by his daughter, Fiona, grandchildren Robert and Sophia, son-in-law Simon and sister Jean. His wife, Pamela and daughter, Jennie, pre-deceased him.

In closing, I would like to express my appreciation of the assistance provided by Fiona Dalziel in providing invaluable information on Jock's career. Ross Hawke, who worked in tandem with Jock from 1941 onwards and succeeded him at Whyalla, together with Ross Stacey, also assisted in this tribute.

Rob Gehling

NAVAL ARCHITECTS ON THE MOVE

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

Joshua Bolin has moved on from Guido Perla and Associates and has returned to van Oosanen and Associates to take up his position as a naval architect in Wageningen, The Netherlands.

Angus Bratter, a naval architecture student at UNSW Sydney, has commenced working part-time at Svitzer Australasia at Port Botany while he completes the requirements for his degree.

Stuart Cannon has moved on within the Defence Science and Technology Group and has taken up the position of Program Leader in Melbourne.

David Cox has retired from the Capability Acquisition and Sustainment Group and, after a six-month break including a vacation in the UK, is now contracting to the Maritime Command and Control System Program Office of the Department of Defence in Canberra.

Liam Finegan moved on from ASO Marine Consultants in 2013 and, after some time at Algorithmic Trading System Design and consulting to various UAE-based clients, has completed a Master of Commerce degree in Econometrics and Quantitative Finance at the University of Sydney.

Stuart Grant moved on from Alloy Yachts in 2012 and is now a business consultant in Waikato, New Zealand.

Brad Hillman continues as Newbuilding Project Manager at Interorient Marine Services in Limassol, Cyprus.

Scott Hunter has moved on from Aquantis and has taken up the position of Chief Technology Officer with Wave Swell Energy in Sydney.

Sue-Ellen Jahshan has moved on within Thales Australia and has taken up the position of Submarine Hardware Work Package Manager in Sydney.

James Johnston, a naval architecture student at UNSW Sydney, has commenced working part-time at ASO Marine Consultants in Sydney while he completes the requirements for his degree.

Bryan Kent has moved on from AWD Group and has taken up the position of Territory Sales Manager with Porter Equipment Australia in Sydney.

Geoffrey McCarey, a naval architecture student at UNSW Sydney, has commenced working part-time at Spear Green Design in Sydney while he completes the requirements for his degree.

Campbell McLaren has moved on from Makani Power and has taken up the position of Senior Composite Structures Engineer with Kitty Hawk and Zee Aero at Mountain View in California, USA. These companies are working on prototypes of Larry Page's flying car!

Adrian MacMillan has moved on within Woodside Energy and has taken up the position of SNE Floating Facilities Lead in Perth.

Jesse Millar has moved on from BMT Design and Technology and has taken up the position of Deputy Engineering Manager with Leidos Australia in Melbourne.

Todd O'Brien, a recent graduate of the Australian Maritime College, has taken up the position of naval architect at

Oceantech Design in Adelaide.

Dimitrije Radukanovic has moved on from Schenker Australia and is now consulting as RaduCan, with special expertise in marine heavy lifts, in Perth.

Roger Ramsey has retired from BAE Systems and is enjoying his retirement interspersed with occasional selected consultancy work.

Graham Rayner moved on from Defence Materiel's European Office in London in 2006, and then from Defence in 2007 and, after some time at Qinetiq, returned to Defence working on major projects. He retired from Defence in 2015, and now enjoys military and family history, and setting up a national memorial to peace-keepers.

Kris Rettke has moved on within the Amphibious and Afloat Support Systems Program Office of the Capability Acquisition and Sustainment Group and has taken up the position of Acting Engineering Manager in Sydney.

Tony Sammel completed his Doctor of Medicine in 2010, and is now in his final year of training as a specialist in rheumatology (arthritis and autoimmune diseases) at St Vincent's Hospital in Sydney.

Ian Sargeant continues with AMD Consulting, now telecommuting from Brisbane.

Felix Scott moved on from High Modulus in 2012 and has now taken up the position of Design Engineer with Yachting Developments in Auckland, New Zealand.

Greg Shannon has moved on within Jowa AB and has taken up the position of Technical Sales Director in Göteborg, Sweden.

Chris Shead has moved on from project work in the real-estate industry and retired in 2014 — and is enjoying life in the slower lane.

Mark Smallwood has moved on within the Office of the Chief Investigator Transport Safety and has taken up the position of Manager Technical and Investigation Support in Melbourne. Mostly rail these days, but still the occasional marine investigation.

Evan Spong moved on from One2three NavalArchitects in 2013 and has taken up the position of System Technical Authority for the FFG Fleet with BAE Systems on Garden Island in Sydney.

Ruben Spyker has moved on within ASC and, in 2013, took up the position of Technical Director of the AWD Program in Adelaide.

Paul Stanyon continues consulting as Stanyon Marine Consulting in Coomera, Qld, providing design, surveying and consultancy services. Friends can find out more at www.stanyonmarineconsulting.com.au.

Nick Stark continues as Senior Naval Architect at Silver yachts/Hanseatic marine in Fremantle.

David Steed moved on from Austal Ships in 2009 and took up the position of Project Manager with Crondall Energy Consultants in Winchester, UK.

Paul Steinmann continues consulting as Halcyon International, and now includes VEEM Ltd among his clients, managing the product commercialisation of the VEEM Gyro stabiliser.

Samuel Stevens moved on from Oceantech Design in 2006 and, after some time at Robert Allan, Strategic Marine (Vietnam) and Austal Ships (Phillipines), in 2015 took up the position of Managing Director with GNV Marine in Port Lincoln, SA.

Mitchell Stone has moved on within the McDermott group and, from McDermott Australia, moved to McDermott International in 2013 where he took up the position of Operations Engineer.

Dash Swift moved on from Acergy in 2009 and, after some time at Sapura Acergy, moved to Subsea 7 where he has risen through the ranks to take up the position of Lead Engineer in Perth.

Mark Symes continues as lecturer and course coordinator at the Australian Maritime College in Launceston, and is now Chair of the Tasmanian Section of RINA.

Longbin Tao moved on from Griffith University in 2008 and took up the position of Lloyd's Register Chair Professor of Offshore Engineering at the University of Newcastle-upon-Tyne in Newcastle, UK.

Belinda Tayler continues as BT Consulting and in 2011 took up the position of General Manager Defence and Commercial with Noakes Group in Sydney.

Rob Thompson continues as a Marine Accident Investigator with the Transport Accident Investigation Commission in Wellington, New Zealand.

Todd Tippet moved on from the Royal Australian Navy in 2012 and took up the position of Port Engineer with Teras Australia in Perth.

Peter Tomic has moved on from Echo Yachts and has taken up the position of Marine Operations Manager with Siemens Wind Power in Vejle, Denmark.

Emma Tongue has moved on from Crondall Energy Consultants and is now consulting to the oil and energy industry in Perth.

Lachlan Torrance has moved on from QGC and is now consulting to the oil and energy industry in Brisbane.

Chris Tucker continues consulting as Chris Tucker Marine Design in Melbourne.

Rob Tulk continues as the Senior Naval Architect at One2three Naval Architects, in Sydney,

Tom Urie has moved on from ASC and is now consulting as Tom Urie Marine Consulting in Melbourne.

Nicholas van den Hengel moved on from the Amphibious and Afloat System Project Office in 2012 and, after some time at Raytheon Australia and the SEA5000 Future frigate project, is now consulting as a chartered naval architect in Sydney.

Guido van der Veen has moved on from Frontier Engineering Solutions and has taken up a position as a naval architect and structural engineer at Intecsea in Perth.

Drew van Ryn continues as a naval architect at One2three naval architects in Sydney.

Max van Someren moved on from Austal Ships in 2008 and, after some time at Royal Haskoning DHV in London and Frazer Nash Consultancy in Bristol, UK, in 2016 returned to Australia to Austal Ships where he took up the position of Technology Development Manager in Fremantle.

Tony Vine moved on from Naval Headquarters in Hobart in 2010 and took up the position of Executive Director of the Royal Australian Navy's Safety Program in Coffs Harbour.

Robin Virant moved on from Andersen Yachts in 2004 and, after some time at Defence Maritime Services, Chevron and Germanischer Lloyd, is now consulting as Raven Maritime in Melbourne.

Ahamed Wajeeh continues consulting as Optimum Solutions in Male, Maldives Islands.

Mike Warren has moved on within ASC and has now taken up the position of Build Strategy Manager in Adelaide.

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

Phil Helmore

FROM THE ARCHIVES

Punitive Penalties for Late Delivery of Pre-Pre-Dreadnoughts.

Graham Rayner

Late delivery of a ship can cause significant problems and, for commercial operators, they are obvious. This usually translates into "liquidated damages" — a sum of money representing the lost potential income to the operator, or the costs the operator might incur in managing the late delivery of the ship (e.g. leasing an alternative until the ship is ready, delaying maintenance on another vessel so that it can absorb the extra workload, etc.) But what if the government is the customer? Today the courts recognise that a government has consequential costs if a ship, even a warship, is delivered late. This was not the case in the mid-19th century. Liquidated damages, when applied in government contracts, were seen as penalties. None more so than the contracts placed by the government in the first days of January 1856 for the construction of a fleet of floating gun batteries, the precursor to the battleship concept developed and refined over the next 70 years. They were to be used in the Crimean War, then still raging, and after the Royal Navy had suffered terrible losses when using conventional wooden-hulled warships in the siege of Sebastopol and elsewhere. They saw the advantages of using specially-designed floating gun batteries in such circumstances — heavily armoured sides and decks, and shallow draft to close enemy castle fortresses — shaped much like the classic box-shaped vessel of naval architecture studies.

To reinforce the urgency of the construction program, the government insisted on a delivery date of 14 April 1856 — some 14 weeks after contract start — and stipulated that the ships had to be delivered either to London or Portsmouth by that date. A ship of that size would typically take over 12 months to build, especially as they were some of the earliest fully-iron ships of any kind. Furthermore, to encourage adherence to the delivery date of 14th April, the government included a clause in the contracts that required the contractor to pay a penalty of £1000 *per day* for any late delivery. Although the contract value is unknown, the construction costs of similar ships at the time were approximately £50 000 to £70 000. Therefore the penalty represented about 2% of the contract value for each and every day a ship was delivered late. In two weeks, over a quarter of the contract value would be lost. Put in today's terms, that might work out as \$100 million per day late fee for the air-warfare destroyer contract! Small wonder then, that the three shipbuilders — Samada Brothers in London, Robert Napier in Glasgow and Palmer Brothers of Newcastle-upon-Tyne — threw every worker they could muster into the build program. One thousand workers and more were used at each site, seven days a week, and suppliers of material and equipment were expected to follow suit.

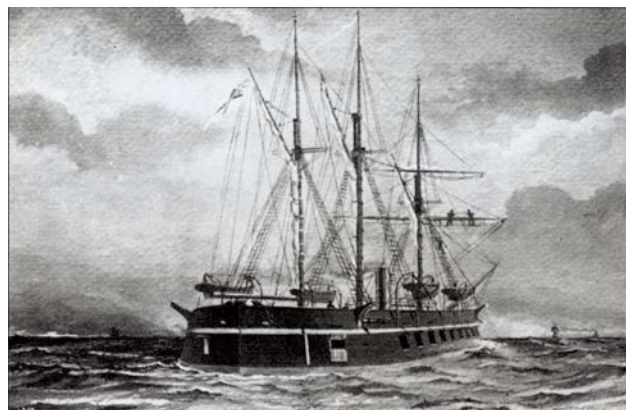
In the event, the Crimean War ended in the early days of April 1856, and the urgency evaporated. Some would say thankfully, as none of the shipbuilders met the delivery date, all ships were delivered within days of each other but all were late. The government elected not to claim its late fee. Quite apart from the contractual interest, these three ships are worth a look.

Not only were they at the forefront of a new type of vessel, with only a few in service in the RN and the French Navy (none self-propelled or sea-going), they were among the first fully-iron warships to be built, and the first to use rolled iron plates [1]. The next major evolution of warship design would be the Pre-Dreadnought battleships. Perhaps we should read a description of the gun batteries as reported in the press of the day, and note how close HMS *Erebus*, and perhaps the other two, came to diving straight to the bottom when it was launched. The main deck was the gun deck and if the painting of HMS *Terror* [2] is used to judge, only a few feet above the design waterline. All three ships were completed on the slipway before launch. The florid language is typical of contemporary journalism and the two separate descriptions help put together a picture of the construction and layout of the ships. The extracts are unedited and are as published. [Except for the addition of metric conversions — Ed.]

Shipping Gazette and Sydney General Trade List, Monday 21 July 1856, page 151 [3],

Launch of the Erebus.— On Saturday, 19th April, the *Erebus* floating battery was launched in the most, successful manner from the building-yard of Messrs. Robert Napier and Sons, at Govan, about two miles below Glasgow.

On taking the water she dipped deeply on account of the immense weight, and was submerged for a moment or two almost to the level of the deck [weather deck], but as all the port-holes were closed with the exception of those at the bow she shipped little or no water, and



HMS *Terror*

gradually rose upon the reflux of the wave. Two immense chains, fastened to two anchors of the same weight as those used on board the Duke of Wellington [131 gun first rate wooden ship of the line], and which were buried in the earth, covered with immense iron forging plates, acted as a check against the ship touching the opposite side of the bank. When the temporary warp checks on the chains had snapped, the anchors were drawn forward about two inches, and would in all probability have been drawn out altogether, but that the chains in the interior of the battery were gradually slackened from the windlass, whereby the *Erebus* got smoothly across the stream, and was brought up after slightly grazing the north bank, from which, however, she did not sustain the least injury. When afloat the battery drew 8 ft 4 in (2.54 m) of water aft, and 6 ft 8 in (2.03 m) at the bow.

The *Erebus* left in the evening for Portsmouth, under the command of Captain Case.

She is 180 ft (54.86 m) long, with a breadth of beam of 50 ft (15.24 m), and a depth of 16 ft (4.88 m). With the exception of being nearly as flat on the bottom as she is upon the deck, she is framed and plated like any ordinary iron vessel; but there is this peculiarity in her construction that, over the iron hull, for a distance of 12 ft (3.66 m) from the top of the gunwales downwards, the vessel is sheathed with teak planking 6 in (150 mm) in thickness: and then, again, over the planking, there are massive malleable iron plates no less than 4 in (100 mm) thick. Thus, with the inside plates, which average from ¾ to ½ in (19 to 12 mm) thick, the entire hull of the ship above water-mark forms, as it were, an iron and wooden wall of no less than 104 in (2.64 m) [sic] in thickness — a wall apparently so formidable as to be capable of resisting the effects of shot of the largest size. The battery is pierced for 30 guns, there being 15 portholes on each side; and her armament will consist of guns 11 ft (3.35 m) in length, with an 8-inch bore, and capable of throwing 100 lb (45 kg) shot. She is supplied with two decks — a gun-deck, which is the lower, and an upper or weather-deck. The battery has been fitted with seven water-tight bulkheads or compartments, extending from the bottom of the vessel upwards to the gun-deck.

Newcastle Courant of 25 April 1856 [4],

Yesterday afternoon, the third and last of the monster floating batteries ordered by the Government at the beginning of the year, was launched from the flourishing

and enterprising iron ship-building yard of Palmer Brothers, of Jarrow.

Beauty of design and fine model, hitherto the distinguishing feature of iron vessels, were in the instance totally disregarded; and bulk, strength, durability, and resistance, bidding defiance to all assailants, have been substituted. Looking at her from externally, her appearance carries with it something like what her name indicated, viz., Terror; and, as to her internal preparations and arrangements for destructive warfare of the fiercest and deadliest nature, with due regard for the protection of the lives of her crew, she undoubtedly outrivals all in naval architecture. All that science and ingenuity could devise, combined with the untiring sinews of the men, who toiled from night to morn to complete her, has evidently been in requisition, with the object once contemplated of testing the stronghold of the Autocrat, and to show him that what England could not do with the broadside of her invincible wooden walls, in consequence of the want of depth of water, the fleet of gun-boats and floating batteries would accomplish. A timely concession, and ultimately in terms of peace have, however, prevented the deadly contest, and, as to their future use, time only will determine. ...

It is stated, that since the commencement of the battery, on the 7th January, until the launch, upwards of 1000 men have been employed daily, in her construction. Her engine and boilers are fitted within her; by Saturday her steam will be up, and, it is expected, that she will be on her way to Portsmouth.

The following is a brief description of the floating battery:-

The Terror is 2000 tons (2032 t) burthen, and about 190 ft (57.91 m) in length, in breadth 48 ft 6 in (14.78 m), depth 18 ft 6 in (5.64 m). Spoon bowed, framed and plated like an ordinary iron ship. Outside of the plating, planks of teak, 6 in (150 mm) in thickness, are bolted, and over these are plates of iron 4 in (100 mm) thick. This sheathing of wood and iron is expected to be proof against shot or shell. The form of the vessel is very peculiar, having great breadth of beam, and being very shallow in proportion to the breadth, and this is continued uniformly almost from the bow to the stern. The sides stand out, but the bottom is nearly flat, so as to make it float on a small draught of water, to enable her to draw up close under the walls of a fortress. The beams forming the upper or weather deck are fitted close to each other, and are exceedingly strong. The deck planks are of teak, covered in thick iron plates, shot and shell proof. The beams of the lower or fighting deck are also very strong, fitted close to each other, and planked with oak; and this department of the vessel is ventilated by air tubes, supplied by fanners, driven by donkey engines in the engine room. These fanners will be of great service in clearing away smoke, and keeping the atmosphere in a cooling temperature for the men at the guns. As to the men appointed to keep a look-out on the weather deck, they are sheltered from shot in small round-houses, made of strong plate iron, placed on the weather deck. Gutta percha tubes enable the look-outs to communicate from these houses to the pilot or steersman, the steering gear being placed on the fighting deck. The officers' cabins are also on the fighting deck, the fittings of which are portable, and can easily be taken down, or hooked to the beams above with

the greatest facility. Underneath the fighting deck are placed the magazines, shell and store-rooms, all of which are fitted up in the same manner as in ships of war. The rudder is peculiarly shaped for steering the vessel in deep water, being made to hang downwards below the vessel's keel or bottom when necessary. A screw engine of 200 HP (149 kW), of high pressure, by Messrs Napier, of Glasgow, supplied by steam from four strong circular boilers, will propel the Terror.

The following are the mechanical particulars of the Terror:-

Draft of water forward	5 ft 6 in (1.68 m)
Ditto aft	7 ft 2 in (2.18 m)
Bow port from water	7 ft 10 in (2.39 m)
Midship port ditto	6 ft 6 in (1.98 m)
Stern port ditto	6 ft 3 in (1.91 m)

The three batteries did not see any service in the role for which they were designed. HMS *Terror* was sent to Bermuda in 1857 and acted as a guard ship there until it was sold in 1902 and HMS *Erebus* was used in various roles until sold in 1884. In 1873 HMS *Thunderbolt* was decommissioned and converted into a floating pierhead at Chatham Dockyard. She was briefly re-commissioned in 1916 as HMS *Deadalus* as a ship to which RN personnel were posted to the fledgling Royal Naval Air Service (the personnel actually trained at RNAS Cranwell in Lincolnshire). The pierhead/hulk was sunk when hit by a tug in 1948, and was raised and broken up the following year.

Footnote

A challenge in researching this article was that these ships have largely been forgotten. It was made worse by the fact that *Terror* and *Erebus* were named after ships of the same name lost with all 129 aboard in the Arctic only ten years earlier. The expedition was led by Sir John Franklin who had been Lieutenant-Governor of Van Dieman's Land between 1837 and 1843. Franklin had been viewed as progressive and humane (for the day) and his wife made a significant contribution to Tasmanian society during his tenure.

References

- [1] Dillon, M. (1903), *Some account of the works of Palmers Shipbuilding and Iron Work Company*, newcatalog.library.cornell.edu/catalog/6778112.
- [2] www.tynebuiltships.co.uk/T-Ships/terror1856.html.
- [3] www.trove.nla.gov.au.
- [4] www.britishnewspaperarchive.co.uk.

Smooth seas for NUSHIP *Hobart* during
Sea Acceptance Trials
(Photo courtesy AWD Alliance)

