THE AUSTRALIAN NAVAL ARCHITECT

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Australia's first air-warfare destroyer, the future HMAS *Hobart*, taking shape in Adelaide
(Photo AWD Alliance)

THE AUSTRALIAN NAVAL ARCHITECT

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Cover Photo:

NUSHIP *Canberra*, the first of the RAN's new LHDs, approaching Sydney Heads inbound for the first time on 13 March 2014
(RAN Photograph)

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From the Division President

For those of you who were unable to attend the Annual General Meeting of the Australian Division in Perth on 19 March 2014, the report which I presented to the meeting on our activities during 2013 was as follows:

"Another busy twelve months for the Australian Division has flashed by since my report to the last AGM in 2013. The Division Council met in June, September and December and will meet again before this report is presented to the 2014 AGM. I again wish to acknowledge the support that I have received from all of our Council members around the country and, particularly, Vice President Dr Tony Armstrong, Treasurer Craig Boulton and Secretary Rob Gehling.

"The key outcomes from each Division Council meeting are reported quarterly in *The Australian Naval Architect*. Thanks again to John Jeremy and Phil Helmore for their ongoing enthusiasm in the production of this great publication, and a particular mention for Jesse Millar who took on the task of Advertising Manager for *The ANA*. Thanks, too, to all of our members who have contributed to the enhancement and promotion of our profession in myriad ways throughout the year, be it in government, industry, academia or through participation in Section activities.

"One of the highlights of the year was the Pacific 2013 International Maritime Conference held in October to coincide with RAN's Fleet Review. By all accounts the conference was again a great success, and my thanks go to all of the organisers for putting in so much of their time to make it so. Thanks also to those members who gave their time to crew the RINA stand at the accompanying exhibition.

"I was particularly proud to be able to present the revived Walter Atkinson Award to Ross Ballantyne and Gregor Macfarlane during the SMIX Bash in December. Thanks are due to Kim Klaka and the team who evaluated the entries and selected the winner. I look forward to a wealth of papers from around the country being nominated for this year's award!

"The year saw the introduction of the new National System for Domestic Commercial Safety, keeping many of our members busy on both sides of the fence as the system finds its feet — there is a lot of work to be done yet, but I have been impressed with the willingness of most participants to work together for practical outcomes in this new legislative environment.

"Another achievement has been the reinvigoration of the RINA–Engineers Australia Joint Board after a two-year hiatus. The cooperation between our Institutions is more important than ever in these times of legislative change, and I am pleased that the Board will now meet at six-monthly intervals to consider and act upon matters of joint interest or concern.

"The year has also seen the release of the Defence White Paper and the Future Submarine Industry Skills Plan. While the recent change of government will inevitably mean some reprioritising of Defence requirements, Council felt that it was important to make the Minister aware of our concerns about the boom-and-bust nature of Defence shipbuilding in Australia, provide some thoughts on the way forward, and offer to be involved as policies are developed. A letter to this effect has been submitted to Minister Johnston.

"Once again, the pages of *The ANA* continue to show the wide variety of vessels which are designed by our world-capable naval architects, and built both here and overseas — they are a credit to our members.

"The year ahead, while not being marked by any major maritime events, will still be challenging for all us and I look forward to working with you all for the benefit and enhancement of our profession and the Institution."

I would remind you all that the closing date for nominations for the Walter Atkinson Award, mentioned above, is 15 July 2014. This date is fast approaching and I look to you all to consider the papers presented in the last twelve months and forward nominations through your Sections or directly to our Secretary, Rob Gehling, email rina.austdiv@optusnet.com.au.

As always, I am available for discussion and comment on any topic of relevance to Australian naval architects, by email at jimb@austal.com or telephone (0418) 918 050.

Jim Black

Editorial

At some 320 pages, the recent Australian National Audit Office report on the Air Warfare Destroyer Program (Audit Report No. 22 2013–14) contains much which will be familiar to those who have been involved in naval construction projects in the last three decades or so.

Adopting a proven design which has been already built and is in service with another navy appears to be a low-risk approach, but adapting technical information from a different shipbuilding culture and modifying it to meet Australian requirements is no simple task, particularly when the baseline design is continuing to evolve. With a ship as complex as our new destroyers, design changes and inconsistencies in production information are to be expected, but the number reported, over 6000 revisions (to October 2013) to the 2132 production drawings, is certainly large by any measure.

An immature production package will have inevitable consequences on the cost of construction as the problems arising from detailed-design conflicts and design changes are resolved. Add to these difficulties the challenges associated with the reestablishment of an experienced and capable workforce and the development of quality standards which are understood and accepted by all participants, and it is not surprising that production productivity is lower than planned. It is simply not possible for an industry to keep skilled and experienced shipbuilders sitting around doing nothing in shipbuilding whilst waiting for the next major project. Capability will inevitably be lost, with consequent cost and delay as production restarts. The ANAO report says that the project is currently facing a 6.8% overrun on target cost. This overrun may grow as many challenges still lie ahead in the completion, setting to work and trials of the first ship. However, if future costs can be reasonably contained, then the AWD Alliance will, in my opinion, have done well under the circumstances. The fact that it is a three-ship program will help and many of the difficulties of the early years of the project will have been passed as the two follow-on ships are built.

As has been stated many, many times, the only way to avoid the difficulties faced by the AWD project (and others in the past) is by maintaining continuity in naval construction and the avoidance of the stop-start nature of naval shipbuilding in Australia. We are not alone in learning this lesson — there are overseas precedents as well. There have been encouraging statements of intent from the Commonwealth Government to avoid the problem in the future; however, construction of the AWDs is now well advanced and hull block work is tapering off. It is arguably already too late to prevent another gulf in continuity from causing an inevitable repeat of the problems faced in the early years of the AWD program.

Despite the repeated challenges of this nature faced by Australia's naval shipbuilding industry the resultant ships have been well built and a credit to those who have built them. I expect that our new destroyers will be no exception.

John Jeremy

LETTERS TO THE EDITOR

Dear Sir,

Considering the current media attention given to the uses of Unmanned Aerial Vehicles (UAVs or 'drones'), I find it remiss that there has been little attention paid to their potential.

At present, the majority of the cost associated with freight shipping stems from paying the wages of the crew on lengthy voyages. Voyages are, in turn, lengthy because slower speeds conserve significant amounts of fuel, the other main component of the cost of international freight. Indeed, freight companies experience significant difficulty finding crews of sufficient skill and sufficient number willing to undertake lengthy voyages. Where cargo is not time sensitive, an unmanned ship could make its journey far slower, and thus with much greater fuel economy, than it could were it carrying crew. Furthermore, insofar as a crew requires living quarters and amenities, removing the need for crew frees up additional space for cargo.

The other argument for the adoption of autonomous ships is safety, because human error is the primary source of accidents at sea. As ships are run increasingly by computers receiving input from sensors, the need for a crew manning the bridge has decreased. Sonar detects collision risks far more effectively than human lookouts (making it very unlikely that Clive Palmer's *Titanic II* will meet the same fate as her namesake), just as satellite positioning is a more-efficient means of staying on course than observing the stars.

The technology required for remote navigation exists. The maritime division of Rolls Royce operates virtual ships' bridges for the training of crew and officers and, save for entering and departing port, when human captains could be ferried aboard in the manner of pilots, all controls and radio communication with relevant authorities could be maintained from land. As a ship following a heading at a constant speed through empty ocean does not require the constant attention of a helmsman, one land-based captain could captain more than one ship, leading to further increases in efficiency.

The two main areas of concern with any maritime undertaking are mechanical failure and piracy. Where mechanical failure is concerned, a fail-safe system could be built in such that, at the first sign of trouble, the ship would automatically cut engines and drop anchor or heave to once it had decelerated sufficiently, and then wait indefinitely for assistance or instruction. In this state, the ship is merely a large static object in the ocean, as contrasted with conventional drones, which have an unpleasant propensity to fall out of the sky when mechanical failures occur. Should an incident of piracy occur, an unmanned ship is far easier to secure by armed force than a ship with crew who have been taken hostage, reducing the risk of crew fatalities.

As with all new technologies, legislation must be written before innovations can be implemented. In this case, great benefits are possible should autonomous shipping be utilised to its full potential.

Adela Greenbaum
UNSW Student

Dear Sir,

I am a Brazilian student of Naval and Oceanic Engineering from the Federal University of Rio de Janeiro, participating in a program of scholarships offered by our government to study for a year at the University of New South Wales.

Brazil, which was the third-largest shipbuilder in the 1970s, witnessed this business almost break in the following two decades. Now we are seeing the successful reconstruction of the industry, mainly encouraged by the offshore area.

"Pre-salt" oil and gas are the medium-to-high quality reserves located in the rock layers below the salt layer. These reserves can reach up to 8000 m in depth from the sea surface, including 2000 m of salt, which requires a lot of technology to retrieve. Together, proven, possible and probable reserves can produce from 50 to 100 billion barrels of oil in Brazilian territory alone. The first discovery of "pre-salt" reserves along almost all of the Brazilian coastline has significantly increased the demand for platforms and tankers, and vessels to support them. On 27 February 2014, Petrobras, our largest state oil company, reached a record of 412 000 barrels of oil produced. With the new platforms to be built, this may exceed one million barrels in 2017.

Not only that, but the government also decided to start taking advantage of the thousands of kilometres of navigable waterways in our country, and boost maritime and fluvial transport which has been forgotten for a long time, increasing the investments in cabotage vessels. Petrobras already has a proposal for the construction of 20 tugs and 80 barges, which will be able to replace 40 000 truck trips per year.

At the moment, the naval industry employs around 78 000 people in the shipyards in operation. However, in the next two years, four more shipyards are expected to start operation, from north-east to south Brazil. The projection is for over 30 000 new jobs.

The continuity of this growth and the government's initiative to prioritise national shipyards and products will hopefully relocate Brazil among the leading nations of the shipbuilding industry. It is expected that, some time from now, we will be competing for markets with Asian powers such as Japan, South Korea and China.

I, personally, am looking forward to this day and hope to be part of this history.

Amanda Oliveira Zebulum
UNSW Student

Dear Sir,

I am writing to express my admiration of the team behind *Wild Oats XI*, the maxi yacht which has taken line honours seven times in the Sydney–Hobart Yacht race in the last nine years. As a keen sailor myself, I can appreciate the dedication and hard work of the crew and skipper to achieve such consistently-excellent results. However, I am also acutely aware of the importance that the design of the yacht holds. The design of the yacht, and the calculation of every miniscule detail, is what allows the crew to pursue and achieve that prestigious podium title, first place.

What I love most about yacht racing, notably the Sydney–Hobart Yacht Race, is that it continues to push the yachting industry well beyond the barriers that nature has provided. *Wild Oats XI* is a perfect example of this; her original design by Reichel/Pugh has continued to evolve as technology improves, ideas develop and lessons are learnt. She originally featured the well-known canting-ballast twin-foil design. This system has been refined and altered after racing experiences. In 2011 she missed out on line honours by 2 min 48 s which, in a 628 n mile race, is a frustratingly-close result. This result was partially attributed to the addition of two amidships daggerboards whose drag was detrimental in the light conditions of the 2011 race. Following this disappointment, the vessel was fitted with a new code-zero sail and a retractable forward centreboard. This allowed her to reduce drag when sailing upwind in lighter conditions by partially retracting the amidships daggerboards. The keel tip now also sports vertical and horizontal wingtips which were added to reduce the drag of the keel by reducing the vortices that are present at the keel tip. In 2012 these three additions led to her beating her previous race-record time by 16 min 58 s, which is no small feat!

I firmly believe that this continual process of research and development is what makes yacht racing such a great, evolving sport. It is this process that has allowed *Wild Oats XI* to become such a formidable name in yacht-racing circles. I eagerly await the next Sydney–Hobart Yacht Race and the astounding results and innovations that it continually produces.

Bryce Waters
UNSW Student

How sailing vessels have changed — the AC45 catamaran *Oracle Team USA* passing the tall ship *Soren Larssen* during trials with *Team Australia* on Sydney Harbour in March
(Photo John Jeremy)

Dear Sir,

The conscious use of energy and fossil fuels is leading us to a gradually more environmentally-friendly naval industry. One of the smartest solutions is solar propulsion, which is being developed throughout the world by numerous universities and research centres.

In this respect, many solar boat competitions are held frequently across the globe. At my home university in Brazil, there is a special team which builds, tests and operates small solar boats for entry in worldwide championships. They are responsible for the crafting of the vessels since they buy the raw material.

One of the most important solar competitions around the world is the DONG Energy Solar Challenge, which takes place in the Frisian region of northern Netherlands every two years. In this demanding contest, teams must endure through 220 km of canals and rivers over six days.

The race is divided into three classes: the A class is for one-seater boats, the B class is for two-seater boats, and the open or C class can have any number of crew.

The key to good performance lies in making the most of the solar energy obtained by solar panels. The energy is stored in batteries which cannot be recharged after the start of the race.

At the moment, the challenge is focused on higher professional education, universities and companies from industry. However, the event is also concerned with generating youthful enthusiasm for the subject. With an education course and a two-day event, Dutch high-school and intermediate vocational-education students are presented with innovative techniques, so it influences them to take the option of a technical education within this scope.

I personally think that this sort of initiative should be valued and stimulated all over the world. Moreover, I strongly believe that, within a few years from now, most naval architects should have greater knowledge of alternative kinds of energy, including renewable energies.

Gabriel Campagnac Wollner
UNSW student

NEWS FROM THE SECTIONS

ACT Section

The ACT Section has held a number of technical and social meetings since the previous report in the November 2012 issue of *The ANA* and a brief summary of these is provided here.

On 26 February 2013, on an opportunity basis as a result of the visit of Dr Frans van Walree from Maritime Research Institute Netherlands (MARIN) to the Department of Defence in Canberra, Frans gave a presention to the section on *Seakeeping Behaviour of Fast Vessels*. The talk focused on the hydrodynamic research on this type of vessel carried out during the completed FAST 1 and 2 Joint Industry Projects and the on-going FAST 3 JIP. Frans has been a project manager at MARIN since 1985 and at the time was on an extended research visit to DSTO Melbourne.

On 3 April 2013, Elliot Thompson, a graduate naval architect with the Directorate of Navy Platform Systems within the Department of Defence, gave a presentation on *Application of the International Maritime Organisation's Energy Efficiency Design Index (EEDI) to Royal Australian Navy Vessels*. This study had been undertaken as Elliot's BE thesis project in 2012. Elliot later provided this presentation to RINA NSW and this has been covered in more detail in an earlier issue of *The ANA* [*see* The ANA*, November 2013* — Ed.].

On 30 April 2013 the AGM of the ACT Section was held. Key changes included Bruce McNeice taking on the role of Chairman, Ray Duggan that of Vice Chairman and Claire Johnson that of Treasurer.

On 28 May 2013 Michelle Greche from the Australian Maritime Safety Authority provided a presentation on *Simulating Human Movement and Behaviour in Escape and Evacuation* which was based on work which Michelle had undertaken with colleagues at her previous position with the Defence Science and Technology Organisation.

On 19 June 2013 Jim Black, Australian Division President, and Rob Gehling, Australian Division Secretary, hosted a presentation and discussion forum with section members entitled *The Division, the Section and You*.

On 13 August 2013 Jillian Carson-Jackson, from AMSA, who is also the Secretary of the Nautical Institute SE Australia, gave a presentation on *Satellite AIS*, including its development and current utilisation.

On 25 September 2013 Peter Hayes, Naval Architect within the Directorate Navy Platform Systems (DNPS) of the Department of Defence, provided an updated presentation on *Developments in Landing Craft Stability*, outlining the work related to his masters research project to develop new stability criteria suitable for naval landing craft.

On 17 October 2013 Dan Curtis, of the Defence Materiel Organisation (DMO) within the Department of Defence, gave a presentation on the acquisition and operation of Australian Defence Vessel (ADV) *Ocean Shield*. Dan was accompanied by Master of the ship, Captain Jason Britton, who also fielded questions during the presentation. The RINA Chief Executive, Trevor Blakely, also visited the section on 17–18 October 2013 and this provided him with an opportunity to participate in the meeting and briefly update members on RINA activities.

On 21 November 2013 the ACT section held its annual dinner at the Canberra Yacht Club in association with a technical meeting *Sailing on* Young Endeavour *— a Naval Architect's Perspective* attended by 24 members and guests. Due to illness of the originally-planned guest speaker, Claire Johnson, Naval Architect within DNPS, stood in as our speaker. Claire spoke of her voyage in STS *Young Endeavour* as one of the junior crew, accompanied by a selection of slides. Thanks to Claire for this interesting presentation and responses to the wide-ranging questions.

On 17 February 2014 Richard Dunworth, the Stability Technology Manager within DNPS, provided a presentation *Back Against the Wall*, outlining a more-accurate means of analysis of the results of inclining experiments. The presentation was an update on one Richard had previously provided within the Department of Defence and at Pacific 2013. The full updated paper was published in the February 2014 edition of *The ANA*.

The technical meetings of the section are typically arranged jointly with the Nautical Institute, with between 12–18 members and guests attending.

The Section Committee met on four occasions after the previous AGM, on 13 June 2013, 14 August 2013, 20 September 2013 and 29 January 2014.

The 2014 AGM of the section was held on 28 April 2014 with regular AGM business being attended to. Bruce McNeice and Ray Duggan continue to serve as Chairman and Vice Chairman respectively. Claire Johnson also continues in the role of Treasurer. Richard Milne and Kerry Johnson have stood down from their positions as Secretary and AssistantSecretary and these roles have been taken on by Joe Cole and Martin Grimm respectively. It was noted at the AGM that John Lord is now the ACT Section's nomination for Division Council, a position vacated by Ian Laverock.

Martin Grimm
Bruce McNeice

New South Wales

Annual General Meeting

The NSW Section held its sixteenth AGM on the evening of 5 March, following the March technical presentation in the Harricks Auditorium at Engineers Australia, Chatswood, attended by ten with Alan Taylor in the chair.

Alan, in his second Chair's Report, touched on some of the highlights of 2013, which included nine joint technical meetings with the IMarEST (Sydney Branch), with attendances varying between 56 (for Richard Stanning's presentation on *James Cameron's* Deepsea *Challenger—the Buoyancy that Brought him Back*) and 17, with an average of 30. This was an improvement on the previous year's figures of 39–14 with an average of 22. SMIX Bash 2013 was successful and was attended by 200, including a number of national and international guests.

Adrian Broadbent presented the Treasurer's Report. The EA venue at Chatswood had, as usual, been our major cost for the year. However, with a close watch on the outgoings, we had managed to operate within our budget and have a zero balance in the Section account at 31 January 2014. SMIX Bash is funded separately through the Social account and, although SMIX Bash 2013 just broke even, the Social account currently has a reasonable balance which will enable preliminary arrangements for SMIX Bash 2014.

During the year, Rozetta Payne resigned from the Committee. At the same time the Committee was strengthened by the addition of Sue-Ellen Jahshan, who agreed to take on the role of Auditor. Other committee members have agreed to continue their membership and positions for a further year. As a result, the committee for 2014 is as follows:

Chair and AD Council Member	Alan Taylor
Deputy Chair	Valerio Corniani
Treasurer	Adrian Broadbent
Secretary	Anne Simpson
Assistant Secretary	Nathan Gale
TM Program Coordinator and Website	Phil Helmore
Auditor	Sue-Ellen Jahshan
Members	Craig Boulton
	Graham Taylor
	Rob Tulk

The NSW Section is represented on the Australian Division Council by Craig Boulton (Treasurer) and Adrian Broadbent (NSW Nominee).

Committee Meetings

The NSW Section Committee met on 18 March and, other than routine matters, discussed:

- SMIX Bash: Some sponsors for 2013 still being chased; Thursday 4 December has been pencilled in with the Sydney Heritage Fleet for *James Craig* for 2014. Alternatives to the silent auction were discussed.
- Technical Meeting Program: The program of meetings has been re-arranged to suit some of the presenters. Engineers Australia cannot monitor "hits" on webcasts, although this is in the pipeline.
- RINA prizes for UNSW students in Years 1, 2 and 3 were approved for 2014.

The NSW Section Committee also met on 29 April and, other than routine matters, discussed:

- SMIX Bash: All sponsorships for 2013 have now been received, and accounts finalised.
- Technical Meeting Program: The RINA (NSW Section) website now shows links to all webcasts (on the Engineers Australia website) of technical presentations made to the Section, since we commenced in 2011.

The next meeting of the NSW Section Committee is scheduled for 17 June.

The Quest for Speed under Sail

Sean Langman of Team Australia gave a presentation on *The Quest for Speed under Sail* to a joint meeting with the IMarEST attended by sixty-one on 5 March in the Harricks Auditorium at Engineers Australia, Chatswood. This attendance set a new record, being the highest of the 70 meetings we have had since Engineers Australia moved to Chatswood in June 2006. It is more than double the average attendance of 26 since the move to Chatswood.

Introduction

Sean began his presentation by saying that he was born on the pearling lugger, *Sharlene*, which his parents had brought down to Sydney from Port Moresby and kept in Rushcutters' Bay where the CYCA (Cruising Yacht Club of Australia) now stands. Here he showed a picture of his mother holding him in her arms on board the boat, with his elder sister sitting on the bulwark rail. His first boat was *Vagrant*, an 8 ft (2.44 m) pram dinghy (like a sabot) in far north Queensland. He found the mast on a junk heap, but his father said that he would have to buy the sail, so he did, with the proceeds of mowing lawns! His father then made the centreboard and rudder. Although his dinghy did not have enough rocker in the keel, and was five times the weight of a sabot, he set out to beat them!

Xena

Sean had sailed Olympic-class boats, and that led him to

Xena, which he called “a skiff on steroids”. He learned some valuable lessons on *Xena*; principally that righting moment is king, but also about drag and balance. *Xena* started as an Open 60 Vendee Globe round-the-world vessel. She had variable displacement, variable righting moment, minimum crew and minimum sails (to minimise excess weight). She was built under the IMOCA (International Monohull Open Class Association) rule, but raced under the IRC (International Rule Club, administered by the RORC) in Australia. Her standard displacement was 68 000 kg, including 3000 kg (variable) of water ballast. One great feature of *Xena* was her carbon fibre construction — because the vessel bent. The rule required the vessel to be measured on the hard with the rig slack, and then in the water with the rig tight. The tightened rig caused the hull to bend, and so to shorten the measured length on the waterline!

Today, modern sailing vessels have bulbs at the ends of their fin keels — this is to maximise righting moment, but it is bad for drag. Sean’s philosophy is that he wants to sail the boat upright. He prefers minimum crew to minimise the weight on board, doesn’t have the crew with legs hanging over the side so it is safer, and arranges for the crew to get lots of rest. Similarly, he sails with a minimum number of sails on board, because they weigh too, and he ended up buying second-hand sails, although they had great sponsorship from AAPT and Grundig.

Sean wanted to race *Xena* with six crew, and talked to the CYCA (Cruising Yacht Club of Australia), which runs the Sydney–Hobart yacht Race). Their view was that six crew was appropriate only for small vessels, as this was all about safety. They ended up sailing *Xena* with eight crew.

The Kite Experiment

Xena had become fast upwind, but her best was downwind. They were approached by KiteShip from the USA about using a kite to increase downwind speed by using a kite to lift the vessel out of the water and minimise the displacement. They went offshore and tried. They found that they had to drop the mainsail to deploy the kite, which then ran at about 250 m above the yacht. They had a lot of fun, and a lot of laughs, but didn’t ever get above 12 kn. They then hauled down the kite, re-hoisted the main, and set the asymmetrical spinnaker. Suddenly they were doing 25 kn instead of 12 kn! *Xena* planes, just like a skiff, and so goes faster than the wind on some points of sailing.

The RORC banned the kite, which didn’t work anyway, but it also wasn’t good for publicity or the sponsors!

Xena at speed
(Photo courtesy Sean Langman)

The kite experiment
(Photo courtesy Sean Langman)

Wot Rocket

Wot Rocket was Sean's idea for breaking the world speed-sailing record, which he first sketched out on the inside of his shower screen, then translated into a sketch, and then did some serious drawings and weight calculations with naval architect Andy Dovell.

The basic idea was for a slim hull, supported by T-foils forward and aft, with a slim crew pod to windward, and a very high aspect ratio wingsail.

The rules for the world sailing speed record say that the record attempt must be from a standing start. They came up with the idea of staged foils to get to maximum speed. They wanted no parasitic resistance, low air resistance and low water resistance.

The forward and aft foils are of milled steed construction, heavy but robust. The angle of attack of the forward foil is controlled by the co-pilot, while the pilot steers with a small rudder. The sail is a solid wing, which gave them a lot of grief, but was unstallable unless forced. The vessel was designed and built as a proa, to sail on the starbord tack but, in fact, also sails on the port tack, and sails backwards very well!

She was designed to exceed 50 kn. The crew pod is supposed to fly 300 mm above the water. Sean says that *Wot Rocket* accelerated quickly, even quicker than the Porsche which he was driving at the time, and they just couldn't control it. The top element of the rig was designed to be jettisoned when they became foilborne. However, when the vessel changes from buoyant flight to air flight, the forces change. They were doing a speed attempt, and pushed the button to jettison the top element at 46 kn, and they cartwheeled and did major damage!

They have done some more work on *Wot Rocket*, and are ready to go again, but the Australian Paul Larsen on *Vestas Sailrocket* has achieved 55.32 kn over a one mile course, and 65.45 kn over a 500 m course with a 68.01 kn maximum speed.

Wot Rocket at speed on Botany Bay
(Photo courtesy Sean Langman)

Concepts

Where are we heading? As things are evolving for sailing cheaply and getting line honours in the Sydney–Hobart Yacht Race, canting keels and variable displacement (i.e. water ballast) seem to be the future. Sean has sailed on these vessels, and all the super-maxis are push-button sailboats. He wants to go sailing without machinery, i.e. without powered winches, for humans to sail the vessels and to compete with the mainstream sailors. He has therefore come up with an idea which has evolved over time.

The first attempt was the idea of a canting keel, with crew pods above and outboard of the sides of the hull. When he took this idea to the RORC people, they said that they would give it a rating, although it was almost a multihull.

This morphed into the canting-deck boat concept, the Langman 100 (L100) where, as the vessel heels, the displacement increases, the hull cants and the deck and pods stay level. Leeway is a concern, so this would require wings on the aft end of the bulb on the canting keel.

Revision 1 of the L100 was put to the RORC as a full canting-deck boat, with water ballast in the ends of the wings, a short mast and a narrow hull. The vessel would have a displacement of 10 000 kg, i.e. half the displacement of *Wild Oats XI*, but twice the righting moment and with less drag. The RORC said that there were a few things wrong — including the fact that you were not allowed to adjust the rig. Sean asked about canting keels; was that adjusting the rig? They conceded the point.

However, in the light of discussions with the RORC, they changed the general arrangement drawing to show upturned wings, which got a green light, and then took it to the CYCA for approval of knock-down recovery. They had to have righting moments with tanks full, with tanks empty, and in between. The vessel had to be self righting. They received the OK from the CYCA.

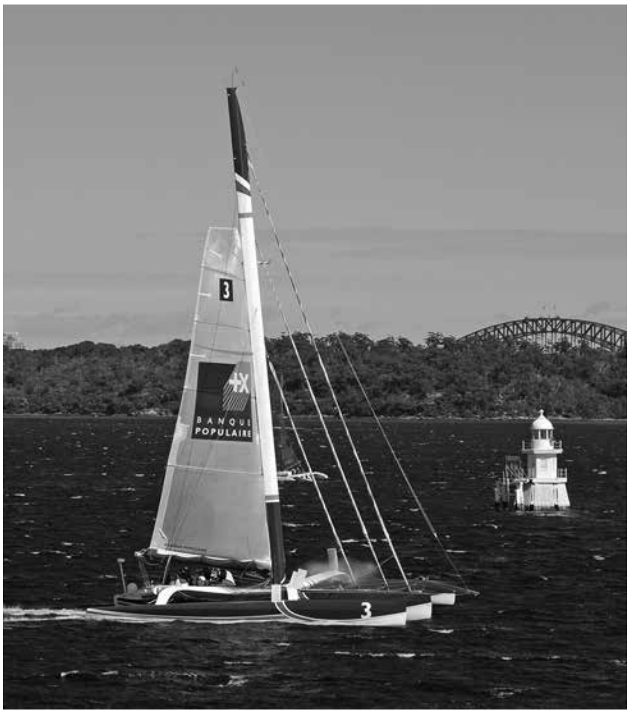
At the time, Sean was campaigning *Loyal* for Investec. He went to the directors and said that he wanted to build the L100, and it would cost $2 million. They ended up with a deal.

Team Australia

There have been many ORMA 60 trimarans (Ocean Racing Multihull Association 60 ft — 18.29 m — length and beam) built, principally in France. They each cost $7 million to build! *Banque Populaire* won the TransAtlantic and established a new 24 h record of 690 n miles.

Sean went to Lorient, France, looking for parts, principally a mast, for the L100; he did not have a particular interest in a multihull. In Lorient there were plenty of sailing vessels, both monohull and multihull. However, he went for a sail on *Banque Populaire*, although he only wanted the mast, and was impressed. They had a deal for him — he could have the boat, *three* masts, a container full of spares and two Frenchmen, the lot for €500 000, but he had to employ the two Frenchmen for two months. All well and good, but how was he going to get the package to Australia? Well, there was a shipping line which owed them money, so they could lean on the line for transport from Brest to Sydney via Papeete, Noumea and Auckland for him. He checked with his weather guru, Roger "Clouds" Badham, who said that there was a good weather window coming up. So the two Frenchmen sailed the boat from Noumea to Sydney and they had the rest of the gear delivered. The vessel was re-named *Team Australia*.

When he returned to Australia, he wanted to start construction of the L100, but found that the deal with Investec had fallen through.



Team Australia (as *Banque Populaire*) during an early sail on Sydney Harbour

(Photo John Jeremy)

Compared to a super-maxi, *Team Australia* had a displacement of 6.2 t, which they have now reduced to about 5.8 t. They have a retractable propeller unit with a four-bladed fixed-pitch propeller, and they have replaced a 30 hp (22.4 kW) engine with one of 22 hp (16.4) kW and so have less weight.

When they were in New Zealand, a sister ORMA 60 vessel appeared to have the edge on them, but was heavier upwind. So they changed the angle of attack of the wingmast and, after that, could always beat them.

Team Australia (as *Banque Populaire)* showing the curved lift foils

(Photo courtesy Sean Langman)

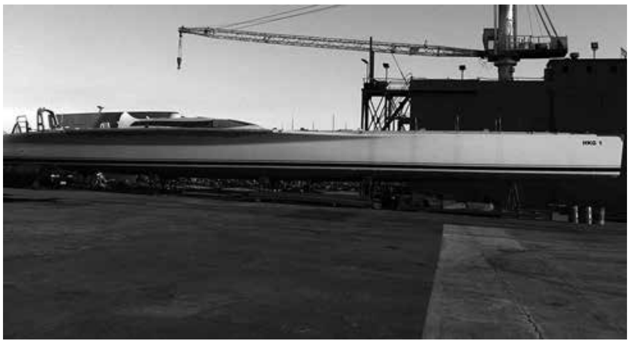
On *Wot Rocket* they couldn't harness the acceleration, mainly because of the way the forces were set up; if they had been set up correctly, then they would have been able to fly. *Team Australia* has lift foils which are curved, asymmetric and have wingtips. The dagger boards have trim tabs, which enable great control. The foils are a fair way forward so that, when they go from displacement mode to foilborne mode, the lift is far enough forward to prevent nose-diving. It actually feels a bit like a spring cushion, and it is very easy to fly.

L100 Revision 6

Revision 6 of the L100 still has the ORMA 60 mast and rig, but the rig can cant. After the last Sydney–Hobart Yacht Race, they are trying to keep the centre of gravity as low as possible to keep the keel in the water. On a canting-keel vessel, the bulb tends to break the water surface. On Rev. 6, the wings are now fixed to the hull and the boat heels to a maximum of 14^{o}, due to the righting moment from the T-foil underwater to leeward and the 1600 kg of crew at the end of the rig to windward. There is no flap on the foil. All of this gets the result, using what you've got.

Natural Selection

Sean recently came across the vessel *HKG 1* in the Philippines. The vessel is 115 ft (35.05 m) long, has a lifting canting keel with a 10 tungsten bulb, a canting rotating wingmast, bow rudder, etc., but did not perform as well as expected. The bulb was lying in the middle of a paddock. Sean idly laid the drawing of *HKG 1* over the drawing of the L100, and had a sharp intake of breath. If he could do a deal for the vessel, cut 15 ft (4.57 m) off the aft end, put in ORMA 60-type cross beams and add foils, he would just about have his L100! He has now done some calculations, and thinks that he can have his L100 with a displacement of less than 16 t with no water ballast.



HKG 1 in the Philippines
(Photo courtesy Sean Langman)

***Team Australia* Records**

They have been doing sea trials on *Team Australia*. In February 2013 he set out on a quest with his mates to set a new record for the Sydney–Hobart passage under sail. There was very little press coverage as they set out in an east-coast low-pressure system which "Clouds" said was the equal of that which caused havoc with the 1997 Sydney–Hobart fleet. At one stage off Wollongong, they were registering 42 kn on the log. In the event, they speared into Hobart on 25 February, having covered the 630 n miles in an elapsed time of 29 h 52 min 23 s at an average speed of 21.1 kn and knocking 12 h off the previous record.

They have found that young-and-fit is good, so they have a fitness program for all of those involved.

The next record in their sights was the Trans-Tasman, from Sydney to Auckland. They had perfect conditions, went hard early, and so got to the top of New Zealand in a very fast time, despite having 6 m seas at one stage. From there they beam reached into Auckland on 20 October 2013, covering the 1260 n miles in an elapsed time of 2 days 19 h 2 min 45 s at an average speed of 18.8 kn; a new record.

They have also done Pittwater to Coffs Harbour, 225 n miles in an elapsed time of 17 h 3 min 5 s at an average speed of 13.2 kn on 3 January 2014; another new record.

What the French told Sean about the ORMA 60 was right: it is a fantastic sailboat and has a lot to offer. They have changed the sail size, altered the cant of the mast and put trim on the foils. The next project will be putting an adjustable T-foil on the main rudder.

Conclusion

The quest for speed under sail is an evolving one. Sean tends to fly by the seat of his pants, and goes with what feels right. He has plenty of ideas, most of which work, and some of which work after modifications by trial-and-error. The L100 is coming!

Questions

Question time was lengthy and elicited some further interesting points.

The kite experiment on *Xena* showed them that kites may be OK on large commercial vessels, but they are not conducive to speed on yachts. The kite tows the vessel from the bowsprit chainplates, and they couldn't deploy it with the mainsail up.

When asked could you get a monohull to foil out of the water like a multihiull, Sean replied that the Moth class is monohull, and they have been foiling for years.

The L100 does not have lifting foils to bring the hull out of the water; they are righting-moment foils.

Super-maxis sail upwind at about 12–13 kn. They are not interested in rating formulae or handicaps; they are only interested in getting to the finish line first.

When asked if he could use a T-foil forward, Sean replied that a T-foil provides resistance, and you don't want lots of stuff underwater. Under the IRC rules, the vessel has to be monohull, and self righting. The length is restricted to 100 ft (30.48 m). The L100 has minimum parasitic drag, with minimum underwater projections. *Wild Oats XI* has been nicknamed the Swiss Army Knife because of all her underwater projections which she can deploy or retract as required.

If Sean could get the money to build the L100 and use the ORMA 60 rig, then he would build the vessel here in Australia. However, the Philippines has a low labour rate, and they have shipyards with thousands of employees, and that looks attractive.

The vote of thanks was proposed, and the "thank you" bottle of wine presented, by Phil Helmore. The vote was carried with acclamation.

Sean's presentation was recorded by Engineers Australia and is available as a webcast at http://mediavisionz.com/ea/2014/easyd/140305-easyd/sessions/140305-easyd/.

Air Warfare Destroyer Project Recovery

Chris Eggleton of Forgacs Engineering gave a presentation on *Air Warfare Destroyer Project Recovery* to a joint meeting with the IMarEST attended by twenty-eight on 2 April in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Chris began his presentation by saying that he had started his naval career at the Royal Hospital School in Holbrook, Suffolk, UK, a boarding school for the sons of serving Royal Navy personnel, when he was 11 years old. After matriculation, he joined the RAN as an apprentice electronic technician at HMAS *Nirimba*, Quakers Hill, in 1973. Completing 33 years operational service; many sea postings in DDGs; and overseas and local equipment application courses, Chris was selected for Officer training in 1985 and graduated as a Weapons and Electrical Engineering Officer, culminating in promotion to Commander and appointment as the ANZAC Ship Project Program Director, ANZAC

Alliance Executive General Manger, and ANZAC System Program Office Director in 2002, with associated recognition by the IMarEST.

He then showed a video which demonstrated the capabilities and limitations of the Hobart-class air-warfare destroyers (AWD). One of their major functions is the defence of the two LHDs also being acquired by the Royal Australian Navy, a role which the AWDs are very capable of delivering.

The AWD Building Program

Forgas' experience at their Tomago yard included but exclusively: HMAS *Tobruk*; blocks for the Anzac-class frigates; and major refits on HMAS *Manoora* and *Kanimbla*, providing a good shipbuilding pedigree and track record. However, at the time of tendering and contract award, Forgacs had not conducted any shipbuilding work for ten years and most of the workers with shipbuilding experience had left, the project workload at the time of contract tender not being shipbuilding related.

By way of introduction to the AWD program, Forgacs was tasked to, and built, a pilot block (715) for the project to demonstrate their capability which subsequently showed that the fabrication quality was good and facilities adequate. However, the block was small in size and of low complexity relative to the other blocks, and probably of limited applicability in terms of assessing the ability to deliver the program. Notwithstanding, after careful consideration, Forgacs management bid for six major and four minor blocks per ship, based on a workable plan to meet the contract schedule. This plan required a maximum resource level of about 400 tradespeople and project-management practitioners, which were estimated to be readily available in the market.

By way of further clarification, the AWD's aggressive delivery schedule was the single limiting factor on the number of blocks for which Forgacs felt comfortable bidding. They felt that they could manage ten blocks per vessel, but would struggle with more than that without schedule relief. In the emergent build program for the three air-warfare destroyers, the following blocks were ultimately allocated:

	Ship 1	Ship 2	Ship 3
ASC	10	9	9
Forgacs	14	13	10
BAE Systems	7	4	7
Navantia	0	5	5
Total	31	31	31

It is of note that Forgacs initially tendered, committed and prepared the workforce for the 'build to print' of 29 blocks, of which 12 were relatively minor in complexity.

Project Challenges

The key challenges which Forgacs faced from the start included:

- a significant delay in executing the contract;
- limited systems, shipbuilding maturity, and processes in place for large-scale projects; and
- the need to invest in the upgrade of the shipyard simultaneous with production.

For myriad reasons, work packs were delivered very late from ASC, which caused delay in the block production schedule right from the beginning. Very few of the early contract delivery dates for work packs were met and, consequently, there was a very slow ramp-up of labour requirements. For instance, at 11 months into the schedule, the project at Forgacs was still only working about 3000 manhours/week. Understandably, a good CPI result was achieved at this unrepresentative low volume but, unfortunately, as a result of this, performance estimates were revised pre-emptively;

e.g. structure and pipe rates were adjusted down by more than 10% against this early CPI result for initial blocks.

Subsequently, as production volume began to increase after July 2010, CPI began to decrease; productivity was challenged by major design changes and workforce capacity and skill-level issues made resourcing to meet the schedule a problem. Concurrently, a major upgrade to the existing facilities and equipment was required to provide the capability to meet the capacity needed for the project. This upgrade occurred from late 2009 to March 2011, during which time the project workload was ramping up to an even higher volume; the additional complexity of simultaneous production and facility upgrade was a significant burden on project management and engineering resources. This situation was repeated when the second site at Carrington was introduced to meet the increased block allocation as BAE reduced its involvement in the program.

A notable unplanned load on the project-management team was that they were contractually sized and budgeted for 'build to print'; however, build-to-print was never realised in the work packs delivered from ASC. Despite representation on the matter, no additional budget was provided to increase the pre-project management for the benefit of delivering build-to-print. Thus, the task was passed onto the supervisors and tradesmen on the shop floor and, consequently, production hours increased disproportionately. Added to this increase was the previously-articulated late delivery of work packs from ASC, retarding the ramp-up of production workload for approximately a year into the schedule and exacerbating the production workload.

The BAE decision to reduce its involvement in the program precipitated a negotiation to re-allocate an additional 15 blocks to Forgacs. At the time, Forgacs management was over-optimistic about the ability to upscale further. Placing the decision in context, there existed a contemporary very tight labour market for skilled trade resources (due to the mining boom), and there was very limited internal experience against the current industrial relations landscape within Forgacs to bring in extra resources in a controlled and efficient manner.

The additional block allocation did not enjoy an adjustment to the contract schedule but, somewhat counter-intuitively, introduced a further price reduction (of the order of 10%) applied over the structure and pipework scope. This additional work further exaggerated the over-commitment of resources and infrastructure. Forgacs mitigated the risk by expanding the facilities available and investing to accommodate the new blocks by leasing the Carrington shipyard, with a further simultaneous upgrade absorbing even more engineering and production resources. Risk assessments carried out at this time did not identify the full consequence of these impacts on schedule and cost.

Design On-the-run

As detailed above, Forgacs was simultaneously dealing with extensive design changes coming from Navantia through ASC, requiring removal of pipework and bulkheads, and extensive rework. This, of course, put additional heat (from both cutting and welding) into the completed blocks, causing deformation and dimensional tolerance issues. This, in turn, generated significant quality-assurance activity and associated rework, exacerbating the problem of heat into the blocks and, in many instances, making the problem worse. Schedule was also affected synergistically as the delays in material logistics supply further affected completion of the work.

A lack of recognition of the underlying impact and distraction caused by frequent changes added significantly to the already-existing resource challenges. Forgacs fell further behind on CPI due to the volume of changes and rework. Noting the impact on schedule through changes to design, ASC requested that Forgacs 'stop work' on blocks for Ship 2 to allow time to catch up on work packs and materials delivery. Resources were diverted to blocks for Ship 1 in early 2012.

Change Control

The AWD Program was unable to deliver design changes on a timely basis, resulting in long delays in work progressing design amendments out to the production work force; as a consequence, major rework was regularly required due to design changes arriving post production completion or commencement. As a solution, responsibility for change notification requests (CNR) was transferred to Forgacs in October 2011. A contractual agreement included additional program resources to run the CNR process. Forgacs then had to do their own changes and develop these into work packs. This resulted in an additional requirement for naval architects, technicians and shipwrights, which resulted in scouring the Hunter region, Sydney, and even overseas, for these scarce resources. However, the volume of new changes, and the cumulative backlog already existing prior to handover, created a mountain of effort just to catch up. Approximately 1600 changes were processed up to May 2013, when the process responsibility was handed back to ASC. Many fewer changes have occurred since the handover and this has much improved productivity, quality and schedule.

The Perfect Storm

In addition to the above and including the following, from July 2012 to July 2013, a significant number of events and challenges occurred that were counterproductive to maturing as a ship yard and delivering strong performance:

- the additional workload from taking on more blocks;
- the continued need to upscale capacity;
- Change Notification Request responsibility transferred to Forgacs;
- hundreds of new personnel to recruit and train to reach a military specification not otherwise used in the region;
- a lack of material supply on time, including a prior hold on copper pipe and other significant material shortages;
- EBA negotiations with the AMWU, essential for the future viability of the company, ran for eight months with strikes and morale issues; and
- the non-uniform or ambiguous interpretation and application of quality standards by internal and external quality processes created significant rework, not always in the best interest of the project.

In the middle of all this, the company's founder and leader, Steve Forgacs, died—a big loss. Despite the vacuum which he left, the family decided to soldier on, and appointed a new CEO and a management team to assume control.

Forgacs Improvement Program

From July 2013 onwards, Forgacs delivered a turn-around in performance to provide a robust platform for the remainder of the program:

- key leadership and project management resources were introduced;
- a Group HSE manager was recruited to begin the culture change required to sustainably improve safety performance;
- the Forgacs Production System (FPS), based on LEAN methodology, was developed and implemented;
- Forgacs designed, installed and commissioned a new panel line at Tomago which came online in September 2013. This significant investment provided increased productivity at the high standard of quality required;
- EBA negotiations with the AMWU were concluded and trade resources were expanded to supplement for the 'bow wave' of workload; and
- a 'Gold Quality' inspection standard was agreed with the client (on what constituted a good weld) and was implemented to remove ambiguity, improve acceptable throughput and to minimise late-stage rework.

Performance KPIs

Forgacs vastly improved their safety performance record after mid-2013, largely due to increased safety resources for the increasing workforce, and the education and inculcation of the safety paradigm on a high volume of new resources. Increased on-the-ground safety resources were applied as well as workforce re-training, and a Group Safety Manager position was added to 'professionalise' the safety program and to refine more-effective schemes.

Structural NDT failures dropped dramatically due to the developing processes of first-time quality becoming established. Quality continued to improve as production volume increased, with the early-stage prevention of failures and distortion removing the need for high-cost late repairs. Deck-panel welding was identified as the early-stage root cause of quality failures, and Forgacs developed and implemented a new quality-targeted deck-panel welding line. This resulted in a significant improvement in both initial weld quality and early failure detection, and provided noticeable improvement in total structure quality as the defect-free components flowed through to later stages of construction.

Moving Forward

The maturity, capacity, and capability of Forgacs have now matured to enable the delivery of high-quality blocks in a timely manner. Forgacs continues to improve productivity, seeking external advice and support to further optimise processes. Design change and material supply are no longer frequent an issues, but the accumulated delays in the program roll forward against the original schedule. Upskilling at both the trade and engineering level is delivering improved capability and has matured internal processes. Several million was spent on training high-specification weld skills in 2013, and ten graduate engineers were recruited into the project organisation.

Forgacs and ASC are now implementing a Capability Services Agreement to cover the remainder of the project; this agreement has served to profoundly improve the ASC–Forgacs relationship and has been instrumental in dramatically improving program performance and upskilling the supervisory work. The agreement is about working more closely together to deliver the program and the teams at the Newcastle facilities are now homogenous and under the same quality processes. With a more-collaborative approach, the now scaled-up capacity at Forgacs can be leveraged to deliver a superior outcome for the remainder of the program.

Lessons Learnt

In a basic retrospective appraisal of the program, tactical changes to the project approach could have saved significant cost to the ultimate client by:

- allowing sufficient time within the project schedule for planning production, delivery of materials and defining the full work scope ahead of commencement of production;
- increasing the level of fit-out on the block prior to ship consolidation, when access to the work front is easier, more flexible and faster;
- providing a clear understanding of the level of design detail to be supplied, so that the supplier can prepare appropriately;
- use of industry-standard or indigenous capability for sizing where possible; this would minimise man-hours spent producing items from scratch (e.g. cut-throughs); and
- local procurement of steel at project-negotiated rates just-in-time; this would ensure that the materials purchased best suited production methods, arrived on time and in good condition.

At a more strategic level, some other lessons include a methodology to be established to ascertain shipbuilding maturity, readiness or gateway criteria based on, amongst others, three key issues:

- Firstly, a design for modular construction from end to end, fully engaging principles associated with 1-3-8 design and construct and maximising the fit-out of blocks. "Grand blocking" (the merging of several blocks) as well as full utilisation of Lean principles, as used in the construction of the Virginia-class submarines in the USA, should be considered; this has saved billions of dollars there.
- Secondly, you must have a trained workforce. Having the right number of skills and experience available at the start of the project, and ensuring that the experience/inexperience mix is at the appropriate level for the function required, is critical.
- And, finally, the shipyards need to collaborate more, to understand each other's strengths and capabilities, and have the blocks allocated accordingly. Fierce collaboration across the shipyards to share and build on best practice, with the overarching objective of reducing cost and improving quality, is essential if we are to build a truly-competitive industry delivering world-class warships.

Solutions for the future include agreeing on a vision for naval shipbuilding in Australia, getting in early on planning and preparation, and investing early to provide capable facilities.

Smoothing the workload is, and has been, a continuing problem in Australia. It is hard to convince politicians that a skilled workforce must be maintained from one build program to the next, or the skills drift off to other areas for lack of work. They are then not available when required!

Summary

Forgacs initially tendered, committed and prepared for the build-to-print of 29 blocks, of which 12 were relatively minor in complexity. Despite risk assessment, Forgacs underestimated the ramp-up to the capacity required to reach the schedule and quality demands of the initial scope. This was exacerbated by the award of additional work.

Challenges impacting productivity, cost and schedule included late delivery of work packs, frequent material shortages, introduction of additional blocks, and a high number of design changes. These challenges had a direct impact, but also a knock-on effect to the subsequent program.

Forgacs, having turned around critical performance in safety, quality and project management, is now delivering high-quality blocks to specification and schedule, although cost remains an issue. With a more collaborative approach, the now scaled-up capacity at Forgacs can be leveraged to deliver a superior outcome for the remainder of the program.

Questions

Question time was lengthy and elicited some further interesting points.

Now that the construction yards have experience in building the AWD hulls, it would be perfectly practical to continue building the hulls, take the Aegis combat system off and replace it with different radars and weapons, and to have a number of 6000 t frigates; i.e. on a big, capable platform.

The stop-start nature of naval shipbuilding in Australia provides a feeling of déjà vu; we continue having to learn the same lessons all over again each time there is a naval build program. The same lack of a trained workforce existed at the commencement of construction of HMAS *Success*, and for many ships before that.

Forgacs is trying to get together with other shipbuilders to provide a solution to give the Department of Defence the ships that they require. They have looked at Damen, Fincantieri, etc., and what other consortia are doing. Such collaboration would solve some problems of employment in NSW and Victoria and ensure that the workforce continues in employment and is skilled. However, without a follow-on contract, BAE Systems are laying people off in Williamstown already, Forgacs will close the Carrington yard in September this year, and will close the Tomago yard next year!

The vote of thanks was proposed, and the "thank you" bottle of wine and certificate presented, by Murray Makin. The vote was carried with acclamation.

Chris' presentation was not recorded.

Chris Eggelton (L) and Murray Makin
(Photo Phil Helmore)

Design and Construction of Cutting-edge Vessels

Brett Crowther, Justin Steel and Stewart Wells of Incat Crowther gave a presentation on *Design and Construction of Cutting-edge Vessels* to a joint meeting with the IMarEST attended by thirty-seven on 7 May in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Brett began the presentation by saying that Incat Crowther employs both naval architects and engineers; they have 40 staff in three offices in Australia, the USA and Brazil. They have six project teams involved in the design of their vessels and, in May 2014, have 72 vessels which they have designed under construction, in steel, aluminium and composite.

63 m Crew Supply Vessel

Brett described this vessel for the project manager, Crayke Windsor. The requirements for this vessel had evolved from previous vessels (the Lynx class) for the same customer, who wanted the largest possible platform having a gross tonnage of less than 500 ITC (where SOLAS requirements kick in), and with speed optimised for five Cummins QSK60 main engines. Larger MTU engines were considered too expensive, as the vessel was to have a higher deadweight capacity at a lower speed than the Lynx-class vessels. However, the previous vessels were 58 m catamaran workboats of just less than 500 ITC, so they could hardly make the new vessel much bigger.

The new vessel is a monohull, having a small wheelhouse forward but with an aft-facing station for dynamic positioning control.

The vessel carries 60 000 L of rig fuel in addition to the ship's fuel. There are four steerable jets and one booster. The vessel can carry deck cargo of 300 t. The final tonnage calculation gave 498 ITC and 89 GRT (a US measure).

Here Brett showed a rendering of the new vessel.

Traditional Numerical Calculations

The vessels are classed with ABS, and so they carried out the traditional longitudinal bending calculations in accordance with the ABS Rules and the vessel passed the section modulus requirements. They then built a finite-element model of the vessel (which was not required by the rules) and investigated the global sagging mode, finding high stresses at the keel and at the bulwark near amidships at the cut-out for the boarding gates. The high local stresses were relieved by using thicker local plate inserts. They also checked for buckling, global compression, and longitudinal stress everywhere.

Noise turned out not to be a problem on this vessel, as the crew are at one end of the vessel (forward) and the engines are at the other end (aft). However, on the catamaran Lynx-class vessels, the crew are accommodated in the hulls with the passengers on deck, and the noise of water slamming is the problem. Acoustic insulation was required for the catamarans for the slamming.

Alternatives Considered

A number of different hullforms was considered:

1. an existing hull for which they had both tank-test and full-scale data;
2. a version of the hullform, but with a plumb stem;
3. a version of the hullform, but having a higher chine line, reduced forefoot volume, and flatter topsides; and
4. a version of the hullform, but having a lower chine line, increased forefoot volume, and a finer stem.

Hull 1 had been validated against the tank-test results, so they were confident of their baseline vessel.

For Hull 2 they created a 3D model and the CFD results predicted that the resistance was significantly less than for Hull 1. They were not sure about the validity of this result, and so kept on analysing.

For Hull 3 they created a 3D model and the CFD results predicted that the resistance would be more than for Hull 2; this was more believable.

For Hull 3 they created a 3D model and the CFD results predicted that the resistance would be more than for Hull 2, but less than for Hull 3.

They chose to use Hull 4 as the best compromise between resistance and seakeeping.

Thruster Configuration

The vessel is classed for Dynamic Positioning 2 (DP2). This means that the vessel must be able to withstand a single-point failure anywhere in the system which takes a piece of equipment offline (e.g. one bow thruster or one waterjet) and still be able to maintain station.

The vessel is fitted with three bow thrusters of 149 kW each and, coupled with the five waterjet units, enables the vessel to maintain station. Drop-down thrusters are better for station keeping, but are more complex and tunnel thrusters were used instead. They used CFD analysis to check the streamline flow around the tunnel openings and found that at 37 kn, the thrusters contributed an additional 7% to the total resistance. This prompted an analysis of having vertical gratings over the openings, horizontal gratings, outboard fairings, inboard fairings, and combinations thereof. The conclusion was that vertical gratings were better, i.e. provided less resistance) than horizontal gratings, and integrated outboard fairings were better than inboard, but overall there was little difference between them. The waterjets are interesting, as the design has advanced significantly in recent years. Now they can provide split buckets, which gives more-efficient thrust vectoring.

Multiple cases of loss of equipment were considered, e.g. one dead bow thruster, with the wind and current coming from the same direction—this is the worst-case scenario. A plot of this case showed that, in 25 kn wind and 3 kn current from the same direction, the vessel would start to lose the ability to hold station if the heading of the vessel was 40^{o} to the wind/current direction.

70 m Fast Crew Boat

Justin Steel, the project manager for this vessel, said that this vessel is currently under construction at Incat Tasmania in Hobart. He showed a general arrangement of the vessel, and said that the primary purpose is to carry workers to offshore platforms. The vessel is classed with DNV and complies with the HSC Code.

The form of the vessel is driven by the fact that it carries a motion-compensated platform amidships. The superstructure is resiliently mounted (this type of vessel is usually fully-welded) to isolate the passengers and crew from the noise. Seakeeping and motion-sickness incidence are important, so the passengers are located on the main deck amidships to minimise pitching motions.

The frog-transfer zone for the rig is located at the aft end of the main deck. This is a slow method of transferring personnel to (and from) the rig, as only three crew can be moved in the frog at one time, but the capital costs are low. The motion-compensated platform amidships is more complex, but allows a continuous stream of people to go on and off the rig simultaneously. This offers a solution which is cost-effective and safe in comparison with the alternative sea-air (helicopter) service. The frog-transfer system is there as a backup. The vessel offers increased operability in comparison to existing vessels.

Principal Particulars

Principal particulars of the vessel are

Length OA	70.0 m
Length WL	67.6 m
Beam OA	16.0 m
Depth	6.00 m
Draft (hull)	2.00 m
Personnel	150
Crew	14
Fuel oil	50 000 L
Fresh water	10 000 L
Grey water	3000 L
Sullage	3000 L
Main engines	4×MTU 16V4000 M73L each 2880 kW @ 2050 rpm
Propulsion	2×Hamilton HT-900 S waterjets
Generators	4×550 ekW
Bow thrusters	4×224 kW azimuthing retractable
Speed (service)	30 kn
(maximum)	36 kn
Dynamic Positioning	DNV DYNPOS-AUTR R Control system
Crew-transfer	Ampelmann stabilised access platform Frog-9 crane-lifted rigid basket
Safety Equipment	12-person rescue boat 6-person MOB boat 2×200 pax liferafts and 2×00 pax MES
Construction	Marine-grade aluminium
Flag	Azerbaijan
Class/Survey	✠1A1 DNV HSLC Service 2, R1, EO, DYNPOS-AUTR, CLEAN-DESIGN, COMF-V(3) C(3), NAUT-HSC, NAUT-OSV(A) IMO DP Equipment Class 2

Here Justin showed a rendered image of the vessel.

Dynamic Positioning

Like the 63 m crew supply vessel, this vessel is classed for DP2, and must be able to hold station in 38 kn of wind, 2 kn current, and 2 m head seas despite the failure of anyone item of main equipment (thruster, main engine, generator, control module, etc.) Holding station means within ±5 degrees in yaw, and ±2 m in position.

There are four electric generator sets, four retractable azimuthing bow thrusters, and four waterjets with split buckets for improved thrust vectoring of the sway force. The loss of any one of these is a loss of 25% capacity in that area.

Tests and Analysis

A 1/13 scale model, 5.2 m long and 303 kg, was tested for resistance and seakeeping in the towing tank at the Maritime Research Institute Netherlands in Wageningen, the Netherlands. They also had predictions of ship motions and global loads, including the calculation of short-term statistics, long-term statistics and operability from the numerical method in the VERES (Vessel RESponse) software from MARINTEK, the Norwegian Marine Technology Research Institute in Trondheim, Norway. They obtained damping factors from the trials data from a 52 m catamaran vessel.

General

Justin showed a photo of the model of the vessel in 2.6 m head seas, and videos of the frog-transfer system and the operation of the motion-compensated platform amidships, with the platform level and the ship rolling, pitching and heaving underneath—very impressive!

He also showed a photo of the construction progress on the vessel in Hobart [*see Page 23* — Ed.].

The vessel will be operated by Caspian Marine Services (CMS), which is owned by Azerbaijan and BP Platforms. The vessel will be delivered on her own bottom to CMS in Baku, Azerbaijan, via the Mediterranean Sea, the Bosphorus, the Black Sea and a transit of the Volga-Don Canal to the Caspian Sea.

24 m Catamaran Passenger Ferry

Stewart Wells, the project manager for this vessel for Captain Cook Cruises (CCC), said that the objectives were to expand their hop-on/hop-off service on Sydney Harbour. They (CCC) wanted to be able to carry 196 passengers, with low wash, with fuel efficiency, low maintenance, and the capability to operate in both Class 1D (sheltered waters) and 1C (up to 30 n miles offshore), and all with a new, higher, level of experience for the passengers.

Here Stewart showed a general arrangement, and a photograph of the new vessel, *Elizabeth Cook*, sailing under the Sydney Harbour Bridge.

Principal Particulars

Principal particulars of the new vessel are

Length OA	23.9 m
Length WL	23.5 m
Beam OA	7.20 m
Depth	2.20 m
Draft (hull)	1.00 m
(propeller)	1.40 m
Passengers	198 (1D) 127 (1C)
Crew	3
Fuel oil	2000 L
Fresh water	250 L
Sullage	1500 L
Main engines	2×Scania DI13 070M each 368 kW @ 1800 rpm
Propulsion	2×propellers
Speed (service)	25 kn
(maximum)	27 kn
Construction	Marine-grade aluminium
Flag	Australia
Class/Survey	NSCV 1C/1D

Requirements

There were very specific requirements from the operator, and the vessel turned out to be hard to fit into the established brand and standards of CCC. Multiple arrangements were developed, and the process was iterated on the aesthetics of the external profile. They eventually settled on the first option, which had a swept-back wheelhouse.

There were challenges with the new regulations and the structure. This was the first vessel to go through under the Australian Maritime Safety Authority administering the NSCV under the Single National Jurisdiction for Commercial Vessels.

One of the issues was crewing of the vessel, which ended up being accredited for two crew with 198 passengers.

The dual classes mean that the vessel can operate up the river to Parramatta with 198 passengers in Class 1D, and across to Manly with 137 passengers in Class 1C, but also has to meet the requirements of both commuters and leisure patrons.

Design

The vessel's hulls are narrow, and so they added a centre bow to provide reserve buoyancy forward. CCC have a number of vessels in operation, but they wanted a new, higher, level of passenger experience to far exceed that of any other vessel on the harbour, and they (and CCC!) think they have achieved it.

They did extensive CFD analysis of the wake and resistance, and the development of the hull shape was an iterative process.

The structure is in accordance with the requirements of the Special Service craft rules of Lloyd's Register (which are specified by the NSCV). However, there is more welding and structure required bythe SSC Rules than by DNV's High Speed, Light Craft and Naval Surface Craft rules, and so the structure ends up being heavier. However, they chose to go with the SSC rules under AMSA's survey, rather than go to classification with DNV; the owner did not have a preference.

Moving On

Three more vessels to this design are now under construction, as CCC is expanding their fleet. The new vessels have minor refinements of the existing platform, including in the wheelhouse region. The second vessel was launched on 7 May (the date of the presentation!) and was within 200 kg of the mass of the first vessel.

Vote of Thanks

The vote of thanks was proposed, and the "thank you" bottle of wine and certificate presented, by Sue-Ellen Jahshan, a previous employee of Incat Crowther. The vote was carried with acclamation.

This presentation was not recorded.

Phil Helmore

CLASSIFICATION SOCIETY NEWS

LR Launches New Class Direct App

Lloyd's Register has launched a new Class Direct app for iPhone, iPad and Android mobile devices which can be used by owners and operators of LR-classed vessels. This is based on the functionality of LR's Class Direct web service. If you already have a Class Direct account, then you can use your existing username and password to access the app.

With the app, you can:

- book a survey with Lloyd's Register;
- browse the classification data which Lloyd's Register holds for your vessels;
- monitor and check the status of your vessels' surveys; and
- create a list of favourite vessels for quicker access.

The iPhone/iPad app is available now on the LR App Store, www.lr.org/classdirectapp. The Android app is available on Google Play, https://play.google.com/store?hl=en, and search for "lr class direct" (without the quote marks).

If you don't already have a Class Direct account then you can sign up for free on www.lr.org/classdirectapp.

Lloyd's Register's *Class News* No. 07/2014. 18 February 2014

DNV GL wins Environment Protection Award

DNV GL, the world's leading ship classification society and one of the world's leading risk and sustainability service providers, won the Environment Protection Award at the 2014 Seatrade Asia Awards held on 7 April.

"We are honoured to have received this award, which reflects the industry's recognition of DNV GL's environmental best practices," said Steen Lund, Regional Manager for DNV GL Maritime South East Asia and Pacific.

DNV GL won the award based on its commitments to safeguard the environment and its efforts to reduce the carbon footprint in the maritime industry.

DNV GL

- has established its Clean Technology Centre where it has been delivering innovative projects in the areas of renewable and clean energy, green ship and offshore solutions, green ports, climate change and grids and electro mobility;
- has developed the trim optimisation software Eco-Assistant, which reduces fuel consumption and environmental impact of a vessel; since its launch in 2009, more than 450 systems have been installed on board vessels;
- has launched its ECO Research Centre aimed at conducting research to strengthen energy efficiency solutions for Asian clients; the initiative is supported by the Maritime and Port Authority of Singapore under its Maritime Cluster Fund;
- is leading the LNG agenda across Asia via DNV GL's pilot LNG technical forum and engagements with stakeholders across the Asian maritime community to facilitate safe transport and use of LNG as ship fuel; and
- is cutting down on business travel by building on video-conferencing abilities throughout the company and using a Flight Footprint Tracker to track flights and provide a baseline for reporting on the environmental footprint and setting targets for future goals.

Its new office in Singapore is also a fine example of combining intelligent building structures and energy-efficiency consumption by setting green initiatives such as implementing motion-based sensor lightings, controlled central air conditioning, central recycling waste-collection areas and other intelligent initiatives that go to make the DNV GL office one of the most energy-efficient buildings in Singapore.

Steen Lund added, "As we move forward, we aim to continue our commitment towards fulfilling our purpose of safeguarding life, property and the environment. We will continue to bring innovations forward to help our customers become more energy efficient."

The Seatrade Asia Awards is an annual gathering of leading industry executives and a platform to recognise companies who excelled in their respective fields in the maritime industry. The Environment Protection Award was given to the organisation which had taken significant steps to reduce its environmental footprint, invest in green technology and promote environmental awareness.

The winners were assessed by a panel of influential bodies including Anglo Eastern Ship Management, Singapore Maritime Foundation, Asian Shipowner's Forum, Korean Register, Philippine Transmarine Carriers and Intertanko.

DNV GL Introduces Next Generation Energy-efficiency Methodology

DNV GL presents a novel approach which overcomes the challenges of assessing on-board energy efficiency in a consistent manner. As a result, priorities for improvement can be determined accurately. In a new report released recently, DNV GL answers the question: How can a ship manager identify the biggest sources of useful energy that are currently being wasted on their ships?

"Ship operations and environmental legislation have become more complex, and it has become increasingly difficult to assess or even define efficiency with consistency and accuracy," said Rune Torhaug, Director, Strategic Research and Innovation, DNV GL. "We have therefore revisited the basic and universal laws of thermodynamics to develop a methodology based on exergy, sometimes called available energy, which is a metric for describing the maximum useful energy that can be derived from a process, component or system."

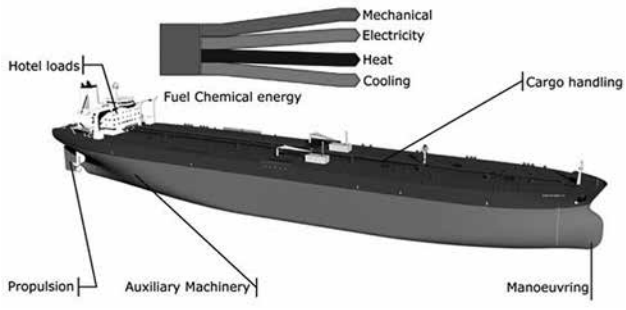
The methodology can be adjusted to suit newbuilds still in the design phase, or operating ships, and it is designed to help managers make the most out of their Ship Energy Efficiency Management Plans. Using both on-board measurements and the DNV GL modelling suite COSSMOS, energy losses throughout the ship, including hull, propulsion power train, machinery and electrical systems, are quantified and ranked. Even difficult-to-capture processes, such as throttling and fluid mixing, can be incorporated.

The report includes an analysis of a waste-heat recovery system. These complex systems can easily contain 70 components. "Through our exergy-based methodology, the true sources of useful energy losses were identified, revealing a picture far from self-evident. Subsequent optimisation in DNV COSSMOS yielded an increase in fuel savings that halved the payback time of the system," said George Dimopoulos, senior researcher and project manager of this position paper.

A second study examined the fuel pre-processing sub-system for the marine fuel cell on board the offshore supply vessel *Viking Lady*. This resulted in a solution capable of a remarkable 50 per cent reduction in exergy losses.

When the main engine of an Aframax tanker was analysed using operating data in combination with COSSMOS modelling, the true sources of losses were identified with greater accuracy than a traditional energy analysis, says Dimopoulos. "In fact, the standard energy analysis failed to identify the turbocharger as being the second-largest contributor to exergy loss."

With this 'common currency' for efficiency, DNV GL provides a way of energy management which will work for all ships, and all systems and components that convert energy on board. It thus offers ship managers an unparalleled way of prioritising investment in technology alternatives or new operational strategies.



DNV GL's energy-efficiency methodology analyses exergy (Image courtesy DNV GL)

About DNV COSSMOS

Developed by DNV GL Strategic Research and Innovation, DNV COSSMOS is a computer platform which models, simulates and optimises complex and integrated ship machinery systems with respect to energy efficiency, emissions, costs and safety. With COSSMOS, DNV GL is able to analyse alternative configurations in new vessels, perform assessment and optimisation in ships in operation systems, and evaluate the potential of new technologies.

Mike Mechanicos

FROM THE CROWS NEST

CurveExpert

Not everyone has to fit curves or surfaces to sets of data using regression analysis. However, if you do, then there is an excellent tool available.

CurveExpert Professional is a cross-platform solution for curve fitting and data analysis. Data can be modelled using a toolbox of linear regression models, nonlinear regression models, smoothing methods, or various kinds of splines. Over 90 models are built-in, but custom regression models may also be defined by the user. Full-featured graphing capability allows thorough examination of the curve fit. The process of finding the best fit can be automated by letting CurveExpert compare your data to each model to choose the best curve. The correlation coefficient coefficient (R) and the coefficient of determination (R^2) are automatically generated. The software is designed with the purpose of generating high-quality results and output while saving time in the process.

This software is easy to use, and has been successful in thesis project work by UNSW students for fitting van Oortmerssen-type equations to resistance data, with up to 50 coefficients to be determined from 2500 data points.

CurveExpert is shareware, available on the web at www.curveexpert.net for a 30-day free trial, and for $70 thereafter.

Phil Helmore

IMO to make Container Weighing Mandatory

The International Maritime Organisation (IMO) is on the brink of amending SOLAS to make it a mandatory requirement to verify the weights of containers before they are loaded on board a ship. The mis-declaration of container weights has been an issue that has concerned many in the shipping industry for some time. The SOLAS amendment will require all containers to be either be directly weighed to confirm the shipper's declared weight, or to use a method of "calculated" verification whereby the shipper can weigh all packages and cargo items including pallets, dunnage and the tare (unladen) weight of the container to confirm the weight. This compromise solution will disappoint many who wanted all containers to be actually weighed, but some argued that it would not be possible in some countries to weigh each container.

www.rina.org.uk/container_weights.html

COMING EVENTS

NSW 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 for remaining for 2014 (with exceptions noted) is as follows:

4 Jun	Rob Gay, Director, PriceWaterhouseCoopers *Reliability-centred Maintenance in a Maritime Environent*
2 Jul	Neil Edwards, Principal, Edwards Marine Services *New RAstar 3400 Tugs Building at Sanmar Shipyard in Turkey for South America*
6 Aug	Selwyn Oliveira, Marine and Diesel Manager, Alfa Laval Australia *Ballast Water Treatment*
3 Sep	Tony Fielding, Project Director, Teekay Shipping *CSIRO's New Research Vessel, RV* Investigator
1 Oct	IMarEST TBA
4 Dec	SMIX Bash

Contract Management for Ship Construction, Repair and Design

Fisher Maritime's widely-respected three-day training program, *Contract Management for Ship Construction, Repair and Design*, will be available in Perth on 12–14 November 2014 and Auckland, New Zealand, on 18–20 November 2014.

This program is a lessons-learned one, not a theoretical course on contract management. It bears a lot of "scar tissue" from marine contractual disasters. It is designed for:

- Project Managers (Yards and Owners)
- Contract Managers and Specialists
- Newbuilding Shipyards, Repair Yards
- Fleet Managers
- General Managers of Shipyards
- Financial Managers (Yards and Owners)
- Ship Conversion Specialists
- Naval Architects, Marine Surveyors
- Federal, State, and Provincial Agencies
- Ferry Operators (Public and Private)
- Naval Shipyards
- Owner's Representatives
- On-Site Representatives
- Major Equipment Vendors
- Marine Superintendents
- Consultants and Attorneys

The presenter, Dr Kenneth Fisher, is recognised worldwide as the leading authority on the development and management of complex contracts and specifications for ship construction, conversion, repair, and design. He is author of the 2004 RINA publication, *Shipbuilding Specifications: Best Practices Guidelines*, and of the 2003 SNAME publication, *Shipbuilding Contracts and Specifications*. As an arbitrator, expert witness, consultant, and instructor for more than 30 years, he brings clarity and organization to an otherwise-complex set of management requirements unique to the maritime industry.

For details of topics covered, visit www.fishermaritime.com/publications/pdf/cm.pdf, and for registration, visit www.fishermaritime.com/projecttraining/registration.html and click on the button for *Register for our AUST/NZ Programs*.

HPYD5 Conference

The High Performance Yacht Design Conference HPYD5 will take place in Auckland, NZ, as part of the Volvo Ocean Race stopover in early March 2015.

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 are due on 1 July and final papers are due on 1 October 2014. All papers will be reviewed by an international technical panel.

An exciting development is that an agreement has been reached with SNAME (Chesapeake Section) and Ecole Navale (Innov'Sail) to provide a coordinated rolling three-year program of high-quality yacht technical conferences.

See www.hpyd.org.nz for more details.

Pacific 2015 IMC

No, it is not a typographical error. The next Pacific event has been brought forward to October 2015.

The Pacific 2015 International Maritime Conference, organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology, and Engineers Australia, will now be held on 6–8 October 2015. However, due to reconstruction of the Sydney Conference and Exhibition Centre at Darling Harbour, the venue will be at the Sydney Conference and Exhibition Centre at Glebe Island, as previously advised.

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 150 dpi. A resolution of 300 dpi is preferred.

Progress at Austal on Patrol Boat Contract

The Minister for Immigration and Border Protection, Scott Morrison, participated in a keel-laying ceremony on 31 March for the sixth Cape-class patrol boat being built at Austal's Henderson shipyard in Western Australia.

The vessel, *Cape Leveque*, is the sixth of eight Cape-class patrol boats being built by Austal for the Australian Customs and Border Protection Service under a design, construct and in-service support contract valued at approximately $330 million.

The first-of-class Cape-class patrol boat, *Cape St George*, was delivered to the Australian Customs and Border Protection Service in April 2013. A second vessel, *Cape Byron*, is expected to be delivered by mid-year. All eight vessels are on track to be delivered by August 2015, in line with the contract.

The keel-laying ceremony is a time-honoured shipbuilding tradition where three specially-minted coins are placed under a keel block as a symbol of good fortune and to bless the ship. These coins will be removed just prior to the patrol boat's launch.

The three coins for the *Cape Leveque* keel-laying ceremony were placed by Minister Morrison; Austal Chairman John Rothwell AO; and Customs and Border Protection Regional Commander WA, Rod O'Donnell.

At the ceremony, Minister Morrison commended Austal for achieving the project to date on time and on budget.

"The reason that we're doing this here is not through any act of generosity to Austal; we're doing it because they know how to do a good job," he said.

"They're a competitive outfit which knows about product and knows about service, and they know about partnership in working together with government to deliver these major programs."

The second Cape-class patrol boat was officially named *Cape Byron* during a ceremony held at Austal's Henderson shipyard on 28 April.

Senator Michaelia Cash, Assistant Minister for Immigration and Border Protection, Arakwal People of Cape Byron and crew of *Cape Byron* with the Governor of NSW, Her Excellency Prof Marie Bashir on board *Cape Byron*
(Photo courtesy Austal)

Cape Byron was launched in January 2014 and has since undergone final fitting out and sea trials, with final crew familiarisation to be completed prior to delivery to ACBPS.

The naming ceremony was attended by the Assistant Minister for Immigration and Border Protection, Senator Michaelia Cash, and Her Excellency Professor the Honourable Marie Bashir AC, Governor of NSW, who officially named the vessel after Cape Byron in that state.

The third Cape-class patrol boat, *Cape Nelson*, was launched at Henderson on 5 May 2014. Following maritime tradition, specially-minted coins were placed under the keel block of the vessel as a symbol of good fortune on 13 August 2013. These were removed prior to the launch and will be presented to the boat, ACBPS and Austal at a later date. The boat was then lowered into the water using Austal's slipway facility.

With the vessel in the water, Austal is on target to achieve completion and sea trials prior to an official naming ceremony and final delivery to ACBPS in the third quarter of 2014.

Cape Nelson entering the water
(Photo courtesy Austal)

As part of the $330 million contract, Austal will also perform ongoing in-service support for the Cape-class fleet over at least eight years, encompassing a full range of intermediate and depot-level maintenance activities, valued at a minimum of $50 million.

The Cape-class patrol boats have been designed and constructed to provide greater range, endurance and flexibility, as well as enhanced capability to operate in more-severe sea conditions than the current ACBPS Bay-class fleet and the Royal Australian Navy Armidale-class fleet.

Each of the vessels is named after a cape from each state and territory.

Austal Delivers Third JHSV

In March Austal delivered the third Joint High Speed Vessel (JHSV 3), USNS *Millinocket*, to the US Navy. USNS *Millinocket* was built by Austal at its shipyard in Mobile, Alabama, under a 10 ship, $US1.6 billion contract.

Austal's Chief Executive Officer, Andrew Bellamy, said that the Joint High Speed Vessel program has matured through the implementation of productivity and efficiency improvements at Austal's US shipyard since construction commenced on JHSV 1.

"We have taken a very proactive approach in making operational improvements at the shipyard through each step of the JHSV program," Mr Bellamy said.

"It is pleasing to see the benefits of these improvements, with Austal's JHSV program maturing into the phase of efficient, serial production of the vessels."

Delivery of USNS *Millinocket* to the US Navy follows USNS *Spearhead* (JHSV 1), which was delivered in December 2012 and has been deployed, and USNS *Choctaw County* (JHSV 2), which was delivered in June 2013.

Ships currently under construction are JHSV 4, which was christened in January and is being prepared for sea trials, JHSV 5, which has begun final assembly, and JHSV 6, which commenced construction in January in the module manufacturing facility.

Five Independence-variant Littoral Combat Ships are also in construction at Austal's US shipyard under the Company's 10-ship, $US3.5 billion contract with the US Navy. USS *Jackson* (LCS 6) was launched in December 2013 and is preparing for sea trials before delivery to the US Navy by the end of 2014. USS *Montgomery* (LCS 8) is expected to be launched in 2014, while LCS 10, LCS 12, and LCS 14 are in various stages of construction.

Sea Trials for NUSHIP *Canberra*

At the beginning of March Australia's first LHD, *Canberra*, sailed from the BAE Systems shipyard in Victoria for contractor's sea trials.

Along with project staff from BAE Systems and the Defence Materiel Organisation, a significant number of *Canberra's* ship's company also sailed in *Canberra* for the sea trials.

Commanding Officer of NUSHIP *Canberra*, Captain Jonathan Sadleir AM, said that it was an important familiarisation opportunity for the ship's company.

"Some of our technical personnel are involved in assisting with observing the trials. This provides an excellent opportunity for our people to build on their training so far and further familiarise themselves with the systems and equipment onboard, so that they are ready to take responsibility for those systems when the ship is handed over to Navy," Captain Sadleir said.

"To have the opportunity to see the ship operate at sea ahead of taking responsibility for her is a valuable learning experience.

"We also have some of our chefs embarked, preparing the meals for everyone onboard during the sea trials program — again a great way to get to know their brand-new working environment," he said.

During the trials, *Canberra* operated within Port Phillip Bay and in various areas off the Victorian and New South Wales coasts including near Eden and in Jervis Bay. The first trials phase culminated with *Canberra* entering Sydney Harbour for the first time on 13 March for docking in the Captain Cook Dock at Garden Island. On completion of the docking she returned to Williamstown to commence the final phase of sea trials involving communications and combat systems.

Final Submarine Sustainment Review Report

The fourth and final review into the Collins-class submarine sustainment program by expert John Coles, released on 8 April, confirms that submarine maintenance and availability has significantly improved.

The review findings have been welcomed by the Minister for Defence, David Johnston, and the Minister for Finance, Mathias Cormann.

NUSHIP *Canberra* alongside at Fleet Base East for the first time on 13 March, dwarfing ADV *Ocean Shield* astern of her (Photo John Jeremy)

The report found that two and frequently three submarines are now available for deployment at any one time. In the recent past, we were often reliant on a single boat.

"The report notes remarkable progress in several areas," Minister Johnston said.

"This includes greater availability of spares, less planned maintenance over-runs, fewer breakdowns and faster repairs to operational boats when problems occur."

The final report also confirmed an increasingly-collaborative effort by all partners involved — Navy, Defence Materiel Organisation and the submarine maintenance contractor, ASC.

"We are particularly pleased with the improvements in submarine productivity from ASC, which has meant better support of the Navy's submarine capability," added Minister Cormann.

"The signs are encouraging, but there are still risks ahead with more work needing to be done," Minister Johnston said.

"The Collins class is a sophisticated platform which operates in a demanding environment, and continued improvements in availability will lack resilience until the Coles recommendations are fully implemented."

The report is available at www.defence.gov.au/dmo/Newsitems/7apr14_coles.cfm.

New Defence White Paper

On 4 April the Prime Minister and the Minister for Defence announced that the Government will develop a Defence White Paper to be released in 2015 which will underpin a costed, affordable plan to achieve Australia's defence and national security objectives.

The White Paper will align defence policy with military strategy and deliver an affordable Australian Defence Force structure.

The Government has declared that it is committed to returning Defence spending to two per cent of Australia's gross domestic product in the next decade as the budgetary position improves.

The Defence White Paper will assist in developing a costed acquisition programme and a 10-year Defence Capability Plan and an updated Defence Industry Policy Statement.

It will be informed by the Government's Commission of Audit and a first-principles review of the Department of Defence that will be undertaken during 2014.

The Defence White Paper will also consider the merits of an enhanced Defence presence in northern Australia.

It will draw on parallel work being done on the Northern Australia White Paper which the Government is developing in partnership with Queensland, Western Australia and the Northern Territory.

In developing the White Paper, the Department of Defence will consult with industry, the public, Australia's allies and regional partners.

The White Paper's development will be supported by the Expert Panel announced previously by the Minister for Defence.

This Expert Panel will provide input at all stages of the process, to challenge any key assumptions and ensure strong public consultation during the development of the White Paper.

Incat Boosts Manufacturing Workforce

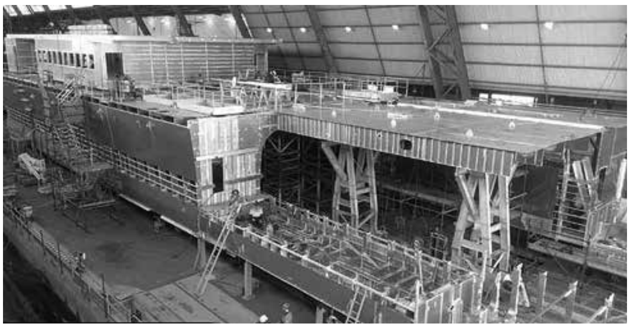
Responding to increased interest from around the world for its innovative high-speed vessels, Incat Tasmania has increased its shipbuilding workforce to meet the demand. The Company reported on 3 March that it had put on around 30 men in recent weeks and more were to start in the weeks ahead.

Those employed have been mainly skilled tradesmen in the areas of welding, fabrication, electrical, fitting and fitout but, importantly, Incat has also put on unskilled workers as trade assistants and labourers. It is anticipated that some of these will be put on as apprentices in the future, providing a much-needed boost to Tasmania's manufacturing industry and the economy and ensuring that there is a trained and skilled workforce to meet future employment demands.

Incat Chairman, Robert Clifford, said "I am delighted to see so many former Incat personnel expressing interest in working for the company again, and it is also encouraging to see other skilled workers from a range of industries recently submitting applications to be considered for future employment opportunities.

"Incat is hopeful of securing further orders and continuing to be a world leader in the shipbuilding industry but we need workers to build our vessels. We are extremely proud of the level of skills and the quality of our product — it is this reputation for quality that is opening new markets".

The ships currently under construction are both for new clients, a 70 m fast crew boat for the Azerbaijan oil industry, and an 85 m commercial passenger and vehicle ferry for a new Japanese customer.



Progress with the erection of the 70 m fast crew boat *CMS Express* in March this year (Photo courtesy Incat Tasmania)

New Contracts for Austal

In March Austal announced that it had been awarded a contract from a naval customer in the Middle East for the design, construction and integrated logistics support of two 72 m high-speed support vessels (HSSV). The value of the contract is approximately $US124.9 million.

Austal will build the HSSVs at its shipyard in Henderson, Western Australia. Construction of the first vessel is expected to commence during 2014, with the second vessel expected to be delivered in 2016.

The HSSVs will be deployed with a similar mission to the Joint High Speed Vessels currently being constructed by Austal for the US Navy at the company's shipyard in Mobile, Alabama.

The HSSVs will offer a range of capabilities to support naval operations, including helicopter operations, rapid deployment of military personnel and cargo, and search and rescue operations.

Austal's Chief Executive Officer, Andrew Bellamy, said that the contract reflected the Company's strategy of pursuing higher-value defence-vessel export opportunities in new markets.

"I am delighted that we have been awarded this contract, which is in line with our strategy of leveraging our revolutionary intellectual property and technology to new defence markets, particularly for underpinning the Henderson shipyard," Mr Bellamy said.

"This contract reinforces the significant progress we have made in positioning Austal as a prime defence contractor.

"At Henderson, for example, we have a proven ability in designing, constructing and supporting defence vessels, including our current eight-ship Cape-class patrol boat contract for the Australian Customs and Border Protection Service. Meanwhile, our commercial ferry operations have been successfully transferred to our Philippines shipyard.

"The contract also illustrates the growing recognition by international naval forces of the utility of high-speed support vessels, following on from our ten-ship Joint High Speed Vessel contract for the US Navy."

In April Austal announced that it has been awarded a contract from the Abu Dhabi National Oil Company (ADNOC) to design and construct two 45 m high-speed catamaran ferries. The contract is valued at approximately $30 million.

The high-speed ferries will be designed and constructed at Austal's Philippines shipyard. Construction will commence in the second quarter of 2014, with both vessels expected to be delivered in 2015.

The high-speed ferries will be used to transfer cargo, personnel, and equipment to ADNOC offshore installations. ADNOC is one of the world's leading oil and gas companies, with substantial business interests in upstream and downstream activities, and is steadily growing its fleet of offshore support vessels.

Andrew Bellamy said that it was pleasing to win the contract, which was in line with Austal's strategy of targeting commercial vessel opportunities in the oil and gas market.

"Given the subdued commercial ferry market, we have repositioned our commercial business to be more competitive and target sectors which will deliver value from the depth of knowledge which Austal has in designing and constructing these vessels," Mr Bellamy said.

"Expanding into the Philippines was a key step in increasing competitiveness, and we have enhanced this through the ongoing transfer of technology to the shipyard.

"We also identified new and emerging markets, such the Middle East and the energy sector, as key targets to drive value from the shipyard.

"This contract is very pleasing as it demonstrates Austal's ability to use our deep know-how and competitive position to win work in this target market.

"It also illustrates the confidence that ADNOC has in Austal and our shipbuilding facilities in the Philippines, which has been earned through a competitive tendering process and backed up by several successful recent deliveries from Austal's Philippines shipyard."

Austal delivered an 80 m commercial ferry, to a repeat customer, in December 2013 which was designed and constructed at its Philippines shipyard.

Austal Delivers First of Three 27 m Wind Express Vessels

The first of three 27 m wind-farm support vessels, *Church Bay*, has successfully completed sea trials at Austal's Philippines shipyard and has been shipped to Europe where it was expected to commence operations for the UK operator Turbine Transfers shortly after the end of April. The vessel will operate off the German coast under contract with Dong Energy.

Turbine Transfers is a wholly-owned subsidiary of Holyhead Towing Company which has been operating work boats since the early 1960s. Its long-term customers include Siemens, RWE NPower, Van Oord, Dong Energy, EnBW and Royal Boskalis Westminster.

The Managing Director of Turbine Transfers, Captain Mark Meade, said "We have been very happy with the previous three 21 m Wind Express vessels built by Austal and we have high expectations for the new, larger 27 m craft.

"*Church Bay* performed well on trials and met all performance expectations."

"We are especially pleased with the exceptional seakeeping, coupled with the hull's ability to carry additional deadweight with a minimal loss of speed, provided by Austal's fine entry Z-bow hullform."

Joey Turano, President and General Manager of Austal's Philippines shipyard operations, said that the vessel had been specifically designed for operation in rough sea conditions.

"We have built on the experience in designing and constructing the smaller 21 m sister at the Philippines shipyard to ensure that the Wind Express 27 provides stability and fuel efficiency through its highly-refined catamaran hullform, requiring less power and fuel to meet operational requirements," Mr Turano said.

"Given the high tunnel height and Austal's advanced Z-bow chine hullform, the vessel is able to operate at speeds of around 30 kn with targeted seakeeping ability in up to 2 m significant wave height.

"*Church Bay* also has a four-engine arrangement with four independent drive trains, which is believed to be unique in the wind-farm support-vessel market and provides an unparalleled degree of operational efficiency.

"Combined with the proven highly-efficient Austal hullform, it delivers the capability of greater reliability combined with greater range and lower operating costs.

"I am very pleased that we have delivered this vessel and look forward to delivery of the next two vessels to our repeat client."

With a trials deadweight of 12.5 t, *Church Bay* achieved a top speed of 31.4 kn and a comfortable cruising speed in the range of 26–27 kn. The vessel has four Caterpillar C18 diesel engines rated at 553 kW at 2100 rpm, each driving a Rolls Royce 36A3 waterjet. The advantage of the four-engine installation with each engine driving its own waterjet is redundancy. In trials, with one engine shut down, *Church Bay* achieved 24.2 kn and, with only one drive train operational in each hull, the catamaran still achieved a sustainable speed of 13 kn.

Church Bay being loaded for delivery
(Photo courtesy Austal)

In addition to incorporating the proven features of hull shape and high tunnel which have been fundamental to the success of the three earlier 21 m vessels achieving an exemplary reputation as excellent rough-weather boats, the latest 27 m design also incorporates the option for fitting a pair of fixed T-foils. Each of the three vessels has the appropriate structure so that T-foils can be fitted should operating conditions dictate, such as no draught limitations in the area of operation and charterers requiring more comfortable operations. Based on Austal's experience with ferry operations, the fitting of fixed T-foils improves seakeeping performance in the transit mode by as much as 30 per cent. It is expected that they will also offer improvements during zero- and low-speed operations.

Turbine Transfers is taking delivery of three sets of fixed T-foils but only the third vessel in the current series, *Mill Bay*, will be have them fitted at the time of delivery. The other two vessels, *Church Bay* and *Bull Bay*, had foils pre-fitted prior to launch but they were removed and replaced with cover plates for shipping, as they will initially be operating in shallow water areas when they enter service in Europe.

The 27 m Wind Express vessel's practical arrangement enables comfortable transits for up to 12 wind-farm personnel, with a high-quality interior fit-out, good visibility, and ample fore and aft cargo stowage space. It also has accommodation for up to eight crew in a live-aboard, four-cabin arrangement, with bunks located on the main deck aft of the passenger saloon.

The subsequent 27 m vessels in the three-vessel contract, *Mill Bay* and *Bull Bay*, were expected to be loaded for transportation to Europe by the end of April.

Principal Particulars

Length OA	26.5 m
Length BP	24.0 m
Beam moulded	7.5 m
Hull draft	1.4 m
Crew	3
Wind-farm personnel	12
Deck cargo	10 t
Deadweight (max)	22 t
Fuel	15 800 L
Main engines	4 × Caterpillar C18 each 553 kW at 2100 rpm
Waterjets	4 × Rolls Royce 36A3
Speed (12.5 t dwt)	31.4 knots (trials)
Range	>700 n miles (with 20% reserve)
Classification	Det Norske Veritas ✠1AHSLC Wind Farm Service 1 R1

New Australian Defence Force Command Team

On 4 April the Prime Minister and the Minister for Defence announced a number of senior Australian Defence Force appointments.

Air Marshal Mark Binskin, AC, will become Chief of the Defence Force when General David Hurley, AC, DSC, completes his tenure on 3 July 2014.

The Government has also recommended to the Governor-General that Vice Admiral Ray Griggs, AO, CSC, RAN, be appointed as Vice Chief of the Defence Force and that Rear Admiral Tim Barrett, AM, CSC, RAN, be appointed as the incoming Chief of Navy. Both will commence their appointments on 3 July 2014 for a period of four years.

The Government also recommended that the Chief of Army, Lieutenant General David Morrison, AO, and the Chief of Air Force, Air Marshal Geoff Brown, AO, remain in their current positions until July 2015.

These 12 month extensions to their appointments bring these positions into line with new four-year tenure arrangements for statutory appointments and ensure continuity and stability in these key leadership positions.

VLS installed in NUSHIP *Hobart*

Six strike-length missile modules for the Hobart-class Vertical Launch System (VLS) were installed during April into the first of the RAN's air-warfare destroyers, *Hobart*, marking a significant Combat System load-out achievement for the project.

The VLS MK41 modules are a critical part of the Hobart-class combat system which will enable the Navy's new guided-missile destroyers to execute air warfare and ship self-defence tasks. It is the first major combat system element to be loaded into the ship following consolidation.

Each ship will be fitted with six VLS modules, each containing eight cells, giving a total of 48 cells per ship. Each cell is capable of accepting, storing, preparing for launch, and launching either a single SM-2 Missile or four Evolved Sea Sparrow missiles.

AWD Alliance CEO, Rod Equid, said that the VLS load out is the first multi-module VLS load out and has built on the in-country expertise developed through the Navy's FFG Upgrade Project which involved installing a single-module VLS.

"Whilst the Anzac-class and Adelaide-class frigates have a single-module vertical-launch system, the new Hobart-class destroyers will have a multi-module configuration which will provide more capacity for air warfare. It will also be the first configured to fire SM-2 medium-range weapons and has the flexibility to support multiple missile types within a single weapon launching system," said Mr Equid.

"Complex installation work, such as the VLS, involves different groups working together to get the job done and has drawn on the technical expertise of the Commonwealth of Australia, the United States Navy and Thales. It has been a true representation of how the Alliance operates."

"The installation has been a coordinated activity between the

AWD Alliance's Production and Test and Activation teams for the preparation of the VLS compartment and providing the subject matter expertise for pre-staging work."

The modules were taken out of storage from an Adelaide warehouse facility earlier this year and moved into the purpose-built mobile staging platform located alongside the ship on the common-user facility at Osborne for pre-staging work prior to installation. Following installation, the system will be operationally tested during the upcoming combat system light-off period.

The acquisition of the VLS modules was made by the Commonwealth of Australia, through the United States Foreign Military Sales program.

Shipping a VLS module into *Hobart*
(Photo AWD Alliance)

Progress with the erection of the future HMAS *Brisbane* in April 2014
(Photo AWD Alliance)

The first air-warfare destroyer, *Hobart*, in April 2014
(Photo AWD Alliance)

48 m Catamaran Passenger Ferry from Incat Crowther

Incat Crowther has announced that it is designing a fourth vessel for UltraMar of Cancun, Mexico. The 48 m catamaran passenger ferry, to be built at Midship Marine in Louisiana, USA, will operate on UltraMar's busy Playa de Carmen–Cozumel run.

Following the success of the Incat Crowther-designed *Ultrajet I*, *Ultrajet II* and *Ultrajet III*, UltraMar approached Incat Crowther to develop a high-capacity boat for the operator's demanding Cozumel operation. High on the priority list was loading and disembarking more than 800 passengers, upgraded cargo handling, and a robust platform fit for high-turnaround frequency and exposed dock facilities.

The vessel will be fitted with hinged boarding ramps. A pair will be located on the mid and main decks at amidships for passenger loading, whilst an aft pair will give direct access to the cargo room, which will be loaded via a portable conveyor belt. This cost-effective system has been well proven on other Incat Crowther vessels where efficient turnaround of high passenger and cargo volumes has been a requirement. The boarding ramps will be supplemented by large staircases inside and out to further aid movement.

218 passengers will be seated in the main-deck aft cabin, whilst the forward end of the vessel's main deck will feature a premium-class area. This area will have 64 seats at increased pitch and width, fitted with folding tables. The foredeck will seat 50 passengers.

The mid deck seats 209 passengers outside and 60 inside. There is a stage at the forward end of the outdoor seating area on this deck for Ultramar's trademark musicians to entertain passengers. Above, the roof deck will seat 216.

The vessel will continue UltraMar's commitment to an ultra-modern fleet, with the customer experience being enhanced by large windows with panoramic visibility. To be finished in UltraMar's distinctive yellow-and-blue livery, the vessel will grab even more attention during evening service with the fitment of the operator's signature underwater LED lighting.

The vessel will be powered by a pair of Yanmar 12AYM-WGT main engines, each producing 1340 kW at 1900 rpm, offering an efficient service speed of 24 kn, and a maximum speed of 28 kn.

Principal particulars of the new vessel are

Length OA		48.8 m
Length WL		44.7 m
Beam OA		11.0 m
Depth		4.00 m
Draft	(hull)	1.60 m
	(propeller)	2.00 m
Passengers		817
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)	24 kn
	(maximum)	28 kn
Construction		Marine-grade aluminium
Flag		Mexico
Class/Survey		USCG Subchapter K

Starboard bow of 48 m catamaran passenger ferry for UltraMar
(Image courtesy Incat Crowther)

Starboard quarter of 48 m catamaran passenger ferry for UltraMar
(Image courtesy Incat Crowther)

Magen Defender and *Masud Defender* from Incat Crowther

Incat Crowther has announced the delivery of a pair of 20 m monohull crewboats from Veecraft Marine in Cape Town, South Africa. *Magen Defender* and *Masud Defender* are based on the proven platform of 2011's *Ahuva*, also built by Veecraft Marine. They feature a large cargo deck forward, with a pair of doors from the passenger compartment allowing bow loading either side of the foredeck cargo.

The foredeck features removable handrails to facilitate flexible loads and passenger movements, whilst the vessel's excellent stability at rest further increases transfer safety.

The main-deck passenger cabin features seating for 25 passengers and a head with lavatory. Under the raised pilothouse are bins for passengers' luggage.

Below deck, crew accommodations include two staterooms for a crew of six with galley, mess and a head with shower and lavatory. Two large storage lockers and engine-room access for crew use are also located below deck.

A notable requirement for the vessels was their bullet-proof pilot-house. As well as fitting bullet-proof glass, they are plated with Armox 500T steel, capable of withstanding an AK-47 cartridge fired at a distance of 10 m. The pilot-house itself features overhead windows forward to enhance visibility when approaching offshore platforms. Heavy-duty replaceable fendering is fitted all round, and a 3000 L/h remote-control fire monitor is fitted to the pilot-house roof.

The vessels are each fitted with a pair of MAN D2842 LE410 main engines, each producing 824 kW. Propulsion is via a pair of propellers, recessed into tunnels to meet the demanding draft requirement.

Principal particulars of *Magen Defender* and *Masud Defender* are

Length OA		20.4 m
Length WL		19.7 m
Beam OA		5.50 m
Depth		2.15 m
Draft	(hull)	0.85 m
	(propeller)	1.34 m
Passengers		25
Crew		6
Cargo deck area		27.4 m^2
Fuel oil		5200 L
Fresh water		1300 L
Sullage		350 L
Main Engines		2×MAN D2842 LE410 each 824 kW @ 2100rpm
Propulsion		2×propellers
Generators		2×TBD
Speed	(service)	28 kn
	(maximum)	30 kn
Construction		Hull and passenger cabin: Marine-grade aluminium Pilot-house: Armox 500T steel
Flag		Nigeria
Class/Survey		BV ✠Hull ✠Machinery, Crew Boat, Sea Area 2

Magen Defender (L) and *Masud Defender* show their paces
(Photo courtesy Incat Crowther)

Foredeck and pilothouse on *Magen Defender*
(Photo courtesy Incat Crowther)

Magen Defender and *Masud Defender* at speed
(Photo courtesy Incat Crowther)

African Runner from Incat Crowther

Incat Crowther has announced the commencement of construction of a 30 m wave-piercing catamaran crewboat by Veecraft Marine in Cape Town, South Africa, for Africa Diving Service of Nigeria. The vessel is intended for utility use in Nigeria, and will deliver significant improvements in versatility and efficiency.

Powered by a pair of Caterpillar C32 ACERT main engines, each delivering 1081 kW, the vessel will have a service speed of 30 kn in Sea State 3.

The vessel has seats for 22 passengers, as well as accommodation for 15. An additional 8 crew can be accommodated in a self-contained deck-mounted module. With features including a 53 m^2 cargo deck, surfer-style bow loading, fire-fighting monitor and ballistic-protected wheelhouse, the vessel will match the capacity and functionality of larger monohulls with reduced capital and operational costs.

The vessel is based on successful vessels built to Incat Crowther's design, *Topaz Zephyr* and *Topaz Zenith*, delivered in 2011. *Magen Defender*, *Masud Defender* and *African Runner* further strengthen the partnership between Veecraft Marine and Incat Crowther in the supply of commercial vessels to Africa.

Principal particulars of *African Runner* are

Length OA		30.3 m
Length WL		25.0 m
Beam OA		8.50 m
Depth		3.20 m
Draft	(hull)	1.35 m
	(propeller)	1.90 m
Passengers		22
Crew		15
Cargo deck area		53 m^2
Fuel oil		30 000 L
Fresh water		4000 L
Sullage		500 L
Main engines		2×Caterpillar C32 ACERT each 1081kW @ 2000–2300 rpm
Propulsion		2×propellers
Generators		2×Caterpillar C4.4
Speed	(service)	30 kn
	(maximum)	33 kn
Construction		Marine-grade aluminium
Flag		Nigeria
Class/Survey		BV ✠Hull ✠Machinery, Crew Boat, Sea Area 2

Starboard bow of *African Runner*
(Image courtesy Incat Crowther)

Starboard quarter of *African Runner*
(Image courtesy Incat Crowther

Ten 42 m Infield Utility Vessels from Incat Crowther

Incat Crowther has announced the first deliveries of a 10-boat order for 42 m Infield Utility Vessels to Brunei's PTAS Marine. Developed in conjunction with builder Strategic Marine, the project called upon Incat Crowther's track record in steel crewboats to meet strict performance criteria.

PTAS Marine was contracted by Brunei Shell Petroleum to build and operate nine vessels to support their offshore platforms for a period of ten years. Incat Crowther supported Strategic Marine in their technical proposal for the project, committing to a timeframe of just 15 months from contract signing to the delivery of the ninth vessel. The tenth boat will be retained by PTAS as a backup vessel throughout the contract period.

The first of the vessels, *PTAS Amanah 1*, was delivered in December, with *PTAS Amanah 2*, *PTAS Amanah 3* and *PTAS Amanah 4* subsequently being delivered. The remaining vessels are nearing completion at Strategic's Vietnam yard and undergoing sea trials.

The vessels' hulls are built from steel, with aluminium superstructures. The vessels are classed to LR's SSC rules.

The design features a 100 m^2 aft working deck capable of carry 10 t of cargo. An aft platform is fitted for personnel transfers. The main-deck cabin seats 30 personnel, as well as accommodating 100 survivors in the event that the vessel is called into an emergency situation. A sick bay is also located on this deck, as are a galley, crew mess and food storage for the vessel's 12 crew.

The vessels' crew sleep below decks, with a noise lock/service void separating them from the engine room. The vessel meets stringent noise requirements, which include a maximum volume of 65 dBa in all accommodation spaces.

Additional features include oil-dispersant spray booms port and starboard, and an aft-facing firefighting monitor.

The vessels' propulsion system consists of a pair of Cummins KTA38 outboard engines and a single Cummins KTA50 central main engine. The central engine drives the fire-fighting monitor, and all three drive fixed-pitch propellers through Twin Disc gearboxes. They have a service speed of 20 kn and a top speed of 21.5 kn.

Principal particulars of the new vessels are

Length OA	42.0 m
Length WL	40.5 m
Beam OA	8.00 m
Depth	3.65 m
Draft (hull)	1.78 m
(propeller)	2.45 m
Deck area	100 m^2
Deck load	3.5 t/m^2
Deck cargo	10 t
Personnel	30
Crew	12
Survivors	100
Fuel oil	13 000 L (day tanks) 45 000 L (long range tanks)
Fresh water	15 000 L
Sullage	3000 L
Oil dispersant	3000 L
Main Engines	2×Cummins KTA38-M2 each 1007 kW @ 1900 rpm 1×Cummins KTA50-M2 1342 kW @ 1900 rpm
Propulsion	3×fixed-pitched propellers
Generators	2×Cummins 6BT5.9, 80 ekW
Speed (service)	20 kn
(maximum)	21.5 kn
Construction	Hull: Steel Superstructure: Marine-grade aluminium
Flag	Brunei
Class/Survey	LR ✠100A1 SSC Workboat Monohull G3 ✠LMC

Amanah 1 ready for launching
(Photo courtesy Incat Crowther)

Amanah 1 testing her fire monitor
(Photo courtesy Incat Crowther)

28 m Catamaran Utility Vessel from Incat Crowther

Incat Crowther has announced that Marine Diesel Services has commenced construction of a 28 m catamaran utility vessel to be delivered to Nordic Maritime. The new vessel will build on the expertise and experience which Incat Crowther has demonstrated with vessels such as *Unlimited*, *Limitless*, *Straight Shooter* and *Vejunas*, resulting in one of the most capable and versatile vessel of its type and size.

With seating for 42 day personnel, and accommodation for an additional 10 overnight personnel in addition to the vessel's 6 operational crew, the vessel will perform seismic and crew-supply roles in south-east Asia.

The aft deck of the vessel measures 70 m^2, with a 3 t/m^2 deck rating. It will be fitted out with pad eyes for towing, a 3 t A-frame, an integrated winch base and a deck crane. There will also be multiple lashing points for tying down containers and other freight.

Dedicated to personnel in transit, the aft portion of the main-deck outfit features a four-person cabin, changing room, bathroom, showers, medevac, seats for 42, and ample luggage racks. Personnel accommodation continues in the starboard hull with a four-person cabin and a two-person cabin, both with ensuites.

The forward end of the main-deck cabin features a crew galley and mess, as well as access to the port hull, which accommodates six crew in an arrangement which mirrors the personnel accommodation in the starboard hull.

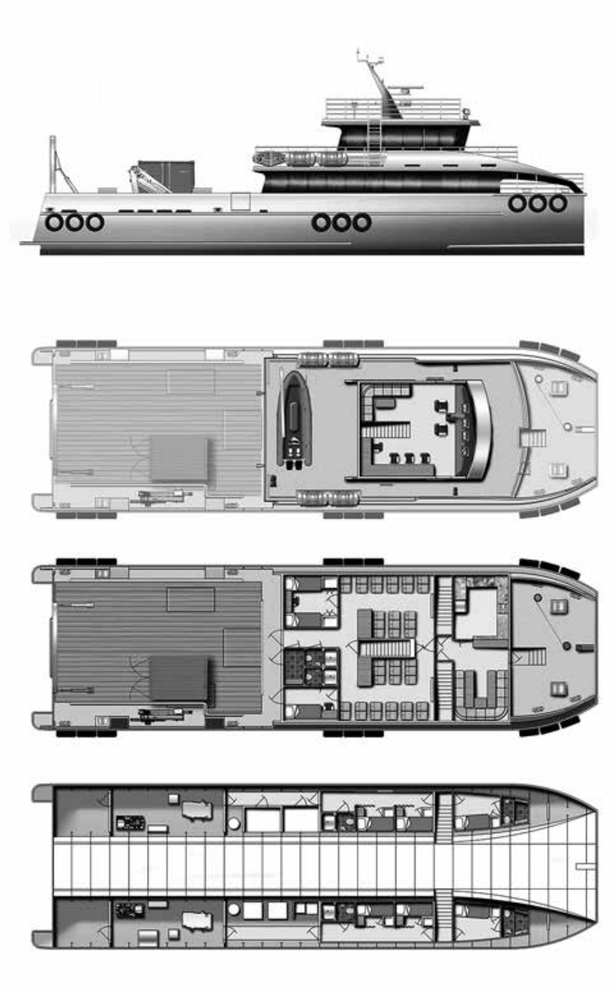
The hulls also house a cool room, a pantry and a laundry, further enhancing the vessel's long-range credentials.

The vessel will be powered by a pair of Caterpillar C18 main engines, each producing 533 kW. The vessel's service speed will be 12 kn, with a top speed of 16 kn.

The vessel will be classed by ABS and is due to be delivered in the fourth quarter of 2014.

Principal particulars of the new vessel are

Length OA		29.9 m
Length WL		28.5 m
Beam OA		8.50 m
Depth		3.60 m
Draft	(hull)	1.35 m
	(propeller)	2.00 m
Day Personnel		42
Overnight Personnel		10
Crew		6
Fuel oil		30 000 L
Fresh water		1500 L
Sullage		1500 L
Main engines		2×Caterpillar C18
		each 533 kW @ 2100 rpm
Propulsion		2×propellers
Generators		2×Caterpillar C4.4, 86 kVa
Speed	(service)	12 kn
	(maximum)	16 kn
Construction		Marine-grade aluminium
Flag		Indonesia
Class/Survey		ABS ✠A1 HSC Crewboat



General arrangement of 28 m catamaran utility vessel
(Image courtesy Incat Crowther)

John Jacob from Incat Crowther

Incat Crowther has announced the delivery of *John Jacob*, a 62.6 m aluminum monohull crew supply vessel, for Barry Graham Oil Service (BGOS) of Bayou La Batre, Alabama, USA. Built to a high standard by Halimar Shipyard in Morgan City, Louisiana, the project's successful completion is the result of a close collaboration between operator, shipyard, and designer.

Driving factors in the design-and-build process included providing a modern and fuel-efficient design meeting the latest demands of crew supply vessels in the Gulf of Mexico, whilst maintaining continuity with existing BGOS fleet operational features. The teamwork between Incat Crowther and Halimar during the design-and-build process was instrumental in ensuring that *John Jacob* meets and exceeds BGOS expectations.

John Jacob has a vast aft cargo deck of nearly 340 m^2, which carries loads of up to 443 t.

The main-deck cabin houses 72 passenger seats, passenger shower and toilet, stores, a dedicated DP equipment room, and access to the upper-deck wheelhouse and below-deck accommodations. A deck locker, accessed from the cargo deck, is provided for storage of deck-cargo securing equipment and other safety gear. Upstairs, the wheelhouse features both forward- and aft-facing control stations and smartly-designed control consoles.

Below decks, *John Jacob*'s crew members are accommodated in twin cabins, capable of sleeping a total of 12. Adjacent to these is a crew galley and mess area, as well as a large pantry.

The vessel's hull houses a multitude of tanks. In addition to the vessel's 57 900 L of fuel, 66 200 L of transferable fuel can be carried. Further tanks hold the vessel's fresh water, grey water, and sewage, while dual-purpose water tanks can also be used to carry up to 161 200 L of rig water or ballast.

The vessel is powered by a quartet of Cummins QSK 50 engines, rated at 1342 kW each. These drive through Twin Disc MGX 6848 gearboxes to four Hamilton HM811 waterjets via cardan-shaft assemblies from Driveline Service of Portland. The vessel reached a top speed in excess of 32 kn during sea trials.

The vessel is USCG Subchapter T approved and ABS classed for DP2 service. Three Thrustmaster 112 kW tunnel bow thrusters combine with the four jets and a Beier Radio DP2 control system to give the vessel superior maneuverability. Electric power is generated from three Cummins 6CTA gensets rated at 185 ekW.

Additionally, a FiFi-1 firefighting system is installed for the purpose of combatting off-ship fires. The system includes two FFS engine-driven pumps, each with 24 094 L/min capacity, with integral clutch assemblies and remote-controlled monitors.

Principal particulars of *John Jacob* are

Length OA	62.6 m
Length WL	55.2 m
Beam OA	9.80 m
Depth	4.60 m
Draft (hull)	2.30 m
Passengers	72
Crew	12
Deck area	340 m^2
Deck cargo	443 t
Ship's fuel oil	57 900 L
Cargo fuel oil	66 200 L
Ship's fresh water	4920 L
Ballast water	73 220 L
Rig water	161 200 L
Grey water	2340 L
Sullage	2120 L
Main engines	4×Cummins QSK 50 each 1342 kW @ 1900 rpm
Propulsion	4×Hamilton HM811 waterjets
Speed (maximum)	32 kn
Bow thrusters	3×Thrustmaster 30TT150AL
Generators	3×Cummins 185 ekW
Construction	Marine-grade aluminum
Flag	USA
Survey	USCG Subchapter T
Class	ABS ✠ A1 HSC Crewboat ✠ AMS ✠ DPS-2

Stewart Marler

New Sydney Ferry Designs Underway

The NSW Minister for Transport, Gladys Berejiklian, announced on 4 April that the NSW Government is getting on with the job of designing brand new-ferries for Sydney Harbour to provide improved comfort and reliability for customers.

John Jacob on trials
(Image courtesy Skeet's Photography)

Sydney-based One2three Naval Architects has been appointed to prepare concept designs for six new ferries before a major construction tender goes out later this year.

"The NSW Government is providing new ferries in 2016 as part of Sydney's Ferry Future, our 20-year plan to modernise and expand Sydney's ferry network," Ms Berejiklian said.

"Sydney's Ferry Future is our blueprint to expand the ferry network and cater for future growth with new ferries, upgraded wharves, additional routes, improved travel times and more services.

"We have asked the naval architects to think outside the box when designing these new ferries and consider how they can include modern customer-friendly elements while retaining the much loved iconic heritage features of Sydney's ferries.

"The new ferries will be designed to carry about 400 passengers and will operate in the Inner Harbour, serving all routes between Rydalmere in the west and Watsons Bay in the east.

"In October last year, customers took around 1.4 million journeys due to the International Fleet Review, which is the biggest month of patronage in the history of ferries on Sydney Harbour."

The October long weekend during the International Fleet Review saw 400 000 journeys taken on Sydney Ferries services, compared to more than 280 000 for the same period in 2012.

Cruising

The summer season continued through late February with visits by *Crystal Symphony, Pacific Pearl, Artania, Carnival Spirit, Black Watch, Queen Mary 2, Pacific Jewel, Diamond Princess, Sun Princess, Rhapsody of the Seas, Ocean Marina, Arcadia, Pacific Princess, Amadea, Voyager of the Seas, Seabourn Odyssey Costa Deliziosa.* The season wound down through autumn, with return visits in March by many of these vessels plus visits by *Queen Elizabeth, Oosterdam, Balmoral, Queen Victoria, Celebrity Solstice, Europa, Ocean Princess,* and *Radiance of the Seas.* April saw return visits by some of these vessels and added visits by *Sea Princess* and *Dawn Princess*, while May saw some return visits and added a visit by *The World.*

Pacific Jewel, Pacific Pearl and *Carnival Spirit* are the only vessels scheduled for cruises over the winter months until *Sun Princess* and *Dawn Princess* arrive on 20 September herald the next summer season.

Phil Helmore

Random Thoughts of a Geriatric Naval Architect

by

Robert Campbell BSc FRINA

I belong to the vintage of the slide rule and the Fuller's 'barrel' — well before the advent of computers and when computer drafting was a piece of fantasy thinking. I am a product of the old school, a mere eighty or so years ago, when all aspects of design were undertaken manually using drawing pens, bow compasses, straight-edges, 'T' squares, set-squares, and other paraphernalia associated with drafting work. Calculations, such as hydrostatic sheets and cross curves of stability, were laborious in the extreme and took days, if not weeks, to compile. A consummate ability in simple arithmetic — not an essential in modern practice — was a prerequisite for such work, adding machines were then in their infancy and a luxury we poor budding naval architects could not afford.

The cylindrical Fuller Calculator, made in England by Stanley, was first produced in the nineteenth century and was equivalent to a slide rule 12.4 m long. It is said that a skilled operator could produce accurate results to six decimal places
(Photo John Jeremy)

For plan preparation there were 'drafting tables', often with not quite regular surfaces or facing edges, which somewhat complicated the accurate preparation of lines plans on cartridge paper. Then there was the multitude of other plans, all done on blue tracing linen, with ammonia or blue print copies for issue to the yard. All in all, it was a somewhat complicated challenge not faced by the modern naval architect, albeit he has problems of his own.

But let me start at the beginning. 'Why on earth do you want to become a naval architect — it's a chancy business?' That was my father's response to my hesitant proposal to enter the marine field. Why did I opt for such a 'chancy business'? It was 1944, the Second World War was nearing its end and it was either the Navy (being afflicted by *mal de mer* — not an attractive option), the coal mines (again not to my liking) or taking up a profession having 'strategic' importance which the Government was at that time encouraging. As a citizen of Glasgow, with its then prowess in the shipbuilding field, what could be more natural to consider than taking up a maritime career, specifically with a view to becoming a naval architect, that supreme icon of maritime achievement.

Having just completed secondary school at a country village high school some twenty miles north of Glasgow, I found that there were no experts in the marine field readily available to consult as to how to go about becoming a naval architect. My father talked to one or two contacts, and the consensus was to 'go to the University' — specifically Glasgow University, then the pre-eminent University offering a degree program in naval architecture. That is what I did but, with hindsight, it was the wrong way around. What I should have done was to become a trainee, then called an apprentice ship draughtsman, in one of the many Clydeside shipyards. Then, after acquiring some basic knowledge of, and skills in, the industry and the practice of marine design, apply to the University to enter the Engineering Faculty to pursue a program in naval architecture. What did happen was that, after completing the first year of the engineering degree course, I made application to one of the Clydeside yards, Barclay, Curle & Co at Whiteinch in Glasgow, as an apprentice draughtsman and was, to put it mildly, somewhat adrift for the next six months while trying to absorb the elementary terminology and techniques of marine technology and ship draughtsmanship. I was subjected to the practical pranks of the drawing office, as indeed all raw recruits were, but am indebted to the kindness, guidance and assistance given by the senior members of the design office — many of whom became good colleagues and with whom I maintained contact over the years to come.

The scheme then in operation for becoming a naval architect was the 'sandwich system' — in essence six months at University, as was the then extent of an engineering degree program year, then six months in the shipyard for practical experience in the 'art', and this extending over the nominal four years of the University degree program/five year apprenticeship. After completion of the apprenticeship and success in obtaining the degree in engineering (naval architecture) you were, in nominal terms, a naval architect. In practical terms it was many years later, after having gained much practical experience at a senior level, that one could in all truth call oneself a naval architect.

In my case, I was to suffer and endure many vicissitudes before reaching that pinnacle — if indeed in all modesty I ever reached it. It was 1949 before I managed to finish the nominal four-year program — the second year of the engineering program was a 'bugbear' which saw the demise of many budding engineers — and concurrently completed my apprenticeship. In the interests of producing a maximum of engineering graduates in the immediate post-war years, the University authorities had been persuaded to compress the four-year program to a two-and-a-half-year period, with the second, third and fourth years having to be taken without a break — no mean task. I took the full four years to complete the program and believe I benefited from it. The first two years of the university program were dedicated to general engineering subjects — in the main, mathematics, chemistry, physics and so-called elementary studies of heat engines and electrical engineering. It was not until the third year that the program divided to the study of specific areas of the engineering professions. In the case of the naval architecture program these comprised ship calculations, strength, stability, waves and rolling, resistance and propulsion, ship drafting — plus a year of advanced natural philosophy — and two years of hydromechanics/hydrodynamics. It was all rather academic but 'brain testing', which is essentially what a university is all about. In those days, a more-practical course could be obtained by attending the then Glasgow Technical College and qualifying with a diploma in naval architecture — now the University of Strathclyde, also offering a degree program in naval architecture.

In my final years at university, I was fortunate to study the naval architecture subjects under Professor Andrew Robb who was then a highly-regarded figure in the naval architecture profession and whose treatise on the subject [*Theory of Naval Architecture* — Ed.]is one of the recognised top works of reference. I enjoyed his tutelage. A fellow colleague [*Michael Pearson* — Ed.] and I had the benefit of essentially proof reading his chapters on ship stability, with its many diagrams of rectangular- and triangular-shaped vessels at various angles of heel to illustrate the formulae developed, all done in his inimitable and precise handwriting, there being no word processors in those days! While the Engineering Faculty was located in the James Watt building — separate from the main University — the naval architecture school was within the main precincts of the University adjacent to the Tower, that well-known landmark of the University. This tended to make us somewhat insular from the mainstream of the engineering fraternity, but also gave us a bit of elitism.

The practical side of getting to know the nuts and bolts of the profession was achieved the hard way, by way of the apprenticeship and post-apprenticeship experience in a shipyard drawing office. We potential graduates enjoyed no favours, being treated the same as the other apprentices and junior staff, and were expected to do our stint in the humble areas of plan printing, clerical duties and records, etc. — all good experience. A period in the yard, the plater's shop or elsewhere, was normally part of the apprenticeship training and one which I somehow managed to avoid. But I was brought up in the era of riveting and asbestos, both of which have been to the health detriment of many in the industry. It was the transition period — ships were being partially riveted and partially welded, moving towards the all-welded ship.

The drawing office essentially comprised three sections — the steel section which, as the name infers, undertook preparation of all the structural plans required for the build of a ship; the arrangement section, which prepared all the arrangement and outfit plans and specifications; and, finally, the so-called scientific section (nominally the design office), which undertook initial design work and all the calculations associated with ship design and construction. It was normal practice to gain experience during the apprenticeship in each of these areas and upon, completion of the apprenticeship to be delegated to a specific area. If you were a university graduate this was naturally, and indeed inevitably, the design office.

How did one go about the initial design process in those days? In the first instance, generally in response to an enquiry from a prospective owner, it was a case of making a rapid assessment of dimensions, a sketch layout, and estimates of materials for use in assessing a building price, for submission to the owner for his consideration. In the event that this was acceptable, the detailed-design processes were undertaken. The basis for this initial design assessment was the established practice of utilising a data bank of proven designs from which a preliminary selection of ship dimensions was made. Thereafter, depending on the type of ship, an initial determination of the hull parameters (e.g. block coefficient) was calculated, using either an assessment based on the selected dimensions and/or by formulae. A load draught was established using the freeboard rules and, hence, a load displacement. Using the data bank, a preliminary estimate of the lightweight was calculated (steel weight + outfit + machinery) which, when subtracted from the load displacement gave, of course, the deadweight — the main prerequisite of cargo ships in those pre-container days. All this was done using the indispensable slide-rule.

The next stage, depending on the type of ship, was to develop an initial body plan so that more-accurate estimates of the key parameters could be checked. Again, this had to be done manually using accumulated data and selecting the design of ship deemed closest in hullform to the projected design. A plot of the sectional areas of the selected basis design was utilised and, by a process of refinement of this curve of areas to meet the parameters of the new design, the sectional areas were established. Thereafter, by a process of interpolation, the body sections of the new design were obtained, these being then further refined by the drawing of a lines plan which was then adjusted to provide acceptable angles of entrance and any other desirable criteria. Utilising this 'first shot' body plan, more-detailed checks of displacement, deadweight and capacities were possible — further refinements were made, and so the design was progressed. Concurrently the general arrangement and principal structural plans, midship section and profile and decks, were developed and again on-going checks of weight, strength and, ultimately, trim and stability were done. That, in a nutshell, was the then established practice for evolving a new design.

In those days, the practice in shipyards on the Clyde was to concentrate on the construction of ship types for which the yard had an established reputation and, in many cases, where a close relationship existed with specific shipowners. While this might seem non-competitive, it had the distinct advantage that the shipyard had an intimate knowledge of the owner's requirements with regard to the multitude of details which go into the building of a ship. In the case of Barclay Curle, there was a long-standing relationship with the British India Steam Navigation Company, better known as the 'BI'. During the sixteen years I was employed at Barclay Curle, some twenty ships were built for BI, ranging from 84 m cargo liners (pilgrim ships employed on the

Pakistan/Indonesia to Persian Gulf trade) up to 186 m liners (e.g. the passenger/troopship *Nevasa*) with the bulk being the intermediate-size cargo ships of some 137–146 m length. All such ships were generally of diesel propulsion, single screw and provided with comprehensive cargo-handling facilities (the exceptions were the passenger ships which had steam-turbine propulsion). Other regular customers were the Australian company, Burns Philp, for whom three ships were constructed while I was in the employ of Barclay Curle, and the Ellerman Line. Five oil tankers were designed and built over the years 1950 to 1963, four for Norwegian owners — some 161.5 m in length and 20 000 t deadweight — with the fifth being a large 229 m tanker of some 70 000 t deadweight, the largest ship ever built at the yard.

I completed my sandwich-system apprenticeship in 1949 and became a ship draughtsman assigned to the design section of the drawing office, at the magnificent salary of five pounds and nine shillings per week — a just-liveable wage in those days. I spent some three years as a design draughtsman, during which I gradually acquired increasing expertise in the more complex calculations associated with ship design.

In particular, I became somewhat of an expert in launching calculations. The layout of the berths in the Barclay Curle yard and the constraints imposed by the River Clyde at that location made successful launching a daunting task. While the determination of key factors relating to the launching was not unusual, the assessment of the travel within the restricted width of river was another matter. Doubtless, nowadays this can be more-accurately determined by the use of computer modelling, etc. when required and, increasingly, this is not a major factor with side launchings, building docks, floating docks and shiplifts. In those days, the 1950s, it was somewhat conjectural and estimated on the basis of past practice, using data from recordings of previous ship travels, with adjustments for launch weight, drag-chain weight and imponderables (tide and ship configurations). In spite of these best estimates, not infrequently a ship gave the opposite river bank a nudge — might I say invariably because of the strong tidal flow and the time taken for the attending tugs to get their charge under control. I well remember the anguish endured prior to the successful launch of the troopship *Nevasa*, some 186 m in length overall, into a river a mere 305 m in width. Background data relating to the launch of *Queen Mary* in 1936 from John Brown's yard further downriver was useful on this occasion. *Queen Mary* actually travelled across the Clyde and into the River Cart which fortuitously entered the Clyde at a point just opposite the launch slipway.

Another highly-complex hand calculation in those days was the strength of masts, taking into consideration the variety of working forces imposed by derrick loadings and the numerous shrouds and stays giving support to the mast structure. Computer programs would have been a godsend for such calculations, now highly unlikely with modern ship-borne gear or dependence on shore facilities. However, much of the work was of a routine nature associated with ships under construction — displacement sheets (what a chore), cross curves of stability (an even greater chore), capacity calculations, ullage tables for tankers and, an even bigger bore, free-surface calculations, inclining experiments, trim and stability, and the preparation of the final trim-and-stability books and calibration tables, etc.

The more-interesting aspect of the design office was its core function — the development of new designs for tender preparation in response to enquiries received by the shipyard. I have already outlined the processes involved and, by and large, they still apply today, although using somewhat more sophisticated techniques. There is no doubt that more-rigid criteria with regard to safety aspects now apply, such as with regard to freeboard, initial and damaged stability, fire prevention regulations and structural strength. These are in the main as a consequence of increased concerns related to ship safety and, in the case of oil tankers, structural integrity. While these nominally impose additional workload on the designer, this is offset by the proliferation of computer programs which have been developed to handle just such work. Additionally, such programs can provide the designer with a variety of options to consider and from which to select the optimum to solve the particular problem or problems involved.

To revert to my career — in 1952, only three years after completing my apprenticeship, I was promoted to take charge of the so-called 'scientific section' of the drawing office. In common with many other of the Clydeside shipyards, Barclay Curle did not have a design office as a separate entity and, although most of the design work was done by the scientific section, the initial general arrangement drawing and structural details were undertaken by other sections of the drawing office — these being the arrangement and outfitting section (for the general arrangements) and the steel section (for the scantlings and structural aspects). The overall operations of the three sections of the drawing office came under the responsibility of the chief draughtsman who, in turn, was responsible to the technical manager and, through him, to the Managing Director.

In 1956 I was again promoted to the new position of

Naval Architect to the shipyard with direct control for the operations of the design office, as it was now called, while the operation of the other sections of the drawing office went under the control of the Chief Draughtsman. In the interim, I had authority to call on the expertise of the drawing office as required for general arrangement layouts and structural work until such capabilities were worked up within the design office. Some three years later, I assumed control and responsibility for all the design and drawing office activities. By this time — the late fifties/early sixties — new contracts were becoming increasingly difficult to obtain due to the competitiveness of overseas shipyards, initially Scandinavia and Germany and, later, Japan and Korea. A significant drawback was the obsolescence of the shipyard — inefficient layout, deteriorating facilities (slipways and workshops) and old equipment. During the late 1950s a number of visits were made to various modern overseas shipyards and feasibility studies undertaken to modernise the entire shipyard. The number of building berths was reduced from five to two, and these were subject to substantial piling to sustain the loads imposed by launching of large ships — tankers and bulk carriers up to some 80 000 t deadweight and large passenger ships up to 183 m in length. The yard layout was streamlined to meet modern pre-fabrication techniques with large-capacity cranes to handle the pre-fabricated units from the sheds to the building berths. New workshops were built with the latest gear and equipment to speed production. Alas it was all too late. While some six or so ships were built, including the aforementioned 60 000 t tanker, the yard was unsustainable and finally closed in 1968. What a tragic waste it was — all these modern facilities and the new slipways were largely bulldozed, although a number of the buildings were utilised by an incoming marine-engineering company[1].

However, before this occurred I had decided that it was time for a move. I had become uneasy at the number of yards closing and the death-knell for me was the closure of the world-famous Denny shipyard at Dumbarton in 1962. While I might have readily transferred to another area of the UK where shipbuilding was still thriving, in particular to Swan Hunter at Newcastle on Tyne, of which Barclay Curle had been a subsidiary since 1912, or joined one of the statutory authorities, I considered that the time was opportune to go further afield. I initiated enquiries in Canada, the USA and Australia, primarily on the basis that these countries were English speaking and, from my investigations, appeared attractive options. While I had responses from a number of these prospects, and almost accepted a senior post with Canadian Vickers at Montreal in Canada, I finally accepted a position with the Australian Shipbuilding Board in Sydney, Australia. I might mention that this was quite a daunting venture — emigrating at age 34 with a wife and four children in tow.

In many ways, the first five to ten years with the ASB, as it was commonly known, were the most challenging, and yet enjoyable, of my career. Initially I was Assistant Superintendent of Hull Design, a post I occupied for some three or four years. I was subsequently was promoted to Controller of Design, in charge of all the operations of the design sections of the ASB — hull, machinery and electrical design and research. The primary function of the ASB was the promotion of a sustainable shipbuilding program, achieved by administration of the shipbuilding bounty in association with the provision of specialised design and technical services to the industry. The ASB was an independent authority, although the staff was attached to a Government department, initially the Department of Transport and, in its final years, the Department of Industry and Commerce. The number of yards recognised as eligible for the subsidy or bounty was limited and during the 1960–70 period, comprised seven shipyards: Walkers Limited at Maryborough, Evans Deakin at Brisbane, the State Dockyard in Newcastle, Cockatoo Dockyard in Sydney, Williamstown Dockyard in Melbourne, the Adelaide Ship Construction Co. in Adelaide and the BHP shipyard at Whyalla. In practical terms, most of the ASB activities were with Walkers, Evans Deakin, State Dockyard, Adelaide Ship Construction and the BHP yard at Whyalla. Cockatoo and Williamstown were mostly engaged in naval shipbuilding and repair activities.

From 1964 to 1979 I was intimately involved in the design of a wide range of ships and even small craft, which was a novelty to me. One of our principal clients was the Commonwealth Government's Australian National Line, the largest operator of coastal shipping, which ran a variety of ship types — bulk carriers, general cargo ships, passenger ferries and ro/ro ships. The designs undertaken by the ASB ranged in size from 9 m motor cruisers for various government instrumentalities to ro-ro ships and bulk carriers up to more than 150 m for various shipowners. Our principal function was the development of basic designs, in discussion with the shipowners, superintendents, and the preparation of documentation, plans and specifications for the calling of competitive tenders from the recognised shipyards, the subsequent analysis of these, and the provision of ongoing technical and design assistance to the successful shipyard and, finally, attending the various trials and hand-over to the shipowner.

In the course of being responsible that work, I naturally had to visit the various yards to discuss the development of the working plans and technical matters, and to travel overseas to evaluate projects being considered by the Australian Government which involved the possible building of ships in Australia for supply under a Government aid program. These generally were for various Pacific nations — the Philippines, Fiji, Tonga, Western Samoa, Vanuatu and others. There was also a close affinity with New Zealand, in particular with the Union Steamship Company which operated a number of ships on the trans-Tasman trade and on the Australian coast.

The mid-to-late sixties saw the gradual introduction of computer techniques to ship design and ship construction. Initially this was for ship design calculations but gradually advanced during the 1970s and 1980s to computer drafting in the drawing offices and the shipyards. It was a great help to the ship designer — no more arduous hand calculations — and enabled much more rapid and accurate resolution of design problems, including the comprehensive evaluation of options. Nowadays there are probably only a few of us left who could operate a slide rule and develop design drawings by hand. Somehow, I feel that the romance has gone — sacrificed at the altars of efficiency and profit.

The 1970s and 1980s saw quite substantial changes to

1. There are some excellent photos of the yard at this time on the web — search for Barclay Curle — Ed.

the regulations affecting safety — intact and damaged stability, structures, life-saving appliances, fire prevention and others — all of which had a major impact on the design and construction of ships. Of particular note with regard to the Australian scene was the introduction of the Uniform Shipping Laws Code, applicable to all States of Australia and the Commonwealth, a much needed reform which clarified legislation throughout Australia.

During the late years of the 1960s and through the 1980s, my role originating new design work and coordinatiing and managing the various components of the design meant that I was less involved in the detailed design processes. Nevertheless, it was important to maintain an ongoing interest in the latest design concepts and techniques as they evolved, which was vital for the efficiency of the organisation.

In the late 1960s I also took a direct interest in the Australian Branch of the Royal Institution of Naval Architects by becoming a member of the Branch Council. In 1968 I became President of the RINA Australian Branch, a position I occupied for several years. I also undertook responsibility for giving addresses on the shipbuilding industry to a variety of organisations and, in particular, to the Industrial Mobilisation Courses conducted by the Department of Defence, which were attended by nominated senior staff from industry and the public service to familiarise them with strategic industries which might be called upon in an emergency and the operations of the Australian Defence Force.

The ASB had been formed in the early years of the Second World War to organise a merchant shipbuilding industry which was virtually non-existent at that time, having suffered neglect during the years after the First World War and the depression of the thirties. The Board had to recruit staff from a variety of sources and, in liaison with the Navy and various commercial engineering interests, set about reactivating 'mothballed' shipyards and establishing new ones. It continued in operation post war, because shipbuilding was regarded as an industry of vital strategic importance to the nation. In the 1970s and into the 1980s, strategic considerations diminished in importance in a changing political environment in which economic and free-trade considerations predominated. Up to the early 1970s, ships for operation in the coastal trade were largely a prohibited import which, in effect, meant that the Australian shipyards had a virtual monopoly on the building of new ships for coastal operation. In practice, by and large, this ensured an ongoing capability in the design and building of larger ships like ro-ro cargo ships, passenger ferries, tankers and bulk carriers. There were many who opposed this practice — the 'unregistered' shipyards on the grounds of discrimination, and the shipowners on the grounds that they could obtain ships at much less cost from overseas yards, such as those in Japan and Korea. In 1972 the then Labour Government amended the legislation which debarred foreign-built ships from operating in the coastal trade and this, essentially, was the death knell of the large shipbuilding industry. While the ASB was retained as an instrumentality which could

Bob Campbell (left) and his team at the Ship Technology Unit in the 1980s
(Cockatoo Dockyard Photograph)

advise the Government on the shipbuilding industry, its operational arm — the technical and design areas — had less work as more ships were built overseas. The design sections continued in operation during the later part of the 1970s with their services being, in the main, sought by various Commonwealth Government departments and instrumentalities such as the CSIRO.

In 1981 a decision was taken by the Commonwealth Government to transfer the design and technical services of the ASB to the private sector. The effect was that the majority of the specialist staff was dissipated to various areas of the engineering industries at large. Some went to the Naval Technical Services of the Royal Australian Navy, others to various areas of general engineering, and some opted for early retirement. I made the decision to set up a consultant design and maritime-technology organisation, for which I made a selection of key personnel from the ex-ASB staff. While relatively small in numbers, it had the capability of undertaking a wide range of marine-design activities and specialised in providing expertise in the expanding area of maritime technology — trials evaluation, vibration, noise and acoustics — for which specialised gear and equipment was required. After negotiations between the Department and Cockatoo Dockyard Pty Ltd, the Ship Technology Unit (STU) was established as a division of Cockatoo Dockyard, with me as manager in charge of operations. While we were a department of Cockatoo, the STU had virtually autonomous control of its operations. During the 1980s it thrived and expanded in size, gaining a reputation within the marine industry for its expertise and efficiency.

In 1987, on reaching the age of sixty, I fulfilled a decision made years before to retire from full-time employment and I resigned from the STU. Sadly, it was only a few months after my retirement that the decision was made by the new owners of Cockatoo Dockyard Pty Ltd to disband the STU around the time that the Commonwealth decided not to renew the company's lease of Cockatoo Island after the current lease expired at the end of 1992. In 'retirement' I established myself as a marine consultant under the banner of Maritime Consultative Services and was kept busy over the next five years on a variety of projects, many of which were associated with the operations of the STU which had been continued on a much-reduced scale as an independent consulting firm specialising in marine-technology matters. I was a director of this reformed STU until I retired (again) and gave up involvement in virtually all commercial activities.

In 1991 my wife and I moved to Kurrajong Hills in the foothills of the Blue Mountains, some 60 km west of Sydney. I maintained an ongoing interest in the affairs of the Australian Division of the Royal Institution of Naval Architects as a member of Council until retiring from it in 1997. Nevertheless, I was persuaded to continue to give service organising maritime conferences and symposia. I was chairman of the organising committee for Sea Australia 2000, held at the Darling Harbour Exhibition and Conference Centre in February 2000, which was a highly-successful event attended by some 350 delegates from all areas of Australia and world wide. I was also on the organising committee for the next two conferences, the Pacific 2002 and Pacific 2004 International Maritime Conferences held at the same venue in Darling Harbour. I then tendered my resignation but the organisers were good enough to invite me to subsequent conferences as a guest member.

It has been an interesting career, one with somewhat unexpected results. From a somewhat naive 17-year-old raw recruit to progressing to senior positions within the industry and finally gradually easing myself into retirement while, hopefully, still giving some service to promote naval architecture, the second-oldest of the engineering professions. I am still a Fellow of the RINA and read *The Naval Architect*, some of which is now beyond me! I was delighted to receive a certificate acknowledging my over 60 year's membership of the RINA from the Chief Executive of the RINA, Trevor Blakeley, at the Pacific 2013 IMC Cocktail Party at the Australian National Maritime Museum.

I have continued my interest in the profession by developing, with a colleague, a history of Australian shipbuilding. I am also a member of the Australian National Maritime Museum and, some years ago, presented a paper to a Symposium there on the subject of *Shipbuilding in Sydney*.

THE INTERNET

Webcasts of NSW Section Technical Presentations

Engineers Australia records technical presentations made to RINA (NSW Section) and IMarEST (Sydney Branch) for webcasting. The webcasts are placed on the Engineers Australia website, usually within a few days of the presentation.

Sean Langman of Team Australia gave a presentation on *The Quest for Speed under Sail* to a joint meeting with the IMarEST attended by sixty-one on 5 March in the Harricks Auditorium at Engineers Australia, Chatswood. This attendance set a new record, being the highest of the 70 meetings we have had since Engineers Australia moved to Chatswood in June 2006. It is more than double the average attendance of 26 since the move to Chatswood. The webcast of the presentation is available at

http://mediavisionz.com/ea/2014/easyd/140305-easyd/sessions/140305-easyd/.

The list of all recordings made of technical presentations made to RINA (NSW Section) and IMarEST (Sydney Branch) is now shown on the RINA NSW Section website, www.rina.org.uk/NSWwebcasts.html, with hotlinks direct to each webcast on the Engineers Australia website.

Phil Helmore

National Standards for Commercial Vessels

The Australian Maritime Safety Authority (AMSA) is reviewing and rewriting the National Standards for Commercial Vessels (NSCV) and the National Standard for Administration of Marine Safety (NSAMS). This is a major task which is expected to be completed within three years. There will be many opportunities for interested parties to contribute to the process. To get the conversation started and to ensure that all issues which need to be addressed are identified, AMSA is inviting early comment on the standards listed below. There will be many other opportunities to become involved, including as reference-group members and during further public and inter-agency comments periods.

Title	Documents/Links
NSCV Part C7A – Safety Equipment	Draft Amendment
NSCV Part B – General Requirements	Discussion Paper
NSCV Part C4 – Fire Safety	Discussion Paper
NSCV Part F2 – Leisure Craft	Discussion Paper
NSCV Part G – General Safety Requirements for Vessels	Discussion Paper
National Standard for Administration of Marine Safety 4	Discussion Paper

When consultation periods end (none are given on the website for these standards), all responses will be analysed and considered along with other available information to help make decisions, develop policy or finalise regulatory changes.

Please use the relevant public comment form to submit your feedback.

For more information or to obtain the public comment forms, visit www.amsa.gov.au/community/consultation/.

Phil Helmore

Adjustment to Ballast Water Management Convention Implementation Schedule

The table has been amended to clarify the implementation dates for Regulation D-2 of the Ballast Water Management Convention.

The International Maritime Organization's governing body, the Assembly, recently adopted Resolution A.1088(22) which adjusts the implementation schedule for the Ballast Water Management (BWM) Convention. The major changes are that:

- all ships which are in service and under construction at the time that the Convention enters into force are considered to be existing ships;
- the BWM Convention renewal survey has been harmonised with the MARPOL IOPP (International Oil Pollution Prevention) renewal survey; and
- references to compliance by the next "intermediate or renewal survey" have been changed to compliance by the next "renewal survey".

The table below shows the adjusted implementation schedule, detailing the dates by which ships will be required to discharge ballast water in compliance with the D-2 discharge standard (i.e. using a ballast-water treatment system). As the Convention cannot be amended before it enters into force, the Resolution only recommends that administrations apply these changes. However, once the Convention enters into force, it is likely that these changes will quickly be mandated by an amendment to the Convention.

Once the Convention enters into force, all ships will also be required to have on board an approved ballast-water management plan and ballast-water record book.

Lloyd's Register's *Class News No. 02/2014* (amended)

Class can generally provide tailored marine consulting services to help with all aspects of ballast-water management. These include help with developing a BWM compliance strategy or selecting the most suitable ballast-water treatment technologies and systems.

Phil Helmore

Ballast capacity (m^3)	Existing ships Constructed before 2009	Existing ships Constructed in or after 2009 but before 2012	Existing ships Constructed in or after 2012
<1500	Entry into force (EIF) before 1 January 2017: compliance by 1st IOPP renewal survey after the anniversary date of the delivery of the ship in 2016 EIF after 31 December 2016: compliance by 1st IOPP renewal survey after EIF		
1500–5000	Compliance by 1st IOPP renewal survey after EIF		
>5000	EIF before 1 January 2017: compliance by 1st IOPP renewal survey after the anniversary date of the delivery of the ship in 2016 EIF after 31 December 2016: compliance by 1st IOPP renewal survey after EIF		Compliance by 1st IOPP renewal survey after EIF

EDUCATION NEWS

University of New South Wales

Student–Staff Get-together

The naval architecture students and staff held a get-together on Thursday 26 March. This was to enable the students in early years to meet and get to know the final-year and post-graduate students and the staff on a social level, and to discuss the course 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 year we have seventeen students in the third year and seventeen in fourth year (five expecting to complete in mid-year), many of whom attended. One of the post-graduate students came along as well as four full-time staff. A broad mix, and some wide-ranging discussions ensued.

Inclining Experiment

The Sydney Heritage Fleet provided access to their yacht *Boomerang* for the Year 3 naval architecture students to conduct an inclining experiment at Rozelle Bay on 7 May. The students conducted the experiment with the guidance of lecturer Phil Helmore. The day turned out fine, but with the wind gusting 15–20 kn and making the conditions tough for an inclining. However, it was more important to go through the whole process than to obtain a perfect set of results, and the experiment was completed with the students making a good fist of their first inclining. The theory of stability is fascinating, but seeing it in practice at an inclining makes it come *to life* for the students.

Thesis Projects

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

Radius of Gyration of Ships

For any ship motion analysis code, it is necessary to input the roll and pitch radius of gyration as well as the usual displacement, *KG*, *GM*, and LCG (or draft and trim) data. While the latter can easily be obtained from loading conditions in trim-and-stability booklets, roll and pitch radius of gyration are not readily available data and are usually estimated.

For the pitch radius of gyration, ship motion code manuals typically suggest using $0.25 \times L_{pp}$. For roll radius of gyration they suggest using 0.35×B. The question is, what are typical figures for different types of monohull ships, let alone catamarans and trimarans? The radius of gyration in pitch can reasonably be calculated if a longitudinal mass-distribution curve is available (required for longitudinal strength analysis for example). The yaw radius of gyration is probably much the same as the pitch radius of gyration for slender monohulls (and this is typically what is measured with the bifilar method when models are set up for ship motions experiments in a towing tank). It is more difficult to calculate the radius of gyration in roll, as weight estimates for ships are typically not in a format amenable to calculating this value.

Yang Du is investigating the radius of gyration in a three-pronged attack. Using the bifilar method, he has measured the radius of gyration in yaw of a 1.6 m model (including superstructures) of a vessel designed by Boulton Riley and Hercus and tested in the towing tank at the University of Sydney by Bob Halliday. He has then made a 3D model of the vessel in Rhino software, and calculated the radii of gyration in yaw and pitch, and found these to be within 0.5% of each other, and close to the experimental value. He is now using Bentley Engineering's Maxsurf Motions software to investigate the motions of the full-sized vessel, and determine the sensitivity of the RAOs in pitch to the input value of the radius of gyration.

Tug Stability Criteria

Currently, tugs in Australia are required to meet the NSCV Part C6A general requirements, and specific requirements which relate to towing. The NSCV has been derived from, but relaxes a little, the USL Code Section 8.C.10. However, tugs have been coming to Australia from other countries and meet classification society (i.e. IACS) criteria for stability whilst towing. These requirements are usually easier to pass than the NSCV and, when the tug enters state survey, many of the tugs fail the NSCV criteria.

Many failures arise now (as opposed to when the USL Code was used), because the NSCV requires ocean towing to have the towline pull apply horizontally. State authorities had often allowed the USL Code to be interpreted so as to apply the towline pull at upwards at 30 degrees to the horizontal, even on ocean tows.

In addition, the USL Code and the NSCV both specify that the area above the towing heeling-lever curve, but below the GZ curve, must be a percentage which relates to the area under the GZ curve. Classification society stability requirements (most of them), on the other hand, specify that the area above the towing heeling-lever curve, but below the GZ curve, must be a percentage which relates to the area under the towing heeling lever curve. The NSCV takes the vertical heeling lever from the towing point to the centre of lateral resistance, whereas IACS takes it from the towing point to the centreline of the propeller shaft or propulsion unit.

Lucy Xu is conducting an investigation of the criteria, and has searched the literature for data on the forces tending to capsize a tug by self-tripping (under the influence of the tug's own propulsion) and tow-tripping (when the tug becomes out-of-control and is dragged behind the vessel it is meant to be servicing, i.e. in situations such as girting. She is now investigating the effect of changes in the vessel's parameters (such as length/beam ratio and displacement/length ratio) to see whether changes in these affect whether the vessel can meet both sets of criteria.

Post-graduate and Other News

MMEPD

The Mechanical and Manufacturing Engineering Precinct Development is on schedule.

The J17 Link Wing (between Mechanical Engineering and Computer Science and Engineering) has been completely demolished, and excavation has been completed for the new footings which, in turn, will allow the erection of the new building structure. The new J17 South Link Wing will house state-of-the-art computer labs for 300 students and a 350-seat lecture theatre.

By nature, the future construction works, including the subsequent removal of spoil, is noisy and dusty work. Richard Crookes Constructions have all the necessary controls in place in an attempt to mitigate disturbances.

The fitout works have begun on Willis Annex (the lab building) South. The existing structure was carefully 'stripped back' and restored, leaving the skeleton of the roof structure exposed. This work will allow Willis Annex's internal laboratory layouts to be larger, and offer greater flexibility for the changing requirements of the laboratory users in the future. The new laboratories will be equipped with many new services and this will allow greater flexibility in the space as users are not restricted by available services.

The MMEPD Construction Commencement Ceremony was held in April to acknowledge not only the 'turning of the sod' after completion of the excavation, but also to acknowledge the generous philanthropic donation to the project by Len Ainsworth. His generosity has provided funding necessary to assist UNSW with the establishment of the new Mechanical and Manufacturing Engineering Building.

The schedule has us moving back into the refurbished buildings for the start of Semester 1 next year.

MOOCS

UNSW's first Massive Open Online Course (MOOC) to be offered via the education platform Coursera went live on Monday 28 April and more than 20 000 students have already enrolled. The MOOC, *Introduction to Systems Engineering,* has been developed at UNSW Canberra by Dr Mike Ryan and Dr Ian Faulconbridge, who are highly-experienced and well-respected practitioners in systems engineering, an interdisciplinary field which focuses on the design and management of complex engineering projects over their life cycles. The nine-week UNSW course is believed to be the first MOOC to cover systems engineering in a comprehensive way. You can watch the introductory video at https://www.coursera.org/course/introse.

UNSW's next two MOOCs, *Learning to Teach Online* and *Mechanics: Motion, Forces, Energy and Gravity, from Particles to Planets,* will launch in July and August respectively.

UNSW announced in 2013 that it was joining some of the world's leading universities, including Stanford, Yale and Columbia, in partnering with US-based Coursera, the largest provider of MOOCs. "To launch such a high-quality, popular course as our first MOOC with Coursera marks a significant milestone for UNSW," Deputy Vice-Chancellor (Academic) Professor Iain Martin said. "We have learnt a great deal from the development of our first MOOC. This knowledge will not only inform future open courses but will also help us to enhance the educational experience of our own on-campus students."

Enrolment in the *Introduction to Systems Engineering* course is free to anyone, from novices to experienced practitioners, such as project managers, engineers, and quality-assurance representatives. The course comprises eight modules delivered through video lectures, readings, quizzes and a series of exercises, including peer review of other students' work.

"We are delighted to be offering the first MOOC in systems engineering and we are looking forward to providing the course as an entrée to further higher learning," said Dr Ryan. "It provides a rare opportunity for a large number of people to be exposed to such a critical discipline in a complex, changing world."

For more information on UNSW MOOCs visit https://www.coursera.org/unsw

http://newsroom.unsw.edu.au/news/general/20000-students-enrol-unsws-first-mooc-coursera

First find the haystack — ADV *Ocean Shield* and a RAAF AP-3C Orion aircraft searching in the Indian Ocean for the missing Malaysian Airlines flight MH370 during March
(RAN Photograph)

Fuel Optimisation with HydroComp NavCad®

HydroComp NavCad® is the most widely-used software for predicting vessel resistance and propulsion within the marine design community. With growing emphasis on fuel consumption and efficiency, naval architects and marine engineers are continually looking to reduce fuel consumption, both as part of the design spiral and also during operation.

Drag Reduction

Strategic design-side fuel savings can be found by using optimised hullforms. According to Donald MacPherson, HydroComp's Technical Director, "NavCad's drag reduction tool provides designers with a meaningful metric to identify changes to the present hull design which will reduce drag and increase performance and efficiency. For example, it offers practical insight into the 'What if' questions — *What if the half-angle of entrance is decreased? What if I add a bulb? What if the LCG is shifted aft?* Designers and naval architects now have the ability, early in the design, to rapidly evaluate the influence of various hull parameters on vessel drag and, more importantly, on real operational efficiency."

The Drag Reduction tool can be applied to any vessel in NavCad. Once the initial hull parameters have been entered, the predicted resistance can be calculated using one of NavCad's more than three-dozen resistance methods. The designer's selection of the most appropriate resistance prediction model is assisted by NavCad's Method Expert ranking system.

The resistance curve for the initial design is known as the "basis" resistance. The drag-reduction analysis then evaluates the influence on resistance (increasing or decreasing, plus its significance) of the change in various hull parameters — length, displacement and transom immersion, to name a few. The hull parameters are then organised by influence, with the most significant parameter presented at the top of the table.

Development of an optimised system also needs consideration of the hydrodynamic influences of the parameters across the operating speed range. For example, transom immersion is beneficial at high speed, but detrimental at lower speeds. In order to consider the influences on overall operation, NavCad's drag-reduction analysis allows the user to enter primary and secondary operating profiles using speed and time at speed.

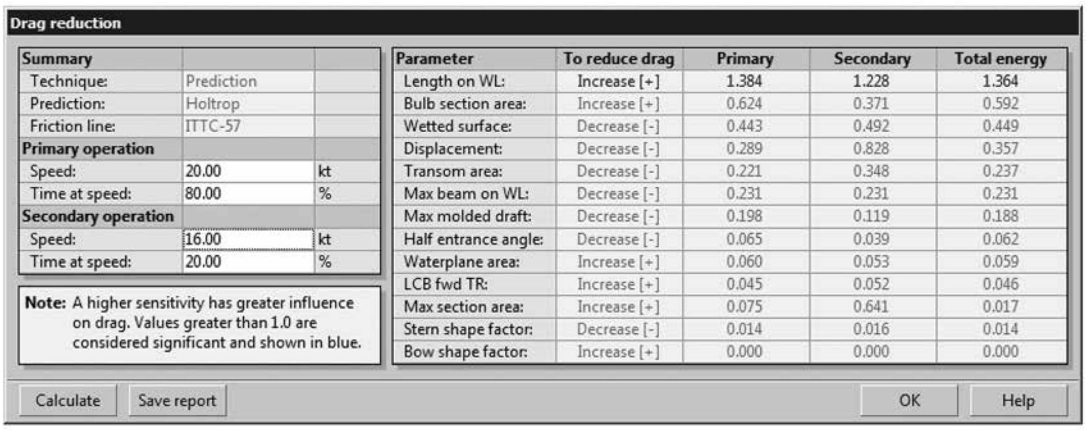
Additionally, since the motivation for drag reduction is typically fuel consumption, the magnitude of the drag at speed must be part of the assessment, not solely the proportional reduction in drag. In other words, since resistance at top speed can be substantially higher than at lower speeds, it should have greater significance in the analysis. NavCad's Drag Reduction tool includes a "total energy" weighted influence, which is calculated based on the primary and secondary operating profiles. This "total energy" approach allows the user to truly evaluate the effect of a hull parameter on the change of overall energy consumption of the vessel.

Effect of Initial Trim

The benefits of trim optimisation have been well documented for some years. NavCad's Effect of Initial Trim tool provides useful information to designers and operators alike. In an effort to reduce fuel consumption, ship operators are often interested in the effect of initial trim on the performance of the vessel. This supplemental tool provides an essential assessment of the effect of initial trim on bare-hull resistance for ships large and small.

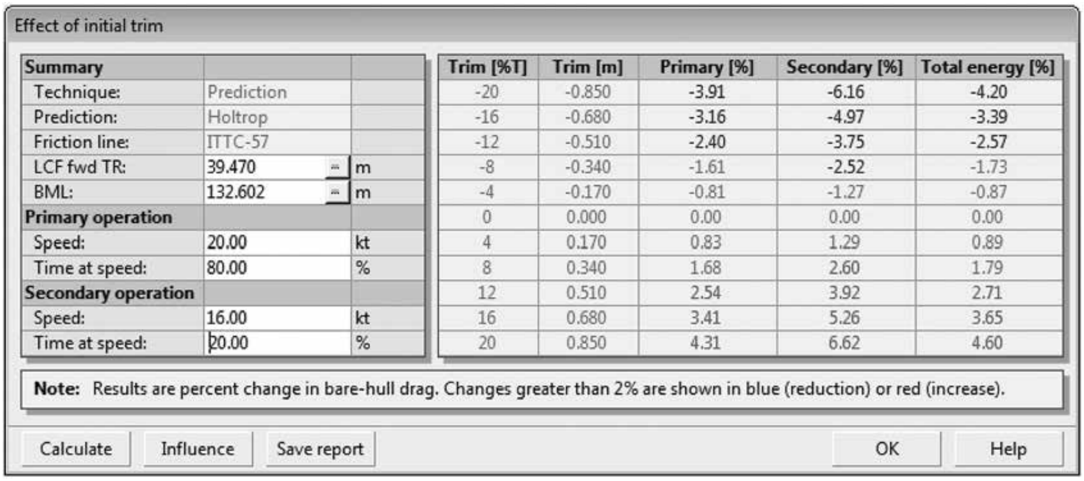
Once hull data has been entered and a resistance prediction built, you can use the Effect of Initial Trim tool to evaluate how much change in bare-hull resistance can be achieved for a constant displacement with different amounts of trim. A trim range of ± 20% draft is presented. Like the Drag Reduction tool, you can define primary and secondary speeds of operation, and NavCad evaluates a total-energy weighted average of two speeds.

This analysis modifies certain hull parameters based on the trim value and then the new resistance for the revised "trimmed" hull is predicted. Given that the hull data is parametric, NavCad will internally predict the changes in corresponding hull data based on fundamental geometric and hydrostatic relationships. A change in trim will also affects other data, such as LCB position, bulb or transom immersion, and wetted surface.



Parameter	To reduce drag	Primary	Secondary	Total energy
Length on WL:	Increase [+]	1.384	1.228	1.364
Bulb section area:	Increase [+]	0.624	0.371	0.592
Wetted surface:	Decrease [-]	0.443	0.492	0.449
Displacement:	Decrease [-]	0.289	0.828	0.357
Transom area:	Decrease [-]	0.221	0.348	0.237
Max beam on WL:	Decrease [-]	0.231	0.231	0.231
Max molded draft:	Decrease [-]	0.198	0.119	0.188
Half entrance angle:	Decrease [-]	0.065	0.039	0.062
Waterplane area:	Increase [+]	0.060	0.053	0.059
LCB fwd TR:	Increase [+]	0.045	0.052	0.046
Max section area:	Increase [+]	0.075	0.641	0.017
Stern shape factor:	Decrease [-]	0.014	0.016	0.014
Bow shape factor:	Increase [+]	0.000	0.000	0.000

HydroComp NavCad Drag Reduction tool



Effect of initial trim

Summary		
Technique:	Prediction	
Prediction:	Holtrop	
Friction line:	ITTC-57	
LCF fwd TR:	39.470	m
BML:	132.602	m
Primary operation		
Speed:	20.00	kt
Time at speed:	80.00	%
Secondary operation		
Speed:	16.00	kt
Time at speed:	20.00	%

Trim [%T]	Trim [m]	Primary [%]	Secondary [%]	Total energy [%]
-20	-0.850	-3.91	-6.16	-4.20
-16	-0.680	-3.16	-4.97	-3.39
-12	-0.510	-2.40	-3.75	-2.57
-8	-0.340	-1.61	-2.52	-1.73
-4	-0.170	-0.81	-1.27	-0.87
0	0.000	0.00	0.00	0.00
4	0.170	0.83	1.29	0.89
8	0.340	1.68	2.60	1.79
12	0.510	2.54	3.92	2.71
16	0.680	3.41	5.26	3.65
20	0.850	4.31	6.62	4.60

Note: Results are percent change in bare-hull drag. Changes greater than 2% are shown in blue (reduction) or red (increase).

Calculate | Influence | Save report | OK | Help

HydroComp NavCad Effect of Initial Trim tool

Is "Optimum" Attainable?

NavCad's tools specifically do not identify a singular optimum figure but, rather, indicate trends and influences. "How much authority does a designer really have to implement a drag-optimised hull form? Or an operator to run with a precise trim?" asked Donald MacPherson. "So many different design requirements — stability, structure, loading, producibility — influence a vessel's design and construction that employing a unique hydrodynamic optimum is rarely attainable. The same is true for operational constraints. You can only trim so far."

The hunt for precise optimum-design characteristics and operational settings can also lead to increasingly-complex design procedures. "You will not need to go to school to effectively utilise these tools" said MacPherson. "By knowing the general hydrodynamic influences and trends as suggested by these tools, a designer can fulfill exceptional hydrodynamic performance in a way that does not compromise the larger system. It is extremely valuable for a naval architect to simply know in which direction to push a parameter when juggling the various, and often competing, design requirements."

BMT Nigel Gee Provides Design to Strategic Marine

BMT Nigel Gee Ltd, a subsidiary of BMT Group, a leading international maritime design and engineering consultancy, announced on 31 March that it had won a design contract for the construction of up to eight advanced 26 m Windfarm Support Vessels (WSV), to be built by the Australian shipbuilder, Strategic Marine. The vessels are to be built for Njord Offshore Ltd, who has already taken delivery of eight BMT designed 21 m WSVs, also built by Strategic Marine.

Developed from BMT's well-established range of WSVs with Njord Offshore, the vessels will be 26 m in length with a beam of 9.1 m, powered by four Scania DI16 070 diesel engines, driving Servogear controllable-pitch propellers (CPP) through a combining gearbox. Capable of speeds in excess of 27.5 kn with 10 t of deadweight, the vessels will have a resiliently-mounted superstructure together with the BMT-patented Active Fender System. Furthermore, they will be built to the DNV Wind Farm Service 1 R1 notation, suitable for operation up to 150 n miles from shore.

These vessels will offer significant improvements in efficiency and comfort, with market-leading fuel consumption and noise levels. The first two vessels will be delivered early in 2015.

An impression of the 26 m WSV
(Image courtesy BMT Nigel Gee)

Tom Mehew, Director of Njord Offshore, commented: "We have now completed over 20 000 transfers with our BMT-designed 21 m WSVs and have been delighted with their performance. Therefore, going back to BMT for the 26 m design was an easy choice for us. Designed specifically for windfarms further offshore, the design and layout of the 26 m WSV will offer increased speed, efficiency and operational capability for our clients."

Commenting on the order, Ed Dudson, BMT Nigel Gee's Technical Director, said "These 26 m vessels are designed specifically to provide improved operational flexibility, capability and efficiency. The arrangement of the vessel has been developed in close co-operation with Njord Offshore and offers a highly-versatile deck and accommodation design. The selection of CPPs provides very high bollard pull capability without any reduction in high-speed operation or fuel economy. This contract further reinforces BMT's position as a leader in the design of offshore windfarm support vessels."

Paul Liddington, Business Development Manager at Strategic Marine, commented "We are extremely pleased to be working with BMT Nigel Gee again to offer Njord Offshore another world-class product. In addition, we are extremely proud that Njord Offshore have again chosen Strategic Marine to build their next fleet of larger 26 m WSVs. The order clearly signifies recognition of the build quality and customised service which Strategic Marine provides.

"With the organisation's strategically-located fabrication yards in Singapore and Vietnam, we have the capability to build in either location or in combination to suit client and timescale requirements. In this instance, the aluminium hulls will be built in Vietnam and then shipped to Singapore for outfitting and delivery. This allows Strategic Marine to offer very competitive pricing for these new vessels. With these vessels getting larger and more sophisticated, our local purchasing network and Asian labour rates makes our high-quality products highly competitive compared to other areas of the world."

Wärtsilä Environmental Seal Systems Allow Mineral Oil to be used in US Waters

Wärtsilä has announced that its Airguard™ and Oceanguard™ propeller-shaft sealing systems can continue to utilise mineral oil since they meet the guidelines set out in the US Environmental Protection Agency's (EPA) 2013 revised Vessel General Permit. The guidelines came into force in December 2013.

This means that the Airguard™ and Oceanguard™ seals meet the defined regulatory prerequisites and that owners and operators of commercial vessels of over 24 m length, sailing within US waters with either of these Wärtsilä systems installed, are not required to change to an Environmentally Acceptable Lubricant (EAL).

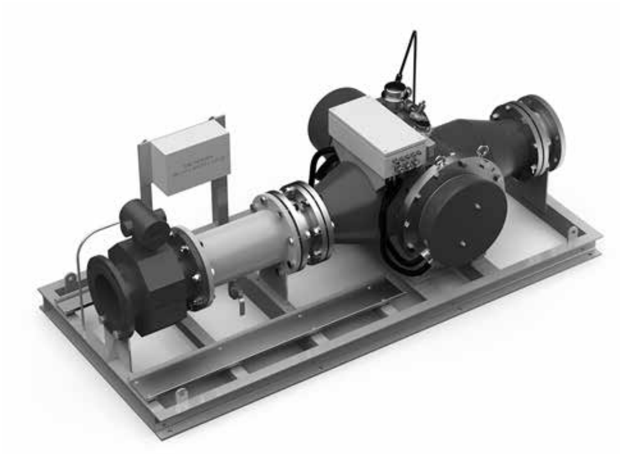
With the Wärtsilä Airguard™ and Oceanguard™ propeller-shaft sealing systems there is no oil-to-sea interface. An air chamber or separation space within the seal captures any water or oil leakage, which is then transferred to inboard tanks for monitoring and further treatment. This completely eliminates oil drips or leakage into the sea. The EPA requires these designs to be functioning normally, which can be assured by proper operation and maintenance according to Wärtsilä's guidelines. In case of system failure, both systems also prevent any reasonable possibility of oil leakage, which is the second criterion for the continued use of mineral oils.

Wärtsilä offers customers a full range of solutions which promote environmental sustainability. Its portfolio of seal solutions ranges from Bio Seal Rings to the most-advanced environmental seals on the market. The Airguard™ and Oceanguard™ propeller-shaft sealing systems have a long, proven, and successful operational track record. Upgrade and retrofit options are also available.

Most commercial sterntubes are of the oil-lubricated type and require a robust and reliable sealing solution. Wärtsilä has many years of experience in developing the technologies behind its range of oil-lubricated sealing products, which includes both face- and lip-seal variants to deal with a wide variety of operating profiles. The systems are designed to withstand abrasive waters and are compliant with all anti-pollution requirements.

Wärtsilä's AQUARIUS UV Ballast Water Management System Certified for Hazardous Onboard Areas

Wärtsilä has announced that its Wärtsilä AQUARIUS UV Ballast Water Management System (BWMS) has successfully completed verification testing for explosion-proof (EX) requirements. The verification was handled through DEKRA, a Notified Body in Germany and a leading global provider of auditing and certification services, specialising in the fields of safety, environment and health. It now means that the AQUARIUS UV BWMS range is EX certified for Zone 1 hazardous-area operation in marine and offshore installations.



The Wärtsilä AQUARIUS UV ballast water management system (Image courtesy Wärtsilä)

It is an International Maritime Organization (IMO) requirement that the BWMS for ships having hazardous areas onboard must be EX certified. Wärtsilä has taken a systems approach to the EX validation process and the complete AQUARIUS UV BWMS module, not only the electrical components, making it compliant with the EX and IMO regulations. This approach improves accessibility, since the modular design allows some system components to be located outside the hazardous area, thereby increasing the availability and maintainability of the whole system.

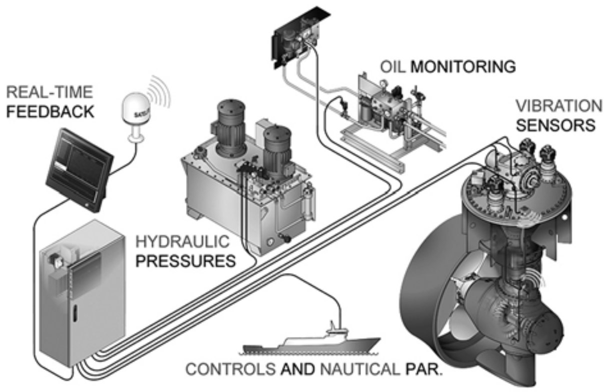
"This is yet another important step towards making the Wärtsilä BWMS range available for the full range of marine and offshore applications. We have taken the position that it is not enough to have merely the electrical parts certified, which is the case with many other systems. As a result, owners and operators can have peace of mind in knowing that the entire Wärtsilä system module is explosion proof when installed inside a hazardous area," said Dr Joe Thomas, Director, Wärtsilä Ballast Water Management Systems.

Ratification of the IMO's Ballast Water Convention, which will require the owners of up to 40 000 vessels worldwide to install a BWMS, is widely anticipated. As a consequence, shipowners will need to evaluate, as a matter of some urgency, the ballast-water treatment technology best suited to both their existing ships and future new-build programs.

The Wärtsilä system comprises a modular BWMS utilising a two-stage approach involving filtration and medium-pressure UV disinfection technology. The AQUARIUS UV BWMS completed land-based testing in 2011 at the NIOZ test facility in the Netherlands. Ship-based trials were completed on a Dutch-flagged 2000 dwt chemical tanker and were carried out by the independent consultants, GoConsult, and witnessed by Lloyd's Register. The trials involved testing in both salt- and fresh-water environments to demonstrate compliance over a wide range of operating conditions. The results consistently met or exceeded the IMO D2 discharge standard. The Wärtsilä AQUARIUS UV BWMS received IMO Type Approval in December 2012 and US Coastguard AMS acceptance in October 2013.

Wärtsilä's Propulsion Condition Monitoring Service Recognised by Three Major Classification Societies

Wärtsilä has received service-level recognition for its Propulsion Condition Monitoring Service (PCMS) by DNV GL. Wärtsilä is the first company to attain this type of recognition from three of the major classification societies, namely the American Bureau of Shipping, Lloyd's Register, and DNV GL.



Overview of Wärtsilä PCMS system for a steerable thruster
Image courtesy Wärtsilä

The approval, which was received in February 2014, means that surveyors from the classification societies may rely on Wärtsilä's PCMS when assessing propulsion equipment. This eliminates the need for the compulsory five-year internal inspection, which often requires dry docking. Instead, with the Wärtsilä PCMS continuously monitoring the equipment, major thruster overhauls can be carried out at intervals of anywhere between five and ten years, based on the actual condition of the propulsion equipment. PCMS increases the reliability and availability of monitored equipment and reduces overall lifecycle costs.

The service-level recognition represents confirmation that Wärtsilä's PCMS is well suited for its intended purpose of condition monitoring and condition-based maintenance of propulsion equipment. Furthermore, by replacing visual internal inspections with a yearly review of the PCMS reports, surveyors can more easily make decisions affecting classification or statutory surveys to ensure compliance with applicable class rules and various international conventions.

"Financially this will have a big efficiency impact on the operations of marine customers. PCMS enables condition-based maintenance and eliminates the need to perform an overhaul simultaneously with the compulsory five-year inspections unless, of course, PCMS shows that there is a need for it. Prior to attaining this service-level recognition, approvals could only be given on a vessel-by-vessel basis. With the service-level recognition, this will become much easier," said Frank Velthuis, Manager of Wärtsilä's CBM Centre Propulsion.

Wärtsilä sees its condition and performance-monitoring services as being a prerequisite to supporting customers in the future, and a logical complement to its service agreements business. Monitoring the performance and condition of a ship's equipment enables owners to optimise its usage and predict the maintenance need, thereby improving asset performance and reducing the total cost of ownership.

New Contract for Forgacs

A contract worth almost $5 million between the Defence Materiel Organisation and Newcastle-based shipbuilder Forgacs Engineering Pty Ltd, for the manufacture of a 30 m Landing Craft Medium, to be given to the Kingdom of Tonga by the Australian Government, was welcomed by the Minister for Defence, Senator David Johnston, on 14 May.

Senator Johnston said that the Australian-built vessel would be presented to the Kingdom of Tonga as a sign of Australia's long-standing commitment to the South Pacific.

"The awarding of the contract for the Landing Craft Medium to Forgacs, a local shipbuilding firm, is a modest but important step for the sustainment of their operations into 2015," the minister said.

"The presentation of the Landing Craft Medium to the Kingdom of Tonga will enhance the Tongan military's capacity to reach remote communities for nation-building construction activities, as well as responding to domestic humanitarian-assistance and disaster-relief operations, such as cyclones.

"This demonstrates the importance which Australia places on our Defence Cooperation Program with Tonga, and is indicative of Australia's broader long-term commitment to security and stability in the South Pacific."

Senator Johnston said that Forgacs had indicated that the contract, valued at several million dollars, would result in a team of 30 specialists being employed until the end of March 2015 at Forgacs' Carrington facility in Newcastle.

Delivery to the Kingdom of Tonga is expected by mid-2015. Under the Defence Cooperation Program with Tonga, Australia will also deliver a range of services in support of the vessel's operation, including engineering and technical services as well as logistic support.

Australia has a deep and long-standing defence relationship with Tonga. This is centred on support for Tonga's three Pacific patrol boats, a significant training program for Tonga's land forces, as well as a number of infrastructure projects. Tonga has made a significant contribution to regional security through support to the Regional Assistance Mission to Solomon Islands operation, as well as contributing to the International Security Assistance Force mission in Afghanistan.

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on Wednesday 19 March 2014 by teleconference based in Perth. The President, Jim Black, chaired the meeting. Some of the more significant matters raised or discussed during the meeting are outlined as follows:

Division President for 2014–15

Jim Black indicated to the meeting that, in the absence of another nominee, he was prepared to accept re-election for the coming year. This offer was accepted unanimously by Council, which offered him its full support in carrying out this role.

Training in Naval Architecture below Four-year Degree Level

The Council has been working with Manufacturing Skills Australia for over a year in facilitating courses at this level following the cessation of the TAFE NSW courses. The Council heard that this work is beginning to show signs of success, with the emergence of a Diploma course in Brisbane and an Associate Degree course at AMC–UTas.

RINA's Incoming President

As many members will already know, this year the Institution will welcome into office its first non-UK-based President, Mr Bruce Rosenblatt of the United States.

Joint Board on Naval Architecture

The Council noted the outcomes of the RINA–Engineers Australia Joint Board meeting in January, which considered important matters relating to the agreement of cooperation between the two institutions, review of the NPER General Area of Practice guidelines and issues relating to Queensland registration of engineers. Subsequent to the Council meeting, the Joint Board has met on two further occasions to progress these matters.

Viewing Presentations to NSW Section on the internet

Members should note (and the Council was informed) that the NSW Section page on rina.org.uk now includes a page providing links to all recordings made of the presentations given at NSW Section technical meetings. Anyone unable to attend those presentations is welcome to view them and provide me or other Council members with feedback on this facility. Similar provisions may be made for other Sections' pages should there be an appropriate demand.

Future Form of *The Australian Naval Architect*

In view of the ongoing cost of producing and circulating this journal in printed form, the Council gave initial consideration to options for moving to soft copy, either as an option or as the only method of delivery. The various issues associated with such a move are complex, and members are urged to make known to Council members any comments they may have on this possible change.

In parallel with consideration of this possible change, Council gave initial consideration to procedural changes which may improve the attractiveness of advertising in the journal.

Next Meeting of Council

The next meeting of the Council of the Australian Division will be held on Wednesday 14 June at 1400 Eastern (1200 Western) Standard Time, at which new Council members nominated by their Sections will commence their two-year terms. The Council expressed its appreciation for the contributions of retiring members.

Members should note that nominations will close on Monday 14 July for the 2014 Walter Atkinson Award for the best written paper presented to a meeting or conference conducted under the auspices of the Division in the 12 months ending 30 June 2014. This includes Section technical meetings and PACIFIC 2013. Full details may be obtained from the Walter Atkinson Award tab on the Division's page of the rina.org.uk website. Nominations should be submitted to me.

Rob Gehling
Secretary

60-year Membership Certificate

Following the March technical presentation to RINA (NSW Section) and IMarEST (Sydney Branch), the Chair of the NSW Section, Alan Taylor, presented John Doherty with a certificate for his sixty years of membership of RINA. John and Jim Eken founded the Sydney-based consultancy, Eken and Doherty and then, when Jim Eken retired, ran the company M.J. Doherty and Co. until his own retirement.

Membership certificates commence at 45 years, are given more rarely at 50, even more rarely at 55 years, and *very* few at 60 years! John has joined Bob Campbell, who was presented with his 60-year membership certificate at the Cocktail Party for the Pacific 2013 International Maritime Conference, in a select club.

A number of former employees were present to congratulate John on his achievement.

Alan Taylor (L) and John Doherty with his 60-year membership certificate
(Photo Phil Helmore)

Changed Contact Details?

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

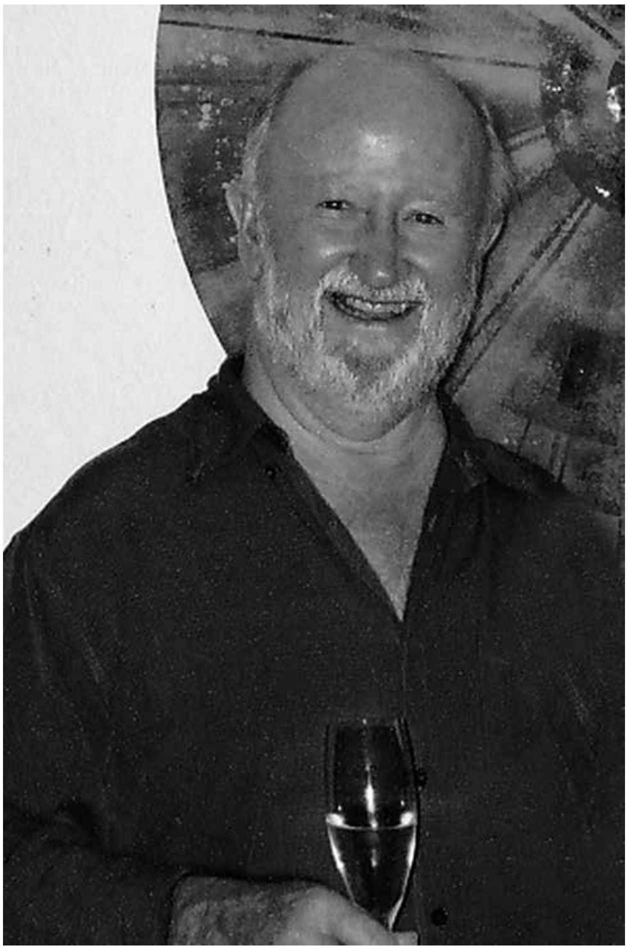
Please advise RINA London, *and* the Australian Division, *and* your local section:

RINA London	hq@rina.org.uk
Australian Division	rina.austdiv@optusnet.com.au

Section	ACT	rinaact@gmail.com
	NSW	rinansw@gmail.com
	Qld	peter@directmarinesolutions.com.au
	SA/NT	danielle.hodge@defence.gov.au
	Tas	mfsymes@amc.edu.au
	Vic	srkelly@globalskm.com
	WA	rina.westaus@gmail.com

Phil Helmore

VALE JIM WORT



Jim Wort

It is with sadness that *The ANA* records the unexpected passing of James (Jim) Wort on 8 February 2014 after a short stay in Townsville hospital.

Born in Sydney on 9 November 1930, Jim completed his Boatbuilding and Shipbuilding apprenticeship at Cockatoo Docks and Engineering Co. and continued his employment there. In 1952 Jim's work took him to the Vickers Naval Yard on the Tyne, UK, where, for the next three years, he was in charge of building and outfitting steel ships and prototype frigates for the Royal Navy. On his return to Australia, Jim was made Assistant Shipyard Superintendent at Cockatoo, responsible for building frigates for the Royal Australian Navy.

In 1958 Jim moved on to Adelaide Ship Construction as Assistant Shipyard Manager and, later, as Shipyard Manager, building various vessels, including a series of hydroconic-hullform tugs to Burness Corlett's patented design. He then worked in Devonport, Tasmania, for three years building various vessels including wooden boats for the Royal Australian Navy, before coming back to Cockatoo for a further three years.

Jim Wort (left) with Don Metcalfe at the keel laying of the frigate HMAS *Parramatta* at Cockatoo Island in January 1957 (Photo John Jeremy Collection)

Jim settled in Queensland in 1968, where he superintended new builds at the Evans Deakin shipyard at Kangaroo Point in Brisbane, and this was followed by an extended period, from 1971 to 1985, as the state and overseas General Manager of Gardner Bros Contractors.

Jim finally dropped anchor in the Whitsunday Islands in 1986. Here he ran his own bareboat-charter company and did consultancy work, which led naturally to him applying for Queensland accreditation as a marine surveyor and ship designer when the private system was set up in 1996. Jim remained active in this field until his untimely passing. As part of the Whitsunday community, Jim was a tireless champion of small-business operators, and he used every opportunity to promote the industry in the Whitsundays as a tourist destination.

Jim's ashes were spread on the waters of Pioneer Bay in the Whitsundays in a private ceremony

Jim is survived by his wife Rosa, son Donald, step-daughter Dianne, and four grand-children.

Werner Bundschuh
Ben Morgan

NAVAL ARCHITECTS ON THE MOVE

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

Nichola Buchanan has moved on from Burness Corlett Three Quays Australia (which has ceased operations), and has taken up a position as a naval architect with DMS Maritime in Sydney.

John Butler has moved on from Burness Corlett Three Quays Australia (which has ceased operations), and is now consulting as John Butler Design in Sydney. He has expertise in the fields of vessel stability analysis, structural integrity, design management and survey inspections, as well as block lifting and handling, and has provided services to the cruise ship, oil and gas, defence, and civil barge sectors. Friends can find out more about these services at www.johnbutlerdesign.com.au.

Chris da Roza has moved on from Burness Corlett Three Quays Australia (which has ceased operations), and has taken up a position with DMS Maritime in Sydney, providing port and support-craft services to the Royal Australian Navy.

Nathan Gale has moved on from Burness Corlett Three Quays Australia (which has ceased operations), and has taken up a position as a maritime insurance broker with FP Marine in Sydney.

LEUT Geordie Grant has recently achieved his Marine Engineer Officer Certificate of Competence (MEOCC) and moved on from his position of Assistant Marine Engineer Officer on HMAS *Stuart* at the end of March, and has taken up a position in Fleet Engineering Division, working with the Centre for Maritime Engineering in Sydney.

John Hayes has moved on from DOF Subsea and has taken up a position as an Operations Engineer with Subsea 7 in Perth. He is currently working with the tugs and barges for the Gorgon heavy lift and tie-in installations, and shuttling back and forth from/to Dampier.

Ruth Jago has moved on from Petrovietnam Technical Services Corporation and has taken up a position as Installation Engineer at Lundin Malaysia in Kuala Lumpur, Malaysia.

Alex Law has moved on from the Centre for Maritime Engineering and has taken up a position as a naval architect with Rolls-Royce Australia Services in Sydney, contracting to the Amphibious and Afloat Support Systems Program Office on Garden Island.

Anthony Livanos moved on from Austal ships nine months ago to go travelling overseas, and has now taken up a position as a naval architect with Nauti-craft in Dunsborough, WA. Nauticraft have developed suspension technology for vessels, and there is a video available at www.youtube.com/watch?v=_8n6pPh6i6M&feature=youtu.be

Gordon MacDonald has moved on within BMT Design and Technology and has taken up the position of Managing Director in Melbourne.

Campbell McLaren has moved on from Premier Composite Technologies in Dubai and has taken up a position as a Composite Structures Engineer with Makani Power in San Francisco, USA.

Warwick Malinowski has moved on and has taken up a position with Rolls-Royce/Kellogg Brown & Root at Garden Island in Sydney.

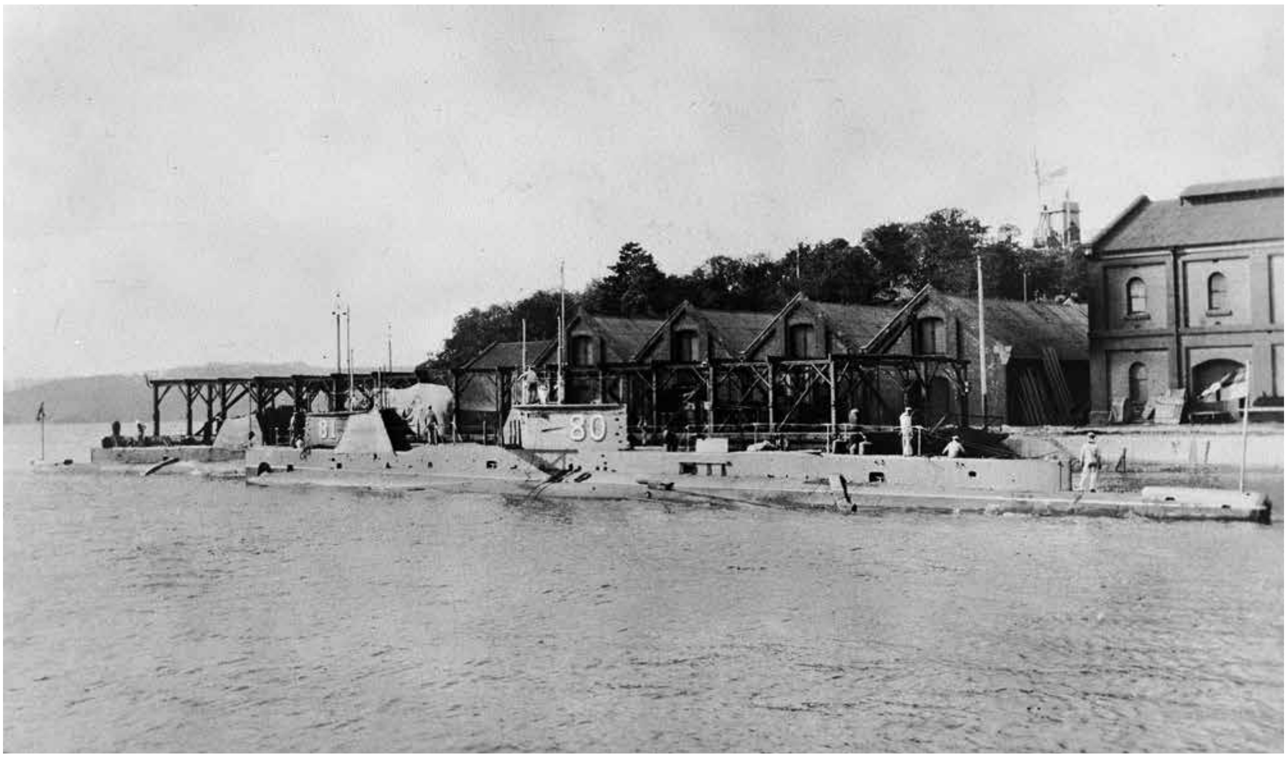
Peter Tomic moved on from the Australian Maritime College three years ago and, after two years at Austal ships, took up the position of Deputy Dockmaster with BAE Systems in Henderson, WA.

Ramesh Watson has moved on from Diab Group and has taken up a position as an engineer with Evapco Australia, a manufacturer of cooling towers and evaporative condensers, in Sydney.

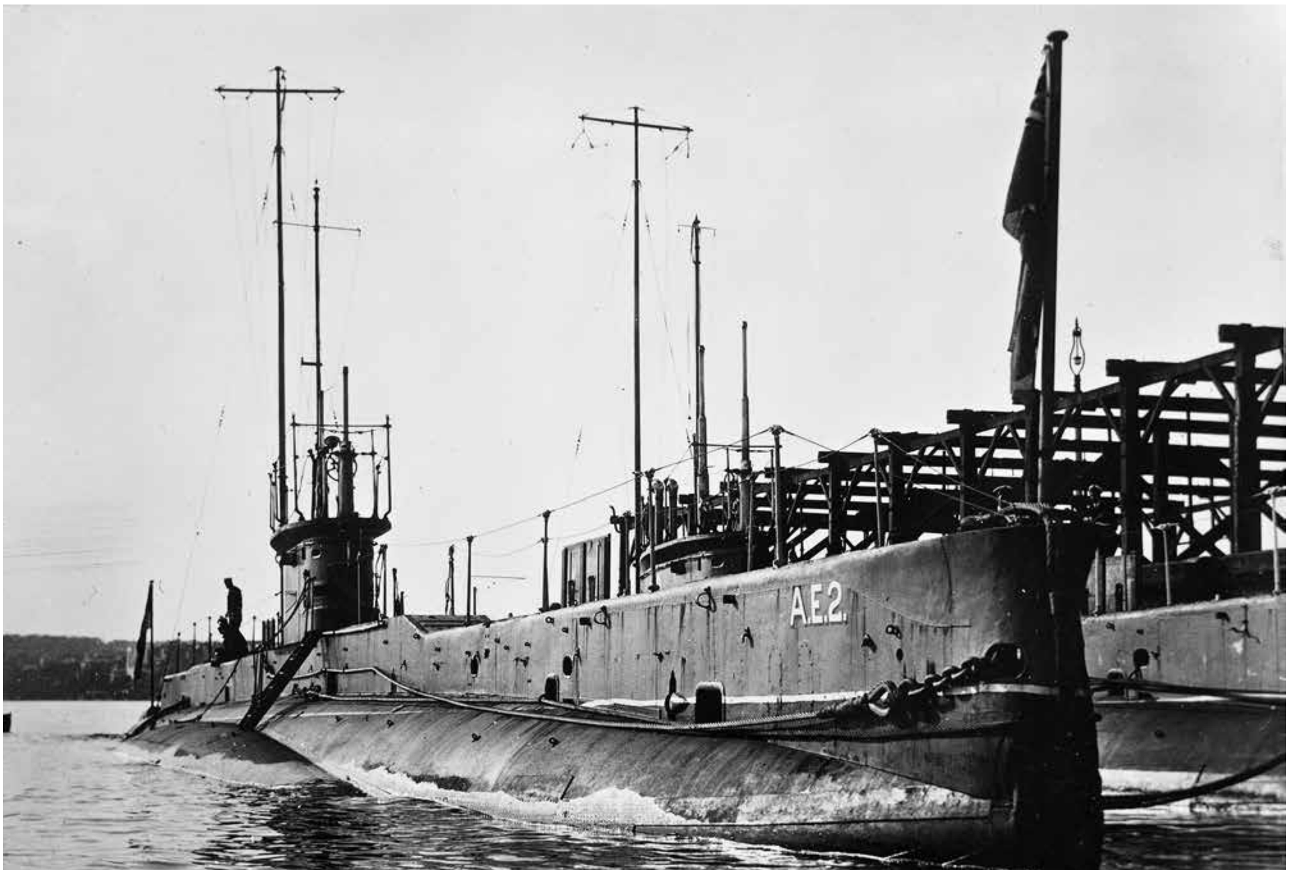
This column is intended to keep everyone (and, in particular, the friends you only see occasionally) updated on where you have moved to. It consequently relies on input from everyone. Please advise the editors when you up-anchor and move on to bigger, better or brighter things, or if you know of a move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

Phil Helmore

FROM THE ARCHIVES



It is 100 years since Australia's first submarines, AE1 and AE2, arrived in Sydney on 24 May 1914 following their delivery voyage from the UK. Their service was short. AE1 was lost on 14 September 1914 and her wreck has not yet neen located
(Photo RAN Historical Collection)



AE2, seen alongside AE1 at Garden Island, penetrated the Dardanelles on 25 April 1915 but was lost in the Sea of Marmora four days later, where she remains today
(Photo RAN Historical Collection)