THE AUSTRALIAN NAVAL ARCHITECT

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In October Australia's national sail-training ship *Young Endeavour* won the Australian Sail Training Association 2009 Billy Can Trophy after winning the Tall Ship Regatta in Fremantle, Western Australia. *Young Endeavour* raced the Western Australian square-rigged ship *Leeuwin II* over a 16 n mile course. The ships sailed north along the coast before heading out to sea, then turning and racing to the finish line outside Fremantle Harbour.

The photograph shows *Young Endeavour* leading *Leeuwin II* during the race.

The Sydney-based *Young Endeavour* visited Western Australia for the first time since 2001 as part of a circumnavigation of Australia. The ship arrived at Fremantle on Wednesday 21 October crewed by 24 young Australians from around the country.

During their eleven-day voyage these young Australians have learned the skills to successfully sail a square-rigged ship, taking command of *Young Endeavour* and sailing her along the Western Australian coast. They have participated in sail handling, working aloft and ship watchkeeping, as well as helm and navigation activities, maintaining look-out, and assisting the chef.

Since 1988 the Young Endeavour Youth Scheme, in partnership with the Royal Australian Navy, has provided challenging training voyages for over 11 000 young Australians in the tall ship *Young Endeavour*. These voyages provide the youthful crew with a unique, challenging and inspirational experience that increases self awareness, develops teamwork and leadership skills, and creates a strong sense of community responsibility. Voyages in *Young Endeavour* are open to all Australians aged 16–23.

(RAN Photograph)

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One of the patrol boats recently completed by Austal for the Trinidad and Tobago Coast Guard showing her paces during trials
(Photo courtesy Austal Ships)

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From the Division President

I thought that for this edition of *The Australian Naval Architect* I would report on the 17th International Ship and Offshore Structures Congress which I recently attended. However, before I do that I would like to use this column to express my sincere thanks to Keith Adams for his service to the Division over many years. Keith has recently decided to retire as Secretary of the Australian Division. Keith was of great assistance to me in my role as President and I wish him well in his retirement. Secondly, I would like to welcome Rob Gehling to the position. Rob was a highly-effective President and his acceptance of the position of Secretary gives me great confidence as we face the future.

The 17th International Ship and Offshore Structures Congress was held between 16 and 21August 2009 in Seoul, Korea. The aim of the congress is to facilitate the evaluation and dissemination of results from recent investigations, to make recommendations for improvements in the design and production procedures and criteria, to discuss research in progress and planned, to identify areas requiring future research and to encourage international collaboration in the various disciplines underpinning structural design, production and operation of ships and offshore structures. To achieve this outcome it operates in a similar way to its sister organisation, the ITTC.

The structure of the ISSC consists of a standing committee, eight technical committees and eight specialist committees. One of the main roles of the standing committee is the organisation of the congress and the selection of members for the committees. The technical committees review topics such as the environment, loads, quasi-static response, dynamic response, ultimate strength, fatigue and fracture, design principles and criteria as well as design methods. The specialist committees, on the other hand, address topics which are of current interest and include topics such as damage and assessment after accidental events, floating production systems, fabrication technology, naval ship design, sailing yacht design and condition assessment of aged ships. The committees take three years to put the reviews together and are a valuable resource for all of those people working in the field as well as being an excellent introduction for those students starting their careers in particular areas. If you wish to read some of the recent reports, then they can be found under the materials heading at www.issc.ac/index.htm.

Involvement in the ISSC is by invitation only and should be restricted to committee members, observers, correspondents and others qualified by reason of professional responsibility or published work to contribute usefully to the discussion of the congress. The list of attendees is also not to exceed about 250 people. At the congress in Korea there was one other member, besides me, who represented Australia. Tauhid Rahman from DNV has agreed to work on the naval ship design committee for the next three years, having completed a term on the condition assessment of aged ships and offshore structures committee. I am sure Tauhid will make a useful contribution and I certainly look forward to the outcome of that particular committee in three years time. I have decided to contribute to the quasi-static loads committee.

As well as being a committee member, I represent Australia as the corresponding member. Australia has a corresponding member because it does not have a position on the standing committee. The purpose is to simplify the contacts with Australia and this is achieved in several ways. It is my task to nominate Australian membership of various committees and to invite observers to each of the ISSC meetings. Secondly, I send material of a technical nature to the appropriate committee chair so that Australian public-domain research activities are reported.

As I write this article, a little earlier than usual due to my overseas work commitments, news of the tragic incident involving *Shockwave* (PriceWaterhouseCoopers — maxi yacht) is in the news. I, like all those involved in the industry, find this particularly sad and our thoughts go to the families of those lost in this fatal incident. The news went worldwide because of Australia's dominance in this sport. It is this dominance in certain activities that many people at the ISSC ask me about and, particularly, why there is no Australian involvement. The next ISSC congress is to be held in Rostock, Germany, in 2012 and it would be excellent if I can invite more Australian members, particularly from the area of high-speed craft or yacht design activities. If you would like to become involved, then please contact me and we can discuss your further involvement.

Stuart Cannon

Editorial

Readers will notice that the familiar Wärtsilä advertisements no longer appear inside the front cover and on the back cover of *The Australian Naval Architect*. Unfortunately, due to world-wide business contraction brought about by the recent financial troubles, Wärtsilä have decided to cancel their regular sponsorship of *The ANA*. The support Wärtsilä has given to the RINA in Australia over the last ten years, through sponsorship of *The ANA* and other Australian Division and Section activities, has been outstanding and of enormous value to the Australian Division. We will miss it greatly but hope that we may be able to welcome them back when conditions improve.

The ANA is produced 'on the smell of an oily rag', but printing and distribution costs are considerable. Over the years we have endeavoured to make the demands on Division funds as small as possible, even though *The ANA* is a major part of the service the Institution provides to members in Australia. The absence of a major corporate sponsor will make a big difference and it is unfortunate that major Australian firms in our industry have not yet recognised the value of supporting the Institution which serves their naval architects with a modest financial contribution to our expenses. Perhaps members might consider having a word in appropriate ears as the opportunity presents itself.

Of course, we could always produce *The ANA* as an electronic publication only. However we know that members like a hard copy journal and it is also read by many others who come across a copy from time to time. It is an advertisement for the Institution and its members and hopefully we can keep it that way.

John Jeremy

Letters to the Editor

Dear Sir,

I am researching available data concerning the first Commonwealth Shipping Line which was established during the First World War. Besides the construction of steel steamers in four states, a programme was begun to build several wooden steamers in Australia. Construction of two of these ships was begun by a new firm, Kidman and Mayoh. They were designed by naval architect A. C. Barber, who was employed by the firm Kay McNicol & Co.

The building site chosen was at Kissing Point, on the Parramatta River. The dimensions of the ships were length 240 feet (73 m), beam 44 feet (13.4 m) and depth 24.41 feet (7.4 m). They were to be named *Braeside* and *Burnside.*

Each ship was built with a sag of 9 inches (0.28 m) in the keel. Their construction was a 'bit erratic' — there were several workmen who were not tradesmen, only very few shipwrights and nobody took any notice of the naval architect, Mr Barber for, immediately after *Braeside* was launched, she developed a hog of 23 inches (0.58 m)!

I have tried in vain to find a copy of the plans of these ships, but they seem to be elusive. Perhaps a reader may know if they are still in existence? Both vessels were eventually broken up before being commissioned.

A description of this project can be found in *Build a Fleet, Lose a Fleet*, by Captain R. McDonell, The Hawthorn Press, Melbourne, 1976.

Neil Cormack,
nco82862@bigpond.netau

Dear Sir,

Firstly, regarding the recent simultaneous docking of three major RAN vessels at the shiplift in Henderson, WA, a fourth vessel could be added to the story — 10 km away on the WWII slip at the Maritime Museum in Fremantle, there is the Oberon Class submarine ex-HMAS *Ovens*, which we assisted in docking some years ago.

Secondly, since the triple docking, the following questions have been asked:

"What if all three vessels had to stay docked and another Anzac-class frigate needed an urgent unscheduled docking there?"

The answer would be: "Yes, this fourth ship could have been docked in a static cradle on the shiplift platform — this has been done in the past. There are sufficient bilge blocks for all four vessels."

Furthermore, in the future with the adjacent new floating dock and three multi-purpose cradles, an additional submarine and a frigate could also be docked.

"Could a future air-warfare destroyer be docked at Henderson?" The answer again is "Yes, in the shiplift."

Hugh Hyland

Dear Sir,

We thank Stuart Friezer for his response to our article *What Future for Fast Ferries on Sydney Harbour* (*The ANA*, February and May 2009).

Stuart noted a world-wide trend to scrap existing hydrofoils and replace them with what he considered were more cost-effective vessels, and sought comments on this and the reasons why the Sydney hydrofoils were not continued. We agree that the trend has been to replace hydrofoils with simpler designs. Catamarans now offer speeds equivalent to hydrofoils with greater versatility, including flexibility in operating speed, simpler construction in some respects, as well as maintenance advantages. None the less, the Rodriquez shipyard, with a long record of hydrofoil manufacture and more-recent experience in the construction of catamaran and monohull fast ferries of various sizes, remains committed to the development of hydrofoil designs, with trials underway on a prototype of a new fully-submerged hydrofoil ferry.

Modern hydrofoils excel over longer distances with greater fuel economy and passenger comfort in a seaway, particularly when equipped with motion-control systems. Size for size, we don't believe that there is a catamaran, monohull or other high-speed passenger ferry design which could match hydrofoils in terms of speed or comfort in a seaway. These factors are less crucial on the short Manly run, despite occasional large swells rolling in through Sydney Heads. We would like to note that, despite the decline in the fleet of pure hydrofoils, numerous monohulls and catamarans are being fitted with a variety of foil-type control systems to improve seakeeping and, in the case of hydrofoil-supported catamarans, also to improve performance and fuel economy.

We feel that the decision to replace hydrofoils on the Circular Quay–Manly route was a political one as much as anything else. Wave-piercing catamarans at the time were seen as a revolutionary new locally-designed-and-built high-speed ferry, and the then NSW Transport Minister wanted these vessels to replace hydrofoils on Sydney Harbour as part of an election promise. As we noted in our article, the PT 50 and RHS 140 were much better-suited hydrofoils for the Manly service than the larger RHS 160F. Had three new RHS 140s been ordered in 1984 instead of the two RHS 160Fs, we believe that there is a good possibility that the hydrofoil service would have survived beyond 1990.

Stuart made some other observations:

- hydrofoils are more complex and, therefore, expensive;
- foils need to be maintained to a very high level of fairness in order to fly; and
- the drive train is complex.

Hydrofoils are essentially similar to monohull ferries but with foils added, and the hull structure must be designed to support loads transferred from the foils. Naturally, the foil system requires additional initial design effort and adds to construction cost; however, this should not be seen as an insurmountable difficulty, particularly if through-life savings can be achieved through reduced fuel consumption. The surface-piercing foil design which we illustrated does not rely on a motion-control system, though it would benefit from one. Such systems are no more complicated than motion-control T-foils, flaps or interceptors fitted to catamarans and monohulls.

We agree that the foils need to be maintained to minimize marine growth in order for hydrofoils to fly efficiently, including overcoming the resistance hump as the craft transitions to foilborne operation. However, marine growth likewise has an adverse impact on displacement hulls. In the

case of catamarans, where frictional resistance dominates, a hull and propulsors would likewise need to be maintained to a high level of finish to avoid speed loss.

The Z-drive propulsion we proposed is certainly more complex than a pair of inclined shafts supported by A-brackets. Our rationale for this arrangement was to reduce appendage resistance, improve propeller efficiency, and minimize the risk of cavitation damage to the propellers. Z-drive propulsion arrangements are in widespread use in the pleasure-craft market, including sizeable motor boats, so we do not see this as being conceptually risky. Certainly the Speed-Z system has been applied to a number of monohull, catamaran and hydrofoil catamaran fast ferries, though we have been unable to determine the current status of production of these units. For one variant of the new Rodriquez fully-submerged hydrofoil design, dual-propeller Z-drive units are being developed by Rodriquez Marine Systems.

Stuart remarked on the difficulty of sourcing a commercial two-speed gearbox. It is worth noting that Rodriquez is adopting a two-speed gearbox on these new hydrofoils to optimise propeller performance with resistance over the speed range. The lower gear is employed for take-off and second gear is engaged in 0.2 seconds for foilborne operation.

We included Figure 1 in Part 2 of our article showing operating cost per hour per seat for different vessels in the Sydney Ferries fleet with the aim of illustrating that, as a general rule, slower-speed vessels with higher passenger capacity are more economical if they can be fully utilised. We agree with Stuart that a Freshwater-class ferry (with a capacity for 1100 passengers) if carrying only 150 passengers is not efficient compared to a purpose-designed 150 passenger ferry.

Stuart considered that we should have compared a hydrofoil and catamaran of equivalent capacity. We simply compared our 150 passenger hydrofoil option against a nominal 320 passenger catamaran as that is the capacity of the new catamaran *Ocean Dreaming 2* which has been introduced by Bass and Flinders Cruises. In that comparison, in order to break even on ticket price, it can be seen that the smaller-capacity hydrofoils were required to achieve a higher average load factor than the catamarans. We felt this was possible on the basis of the more-frequent schedule attracting greater patronage.

Since preparing our article, we have sought the opinions of shipbuilders regarding the acquisition cost of locally-built hydrofoils and catamarans as a check of our assumption in Part 2. Marc Richards, Chief Naval Architect at Aimtek, has estimated a mean cost of $7.5 million for a 150 passenger hydrofoil and $3.5 million for a 150 passenger wave-piercing catamaran designed for the Manly service. On the basis of these relative acquisition costs, hydrofoils would be unable to break even with the catamaran alternative on the Circular Quay–Manly service, regardless of any differences in through-life fuel costs. Our challenge is therefore to determine means by which the cost of construction of hydrofoils can be reduced to be comparable to that of catamarans.

Martin Grimm
Garry Fry

NEWS FROM THE SECTIONS

South Australia and Northern Territory

Annual General Meeting

At the Annual General Meeting, held on 27 May 2009 at the British Sailors' Society in Port Adelaide, the existing committee was confirmed for the next year as follows:

Chairman	Ruben Spyker
Deputy Chairman	Graham Watson
Honorary Secretary/Treasurer	Peter Crosby
Members	Adam Podlezanski
	Neil Cormack
	Sam Baghurst

The following were also appointed to the committee:

Members	Danielle Hodge
	Nik Parker

DSTO's Contribution to the 2007 Survey of AE2

On 23 June, at a combined RINA/IMarEST technical meeting, Dr Roger Neill gave a presentation on DSTO's contribution to the 2007 survey of *AE2* at Engineering House, North Adelaide. Roger's presentation described the work of a specialist team comprising divers, archaeologists, marine engineers and scientists to undertake a detailed survey of Australia's WW1 submarine *AE2*. The work was undertaken to celebrate the centenary of defence science in Australia, noting that *AE2* is the largest intact remnant of Australia's Gallipoli campaign. The meeting was well attended and the RINA Section and IMarEST Branch committees are grateful to DSTO for their support of this meeting.

Peter Crosby

Roger Neill (L) and Peter Crosby at the presentation on survey of *AE2*
(Photo courtesy Peter Crosby)

Western Australia

On 16 October a group of around 16 WA Section members of RINA visited the super yacht *Eos* during a docking at Henderson.

Langan Design/Francois Catroux designed the vessel, which was built by Lurssen Yachts in Bremen, Germany, in 2006 at a cost of €100 million. She is the world's largest

aluminium sailing yacht and is owned by Barry Diller, CEO of Fox Movies Inc.

Eos is a 92.9 m long, three-masted Bermudan-rigged schooner. The masts and booms are made of carbon epoxy. Each mast towers to 60 m — limited by air drafts for the Panama Canal and bridges in US ports. The sails are a one-man remote operation but, being expensive, they are rarely used and remain furled within the "A" section masts. The rigging alone would cost $12 million to replace.

There are two MTU main diesels driving twin shafts with controllable-pitch propellers. There are both below- and above-water exhausts, the selection depending on the vessel's speed. She reached 18 kn on builder's trials, and normally cruises between 12 and 16 kn. There are two pairs of active-fin stabilisers, though use of the aft set is avoided as it disturbs flow to the propellers. Bow and stern thrusters are fitted.

Four main boats are carried, one for rescue, as well as several smaller recreational craft.

Eos is classified by GL, has a crew of 19 and carries 12 passengers within sectors around various parts of the world.

Hugh Hyland

The super yacht *Eos* ashore at Henderson
(Photo courtesy Hugh Hyland)

New South Wales

Committee Meetings

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

- SMIX Bash 2009: Sponsorships have started arriving, and more are being sought; bookings have commenced.
- Technical Meeting Program 2010: Three presentations secured for March, May and July; presentation pending for September.
- Pacific 2010 IMC: Many papers submitted; space for only 70 presentations in two parallel sessions has meant some not accepted.

The NSW Section Committee also met on 28 October and, other than routine matters, discussed:

- SMIX Bash 2009: Sponsorships continuing to arrive and more are being sought; bookings are coming in thick and fast; drawings of *Gretel II* have been sent to Bill Bollard for 40th anniversary model construction.
- Technical Meeting Program 2010: The possibility of a TM in November 2010 was canvassed, making it ten meetings for the year (rather than the current nine) with five each organised by RINA and IMarEST, and this will be explored with IMarEST.
- Pacific 2010 IMC: Papers for refereeing have been received, and comments will be returned to authors by 7 November for final submission (with unrefereed papers) by 16 November; early-bird registration closes then.
- Pacific 2010 Professional Development Forum: Maritime Australia organised a PDF at Pacific 2008, where high-school students and careers advisers are invited along on the last day to attend presentations and the exposition to find out about careers in the marine industry. Options for speakers and information for "showbag" resource kits will be explored, and RINA will have a stand at the exposition.

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

Design Development of *Plastiki*

Andrew Dovell of Dovell Naval Architects gave a presentation on *The Design Development of the 60 ft Sailing Yacht* Plastiki to a joint meeting with the IMarEST attended by thirty-one on 2 September in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Andy began with a brief outline of his background. After graduating in naval architecture from the University of California at Berkeley, he became involved in tank testing the USA's contenders for the 1987 America's Cup match in Fremantle. He came to Australia with the USA team, and met Alan Bond who subsequently invited him to assist the Australian team do their model tests for the next challenge in Australia rather than in the USA and The Netherlands. Andy obtained a dynamometer from the USA, and then tested the Australian syndicate's models in the towing tank at the Australian maritime College in Launceston. Alan Bond went broke, but Andy stayed on, met Iain Murray and Ian Burns, they formed Murray, Burns and Dovell, and they had a long successful partnership.

The Eastern Garbage Patch

The Eastern Garbage Patch (also known as the Great Pacific Garbage Patch or the Pacific Trash Vortex), is a gyre (or convergence zone) of marine litter in the central North Pacific Ocean which is estimated to be twice the size of Texas. The patch is characterized by exceptionally-high concentrations of suspended microscopic plastic and other debris which has been trapped by the currents of the North Pacific Gyre. This results in water which contains more than six parts of plastic (mostly in almost microscopic form) for each part of phytoplankton, and so the food chain is being choked from the bottom up; this is a dire situation.

Adventure Ecology, headed by David de Rothschild, found out about this in the USA and started a project to bring it to the attention of the public. Why not simply convert a vessel? Well, that would be a bit like "preaching to the choir". A far more attention-grabbing idea was to build a boat from recyclable materials, voyage through the patch with marine biologists on board, and find out what is really happening there.

The Initial Design Brief

Adventure Ecology asked Andy to make a presentation to them on possibilities for a boat made from recyclable materials. The decision was made early on that the design could not rely on materials having high strength/weight ratios. The Polynesians have been using catamarans made of low-strength materials for millennia. The gimmick they came up with was that the catamaran hullform had to float solely on used 2 L drink bottles, which could be supported by an internal framework of a timber (plywood) centre girder as a backbone and transverse bulkheads in each demihull, with laminated beams supporting the cross-deck structure and a deckhouse of corrugated iron.

The Prototype

Adventure Ecology liked the idea, so they went ahead with building a 23 ft (7.0 m) prototype with a bamboo cross structure. There was no outside shell, just used 700 mL PET bottles for the prototype. By themselves, with caps screwed on, the bottles were pretty flexible, and needed to be pressurized. They considered taking them into a decompression chamber, but realized that they would be there for a month of Sundays to complete the job. The solution they came up with was to drop a few chips of dry ice into each bottle and then screw the caps on; this took the pressure in the bottles to about 3 bar (300 kPa) and so they were effectively incompressible. The bottles on the prototype were simply roped into place, but they realised that they would need a more-substantial system of attachment for the full-size vessel.

Andy showed slides of the vessel under construction, and being launched from a pier in San Francisco.

They used two Hobie 18 masts with mainsails and a jib. They realized that the rudder system would be highly loaded, and so they wanted to use steering oars. However, in practice, they found that they could steer with the sails, but could *not* steer with the oars!

The PET bottles provided sufficient flotation, but they thought that they would have a problem with the frictional resistance of the bottles with so much surface area and tur-

bulence. They tried wrapping the hulls in recycled plastic from the soft side coverings of truck trailers. However, the prototype was able to sail at 7 kn with the plastic covering, and 5.75 kn without it, which was plenty for the purpose. This translated to about 10 kn for the full-sized vessel. An unexpected bonus was that the uncovered plastic bottles provided significant damping to the vessel's rolling motions.

Here Andy showed slides of the vessel sailing towards the Golden Gate Bridge on San Francisco Bay.

Developments in the Design Brief

Not satisfied with the success and lessons learned from the prototype, Adventure Ecology thought that the vessel needed further development. The life cycles of steel, aluminium and timber are known very well. However, there is a need to know more about the recycling of plastic. They had conversations with the plastics industry, which is still designing plastics which cannot be recycled! Adventure Ecology therefore wanted to build the structure entirely from recycled plastics to show that it could be done. At that stage, the project almost stalled, because they could find nothing of sufficient strength to replace the timber centre girders and transverse bulkheads.

Developments in Plastics

They then came across two new plastic products.

The first, Self-reinforced PET, is a thermo-plastic product which has two versions, one which melts at 300°C and one at 400°C. If these are woven together, and then heated to 300°C, then the lower-temperature on melts and becomes the matrix, behaving very much like a pre-preg in a composite layup. The mechanical properties aren't bad:

σ_Y = 50 MPa σ_U = 130 MPa E = 5 GPa

The layup is lighter than FRP, and the stiffness and strength are a bit less, but the strength/weight ratio is about the same, which is not bad for something which can be recycled! Lotus in the automotive industry likes this product, and is starting to use it in their cars.

The second is a PET core material which is manufactured by Arax. Manufacturing is a long process, but the end product is remarkably cheap due to the parent material being so cheap.

Combining the two new products, they did a test layup of SR PET skins over a PET core, and had a world-first recyclable panel! They sent a sample to High Modulus in New Zealand for testing and found that they had no problems with either adhesion or core shear.

Andy passed around some samples, showing both a single-skin layup and a sandwich layup; they looked and felt much like FRP layups.

The downside is that they can only manufacture flat panels, because the tooling needs to be steel (timber and FRP moulds are destroyed by the heat), so they can't do anything curved. Fortunately, however, the construction of the boat required a lot of flat panels for the centre girders and transverse bulkheads.

Redesign

They redesigned the vessel to the full size of 60 ft (18.29 m). The deckhouse changed from corrugated iron to plastic as well, using their new panels to form a tessellated geodesic dome.

Here Andy showed a 3D model of the full-sized vessel.

Manufacturing the cross-beams was the trickiest. They vacuum bagged single skins for the outsides of each beam. The top and bottom skins were then heated, and bent to the required curvature and assembled with the side skins, giving a stiff structure.

Andy then showed slides of the full-size vessel under construction.

They found that welding/glueing panels together was a problem, until they came across an organic glue which comes from cashew nuts; another first! This will be in hardware stores everywhere, real soon now.

The full-sized vessel has 40 000 2 L PET bottles for flotation. These are strapped in place using PET packing straps. The gimmick of the vessel is that she will attract attention, just siting alongside the wharf. People will ask "Will she make it?"

Progress

The vessel should be finished within the next month or two, and ready to sail from San Francisco by the end of November. The schedule shows that the vessel will sail to San Diego, Hawaii, Vila and end up in Sydney.

The vessel will be crewed by six people. These will include Jo Royle from the UK (Master), David de Rothschild (Director of Adventure Ecology), a marine biologist, and a grand-daughter of Thor Hyerdahl (the master and master-mind of the *Kon Tiki* expedition). The name of the vessel, *Plastiki*, is a play on the words "plastic" and *Kon Tiki*.

When the vessel reaches Sydney, she will be mulched and recycled, to show that it can be done. As a result, there will be *Plastiki* fleecy jerseys and plastic cups for sale!

Conclusion

Dovell Naval Architects have designed a vessel which will fulfil the requirements of the owners and, at the end of the day, can be recycled!

There have been real benefits in being involved in this project. Andy has seen the development of the SR PET, the core material, and the organic glue. SR PET, even without the core, is a material which can be used for layups in craft up to about 10 m in length, such as a 5.5 m runabout. FRP boats of this size are not used much because aluminium is very damage tolerant, and easily repaired in the event of damage.

Questions

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

They tried using PVC tubes between the bottles on the prototype to aid the ropes in strapping the bottles to the frame. However, on the full-size vessel they will use only the PET packing straps with clips.

They could find nothing recyclable to use to replace the aluminium masts, so these will not be recycled. For the rigging they may be able to use PET rope. North Sails have proposed using a unique plastic for the sails, but these may not be ready in time.

The vessel has no keel, as they did not want to have any highly-stressed areas. She will not sail upwind.

All systems on the vessel have been designed to be environmentally friendly. Andy advised that overboard

discharge of sewage was the most friendly way. However, the voyage will be under intense media scrutiny, so sewage will not be discharged overboard, but will go into composting toilets.

There are some fancy systems on board, and these will need lots of power, so they will have the deckhouse covered n solar panels.

The PET core material was developed by Arax in response to a shortage of foam, to sell to the smaller boat manufacturers. However, the wind-turbine manufacturers came across it, and it suits their purpose, so they now use it a lot.

When the SR PET layup is used as a single skin, the strength is slightly less than FRP, the weight is slightly less, but the strength/weight ratio is about the same, and it is totally recyclable. The material is thermoplastic, not thermosetting, so it is easy to do things with it.

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

Site Visit to Sydney City Marine

Jonathan Toomey, of Sydney City Marine led a tour of the new facilities of Sydney City Marine under the western side of the Anzac Bridge, Rozelle Bay, and which was attended by 31 members and friends of RINA, IMarEST, the Company of Master Mariners of Australia and the Nautical Institute on 23 September.

Introduction

There was ample on-site parking and, after signing in, the group gathered in the big main shed which has 30 m clearance from the floor to the roof. Here there were a straddle carrier which has a capacity of 100 t and 7 m beam, and two vessels on cradles undergoing refits. There is 6200 m^2 of open hardstand and 3200 m^2 of undercover hardstand for all-weather operations.

The sheds all collect rainwater which goes into 750 kL storage tanks. All used water (e.g. from washing down) is collected, so that there is no runoff to the harbour, and this then goes through a treatment plant to remove solids and bacteria (and so is *almost* drinkable!) before going into the storage tanks.

Also in the shed were 60 t and 47 t boat trailers, manufactured by Roodberg in The Netherlands (see www.roodberg.nl). They are towed by a purpose-built tractor, are submersible, have adjustable beam, and are used for removing vessels from the water via the slipway and moving vessels around the yard.

Sailing yachts are supported on cradles while refitting and, because of windage, special stays are led from 7/8 of the height of the mast on each vessel to big concrete blocks as a safety measure.

On-site containers are leased to the contractors, who use them for storage of equipment and for small workshops. A bonus is that they provide a good sound barrier, as the facility has obtained approval to operate 24 hours per day, 7 days per week, and they are conscious of the need to attenuate noise for the benefit of surrounding residents.

There is a total of 360 m of in-water repair space alongside the eight berths which range in length from 28 m to 60 m. The depth of water alongside the berths is 8 m at low water.

Shiplift

The platform for the shiplift is steel and was built in sections offsite, blasted and painted, the sections transported onsite by truck and then assembled onsite. The piers and supporting piles were not designed to take wheel loads during installation of the platform, and so special arrangements have to be made for moving the platform into position.

It took eighteen months to decide on a long-term paint system for the platform, because it cannot be brought ashore every ten years to repaint. The system chosen is from Zintec Corrosion Solutions (see www.zinga.com.au) who import the Zinga paint from Belgium. The paint is zinc based, has a guaranteed life of 40 years (including an insurance policy), needs only two coats to complete, and can be touched-up onsite. Other advantages include ease of application (by brush, roller or spray), and that any damage to the coating is isolated because water cannot penetrate under surrounding paint and spread.

The cradles are of simple beam construction, and have supports which are adjustable in both height and angle, and each has 25 t capacity.

There is a self-powered Abi trailer, which runs in tracks on the sides of the platform, to move the cradles onto and off the shiplift facility. When the shiplift has lifted the cradle and vessel out of the water, the trailer drives onto the shiplift and hydraulically lifts the cradle and vessel, drives them ashore to wherever is convenient, and lowers them into place. The waterway for the shiplift was dredged to a depth of 8.5 m. However, when subsequently checked, it was found that this had reduced due to siltation. They can't use sheet piling here, so they have used a blanketing approach in which the area was re-dredged, and then concrete pumped onto a fabric like a patchwork quilt at the datum level. About 4500 t of material was removed, and about 1000 t of concrete installed.

The platform for the shiplift has been certified by Lloyd's Register as a lifting platform, but has not been classed—the materials were not from LR-approved works—but will be subject to annual surveys.

The trailer and shiplift can handle vessels displacing up to 600 t and vessels up to 50 m in length. It is the largest in Australia, and one of the largest in the world. It is due for commissioning in November.

Spray-painting Shed

The spray-painting shed is completely enclosed. It can take vessels up to 40 m in length, and up to 23 m high. It is 18 m wide, and is the largest spray shed in the southern hemisphere.

A 10 t gantry has been installed for engine removal, etc. The steel structure has been sheathed to avoid paint build-up, and there is a three-level filtration system to remove dust, paint overspray and the like. Lights have been installed to give the same amount of light as on a sunny day outside. There is no natural light, and so the light is even and constant at all times. There is no temperature control, as it is not usually needed for paint application. It may be required once or twice per year, but it is cheaper to hire in the equipment when needed than to have it permanently installed.

Operations

The original investment in the operation was of the order of $40 million, and they had a 25 year lease on the site from the NSW Maritime Authority; however, the investment has grown to of the order of $60 million, and so they have arranged with the NSW Maritime Authority to extend the lease to 43 years.

There are external limits on the vessels which can reach the facility, and some limits placed by the facilities themselves, but they can cater for most vessels which are likely to want to use them. The Sydney Harbour Bridge has an air-draft limit of 52 m, but the Harbour Master prefers a limit of 49 m so that there is a clearance of at least 3 m. Vessels of up to 60 m in length and 8 m in draft can be accommodated alongside the berthing facilities, and vessels of up to 600 t displacement and 50 m in length can be removed from the water.

At present they are removing five boats from the water per day, and returning five to the water, and this is growing all the time. They are capable of up to fifteen of each.

Refreshments

In a very thoughtful move, Jonathan had provided refreshments to follow the tour, and visitors were able to discuss the facilities and ask further questions while enjoying beer, wine, soft drinks and hors d'oeuvres.

The vote of thanks was proposed, and the "thank you" bottles of wine presented, by Graham Taylor. The vote was carried with acclamation.

Forum on Harbour Ferries

An expert panel provided the focus for a joint meeting with the IMarEST attended by 36 on 7 September in the Harricks Auditorium at Engineers Australia, Chatswood. Each of the experts made a presentation on *The Design and Operation of Harbour Ferries* and then the meeting was opened to discussion and questions from the floor.

Sydney Ferries: A User's Perspective

Mori Flapan is the Principal Technical Adviser to the National Marine Safety Committee (NMSC). He has been project leader for the new Part A, Part B, Part C Subsections 4 Fire Safety, 5A Engineering, 6A Intact Stability Criteria, 6B Buoyancy and Stability after Flooding, 6C Stability Tests and Stability Information and Part F Section1 Fast Craft of the National Standard for Commercial Vessels. A naval architect with a diploma in law, Mori has worked for private ship design firms and for a government survey authority. His experience includes three years with M.J. Doherty and Co., designers of offshore supply vessels, tugs and bulk carriers, and three years with International Catamaran Designs, working on the safety aspects of high-speed car and passenger-only ferries and trawlers. For eight years he was a naval architect and later the senior naval architect surveyor for the Waterways Authority of NSW. For 20 years Mori was involved both professionally and at a voluntary level in the restoration and operation of the historic ships of the Sydney Heritage Fleet.

Mori's interest in Sydney's ferries comes from a number of sources: he is a daily commuter; has conducted plan approvals for a number of the ferries in the 1980s and 1990s, including both high-speed and conventional, Manly and inner harbour; and has keenly followed their history from the earliest times to the present.

Introduction

Mori began by outlining the Sydney Ferries operations, including 31 vessels on eight routes on the harbour to 45 different wharves. The wharves themselves present logistic problems, as they are owned and maintained by different agencies. The ferry network covers 37 km from Parramatta to Watson's Bay and Manly, with 14 million passengers carried per year on 179 000 services, or an average of 78 passengers per vessel. The Manly run accounts for 47%

of the total, inner harbour 35%, Parramatta 10% and the eastern suburbs 8%.

There are conflicting demands between the needs of commuters and tourists; 43% of ferry passengers use the service for tourism or leisure. The commuters demand high peak-time capacity, whereas tourists are happy with lower speeds and economical operation outside of peak hours is desirable. Summer-time demand is double that in winter.

There is a chicken-and-egg problem here: does the demand drive the supply, or supply drive demand? Now governments are tending to lead rather than respond, so that they need to drive the demand, rather than respond to it. To what extent can adjustments to the supply drive the demand?

Commuters want reduced commuting times, high reliability of service, competitive pricing and reasonable comfort.

Commuting Time

Commuting time comprises time waiting, loading, berthing, on passage, berthing and unloading. Each of these can be improved.

The Manly ferry timetable, published in the 1906 first edition of *The Manly Daily,* showed a half-hourly service with travel times very similar to the timetable of 2006! The Freshwater class was designed for a service speed of 18 kn, but are now limited to 15 kn because of wash. The whole concept was based on the 18 kn service speed, and the service could not be provided at 15 kn, and they ended up having to build one more ferry to do the job!

In 1911, the Cremorne service saw the introduction of a 15 minute timetable outside peak hours, with additional ferries operating during the peak periods. In 2009, the Cremorne service runs at 30 minute intervals outside of peak hours, and increasing to 45 minutes at night!

Costs

Ferry fares are currently more expensive per kilometre than either bus or rail. For example, a single fare from Manly to the Sydney CBD currently costs $6.40 by ferry and $5 by bus, and a TravelTen $48 by ferry and $40 by bus.

In general, commuters like higher speed. However, some tourists want slower speeds (at least for their first trip!). The concept of the hydrofoils on Sydney Harbour was that the tourists would use the hydrofoil and the commuters use the conventional ferries; however, in practice, the reverse happened. Speed has the obvious advantage of shorter passage times, and the obvious disadvantage of increased fuel per vessel per hour. However, the issue is more complex than that, because speed can reduce capital and operating costs by multiplying the capacity of each vessel.

Generally, the larger the capacity of the vessel, the less the cost per person—assuming that the vessel runs near full. The issue of high demand has traditionally been handled by using ferries of large carrying capacity. Demand for ferry services fluctuates greatly depending on the time of day, day of the week and season. The large ferry with its high capital costs, overheads, crewing and fuel costs will not be an economical solution outside of peak loading.

Comparative operating costs per operating hour per seat, taken from the Walker Report, are:

	Speed < 20 kn	**Speed > 20 kn**	
Freshwater class	$1.50	RiverCat	$3.10
First Fleet Cat	$2.00	SuperCat	$4.00
Lady class	$2.10	Harbour Cat	$4.90
		JetCat	$6.50

However, if the costs are taken on the basis of per nautical mile per seat, then the results look much more even:

Freshwater class	$0.12	RiverCat	$0.16
First Fleet Cat	$0.18	SuperCat	$0.17
Lady class	$0.19	Harbour Cat	$0.23
		JetCat	$0.20

And finally, if the comparison is done assuming that the vessel is carrying 100 passengers (irrespective of capacity), the tables are turned again and the high-speed catamarans perform much better:

Freshwater class	$0.95	RiverCat	$0.35
First Fleet Cat	$0.55	SuperCat	$0.41
Lady class	$0.99	Harbour Cat	$0.31
		JetCat	$0.45

Frequency of service is just as important as speed. Shortening the travel time by 10 minutes does not mean much after 40 minutes waiting! A larger number of smaller ferries satisfies customer needs better than a smaller number of large vessels.

Reliability

High reliability of service means that the service is unaffected by sea/weather conditions, and that mechanical reliability is backed up by redundancy, and that safety is inbuilt.

Vessels need to be designed for the intended service. For the Manly service, this means operation in seas of 2.5 m significant wave height. For other areas, there is operation in confined waters for the Neutral Bay service, operation in environmentally-sensitive areas such as up the Parramatta River, and all vessels have challenges regarding wake and manoeuvring in Circular Quay. Recent attempts to modernise the fleet since the mid 1990s have attempted to develop a "universal vessel", capable of operating in all harbour services from Manly to Parramatta. Ultimately, the owner's expectations and specification of requirements were not realistic, and compromised the ability of the vessels to do any job really well.

A qualitative analysis of the characteristics required for Manly, inner-harbour and up-river vessels shows that they are quite different and cannot all be met by one vessel.

The vision of Sydney Ferries, taken from the Walker Report, is to replace the fleet with two classes—32 smaller vessels carrying 300 pax at 18 kn for inner harbour and lower Parramatta River service, but capable of running on the Manly service if necessary, together with 8 larger ferries carrying 800 pax at 18–20 kn for the Manly service. However, feedback from masters suggests that there should be three specific types of ferries in the Sydney Ferry Fleet: a Manly ferry, an inner-harbour ferry and an up-river ferry.

Double-enders

A number of experienced ferry masters have indicated support for larger ferries to be double-ended. Their argument is that it reduces risk by avoiding having to reverse and turn within the congested waters of Circular Quay, and it reduces the docking and undocking time, both by avoiding the manoeuvre and waiting for others to clear. For reasons of safety, access to Circular Quay was limited to double-ended ferries in 1914, but we have forgotten the corporate history.

The benefits of modern high-speed ferry design have so far eluded the double-ended concept; the two seem incompatible. In 1988, the double-ended catamaran ferry *Kea* was built for service on Auckland Harbour, NZ. She is 27 m long and carries 400 passengers at 15 kn. As far as is known, she is still in service, but no more were built.

Technology to the Rescue?

Technology has come a long way since 1914, when single enders were banned from Circular Quay. Modern single enders, if properly designed and equipped, should be far more manoeuvrable. But is that enough? There are real concerns that Circular Quay is liable to over congestion. To address this, the Walker Report suggested establishing a second hub at Darling Harbour. Single-ender designs need to be nimble, with good vision from the helm, and a system of traffic control could be considered.

Rapid embarkation and disembarkation of passengers has a number of benefits: it reduces commuting time without burning extra fuel for speed. It can increase the effective passenger capacity throughput per hour, thus reducing the number of vessels required and increasing the number of vessels that a wharf can service. Bow loading arrangements similar to those used in New York and Hong Kong should be investigated. Otherwise, careful design of access ways, gangways and wharves is needed.

Proposal

Mori then described his own proposal for the Manly service. This would be an aluminium catamaran of length 45 m and breadth 12 m to fit in with existing infrastructure. This vessel would be capable of carrying 450 passengers seated, or 600 passengers both seated and standing. This assumes only a single service operating to Manly. A minimum speed of 22 kn would would avoid the need for an additional vessel. Dual services are highly inefficient as they duplicate resources, including reserve vessels, and dilute patronage for each other.

Three options were considered: vessels operating at 22 kn; vessels operating at 30 kn, and dual-speed vessels operating at 30 knots in peak hours and 22 kn in off-peak times. These proposals were compared against replacement Freshwater and JetCat proposals. In this comparison, the JetCat replacements had the least capital and operating costs, but were low on comfort, reliability and tourist satisfaction. The 30 kn 45 m catamaran had low capital and operating costs, but had high emissions offpeak and did not satisfy tourists. The 22 kn 45 m catamaran had high capital and operating costs, but had low emissions offpeak and did not satisfy commuters. The 45 m dual speed catamaran had mid-range capital cost, low operating cost, satisfied tourists and commuters alike, but was more complex. However, it also ticked all the boxes for reduced commuting time (by way of waiting time, loading time, unberthing time, passage time, berthing time and unloading time), high reliability of service, competitive pricing and reasonable comfort.

Sydney Ferries: A Naval Architect's Perspective

Stuart Friezer began his career with International Catamaran Designs in 1990, working on a wide range of designs, including the JetCats for Sydney Harbour. In 1994 he started his own design consultancy, Stuart Friezer Marine. Initial projects included three composite Rocket ferries for Matilda Cruises, and eight CityCats for Brisbane in collaboration with Grahame Parker Design. In 1996 SFM started working on new designs with Incat Tasmania, the first being their 86 m wave-piercing catamaran (WPC) ro/pax ferry, then 91 m, 96 m, 98 m and, finally, the 112 m wave-piercing catamaran ro/pax ferry. Since 2003 SFM has completely designed small passenger ferries which were simple, super lightweight and fuel efficient. These include the 22 m wave-piercing catamaran *Tangalooma Express* and the 27 m wave-piercing catamaran *Haba V — Evolution*. In 2009 SFM undertook consulting on upper-Parramatta river services, looking at the problems of silting, navigation and wash, and is currently developing new-generation designs which are lighter, stronger and more efficient. There is strong interest from overseas but, sadly, none from Sydney.

Being based in and on Sydney Harbour, Stuart initially designed the SFM 40 m WPC around the needs of Sydney Ferries for the Manly–Circular Quay service. Subsequently he has found that there is a worldwide demand for these designs. He has taken a personal interest in ferries on Sydney Harbour and completed a study on what the best technical solution might be. He wants Sydney Harbour to have a ferry fleet and service of which we can be proud.

Introduction

Stuart began by outlining the objectives for the ferries on Sydney harbour: they must be competitive with other forms of public transport in terms of travel time and cost (at present, they are not); they need to have minimum environmental impact in terms of wash, pollution and noise; they need to be safe; and, finally, they need to be (at least) comparable to cars in terms of travel time and cost.

There are three reasonably distinct areas of the harbour and, in order to meet the needs of these areas, there needs to be three different types of vessels. These can be summarised as Manly ferries (to go across the heads), harbour ferries (which do not need to go across the heads), and Parramatta River ferries (to go up the river to Parramatta). The RiverCats were intended to go to Parramatta, and assumed a 2.5 m depth of water; however, the channels are moving and silting, and the solution today is different to what it was 10 or 20 years ago.

Manly Seacat Ferries

Ferries for the Manly service should be:

- larger to handle the numbers of passengers;
- ocean capable, and ocean safe;
- be iconic, because they are representing Sydney to the rest of the country and the world;
- be efficient;
- be lightweight; and
- have low through-life costs.

One solution would be to use vessels which have 400–450 passenger capacity with variable operational speeds of 22 and 30 kn and fast loading and unloading times. A 40 m wave-piercing catamaran would fulfill all of these requirements. The wave-piercing catamarans are iconic, and tourists like them. The need for good passenger flow for loading/unloading operations can be filled by having

multiple gangways. A 10-minute timetable can be achieved in peak times by providing six vessels capable of 30 kn, or seven if there is a requirement to have one on standby. A half-hour timetable can be achieved with two vessels capable of 22 kn in off-peak times.

The cost turns out to be very sensitive to the percentage of load carried, and costs approximately double if the load reduces from 80% to 30%. Nothing can beat a Freshwater-class ferry carrying an 80% load of 880 passengers, but many alternatives can beat it when only carrying 200. The WPC proposal works fine when carrying 200 passengers.

Harbour Ferries

These vessels would be used for inner-harbour routes. They should:

- have variable operational speed;
- be modular in design and configuration;
- be simple and easy to maintain;
- be able to carry up to 300 passengers
- be capable of mass production, as around 20 vessels will be required;
- have extremely low wash;
- be super lightweight and efficient;
- have low through-life costs; and
- be integrated with other forms of transport.

A 30 m conventional catamaran would fulfill all of these requirements.

It is suggested that that one of the real problems at present is the lack of integration, especially with buses. One proposal is that if all ferries had bicycle racks installed, and Sydney had a better network of cycle ways, then we could start a whole new generation of cycle riders!

As far as the load carried goes, we should be targeting an average of 50%; i.e. close to 100% in peak times, 30% in off peak, and 50% average.

It is instructive to look at the critical wash speeds. If we look at a graph of ship speed vs critical water depth (where the depth Froude number is unity), we see that the worst speed for a depth of 2 m is 8 kn, which is NSW Maritime's restricted speed, and the critical speed for a depth of 8 m is 15 kn, which is the restricted speed of the Freshwater-class ferries!

River Ferries

River ferries must be able to operate on the Parramatta Rive. They should:

- be capable of speeds of 15–25kn;
- be waterjet powered;
- have a draft of no more than 450 mm;
- have high manoeuvrability;
- have low wash and environmental impact;
- be efficient;
- have low through-life costs; and
- be super lightweight.

A 17–20 m catamaran would fulfill all of these requirements. The only way to reduce environmental impact is to reduce the size and displacement of the vessel. This was brought home in the 1990s when Graham Parker Design was investigating the design for the RiverCats. Being small and light reduces the size of the transverse waves.

How to Achieve Super-lightweight Ferries?

Stuart then gave a brief history of the lightweight ferry industry. When the Tasman Bridge collapsed in Hobart, International Catamarans was born, and stepped in with the design and construction of two catamaran vessels. Alan Payne designed the First Fleet-class catamarans for Sydney; these vessels were heavy and had serious wash problems, but are well liked by the operators and by the Walker Report. [*The length of these ferries was reduced for industrial reasons when the design was well advanced — this change was substantially responsible for the wake problems* — Ed.] The JetCats were designed in the early 1990s, and were good at the time, but never performed to expectations. Stuart Friezer Marine has designed a 27 m wave-piercing catamaran of the Evolution class which has a structural mass of aluminium of 18 t and a lightship of 42 t. So super-lightweight ferries are available, but are just not mainstream.

In future, the items to consider include minimising surface area in order to minimise weight; taking a minimalist approach to layout and configuration; more structural optimisation; lightweight and cost-effective fit-out and systems; and the use of composites.

Much of the plating on a 27 m aluminium catamaran can be 4 mm, with some 5 mm and some 8 mm. Composites are good for bulkheads and superstructure. 4 mm aluminium comes in at around 12 kg/m^2, but composites in the same location come in at around 4 kg/m^2, so using the right material in the right way can result in significant weight savings.

Sydney Ferries: Classification and Regulatory Aspects

Chris Hughes graduated from UNSW in 1998 and joined British Maritime Technology in Southampton, UK, where he worked on ship manoeuvring modelling and simulation. Following a sabbatical sailing on a superyacht, he returned to BMT as product manager for hull-stress-monitoring and ship-performance-monitoring systems. In 2007 he left the cold weather and warm beer of England, and joined Lloyd's Register's Sydney Design Support Office as a Surveyor. With the recent adoption of LR's Rules within the NSCV, he has the opportunity to work with future stakeholders towards providing not only safe and seaworthy, but also efficient and viable, ferries for Sydney Harbour.

Introduction

Chris began by saying that Sydney Ferrries have had a long association with classification. The SuperCats have been in class with Det Norske Veritas for nine years. The JetCats have been in class with LR for 19 years, the Freshwater-class ferries have been in class with LR for 25 years; and *South Steyne*, built in 1938, is *still* in class with them!

The NSCV

The regulations are now changing, as the National Standard for Commercial Vessels replaces the Uniform Shipping Laws Code in a phased introduction. As of 1 October 2009, the following sections of the NSCV have come into force:

Part	Section	Description
C	3	Construction
C	6A and 6C	Stability
C	7B and 7D	Communication and Navigation Equipment
E		Operational Practices
F		Fast Craft

Part C (Design and Construction) Section 3 (Construction) replaces Section 5 Parts A, B, G, H, K and L, while M (timber) has been maintained.

Chapter 3 (Deemed-to-satisfy Solutions for Determination of Scantlings) of C3 says that vessels of length 35 m or more must be classed, but that vessels of length less than 35 m may be either classed or constructed in accordance with the relevant rules of Lloyd's Register, the USL Code (Section 5 Part M), or relevant Australian or ISO Standard, and for the relevant type of operation (robust or light). The relevant LR rules would be the rules for Special Service Craft, Inland Waterways, or Wooden Yachts. However, it is expected that 95% of the vessels under the NSCV would come under the SSC Rules.

Lloyd's Special Service Craft Rules

The SSC rules are more relevant to, and focussed on, Sydney ferries than the USL Code. They apply to high-speed craft, light-displacement craft, monohulls and multihulls, steel, aluminium and composites, and foil-assisted and foil-borne craft. Under the SSC Rules, various operational areas are defined for restricted service; i.e. the scantlings are fit for the defined operational area, and this is important for high-speed craft to minimise the mass of structure.

Operation Environment and Design Considerations

For high-speed craft the scantlings are a function of the vertical accelerations which, in turn, are a function of the vessel speed and wave height. A specified operational environment will therefore determine the vessel characteristics. A compromise will need to be made between the scantlings/displacement and the environment/permissible wave height. Service restrictions can be placed, e.g. for inner-harbour operations, or for Parramatta River operations only. For the Manly crossing there is a need to make a business economic decision on the operational envelope; i.e. under what conditions must the vessels continue to operate? This decision needs to be made early on.

LR places a limit of vessel speed on permissible significant wave height for operations, and this gives a large amount of flexibility in the operating environment.

Human Factors

Sydney ferries operate in a demanding environment:

- short voyages and frequent berthing;
- high traffic density;
- high speed; and
- reduced visibility.

Part F of the NSCV addresses many of the operational/human factor aspects of the design and operation of fast craft.

The design of the bridge needs to take into account the visibility of equipment, the usability of systems, the limitations of people (in terms of reach, vision, workload, etc.), alarms and alerts, SOLAS Reg.V/15, and the IMO guidelines on ergonomic criteria.

As an example, Chris quoted the case of an accident which occurred because the master of a vessel, intent on watching where the vessel was going and with his back to the console, reached for the Take Over Control button. However, instead, he pressed the Emergency Stop button which was placed right next to the Take Over Control button and without any protective cover!

Other aspects which need to be considered include access and egress, and crew resource management via workload and job allocation (there is now an IMO guidance manual on fatigue mitigation and management).

The regulatory environment is changing, and becoming more relevant and flexible for fast craft. Operational requirements will affect the vessel characteristics, and should be considered early in the design process and refined as the design progresses.

Open Discussion

Replying to a question from the floor re fire protection for composites, Stuart indicated that there have been significant developments over the last three–four years, and that there are products on the market and available.

Tauhid Rahman said that the criteria look like performance-based design criteria rather than prescriptive, as in IMO's goal-based design criteria. However, the regulatory regime has a touch of prescriptive rule requirements. How does the panel see the difference between goal-based and prescriptive design criteria?

Stuart replied that the cost of weight versus performance needs to be considered. Through the use of better structural analysis the structure can be made lighter and stronger. A good monohull is heavy and goes through the waves, whereas a good catamaran is light and goes over the waves.

Mori replied that the NSCV is designed to have deemed-to-satisfy solutions, but that consultants are free to propose equivalent solutions. For goal-based design, the goal needs to be agreed, so it is important to sit down with the authority and decide how to measure success. Once this is established, then the consultant can show, using models, that the outcome can be achieved (this may be a challenge!) Then it must be shown that the vessel has been built in accordance with the model. Using prescriptive rules is much easier, but you *can* use alternative approaches.

Jennifer Knox said that both Mori and Stuart had independently come up with similar proposals for the manly service; i.e. catamarans operating at dual speeds of 22 and 30 kn. However, Mori's proposal was for 4 vessels and Stuart's for 6: why the difference? Also, could trimaran hullforms be used in lieu of catmarans?

Mori replied that his figures were somewhat rubbery; his proposal was put together over one weekend for submission to the Walker Enquiry. On his regular commuting voyages to and from Manly on Freshwater-class vessels, he usually sees about half the seats empty (even in peak hours). He therefore developed his estimate of peak requirements on 50% of 1100 capacity = 550.

Stuart replied that his figures were based on all seated, but Mori's include some standing and would require a slightly larger vessel. He had considered other hullforms. Monohulls have higher power requirements for the same speed. Trimarans have stability problems; they are, in effect, stabilised monohulls and are much more complicated than monohulls. They are longer than catamarans, and the

crewing requirements increase. Catamarans can handle bigger load variations, and are more manoeuvrable.

Georgios Spiliotios asked do we know which naval architects have been involved in the tendering process for the ferry operations?

Stuart replied that Sydney Ferries had not employed a naval architect; they employed a consultant, and so their strategies were not fully informed on naval architectural aspects.

Mori replied that he had contacted some of the ferry masters who had worked on the Queensland routes, and this had opened up possibilities. A real benefit of employing a naval architect is the wide experience that is brought to bear. Some of the tenderers had employed ex-ferry masters on their teams.

Graham Taylor proposed that natural gas should be considered as a fuel. Fifty years ago, LNG carriers were using boil-off from the cargo as fuel. Now there are LNG guidelines, and the classification societies have rules for LNG-fuelled marine engines.

Stuart replied that natural gas adds 20% to the capital cost. He had looked at LNG as a fuel, and one of the problems is that the LNG tanks must be located so that they cannot be damaged.

The vote of thanks was proposed, and the "thank you" bottles of wine presented, by Graham Taylor. The vote was carried with acclamation.

Phil Helmore

COMING EVENTS

SMIX Bash 2009

The tenth SMIX (Sydney Marine Industry Christmas) Bash will be held on Thursday 3 December aboard the beautifully-restored *James Craig* alongside Wharf 7, Darling Harbour, from 1730 to 2130. This party for the whole marine industry is organised jointly by RINA (NSW Section) and IMarEST (Sydney Branch).

Tickets are available from Adrian Broadbent of Lloyd's Register Asia on (02) 9262 1424, fax 9290 1445 at $45 per head; cash or cheque (payable to RINA NSW Section) only. There is a limit of 225 guests on board *James Craig*, so it would be wise to book early.

For further details and booking form, see the advertisement elsewhere in this issue.

Pacific 2010

The Pacific 2010 International Maritime Exposition and Congress will be held at the Sydney Convention and Exhibition Centre, Darling Harbour, Sydney, from Wednesday 27 to Friday 29 January 2010. It will include:

- The Pacific 2010 International Maritime and Naval Exposition, organised by Maritime Australia Ltd, to be held from Wednesday 27 to Friday 29 January.
- The Royal Australian Navy Sea Power Conference 2010, on the theme of Combined and Joint Operations from the Sea, organised by the Royal Australian Navy and the Sea Power Centre Australia, to be held from Wednesday 27 to Friday 29 January. Further information on the conference can be obtained from the conference website www.seapower2010.com or by contacting the conference organisers, Navy Events and Marketing, email navymarketing@bigpond.com.
- The Pacific 2010 International Maritime Conference, organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia on the theme Meeting the Maritime Challenges, to be held from Wednesday 27 to Friday 29 January. Further information on the conference, including the conference and social programs, can be obtained from the conference website www.pacific2010imc.com or by contacting the conference organizers, Arinex Pty Ltd GPO Box 128, Sydney, NSW 2001, phone (02) 9265 0700, fax (02) 9267 5443 or email pacific2010imc@arinex.com.au.

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CLASSIFICATION SOCIETY NEWS

Boiler Safety and Low-sulphur Fuels

As a result of various environmental regulations, main and auxiliary boilers will be required to change from standard heavy fuel oil (HFO), for which many of them were specifically designed, to operate on low-sulphur fuel oils. These will almost inevitably be gas oil fuels. When using, and changing to and from, low-sulphur gas oils, it will be necessary to ensure that boiler safety and availability are not adversely affected.

This has been taken into account in Lloyd's Register's Rules since 2007. However, due to the current level of interest in using low-sulphur gas oils to meet the EU Directive 2005/33/EC 'at berth' requirements, the California Air Resources Board's California waters requirements and the post-1 January 2015 revised MARPOL Annex VI Section A requirements, the following points are highlighted to owners and operators:

- Boiler and fuel system manufacturers should be consulted for fuel-switching guidance and to confirm that the boiler, combustion control systems and associated fuel-system components, such as pumps, are suitable for the intended types of fuel.
- The furnace purge process must be functioning correctly. It is essential that the whole of the furnace space is fully purged before re-lighting any fires.
- Burners in general, and tips in particular, must be appropriate to each type of fuel to be used.
- The spark igniters (or equivalent) must be correctly functioning and positioned so as to readily ignite the fuel spray on start up.
- All boiler flame detection and related safety systems must be operating correctly. In the case of flame detectors, they must be correctly positioned to pick out the particular flame pattern which is encountered with the types of fuel to be used.
- Manual and automated combustion control-system functions should be checked as necessary to ensure that they are operating correctly and reliably.
- Due to their searching nature, the use of gas oil fuels in systems which have generally previously operated with HFO can result in seepage of fuel from pipe flanges, equipment seams and other fittings.
- To ensure the minimum quantity of carbon deposition material within the combustion and uptake spaces, soot blowers should be operated at the latest possible opportunity before entry into coastal and port waters.
- The boilers, burner and fuel-oil system, including the relevant automatic controls, should be reviewed by means of a HAZOP workshop, through which the action points for the operators and manufacturers can be identified.
- Oil fuel-burning arrangements must be in accordance with the Rules of the relevant classification society.

The above list is not exhaustive. Owners are reminded that all modifications to main and auxiliary boilers and associated fuel-supply and control systems must be appraised by the vessel's classification society in order to ensure that class is maintained.

Persian Gulf Area Ballast Water Management Regulations

With effect from 1 November 2009, all ships, regardless of flag, will be required to exchange, treat or deliver to a shore reception facility all ballast water taken up outside the Regional Organisation for the Protection of the Marine Environment (ROPME) Sea Area*. This comprises the states of Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

Vessels arriving from outside the ROPME Sea Area are to exchange ballast water in waters at least 200 metres deep and 200 nautical miles from the nearest land. If this is not possible for safety reasons, ballast may be exchanged in areas within the 200 nautical mile limit, as long as such exchanges are more than 50 miles from the nearest land and in waters at least 200 metres deep.

If a ship cannot exchange ballast in the specified depths or at the required distance from land, then it will be required to provide the respective port authority with the reason why exchange cannot be achieved. Further ballast water management measures may also be required.

Ballast which has been treated with a ballast water treatment system approved in accordance with IMO standards need not be exchanged.

Ships will be required to have on board an approved ballast water management plan in accordance with the IMO standards. Ships should also have and maintain a ballast water record book.

* The ROPME Sea Area (RSA) is defined as extending between the following geographic latitudes and longitudes, respectively: 16°39'N, 53°3'30''E; 16°00'N, 53°25'E; 17°00'N, 56°30'E; 20°30'N, 60°00'E; 25°04'N, 61°25'E.

Port State Control and Bilge Discharge Piping Systems

Lloyd's Register has been advised that some owners and operators have recently encountered difficulties with port state control officers (PSCO) over engine-room bilges being pumped directly overboard. Deficiencies have been raised by PSCOs, requiring ships' staff to blank off bilge-pumping overboard discharges.

This is in contravention of SOLAS Chapter II-1, Regulation 21. Rendering the bilge-pumping arrangements inoperative is potentially dangerous and can leave ships unable to tackle flooding or fire efficiently or promptly.

This issue was originally raised with the IMO by IACS. IACS advised IMO of the requirement to comply fully with SOLAS*, as well as with MARPOL Annex I, Regulations 15 and 34, and highlighted the ISM Code requirement that personnel involved with the ship's management have an adequate understanding of the relevant rules, regulations and codes.

*In the event of a flood, or the flooding of a space in the event a fire is extinguished by a water system, a ship would need to utilise the bilge-pumping arrangements to remove water as quickly and efficiently as is possible, regardless of whether it is contaminated oil or not, in order to avoid

compounding the emergency by the detrimental effects of the water on stability and hull stresses.

The IMO agreed with IACS' viewpoint and issued a circular on the matter, the text of which is included below, which may be of some assistance in helping to refute some of the related deficiencies. PSCOs should be fully aware of its contents.

IMO MSC-MEPC.4/Circular 3 of 19 December 2008

Blanking of Bilge Discharge Piping Systems in Port

1. The Maritime Safety Committee and the Marine Environment Protection Committee have become aware of several instances where deficiencies have been raised by port state control officers and other surveyors concerning requiring the ship's crew to blank off bilge-pumping overboard discharges. This practice is in contravention of SOLAS regulation II-1/21, as the bilge-pumping arrangement is rendered inoperative and leads to a potentially dangerous situation where the ship is left unable to efficiently and promptly tackle an emergency situation in case of flooding or fire.
2. The Committees, being concerned about the above situation, request full compliance with the requirements of SOLAS regulation II-1/21 in relation to those bilge-discharge piping systems whose primary purpose is to secure the ship's safety in the event of emergency situations, such as fire or flooding and which, as such, must be available for use at all times.
3. Consequently, the Marine Environment Protection Committee, at its fifty-eighth session (6 to 10 October 2008) and the Maritime Safety Committee, at its eighty-fifth session (26 November to 5 December 2008), approved the issuance of this circular and invited Member Governments to bring its content to the attention of their maritime and port authorities, including port state control officers.

Damage Control Plans and Booklets

To date, the SOLAS Convention has required damage control plans and booklets to be carried on board:

- passenger ships, regardless of size, since at least 1974;
- dry cargo ships over 100 metres in length, constructed on or after 1 February 1992;
- dry cargo ships over 80 metres in length, constructed on or after 1 July 1998; and
- all ships, regardless of length, constructed on or after 1 January 2009.

The text of the current requirement (applicable to all ships constructed on or after 1 January 2009) can be found in SOLAS Chapter II-1, Part B-4, Regulation 19. Further guidance on what the damage control plan and damage control booklet should contain is provided in circular MSC.1/Circ.1245. The previous circular on the subject, MSC/Circ.919, gave similar information for ships which had to provide these documents under the earlier requirements.

Some tankers may have damage control plans as part of their Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP).

If damage stability approval is carried out by Lloyd's Register, then the damage control plan and booklet will also be examined as part of that assessment. It should be noted that the documents will be stamped "examined" only, rather than "approved", as some of the requirements are operational in nature. If damage stability approval is carried out by the Flag Administration, or is not required to be carried out, then it is expected that the Administration will examine the damage control plan and booklet.

Modifications which affect the watertight boundaries or other items given in the plan or booklet should be discussed with the body which is responsible for the damage stability assessment. Such modifications include adding or removing valves from pipelines, moving bulkhead penetrations and adding new pipelines.

GL's POSEIDON Software

POSEIDON is Germanischer Lloyd's computer-based structural design-and-analysis tool for shipyards, design offices, owners and operators. Its user friendly interface, rich features and intuitive processes facilitate the rapid development and analysis of hull structures.

POSEIDON was developed by shipbuilders for ship builders. Its logical, intuitive structure and user-friendly interface can be used by anyone familiar with PCs and ship design. POSEIDON is a great tool for reducing planned maintenance costs and minimising unscheduled structural repairs.

How do you benefit from using POSEIDON? By concentrating on designing, rather than obtuse operating instructions. Obtain the results of the FE analysis early in the design stage. Start saving design hours by getting the POSEIDON advantage for your design office. Improve your life-cycle costs and specify POSEIDON for your newbuildings. POSEIDON improves productivity and lowers costs of structural design. POSEIDON improves ship quality and yard productivity by promoting the optimised distribution and weight of structural material and speeds approval time through electronic transfer and processing. POSEIDON cuts cost of planned maintenance and helps Shipyards and Design Offices to avoid unscheduled repairs.

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- Modelling of complete symmetrical or asymmetrical hull structures to ice class
- Special tools are included for hatch cover assessment

POSEIDON supports GL's Rational Ship Design (RSD) class notation which can help operators to better plan

maintenance. The utilization factors and explicit corrosion margins assist the operator in planning coating and plate renewal strategies. The ship's data file can also be used in association with GL's Emergency Response Service (ERS) to assist operations in coping with casualties. To learn more about this software, visit www.gl-group.com/en/11781.php, and click on "More about POSEIDON" at the right side of the web page.

GENERAL NEWS

Commendation for Work of DSTO and RINA

On 14 August Greg Combet, Minister for Defence Personnel, Materiel and Science, commended the Defence Science and Technology Organisation for its work in support of the Commission of Inquiry into the loss of HMAS *Sydney (II)*. Mr Combet praised the efforts of the Defence Science and Technology Organisation (DSTO) and the Royal Institution of Naval Architects (RINA) whose reconstructive work was crucial in uncovering the circumstances surrounding the loss of the ship.

"Through the Commission of Inquiry's report we now have a better understanding of the circumstances which resulted in Australia's greatest naval tragedy, the loss of HMAS *Sydney* and all 645 crew members," Mr Combet said.

"The expertise of DSTO and RINA was invaluable in assisting the Commission's determination of what happened to *Sydney*."

A key piece of evidence placed before the Commission was a computer-generated simulation produced by DSTO to depict the final hours of the ship.

The simulation, based on extensive scientific computer models, an exhaustive analyses of video imagery and photographs of the wreck site, as well as historical documents and photographs, illustrated the extent of the torpedo and shell damage sustained by the vessel.

"While some World War II vessels survived single torpedo hits or damage from larger-calibre shells, *Sydney* endured sustained attack at close range," Mr Combet said.

"I hope the publishing of this report ends the controversy which has surrounded the loss of the HMAS *Sydney*.

"The relatives of the crew can take some comfort from the comprehensive and dedicated work undertaken to determine the final hours of the tragedy," Mr Combet said.

A copy of the Commission's report can be found on the Defence Internet site at www.defence.gov.au/sydneyii/finalreport and a copy of the DSTO/RINA report can be found at www.defence.gov.au/sydneyii/exhibits as Exhibit 106.

AWD Project Update

In October Greg Combet, Minister for Defence Personnel, Materiel and Science, announced that Australia's $8 billion air-warfare destroyer (AWD) project was progressing well and would commence hull construction in the next few months.

During a visit to Adelaide to inspect the progress of the project, Mr Combet said that work had now begun on fabricating what is known as a 'pilot block' at ASC's shipyard in Adelaide. This followed the successful testing of the steel-plate cutting capabilities of the South Australian company Ferrocut.

The AWDs are being constructed using the block method, with 30 per cent of the blocks being made at ASC in Adelaide and 70 per cent at BAE Systems in Victoria and at Forgacs in NSW.

Similar fabrication of blocks will commence in November at BAE's facilities in Williamstown, Victoria, and in December at the Forgac's facilities in Newcastle, NSW.

"Successful completion of pilot blocks is a key step in the move to full-scale production of the three AWDs and demonstrates that the project is successfully moving from design to the construction phase," Mr Combet said.

Mr Combet also said that Australian companies were continuing to demonstrate their ability to win work on the AWD project. The AWD Alliance has recently signed six contracts worth approximately $18 million with Australian companies for the supply of a wide range of services and equipment for the three air-warfare destroyers.

"Scientific Management Associates has won a contract initially worth $13 million to supply a range of integrated logistic support services to the project. This is crucial work which will ensure that the highly-sophisticated AWDs are well supported to meet the Navy's operational requirements."

Mr Combet said five South Australian companies had also recently won work on the AWD project.

"Ottoway Engineering, based in Adelaide, has won a contract potentially worth up to $3.7 million, and United Fasteners, Priority Engineering Services, Century Products and Whyalla Fabrications have also won work on the AWD project to provide a range of materials and services," he said.

The AWD Alliance has also signed a $12 million contract with Eurotorp for the provision of the torpedo-launch system for the three ships.

The AWD Alliance is made up of the DMO, ASC as the shipbuilder and Raytheon Australia as the Combat System Systems Engineer. The first ship is scheduled for delivery in 2014.

FFG Upgrade Nearly Finished

On 21 September Greg Combet, Minister for Defence Personnel, Materiel and Science announced that the project to upgrade the Adelaide-class Frigates (FFG) is now a step closer to its conclusion with the contractual acceptance of HMAS *Newcastle,* three months ahead of the schedule.

Mr Combet officiated at a ceremony at Garden Island for the contractual acceptance of HMAS *Newcastle*, the fourth and final FFG to undergo the upgrade program.

"The FFG Upgrade program, formally known as Project SEA 1390 Phase 2.1, has been a very complex project involving a high level of sophisticated naval systems integration. The project involved the development of new technology systems and the integration of those systems with legacy FFG equipment," said Mr Combet.

"It is well known that the FFG Upgrade program has been on the Government's project-of-concern list due to the long delays in the delivery of this project. Therefore I am very pleased to see the acceptance of this final frigate."

"The contractual acceptance of HMAS *Newcastle* now means that the Defence Materiel Organisation has determined that the material properties of all of the upgraded ships are in suitable accordance with contracted requirements."

"Given the problems which this project faced in the past, it has taken very good leadership by all parties, including Navy, DMO and Thales and its subcontractors to reach this point. It has also highlighted to me the importance of the work being undertaken in the Government's project-of-concern unit to remediate problematic projects."

"The upgraded FFGs represent a significant advancement in naval capability for the ADF. They also represent Navy's migration path to introduction-into-service of the air-warfare destroyer, introducing area air defence and advanced data-link capabilities with the integration of the Standard Missile 2 and Link-16 capabilities respectively," Mr Combet said.

The contract final acceptance milestone for all deliverables of the FFG Upgrade contract is scheduled for achievement prior to 31 December 2009.

Submarine Design Capability Study

On 3 November Greg Combet, Acting Minister for Defence, announced that a contract had been signed with the United States RAND Corporation to complete a Domestic Design Study for the Future Submarine Project, SEA 1000.

"As outlined in the White Paper, the Government has decided to acquire 12 new submarines, to be assembled in South Australia. This project will be the largest and most complex defence procurement undertaken in Australia's history," said Mr Combet.

"The Domestic Design Study will examine Australia's submarine design capability and capacity. Investigations by the project to date have aimed at developing an understanding of the capability of the international submarine industry.

"The RAND Corporation brings internationally-recognised expertise to the Domestic Design Study, having completed similar studies for both the United States and United Kingdom governments," said Mr Combet.

"The results of the Domestic Design Study will inform project strategy options for consideration by Government during 2010, and is an example of the Government's careful planning for Australia's next generation of submarines," Mr Combet said.

"The Defence Materiel Organisation is undertaking a number of studies to identify and explore all the options to ensure that we have the appropriate design capability to support our submarines throughout their life. The information we collect through this process will help to develop strategic options for the Government's consideration," said Mr Combet.

The report is to be completed by February 2010.

Austal's Hong Kong Passenger Ferry Fleet Complete

In September Austal completed the delivery of fourteen high-speed passenger ferries for Hong Kong's Venetian Marketing Services Limited (VMSL) following the successful, on-schedule delivery of the final four vessels.

Each of the 47.5 m aluminium CotaiJets are now in operation between Hong Kong and Macao, servicing the entertainment, gaming, convention and hotel facilities on The Cotai Strip™.

Combining speed, comfort and outstanding interior finishes, each vessel has the capacity to carry 413 passengers at a speed of 42 kn. Currently performing more than 60 sailings each day, the vessels provide a first-class ferry service along what is now the world's largest route in terms of passenger numbers.

Since construction began in 2007, the speed of the project has demonstrated the advantages of Austal's newly-introduced Advanced Shipbuilding (ASB) design and construction techniques. The Cotai Strip™ vessels represent the most extensive use of these techniques to date.

Austal Director — Global Sales and Marketing, Andrew Bellamy, said that Austal's large facilities, skilled workforce and ongoing improvement in production techniques enables the company to continue to offer short delivery times, even for large projects.

"Increased modular construction and the automation of specific construction tasks across Austal's shipyards worldwide have seen significant improvements in our efficiency and productivity, as demonstrated by this project," Mr Bellamy said.

"Austal prides itself on meeting or exceeding customer requirements and we are very pleased to be able to facilitate the on-time delivery of these vessels," he said.

Passenger facilities befitting a luxury entertainment complex, including Beaurteaux Club and Executive seating with leather finish, are spread across two separate levels and cater for up to 413 passengers. A passenger-friendly seating density is achieved by limiting rows to no more than three seats.

The fourteen CotaiJets are each powered by four MTU 16V4000 M70 diesels producing 2320 kW at 2000 rpm, driving four Kamewa 63 SII waterjets. Each ferry is also fitted with transom-mounted SeaState interceptors providing active high-speed ride control for maximum passenger comfort. The latest four vessels have been further enhanced with the addition of forward-mounted T-foils and aft-mounted, T-Max, an auxiliary steering system proprietary to Austal.

The provision of a regular, reliable, fast, high-quality ferry service has contributed to the popularity of the Venetian Macao entertainment complex, which recorded a 7.1 per cent increase in visits during the second quarter, compared to last year's second quarter.

Completion of the The Cotai Strip™ vessels means Austal has now delivered over 50 vessels into the Pearl River Delta region.

Trials for Austal's Caribbean Patrol Boats

The Trinidad and Tobago Coast Guard (TTCG) has described the speed and manoeuvrability of its Austal-built 30 m patrol boats as "impressive" following sea trials in Western Australia in October.

Ordered in 2008, half of the six-vessel fleet has already commenced a 33-day delivery voyage to Trinidad and Tobago, with the remaining three on schedule for completion at the end of the year.

Each vessel will be armed with general-purpose machine guns, and a 20 mm cannon. They will enable the TTCG to provide sustained surveillance in the country's internal waters, the archipelagic territorial sea and its exclusive economic zone.

Recent sea trials demonstrated the manoeuvrability of the lightweight, all-aluminium vessel, which achieved a maximum speed of more than 40 kn, as well as a small tactical diameter and short crash-stop distance.

Director of Trinidad's Defence Transformation and Integration Secretariat, CDRE Garnet Best, said that the TTCG had been impressed with the performance of the vessels so far.

"Our first impressions of the vessel were excellent, with the boat manoeuvring well and the speed right up over 40 knots," CDRE Best said.

"We were also impressed with the low noise levels inside the vessel, given that many similar vessels can be quite noisy. These vessels will be the first of their size in the Trinidad and Tobago Coast Guard with waterjets and, as far as I have seen, the technology is very good."

Austal was awarded the contract following a competitive international tender process. Austal is also providing crew training and five years of scheduled and unscheduled maintenance services in Trinidad and Tobago under the contract.

Unloading one of the last four Austal ferries for Hong Kong's Venetian Marketing Services Limited
(Photo courtesy Austal Ships)

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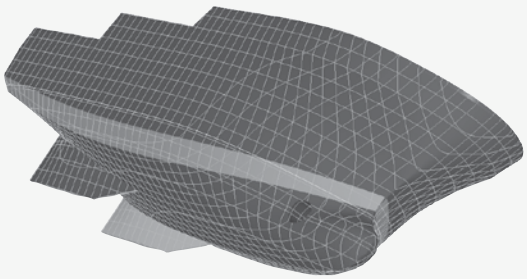

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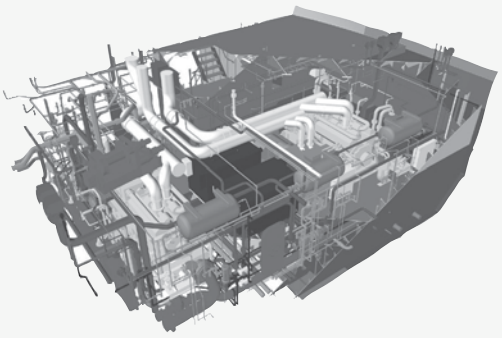

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CDRE Best said that Austal was selected because "they offered the best overall package" and were able to meet the required delivery schedule.

"The best thing about working with Austal is that they are ahead of schedule."

"We have established a very good relationship with Austal, who have provided clear, on-time reporting throughout the project so far."

The first three vessels — TTS *Scarlet Ibis*, TTS *Hibiscus* and TTS *Hummingbird* — departed Austal last month and are likely to be available for the 2009 Commonwealth Heads of Government Meeting (CHOGM), held in Trinidad and Tobago in November.

According to CDRE Best, the vessels would be used to create a security blanket around the waters of Trinidad and Tobago. "We are confident that the speed of the vessels will contribute to their effectiveness in the interdiction of illegal drugs."

"These vessels have been very well designed to perform numerous roles, including the interdiction of illegal drugs, customs and immigration border control, fire services and prisoner transport, protection of our marine environment as well as protection of our oil and gas resources."

Patrol Boat Upgrade Completed

The latest in a series of Australian-sponsored Pacific Patrol Boat refits has been completed and the refurbished vessel was handed-back to the Federated States of Micronesia at a ceremony on 6 November at the Rosshaven Marine Shipyard in Townsville.

Representing the Department of Defence, the Acting Director General of Pacific and East Timor Branch, Mr David Hallett, handed over the newly-refitted patrol boat FSS *Micronesia* to the Secretary of Justice of the Federated States of Micronesia, the Honourable Mr Maketo Robert.

The handover ceremony included an opening prayer and blessing of the ship, a parade by the ship's crew and the signing of an official Certificate of Completion by the General Manager of Rosshaven Marine, Mr Christopher Helps, David Hallett and the Honourable Mr Maketo Robert.

Under Australia's Defence Cooperation Program — sponsored and funded by Defence's International Policy Division — 22 Pacific Patrol Boats (PPB) were built and given to 12 Pacific nations between 1987 and 1997. The 31.5 m PPBs are built to a commercial standard and are used by Pacific nations for maritime surveillance and response, in particular fisheries patrols.

Each PPB will undergo a six-month life-extension refit which will see the repair and refurbishment of key systems to allow a further 15 years operation, bringing the total operational life of the boats to 30 years.

The refit program includes repairs to aging hulls and superstructures, structural modifications to improve and strengthen the hulls, improvements in refrigeration and air conditioning systems, engine, generator and gearbox overhauls and installation of advanced navigation systems.

Since 2003, thirteen PPBs have completed life-extension refits in North Queensland.

The Federated States of Micronesia has three PPBs — *Palikir*, *Micronesia* and *Independence*. Patrol boat *Palikir* completed her refit in 2007. A refit of *Independence* is anticipated in 2011.

Keel of LHD 01 Laid in Spain

On 24 September Greg Combet, Minister for Defence Personnel, Materiel and Science, announced that the official keel laying of Australia's first Amphibious Ship LHD 01 had taken place at Navantia's shipbuilding yard in Ferrol, Spain.

"Under Project JP2048 Phase 4A/B the Commonwealth is acquiring two new Landing Helicopter Dock (LHD) amphibious ships to provide sustainment support for our deployed forces," said Mr Combet.

BAE Systems Australia Defence is the prime contractor for this $3.3 billion project. The Spanish shipbuilder, Navantia, is subcontracted to BAE as the design authority and is required to construct and fit out the hulls of the two Amphibious Ships for the Australian Defence Force.

"The project is on schedule with the ceremony for the keel laying of the hull for LHD 01 occurring exactly one year to the day from first steel being cut. I am also advised that the whole-of-ship design reviews are nearing completion," said Mr Combet.

"After completion of the hulls for the Amphibious Ships they will be transported to Australia. The superstructures will then be constructed, fitted out and integrated with the hulls at BAE Systems' Williamstown dockyard."

"The combat system is to be provided by Saab Systems Australia, which will also integrate the combat management system; and the communications system will be supplied by L3 Communications."

The next major milestone will be the launch of LHD 01 in Spain in March 2011 and then her arrival at Williamstown dockyard in 2012 with LHD 02 arriving in 2014.

"As outlined in the Government's White Paper, these ships will be able to carry a substantial quantity of equipment, stores and personnel. In terms of humanitarian assistance and disaster-relief operations, they will most likely be the best means available to provide assistance in our region," said Mr Combet.

The first module for LHD 01 being placed on the slipway at Ferrol in Spain
(Photo courtesy Navantia)

The shape of ships to come — Spain's *Juan Carlos I* proceeding to sea for trials recently. The ship is the prototype for the RAN's new amphibious ships. The size of the ships is sure to raise the odd eyebrow when the first hull arrives in Australia in 2012
(Photo courtesy Navantia)

LCS 2 Completes Builder's Trials

LCS2 *Independence*, the innovative high-speed trimaran combatant ship being constructed by Austal USA in Mobile, Alabama, as part of the General Dynamics Littoral Combat Ship Team, successfully completed builder's trials on 18 October in the Gulf of Mexico. The trials included more than 50 serials which rigorously tested the ship and all of her systems in preparation for final inspection by the Navy before delivery. Notable achievements during the trials included reaching a sustained speed of 44 kn during the required four-hour full-power trial, with a top speed in excess of 45 kn.

Many of the trials were conducted in high sea-state and wind conditions (2.4 m waves and winds in excess of 25 kn). Despite the weather, the ship repeatedly reached speeds of over 45 kn with propulsion and ride-control systems operating in full automatic mode, proving the effectiveness of the control systems and the highly-efficient and stable characteristics of the trimaran hull form.

A series of high-speed ahead and astern maneuvers in these sea-state conditions proved the effectiveness of the ship's four steerable waterjets. During the repeated high-speed turns the ship demonstrated excellent agility and stability characteristics. The ship's flight deck remained stable despite sea state conditions and manoeuvers.

The ship's open-architecture computing infrastructure (called Open CI), a highly-flexible information technology backbone which integrates the ship's combat, damage control, engineering control, mission package and other onboard computing functions, also proved its effectiveness during the trials. The Open CI 'any display, anywhere' capability was extremely valuable in enabling the LCS 2 crew to electronically reconfigure the bridge area and, at long range, the Core Mission System successfully detected, engaged and eliminated a simulated cruise missile attack by a small, fast-moving jet aircraft. In addition, the LCS 2 crew was able to access detailed performance and operation data from the bridge while the ship was operating, thereby providing them with real-time insight as to how the ship systems were performing.

General Dynamics Bath Iron Works is the prime contractor for the General Dynamics Littoral Combat Ship Team. Partners include shipbuilder Austal USA (Mobile, AL); General Dynamics Advanced Information Systems (Fairfax, VA); BAE Systems (Rockville, MD); L3 Communications Marine Systems (Leesburg, VA); Maritime Applied Physics Corporation (Baltimore, MD); and Northrop Grumman Electronic Systems (Baltimore, MD).

Queensland Industry News

Recently the Gold Coast played host to a workshop aimed at builders regarding compliance with the Australian Builders Plate (ABP). Presented by Marine Safety Queensland, the workshop was planned to educate builders on how they can meet compliance with the ABP requirements. The night consisted of presentations given by Werner Bundschuh (Director, MSQ), Tommy Ericson (Senior Naval Architect, MSQ), Paul Hayes (Department of Fair Trading) and Chris Hutchings (Oceanic Yacht Design). It is hoped that further workshops and information sessions can be planned in the near future to further promote safety in the boating community.

In the local boatbuilding sector, where most companies seem

to be either down-sizing or trying to keep their heads above water, it is the small-boat manufacturers who seem to be going from strength to strength. Tournament Pleasure Boats who are based at Yatala are one such company experiencing considerable growth and demand for their products. Offering a wide rang of trailable sports cruisers, day cruisers and fishing boats from 4.8 m up to 7.9 m, the company is very busy satisfying strong local and international demand with boats being exported as far away as Noumea. Another local manufacturer, Blue Fin Boats, who build quality alloy tinnies, have also been able to tap into the lucrative export market. There is also strong local demand for their proven vessels and, with a range of over 50 tinnies ranging in lengths up to 5.35 m, there is plenty of choice for the consumer.

Local design company Oceanic Yacht Design has recently completed sea trials of its new 17 m power catamaran with pleasing results. The semi-swath-hull catamaran achieved 21 kn at full load with a cruise speed of 17 kn. Designed as a luxury dive-charter vessel, the structure was built to Lloyds Special Service Craft Rules and in compliance with USL Code Class 2B. Other projects underway include preliminary designs for a 14 m fast patrol craft and an 80 m trimaran cargo and passenger vessel.

Chris Hutchings

Austal's Maltese Patrol Boats Launched

The first two of four 21.2 m aluminium patrol boats for the Armed Forces of Malta (AFM) were launched at Austal's Western Australian facilities in October — less than seven months from initial contract signing and the four-vessel fleet is on schedule for delivery in November.

With a speed of more than 26 kn, the vessels are designed to assist the AFM with surveillance and border protection throughout Malta's coastal waters. Each vessel will be equipped with a 12.7 mm gun, as well as two 7.62 mm light machine guns on the aft fly-bridge deck.

The vessels also boast fire-fighting capability via a fire monitor on the aft fly-bridge deck, while a radio direction finder capable of tracking emergency frequencies allows the vessels to perform search-and-rescue operations.

Austal Business Development Manager — Defence, Jamie Robinson, said that the 21.2 m boat was capable of performing a number of different roles.

"One of the standout characteristics of these vessels is their versatility, particularly considering the size of the vessel," Mr Robinson said.

One of the recently-launched patrol boats for the Armed Forces of Malta
(Photo courtesy Austal Ships)

"Customers are increasingly attracted to vessels which meet multiple requirements, avoiding the need for dedicated craft for each role. This combines with a growing need for fast delivery times which, in this case, will be just nine months from initial contract signing," he said.

Adding to the vessel's versatility is a bilge manifold located above the main aft deck, which can perform salvage pumping of another vessel if needed. A stern launching ramp allows the safe deployment and retrieval of a rigid-hull inflatable boat, and dive operations are also supported via low-to-the-water platforms located aft.

Principal particulars

Length OA	21.2 m
Length WL	17.8 m
Beam mld	5.5 m
Depth mld	2.8 m
Hull draft (max.)	1.83 m
Crew	8
Maximum dwt	6 t
Fuel	5000 L
Main engines	2 × MAN D2842 LE410 each 809 kW at 2100 rpm
Gearboxes	2 × ZF 3000 A
Propulsion	2 × fixed pitch propellers
Speed	Over 26 kn
Classification	DNV ✠1A1 HSLC R2 Patrol

Austal Order for Four Ferries

In its third significant commercial order for the year, Austal will design and construct four 41 m high-speed passenger catamaran ferries for the Republic of Trinidad and Tobago. Designed to carry 405 passengers at a speed of approximately 37 kn, the aluminium vessels are intended to help reduce road congestion in Trinidad and Tobago by establishing a water-taxi service between San Fernando and Port of Spain in southwest Trinidad.

The water-taxi service is part of the Trinidad and Tobago Government's "Vision 2020" strategy plan, which aims for an efficient, integrated, multi-modal public transport system. When fully operational the water-taxi service is expected to facilitate the transport of approximately 8000 to 12 000 passengers in a normal working day and will be integrated with other transport systems.

Construction of the four ferries will be shared across Austal's Tasmanian and Western Australian shipyards, with delivery scheduled for late 2010. Included in the contract is a maintenance and training package which will see Austal deliver crew familiarisation and planned-maintenance management.

Austal's design is based on its 41 m catamaran, two of which have been successfully operating in Norway with leading operator OVDS since 2003.

With a combined capacity of 1620 passengers, the four Austal high-speed catamarans will reduce travel times between North and South Trinidad by almost two thirds. The reduction in the number of cars on the road will also deliver environmental benefits, including reduced vehicle exhaust and noise emissions, and reduces the need to maintain and expand major roads and highways.

Passenger seating onboard each vessel is split over two levels, with the main passenger deck featuring four passenger entry points, a central kiosk and dedicated baggage compartment and bike racks. The vessels will be powered by four MTU 16V2000 M72 engines driving KaMeWa waterjets and will be fitted with Austal ride control to ensure passenger comfort.

As well as performing an important water-taxi service, the ferries will provide emergency backup for the existing inter-island service between Trinidad and Tobago. To meet this secondary function, Austal configured all four vessels with the capability to retrofit a forward-mounted T-foil ride-control system at short notice, allowing the vessels to operate in open, unprotected seas.

Principal Particulars

Length OA	41.2 m
Length WL	38.2 m
Beam mld (hull)	10.9 m
Depth mld	4.3m
Hull Draft	up to 2.0 m with ride control fitted
Passengers	405
Crew	8
Fuel	7500 L
Engines	4 × MTU 16V2000 M72
Gearboxes	4 × Reintjes VLJ730 HL/HR
Waterjets	4 × Kamewa 56A3
Service speed	approx 37 kn
Classification	DNV ✠1A1 HSLC Passenger R2 EO Passenger A

An impression of the 41 m passenger catamarans to be built by Austal for Trinidad and Tobago
(Image courtesy Austal Ships)

Camera Cat 4 from Stuart Friezer Marine

Stuart Friezer Marine has designed an 11 m catamaran which was recently delivered to owner Scott Ramsden. The design objectives included:

- handling rough sea conditions safely at speed;
- achieving a comfortable ride in all but the roughest of sea conditions;
- being extremely economical at cruising speeds;
- minimising environmental damage—a smaller vessel of minimal displacement will significantly reduce the wash, and this was doubly important as the prototype needed to get in close to racing yachts without disturbing them; and
- being lighter, simpler and more efficient so that the vessel uses less fuel and produces fewer emissions.

Most catamarans of this size have fat planing hulls and ride just as harshly as equivalent monohulls. A narrow-hulled catamaran has the ability to smooth out the waves, reducing the accelerations experienced by the crew. In larger waves when much of the boat comes out of the water, the narrow hulls land softly and can therefore continue comfortably at higher speeds.

Previous narrow-hulled catamarans have two major handling problems: firstly, in a following sea, one hull digs deep into the next wave crest and broaching occurs and, secondly, during turns they heel outboard, lose freeboard, are unstable and not safe.

SFM's semi-planing catamaran designs and planing sailing dinghies are both very efficient hullforms in their fields. Features in the hull developing dynamic lift are even more important for these higher speeds. SFM was very keen on maintaining some rocker in the new design as this greatly improves efficiency at cruising speeds and helps the hull ride smoothly through the waves and helps with soft landings.

The prototype *Camera Cat 4* was launched in July 2009. It was immediately apparent that the boat was very stable and, even at rest, waves rolled past without much effect. She was fitted with two 250 hp (186 kW) Yamaha four-stroke outboards which fitted neatly to the transoms.

In engine trials in the flat water of Southport, Qld, she achieved 35 kn with super-smooth ride at all speeds. She was then taken offshore into a messy 2 m sea, typical off Southport. She achieved 32 kn going straight into the waves and landed very softly after each airborne event.

In august she had media duties to fulfil during Hamilton Island's Race Week. It was a light and calm regatta and, over four days, she used only 12 L of fuel. This was quite remarkable, given that the owner's previous boat was using 100 L per day last year. She also made significantly less wash than previous vessels, enabling her to get in closer to the action on the racing yachts.

SFM's catamaran designs have been developed to eliminate bow broaching and, in doing so, give great comfort and confidence to the skippers. *Camera Cat 4* has exceeded expectations for steering and handling. Owner Scott Ramsden is now upgrading the steering hydraulics so he can push even harder into turns.

Recently Scott had the opportunity to test the boat in 30 kn winds and 3 m seas on Moreton Bay. This area is very shallow, so the waves are particularly nasty. The boat once again exceeded expectations and was able to handle these seas at any angle. Scott was so confident that he let go of the controls at full speed with the waves astern. He let the boat bury her bows and work her way through the next wave crest without any need for course adjustment.

The new design features which are intended to improve handling have all worked exceptionally well, and SFM is looking forward to using them on lots of other new designs.

The high-speed turning trial also proved successful in these nasty sea conditions.

This design represents a breakthrough in small catamaran design. The smooth, safe ride at high speeds, combined with excellent fuel economy are second-to-none. It is ideal for all

coastal applications, like pleasure/thrill boats, coast guard and rescue. The low accelerations in rough weather will have a positive effect on crew fatigue and comfort.

Principal particulars of *Camera Cat 4* are

Length OA	11.76 m (ex sponsons)
Length WL	11.12 m
Beam moulded	3.32 m (ex sponsons)
Demihull spacing	1.24 m
Draft	0.85 m
Passengers	18
Crew	2
Fuel	2×300 L
Fresh water	100 L
Lightship	4 t
Propulsion	2×250 hp (186 kW) Yamaha outboards
Speed	25 kn
Construction	Aluminium
Survey	Queensland DoT Class 1E/2C

Stuart Friezer

Camera Cat 4 on trials
(Photo courtesy Stuart Friezer Marine)

Camera Cat 4 turning at speed
(Photo courtesy Stuart Friezer Marine)

Motoryacht H_2OME Uses Australian Waterjets

Doen Pacific in Melbourne has recently completed trials on its largest waterjet built to date, previously featured in the May 2008 issue of *The ANA*. This project is the result of an on-going collaboration between the designer and the owner, with Doen having supplied jets for previous projects. The 44 m aluminium motor yacht is powered by two wing

Motoryacht *H_2OME*
(Photo courtesy Greg Cox)

Doen waterjets on *H_2OME*
(Photo courtesy Greg Cox)

diesels and a centre gas turbine. The axial-flow wing jets are sized to allow full power to be applied at cruising speed without risk of cavitation or loss of efficiency. The centre booster jet is fitted with a booster cap to close off the jet nozzle when not in use, reducing the hull drag. The cap hydraulics are controlled by the gas turbine control system.

All three jet units are fabricated from stainless steel aft of the transom, with Doen supplying complete weld-in aluminium ducts forward of the transom. The ducts are supplied complete with pre-machined stern tubes.

The vessel has three controls stations, one with an "eDock" system which has proven to work very well on this size of vessel. This works as a stand-alone station and communicates directly with Doen's CAN-BUS to coordinate control of steering, reversing, engine throttles and bow thruster. The joystick unit moves in two axes, with a twist-knob top providing yaw control/correction.

Principal particulars of *H_2OME* are

Length OA	44 m
Beam	8 m
Displacement	200 t at full load
Engines	2×Caterpillar C32 ACERT each 1342 kW
	1×Vericor TF50 gas turbine rated 3220 kW
Gearboxes	2×ZF 2609

	1×ZF 17465
Jets	2×Doen DJ290 736 mm axial flow 1×Doen DJ350B 889 mm axial flow, booster
Speed	Up to 20 kn on wing engines Up to 37 kn on all engines
Designer	Navirex SRL
Builder	MMGI Shipyard, Monfalcone, Italy

Greg Cox

Vessels in Eden in early September
(Photo courtesy Robert Whiter)

Eden Busy

The port of Eden was busy in early September, with many comings and goings keeping harbourmaster Josephine Clark on her toes. Berthed at the chipmill is the bulk carrier *Opera White*, loading hardwood chips for quality paper manufacture in Japan. Berthed at the Navy/Multi-purpose Wharf is *Ken Ann Maru*, loading pine logs from the Monaro for export to China. Berthed at the breakwater wharf is *Ren Etive*, a rig tender with an undersea vehicle on board. Under way is *Crystal Ocean*, a tender/tanker which heats crude oil and pumps it ashore or into another vessel.

Cruising

After the winter quiet, with only *Pacific Dawn* working out of Sydney, the summer season got under way in October with additional visits to Sydney by *Dawn Princess*, *Rhapsody of the Seas*, *Sun Princess*, *Star Princess* and *Amsterdam*. November moved into a higher gear, with visits by these vessels plus *Seven Seas Mariner* and *Orion*. Vessels berthing regularly at the Overseas Passenger Terminal at Circular Quay is a sure sign that the summer cruise season is under way.

Phil Helmore

l'Hydroptère Achieves Outright World Speed Sailing Record

On Friday 4 September 2009, in Hyères harbour in France, *l'Hydroptère* became the fastest sailing boat on the planet over both 500 m and one nautical mile. *l'Hydroptere* achieved the outright speed sailing record (across all categories) when she surpassed the 50.57 kn record held by Alexandre Caizergues for the 500 m distance while at the same time the team increased their own outright speed record over one nautical mile.

Alain Thébault and his crew of ten achieved the double record of 51.36 kn over 500 m and 48.74 kn over one nautical mile. The previous speed records held by *l'Hydroptere* were 46.88 kn over 500 m (a record for D-Class with sail area greater than 27.88 m^2) and 43.09 kn over one nautical mile (which was the previous outright record for that distance).

These speeds were achieved with an established westerly wind of about 25 kn gusting to 28 kn with relatively flat seas. The record runs came after a day of steadily improving results, as is evident from the running reports in the 'News in Brief' section of the team website. On occasions during these speed runs, top speeds of up to 55.7 kn (103 km/h) were logged on the on-board GPS unit. The double record was achieved during the 8th and last run for the day.

For the record run, Alain Thébault and his crew composed of Anders Bringdal, Jean-Mathieu Bourgeon, François Cazala, Damien Colegrave, Stéphane Dyen, Matt Hodgson, Jérémie Lagarrigue, Pierre Trémouille, Gérard Navarin and Jacques Vincent were on board.

After the result, Alain Thébault remarked "Today the crew was just majestic for this fantastic record, the true representation of a collective work, from an "hydropterian" team very close and determined. The accelerations at over 100 km/h create intense sensations on board that we have never experienced before". Acknowledging the design effort put into *l'Hydroptere*,

l'Hydroptere speed sailing, La Seyne sur Mer, France
(www.hydroptere.com).

A port quarter view of *l'Hydroptere* at speed
(www.hydroptere.com).

he added: "We should not forget that this record is, above all, a technological adventure and a team work which would not have been possible without the support of our partners". Also recognising the sponsorship support for the project, he stated "It is mainly thanks to my partnership with Thierry Lombard, managing partner of the private banking house in Geneva (the foundation year "1796" is mentioned on the mainsail), that *l'Hydroptère* has had the support of a "principal partner" since 2005 and that we started the quest for these records and we could beat them."

Thierry Lombard is also at the origin of the partnership of the *l'Hydroptere* team with the Swiss Federal Institute of Technology in Lausanne (EPFL). The Swiss institute has brought its support in such matters as aerodynamics, composite materials, structural behaviour and video-imaging. The EPFL has put the knowledge of its professors and students, its creativity and calculation power at the flying trimaran's disposal.

The team continued their record campaign at La Seyne sur Mer until 7 October, the end of the period allowed by the WSSRC, in an effort to achieve an even greater speeds if appropriate weather conditions were obtained during this time.

Following the success of the team in achieving records over these shorter distances, with the support of engineers from the aeronautics industry working on a purely voluntary basis, Alain Thébault's is already dreaming of new projects. He sees the next challenge for the boat, re-configured as before for open-seas sailing, being to take on long distance records. Thus *l'Hydroptère* is the only sailing boat-capable of beating the absolute sailing speed record while also being capable of sailing in open seas.

Martin Grimm
(Edited from reports on: www.hydroptere.com)

Composite Superstructure and Deck for 24 m Ferry for Bay Island Transit System

Stewart Schloss
SSM Boatbuilding

The Bay Island Transit System project started after Roy Whitewood from Aluminium Boats Australia (ABA) asked if a composite superstructure would be lighter than an aluminium one, based on his current design of a 24 m ferry. My answer to Roy was Yes! Not only would it be lighter, but a foam-sandwich structure would improve both acoustic and thermal values, saving extra cost in fit out and adding to passenger comfort. I also pointed out that, aesthetically, a composite superstructure would look cleaner than an aluminium one. As there is no corrosion on a composite structure, that would mean less maintenance and an extended life span for the ferry.

With all these things in mind, I set out with a budget to build a superstructure which was constructed fully of a foam-sandwich compound. The deck, also part of the superstructure, was to sit on top of aluminium demi-hulls.

Being experienced in epoxy boatbuilding, I priced the project using a method of flat panels which were stitched together. Using structural core and e-glass laminates, the custom-built panels would be wet bagged together over female moulds. After providing the original cost for the project using this method, ABA advised me that there would be multiple superstructures to be built. I had heard of the resin-infusion method and so, at this point, I decided to enlist the help of naval architect Stuart Friezer, and we were able to improve the design and construction time on paper by using the infusion method.

With that in mind I enrolled in the DIAB training course. The training course was extremely helpful in providing the key elements in the infusion method, and gave me the confidence and ability to take it back to the workshop and implement it. I was able to make the product and material changes which made the building time and budget suitable for this project (12weeks).

The superstructure consists of four moulded parts:

1. Deck mould with camber — 120 m^2
2. Roof mould with camber — 120 m^2
3. Cabin mould complete with window cut-outs and mullions — DIAB supplied kit
4. Structural roof girder — 19.4 m section

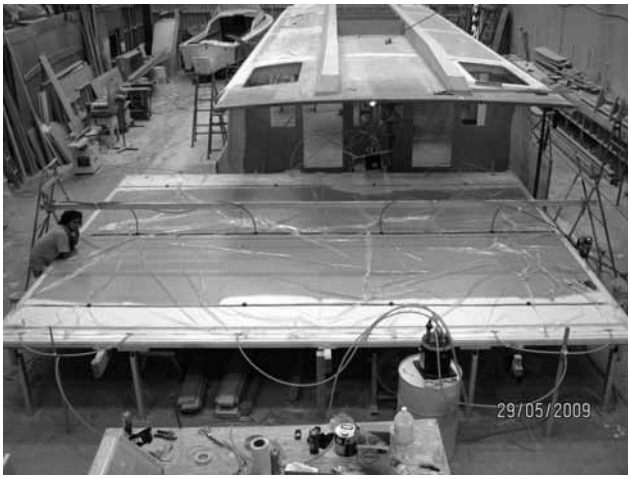
Each module was constructed using the resin infusion method. I used a vinylester resin, H80 foam core (GPC1), and a combined laminate of e-glass and carbon (engineered by the crew at DIAB). Pre-cut kits and grooved core material made tailoring easy. It was a simple job to pre-form the multiple parts in quick succession, which worked like a production line, saving a large amount of time and labour. All the parts were moulded with joining flanges.

Using the resin-infusion method at SSM Boatbuilding allowed us to use a small crew of four employees to build the superstructure, which reduced labour costs by 40%. There was far less material waste and less material handling of products. The end product has a good high glass-to-resin ratio with *no* air voids. Having the parts come off a mould surface meant that assembly was easy. Each part was set on a jig and secondary bonded. After a light fairing on the joints and sanding the superstructure, it was ready for painting. The use of corrosion-inhibiting paint was not required, so a step in the usual painting process was eliminated, saving time and material cost on the project.

Bonding the superstructure to the hull was an easy process. First, the composite deck was bolted to the aluminium hull, and then perimeter bars were laid around for the superstructure to fix between.

Overall, the project was very successful. We had an excellent product to hand over to ABA, which met and exceeded

their expectations. More importantly, the resin-infusion process saved on my labour and material costs, with little or no disposable waste of resin and consumables. Implementing the resin-infusion method in the workshop had initial setup costs; however, it has provided an improved workshop environment which is safer and more efficient. In my opinion it is the future of building large, strong, light-weight structures.



Vacuum infusion of an accommodation deck part with infused parts set on a jig in the background (Photo courtesy SSM Boatbuilding)

Assembly and fairing of the composite superstructure (Photo courtesy SSM Boatbuilding)

Painted composite superstructure ready to be bonded to the aluminium hull (Photo courtesy SSM Boatbuilding)

Finished ferry in service (Photo courtesy SSM Boatbuilding)

Progress with Austal's new 102 m trimaran under construction in Western Australia (Photo courtesy Austal Ships)

THE PROFESSION

Leisure Craft Standard for Public Comment

The National Marine Safety Committee (NMSC) has released for public comment a draft standard to replace the USL Code's Section 18 on Hire and Drive vessels. Responding to the wider variety of hire-and-drive-type activities now available, the new National Standard for Commercial Vessels (NSCV) Part F, Section 2—Leisure Craft aims to provide more user-friendly requirements tailored to specific types of activities.

NMSC's Standards Team Leader, John Henry, said that the draft standard covers a wide range of modern operations, from unpowered off-the-beach craft through to houseboats, PWCs (jet skis) and bareboat yachts.

"National data shows that most incidents involving these craft are the result of driver error, so the emphasis is on safety management and the provision of an adequate briefing, especially for inexperienced and unlicensed hirers," Mr Henry said. "With the approach of summer and the peak tourist season, many of these operations and activities increase, so it is an apt time for stakeholders to be thinking about what safety requirements should be applied through this new standard".

The new standard considers those 'share' boats that fall within the definition of commercial vessels—and there are annexes on recognition of conformity assessment under the European Union system and on sewage holding systems. The draft standard modifies other parts of the NSCV to cater for the specific risks and management approaches used with leisure craft.

"Overall, the new standard allows a more flexible approach to the range of operations without compromising safety for operators and the general public," Mr Henry added.

Stakeholders are invited to attend a consultative workshop in their State. Details and the registration form are available on the NMSC website www.nmsc.gov.au; click on Have your Say, and then the link to Registration under Leisure Craft (currently the information box at the top of the list).

Copies of the document may be obtained by phoning the NMSC Secretariat on (02) 9247 2124 or downloaded from www.nmsc.gov.au (click on Have Your Say). The comment period closes on 16 December 2009, so get your copy today and comment!

For further information, contact Communications Officer, Rosemary Pryor, on (02) 9247 2124 or email rgpryor@nmsc.gov.au.

Port State Control — Concentrated Inspection Campaign

The Paris and Tokyo MoUs' concentrated inspection campaign (CIC), began on 1 September 2009. At the time, a press release advised that a questionnaire listing items to be covered by the CIC would be published. This is now available for download from

www.tokyo-mou.org/Lifeboat CIC questionnaire.pdf, or from

www.parismou.org/ParisMoU/Organisation/Publications/CIC/default.aspx

As previously advised, it is expected that other Port State Control (PSC) MoUs may also join this CIC or carry out a similar exercise.

An extract from the original press release is included here as a reminder:

"In practice the concentrated inspection campaign will mean that during every PSC inspection within the Paris and Tokyo MoU regions, the lifeboat-launching arrangements, maintenance records and other applicable documentation shall be verified in more detail for compliance with SOLAS Chapter III.

Port State Control Officers (PSCOs) shall use a list of 20 selected items to verify critical areas for the safety of lifeboat-launching arrangements, some of which are related to documentation, equipment and familiarisation.

When deficiencies are found, actions by the Port State may vary from recording a deficiency and instructing the master to rectify within a certain period, to detention of the ship until deficiencies have been rectified. In the case of detention, publication in the monthly list of detentions available on the Paris MoU and Tokyo MoU web pages will take place.

It is expected that the Paris MoU and Tokyo MoU will carry out approximately 10,000 inspections during the CIC. The results of the campaign will be analysed and findings will be presented to the governing bodies of the MoUs for submission to the IMO."

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.

EDUCATION NEWS

Australian Maritime College

AMC Bachelor of Engineering Activities Day 2009

In one of the biggest days on AMC's maritime engineering calendar, a full program of unique, challenging and slightly bizarre events took place on Friday 25 September. The objectives of the day were to give students the opportunity to use their engineering knowledge and skills in fun projects and to use the competitions as a real-life disciplinary project management exercise.

The day started with the annual Rat Trap Boat Race which forms part of an assessment for dynamics, a first-year unit taught by Dr Christopher Chin. The main objective of this activity is to give students the opportunity to use their engineering knowledge and skills to design and build a model boat powered by a rat trap and race it over a specified course. This annual event serves as a real-life disciplinary project-management exercise and is co-organised by Roberto Ojeda.

The winning team included Benjamin Corden-McKinley, Riley Graham, Alexis Rodriguez, Ashley Weir and Leonard Kerslake, whose boat travelled the prescribed 10 m distance in 18.12 sec. This means that the current record of 14.53 s still stands for another year.

The second event was the Pasta Bridge Competition with 2nd (Division I) and 3rd (Division II) year maritime engineering students vying for the title of strongest bridge made from dried pasta (one-kilogram total mass and 1 m span).

Division I bridges, built as an assessed component of AMC's Mechanics of Solids unit, aimed to beat last year's winner which supported 26.264 kg. The results were impressive — four teams managed to improve on last year's record. The winning team's bridge, the Dolmio Gorge Conqueror, was able to hold a record breaking weight of 74.7 kg!

Division II bridges, built as an assessed component in AMC's Finite Element Analysis unit, aimed to calculate a safe working load and a ultimate load of pasta bridges. The winning team's bridge, the Twin Towers, predicted the ultimate load with an impressive 90% accuracy!

Event organisers, AMC engineering lecturers Christopher Chin and Roberto Ojeda, said that, while the events had an element of fun, there are important aspects to the day. "These events are about project management and really putting their engineering knowledge to a very real test. It was a lot of fun but it also required some clever thinking and hard work to win on the day."

The final formal activities of the day ended with a series of presentations by final-year naval architecture students on progress with their design projects in the unit Ocean Vehicle Design, working in teams to a specification supplied by an industry 'client'. In September four teams presented their designs to an audience of staff, students and industry experts.

The designs and their industry 'clients' were:

- Patrol boat — Austal Ships
- Pacific Island trader — BMT
- Harbour tug — BAE Systems
- 24 m cruising yacht— Warwick Yacht Design

The marking panel comprised Belinda Tayler from BMT Design and Technology, David Hooper from BAE Systems and Fred Barrett from Fred Barrett Yacht Design. The team judged to have produced the best oral presentation comprised Rowan Frost, Rob Thompson and Samual Wilson-Haffenden.

Engineering staff and students from all years then enjoyed themselves at a barbeque and party held at the AMC Seafarers Bar.

The winning pasta bridge design
(Photo courtesy AMC)

Final Year Research Project Mini-conference at AMC

Twenty one final-year students from the naval architecture, ocean engineering, and the marine and offshore systems courses at AMC presented the results and outcomes from their year-long research projects on 23 October. Many of these projects were supported by industry and/or DSTO, resulting in some very useful and relevant results.

Assessment was carried out by Andrew Tynan and Leo de Yong, from DSTO, Paul Duncan from Worley Parsons, Sam Abbott from Austal Ships and Ed Dawson from BMT. AMC is very grateful to them for giving up their time to do this, and to support the final year students in this way.

As usual, the standard of presentations was very high, and the work reported extremely interesting, with topics ranging from those involving advanced CFD to a study of offshore renewable-energy systems. There was a number of traditional naval architecture topics, as well as a range of those applicable to the oil and gas industry. It is good to note that a quite a few of these students, together with their supervisors, will also be presenting papers at the Pacific 2010 IMC on their work.

The presentations were followed by the traditional dinner in a restaurant in town, where students and staff were able to relax with the external assessors.

For more information, contact Prof. Martin Renilson at AMC on m.renilson@amc.edu.au.

AMC final-year BE students following the mini-conference
(Photo courtesy AMC)

AMC Engineering Students Tour HMAS *Newcastle*

On 12 September 2009, engineering students from the National Centre for Maritime Engineering and Hydrodynamics were invited to tour HMAS *Newcastle* in Hobart.

HMAS *Newcastle* is one of four Adelaide-class guided-missile frigates (FFG) in service with the Royal Australian Navy. *Newcastle* is a long-range escort vessel, capable of air defence, surface and undersea warfare, surveillance, reconnaissance and interdiction. The ship can counter simultaneous threats from aircraft, surface vessels and submarines. In recent years *Newcastle* has deployed in support of peacekeeping operations in East Timor and Solomon Islands, and Operation Catalyst in the Persian Gulf.

Lieutenant David Eyles RAN, Officer-of-the-Watch, Petty Officer Marine Technician Fraiser Morley, and Leading Seaman Marine Technician Nathan Cook showed the AMC students through the main engine room, looking at the gas turbines which power *Newcastle* and other sophisticated systems including the bridge. They were also given detailed explanations of the frigate's highly-manoeuvrable two forward-mounted retractable auxiliary propulsion units which provide excellent maneuvrability in confined waters.

Also, on 9 September, a lucky number of AMC students had the rare opportunity to experience an overnight voyage from Port Arthur to Hobart in HMAS *Newcastle*, getting hands-on experience of sophisticated systems designed for area air defence, anti-submarine warfare, surveillance and more, while the ship was underway.

These activities would not have been possible without the cooperation and involvement of all the staff on board HMAS *Newcastle*.

Irene Penesis

AMC engineering students and HMAS *Newcastle* in Hobart
(Photo courtesy AMC)

Explaining ship control intricacies in HMAS *Newcastle*
(Photo courtesy AMC)

Cavitation Research Laboratory Opening

On 1 October Deputy Prime Minister, Julia Gillard, opened the new $10 million Cavitation Research Laboratory at the Australian Maritime College. The new world-class hydrodynamic facility is unique in Australia and one of only a few worldwide. It marks a major step forward in Australia's research capacity and will make a major contribution to the development of naval vessels and the commercial high-speed vessel industry.

Laboratory investigations will play a critical role in the development of maritime defence capabilities, highlighted in the Federal Government's Defence White Paper.

In opening the facility, Ms Gillard said Australia now had access to a world-class facility that strengthened its expertise in hydrodynamic research for the Navy as well as for the commercial maritime sector.

AMC Principal Professor Malek Pourzanjani said the opening was significant for AMC. "This laboratory marks a major step forward for AMC in terms of research and teaching capabilities on national and international fronts. It is the embodiment of AMC's commitment to experimental facilities and the advancement of knowledge within our field," Prof. Pourzanjani said.

Deputy Prime Minister, Julia Gillard, opens the AMC Cavitation Research Laboratory with AMC Principal Prof. Malek Pourzanjani, and University of Tasmania Vice Chancellor Prof. Daryl Le Grew
(Photo courtesy AMC)

"Within this building there stands eight years of endeavour — the culmination of incredible vision and hard work by a very dedicated team of staff and students led by A/Prof. Paul Brandner."

University of Tasmania Vice Chancellor, Prof. Daryl le Grew said the opening marked another milestone in the AMC–UTas relationship. "This development is an example of the important work taking place within a highly-valued institute of the University and it really highlights the

benefits of the arrangement between UTas and AMC," Prof. le Grew said.

The Cavitation Research Laboratory has been initiated through long-standing partnerships between AMC, UTas and DSTO.

Despite its high-level research capacity, the Cavitation Research Laboratory will be available to students of every level studying at AMC. It will be used for teaching and research in AMC's undergraduate and postgraduate programs, as well as providing high-quality research for academic and industry partners, both in Australia and overseas.

Diversity of projects at AMC include the hydrodynamics of surfboard fins, waterjet propulsion of high-speed ferries, the experimental investigation of new submarine hull shapes, and the investigation of unsteady submarine propeller performance.

Patrick Cranny

Annual UNSW Naval Architecture Student Visit to AMC

On 1–2 October AMC again hosted the Year 3 naval architecture students from the University of NSW for a series of laboratory sessions in the towing tank, cavitation tunnel, model test basin and ship-handling simulator. The UNSW students were accompanied by Dr Rozetta Payne, UNSW Lecturer.

Tony Armstrong Visit and Presentation

Dr Tony Armstrong, R&D Manager of Austal Ships, visited AMC to make a presentation titled *Engineering Excellence on the Move: the Development of High-Speed Ships* to AMC students, staff and visitors. The presentation was part of the Engineers Australia Eminent Speaker Series, following Tony's award of the 2009 AGM Michell Medal.

AMC Actively Involved in ITTC

AMC staff continue to be actively involved in the International Towing Tank Conference (ITTC) community. Short reports on recent activities within the Advisory Council and some technical committees are provided below.

ITTC Advisory Council

The first meeting of the Advisory Council of the 26th ITTC was held at the Swissôtel the Bosphorus in Istanbul on 12–13 October 2009. Professor Neil Bose attended as the representative of the AMC. The first interim reports from all standing and specialist technical committees were reviewed and discussed in order to provide feedback to the technical committees from the Advisory Council. Reports from two working groups, one on climate change and the other on testing in ice, were presented. A discussion was held on how the ITTC AC could respond in a timely fashion to a discussion of the technical implications of a ship environmental-performance index being adopted by the IMO. Dr Stuart Jessup from the Naval Surface Warfare Center, Carderock Division, has recently been appointed the Chair of the Executive Committee of the ITTC.

ITTC Specialist Committee on Stability in Waves

The ITTC specialist committee on stability in waves held its second formal meeting of this conference period in Genoa on 4–6 November 2009. This committee comprises a small number of international experts in the field of ship stability selected by the ITTC to work in this field between conferences. It is chaired by Prof. Martin Renilson from AMC. The committee discussed a range of issues including numerical prediction of capsizing; procedures for predicting the capsizing of damaged ro-ro vessels; roll damping of intact and damaged ships and liaison with the IMO. In addition, arrangements for finalising the benchmark on parametric rolling were discussed. The next meeting will be held in Wageningen, The Netherlands, in June 2010 in conjunction with the annual International Workshop on Ship Stability.

ITTC Specialist Committee on High Speed Craft

The second formal meeting of the ITTC specialist committee on high-speed craft was held in Athens on 8–9 October 2009, in conjunction with the FAST 09 conference. The chair of the committee is Prof. Ikeda from Osaka Prefecture University and the secretary is Giles Thomas from the AMC. The committee has three main terms of reference:

1. Review and identify numerical and experimental developments for the prediction and behaviour of high-speed craft, especially multi-hull vessels, addressing seakeeping, powering, manoeuvring, far-field waves and wash, air resistance and stability.
2. Identify validation data for new designs appropriate for benchmarking purposes. Include relevant data about the ship geometry and loading condition, allowing the validation of numerical techniques in realistic conditions including some or all of the major challenges: large domains, complex bathymetry and unsteady effects.
3. Review, identify any requirements for changes and, if approved by the Advisory Council, update ITTC Recommended Procedures applicable to high-speed craft.

The next meeting will be held at the AMC in April 2010.

Neil Bose, Martin Renilson and *Giles Thomas*

T-Foil Ventilation

The Moth T-Foil program had Jon Emonson (Year 4 NA student) and Sophie Coache (ENSIETA intern student) looking at the effects of strut angle, free-surface disturbance and high loading. The aim was to produce design graphs similar to the Burrill diagram used for cavitation. We made some good progress and all projects were completed successfully, but there is still some way to go. This summer Dr Jonathan Binns hopes to have a local intern student working on the project. Next year we should be publishing some of the results.

For the high-load scenarios tested, we used the RV Davis catamaran test platform, a modified Tornado hull, with launching shown in Figure 1 and the test beam attachment in Figure 2. Some of the visualisations of ventilation are shown in Figure 3, where the left column shows ventilation simulated in the tank, the right column shows ventilation at full scale speeds. We have been able to simulate ventilation at the lower speeds of the towing tank by effectively reducing the cavitation number at the wing tip only. The mechanisms of either ventilation are believed to be similar.

Jonathan Binns

Figure 1 — Launching the catamaran test platform
(Photo courtesy AMC)

Figure 2 — Test beam attachment
(Photo courtesy AMC)

Coasts and Ports 2009 Conference and Ship Under-keel Clearance Workshop

The biennial Australasian Coasts and Ports Conference series represents an amalgamation of the Australasian Coastal and Ocean Engineering Conference and Australasian Ports and Harbour Conference. The 2009 Australasian Coasts and Ports Conference was held in Wellington, New Zealand, on 16–18 September. The conference brings together engineers, planners, researchers and all those working together on coastal and port matters in Australasia.

Dr Jonathan Duffy, a Research Engineer at the Australian Maritime College, presented a paper titled *Investigation into Bank Effect at the Port of Townsville*. The paper outlined a study which was conducted at the AMC to investigate the bank effect experienced in an asymmetrical section of the Platypus Channel. A series of physical scale-model tests was conducted in the AMC towing tank to investigate proposed dredging configurations for the western side of the Platypus Channel. The bank-induced sway force and yaw moment for the proposed dredged configurations were compared to those for the existing channel to establish the most-suitable channel configuration with respect to the mitigation of bank effect.

Following the conference, Dr Duffy and Dr Tim Gourlay from Curtin University of Technology delivered a one-day course on ship under-keel clearance in shallow water. The aim of the course was to share the knowledge which has been gained over the past decade through full-scale squat measurements, model testing and computational advancements. Jonathan and Tim plan to hold another similar course in the future. Interested persons can contact either Jonathan at j.duffy@amc.edu.au or Tim at t.gourlay@cmst.curtin.edu.au for further details.

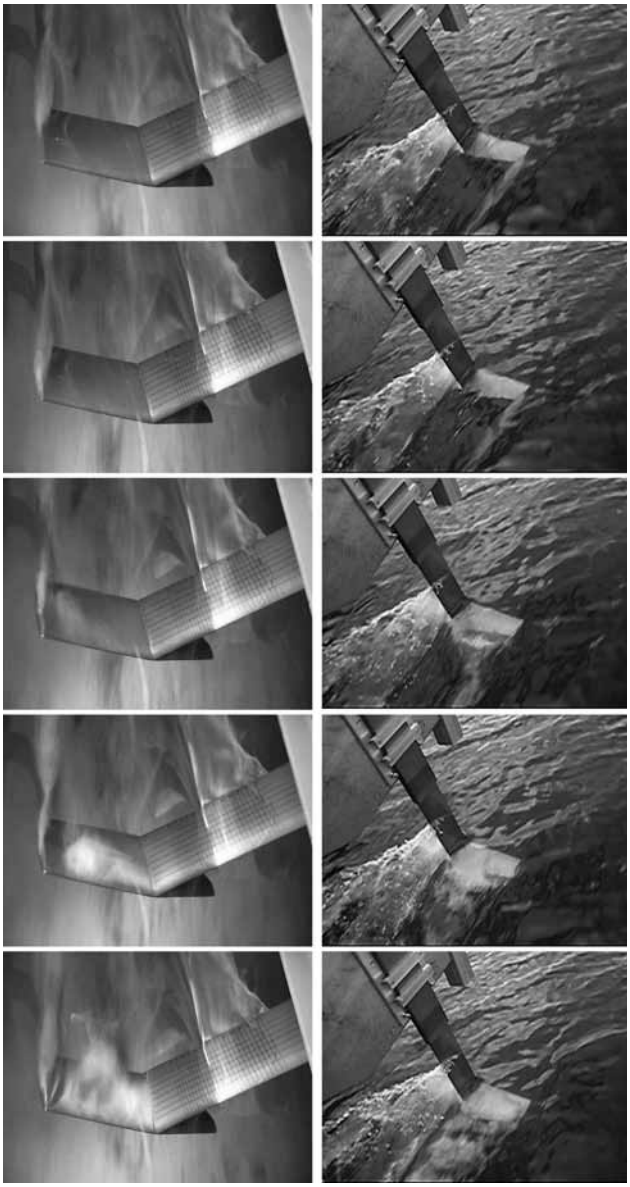


Figure 3 — Foil ventilation visualisations
(Photo courtesy AMC)

Jonathan Duffy

FTV Bluefin Trips

A unique feature of the AMC is that maritime engineering students have extended trips aboard *Bluefin* (AMC's 35 m training vessel). This gives them valuable experience at sea and the opportunity to put theory into practice, whilst learning about life onboard a vessel.

The students work through the day on a given set of activities. In the evening they collate their work and give oral presentations on their findings. The activities include speed and manoeuvring trials, structural investigations, design exercises, hydrostatic analysis, seakeeping measurements, engine-room duty and fishing activities.

The success of the teaching and learning voyages aboard *Bluefin* for second- and third-year naval architecture

Bluefin exiting the Tasman Passage between Cape Pillar and Tasman Island
(Photo courtesy AMC)

students has led to voyages being established for fourth year students, as well as third- and fourth-year ocean engineering and marine and offshore systems students.

In September the second- and third-year NA trips involved a voyage down the east coast of Tasmania from *Bluefin's* home port of Beauty Point to Hobart and back. Highlights included a night trawl in Storm Bay, being holed up in storm conditions at Clarke Island, the sunset in Wineglass Bay, passing through Tasman Passage between Cape Pillar and Tasman Island, and visits by shy albatrosses, dolphins, a white-breasted sea eagle and seals.

You've been working us too hard!
(Photo courtesy AMC)

New Engineering Textbook Takes a Fresh Approach

From researching some of the nation's biggest contemporary engineering projects, explaining sustainable and ethical engineering in an engaging way, through to looking at early Aboriginal and Maori engineering feats, the task of co-authoring a new textbook has been a rich experience for AMC's Dr Anna Carew.

A senior lecturer in Academic Development at AMC, Dr Carew was invited two years ago by the University of Southern Queensland's engineering academic, Prof. David Dowling, to join him and University of Melbourne's A/Prof. Roger Hadgraft in putting together a textbook for first-year engineering students.

The result is the recently-released *Engineering Your Future, An Australasian Guide*, an expansive book published by John Wiley and Sons which draws on the combined academic experience of the authors to introduce engineering students to what professional engineers actually do.

Dr Carew wrote four chapters for the book, including the daunting first.

"I had the pleasure, for a non-engineer, of writing the introductory chapter called *What Is Engineering?* It was fascinating because, although I have spent over a decade working with engineers, my background is as a microbiologist. I was invited to write this chapter because it really needed an outsider's perspective to keep it accessible for first years" she said.

"The text is big on local and Australasian examples, which was an absolute pleasure because I got to research some of the most-fascinating engineering innovations in Australasia and some of the history of engineering in Australia and New Zealand," she said, adding that numerous Aboriginal and Maori examples presented themselves as early and very-obvious engineering achievements.

Praise for the book has so far been widespread. It has been picked up by two universities in Australia, and USQ's website has reported international interest which could lead to UK and US adaptations.

"Some of the leaders of the future direction of engineering education in Australia have come out in very strong terms to endorse the book and support what it's trying to do, which is quite exciting," Dr Carew said. "Part of what the book is trying to do is to support ways of teaching which are slightly different to the ways engineering is traditionally taught — the text supports teaching approaches that are more student-focussed, more problem based and more authentic to the actual practice of engineering," Dr Carew said.

"Perhaps the best response I've had so far was from a colleague who I worked with years ago who had trained as an electrical engineer but wasn't working in that field anymore. She saw the book on someone else's desk and picked it up and read through it. She emailed me and said 'the book is fantastic and I'm going to buy it for my son who is in first year engineering'. So that was wonderful."

The book will be officially launched in December.

AMC and Flinders University Join Forces in New Degree

Collaboration between Adelaide's Flinders University and the Australian Maritime College (AMC) has led to the establishment of a new four-year Bachelor of Engineering (Maritime Electronics) degree due to start next year.

Under the new arrangement, students enrolled in the Flinders degree will spend two semesters of the four-year course studying in the National Centre for Maritime Engineering and Hydrodynamics at AMC's Launceston campus.

Maritime electronics is the application of electronics to all aspects of the maritime industry including naval, commercial or recreational vessels and on-land facilities and sits perfectly within AMC's areas of maritime engineering expertise.

Head of the Department of Maritime Engineering at AMC's NCMEH, A/Prof. Dev Ranmuthugala, said that the new degree would lead to increased student traffic and shared expertise between the two institutions.

"This is an excellent outcome for our partnership with Flinders University and it has opened us up to a range of possible collaborations in the future," he said.

Flinders Head of School of Computer Science, Engineering and Mathematics, Prof. John Roddick, welcomed the new agreement as a timely initiative, saying that the existing shortage of electronics engineers in South Australia was set to increase through new defence initiatives.

"The Government has decided to acquire 12 new future submarines, to be assembled in South Australia. This will be a major design-and-construction program spanning three decades, and will be Australia's largest ever single defence project," he said.

Tasmania's Top Students hit AMC

The best young minds in Tasmania have just wound up their three-day visit to AMC as part of a program which rewards talent with experience.

Thirty-four Year 10 students from across Tasmania spent 19–21 October on AMC's Launceston campus on a Guaranteeing Futures program run with Engineers Australia.

Accompanying the students was Vocational Educational Learning Development Officer, Martin Stalker. He has seen the benefit of last year's initial program and is keenly aware of the personal development which the students undergo.

"Students have pre-existing desires to move into certain fields, so we put programs like this in place to make it possible for them," Martin said. "They love this experience. They are really motivated, really enthusiastic kids."

The students apply for their program through Pathway Planners in their schools. Once accepted, they spend time at UTas in Hobart, Incat, Transend and AMC. There's also a Mentor Engineer phase where students spend up to eight days working in organisations like Pitt and Sherry, DSTO and Tas Alkaloids. Students get mid-term assessments from the companies with whom they are involved.

"Academically, these students are great but, on top of that, they are a really nice group of people. They get on well together, they work really well and they're really focussed."

Aside from the usual facilities tours and overviews at AMC, the top-rating maths and physics students were set a series of practical, hands-on tasks over the three days which included an AMC favourite — pasta bridge building and time in the ship and sailing simulators.

Ship Production put to the Test

It only took 2.7 seconds for the fastest boat to travel across AMC's Model Test Basin this year. The slowest limped home in 4 seconds.

Marine engineering lecturer, Chris Smith, believes the time difference is far less important than the experience which his second-year students get. The exercise is part of the Ship Production course for naval architects.

This year marked a move away from group projects to individual efforts, with 23 boats hitting the water on 5 October, compared to just 10 last year.

"They do everything from mastering the design software, to extracting the parts, nesting them and preparing them for CNC cutting," Chris said.

He said that the real world of design and construction came out in the models, and students had solid guidelines to work to, despite variations in hull design. All vessels have the same displacement.

Models are based on a 12 m pilot vessel currently in operation in Hobart and designed by AMC naval architecture lecturer, Michael Hunn.

From a student perspective, the project is an invaluable exercise in mastering software, including Maxsurf, AutoCad and the emerging industry standard, Catia.

Despite their small size, hours of work go into the design and construction. Models can take up to 10 hours to build. At least twice that goes into design and other preparation.

James Guest says it's rewarding not only to go through the experience but have the proof sitting there at the end

"I think it's a fantastic process and to go through designing your hull, cutting it out, then to have at the end of the day your own little boat which you can sit and look at and say 'this is what I can do', is probably the best thing about," said James.

Ben Cantle endorses lecturer Chris Smith's message of realism from the whole exercise.

"It's real world, even though it's only half a metre long. Apart from the things that are missing on the inside, it's essentially the same process you would use to make one that's 100 m long. You model the shape, get Maxsurf to model the plates, then you get the CNC machine to cut it out and you put it all together."

And while it's all hi-tech, there is no secret to success. While Ben's boat was noted on the day for its high performance and classic clear finish, James's also came home in under three seconds, perhaps thanks to a hi-tech finish of "spray paint from Chickenfeed".

Patrick Cranny

University of New South Wales

Undergraduate News

Graduation

At the graduation ceremony on 17 August, the following graduated with degrees in naval architecture:

Ryan Ayres	Honours Class 2, Division 2
Nick Kitching	Honours Class 2, Division 2
Hamish Bush	Honours Class 2, Division 1
Brocque Preece	Honours Class 1

They are now employed as follows:

Ryan Ayres	Burness Corlett Three Quays Australia, Sydney
Nick Kitching	BAE Systems, Sydney
Hamish Bush	Burness Corlett Three Quays Australia, Sydney
Brocque Preece	One2three Naval Architects, Sydney

Congratulations, all!

Ryan Ayres and Brocque Preece
at the UNSW Graduation Ceremony on 17 August
(Photo courtesy Tracie Barber)

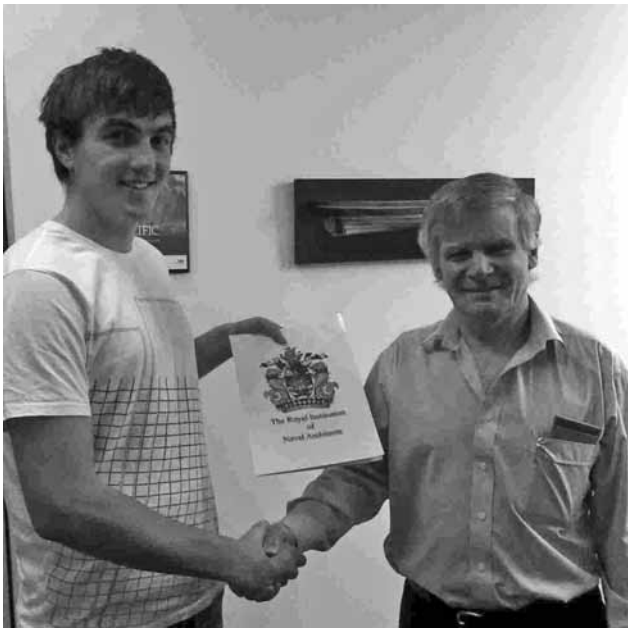
Thesis Conference

At the School's annual undergraduate thesis conference on 24 and 25 September the following presentations on naval architecture student projects were made:

Yew Jinn Chieng	*Thruster Tunnel Flow Improvement for High-speed craft*
Tibor Corbett	*Review of Propulsion Configurations for Offshore Patrol Combatants*
Gordon Danton	*Review of State-of-the-art Ship Noise Management Techniques*
Darren Duarte	*Grounding Survivability of Hydrofoil Craft*
Liam Finegan	*Investigation of Vessel TSS* Cobargo
Matthew Fox	*Renewable Energy Systems for Ships*
Stuart Grant	*Optimisation of a Bulb Wing Keels for Yachts*
Andrew Hoff	*Investigation of Post-tensioning for Ship Structures*
Bran Kent	*Longitudinal Stability Criteria for Ships*
Nai Wee Ling	*Analysis of Ship Emissions for Tugs and Ferries*
Kyle Guo Ng	*Fatigue Analysis of the Hull Girder of a Single-deck Ship*
Drew van Ryn	*Optimisation of NS14 Sail Design*
Konny Zurcher	*Automated Drawing of Marine Screw Propellers*

RINA–Austal Ships Award

RINA and Austal Ships jointly offered an award of $500 and a certificate for the best presentation at the conference by a student member on a naval architectural project. Assessment was made on the basis of marks awarded by School staff, with marks being standardised to remove the effects of marker variability. The award went to Gordon Danton for his presentation on *Review of State-of-the-art Ship Noise Management Techniques*. The award was announced by Mr Phil Helmore at the thesis conference dinner at the Bavarian Bier Café in the Entertainment Quarter at Fox Studios on the evening of 25 September. The certificate and cheque have subsequently arrived and been presented. Congratulations, Gordon!



Gordon Danton receiving the certificate and cheque
for the RINA–Austal Ships Award from Phil Helmore
(Photo courtesy Diane Augee)

Naval architects at the thesis conference dinner
(Photo Phil Helmore)

More naval architects at the thesis conference dinner
(Photo Phil Helmore)

Thesis Poster prize

At the thesis conference dinner, the annual awards for the thesis posters (which adorn the walls of the laboratory building and are updated annually) were made. The 2009 prize for the best thesis poster went to a naval architecture student, Liam Finegan, for his poster on *Investigation of Vessel TSS* Cobargo, which was owned and operated by the Illawarra and South Coast Steam Navigation Company, servicing the south coast of NSW from 1929 until the 1950s.

Lecturer of the Year

Also at the thesis conference dinner, the School's 235 final-year students made their annual award for Lecturer of the Year, inaugurated in 1995. This year the Lecturer of the Year award went to Mr Erik van Voorthuysen.

Visit to AMC

On 1 and 2 October the Year 3 students studying NAVL3620 Ship Hydrodynamics visited the Australian Maritime College accompanied by lecturer, Dr Rozetta Payne. The visit was organised by Mr Gregor Macfarlane, and UNSW is grateful for AMC's hospitality. The group were introduced to the towing tank for experiments by Dr Tim Lilienthal, and then sat in on a lecture on cavitation by A/Prof. Paul Brandner, which they enjoyed, were shown over the new cavitation tunnel, and then attended a seminar given by Dr Payne before adjourning to The Royal Oak for a counter meal. Next day they were introduced to the shiphandling sumilator by Capt. Ian Rodriques, to research activities and opportunities at AMC by Prof. Neil Bose and Dr Jonathan Binns, to the model test basin by Dr Gregor Macfarlane and then seakeeping tests in the towing tank under the guidance of Dr Lilienthal.

UNSW students at the AMC Towing Tank
(Photo courtesy Malinda Wickremaarachchilage)

The students all came away with a better understanding of ship model testing and how it is done in practice. It certainly helped to have naval architects talk about the various aspects of testing and research, and their explanations of the processes brought out the realities and practicalities which you don't get in the theory.

UNSW NAVL3620 students at the AMC Towing Tank
with lecturer Dr Rozetta Payne (second from left)
(Photo courtesy Malinda Wickremaarachchilage)

Vist to Incat Tasmania

The students took the opportunity, while in Tasmania, to visit Hobart, where they were shown over the Austal Ships facility at Margate by Mechanical Engineer, Mr Tony Shea, and Fabrication Supervisor, Mr Brad Churchill. Austal had two vessels under construction; both 41 m passenger catamarans, and it was instructive to be able to see, at first hand, the progress from one vessel to the next, and the details of construction which could be seen when climbing through the vessels. The theory is interesting, but seeing construction under way brings it alive! UNSW is grateful to Austal for their hospitality.

41 m catamaran under construction at Austal Ships in Hobart
(Photo courtesy Ivy Zhang)

Engineering Design Centre

The Faculty's new Engineering Design Centre on the top floor of the Mechanical Engineering Building is now completed and is expected to be opened on 23 November, and operational from then on.

Conference Room in new Design Centre at UNSW
(Photo Phil Helmore)

Design Research Space
(Photo Phil Helmore)

Flexible Teaching Space
Dr Nicole Kessissoglou, Ms Ana Naumoska and Mrs Guilia Jance
(Photo Phil Helmore)

Informal Student Learning Space and galley facilities
(Photo Phil Helmore)

Post-graduate and Other News

Graduation

At the graduation ceremony on 17 August, Suryo Anggoro was awarded his Master of Engineering (ME) degree for his dissertation on *Analysis of the Intact Stability of Indonesian Small Open-deck Roll-on/Roll-off Passenger Ferries*. Congratulations, Ryo!

Head of School

Following interviews for the position of Head of the School of Mechanical and Manufacturing Engineering in late July, an offer was made but declined. The appointment machinery has moved back to square one.

Phil Helmore

Wärtsilä powers Largest Passenger Ship

At the heart of Royal Caribbean's *Oasis of the Seas*, the world's largest passenger vessel, beneath an original carousel, an array of restaurants, surfing simulators, rock-climbing walls, a tropical living park and guests and crew on board, are two sets of three Wärtsilä engines, powering everything on the ship.

STX Europe's shipyard in Turku, Finland officially handed over *Oasis of the Seas* to Royal Caribbean Cruises Ltd (RCCL) on 29 October. The 360 m ship is powered by Wärtsilä's most-modern high-technology equipment. *Oasis of the Seas* is equipped with a total of six Wärtsilä 46 engines, three 12-cylinder and three 16-cylinder engines, generating more than 96 MW. The vessel is also equipped with four 5.5 MW Wärtsilä bow thrusters, which are among the largest in the world.

Wärtsilä's engines are equipped with common-rail technology, which provides an important and very visible advantage. As the combustion and other process parameters can be adjusted for lower-load ranges, smoke emissions can be reduced. Wärtsilä continuously aims to improve the environmental performance of its products and solutions, with the main focus being on improving efficiency and minimizing emissions.

The Wärtsilä bow thrusters make the vessel easy to operate. They have a combined power output of 22 MW. In fact, the bow thrusters alone have more power than is installed on a normal cargo ship!

Pushing the boundaries of cruise ships

Royal Caribbean International, a brand of RCCL, is consistently pushing the boundaries of what is thought to be possible, offering more options and choices for its guests by introducing innovative amenities and a revolutionary design which achieves higher safety and environmental standards.

The cruise line's *Freedom of the Seas* was the largest passenger ship in the world when she was launched in 2006, and the largest ever built in terms of passenger capacity (3634) and gross tonnage (154 407), both records now shared by two other Royal Caribbean vessels of the same class.

And now comes *Oasis of the Seas*, with a passenger capacity of 5400 and a gross tonnage of 225 282. At 360 m length OA, she is 23 m longer than the Freedom-class vessels and introduces even more innovative amenities than ever before. *Oasis of the Seas* has the first-ever living park at sea, with 12 175 plants, 62 vine plants, and 56 trees and bamboo. There's a full-sized carousel, rock-climbing walls, and two surfing simulators which allow guests to surf on the deck and a spectacular amphitheatre-style AquaTheater at the stern of the ship.

Wärtsilä provides the power to meet the onboard energy demand

Propelling a vessel 360 m long, 65 m wide and carrying up to 8500 people — 2165 of them crew members — is no small achievement. The vessel's air-conditioning systems, production of 50 t of ice cubes each day, and heating the water in the 21 swimming pools and Jacuzzis, together consume several megawatts of power, as does carrying all the supplies needed for a seven-day cruise.

The engines are essentially a power plant which produces electricity, which is then used to run everything on board. The majority is used for propelling the vessel, but this floating holiday destination also has many other energy users. "After propulsion, air conditioning is next on the list of major onboard energy consumers," says Fred Danska, Director of Cruise Business at Wärtsilä.

Long-term cooperation between Wärtsilä and Royal Caribbean

Most of the Royal Caribbean ships have featured Wärtsilä equipment, and *Oasis of the Seas* is no exception. The size of the vessels isn't the only thing that has changed in the 40 years Wärtsilä has been working with Royal Caribbean. The engines have undergone continual development, as have customer preferences and choices. What was important in the 1980s is less important today.

In the mid-1990s, suppliers of gas turbines made moves to replace diesel engines on cruise ships. Wärtsilä came up with a solution which reduced emissions. This was common-rail injection technology, now also fitted to *Oasis of the Seas*.

Oasis of the Seas
(Photo courtesy Wärtsilä)

USS *America* Designed with ShipConstructor

USS *America* (LHA 6), designed with ShipConstructor software, will be the most technologically-advanced amphibious warship to date, according to U.S. Navy Capt. Robert Howell, Executive Officer and Director of Contracts, Supervisor of Shipbuilding, Gulf Coast.

Howell made this observation at the recent keel laying ceremony for the ship in Pascagoula. This innovative vessel was designed by Northrop Grumman Shipbuilding Gulf Coast using ShipConstructor, a detail design and production software program for shipbuilding and offshore structures.

"This project is yet another example of ShipConstructor being the tool of choice for US Navy programs," said Darren Larkins, Chief Technology Officer for ShipConstructor Software Inc. "In choosing ShipConstructor, Navy shipbuilders continue to express their confidence in our ability to deliver results on these complex vessels."

USS *America* will feature an innovative propulsion system which uses two induction-type auxiliary propulsion motors powered from the ship's electrical grid. Instead of a well deck for storing smaller vessels, USS *America* has more space for aviation components. Other features include a reconfigurable command-and-control complex, a hospital facility and numerous aviation support spaces.

The future USS *America*
(Image courtesy ShipConstructor)

Wärtsilä has Unique Integrator Role in FellowSHIP

Wärtsilä has been assigned overall responsibility for systems integration in the pioneering FellowSHIP project. Wärtsilä's specially-designed equipment is being used to integrate and create synergies between leading marine technology and state-of-the-art fuel-cell technology. The equipment has been installed onboard the platform supply vessel *Viking Lady* for extensive sea trials. The innovative solution is seen as being an important contributor in the development of environmentally-sustainable marine propulsion systems.

The FellowSHIP project is a joint industry research and development project managed by Det Norske Veritas. It aims to develop and demonstrate hybrid fuel-cell power packs, especially suited for marine and offshore use. The power pack will be used as an auxiliary power source in *Viking Lady*, which is owned by Eidesvik Offshore, Norway. The ship has been designed by Wärtsilä Ship Design, and its main engines and power drives have also been supplied by Wärtsilä. Wärtsilä's electrical and automation business unit in Norway has custom developed the power electronics needed to connect the fuel cell to the ship's electrical network and Wärtsilä has, therefore, the important role of being the systems integrator for the FellowSHIP project.

Wärtsilä's electro and automation business unit specialises in designing and developing technologies related to electrical distribution, controls and power-converter applications.

"For the FellowSHIP project, Wärtsilä has developed the power electronics, and the systems for regulating and distributing energy from the fuel cell to the electrical network. We have also delivered the distribution and control systems," said Ingve Sørfonn, Project Manager and Director R&D, Wärtsilä Ship Power Technology.

In May, the 320 kW fuel cell, produced by MTU Onsite Energy GmbH, a member of the German Tognum Group, arrived at Stord in Norway. Here it was integrated together with Wärtsilä's technology, and tested. During this land testing, all operational modes, shut down conditions, and dynamical behaviour were tested and verified in accordance with the specifications.

The fuel-cell technology is designed to increase efficiency and leads to a considerable reduction in emissions. Fuel-cell technology of this power size has never before been installed in merchant vessels, and the highly-innovative project is unique on a world scale. Wärtsilä has been involved in fuel-cell technology since the mid-1990s and specialises in systems integration.

"Developing better and more environmentally-friendly technologies for the marine industry and offshore market is a very important focus area for Wärtsilä. Wärtsilä invests heavily in research and development aimed at reducing emissions and improving fuel efficiency. Being the systems integrator on what might potentially be the world's most environmentally-friendly ship, is very exciting for us," said Sørfonn. "The vision for the FellowSHIP project is to develop a technology which makes a positive contribution to the environment, and which can be used in marine constructions. We have great expectations for the tests that will now be carried out at sea."

The partners in the FellowSHIP project include Wärtsilä, Eidesvik, Det Norske Veritas and MTU Onsite Energy GmbH. The project is supported by the Norwegian Research Council, Innovation Norway, and the German Federal Ministry of Economics and Technology.

Viking Lady has been designed by Wärtsilä and is equipped with a complete, integrated Wärtsilä propulsion and power electronics system
(Photo by Oddgeir Refvik, courtesy Wärtsilä)

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on Wednesday 23 September. Since travel delays prevented the President, Dr Stuart Cannon, from attending from the start of the meeting, Prof. Martin Renilson assumed the chair for the commencement of the meeting. Some of the matters raised or discussed during the meeting were as follows:

Policy and Funding Guidelines for Section Treasurers

Following inter-sessional consideration of, and agreement to, the draft guidelines by the Treasurer and his Section counterparts, Council approved the Guidelines following a small amendment which had no effect on Sections.

Cessation of Sponsorship for *The ANA*

Council was advised that the generous sponsorship of this journal by Wärtsilä Australia had been discontinued. Council subsequently agreed that every endeavour should be made to cover the revenue shortfall through new sponsorships and advertising in preference to reducing the journal's availability. All members had a responsibility to encourage likely advertisers to use the journal as a cost-effective means of contacting key technical personnel in the Australian maritime industry.

RINA/Engineers Australia Joint Board

Council was advised that the Joint Board had met during August for the first time in over a year. As the two years of my term as Chairman of the Joint Board had expired, the Board discussed rotation of this role to an EA nominee in accordance with the RINA–EA agreement, but this changeover could not be completed at the meeting and was left for consideration by a further meeting expected to be held in October. The Board agreed that it was the appropriate vehicle for inter-institution consultation, such as on policy guidance documents. The Board also considered that scope existed for an improved level of participation by technician grades in both institutions.

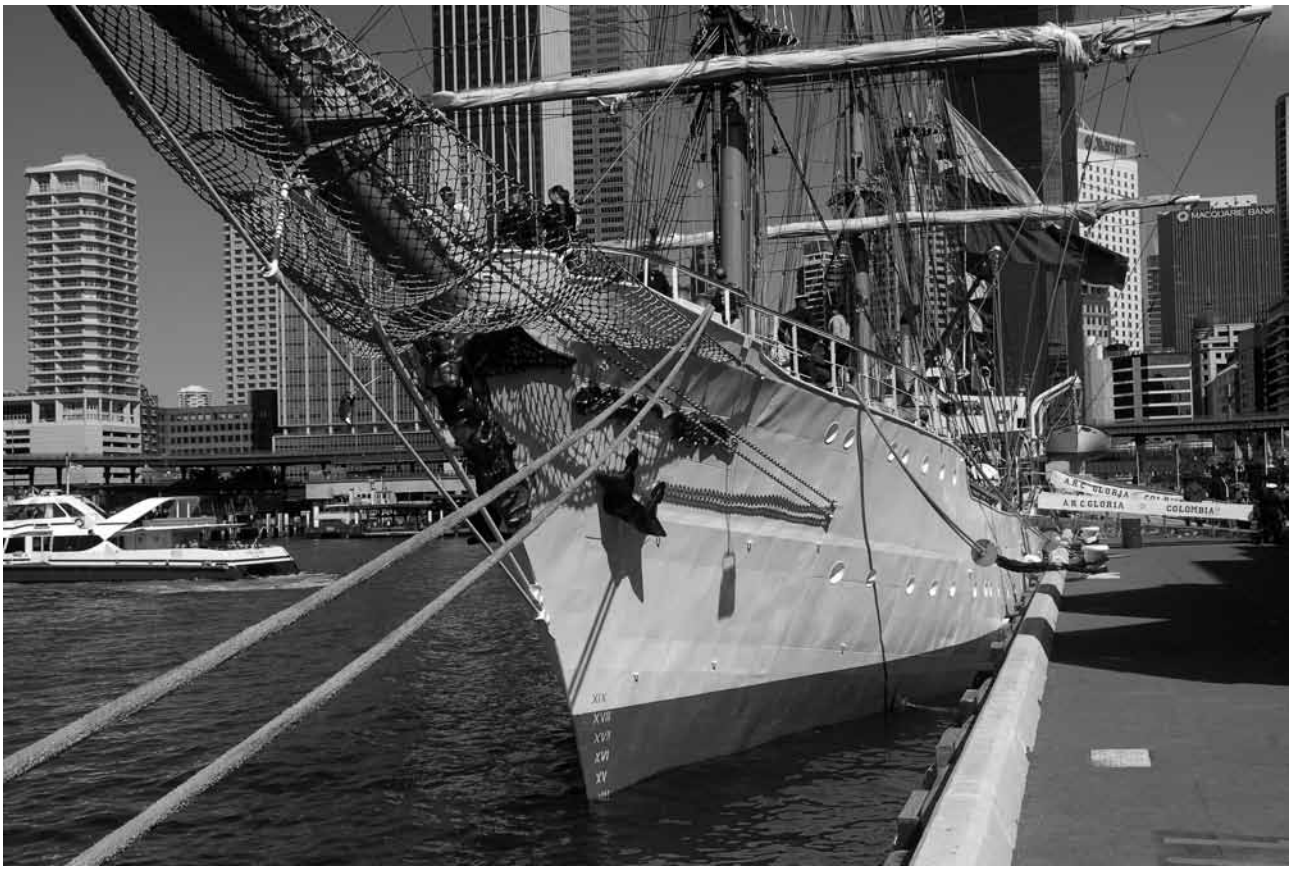
Pacific 2010 International Maritime Conference

Mr Jeremy, as Chairman of the Organising Committee, reported briefly that progress was building steadily towards a successful conference. There had been a good response to the call for papers, and refereeing arrangements established. Sponsorship was understandably lower than for past conferences and the overall event would be smaller.

Inquiry into the Loss of *HMAS Sydney II*

The President reported that the Report of the Commission had been presented to the Chief of the Defence Force and the Report had been released to the public. Talks on the evidence produced by the Defence Science and Technology Organisation (DSTO) and RINA had not been possible prior to the Report's release, but this had now passed and Mr Jeremy indicated that he had already made a presentation to the Navy League and would be making further presentations in the near future.

Dr Cannon took the opportunity of thanking those members of RINA who had contributed to the evidence provided by DSTO and RINA.



The Colombian sail-training ship *Gloria* in Sydney during her visit in September.
She was built in 1969 at Bilbao and has a crew of 51 with 88 trainees
(Photo John Jeremy)

Register of Engineers in Western Australia

Mr Best briefed Council on possible State legislation for the registration of engineers and Council agreed that keeping abreast of developments in this area was one of its essential tasks.

Proposed Single National Jurisdiction for Maritime Safety

Council noted that, while there appeared to have been little progress on this matter since the previous Council meeting, attempts were being made to arrange a high-level address to Pacific 2010 to provide members and industry with up-to-date information on this matter. The Division is seeking to play an active role in its progress.

New Secretary for Division

Mr Adams advised that he wished to retire as Secretary, after 14 years in the position. Council, through the President, thanked Mr Adams for the quality and length of his service in the position. I was subsequently appointed to take over with effect from the day of the meeting.

The next meeting of Council of the Australian Division is scheduled for Thursday 3 December 2009.

In concluding this report, I would like to add my personal appreciation for the job which Keith Adams has done over the past 14 years. I know, from experience as President during those years, that having such an energetic, experienced, aware and knowledgeable person in the Secretary's chair has been invaluable to the smooth operation of the Division and in the interactions which the position involves. I request that members are patient with me as I attempt to fill the void that will inevitably follow. Members should note that previous contact arrangements are being closed down and all future communications addressed to the Division should be sent to:

Email: rina.austdiv@optusnet.com.au
Phone: (0403) 221 631 (mobile only)
Post: PO Box 462
Jamison Centre, ACT 2614

Rob Gehling

Keith Adams Retires

Keith Adams, Secretary of the Australian Division of the Royal Institution of Naval Architects retired recently after some 14 years service to the Division.

Keith is well known to many, particularly Australian Division Council members and Section committees. He joined the Institution as Executive Officer at a time when the Division was being reorganised with the aim of improving service to members throughout Australia. Keith played a major part in making the changes work, and office bearers of the Division are extremely grateful to him for the support, guidance and encouragement he has provided over the years.

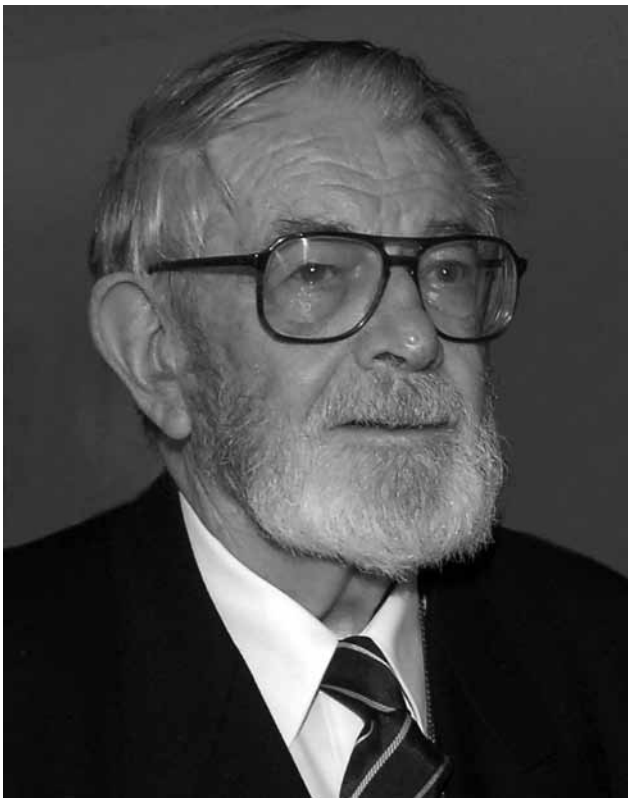
Prior to joining the Institution, Keith held a number of senior appointments with government departments and agencies.

He was science adviser on marine science matters to the Department of Prime Minister and Cabinet and the foundation Executive Secretary of the Australian Marine Sciences and Technologies Committee, a Standing Committee of the Australian Science and Technologies Council.

Keith was involved in the framing and presentation to Cabinet of the submission for the provision of a national Oceanographic Research Vessel and was a member of the Steering Committee for the construction of a vessel for the Marine Science Laboratories built in Hobart. Subsequently Keith was assistant Secretary of the CSIRO Advisory Council before becoming the Secretary of the National Facilities Steering Committee for the operation of RV *Franklin*.

Keith was a long-time serving officer with the Royal Australian Naval Reserve and was made a Member of the Order of Australia for his service to the RAN.

Keith continues as an RINA representative on the organising committee for the Pacific 2010 International Maritime Conference and will, no doubt, continue to maintain his interest in the affairs of the Division to which he has contributed so much. We all wish him well for the future as he seeks a less-active life.



Keith Adams AM
(Photo John Jeremy)

NAVAL ARCHITECTS ON THE MOVE

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

Jim Black has moved on within the Austal Group, and has taken up the position of Special Projects Manager in Fremantle.

Joshua Bolin has moved on from Peter Lowe Design, and spent some time travelling through France, Italy, and the UK before taking up a position as a naval architect with SPT Offshore, a small company in the offshore oil and gas business just outside Amsterdam, The Netherlands. In addition to oil and gas, the company is also moving into renewable energy resources, so is undertaking a number of studies of wind farms. Friends can check out the company at www.sptoffshore.com.

Owen Eckford has moved on from ComfortDelgro Cabcharge Australia and is taking the chance to some work around the house while evaluating opportunities.

Peter Holmes has moved on from Sharaf Yachts (which has closed) in Sharjah, UAE, and is now evaluating opportunities and returning to Australia.

Joanna Mycroft returned to the UK after her holiday in Australia early this year, and took up a position volunteering for The Ahoy Centre (www.ahoy.org.uk), a charity which teaches sailing and rowing to disadvantaged and disabled children. She has now up-anchored from there and is under way through eastern Europe (briefly) and then Egypt, Jordan, Syria and Turkey.

Jason Steward has moved on after two years with Jacobs Australia contracted to the ANZAC SPO and has taken up the position of Service Technical Manager with Austal Ships in Fremantle, where he will lead the provision of specialist technical support to Austal's service and warranty activities worldwide.

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 Rob Gehling, rina.austdiv@optusnet.com.au, when your mailing address changes to reduce the number of copies of *The Australian Naval Architect* emulating boomerangs.

Phil Helmore

HMAS *Darwin* taking part in the Indonesian Fleet Review held on 19 August to celebrate the 64th Anniversary of Indonesian Independence. HMA Ships *Success* and *Leeuwin* were also among the 38 ships which took part
(RAN photograph)

AUSTRALIA'S FUTURE SUBMARINE CAPABILITY

In the case of the submarine force, the Government takes the view that our strategic circumstances necessitate a substantially expanded submarine fleet of 12 boats ... a larger force would significantly increase the military planning challenges faced by any adversaries, and increase the size and capabilities of the force they would have to be prepared to commit to attack us directly, or coerce, intimidate or otherwise employ military power against us.

Defending Australia in the Asia Pacific Century: Force 2030 [1]

The brevity of the above statement, taken from Australia's latest Defence White Paper, understates somewhat its momentous impact on the shape of our future maritime force. The Royal Australian Navy's future submarine fleet will eventually be double the size of the existing fleet, by which time it will also constitute just over 50 per cent of the major combatant force. But numbers alone do not define the substantial capability gain conferred by this decision. Nor do they readily convey the significant effort required by the Navy and the wider Defence organisation to realise the goal of an expanded fleet of submarines likely incorporating even more capability than the existing Collins class.

What else does the Defence White Paper call for?

The submarine decision resonates with several other statements in the Defence White Paper. The Australian Defence Force's primary force-structure determinant is identified as the ability to deter or defeat an armed attack on Australia [2]. Furthermore, within the predominantly-maritime strategy espoused, the capacity to establish sea control is a recurring theme. More particularly, the White Paper calls upon the ADF 'to be prepared to undertake proactive combat operations against an adversary's military bases and staging areas, and against its forces in transit, as far from Australia as possible' [3]. Reference to the possible need for 'Australia to selectively project military power or demonstrate strategic presence beyond our primary operational environment' is also pertinent, as is the assertion that 'Australia might need to be prepared to engage in conventional combat in the region ... in order to counter coercion or aggression against our allies and partners' [4].

So, why submarines?

For as long as submarines have been operating, they have remained potent instruments of maritime power. They have contributed significantly to the preponderance of major naval powers and have lent smaller navies credibility. Though not invulnerable — it would be foolish to suggest otherwise of any weapon system — submarines operate in what continues to be the most opaque of mediums, the undersea environment, from where they can generate effects under, on, and beyond the sea. Technology has yet to render the sea transparent. This physical fact, coupled with their increasing stealth, affords submarines tremendous tactical initiative which readily translates to operational flexibility across the spectrum of conflict.

First and foremost, the submarine is able to operate undetected and conduct its activities covertly, enabling it to operate in waters where it may not be desirable or even possible to position other maritime forces. In areas where sea control has yet to be secured, the submarine can strike a potential adversary's maritime forces and, if necessary, land targets. Beyond denying the use of the sea to an adversary, the submarine has the capacity to contribute significantly to the achievement of sea control by destroying those enemy forces which might seek to dispute it. Indeed, inherent in this substantial offensive capacity is the deterrence offered by the possession of submarines, and their usefulness as force multipliers. While submarines might not offer a visible presence off troublesome shores in times of rising tension, their initial deployment signals national resolve and the promise of serious consequences should a potential adversary choose to open hostilities. The nexus between the tactical initiative, operational flexibility, and strategic value conferred by a capable submarine fleet is starkly evident.

What do submarines do?

Submarines excel in high-end warfighting tasks, such as anti-submarine warfare. A well-designed submarine equipped with superior acoustic sensors, processing systems, and torpedoes, and crewed by a highly-trained team will succeed in anti-submarine missions, and may prove one of the few means by which an adversary's submarine capability can be neutralised in the opening stages of hostilities.

Submarines are also lethal anti-surface warfare assets and can inflict serious losses on the naval combat and logistic-support fleets of an adversary. Recent exercise and real-world experience continues to prove the advantages which rest with submarines when operating against surface units. A successful hit from a single Mk 48 torpedo of the type employed by the Collins class will generally sink large surface combatants and quickly disable bigger ships. The addition of anti-ship missiles to a submarine's arsenal further increases their reach and lethality.

As foreshadowed in the White Paper, land strike will likely become another significant role for RAN submarines. A submarine specifically loaded for land-strike missions could carry a substantial number of cruise missiles alongside a limited number of torpedoes. Submarine-launched land-attack missiles might be among the first weapons fired in a campaign where the threat prevents the use of land-based air power, or other factors prevent ships from positioning for such a strike. Moreover, the ability of the submarine to clear a launch datum and exploit the undersea environment to evade may offer greater impunity against counter-attack. Submarines are also capable of supporting small Special Forces units through covert insertion and extraction.

In addition to direct warfighting, submarines can consistently contribute to intelligence and surveillance efforts. They can collect acoustic, visual, communications and electronic intelligence which promotes our understanding of evolving threats and directly supports the conduct of operations by other forces.

The advent of secure, discrete, and high-data-rate communications for submarines now also means that they can operate as part of a networked force. This does not imply that submarines need to remain a constantly-connected node. Rather, the achievement of effects can be magnified if submarines are supported by the timely flow of information from the rest of a force.

What are the challenges?

The successful introduction of Australia's future submarine capability will face a number of substantial challenges. These challenges give rise to related commercial, financial, and schedule issues which will truly make the future submarine an acquisition program of national dimensions.

In the first instance, the development of a future submarine suitable for Australia's distinctive security requirements is inherently complex. Not least among the technical challenges, will be energy generation and storage needs. Will the future submarine possess air-independent propulsion, for example? Our strategic geography alone imposes unique requirements on the range and endurance of a submarine expected to fulfil the roles and deliver the effects described above. Similarly, payload needs (coupled with the distance from Australia at which the future submarine could be expected to operate) generate additional demands on submarine size. The expected 25-year life of the future submarines also warrants careful consideration. To maintain their long-term effectiveness, they will clearly need to incorporate sufficient design margins for capability growth.

The planned expansion to a fleet of 12 highly-capable future submarines poses its own challenges, for this is not simply an acquisition program. While it is true that considerable effort will be devoted to the development, design and construction of the submarines, the RAN faces the equally-challenging endeavour of rebuilding a sustainable submarine force. Such a force must include the right number of trained and qualified people who will underpin the capability. Closely related are the training systems which will provide our personnel with the skills that they need to exploit all the advantages offered by our future submarines. There must also be through-life support arrangements which will uphold fleet availability and maintain the capability edge essential to the effectiveness of the submarines throughout their operational lives. Furthermore, there needs to be adequate shore-based infrastructure to support the inherent dependencies of submarines.

Finally, and without suggesting that the future submarine capability will change any of the enduring principles of maritime strategy, the RAN will also need to continuously revisit its tactical instructions and doctrine. It will thereby ensure that it remains current as new technologies of consequence emerge from the future submarine development and the other advanced maritime capabilities announced in the White Paper.

None of these endeavours will be simple or straightforward, and it would be simplistic to think that the usual way of doing business will invariably suffice. In fact, it would be fair to say that past business practices have proved less than effective in maintaining our submarine capability. Meeting the challenges posed by the future submarine must therefore begin with a concerted and deliberate effort to remediate current shortfalls. The success of the introduction of the future submarine will hinge on the legacy of our future Collins-class experience.

Conclusion

As one of the most ambitious acquisition programs to be undertaken by the ADF, the future submarine represents a substantial national investment in Australia's long-term security needs. Entrusted to the RAN, this key capability will also impose a substantial responsibility. Only by deliberately confronting the challenges posed will the Navy succeed in introducing the future submarine into service and sustaining it throughout its subsequent operational life.

References

1. Department of Defence, *Defending Australia in the Asia Pacific Century: Force 2030*, Canberra, 2009, p. 64.

2. *Defending Australia in the Asia Pacific Century*, p. 49.

3. *Defending Australia in the Asia Pacific Century*, p. 53.

4. *Defending Australia in the Asia Pacific Century,* pp. 52 and 55.

[*Reproduced from* Semaphore, *Issue 14, October 2009, published by the RAN Sea Power Centre — Australia*]

The Collins-class submarine HMAS *Farncomb* in Sydney Harbour during the Fleet Review in March (Photo John Jeremy)

FROM THE ARCHIVES
A REMARKABLE SUBMARINE

John Jeremy

Australia's first submarines, *AE1* and *AE2*, were two of the most numerous British submarine class of World War I, the E class. Fifty seven were built (including the two Australian boats) and nearly half of them were lost. *AE1* and *AE2* were replaced in the RAN by the six J-class submarines, given to Australia in 1919. They were large and fast submarines capable of some 19 kn on the surface and were designed following a 1914 report (actually false) that the German Navy was building submarines capable of 22 kn on the surface. Despite their speed, the J-class boats were still too slow for a role then regarded as important —as fleet submarines and operating with the battle fleet.

In 1913–14 diesel engines were not believed to be able to provide the power required for this speed and design work was begun at the Admiralty in 1913 on a large steam-powered submarine capable of a surface speed of 24 kn. An experimental steam-powered submarine to an Italian design had been ordered from Scotts at Greenock in August 1913. *Swordfish* was not completed until July 1916 and was not a success, never becoming operational as a submarine and ending her days as a surface patrol ship.

The concept of a fast fleet submarine was revived in 1915 when Vickers proposed a three-shaft design combining steam and diesel power with the diesel on the centre shaft. The best features of this design were combined with the 1913 Admiralty design, resulting in one of the most novel and largest submarines of the time, the K class. Twenty seven were ultimately ordered, although only 17 were completed.

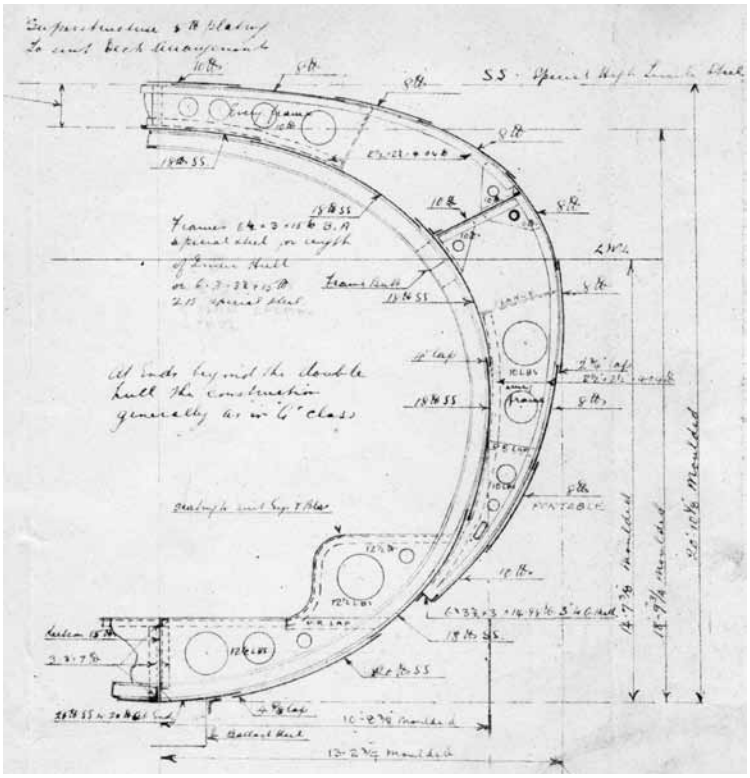
The K-class submarines had a surface displacement of 1914 t and 2698 t submerged. The were 338 feet (103.2 m) long overall with a beam of 26 feet 6 inches (8.08 m) and a draught of 16 feet (4.88 m). They were powered by steam turbines on two shafts delivering 10 000 shp (7457 kW) for a speed of 24 kn on the surface and four electric motors delivering 1400 shp (1044 kW) for a speed of 9.5 kn submerged. Two oil-fired Yarrow boilers were fitted in a watertight compartment which effectively divided the submarine into two. The boilers operated under forced draft, and complex arrangements were fitted to lower the funnels and seal the funnel hatches and ventilation intakes when diving. The boiler room became uninhabitable after the submarine had dived because of heat, but the submarine could be propelled submerged for a time using residual steam in the boilers. A single diesel generator (of the type fitted in the E class) was installed as a back-up and to charge the batteries.

The armament of the K-class included ten 18-inch torpedo tubes (four in the bow, four beam tubes in a compartment amidships and a twin revolving mount in the superstructure). The original design provided for two 5.5 inch (140 mm) guns fore and aft but they were replaced by 4 inch (102 mm) guns and one 3 inch (76 mm) anti-aircraft gun. The 5.5 inch gun was fitted forward in one submarine only.

The K-class submarines were complex and difficult to handle. The safe diving depth was 200 feet with a safety margin of about 50%, and the long submarine could easily exceed the safe depth when diving if great care was not taken, particularly as the hydroplanes had an unfortunate tendency to jamb. The fastest diving time recorded was 3 minutes 25 seconds.

The reputation of submarines suffered from an unfortunate series of accidents and collisions but, as fleet submarines they were regarded as a success. We will never know how they might have performed with the battle fleet in action, as all were completed after the Battle of Jutland and the opportunity to test them in the role for which they were designed never arose. Only one ever engaged the enemy, hitting a U-boat with a torpedo which failed to explode. Most had a short service life — the longest was nine years.

In many ways the K-class submarines were way ahead of their time. Steam power was not to return to submarines until USS *Nautilus* took the first nuclear reactor to sea in 1956.



The midships section of the K-class submarines (John Jeremy collection)

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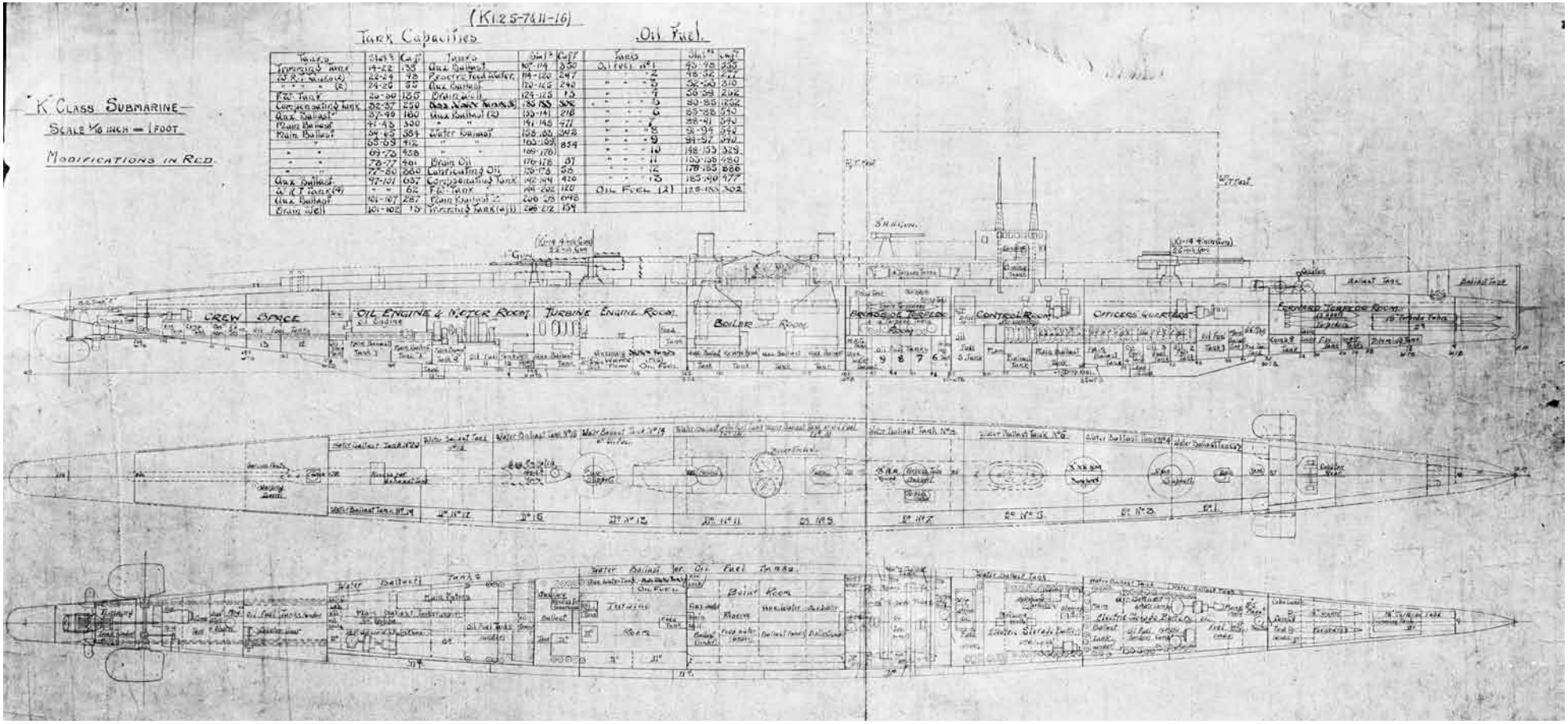

An early general arrangement of the K-class submarines. The forward 5.5 inch gun shown was replaced by a 4 inch gun but the mounting was unworkable at sea due to the low freeboard forward. The submarines were later fitted with a raised 'swan bow' to improve forward buoyancy
(John Jeremy collection)