THE AUSTRALIAN NAVAL ARCHITECT

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Picture courtesy of BAE Systems Marine Ltd.

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Cover Photo:

HMAS *Sirius* arriving in Sydney for her first visit to the port on 23 February 2007 (Photo John Jeremy)

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on the
World Wide Web

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From the Division President

As this is my first article for *The Australian Naval Architect* as the recently-elected President, I think it is appropriate that I start by offering my congratulations to the outgoing President, Rob Gehling. In his last column, Rob outlined what he had achieved in the last year and, if you add those achievements to those of the previous three years, then you will see that Rob served the Australian membership exceedingly well and has left an organisation with a very clear direction. I would like to thank him for this contribution on behalf of the membership.

The Australian Division President is also supported by a team of very enthusiastic members who were either elected or nominated by their respective sections. I would also like to thank these members of council for their work in the previous years and to thank them (in advance) for supporting me in this new role over the next few years.

Before I move on, I would also like to express my gratitude to Lance Marshall and his team at SKM. In preparation for the start of my term as President, it was decided that the Australian Division AGM should be held in Melbourne this year. I tasked Lance to arrange this meeting and then left him to hold the reigns when I was called overseas at short notice. It was reported to me that everything ran like clockwork. SKM are excellent supporters of the Victorian Section by allowing the section to host technical meetings in their theatre. SKM are one of fifty corporate partner members of the RINA, and one of six within Australia.

As I mentioned, I have been handed an organisation that has a clear path determined and so I certainly do not want to "rock the boat" with any significant changes to this course. There will be a range of activities that I need to undertake and comprehend in this role and, I trust that you will bear with me during my learning curve. The first of these challenges will be in a few hours time (I'm writing this on Anzac day) when I attend, via tele-link, my first RINA Council meeting as the Australian Division Council representative.

Now, what of the year ahead? I personally think that so much will happen in the industry over the next twelve months that it will pass very quickly. As most of you are aware, there will be two very important decisions made in relation to new acquisitions for the Royal Australian Navy. Within the next few months the preferred design for both the Landing Helicopter Dock ships (JP2048) and the Air Warfare Destroyer (SEA4000) will be known. Most of us within the industry will have some connection with at least one of these projects which will influence us for a number of years. At the other end of the scale is the new maritime capability for the customs service in the form of four medium patrol vessels of which the first boat will be delivered in July and the remainder before the end of the year. I'm sure there are just as many exciting developments in other sectors, such as the high-speed craft industry. With all this happening, I expect that John Jeremy and the team organising the Pacific 2008 conference and exhibition will have an extremely exciting program which will be a "must" in everyone's diary.

Whilst all this activity travels with its own momentum, there are a few things which we need to consider from the Division Council perspective. Some of these issues are:

- Membership of the RINA continues to grow within Australia. The universities are producing quality naval architecture graduates, and I feel it is important that these graduates see the RINA as the preferred choice for obtaining corporate membership and chartered status. They have options and it will be the institution which provides the most for them that is going to secure their loyalty. I would like to make sure we have things right — after all, they are the future.
- Similarly, the RINA has seen an increase in membership from other engineering disciplines as well as applications from people who have qualifications other than bachelor's degrees. Once again, how does this affect us in Australia?
- The Internet is often the first place many of us turn to now for information relating to any aspect of our lives whether it is to buy a new widget or for assistance with our latest work challenge. Our Internet site has recently changed appearance and it is important that this is consistent and kept up-to-date. I would like to see this reviewed constantly to ensure up-to-date information is provided to the membership on both national and local issues.
- Council nominations were low again last year and there are at least a couple of vacancies to fill. I would like to see a time when members want to serve on council and positions are hotly contested.

I'm sure other issues will arise as the year moves on. However I do welcome any suggestions or improvements that you would like to see made during my term of office. Probably the best way to contact me is via this journal as a letter to the editor, or simply by asking Keith Adams to pass comments onto me directly. I'm certainly looking forward to meeting as many of you as I can, and look forward to the challenges that face me.

Stuart Cannon

Editorial

On Friday 11 May the last two RAN Fremantle-class patrol boats, HMA ships *Townsville* and *Ipswich*, decommissioned in Cairns. Amongst the busiest ships of the RAN, the Fremantle-class has served Australia well for nearly three decades.

The fifteen ships (they are rather too large to be called boats) replaced the Australian-designed and built Attack-class patrol boats which were completed in the late 1960s. They also did a good job but were rather too small for some of the duties they were called upon to perform. The design of their replacements was selected following international tenders and a competitive project definition between the short-listed Lürssen FPB 45 and the Brooke Marine 45 m patrol boat which was based upon their well-proven 37.5 m design. In the risk-averse 1970s, proven designs were required and, after the project definition and the concurrent tendering for the construction in Australia of all ships other than the prototype, the Brooke Marine design was selected. Despite being based on a proven design, their 45 m patrol boat was essentially a new design and the construction of the first ship, HMAS *Fremantle*, was not without its challenges.

The remaining fourteen ships were well built by NQEA in Cairns and all have worked hard ever since.

The Fremantle-class replacements, the Armidale-class patrol boats, are all Australian designed and built — as they should be. They are also larger than their predecessors and, perhaps, their replacements in fifteen or twenty year's time may also be larger. After all, volume is relatively cheap and the improvement in sea keeping and crew comfort can be dramatic.

The design of major warships is likely to be an international collaborative effort for all but a few nations, but there is now no reason not to expect that many of the future workhorses of the RAN will be the product of Australia's own innovative industry.

John Jeremy

Letters to the Editor

Dear Sir,

I would like to share some thoughts on the shipbuilding industry in my home country of Malaysia. I am from the town of Sibu in the state of Sarawak, which is located on the north-west coast of the island of Borneo. Shipbuilding has long played a significant role in contributing to the economy of Sarawak.

The main factors encouraging the local shipbuilding industry are the topographical features on the island, which is mountainous with an abundance of long, winding rivers and hardwood timber logging and the oil industry. As a result, the local shipbuilders have been building a vast number of river-going vessels which are mainly tugs, barges, oil tankers, offshore supply vessels, high-speed passenger boats, patrol boats, ro-pax ferries and small FRP high-speed boats.

The local shipbuilders and ship repairers are divided into two categories, the companies building small FRP high-speed boats and the companies building larger steel and aluminium vessels. The majority of shipbuilders have both shipbuilding and ship repairing facilities on site. The river-transport system has significance for a large section of the population living in the interior and along the coast. Sarawak boasts an economical yet efficient express-boat service which connects the various coastal towns and cities.

Daniel Wong
UNSW Student

Dear Sir,

I have a new interest in submarines. I have just finished the book *The Last Explorer*, which follows the life of Sir Hubert Wilkins, a man who isn't recognised in most households but is probably the most remarkable person I have ever heard about. In 1931, Wilkins set out to prove that the Arctic Ocean was passable. He purchased an old O-type submarine from the US Navy scrap yard for one dollar and set about his task. Although he did not succeed, in his passing he did prove that it was possible and, in 1958, the first US nuclear-powered submarine passed under the North Pole and crossed the Arctic Ocean.

The voyage of *Trieste* has also captured my attention. In 1960 it reached the depths of the Marianas Trench, proving that we now have few limits to where humans can explore. This would have been a most exciting time for explorers and navigators, and I expected a flurry of submersibles to follow *Trieste*'s lead. The cost of such voyages meant that exploration would have to wait.

My interest lies in the fact that the visible world is almost completely conquered, but less than 1% of the ocean floor has been mapped. To me this is the final frontier in world exploration, and the future will bring about some interesting discoveries. The defence and fossil-fuel industries have financed a lot of yesterday's operations but, with the cost of the new submersible technologies decreasing, private funding is looking to be a more-viable option. Are we to see an increase in deep water exploration in the years to come? I definitely hope so.

I believe that exploring the last unknowns will have huge meteorological impacts and give us a more complete understanding of weather patterns. Naval architects have played the most crucial roles in world exploration and, as the second-oldest profession in the world, we will still be at the forefront in the years to come. I am excited to be entering such an influential career in the civilisation of the world.

Sam Shepherd
UNSW Student

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.

Many people use Microsoft Word, but illustrations should not be incorporated in the document.

Photographs and figures should be sent as separate files with a minimum resolution of 150 dpi. A resolution of 200–300 dpi is preferred.

NEWS FROM THE SECTIONS

Victoria

This year has seen the joint technical meetings with IMarEST continue with noticeable success. The first three meetings held have seen a diverse and interesting range of topics which have proven to be well received by members and guests alike:

8 February	*Obtaining Military Naval Capability Using Commercial Standards,* by CMDR Giles Rinckes and LCDR Jeremy Miller of the RNZN
14 March	*The Port of Geelong: Minimising Risk — Maximising Access* by Peter McGovern
12 April	*The Restoration of the Barque* Polly Woodside, by Robert Herd and John Yuncken

All three meetings were well attended, with more than 40 members turning out for the paper presented by the RNZN members. We hope to continue this momentum through the rest of the year!

Nominal dates for technical presentations for the rest of the year (check closer to the date for confirmation) are:

14 June
9 August
11 October
13 December

Many Victorians were pleased to hear the announcement that HMAS *Cerberus* (at Crib Point in Victoria) will remain open and functional. As part of a review of future RAN training infrastructure requirements, the Minister for Defence, Dr Brendan Nelson, has confirmed that HMAS *Cerberus* will be retained at its present location. Dr Nelson said that analysis of the implications of closing HMAS *Cerberus* and relocating those functions elsewhere had showed that there would be "no measurable advantage to Navy personnel or to the Defence operating cost budget from such a proposal."

The Chief Executive of RINA, Trevor Blakeley, visited the Victorian Section as part of his Australian tour and met with members, potential members and corporate members including Tenix, AMT, DSTO, BMT and SKM. Trevor also took the opportunity to present Dr Stuart Cannon with his membership certificate as Fellow of the Institution. Stuart has also recently taken over the role as President of the Australian Division of RINA, and handed over the role of Chair of the Victorian Section to Samantha Tait.

If you have been down to the Melbourne Exhibition Centre recently, then you will have noticed a large hole in the ground at the west end! This is part of a major redevelopment to construct a conference centre, hotel and shopping precinct which will rival the facilities in Sydney's Darling Harbour. Completion is targeted for 2008.

The Melbourne Maritime Museum is being relocated to the east side of the Duke and Orr dock as a result, and will house local maritime history in a more interactive and welcoming design.

The iron-hulled barque *Polly Woodside*, a recipient of the World Ship Trust Medal for the excellence of her restoration, is taking advantage of the temporary closure necessary as a result of the redevelopment work and undertaking some survey, maintenance and preservation strategy work.

Samantha Tait

New South Wales

Visit by Chief Executive

The Chief Executive of RINA, Trevor Blakeley, visited UNSW on Friday 2 March, and made a presentation on RINA, its aims, and the benefits of becoming and remaining a member, to the naval architecture students and staff.

He then dined in the Tyree Room at UNSW with RINA (Australian Division) Past President, Noel Riley; RINA (NSW Section) Chair-elect, Graham Taylor; Member, Mac Chowdhury; and Chair, Phil Helmore, and discussed matters of mutual interest.

Annual General Meeting

The NSW Section held its ninth AGM on the evening of 7 March, following the March technical presentation at Engineers Australia, Chatswood, attended by eight with Phil Helmore in the chair.

Phil, in his fourth and final Chair's Report, touched on some of the highlights of 2006, which included nine joint technical meetings with the IMarEST (Sydney Branch), with attendances varying between thirty-nine (Mori Flapan's presentation on *Vessel Survey Innovations in the New National Standard for the Administration of Marine Safety*) and fifteen. The EA move from North Sydney to Chatswood appears to be having an effect on attendances, and the meeting times have been put back by half an hour for 2007 to see if this helps with travel to Chatswood. SMIX Bash 2006 was successful and was attended by 196, including a number of national and international guests. RINA had a stand at the Pacific 2006 International Maritime Exhibition, and the stand was crewed throughout by the Chief Executive, Trevor Blakeley, and members of the NSW Section Committee.

Phil also presented the Treasurer's Report. The EA venue at North Sydney and then Chatswood had, as usual, been our major cost for the year. However, with a close watch on the outgoings, we had managed to operate within the black all year and have the grand total of $186 in the Section account at 28 February 2007, with $8109 in the Social account (including SMIX Bash funds, with accounts still to be paid — which are covered, with a small surplus).

There is a number of changes to the NSW Committee for 2007. Geoffrey Fawcett resigned from the Committee during 2006 due to an overseas posting. Phil Helmore stepped down from the position of Chair following the AGM, and this position has been taken over by Graham Taylor. As a result, the committee for 2007 is as follows:

Chair	Graham Taylor
Deputy Chair	Craig Hughes
Treasurer	Adrian Broadbent
Secretary	Lina Diaz
Assistant Secretary	John Butler
AD Council Nominee	Craig Boulton
Auditor	Bruce McRae
TM Program Coordinator	Phil Helmore

We would like to have an additional Assistant Secretary, as John Butler works in Newcastle, and cannot make every meeting. If you feel the urge to contribute to your Institution, then the Committee would be very pleased to hear from you!

Section Committee Meetings

The NSW Section Committee met on 20 March and, other than routine matters, discussed:

- SMIX Bash: Most accounts have been paid, and figures show a small surplus after all expenses, to be shared equally with IMarEST; proceeds from the silent auction of the model of *Rani* at SMIX Bash to be donated to the Sydney Heritage Fleet; other venues discussed, but the attractions of *James Craig* are hard to beat despite the limitation of numbers.
- TM Program: Possible presentation for October still to be confirmed.
- Attendance at technical meetings: The committee is concerned that attendances at technical meetings have declined since the move by EA to Chatswood, with maximum attendance having been 23 since the move compared to our long-term *average* of 37! A number of issues were discussed, including the topics, advertising of the meetings, email lists, etc.
- Committee Membership: Recruitment of committee members discussed.
- Website: The new RINA website can only be edited by London. After a number of exchanges of emails, the new NSW Section pages have been edited to show the current state of play, and some innovations made along the way.
- Finance: There has been no change since the last meeting, with $8295 in the bank, made up of $8109 in the Social Account (including SMIX Bash monies), and $186 in the Section Account.

The NSW Section Committee also met on 23 April and, other than routine matters, discussed:

- SMIX Bash: Final figures for SMIX Bash 2006 show a small surplus after all expenses which has now been shared equally with IMarEST, and proceeds from the silent auction of the model of *Rani* at SMIX Bash have been donated to the Sydney Heritage Fleet. The SMIX Committee have another meeting planned soon.
- Committee Membership: Recruitment of committee members discussed.
- TM Program: Further discussions on how to increase attendances, e.g. the topics, advertising of the meetings, email lists, etc.
- Fisher Maritime Presentations: Fisher Maritime is advertising their availability for in-house training on contract management in Australia and New Zealand this year. However, registration workshops are only scheduled here every second year, and in the same years as Pacific conferences, so the next series will be next year.
- Finance: We currently have $2624 in the bank, made up of $2772 in the Social Account, and the Section Account $148 in the red; i.e. the social account is keeping the section account afloat. However, we have invoiced the AD $330 for venue hire, and this will put the Section Account $182 into the black.

EA Presentation on *Queen Mary 2*

John Jeremy gave a presentation on *The 21st Century Passenger Ship Queen Mary 2* to a joint meeting of the Maritime Panel and the joint electrical institutions, IEEE and IET, which are all branches of Engineers Australia, on Wednesday 28 February in the auditorium at the Chatswood RSL Club.

The presentation was attended by 135 which is, in all likelihood, an Australian record for attendance at a technical meeting. The known contenders include Ken Ross and Trevor Cosh's presentation to RINA and IMarEST at the Portside Centre, Sydney, in 1992 on *The Salvage of MT* Kirki *off the Western Australian Coast* (when there was standing room only and "probably more than 100", but no audited attendance figure), and Ian Burns' presentation to the Centre for Engineering Leadership and Management of EA at the Kirribilli Club, Sydney, in 2003 on *America's Cup 2003 — Billionaires Only Need Apply* (with attendance of 102). John Jeremy's presentation was advertised to a huge possible audience, including all of Engineers Australia and its many branches, and to IMarEST and RINA and their interested visitors.

John's presentation appears on Page 45 of this issue.

The vote of thanks was proposed by Noel Riley, who assured John that the audience had found his presentation thorough and entertaining, and had made his own night voyage from Woy Woy enjoyably worthwhile. The vote was carried with acclamation.

Composite Engineering

David Firth, Design Engineer for Gurit Australia, gave a presentation on *Development of Production-oriented Advanced Composite Construction for the New RNLI RIB* to a joint meeting with the IMarEST attended by twenty-eight on 7 March in the Harricks Auditorium at Engineers Australia, Chatswood.

David's presentation appears on Page 25 of this issue.

The vote of thanks was proposed, and the "thank you" bottle of wine presented by Bruce McRae.

Phil Helmore

Use of Biodiesel

Luke Halliday of GHD gave a presentation on *Use of Biodiesel in Medium-speed Marine Diesel Engines* to a joint meeting with the IMarEST attended by 29 on 4 April in the Harricks Auditorium at Engineers Australia, Chatswood. This was the best attendance since the move by EA to Chatswood, and is testament to the growing interest in sustainability.

Luke began his presentation with a short movie which highlighted the problems associated with using fossil-based oils in combustive processes. It outlined the detrimental effects which fossil-based fuels can have on our atmosphere, and illustrated how anthropogenic practices contribute to the global-warming phenomenon and the subsequent decay of our planet.

Biodiesel was then introduced as an alternative which can help reduce the sustainability impacts due to combustion of geological oil and its derivatives. It was defined as a clean-burning renewable fuel, produced from local resources such as vegetable oils or animal fats. Biodiesel is made by chemically altering naturally-occurring fats and oils using methanol and potassium hydroxide as a catalyst. It:

- contains no petroleum, but can be blended with diesel;
- is a green fuel, reducing greenhouse gases;
- is non toxic if spilt;
- is simple to use, biodegradable, and virtually free from sulphur and aromatics; and
- supplies the engine with increased lubrication, thereby greatly reducing engine wear.

A variety of oils which can be used to produce biodiesel were discussed. These include:

- virgin oil feedstock; rapeseed and soybean oils are most commonly used, with soybean oil alone accounting for about ninety percent of all fuel stocks; other crops such as mustard, flax, sunflower, canola, palm oil, hemp and even algae;
- waste vegetable oil (WVO); and
- animal fats, including tallow, lard, yellow grease, chicken fat, and the by-products of the production of Omega-3 fatty acids from fish oil.

Physical characteristics such as cloud point, pour point, specific gravity, cetane number, viscosity and water content were compared for a range of feedstocks.

Biodiesel feedstock plants utilise photosynthesis to convert solar energy into chemical energy. The stored chemical energy is released when it is burned, so plants can offer a sustainable oil source for biodiesel production. Most of the carbon dioxide emitted when burning biodiesel is simply recycling that which was absorbed during plant growth, so the net production of greenhouse gases is small.

The transesterification process (alcohol + ester → different alcohol + different ester) was briefly outlined to give an understanding of why processed oils are preferred over neat oils. A lipid transesterification production process is used to convert the base oil to the desired esters. Any free fatty acids in the base oil are either converted to soap and removed from the process, or they are esterified (yielding more biodiesel) using an acidic catalyst. After this processing, unlike straight vegetable oil, biodiesel has combustion properties very similar to those of petroleum diesel.

Luke then introduced Adsteam Marine Ltd, including a general overview of the company's central business activity, and its associated responsibilities on water. More specifically, the mechanical layout of the test tug, *Wilga,* was given, including engine specifications and ratings. The testing process using B20 (20% biodiesel + 80% diesel) was defined, where the aims of the testing, the method and the necessary apparatus used to measure performance were displayed.

The calculation of overall indicated power (IP) using a pressure-volume (PV) diagram, and the measurement of resultant exhaust emissions were two significant areas of interest which were addressed. Findings of the experimentation were analysed and discussed in light of scholarly references and prior experimentation by others.

Other benefits and drawbacks associated with biodiesel were discussed using a systems analysis. These included biodegradability, the carbon-neutral cycle, price, availability and power in commercial markets.

The overall findings of the trials included the following:

- An increase of 5% indicated power by using biodiesel (specific fuel oil consumption was not calculated).
- Slight increase in NO^X emissions.
- Biodiesel has a lower calorific value than diesel oil.
- Biodiesel ignites 1.5° before TDC (top dead centre).
- Biodisel's higher cetane index resulted in lower ignition-delay time.
- Biodiesel is generally more expensive to purchase than petroleum diesel (biodiesel about $0.80/L and petroleum diesel $0.67/L).

The experiment was based on blends of 20 percent biodiesel with 80 percent petroleum diesel (B20) which can generally be used in unmodified diesel engines. However, pure biodiesel (B100) may require certain engine modifications to avoid maintenance and performance problems due to better solvent properties than petrodiesel, and this will need to be determined by further research.

The vote of thanks was proposed, and the "thank you" bottle of wine presented by Len Michaels.

Nazmul Hossain

Emergency Response Services

Jonathan Branch, Deputy Director Naval Business for Lloyd's Register Asia, gave a presentation on *Ship Emergency Response Service Requirements under MARPOL* to a joint meeting with the IMarEST attended by twenty-eight on 2 May in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Jon graduated in naval architecture from the University of Glasgow, and worked in a shipyard for two years before joining Lloyd's Register, where he worked in the Ship Emergency Response Service (SERS, a branch of LR's Marine Consultancy Service), until last July.

He began his presentation with a look at why clients need emergency incident support. Statistically, a fleet of ten ships suffers, on average, one serious casualty every ten years, based on 8700 reported serious casualties to the world fleet over the last ten years. The average cost to the owner/operator of a serious casualty is US$ 2 million. The commercial and environmental impact of a casualty can be significantly reduced by responding quickly and effectively. Given that accidents will happen, the next question is what does an emergency-response provider do? They hold all the data on a vessel in readily-accessible format, and can thus provide an evaluation of the implications of an incident on strength, stability, flotation, outflow or grounding, or combinations of all of these.

Examples

Jon then said that the technical concerns could be understood more clearly by looking at some cases, and proceeded to show slides of the following:

- *Strength* A bulk carrier in ballast was just leaving a repair yard in China, when she was hit by a similar-sized vessel entering the repair yard, also in ballast.

The striking vessel went on to take the vacant slot in the repair yard, but this vessel had to sail across the bay to an available slot in a different yard. The damage was significant, and conditions had to be developed to keep the bending moment and shear force sufficiently low in way of the damage, together with sufficient draft forward. One option was to part-flood one of the holds to reduce the hog, but LR advised against this due to potential sloshing loads. LR's advice was taken, the vessel performed well against the sea-going limits established, and made the crossing safely.

- *Strength* A chemical carrier part-loaded with methanol had a minor contact with the quay. The master, aware of the risk, sailed the vessel out of port where an explosion took place. Damage was significant, and the slide showed much missing and twisted metal in way of the explosion. Conditions were developed to keep the bending moment and shear force low in way of the damage.
- *Stability* A *s*ingle-hold self-discharging bulk carrier carrying zinc concentrate took water on board from a wave in following seas. A characteristic of zinc concentrate is that it turns into a slurry when wet, and the additional weight of water and the free-surface effect of the cargo slurry led to downflooding into the engine room. As a result, the vessel lost power and communications were made very difficult. On the basis of information available to SERS initially, the situation looked very bad. However, as more information became available, the model was refined and it turned out that only one-third of the cargo had turned to slurry, so the situation was not as bad as feared. The salvors pumped the slurry into ballast tanks, and the remaining cargo was offloaded before making the voyage to a repair yard.
- *Flotation* The tanker *Sea Empress* grounded off Milford Haven on the west coast of the UK. This was a major pollution incident, with about 70 000 t of crude oil lost to the sea. The UK's Marine Accident Investigations Branch report stated that SERS advice during the salvage operation had been "invaluable". As a result of this incident, the UK made a proposal to the Marine Environment Protection Committee of IMO at its 47th session that access to an emergency response service should be made mandatory for oil tankers. Regulation 37(4) to that effect was adopted and entered into force on 1 January this year.
- *Oil Outflow* A single-hull oil tanker in the US loaded with oil had a collision with bridge casement, resulting in damage to the forepeak, a fuel oil bunker tank and a slow leak from the No.1 cargo-oil tank. The total loss of bunker oil was only about 600 t. However, because of tides, this small amount of oil covered 80–100 km of river! The repairs to the bridge cost of the order of US$300 000, repairs to the ship $600 000, lost time for the ship $600 000, and the oil clean-up cost $43 million!
- *Grounding* A container vessel leaving the Schelde River in Antwerp grounded at midships at high tide. The tide then dropped by 5 m, and the vessel broke her back. The vessel was refloated at high tide the next day, but was left with a permanent deflection of 2 m, which showed up well in the slide. The permanent deflection presented a number of technical challenges: the straight keel model was no longer valid; they needed to offload cargo to reduce the forward and aft drafts, but offloading cargo at midships would have led to the vessel breaking apart. An offloading sequence was developed to minimise the bending moment in way of the damage, and deflections were continually monitored by laser. Basically the two torsion boxes were holding the vessel together. The vessel successfully transited to Rotterdam for temporary repairs, made two more voyages, and then underwent full repairs with a new midships section constructed in China.

Delivery of Emergency Response

Having looked at what is involved in emergency response, Jonathan then focused on how it is delivered. He showed a slide of the lines of communication in a typical set-up with a large operator, from the ship to the company's Emergency Response Centre, and thence to SERS. It is important to note that SERS is there to support the client's decision making, giving them confidence in the implications of actions in terms of strength, stability, outflow and grounding forces. All this sounds quite straightforward, but there are many other influences which may also influence a client's decision making in a real emergency, including class, flag, salvors, coastguard, media, P&I club and hull insurers.

The number of stake holders is one of the main reasons why the supplier of emergency response services should remain shore-based in a calm and controlled environment. Ultimately, the master must make decisions based on the advice, requirements and instructions of *all* the various stake-holders.

The Influence of Legislation

Jonathan then illustrated the development of a service from an owner-supplied option to the current status where it is now a legislative requirement under MARPOL.

The evolution began in 1982 when some of the oil majors approached LR with a request for support, as they recognised that they didn't have all the naval architectural issues covered. By 1986 the service was being delivered as an owner's option, and LR was the first class society to do so. In 1989 *Exxon Valdez* ran aground with its enormous consequences. In 1991 the USA legislated its OPA 90 requirements, and LR was then in a good position to provide the support required and business started to take off. In 1994 technology started to catch up and the service was offered using PCs. In 1996 *Sea Empress* ran aground and started the UK government thinking about reducing the risk of pollution. By 2000 the size of SERS business required two on-call teams due to the probability of two simultaneous incidents, and Y2k got us thinking about contingency in systems and the response centre. 2006 was SERS' 20th anniversary, and they hit 2000 ships live in the service giving, on average, 20 emergencies per year. In 2007 MARPOL requirement for tankers came into force.

Looking at some of the legislative requirements in more detail:

- In the Tanker Management Self Assessment (TMSA), credit is given for having access to a 24 h damage stability and structural integrity assessment service "…typically provided by an internal body of qualified naval architects or under contract by a classification society which has appropriate capabilities".

- The ISM Code requires operators to document emergency-response procedures in their safety management system, and to practice them with evidence of doing so.
- The USA's OPA 90 requires "… prompt access to computerised shore-based damaged stability and residual structural-strength calculation programmes ...". It currently applies to oil tankers trading to the USA. Application to non-tank vessels from August 2005 onwards is unclear.
- IMO MARPOL Annex I Regulation 37 (4) applies to all oil tankers (new and existing) of 5 000 t deadweight or more and requires that they "…shall have prompt access to computerised, shore-based damage stability and residual structural-strength programs." This requirement came into force 1st January 2007. Oil is defined as including crude oil, fuel oil, sludge, oil refuse and refined products. Oil tankers are defined as including all vessels with oil in their cargo list, FPSOs and gas carriers.

IMO Marpol Annex I Regulation 37(4) Intent and Best Practice

The intent of Reg. 37(4) is that there should be prompt access to the emergency-response service, and that it should be available 24 hours per day, 365 days per year. The service should have available pre-prepared models, and have access to all plans and documents for the vessel. There should be robust communication systems, and the service be capable of continued support for prolonged periods. There is a ship-specific pro-forma for the transmission of information. The pro-forma follows the response process and its use ensures that *all* the required information is presented. LR has found that providing ship outlines for the crew to sketch damage extents on is a very powerful way to communicate.

LR has available a computerised model of each vessel, and they use recognised naval architectural software (NAPA) for investigation of loadings in intact and casualty conditions.

SERS is shore based, with two dedicated response centres in London (to allow for contingencies). The on-call teams are made up of three persons, partly made up of staff from the SERS department but also including specialists from other departments, giving a far greater spread of knowledge and experience than would otherwise be possible.

The assessment of damaged stability, flooding, oil outflow, grounded conditions, progressive flooding, and evaluating remedial actions is usually more than can be achieved, even by the most sophisticated of onboard computers. Flexibility with input is key to allow the modelling any scenario that may arise. The assessment of remaining local and longitudinal strength following damage, revision of strength limits and evaluation of remedial actions against revised limits are all services which are provided.

Verification of Compliance

Until recently, there has not been much guidance on verification. IACS made a submission to IMO's Marine Environmental Protection Committee meeting in October 2006, and this approach has now been adopted by LR.

IMO Document MEPC 55/6/5, Paragraph 7, provides clarification on the application of the regulation, and on providing evidence that a contract exists linking the ship with a shore-based firm. The shore-based firm is to issue a statement indicating it is capable of providing computer calculation capabilities as per the regulation, and verifying that the master has the means to access the shore-based firm at any time. Jon then put up a slide showing an example of the certificate issued by SERS, confirming that the service meets the requirements of MARPOL and other relevant codes.

Actions for Ship Operators

Actions required of ship operators to ensure compliance with the regulation include:

- Contracting the services of a recognised shore-based emergency response service supplier.
- Placing copy of contract on the vessel.
- Supporting the service supplier in sourcing plans and information required to create a ship model.
- Requesting the service supplier to issue documentation confirming that they meet the requirements of the regulation.
- Placing a copy of this documentation with the procedure for activating the service on the vessel.
- In the event of a class, flag or PSC inspection of the vessel, presenting the evidence to the inspector.
- In the presence of the inspector, calling the service to confirm availability.

If the operator cannot do this, what might be expected? There is no consolidated view at this stage, and the issue is currently under consideration at the Paris Memorandum of Understanding on Port State Control. However, current thinking is as follows:

- *No evidence of contract* — Major non-conformity and detainable.
- *Evidence of contract but no evidence of availability of service* (e.g. due to lack of documents) — Flagged for rectification but not detainable.

Future Legislation

To date, legislation has been reactive, i.e. driven by accidents. The USCG requirements for non-tank vessels is an interim measure, and this may be taken up seriously in future. A lot of damage can be done by relatively little oil. As the evidence adds up, more and more operators are being proactive and taking up an emergency response service

Questions

Question time lasted for nearly half an hour, and elicited some further interesting points.

SERS staff are not on duty 24/7, but someone is guaranteed to be in the office within an hour of calling. This tends not to be a problem, because when an incident occurs, there is so much happening on-site that communication with the outside world is a low priority, and it is common for SERS staff to be waiting on information to be fed to them from the ship.

The NAPA software which SERS uses is strong in both strength and stability analyses (both intact and damaged), and can cater for other analyses as well.

The vote of thanks was proposed, and the "thank you" bottle of wine presented by Don Gillies, who said to Jon that the bottle was not to be regarded as an emergency response! The vote was carried with acclamation.

Phil Helmore

COMING EVENTS

NSW Section Technical Meetings

Technical meetings are generally combined with the Sydney Branch of the IMarEST and held on the first Wednesday of each month at Engineers Australia, 8 Thomas St, Chatswood, starting at 1800 for 1830 and finishing by 2000.

Please note the new time of start, which has been put back by half an hour to help enable travel to Chatswood for those coming from afar, and the parking areas and street are free after 1800.

The program of meetings for 2007 (with exceptions noted) is as follows:

6 June	Jeff Moloney, MAN B&W Diesel Australia *Condition Monitoring*
4 July	Brian Moncrieff, Teekay Shipping *Some Interesting Ship Technical Projects*
1 August	Steve Quigley and Rob Tulk, One2three Design *Design and Construction of Cutting-edge Vessels*
5 Sept	Craig Hughes, ABS Pacific *ABS Offshore Racing Yacht Rule Update*
3 Oct	TBA
6 Dec	SMIX Bash 2007

Pacific 2008

The Pacific 2008 International Maritime Exposition and Congress will be held at the Sydney Convention and Exhibition Centre, Darling Harbour, Sydney, from 29 January to 1 February 2008. It will include:

- The Pacific 2008 International Maritime and Naval Exposition, organised by Maritime Australia Ltd.
- The Royal Australian Navy Sea Power Conference 2008, organized by the Royal Australian Navy and the Sea Power Centre Australia. Further information on the conference can be obtained from the conference website www.seapower2008.com or by contacting the conference organizers, Tour Hosts Conference & Exhibition Organisers, GPO Box 128, Sydney NSW 2001, phone (02) 9265 0700, fax 9267 5443 or email seapower2006@tourhosts.com.au.
- The International Maritime Conference (see adveretisement on Page 11) is being 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*. Further information on the conference can be obtained from the conference website www.pacific2008imc.com or by contacting the conference organizers, Tour Hosts Conference & Exhibition Organisers, GPO Box 128, Sydney NSW 2001, phone (02) 9265 0700, fax 9267 5443 or email pacific2006imc@tourhosts.com.au. Further details of the conference are available on the website www.pacific2008imc.com.

The call for papers for the Pacific 2008 IMC is out, and the deadlines are as follows:

Receipt of Abstracts	24 May 2007 (extended from 3 May)
Authors notified of acceptance	13 June 2007
Receipt of refereed papers	27 September 2007
Receipt of non-refereed papers	31 October 2007
Presenter registration	14 November2007

Twenty-seventh Symposium on Naval Hydrodynamics in 2008

The Symposia on Naval Hydrodynamics are run under the auspices of the Office of Naval Research (ONR) in Washington and are held every two years. The 27th Symposium on Naval Hydrodynamics will be held in Sydney on 17–22 August 2008, which will make it the first time that the symposium has been held in the southern hemisphere. The conference is being organised jointly by ONR, the University of New South Wales, Engineers Australia and Tour Hosts. Further details may be obtained from Prof. Lawry Doctors, who is on the International Organising Committee, by phone on (02) 9385 4098 or email L.Doctors@unsw.edu.au, or visit the website www.27snh-2008.com.

Marine Safety Conference 2008

The National Marine Safety Committee will host the next national Marine Safety Conference in Adelaide, South Australia in May 2008. Dates and more detail will be forthcoming in the next edition of *The ANA*. Meantime, if you are interested in attending, then keep May 2008 clear of commitments!

CLASSIFICATION SOCIETY NEWS

IACS Documents Available on ABS Website

The following IACS documents are available for download free from the American Bureau of Shipping website, and may be useful if you are involved in the construction of steel vessels:

Guide for Shipbuilding and Repair Quality Standard for Hull Structures During Construction (2007) #87

This guide contains information obtained from IACS Recommendation No. 47 *Shipbuilding and Repair Quality Standard*. In order to be consistent with ABS requirements, some specific standards have been modified from the original. The modified standards are indicated in the *Remarks* column of the tables, along with the rule reference. This second edition of the guide, developed based on IACS Recommendation No. 47 (Rev. 3, Nov. 2006), supersedes the first edition published in July 1998.

Guide for Means of Access to Tanks and Holds for Inspection (2007) #154

This guide was developed to support statutory and IACS guidance and provides the base criteria to meet IMO requirements. The guide includes illustrations and clarifies the requirements for means of access. The guide also incorporates the application of current ergonomics practices to the means of access requirements. The application of ergonomics to the means of access requirements will enhance levels of safety as well as quality of work by providing appropriate access for survey, inspection and maintenance activities for tanks and holds. This guide presents the process to obtain ABS approval for the use of alternative materials for the construction of means of access as presented in MSC.151(78), MSC.158(78) and SOLAS Regulation II-1/3-6.

All of ABS's rules for the construction of vessels are also available for download from the ABS website, www.eagle.org.

Craig Hughes

GL Celebrates 140 Years

Germanischer Lloyd was founded in Hamburg, Germany, in 1867, i.e. 140 years ago. The spectrum of services now offered includes newbuilding supervision, ship in-service inspections, ISM, ISO and ISPS certification, quality-management certification and approval of workshops/shipyards, and training activities.

GL sets standards in technology, safety and quality for the maritime and industrial sectors. As a technical supervisory organisation with a global network, the society employs 3200 personnel at 176 locations in 76 countries. It is responsible for the technical safety of more than 6100 ships with over 66 million GT. The society is authorised by more than 124 flag states to perform statutory duties. The current newbuilding orderbook contains more than 1300 vessels totalling over 20 million GT.

GL has held gatherings in Singapore and Shanghai to mark the 140th anniversary, and recently held another in Warsaw, Poland, for the anniversary and to open a new office in the Polish capital.

GL First to Class Submarines

The modern submarine fleet of the South African navy will be classified by Germanischer Lloyd. The order includes the examination of engineering drawings as well as annual safety audits. This makes GL the world's first-ever classification society to be entrusted with the technical inspection of military submarines.

The order comprises three conventional Class 209, 1400 MOD-type submarines. GL will inspect the hull engineering drawings, as well as the engine and electrical systems based on GL's engineering regulations for military vessels. The rules governing classification of naval ships were amended by new specifications for military submarines in February 2005.

The South African submarines will receive the 100 N 6 Submarine class label. Their propulsion systems will be classed MC U.

The first technical inspections are slated for the spring (*northern* — Ed.) of 2007. They will be followed by a six-year classification term. Inspections by technical experts are an effective means to detect and remedy safety-relevant defects.

For further information contact Lorenz Petersen, Head of Department, Navy Projects, on phone +49-40-3614 9254 or email Lorenz.Petersen@gl-group.com.

Nonstop, Issue 4, 2006

ClassNK in Australia

ClassNK (Nippon Kaij Kyokai) established an office in Sydney in 1982. In the twenty-odd years since then, they have managed surveys requested from all over Australia, Papua New Guinea, Solomon Islands, New Zealand, and the western Pacific with the help of surveyors now based in Brisbane, Melbourne and Fremantle. With the establishment of another ClassNK office in Auckland, New Zealand in 1996, the Pacific islands, such as Fiji and New Caledonia, have come under the Auckland office.

Their work includes class and statutory surveys (mainly bulk carriers and oil/chemical tankers), ISM, ISPS, and particular change surveys (e.g. owner, flag), and industrial work (e.g. materials, marine equipment). ClassNK is one of the leading classification societies, with about 6500 ships totalling nearly 150 million gross tons in class, or about 20% of the world merchant fleet.

Current staff in the Sydney office are General Manager, Mr Seiichi Gyobu; Surveyor, Mr Nazmul Hossain; and one administrator.

For further information, contact Mr Seiichi Gyobu on (02) 9929 9722, email sy@classnk.or.jp, or visit the ClassNK website, www.classnk.or.jp.

ClassNK Magazine, 55th Edition

GENERAL NEWS

Anzac Frigate Integrated Material Support Program Alliance Contract

On 1 May 2007, the Defence Materiel Organisation (DMO) entered a new phase of a long term, strategic relationship with Tenix Defence and Saab Systems to support the Anzac-class frigates and shore facilities.

This will be delivered under a contract known as the Anzac Ship Integrated Material Support Program Alliance.

The DMO mission is to equip and sustain Australia's Defence Force. The contract is focused on meeting this mission and will deliver the required support to the Anzac-class frigates.

Eight Anzac-class frigates have been constructed in Australia as part of the overall plan to upgrade the Royal Australian Navy. A further two ships of the class have been built for the Royal New Zealand Navy.

Saab and Tenix have been chosen to support DMO in maintaining and enhancing these ships as they possess detailed knowledge, skill and experience developed over the past 16 years in building, managing and supporting them.

Ten New Ferries from Austal

Austal confirmed in March the recent order from Venetian Marketing Services Limited (VMSL) for ten 48 m passenger catamaran ferries following a competitive international tender process.

Adding to its fleet of thirty-six vessels delivered to China/ Hong Kong waters, Austal was able to deliver a proven solution and the best overall package. This included meeting a challenging delivery schedule for the boats to be in operation in 2007 and 2008.

With the capacity to carry 411 passengers at a service speed of 42 knots, the ferries will provide a link from Hong Kong locations to the new Pac On Ferry Terminal being built by the Macau Government to provide a service to the Cotai Strip on Macau. The Cotai Strip will incorporate a wide range of shopping, entertainment, gaming and convention activities which are currently being constructed.

When opened in 2007, The Venetian Macao will provide a fully-integrated resort destination with unmatched entertainment, convention, gaming and hotel facilities. The first-class resort in Macau will be supported by a first-class ferry service delivering visitors and guests to their destinations on the Cotai Strip.

In conjunction with speed, comfort and outstanding interior finishes, it was also imperative that the builder had a proven track record of excellence in production and achieving aggressive delivery schedules, supported by a proven level of performance to ensure that a reliable service could be maintained.

Commenting on the order and the impressive development projects currently under construction, Austal's Executive Chairman, John Rothwell said;

"With thirty-six Austal passenger vessels in nearby operations, it is a pleasure to be once again doing business in the Hong Kong region. We look forward to these ferries providing a valuable connection service befitting what will be an extremely high-quality development when completed."

With more than half of the world's population living within a five-hour flight from the enclave, Macau's established road, air and sea transportation network is easily available to most of this region. Already the Hong Kong to Macau passenger ferry service is the world's largest single route in terms of passenger numbers. In the last six months of 2006, 3 962 500 passengers travelled to Macau from Hong Kong, up 6% on the same period of 2005.

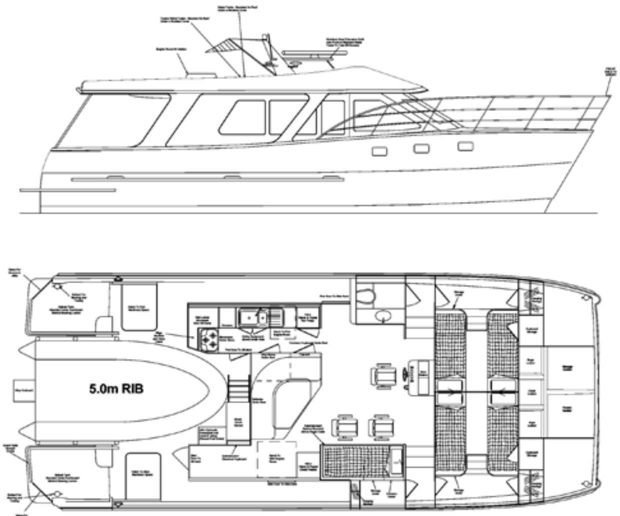
The new ferries will add a dedicated transport link to supply the Cotai Strip. In addition to the 411 passengers carried by each ferry on two decks, special cranage and storage for passengers' luggage is also included. The cabin areas include Beurteaux Club and Executive seats with leather finish accompanied by aircraft-style overhead lockers to provide a carry-on baggage capacity. Combined with electronic ticketing and onboard hotel check-in, the intention is for the new ferries to provide a seamless final connection for the Cotai Strip's guests and visitors.

Powered by four MTU 16 cylinder 4000 series diesel engines driving a Rolls Royce/KaMeWa waterjet propulsion system, each ferry is fitted with transom-mounted SeaState Interceptors providing an active high-speed ride-control system for maximum passenger comfort.

The vessels are being built in accordance with the requirements and under the survey of Det Norske Veritas, conforming to the International Maritime Organisation High Speed Craft Code (HSC 2000) in conjunction with the Hong Kong Marine Department requirements for high speed ferries.

Principal Particulars	
Length OA	47.5 m
Length WL	43.8 m
Beam moulded	11.8 m
Hull depth moulded	3.8 m
Draft, max.	1.6 m
Deadweight, max.	70 t
Passengers	411
Crew	8
Fuel, max.	20 000 L
Propulsion	
Engines	4 × MTU 16V 4000 M70 each 2320kW at 2000rpm
Gearboxes	4 × Reintjes VLJ 930
Waterjets	4 × Kamewa 63 SII
Speed	42 kn
Survey	
Classification	DNV ✠1A1 HSLC Passenger R2 EO

An impression of the ferries to be built by Austal for Venetian Marketing Services
(Image courtesy Austal Ships)



General Arrangement of the Power Cat to be built for the Queensland Department of Fisheries
(Drawing courtesy Brava Marine)

Brava Marine to build Power Cat

A version of the Brava 45 based on the Classico is to be built for the Queensland Department of Fisheries to supply a new style of fisheries patrol boat for the Coral Sea operating out of Cairns. This is an excellent example of Queensland's "Smart State" policy operating in practice, with the new 13.6 m vessel showing the versatility of the Brava hull platform and its suitability for commercial applications. The vessel's brief was both interesting and challenging in that its main functions are:

- To operate as a mobile radar-tracking station.
- To be a mobile slipway and maintenance facility for the 5 m RIB pursuit vessel which is launched and retrieved by a hydraulically-operated cradle mounted in the cockpit.
- To provide stable, comfortable accommodation and a safe workplace for up to four DPI employees.
- To be economical to run and operate.

The Brava 45 meets these requirements perfectly with the Classico's walk-around side decks, and extra shade and cabin area providing a comfortable and safe work environment. The power catamaran's inherent stability is both less tiring to work and live on, and provides a safer platform for operating the RIB cradle.

The Brava 45 with its Controlled Vapour Dampening (pat. pend.) system has already established a reputation as an exceptional sea boat and it is this high-quality, rough-water performance that will allow the vessel to make fast passages out to the reef when required. As the semi-planing hull form is a good load carrier, the weight of the RIB onboard will not have any great effect on the performance.

The vessel will be fitted with two 6LPA-STP 235 kW Yanmar engines for a top speed of 25 kn and economical cruise speed of 18 kn. Fuel capacity will be 1100 L per side and the water capacity 600 L; there will be domestic equipment, domestic type AC with power supplied by a 12 kVA genset. The hydraulic pump for the RIB cradle will also be AC powered, along with all water pumps.

Austal Completes Vehicle-passenger Ferry for Turkey

Following the launch in December of *Osman Gazi-1*, the first of two Auto Express 88 fast car ferries for the Istanbul Metropolitan Municipality, an inaugural voyage for representatives of the operating cities of Turkey was held on Monday 12 March 2007. This was to commemorate the successful completion of sea trials prior to the ferry travelling to Istanbul to commence operations.

To operate on a 39 n mile reciprocal service across the Marmara Sea between Yenikapi (Istanbul) and a new port development in Mudanya servicing the city of Bursa, *Osman Gazi-1* was scheduled to enter service in April 2007, the same month the second ferry was to be launched.

Those present in Austal's Western Australian shipyard for the ceremony and sea trial included the mayors and officials from the cities of Bursa, Mudanya and Güzelyali, representing the ports the ferries will travel between, senior officials from the Istanbul Metropolitan Municipality, the buyer of the ferries and the management and crew from Istanbul Deniz Otobusleri, the ferry operator and on-site construction representatives.

During the ceremony, Aboriginal cultural dancers performed a traditional dance celebrating the occasion, further acknowledging the strong community and business links between Turkey and Australia, exemplified by the ten Austal fast ferries either delivered to or on order for the Municipality.

In his speech, the Mayor of Bursa, Mr Hikmet Sahin, detailed the impact that the arrival of the new ferries will have: "The ferries will provide a previously-unavailable new link for our city enabling direct transit between the port Mudanya and Istanbul in 75 minutes facilitating increased business opportunities due to the efficient movement of people and cargo."

Acknowledging the relationship between Austal and Turkey, Executive Chairman John Rothwell thanked the customer and officials visiting the shipyard: "With the first of ten ferries delivered in 1995, the Metropolitan Municipality is by far our largest customer and Turkey is a showcase for successful fast-ferry operations. These new ferries take into account our extensive mutual experience in high-speed ferry design and operation and offer an exceptional solution for the new service."

A one-hour sea trial followed the formal events during which time speeds exceeding 43 knots were achieved, to the delight of the visitors who experienced the ride in the comfort of the luxurious upper-deck passenger accommodation.

The performance of the fast ferry has also been impressive on official sea trials, with a higher-than-contract speed of 37.4 knots achieved at operating deadweight, 90% MCR and with operational ride control system. With four MTU 20V8000 M71R engines installed at the reduced maximum rating of 7200 kW at 1150 rpm, this allows for low engine stresses, increased fuel efficiency and longer intervals between engine overhauls. These criteria were all important factors in the competitive international tender process which preceded the purchase of these vessels, calling for a thorough investigation and review prior to the final selection of the propulsion equipment package.

Designed to carry 225 cars, or 158 cars and 128 lane metres for trucks and buses, the car deck features mezzanine levels across all lanes with the centre mezzanine capable of being lifted for truck and bus access. With an open bow above the forward turning area, the aft loading point features combined vehicle and passenger ramps for quick deployment and retrieval, enabling fast port turnarounds.

Two spacious upper seating levels with 360° panoramic window views have the capacity to carry 938 passengers on the lower level and 246 passengers above, where two additional VIP cabins provide lounge seating for 16 for a total of 1200 passengers.

Osman Gazi-1 on trials
(Photo courtesy Austal Ships)

All passengers on the lower level enjoy Beurteaux Tourist seating in a mixture of standard rows and table settings, with two large kiosks providing catering forward and aft. Upper-level passengers share a kiosk and are seated in the larger Beurteaux 300 Series Club seats featuring leather trim. Beurteaux VIP Ocean Lounges are provided for the VIP cabins.

A sophisticated audio-visual installation provides a wide selection of entertainment to the various areas via speakers and numerous flat-screen televisions mounted throughout the passenger levels.

Passenger comfort at high speed is aided by Austal's fully active SeaState ride control system featuring forward T-foils and transom mounted interceptors providing dynamic pitch and roll stabilisation in higher sea states.

Safety is, as ever, uncompromised with the installation of passenger-evacuation systems and the classification of the ferries to Germanisher Lloyd ✠100 A5 HSC-Passenger B OC3 notation and the requirements of Turkish Flag. With unmanned engine-room spaces, all vessel and passenger technical operations are monitored and controlled at the engineer's console on the bridge which also features overhanging docking stations.

Principal Particulars

Length OA	87.85 m
Length WL	77.40 m
Beam moulded	24.00 m
Depth moulded	8.25 m
Draught (maximum)	3.63 m
Deadweight	470 t
Passengers	1200
Crew	30
Crew accommodation	16
Vehicles	225, or 126 lane m with 158 cars
Fuel (maximum)	160 000 L

Propulsion

Main engines	4 × MTU 20V 8000 M71R each 7200 kW at 1150 rpm
Gearboxes	4 × Reintjes VLJ 6831
Waterjets	4 × Lips LJ 120E
Service Speed	37.4 kn at 90% MCR, at operational deadweight with RCS in operation

A starboard quarter view of *Osman Gazi-1*
(Photo courtesy Austal Ships)

Onboard *Osman Gazi-1*
(Photo courtesy Austal Ships)

Navy Hydrographic Survey Upgrade

On 30 April the Minister for Defence, Dr Brendan Nelson, announced that Fremantle-based L3-Communications Nautronix Limited had been awarded a $43 million contract with the Commonwealth to upgrade the Hydrographic Survey System on the Royal Australian Navy's four Paluma-class survey motor launches.

The upgrade will reduce the time and effort required to complete hydrographic surveys and navigational charts of Australia's coastal waters. Tactical elements of the system will allow naval vessels to operate in poorly-charted waters at short notice.

The project will use advanced modern sensors and sonars, such as the Petrel Sonar which is manufactured in Australia by Thales Australia, as well as data-handling technologies.

Nine portable hydrographic survey systems will also be used on small craft in support of survey operations. The portable system will allow for hydrographic survey operations in very shallow waters which cannot be reached by the larger survey ships.

Three of the portable systems will be the more-advanced tactical survey system. The tactical system is a portable replica of the survey motor launch system and will provide flexibility to rapidly deploy hydrographic survey teams, such as the Deployable Geospatial Survey Team based in Wollongong.

L3-Communications Nautronix will be responsible for the purchase of the equipment and undertake the systems integration. This project will be the first occasion on which the suite of hydrographic sensors will be integrated into a single data logging and processing system. The first system will be delivered by April 2009.

Defence Industry Policy

On 1 March the Minister for Defence, Dr Brendan Nelson, released a new Defence Industry Policy designed to achieve the cost-effective delivery of equipment and support to ensure that the men and women of the Australian Defence Force (ADF) have the best possible advantage when they go into harm's way.

The new Defence Industry Policy provides a critical framework to guide investment by the private sector and Government in industrial capabilities critical for the long-term support of the ADF.

The Policy Statement sets outs the Government's response to the challenge of ensuring the cost-effective delivery of equipment and support to the ADF in line with Australia's strategic circumstances.

It is intended that this will be achieved through nine strategies:

- A strategic approach to equipping and sustaining the ADF.
- Maintaining priority local industry capabilities.
- Securing value for money through best-practice procurement.
- Creating opportunities for Australian firms.
- Encouraging small and medium enterprises.
- Supporting the development of skills in the defence industry.
- Facilitating defence exports.
- Driving innovation in defence technology.
- Defence and industry working together.
- Implementation of the policy will deliver a more capable, responsive and sustainable local defence industry.

A range of new initiatives will bring Defence and industry closer together through higher levels of Government support for research and development by Australian defence companies, a re-invigoration of efforts to expand defence industry exports, and a broadening of the Government's already-successful Skilling Australia's Defence Industry programme.

The Policy builds on the Government's 2006–07 Budget commitment to the defence of Australia and its interests through a sustained increase in Defence spending of 3% per annum in real terms out to 2015-16.

The new industry policy ensures that Australian industry has every opportunity to compete on its merits for the full range of goods and services which Defence acquires.

It is based on the expectation that Australian defence firms will be used wherever they provide overall value for money and that Government will take every opportunity to leverage its purchase to create opportunities for local firms in global defence supply chains.

The Policy Statement can be downloaded from www.defenceindustrypolicyreview.com.au/docs/DIPR_Policy_Statement_2007.pdf

Tenix Restructures Defence Business

In March Tenix announced a restructure of its defence business to meet emerging challenges and opportunities in this important industry sector. Tenix Defence Pty Ltd has been reorganised into two divisions — Tenix Marine and Tenix Aerospace and Defence.

Tenix Aerospace and Defence incorporates the former Land, Aerospace and Electronic Systems divisions of Tenix Defence. Tenix LADS Corporation, formerly part of Tenix Defence, is now part of Tenix Investments.

The Executive General Manager of Tenix Marine is David Miller, and the Executive General Manager of Tenix Aerospace and Defence is Ian Sharp.

Following the appointment of Paul Salteri as Chairman of the Tenix Group and Robert Salteri's move to a Non-Executive Director position, both Mr Miller and Mr Sharp report to the Group Managing Director and CEO, Greg Hayes.

Mr Hayes said the changes would best position Tenix to meet the emerging opportunities and challenges in the defence industry.

"This structure will give us the flexibility and resources to continue meeting the defence requirements of Australia, New Zealand and customers around the world," he said.

Following the changes, the former Tenix Defence Canberra office is relocating from Barton to Fern Hill to co-locate with the existing Tenix Datagate office.

"We will maintain our high standard of service to the Department of Defence while using our resources most efficiently," Mr Hayes said.

Austal's Largest Individual Contract

An unconditional contract was confirmed on 3 April for the supply of four fast ferries, consisting of two 69 m and two 88 m ships to Austal Auto Express vehicle-passenger catamaran designs.

Commenting on the announcement Austal Executive Chairman, John Rothwell, said "This huge contract is of particular importance, not only in adding to our current strong order book but also as it confirms our presence in a region with substantial growth opportunities for Austal'.

The ferries, which will be built in Australia, are due for delivery in 2009.

An impression of the four fast ferries Austal will build for an as-yet undisclosed customer
(Image courtesy Austal Ships)

New World First Ferry Orders for Austal

In February New World First Ferry Services ordered two new high-speed catamarans for operation between Macau and Tsim Sha Tsui, Hong Kong, from Austal.

With five Austal 47.5 m high-speed passenger catamarans already in service in the New World First Ferry fleet these new ferries will be near copies of the proven design, optimised for service speeds in excess of 42 kn and the comfortable carriage of 418 passengers with high quality passenger amenities.

The new ferries are scheduled to enter service in 2008 to meet the growing tourism demand generated from the remarkable increase in Macau's tourist arrivals since the development of the gaming and mega-resort industry and the extension of the Individual Visitor Scheme.

Mr Tsang Yam Pui, Vice Chairman of First Ferry (Macau), said “To meet the growing demand and remain competitive, First Ferry (Macau) needs to sustain the qualities that bring us success by bringing in brand-new catamarans to provide superb cross-border voyages between Macau and Hong Kong. The acquisition of two new Austal catamarans demonstrates First Ferry (Macau)’s dedication to pursue a high standard of passenger comfort and operational safety and its commitment to the development of Macau.”

Since 1988 Austal has delivered thirty seven high-speed passenger ferries to the Hong Kong/China market, providing an essential public transport solution for passengers travelling between Hong Kong and the Pearl River.

Principal Particulars

Length OA	47.5 m
Length WL	43.9 m
Beam moulded	11.8 m
Depth moulded	3.8 m
Draft, max.	1.6 m
Deadweight, max.	70 t
Passengers	418
Crew	8
Fuel	20 000 L

Propulsion

Engines	4 × MTU 16V 4000 M70 each 2320 kW at 2000rpm
Gearboxes	4 × Reintjes VLJ 930
Waterjets	4 × Kamewa 63 SII
Service Speed	42.5 knots

Survey

Classification	DNV ✠1A1 HSLC Passenger R2 EO

Queensland Industry News

Construction Activity in the Brisbane Area

Aluminium Marine

Aluminium Marine has delivered a 35 m catamaran passenger ferry, *Cat Cocos,* for operation in the Seychelles. The vessel is an Incat Crowther design, and is classed with Bureau Veritas. She can carry 350 passengers, with a first-class lounge forward, an air-conditioned saloon with bar area and, on the upper deck, open seating with another bar area.

Powered by MTU V12 4000 series engines, each developing 1715 kW, the ferry reached a speed of 37 kn on trials.

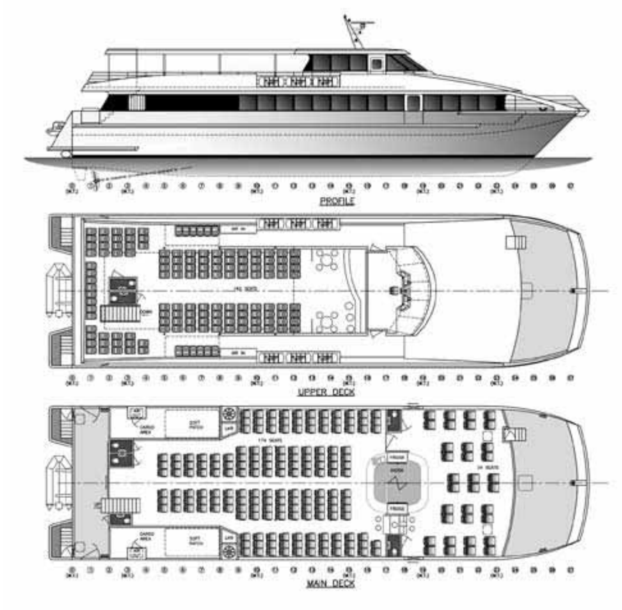
Cat Cocos will operate with *Cat Roses,* a smaller 24 m catamaran passenger ferry which was delivered by Aluminium Marine earlier in the year, and which will run a feeder service for the larger vessel.

Aluminium Boats Australia

Aluminium Boats Australia has delivered a 24 m passenger ferry for the Moreton Bay Islands.

New Wave Catamarans

Following the delivery of an oil-reprocessing catamaran earlier this year, New Wave Catamarans has two 24 m catamarans under construction. The first is another day-dive catamaran for Tusa Dive in Cairns. The vessel is similar to



General Arrangement of *Cat Cocos*
(Incat Crowther drawing courtesy Aluminium Marine)

Cat Cocos (left) and *Cat Roses* (right)
(Photo courtesy Aluminium Marine)

Eclipse, a dive boat which was delivered to Calypso Cruises in Port Douglas last year.

The second vessel is a passenger ferry for Caprice Charters in Sydney. The vessel has been designed to be used in riverways, with proven low-wash hulls, and will be used for seasonal whale watching. This design is very similar to *Crystal Spirit* which was delivered in 2003 and operates a ferry service out of Palm Beach.

James Stephen

New South Wales Industry News

Kamira Holdings 8.5 m Jet Thrill Boat

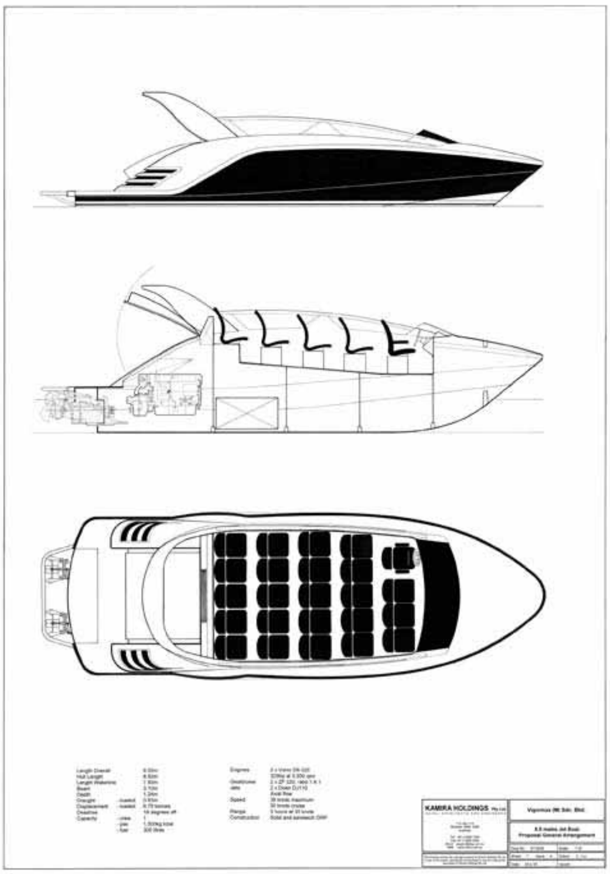
Kamira Holdings is designing a new 8.5 m jet thrill boat for construction by Vigormax in Johor Bahru, Malaysia. The plan is to build a large fleet of vessels for use in south-east Asian resorts, targeting the growing disposable income in China and the rest of SE Asia. The builder will operate the vessels in joint-venture arrangements at a number of locations throughout the region.

The boats will be built from GRP, with solid GRP hull bottoms and balsa/coremat sandwich sides and decks. Solid GRP in the bottom is necessary due to the large number of unidentified floating objects in that part of the world. Each will be powered by two newly up-rated Volvo D6-325 engines, driving Doen DJ110 water jets through ZF gearboxes, giving a top speed of about 38 kn. The passenger capacity has been increased over western versions due to the lower weight of Asians, allowing for 23 passengers with a maximum payload of 1500 kg.

The boats will be certified by CCS (China Classification Society). Work has already commenced in Malaysia on the plug for the hull.

Principal particulars of the new vessel are as follows:

Length OA	9.55 m
Length WL	7.55 m
Beam	3.10 m
Depth	1.24 m
Draft loaded	0.63 m
Displacment loaded	6.75 t
Crew	1
Passengers	23
Fuel	300 L
Main engines	2 × Volvo D6-325 each 242 kW @ 3500 RPM
Gearboxes	2 × ZF 220, RR 1.4:1
Jets	2 × Doen DJ110 axial flow
Speed	38 kn maxium 30 kn cruising
Range	3 h @ 30 kn
Construction material	Solid and sandwich GRP



General arrangement of Kamira Holding's
8.5 m jet thrill boat for Malaysia

(Image courtesy Kamira Holdings)

Kamira Holdings 15 m Patrol Boats

Kamira Holdings has signed up a repeat order for two more 15 m patrol boats for Bakri Navigation in Bahrain, to be built by NGV Tech at their Sijangkang yard in Malaysia. The first three boats arrived in January and have enjoyed an uneventful three months of service. Bakri Navigation decided to order two more on spec., based on the positive response to the first three. Plate is due to start cutting later this month for delivery of the vessels early next year, and these vessels will also go into service in the Middle East.

Principal particulars of the vessels are as follows:

Length OA (hull)	15.01 m
Length WL	13.40 m
Beam	4.00 m
Draught	0.85 m
Displacement	19.3 tonnes loaded
Engines	2 × Caterpillar C18 747 kW
Gearboxes	2 × ZF 550 with 1.262:1 RR
Water Jets	2 × Doen DJ170 Mk2
Genset	1 × 20 kVA
Fuel	3600 L
Water	200 L
Speed	43 kn at full load

Greg Cox

Incat Crowther 24 m Dinner-cruise Catamaran

Incat Crowther is currently designing a 24 m catamaran dinner-cruise vessel for the Sydney Harbour operator, VC Cruises. The vessel will be a low-speed catamaran capable of carrying 400 passengers at a service speed of 10 kn when fully loaded.

The main-deck cabin will contain loose seating for about 176 passengers in various configurations to suit the desired function. The main cabin will also incorporate a fully-stocked bar, food servery, DJ booth and dance floor, plus a removable raised stage. A fully-equipped galley and cool room has been arranged in the port hull, capable of providing food service for the full complement of 400 passengers.

The mid-deck cabin will seat 96 passengers in similar configurations to the main deck and will have its own bar, servery, DJ and dance floor facilities, enabling separate groups to be on the same cruise. Food access to this cabin will be provided via a dumb waiter. Access between the decks was carefully arranged to enable the two groups to be kept separate, while still providing access to the vessel's main viewing decks. Toilets are located on each deck. A small self-enclosed wheelhouse is positioned at the forward end of the mid deck.

Powered by twin Caterpillar C7s, each producing 205 kW, the vessel will have a service speed of 10 kn at full load. This speed will allow the vessel to do a full loop of Darling Harbour to Watson's Bay and back in 1½ hours.

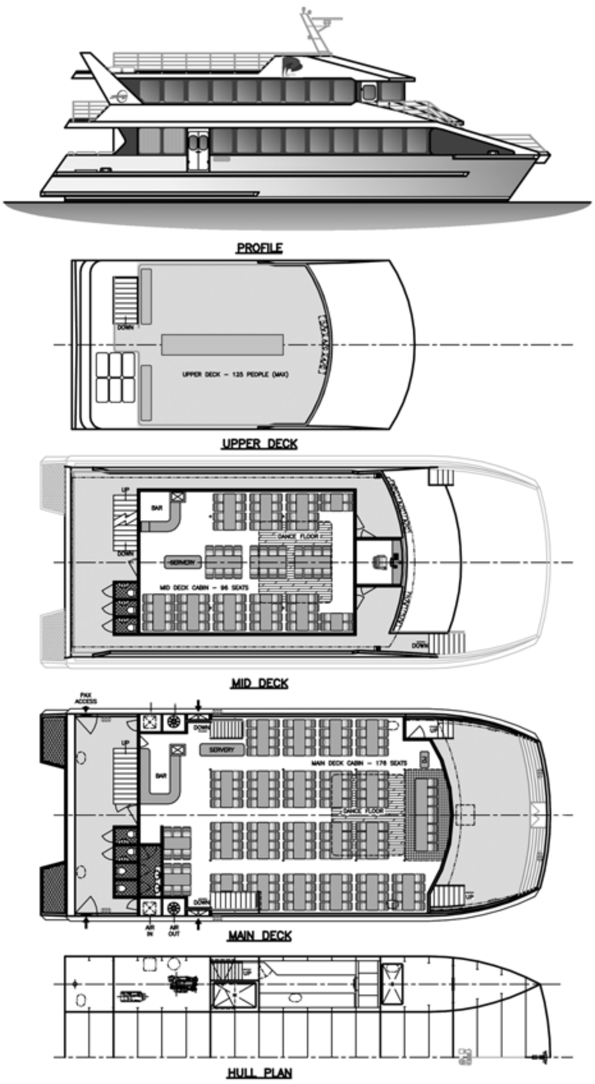
The vessel is to be built by Brisbane-based Aluminium Boats Australia and is expected to be in service in the later stages of this year.

VC Cruises, formerly known as Pacific Pearl Cruises, operate two lunch-time cruises daily for overseas tour groups, and nightly dinner cruises and charters on the traditional charter-cruise route around Sydney Harbour.

Principal particulars of the new vessel are as follows:

Length OA	24.00 m
Length WL	21.25 m
Beam	10.00 m
Draft hull	1.35 m
Passengers	400

Deadweight	37.7 t
Fuel	4000 L
Fresh water	3000 L
Main engines	2 × Caterpillar C7 each 205 kW
Propulsion	Fixed-pitch propellers
Service speed	10 kn
Construction material	Marine-grade aluminium
Survey	NSW Maritime USL Code Class 1E



General arrangement of Incat Crowther's dinner-cruise catamaran for Sydney Harbour
(Image courtesy Incat Crowther)

Incat Crowther 35 m Cruise Catamaran

Incat Crowther is currently designing a 35 m catamaran ferry for the Strahan-based Tasmanian operator, World Heritage Cruises.

The vessel will be a 35 m high-speed catamaran ferry capable of carrying 221 passengers at a service speed of 28 kn when fully loaded. The main cabin contains seating for 140 passengers with further seating for 81 in the vessel's mid-deck cabin. Both cabins contain a mix of comfortable seats and lounges. The mid-deck cabin features uninterrupted views forward. In addition, there are exterior bench seats behind the mid- and upper-deck cabins. The upper deck also houses a small self-enclosed wheelhouse with exterior wing stations. The aft end of the main cabin has been arranged with male, female and disabled toilet spaces. Forward of these are the galley, bar and servery. A dumb waiter connects the galley with a bar and servery located on the mid deck. The vessel provides excellent viewing positions, allowing passengers to take in the impressive scenery that this World Heritage region of Tasmania has to offer.

Powered by twin MTU 8V4000 M70 engines, each producing 1160 kW, the vessel will have a service speed of 28 kn at full load. The vessel will also feature special low-wash features developed by Incat Crowther for low-speed operation in the sensitive ecological regions of Macquarie Harbour and the Gordon River.

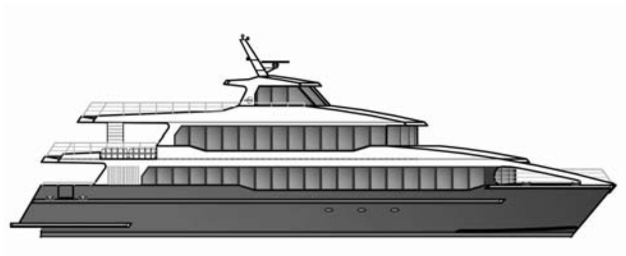
The vessel will be built locally by Richardson Devine Marine. It is expected to be in service in the later stages of this year and will be RDM's 17th vessel with Incat Crowther over an eleven-year period. This will also be the first vessel to be built in RDM's brand-new purpose-built shipyard. The new facility will enable RDM to build two vessels side-by-side up to 45 m in length.

World Heritage Cruises operates daily tours of the world-heritage-listed region of Macquarie Harbour and the Gordon River, visiting convict settlements, high-tech aquaculture farms, and viewing the magnificent pristine scenery along the river. Their company was founded in 1896 and is now operated by the fifth generation of the Grinning family.

Principal particulars of the new vessel are as follows:

Length OA	36.85 m
Length WL	32.30 m
Beam	9.50 m
Draft hull	1.80 m
Passengers	221
Deadweight	28.33 t
Fuel	10 000 L
Fresh water	1500 L
Main engines	2 × MTU 8V4000 M70 each 1160 kW
Propulsion system:	Fixed-pitch propellers
Service speed	28 kn
Construction	Marine grade aluminium
Survey	Marine and Safety Tasmania USL Code Class 1C

Ben Hercus



Profile of Incat Crowther's
catamaran for World Heritage Cruises
(Image courtesy Incat Crowther)

The Spanish Navy frigate *Alvaro de Bazan* arriving in Sydney for a visit recently. This F100 design is one option currently under consideration for the RAN's air-warfare destroyer project
(RAN photograph)

***John Oxley* Restoration**

Restoration work on *John Oxley* is proceeding apace.

Almost all the accessible hull plates, about 70 in total, have been replicated and most are fitted to the hull. About 45 plates have been fully riveted.

Structural work under the boilers has now been completed. The two 30 t boilers were raised to remove their weight from the hull structure, and supported from the dock by a grid constructed of heavy steel sections. Each floor was then cut away from the hull and taken ashore in turn for replication. The new structural members were returned to the ship and bolted in place, with the riveters coming along later to finish the job. The intercostals between the floors were then replaced and the boiler stools reconditioned. Both boilers have been lowered back down to just rest on their stools, with most of their weight held off the hull until hull plating in this region is completed.

Work in the Pilots' Accommodation, with its timber panelling and beautiful Queensland Rosewood furnishings is proceeding, with the compartment contents having been marked, stripped and stored. The concrete deck lining was then removed, to find the riveted steel deck underneath in worse condition than previously believed. Rusted rivets were removed without harming the rusted plates and angles (by descaling and then blowing out with the oxy-acetylene torch). Plates were lifted out with chain blocks and taken ashore, where the workshop team replicated the external shape exactly. Rivet holes were drilled in the new plate by laying the old plate on top of the new plate as a drill guide. New plates were lifted back into place and bolted up. Final preparatory work involved careful aligning of holes and reaming them to final size before riveting. The workforce had made the promise that the compartment deck would be completed before Christmas, and it was!

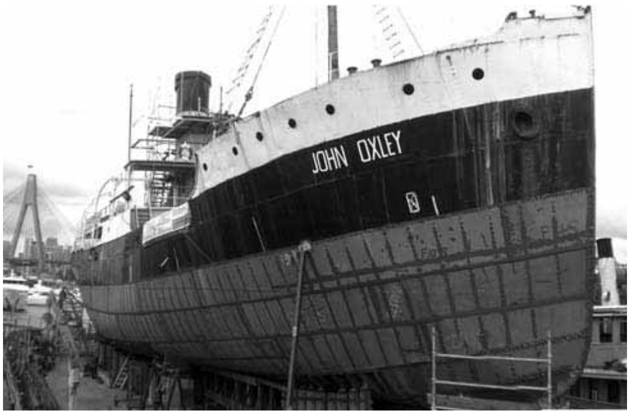
A highlight of 2006 was the Heritage Commission's "Kickstart Grant" for refurbishment of the boilers on *John Oxley*. Both boilers have now been needle-gunned and a grid established for ultrasonic thickness testing, which has commenced, with positive results so far. A boiler inspector has been appointed and recommendations on future work to return the boilers to steaming condition have been made. The original Queensland Harbours and Marine Board work reports on the boilers and engines dating from the 1960s have been unearthed, and reveal that the boilers were extensively re-tubed then. It seems likely that far fewer boiler tubes will need replacing than previously thought.

Much of the machinery in the engine room has had to be shifted away from the hull so that the hull repair teams can get up close and personal with the hull itself. While hull plates have been off, the opportunity has been taken to remove this machinery to the shipyard for overhaul.

The rudder and stock have now been removed, with heavy components such as the emergency steering crosshead and tiller arm dismantled using specially-built heavy pullers and large hydraulic jacks. Current work on these parts is the analysis of the steels used in components, determining welding procedures and obtaining approvals from our survey authority.

Much of the cast-iron bilge system is badly corroded and will need replacement. Patterns for replica bilge system manifold valves have been made and castings donated by a sponsor. The castings are currently being machined on the old, heavy Cincinnati mill which was purchased to do this work. When the bilge manifold valves are complete, they can be installed and a start made on the manufacture of new bilge suction pipes.

For more information about *John Oxley*'s restoration, progress reports, and photos of recent work, visit www.australianheritagefleet.com.au/jo-restoration/jo-news-dec2006.html.



John Oxley hull plating progress in May 2007
(Photo Phil Helmore)

Kanangra Restoration

Work commenced some time ago at the Sydney Heritage Fleet on the restoration of the ferry *Kanangra*. Work in progress includes the following:

The addition of marine ply cladding to the aft wheelhouse is almost complete, and the replacement of the outer steps is under way. Cladding has been removed from the forward wheelhouse to enable review of the structural timbers, with some replacements necessary.

On the upper deck interior there has been a clean-up of the working area, the interior of the DJ's box has had repainting completed, the electricians have completed replacement of the overhead lighting in the aft section, and a small gallery of memorabilia has been erected.

On the main deck interior, work has commenced on scraping paint from the deckhead area around the gangway and passenger transit to *Waratah*. Work has also commenced on removing the covering of the overhead telegraph linkages to enable scraping and painting. The area of inner lower companionways has been stripped to find the original oregon timbers painted over, and restoration is now to be aimed at a full clean and strip, and varnishing instead of painting. On the main deck exterior, work has continued on scraping paint from the outer bulkheads.

Monitoring of the hull, water levels, and pumping equipment continues on a regular basis, and there is no evidence of sea water ingress. It is expected that an in-water survey will be carried out before the end of the year.

For more information about *Kanangra*'s restoration, progress reports, and photos of recent work, visit www.australianheritagefleet.com.au/kanang/update.htm.

SHF Volunteers and Volunteering

The Sydney Heritage Fleet is always seeking volunteers — their projects enjoy the solid work of many volunteers and their valued support is greatly appreciated.

Volunteers come from all walks of life, including both the young and not-so-young, and both men and an increasing number of women on site. They have professors and publicans, managers, businessmen, pharmacists, solicitors and teachers; all united by the drive to progress work on *John Oxley*. Some of the workforce bring valued ship design or repair skills to the project, but many others turn up and quickly learn skills which make them very useful.

If you would like to help — in any way — then contact the yard office at Rozelle Bay on 9298 3888. Alternatively, turn up at the Rozelle Bay shipyard on a Tuesday, Thursday or Saturday, and ask to speak with one of the volunteer leaders.

Cruising

The summer cruise season has wound down after the spate of cruise ships visiting Sydney in January and February, with visits in March by *Statendam, Pacific Princess, Pacific Sun, Saga Ruby, Saga Rose, Orion, Silver Shadow,* and *Delphin Voyager*; and in April by *Sapphire Princess*, *Pacific Princess* and *Pacific Sun*. Over the winter months, *Pacific Sun* is the only scheduled visitor.

Visits to the south coast of NSW by cruise vessels have continued, with *Silver Cloud* in January and *Orion* in March (among others) having called at Twofold Bay recently. Berthing varies, with some at the multi-purpose wharf on the south side of the bay and bussing passengers to Eden, some at the breakwater wharf, and the others anchoring in the bay and ferrying passengers ashore in the ship's boats.

Phil Helmore

Orion arriving in Twofold Bay, Eden
(Photo courtesy Rob Whiter)

Orion berthed at the breakwater wharf, Eden
(Photo courtesy Rob Whiter)

One2three's 40 m *Venetian Lady*

Designed by One2three Naval Architects and built by Island Boats, USA, the monohull *Venetian Lady* was recently delivered to her owner, Biscayne Lady Cruises, located in Miami, Florida. *Venetian Lady* joins a large Biscayne fleet operating a range of sightseeing and wedding/charter cruises. At 40 m long and with two full-length enclosed decks and an upper sundeck, *Venetian Lady* offers a spacious interior for her 149 passenger configuration.

The main deck is arranged for luxurious dining, with loose tables and seating being configured for each event. The vessel's interior features light timber veneers and extensive use of granite and marble. A small dance floor/stage area is located forward, with a suite of electrical components to cater for presentations. The rest-rooms and a large bar are located aft.

The upper deck is configured more as a lounge, with loose leather seating. A large timber dance floor is centred in the cabin, with a second bar located aft. A powder/VIP room and rest-rooms are positioned forward behind the wheelhouse. External decks also feature loose leather lounges, with the sun deck being the deck of choice for wedding ceremonies.

Below decks, *Venetian Lady* is powered by twin Cat C18s at 522 kW brake power, giving a fully-loaded speed of 16 kn. Twin Cat C18s also provide the electrical power to the vessel, supplying power to the walk-in freezer, fridge and an extensive galley sized for 149 guests.

Principal particulars of *Venetian Lady* are as follows:

Length OA	39.86 m
Length WL	34.97 m
Beam overall	8.80 m
Depth	3.20 m
Crew	16
Passengers	149
Fuel	2 × 6000 L
Fresh Water	5600 L
Sullage	5600 L
Survey	USCG Cat T 20 nm Coastwise

One2three's *Venetian Lady*
(Photo courtesy One2three Naval Architects)

Interior of *Venetian Lady*
(Photo courtesy One2three Naval Architects)

One2three's 14 m Landing Barge

One2three teamed with Aluminium Boats Australia and, in a mere 7 weeks designed, nested, cut, fabricated, sea trialled and delivered a 14 m landing barge to Hamilton Island. *Mini Me* was designed to take 5 t of general deck cargo, including a 4WD vehicle, and carries 12 passengers plus 2 crew. *Mini Me* will be utilised in and around Hamilton Island on a range of duties, including transportation of golfers and their powered buggies to a new course being constructed partly on Dent Island, some 900 m "offshore" from Hamilton Island itself.

Mini Me's single Yanmar 6LY2A produces 313 kW brake power, and was taken from the Owner's Palm Beach 30 cruiser. Driving a Doen DJ130 waterjet, *Mini Me* runs at 18 kn loaded, and achieved 24 knots on trials in a light load configuration.

Principal particulars of *Mini Me* are as follows:

Length OA	15.00 m
Length WL	11.45 m
Beam overall	3.90 m
Draft	0.50 m
Crew	2
Passengers	12
Survey	USL Code Class 2D

Rob Tulk

One2three's 14 m landing barge, *Mini Me*
(Photo courtesy One2three Naval Architects)

Activities at Lightning Naval Architecture

Lightning Naval Architecture is currently working on modifications to the 1400 passenger ro-ro ships *Spirit of Tasmania I* and *Spirit of Tasmania II*. The work includes covering the aft open part of the upper vehicle deck with a new light steel roof, measuring 18 m by 21 m. Lightning has been involved in the design of the new structure, rear screens and doors, and drencher system under the new cover, and the obtaining of class approvals. Other work in these ships has included fitting new car-platform decks on the upper vehicle deck. The platform deck design was provided by MacGregor in Sweden with LNA responsible of design for modifications to doors, new drencher and fire-fighting systems and other details. These modifications are carried out by Taylor Bros in Hobart, while the two vessels are in regular service, which at times can be a bit of a challenge.

LNA is undertaking computer modelling for Onboard-NAPA of Finland, for the on-board damage control computer system to be installed on the multi-role vessel HMNZS *Canterbury which is* under construction for the Royal New Zealand Navy. LNA is also carrying out computer modelling, damage stability calculations and preparing the damage control plan for MS *King of Scandinavia*, a passenger ferry operated by DFDS Seaways in Denmark. She is a sister ship of the former *Spirit of Tasmania*.

Other work includes the initial design and calculations for Toll NZ (Interislander) in New Zealand, for a possible conversion of MS *Arahura*, a 990-passenger rail/car ferry operating across Cook Strait.

New structure for the *Spirit of Tasmania* mdifications under construction (above) and ready for erection (below)
(Photos courtesy Lightning Naval Architecture)

FROM THE CROW'S NEST

Austal's Tri a Wonder

The latest issue of *Engineers Australia* (April 2007) carries, as its cover story, *Seven Wonders of Modern Australian Engineering* by Managing Editor, Dr Deitrich Georg.

The first of these wonders is in the shipbuilding arena, and it is Austal's trimaran, *Benchijigua Express*, which is at the forefront of both design and construction, being the world's longest trimaran.

The cited reason for selection is: "The trimaran is a new design for aluminium ships combining the advantages of both monohull and multihull construction. The design allows the centre hull to be built long and slender for speed, with the side hulls stabilising the ship for comfort. The new littoral combat ships will be the most advanced high-speed military craft in the world".

Other wonders described are:

Oil and Gas	The Bayu-Undan Offshore Development for processing gas at sea
Building Services	Council House 2 in Melbourne as a model of green building
Manufacturing	The Global Rear-wheel Drive architecture for Holden Commodore VE
Minerals Processing	HIsmelt Pig-iron Project for making iron
Construction	The Westlink M7 Motorway, Sydney
Materials Handling	Newcastle Coal Port and Associated Supply Chain

The article does not seem to be available online (even to members of EA) and so, if you wish to read it then you will have to find an EA member — he/she will have a hard copy.

Phil Helmore

Benchijigua Express
(Photo courtesy Austal Ships)

Development of Production-orientated Advanced Composite Ribs

Dr M A Hobbs

This paper was presented in Sydney on 7 March 2007 to a joint meeting of the RINA NSW Section and the Sydney Branch of IMarEST by David Firth, Design Engineer for Gurit Australia. It was originally presented at the RINA International Conference on Rigid Inflatables in June 2005.

Summary

Advanced composites using epoxy resin and carbon-fibre reinforcements can bring a number of benefits to RIB manufacture making it possible to build lighter, stiffer structures leading to higher performance.

Whilst the use of epoxy provides benefits in the workplace, by eliminating the problems of styrene emissions during construction, use of these materials can also provide a marketing advantage or allow a premium to be added to the price of the boats.

One potential barrier to the use of these materials is their higher cost. However, through simplification of the structure and material-processing activities it is possible to offset the increased unit cost of the materials by using less material and, more significantly, reduce the number of man-hours required to build the RIB.

This paper will discuss how the consideration of the total technology package of materials, structural design and processing can be used to lead to the 'holy grail' of boatbuilding — lighter, faster cost-effective craft.

The application of this process will be demonstrated using the structural design of the new RNLI Fast Inshore Boat.

Introduction

Composite structures can provide significant advantages in the fabrication of marine structures, including low maintenance costs and the ease with which complex shapes can be fabricated [1]. In addition, the use of advanced composites such as epoxy resin, sandwich construction and carbon reinforcements can provide significant savings in structural weight. A comparison of structural weights relative to aluminium for marine structures using increasing levels of technology is given in table 1 [2].

Construction material	Overall Structural Weight
Polyester CSM/WR Single skin	105-120
Aluminium	100
Glass CSM/WR Polyester/Vinylester Balsa Core	90-95
Glass/Aramid Multiaxials/Foam core	78-82
Glass/Aramid outer skin/foam core/carbon inner skin	70-75
Carbon skins/foam and honeycomb core	55-65

Table 1: Comparison of typical structural weights of various construction technologies

The use of higher-technology composite construction has historically carried a cost premium, due to the increased cost of the materials and higher processing costs. The use of pre-preg and sandwich construction has also required skilled labour in order to achieve consistent results. This has tended to restrict the use of these materials and construction methods to one-off custom vessels where weight reduction is at a premium.

Production vessels have often used lower-technology options such as hand-laminated polyester single skin construction. Increasingly-stringent environmental controls on levels of styrene in the workplace [3] are likely to restrict the use of open-mould processes using polyester and vinylester resin systems.

Reducing the structural weight of a boat can provide more freedom in fit out, or give improved performance, both of which can provide a competitive advantage to a production RIB. Consideration of the total package of materials technology, structural engineering and processing methods can be used in order to provide the advantages associated with higher-technology systems whilst minimising the increased cost.

RNLI Fast Inshore Boat

The design of the RNLI Fast Inshore Boat provided an ideal opportunity to prove that this process could be implemented effectively. The new boat is the next generation of inshore lifeboat based on the successful Atlantic 75 design. It is approximately twenty percent larger, but maintains the successful characteristics of the previous design.

SP's brief was to develop a simple production process which produces a consistently high quality and durable FIB. Whilst weight reduction was not a design criterion, the RNLI subsequently found that reduced structural weight allowed greater flexibility in the fit out of the vessel.

The design brief was achieved by an integrated approach considering:

- Structural design.
- Choice and development of materials.
- Development of the construction process.
- Working closely with the client.

The final structure was lighter and more robust than the previous vessel, and the simplified internal structure gave much more freedom for internal layout, and will allow for easier refit in the future.

Structural Design

The initial structural design considered a number of concepts, from stiffened single skin to a full sandwich structure. Following consideration of the concepts, a number were short-listed for prototyping.

Sandwich structure reduces the number of internal components and also allows greatest flexibility for internal fit out of the vessel. This results in a significant saving in the labour costs for assembly of the structure, as well as a significant weight saving in the internal structure. A transverse frame

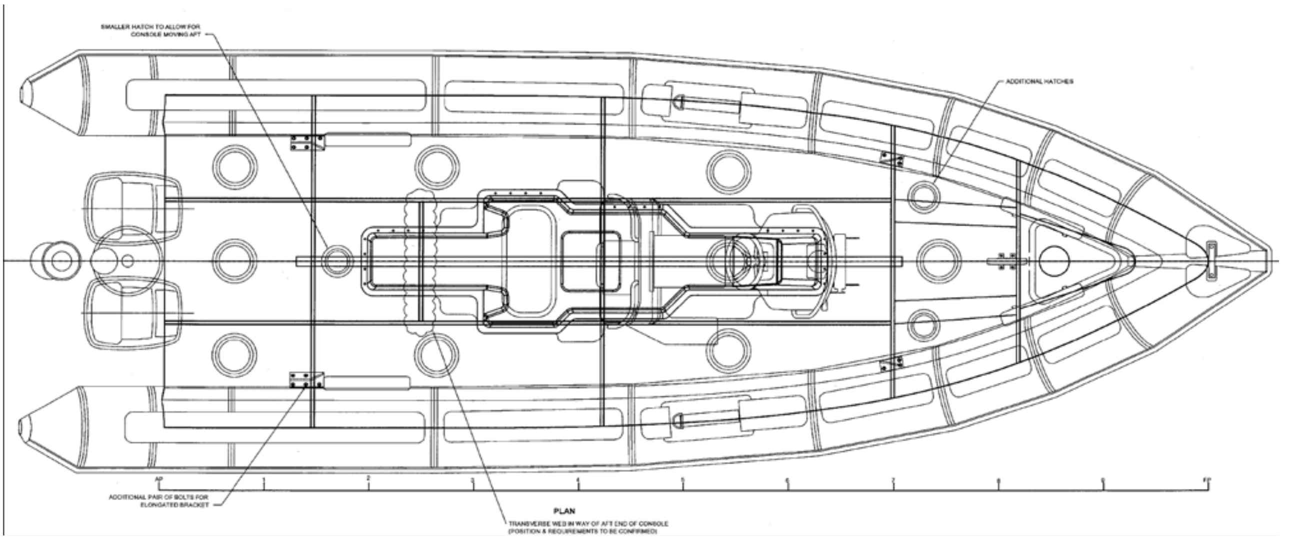


Figure 1 Structural General Arrangement

arrangement suits RNLI's required fit out, and full-height longitudinals are used to support the hull and deck.

The first two prototype boats were built using glass outer skins and carbon inner skins for the hull and deck. The internal structure consisted of four transverse frames with two longitudinals on each side of the boat. Subsequent boats used carbon reinforcement throughout the boat, which allowed the internal structure to be reduced to one longitudinal per side.

A structural GA of the carbon option is shown in Figure 1. This change to all carbon structure and modifications to the bonding of the internals reduced the structural weight of the vessel (complete structure with deck bonded on) from 500kg to 390kg.

This reduced structural weight allows more freedom in the fit out of the vessel and provides more freedom to ballast in order to obtain the optimum centre of gravity and radius of gyration to improve handling of the vessel in rough conditions. Increased unit cost of the carbon fabrics used in the skins is offset by the reduced quantity of the structural materials and the reduced labour required as a result of fewer structural components.

Materials

A significant objective considered during the structural design was to minimise the number of materials, which helps to reduce wastage and simplifies ordering. It is important to use a processing technology which enables a robust, repeatable construction process, as this reduces the variation in the laminate properties. Increased confidence in the construction process enables improved design properties to be considered for the design of the laminates.

It is also a significant advantage to be able to produce cored laminates in a one shot process. This reduces the time required to laminate these components and enables the advantages of sandwich construction to be achieved without significant increase in the labour costs

SP's SPRINT® processing technology [4] offers a robust and reliable process which combines excellent laminate quality with the potential for reduced processing time. The materials consist of a layer of fibre reinforcement either side of a precatalysed resin film. The fibres remain dry and unimpregnated by the resin until the curing process.

This provides improved handling and health and safety compared to traditional pre-pregs. The high breathability produces excellent laminate quality with very low (less than 1%) void content from vacuum-bag processing, and eliminates the need to debulk at regular intervals.

Resin-rich variants with additional resin for core bonding are available which are suitable for one-shot laminating of sandwich components.

Production Techniques

During the manufacture of the first prototype boats, SP developed the production techniques to significantly reduce the labour hours required to build the boats. The boats are delivered for fit out with internals fitted and the deck bonded on, and the first boats required around 1000 hours to get to this stage. This has been reduced to 300 hours by a combination of improved production techniques and feedback from prototyping to modify the structural details. Some of the modifications made to the processing are discussed below.

Kitting

Cutting and fitting core has traditionally been a very time-consuming part of building vessels. This process was taking around 8 man-days in total for the deck and hull. The core is now supplied pre-cut from Corecell in kit form, which incorporates dog-bones to hold the core in place. These kits can be placed directly into the mould as shown in Figure 2.

Cutting the reinforcement fabrics also previously took about 25 man-days for the vessel, and cutting the fabrics also represented a possible source of error. SP's experience with virtual templating and kitting of materials for automotive projects [5] suggested that this could provide significant savings in build time.

In this case, templates were generated from lay-ups in one of the prototype boats. These were then converted to electronic format, forming a kit booklet as demonstrated in Figure 3. This enabled the kitted parts to be fed into nesting software, which drives an automated cutting machine. The pre-cut kit of fabric is supplied to the prototyping facility in a series of cardboard boxes, numbered in the correct order for lay-up of the hull, deck and internals as described in the build manual.

Figure 2 Kitted hull core placed on outer skin in mould

The use of kitted fabrics and core have enabled the lay-up of the hull after tack-off of the gel coat to be achieved in two days, and lay-up of the deck in one day.

Moulded Flanges

The first prototype vessels had internal frames and longitudinals constructed in a similar manner to one-off vessels. Webs and frames were built over-size and then trimmed to the hull shape. Bonding of the internals was achieved using structural adhesive fillets and biaxial tapes. This was taking in the region of 30 man-days to complete.

The use of high performance SP340LV adhesive allowed the structure to be bonded in without over-taping the joints. In later boats, this was taken advantage of by laminating the internal structure in moulds, which enabled the incorporation of flanges for bonding to the hull and adjacent structure. Previously SP340LV had to be mixed either by expensive mixing machines or by hand, which was time consuming and resulted in air entrapment that compromises the performance of the adhesive bond. The adhesive has now been made available in cartridge form, enabling mixing through the use of helical nozzles. The combination of the improved dispensing of the adhesive and flanged mouldings has resulted in a reduction of the time taken to fit the internal structure to around 6 man-days.

Spray Rails

A typical damage-tolerant design of a spray rail for sandwich construction is shown in Figure 4. This can be very time consuming to laminate, as it requires cutting of several plies of laminate as well as fitting of a foam core-piece. In pre-preg construction this detail would also require curing separately from the hull in order to ensure good consolidation of the spray rail laminate.

During the building of these RIBs the prototyping team and materials-development team worked together to develop a mono-component adhesive which would achieve the cured properties required for the spray rails whilst having suitable handling characteristics to enable the spray rail to be applied in one go from a cartridge.

This has enabled the four spray rails on the RIB to be prepared and ready for overlamination with the hull outer skin in round 3-4 man-hours.

Feedback from Production

A further advantage of the integrated approach of this project was the ability to feedback experience from manufacture of the prototype RIBs to the structural design. This enabled modifications of the structural design details to be investigated in order to reduce build time without compromising structural integrity.

One example of this was the influence of the modified production methods on the design of the transom-to-deck joint. The original design is shown schematically in Figure 5, and the construction sequence was as follows:

- Lay-up transom.
- Cut transom to shape.
- Lay-up closing laminate.
- Bond on deck.
- Trim deck.
- Over laminate.
- Fill and fair the transom.

SP has previously investigated the use of solid adhesive spray rails on motor vessels. The use of toughened filled adhesives has provided spray rails with excellent damage tolerance, which are also straightforward to repair. The first candidate adhesives for this role provided the required damage tolerance, but a two-stage application into the spray rail was needed to avoid air entrapment.

This was a time-consuming procedure, and resulted in significant finishing costs to fill and fair the transom.

Once the core and fabrics were kitted, leading to a more accurate deck and transom, it was possible to modify the construction sequence to produce a more-efficient process.

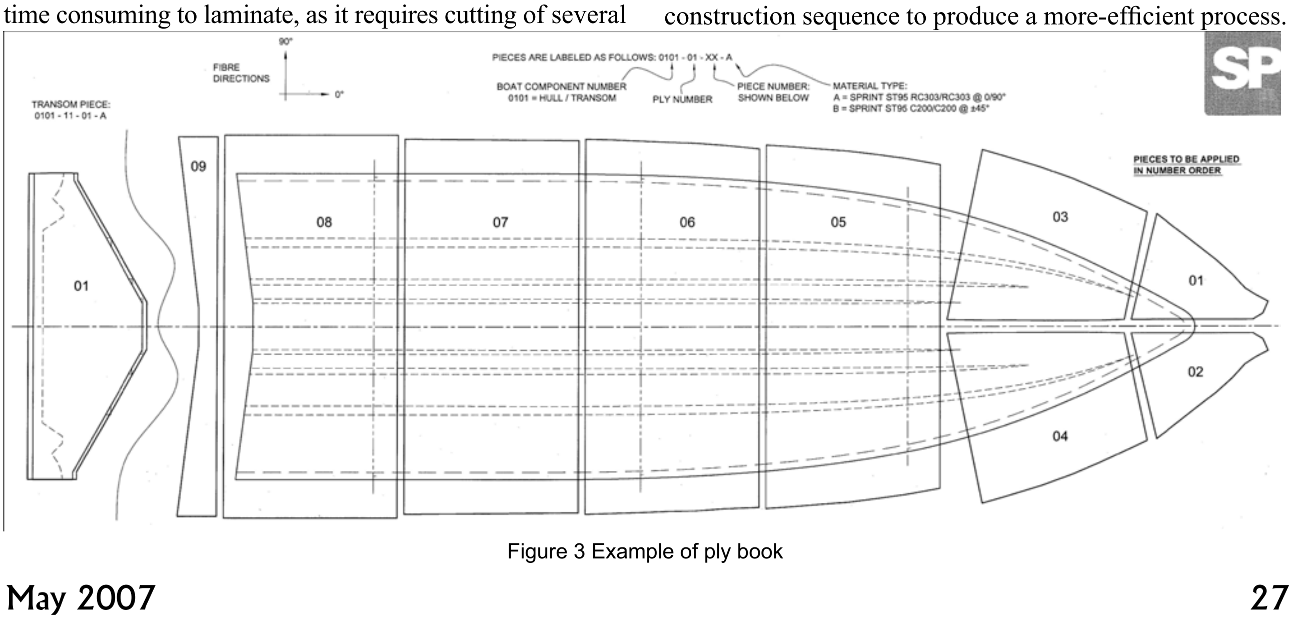


Figure 3 Example of ply book

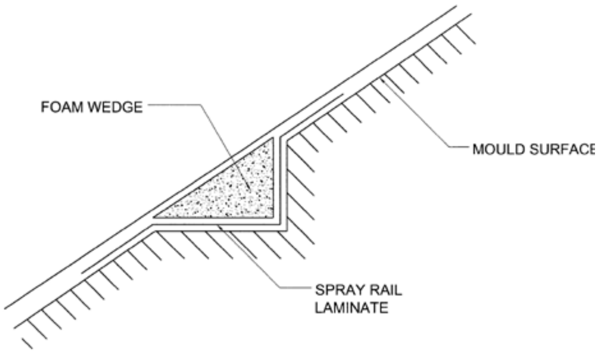


Figure 4 Previous typical spray-rail detail

Additional laminate was included in the deck flange and, combined with the greater accuracy of the kitted construction, this enabled the modified joint shown in Figure 6.

In this case, the kitted core of the transom ensures the correct shape of the transom, and the skin laminates can be laminated around the ends of the core. The deck, with additional laminate in the flange, is then bonded on and does not require over taping.

The modified construction sequence reduces the labour required to create the joint as:

- No trimming of the deck or transom required.
- No wet laminate taping required.
- No additional finishing of transom required.

Further Options

Although significant improvements have been made in the build time during the prototyping run, there are several areas that offer opportunities for further gains.

- Use of laser-alignment system to aid faster and more accurate alignment of fabric kit pieces.
- Improve jigs used for fitting of internal structure.
- Use of more accurate CNC cut moulds for hull deck and internals to improve fit of components and kits.
- Use of intensifiers in place of large vacuum bag.
- Use of improved adhesive-dispensing equipment.
- Improving facilities on mould for demoulding of components.

Conclusions

Advanced composites can bring a number of benefits to RIB manufacture with a lighter, stiffer structure. Reduced structural weight can offer more freedom for fit out, or increased performance.

The higher unit cost of the materials used can be mitigated by consideration of the total package of structural engineering, materials and processing technology to reduce the amount of materials and labour required to build the vessel.

For the design of the RNLI FIB, SP aimed to prove that it was possible to produce a vessel with advanced composites using a fast, efficient production process to assist in the creation of a superior quality and light, durable craft.

This was achieved with a prototype RIB some 20% larger than the previous inshore lifeboat with a 25% reduction in structural weight, which we believe would be capable of production at a comparable cost to the previous vessel.

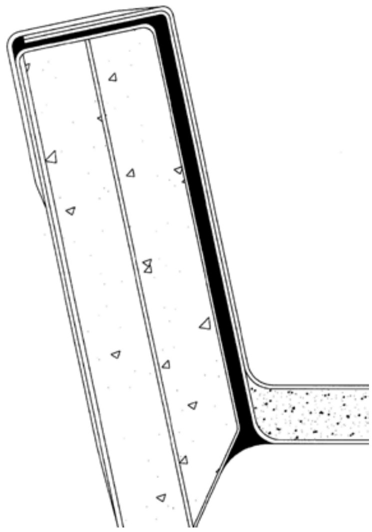


Figure 5 Original transom detail

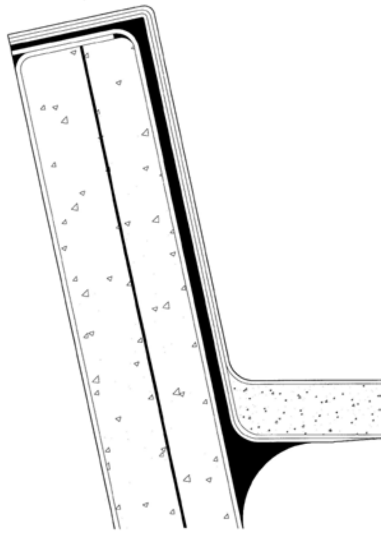


Figure 6 Modified transom detail

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Full-scale Measurements of Containership Sinkage, Trim and Roll

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Abstract

We report on a recent project to accurately measure full-scale sinkage, trim and roll of 16 deep-draft containerships entering or leaving a major container port. Measurements were performed using high-accuracy GPS receivers and a fixed base station. Results were used to calculate the sinkage of the bow, stern and bilge corners, as compared to the static condition. Overall dynamic draft increase and the governing factors affecting under-keel clearance of containerships are discussed.

Introduction

In early 2005 the Centre for Marine Science and Technology was contracted by Hong Kong Marine Department to perform a detailed study into the sinkage and dynamic draft of containerships entering and leaving Kwai Chung, the busiest container port in the world. Part of this study was to carry out full-scale trials on some of the largest containerships, ranging in overall length from 277 m to 352 m, in order to accurately measure sinkage, trim and roll.

It has only been through the continually-increasing accuracy of GPS receivers that full-scale squat measurements have become viable in the past decade. Whereas in model tests, the towing carriage acts as a fixed vertical reference, at full scale no such simple fixed reference exists. Inertial heave sensors are useful for performing seakeeping tests, since amplitudes rather than absolute motions are important in that case. However these sensors tend to "drift" over longer periods of time, so that they cannot accurately give absolute vertical motions.

GPS receivers have the advantage that they give absolute vertical motions relative to a fixed vertical reference on the earth (usually the WGS84 ellipsoid). For ship trials, these vertical heights can then be adjusted to be relative to the nautical chart datum. In this way, once the tidal height is known, the height of the receiver above the static waterline can be calculated. Carrier-phase GPS receivers now have vertical accuracy of the order of centimetres, and can operate in kinematic mode to record the continually changing latitude, longitude and vertical height of points on a moving ship.

Measuring vertical motions using GPS

To measure sinkage and trim of a ship, two GPS receivers are positioned on the ship's centreline, with one forward and one aft. Often the forward unit is mounted on the forecastle and the aft unit atop the bridge. To measure sinkage, trim and roll, three GPS receivers are needed onboard the ship. In this case, the units can be mounted on the forecastle, port bridge wing and starboard bridge wing. Sinkage, trim and roll are then calculated by assuming that the ship is a rigid body.

For high accuracy, an external reference GPS receiver is also required. This may be positioned either ashore or on a small escort vessel.

Once the onboard GPS receivers are fixed in place, a stationary reading of each receiver's vertical height is taken at the berth. This is then used as a reference value with which to compare the vertical height measurements whilst under way.

Shore-based receiver method

The shore-based receiver method is described in Feng and O'Mahony (1998). In this case, a GPS receiver is mounted ashore and kept in a fixed position for the duration of the measurements. Cross-correlating GPS signals between the moving receivers and the shore-based receiver then allows accurate position fixing of the moving receivers.

However, ship sinkage measurements must be taken relative to the instantaneous static waterline around the ship, and this changes as the tidal height changes. Therefore, results must be corrected for the fact that the static waterline height (tidal height) is changing with time and position. Also, the difference between the GPS vertical reference and the mean sea level (geoid undulation) must be accounted for.

Escort vessel method

The escort vessel method is described in Härting and Reiking (2002). In this case, the escort vessel first does its own sinkage and trim test using the shore-based method described above. This allows the vertical position of the escort vessel to be known for any given vessel speed. Then the escort vessel acts as a reference unit for the larger vessel.

The use of an escort vessel removes the error associated with estimating the tidal height at each time and position in the transit. This is because the escort vessel moves up and down with the tide by the same amount that the ship does, so any tidal height effects cancel out. In a similar way, geoid undulation may also be neglected when using this method.

Choosing the appropriate method

In choosing between the shore-based receiver and escort vessel methods for a particular application, the main deciding factors are the availability of tidal data, length of transit, sea state, and cost. These factors are discussed below with reference to performing trials in Hong Kong harbour.

Availability of tidal data

Using a shore-based GPS receiver requires accurate knowledge of the tidal height at each point in the transit. If this cannot be calculated sufficiently accurately, then the escort vessel method should be used.

In the case of Hong Kong harbour, tidal variations are not too large (around 1–1.5 m) and tidal heights are measured continuously at several points around the area.

Length of transit

If using a shore-based receiver, errors increase as the baseline length (distance between shore-based receiver and moving receivers) increases. The baseline length always stays small when using the escort vessel method.

For the Hong Kong trials, the area of interest was around 4 n miles in length, and during this part of the transit the ship was never more than 2.5 n miles from the shore-based receiver, so that baseline errors remained small.

Sea state

The escort vessel method requires a fairly calm sea ahead of the ship, to have a stable vertical reference. Any swell, sea or wake from other vessels will cause an oscillatory vertical motion of the escort vessel, which may be difficult to average out.

Hong Kong has a fair amount of wave wake, generated by the frequent shipping going into and out of the port. In addition, the easterly trade winds in winter cause high-frequency wind waves, while the summer monsoon brings significant south-westerly swells. This would have caused difficulties in gaining stable reference heights from the escort vessel.

Cost

The use of an escort vessel entails additional costs as well as logistical difficulties.

All things considered, it was thought best to use the shore-based receiver method for these trials. For longer transits in calm water with little tidal data available, the escort vessel method is suitable and has been used successfully in Europe, as described in Härting and Reiking (2002).

Description of the trials

Trials location

Trials were conducted on vessels transiting to or from Kwai Chung, the Hong Kong container terminals, via the East Lamma Channel (see British Admiralty chart 3280 for details). For vessels leaving Kwai Chung, measurements were taken from the berth until the vessel passed approximate latitude 22°16' N. This transit includes an initial course towards the WSW, followed by a slow turn to port with final course SSE. The inward transits were the reverse of above.

The charted depth for this section of the transit varies from 15–35 m. The transit is in essentially unrestricted water, with no channel blockage effects. The channel is well-sheltered from the prevailing swell.

Equipment

Trimble 5700 real-time kinematic, carrier phase GPS receivers were used. Three of these (with Trimble Zephyr antennas) were mounted on the vessel, with one at the bow and one on each of the bridge wings. A fourth receiver (with Trimble Zephyr Geodetic antenna) was mounted on the shore, at a secure location close to the container berths. This formed the base station with which to correlate the moving receiver results. This equipment setup gives a root-mean-square accuracy of 20 mm for each moving receiver's vertical position, as stated by the manufacturer for the baseline lengths used in these trials. Sampling rate was 1 Hz.

Arranging transits

Before commencing the trials, Hong Kong Marine Department and CMST spent considerable time liaising with pilots, container terminals, shipping lines and ship masters, organising everything so that the trials could proceed smoothly. It was important that there was no interruption to any of the ships' usual operations.

Although ideally each individual transit should be arranged well in advance, this was impossible due to the changing ship schedules, as well as the safety requirement of only performing daylight transits. Instead, potential target ships were notified in advance and final confirmation of the transit given a few hours before each transit through the Pilots' Association. The Pilots' Association was invaluable in providing up-to-the-minute schedules, liaising with ships' masters, and getting the CMST personnel to and from the ships with the pilots.

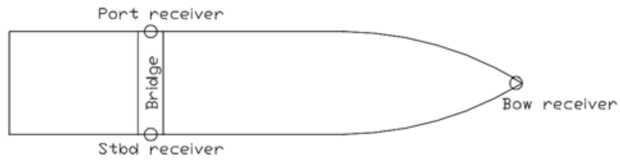

Figure 1 Typical GPS receiver locations on vessel

Figure 2 Typical bow receiver mounting

Through prior planning, round the clock monitoring of ship schedules, and a flexible approach to arranging transits, 20 transits were performed on 16 deep-draft containerships over a 9-day period. The vessels chosen were among the largest containerships currently in operation.

Trials procedure

Two CMST personnel performed the trials on the vessels. Both incoming and outgoing trials were conducted. The procedure for incoming transits is described below:

- CMST personnel board vessel with pilot, carrying equipment up ladder in backpacks.
- Report to bridge, then set up equipment (5–10 minutes).
- Log data through to the berth, then take stationary reading at berth.
- Remove equipment and disembark with the pilot.

For outgoing transits the procedure was the reverse of above.

Data analysis

Trimble Geomatics software was used to take in the data from the three moving receivers and base station, and output (time, latitude, longitude, height) vectors for all three moving receivers.

Matlab software was then written for post-processing the results.

Calculating sinkage from GPS height measurements

This method follows that presented in Feng and O'Mahony (1998).

GPS height measurements are given not with respect to chart datum, but with respect to a mathematically-defined ellipsoid (the WGS84 ellipsoid) that only roughly approximates mean sea level.

We wish to ultimately measure height with respect to the local static waterline, so as to gauge the sinkage of the ship beneath its static floating position.

The first step in this process is to transfer the height measurements from the WGS84 ellipsoid to the geoid, which coincides with Mean Sea Level (MSL). The height of the geoid above the ellipsoid is known as the "geoid undulation" (N) which varies around the globe. Values of N for Hong Kong were taken from Chen and Yang (2001) and are around –1.6m to –1.7m in the area of interest.

Measured GPS heights relative to the ellipsoid (h_{measured}) are then transferred into heights relative to the mean sea level (h_{MSL}) as follows:

$$h_{\text{MSL}} = h_{\text{measured}} - N$$

These can then be transferred to the datum of Lowest Astronomical Tide (LAT), which is used for tidal measurements, as follows:

$$h_{\text{LAT}} = h_{\text{MSL}} + T_{\text{mean}}$$

where T_{mean} is the mean tidal height, i.e. difference between LAT and MSL.

Instantaneous tidal height T is measured relative to LAT, since nautical charts normally use LAT as their datum. Therefore, the height of a GPS receiver above the instantaneous static free surface (h_{fs}) is given by

$$h_{\text{fs}} = h_{\text{LAT}} - T$$

Combining the above equations yields

$$h_{\text{fs}} = h_{\text{measured}} - N + T_{\text{mean}} - T$$

This allows us to transfer the measured height h_{measured} of a GPS receiver above the WGS84 ellipsoid, into the actual height h_{fs} above the static free surface around the ship.

The rising of the ship ∇h_{fs} relative to the static free surface is the difference in h_{fs} between when the vessel is underway and when it is in its static free-floating position at the berth. Therefore

$$\nabla h_{\text{fs}} = (h_{\text{fs}})_{\text{underway}} - (h_{\text{fs}})_{\text{static}}$$

Sinkage is defined as being positive downwards, so it is given by

$$\text{Sinkage} = -\nabla h_{\text{fs}} = (h_{\text{fs}})_{\text{static}} - (h_{\text{fs}})_{\text{underway}}$$

or

$$\text{Sinkage} = (h_{\text{measured}} - N + T_{\text{mean}} - T)_{\text{static}} - (h_{\text{measured}} - N + T_{\text{mean}} - T)_{\text{underway}}$$

For these trials, the region of interest is small and T_{mean} varies little. Therefore the difference between T_{mean} at the berth and during the transit has been neglected, with a small associated error. This reduces the above equation to

$$\text{Sinkage} \approx (h_{\text{measured}} - N - T)_{\text{static}} - (h_{\text{measured}} - N - T)_{\text{underway}}$$

Therefore, in order to calculate sinkage the following quantities are required:

- Measured GPS receiver heights through the entire transit, as well as a static reading at the berth.
- Tidal heights at each time and location in the transit, as well as a static reading at the berth.
- Geoid undulation N over the area of the transit.

Other output quantities

Once the sinkage at each GPS receiver has been calculated over the entire transit, rigid-body dynamics are used to transfer sinkage at the three receiver locations into sinkage at other locations on the vessel, specifically the forward post, aft post, port bilge corner amidships and starboard bilge corner amidships. For consistency, the bilge corners have been taken to be 80% of the half-beam away from the centreline of the vessel.

These extremities of the vessel are the points on the hull which might come closest to the sea floor, and therefore should be taken into account when assessing grounding risk.

Note that the rigid-body assumption neglects any additional hogging or sagging of the vessel while under way, as compared to the stationary condition at the berth. In practice there may be slight additional sagging due to the generally depressed free-surface height over the middle portion of the vessel.

For some vessel layouts, a fourth receiver could be mounted at the stern of the vessel to measure any additional hog or sag whilst under way.

Error analysis

The errors inherent in calculating sinkage of each receiver on the ship are as follows:

GPS vertical error relative to the WGS84 ellipsoid

Expected vertical RMS error was given as an output from the Trimble Geomatics software. This was generally in the range 0.01–0.02 m.

Geoid undulation N

The error in geoid undulation N over the area of interest is not known precisely. It is estimated that differences in N will have errors ranging from zero near the berth to around 0.02m at the end of the region of interest.

Static reading at berth

In order to have a static position elevation at the berth, vertical elevations were averaged over 2 minutes at the berth once the ship had tied up. A small residual movement was normally present, however, due to slight rolling of the vessel or vertical movement due to seiching in the harbour. The RMS error in the static reading was estimated as 0.04 m.

Measured tidal data

The RMS error in the tide gauge at Kwai Chung is estimated to be 0.01m.

Sea surface slope

Measured Kwai Chung tidal data was used for the entire transit, since the entire region of interest lay within a 2.5 n miles radius of the tidal measuring station, and the most important part of the transit was close to the measuring station.

Looking at measured tidal data from other stations in the area allowed an estimate to be made of the likely difference in tidal height between the end of the region of interest and Kwai Chung. We therefore estimate that the RMS error in tidal height due to sea surface slope ranges from zero near Kwai Chung to 0.03 m at the end of the region of interest.

Total error at each receiver

Since all of these data sources are added or subtracted in order to calculate the final sinkage value, the total error is found by summing the squares of the individual errors and then taking the square root. Therefore the estimated RMS error close to Kwai Chung is 0.05 m, and at the end of the region of interest is 0.06 m.

Total error in sinkage at vessel extremities

The errors in bow sinkage will be as above, since a receiver was located directly there. Disregarding sag, the errors at the bilge corners will also be similar since these points are within the space bounded by the receivers. Stern sinkage error will be slightly larger due to the required extrapolation outside the area bounded by the receivers.

Dynamic sinkage

Measured sinkage along transit

Example measured sinkage results, as well as corresponding speed profiles, are shown in Figures 3–6. Since the transit was generally in a north-south direction, and distance along the channel is difficult to define when taking account of manoeuvring near the berths, results have been plotted as a function of midship latitude.

It can be seen that there is considerable oscillation in the sinkage of the port and starboard bilge corners. This is primarily due to roll, as very little heave or dynamic pitch was measured in any of the runs. Spectral analyses of the measured roll have been performed for the cases shown, with large peaks being found at a period of 14 seconds for Ship A and 18 seconds for Ship B. These periods match the calculated natural roll periods of the vessels.

Maximum sinkage

The maximum sinkage almost invariably occurred at the bilge corner on the western side of the transit, due to the combined effects of easterly winds and a turn centred toward the east.

The maximum sinkage, as a percentage of length between perpendiculars, averaged 0.22, with standard deviation 0.13, minimum 0.13 and maximum 0.63.

Factors affecting sinkage for containerships

Dynamic trim

Full-form ships such as bulk carriers, with almost level static trim, tend to trim down by the bow when under way (see e.g. Dand and Ferguson 1973 for model test results). This is due to the longitudinal centre of buoyancy (LCB) being located well forward of the longitudinal centre of floatation (LCF). See Tuck (1966) for calculation of this effect based on potential-flow methods.

For the containerships tested, it was found that in most cases there was little dynamic trim, and that this trim could be either by the bow or the stern, depending on the vessel.

Containerships have their LCB normally slightly aft of amidships and not far forward of the LCF. According to

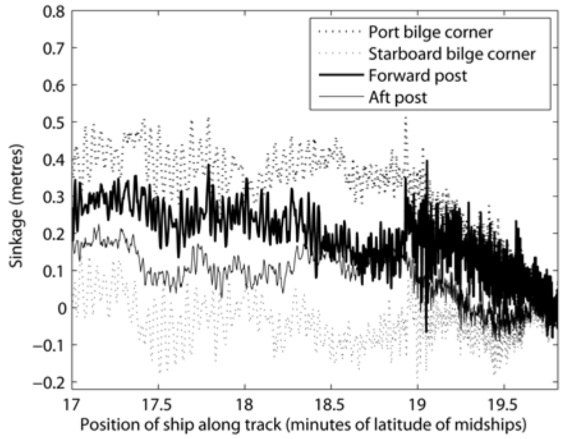

Figure 3 Ship A on inbound transit: sinkage at four points on vessel

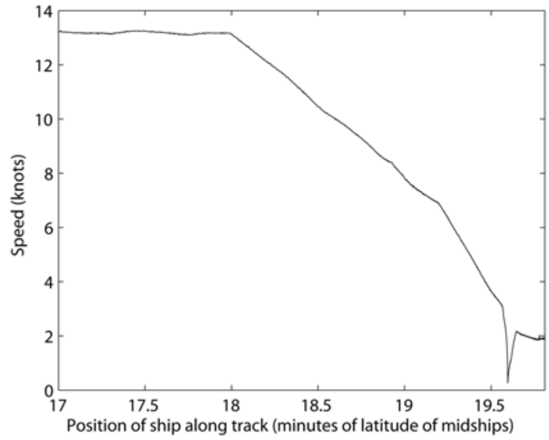

Figure 4: Ship A on inbound transit: ship speed over the ground

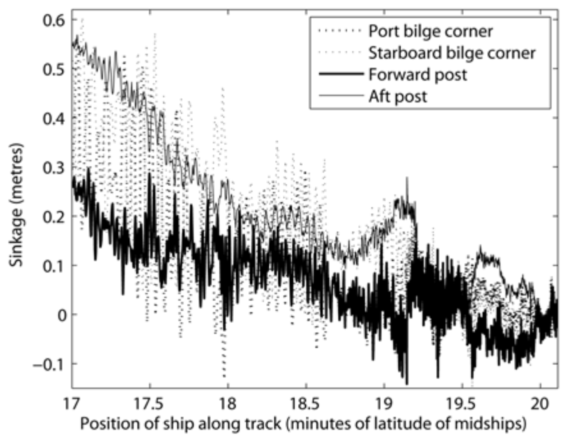

Figure 5 Ship B on outbound transit: sinkage at four points on vessel

potential-flow theory, these ships should experience a slight bow-down trim. However, the effects of the propeller inflow, as well as flow separation near the stern, both act to decrease the overall pressure near the stern and hence tend to trim the vessel by the stern. Therefore the overall dynamic trim of a containership is normally quite small, and may be either by the bow or the stern, depending on the hull shape, loading condition and propeller characteristics. Note that the static trim of the vessel will also affect the dynamic trim.

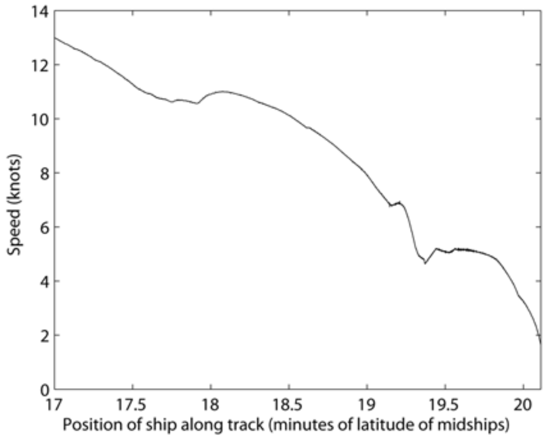

Figure 6 Ship B on outbound transit: ship speed over the ground

LCF sinkage

The LCF sinkage of containerships will generally be smaller than bulk carriers of similar length (or even similar displacement) due to their smaller volumetric coefficient c_∇, defined by

$$c_\nabla = \frac{\nabla}{L_{\mathrm{P}}^3}$$

where ∇ is the ship displacement volume and L_{P} is the length between perpendiculars. A frequently-used formula for LCF sinkage (Tuck 1966, Hooft 1974, Huuska 1976, Gourlay 2006) gives the LCF sinkage, s_{LCF} as

$$\frac{s_{\mathrm{LCF}}}{L_{\mathrm{P}}} = c_s\, c_\nabla \frac{F_h^2}{\sqrt{1-F_h^2}}$$

Where $F_h =$ Froude number based on water depth, i.e. $V/\sqrt{gh}$

$c_s =$ LCF sinkage coefficient, normally in the range 1.2 – 2.4, according to model tests referenced above.

Bulk carriers generally have volumetric coefficients 0.006 –0.010, while containerships generally have volumetric coefficients in the range 0.002–0.005. Therefore the LCF sinkage of a containership will generally be around half that of a bulk carrier of similar length.

Roll

We shall here take roll to mean the instantaneous heel angle experienced by the vessel, as compared to the steady-state heel angle whilst at the berth. This includes both dynamic oscillatory roll caused by swell, or free-decaying roll as well as steady heel due to wind or turning.

For the containerships tested, roll was the most important factor governing maximum sinkage. Rolling of the vessel causes the bilge corners to be displaced vertically downwards, so that for a vessel with level static trim, the bilge corners of the ship are generally more vulnerable to grounding than the bow or stern.

This situation is very different to bulk carriers, which generally experience very small roll angles when transiting approach channels in calm conditions. For these ships, the large bow-down trim means that the bow is the point on the ship most vulnerable to grounding.

It is important to note that there is a considerable difference between containerships and bulk carriers in terms of roll characteristics. Containerships have a relatively high centre of gravity and low metacentric height, which translates into much larger heel angles during turns. Often containerships will be travelling quite quickly through turns, which also increases the turn-induced heel.

Wind heel is also much larger for containerships than for bulk carriers. Containerships tend to have larger above-water profile areas, larger wind heeling lever arms, smaller displacements (for the same ship length) and smaller GMs. These effects all combine to produce much larger wind heel angles for containerships than for bulk carriers.

During the course of these trials, it was noticed that wind and turning both had a significant effect on heel angle and hence sinkage at the bilge corner. These effects were difficult to separate, since they both acted in the same direction over most of the transit. In addition, an oscillatory roll motion was normally present, which may have been excited by changes in vessel direction, wind gusts or any refracted swell entering the area.

Wave-induced vertical motions

No significant swell was noticed in the Hong Kong approach channel during these trials, since it is well-protected from the north-east monsoon swell. However, in any approach channel where swell is present, the resulting wave-induced heave, pitch and roll will all cause vertical motions of the ship and, hence, increase the sinkage.

Hull shape

Bulk carriers tend to have fairly long parallel midbodies. Therefore the combined effects of trim and roll mean that, in a seaway, the forward or aft (normally forward) shoulder of the bilge corners may be particularly vulnerable to grounding.

Containerships, however, have little, if any, parallel midbody. Therefore the forward and aft shoulders need not be considered; rather just the port and starboard bilge corners at their widest point.

Dynamic draft increase

For a ship which has level trim in the static condition, any sinkage at the bow, stern or bilge corners translates directly into an increase in dynamic draft and therefore a decrease in under-keel clearance.

However, for a ship that is trimmed by the stern in the static condition, sinkage at the bow or bilge corners does not translate directly into a decrease in under-keel clearance. Even if the ship is rolling considerably and the bilge corners are experiencing significant downward sinkage, the stern may still be most vulnerable to grounding, due to its already-close proximity to the sea floor.

Therefore we shall here make a distinction between the concepts of "sinkage" at different points on the ship, and the overall "dynamic draft increase".

The dynamic draft at each location on the ship can be found by adding the static draft at that point to the sinkage at that point. The point on the ship with the largest dynamic draft is the point most likely to hit the bottom. The overall dynamic draft is the maximum dynamic draft over the whole vessel.

The difference between the overall dynamic draft and the maximum static draft is the "dynamic draft increase", and is the extra allowance that should be included if the ship is to avoid grounding.

Results

Figures 7 and 8 show the dynamic drafts at different points on the vessel for Ship A and Ship B.

Both Ship A and Ship B are trimmed appreciably by the stern in the static condition (near the maximum latitude shown on the graphs). Therefore, despite significant rolling and sinkage at the bilge corners, the stern still has the maximum dynamic draft and hence governs the overall dynamic draft.

The dynamic draft increase (DDI) is the overall dynamic draft, minus the maximum static draft (static stern draft in this case).

Across all vessels tested, the maximum DDI for each transit (as a percentage of the length between perpendiculars) averaged 0.16, with standard deviation 0.08, minimum 0.06 and maximum 0.39.

Effect of static trim on DDI of containerships

Most of the containerships tested were trimmed down by the stern in the static condition. For some ships the static stern-down trim is used to improve manoeuvring and propulsive efficiency, while for others it is used to offset a known propensity to trim by the bow when under way.

Despite the fact that maximum sinkage generally occurred at the bilge corners, the maximum dynamic draft was normally at the stern due to the static stern-down trim.

This contrasts with the case of bulk carriers, which normally have almost level static trim, bow-down dynamic trim, and very little roll in calm water. Therefore, for bulk carriers in calm water, the bow usually has the largest dynamic draft and hence comes closest to the seabed.

Use of DDI for developing UKC guidelines

Dynamic draft increase is directly related to a decrease in underkeel clearance, and so is the most important parameter to use when assessing the grounding risk of a particular vessel. We have seen here that, for containerships, the DDI is usually significantly less than the maximum sinkage.

However, we would warn against using DDI values from vessels that are statically trimmed by the stern, when developing under-keel clearance guidelines for ports. This is because any DDI values obtained from stern-trimmed vessels will severely underpredict the DDI values for similar vessels with level static trim.

Maximum sinkage values from statically-trimmed vessels will be similar to maximum sinkage values for level-trim vessels. Therefore this is generally the best parameter to use in the first instance for developing generalised under-keel clearance guidelines for a port. Maximum sinkage values can then be converted into DDI values based on each particular vessel's static trim.

Conclusions

Real-time-kinematic GPS receivers, combined with a fixed shore receiver, have been used to measure the dynamic sinkage, trim and roll of 16 deep-draft containerships entering or leaving Hong Kong harbour.

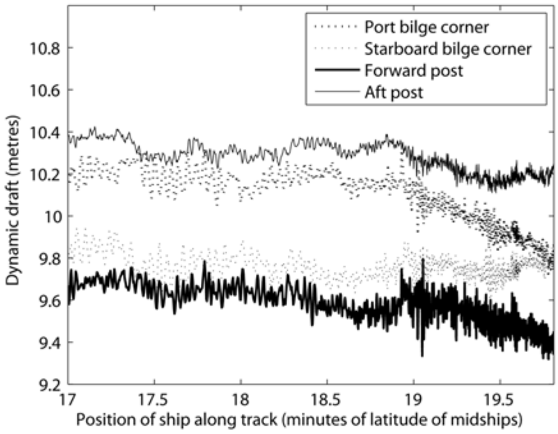

Figure 7 Ship A on inbound transit: dynamic draft at four points on vessel

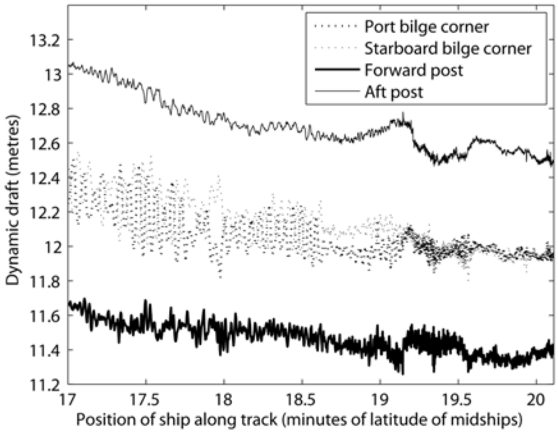

Figure 8 Ship B on outbound transit: dynamic draft at four points on vessel

The RMS error in downward sinkage of each point on the hull was estimated to be around 0.06m, including the effects of GPS error, tidal error, static height error and geoid undulation error.

Maximum sinkage generally occurred at the bilge corner, ranging from 0.13% to 0.63% of the length between perpendiculars over all vessels tested, with an average of 0.22%.

Due to static stern-down trim, the maximum dynamic draft usually occurred at the stern. Dynamic draft increase ranged from 0.06% to 0.39% of the length between perpendiculars over all vessels tested, with an average of 0.16%.

It was found that the important factors affecting sinkage and dynamic draft of containerships are quite different to those for bulk carriers. For containerships, roll due to wind, turning or swell produces large sinkages at the bilge corners. For ships with close to level static trim, the bilge corners will normally come closest to the seabed. For ships trimmed statically by the stern, the stern will normally come closest to the seabed.

Acknowledgement

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the co-operation of the Hong Kong Pilots' Association and shipping lines involved in the project.

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EDUCATION NEWS

Australian Maritime College

AMC Graduation and Prizegiving Ceremony

Mr Rob Gehling, Past President of the Australian Division of the Royal Institution of Naval Architects, spent two days at AMC in March to meet with AMC research and academic staff. Rob also represented RINA at the AMC Graduation and Prizegiving Ceremony which was held on Friday 16 March 2007. The following students received their Bachelor of Engineering degrees:

Benjamin Adamson	Naval Architecture
Tristan Andrewartha	Naval Architecture (Hons Class 1) — DSTO, VIC
Daniel Atkins	Ocean Engineering (Hons Class 2 Div 2) — Clough, WA
James Atkinson	Naval Architecture (Hons Class 2 Div 2) — Travelling, South America
Samual Baghurst	Naval Architecture
James Barton	Naval Architecture — Tenix Defence, VIC
Justin Bentink	Naval Architecture (Hons Class 2 Div 2) —Austal Ships, WA
Graeme Boyle	Ocean Engineering (Hons Class 2 Div 1) — Technip, WA
Russell Brice	Naval Architecture (Hons Class 2 Div 2) — Knud E. Hansen, Denmark
Brendan Campbell	Naval Architecture — Alloy Yachts, Auckland, NZ
Lachlan Carlier	Naval Architecture — Austal Ships, WA
Edward Dawson	Naval Architecture (Hons Class 1) — BMT Defence Services (Australia), VIC
Clint Duncan	Ocean Engineering — Schlumberger, WA
Jay El-Atl	Naval Architecture (Hons Class 2 Div 2) — Austal Ships, WA
Mani Hackett	Naval Architecture — Veem Propulsion Division, WA
Gregory Hansen	Marine and Offshore Systems (Hons Class 2 Div 1) — AMSA, ACT
Kaspar Hebblewhite	Naval Architecture (Hons Class 1)
Danielle Hodge	Naval Architecture — Defence Materiel Organisation, NSW
Joel Ireland	Ocean Engineering (Hons Class 1) — Subsea 7, Norway
Richard Jeffries	Naval Architecture
Tegan Kay	Ocean Engineering — JP Kenny, WA
Giles Mitchell	Marine and Offshore Systems — Clough, WA
Mitchell Pike	Naval Architecture — Acergy, WA
Matthew Playford	Marine and Offshore Systems — Schlumberger, WA
John Polmear	Naval Architecture — Austal Ships, WA
Michael Ray	Ocean Engineering (Hons Class 2 Div 2) — Subsea 7, Norway
Mitchell Stone	Ocean Engineering — J. Ray McDermott
Dash Swift	Ocean Engineering (Hons Class 2 Div 2) — Acergy, WA
Peter Tomic	Naval Architecture — Strategic Marine, WA
Thomas Urie	Naval Architecture (Hons Class 2 Div 2) — ASC, SA
Ryan Watts	Naval Architecture (Hons Class 2 Div 1) — Subsea 7, Norway
Tristan Williams	Naval Architecture — Sea Transport Solutions, QLD

AMC Council Awards

AMC Council Award for High Achievement in Teaching — Dr Giles Thomas and Mr Paul Furness

Dr Giles Thomas is an outstanding educator whose passion for ships and sailing is readily communicated to his students. Since joining the Department of Maritime Engineering in 2003, he has made major contributions to the design and development of units in the engineering programs, especially ocean vehicle design, yacht design and technology and experimental methods. He has introduced new teaching initiatives and has made complementary electronic material easily accessible to the students.

Very positive feedback has been received from students. Giles' teaching is characterised by an emphasis on student-centred learning and active participation in the learning experience. Learning activities are designed to foster the development of generic graduate attributes, such as the ability to participate in team projects and to apply knowledge to real-life problems and situations. As a member of the naval architecture student liaison committee, he is always ready to listen to student concerns and assist them in finding effective solutions.

Giles has facilitated the networking of students with appropriate engineering organisations, so that their project topics are of direct relevance to the organisations. In addition, this networking has assisted students to access appropriate work experience and employment.

It is a measure of Giles' ability as a lecturer that he successfully combines a high teaching workload with a significant research effort.

Paul Furness is a dedicated academic who has clearly demonstrated his abilities in teaching and academic leadership over the past ten years. Together with Giles Thomas, Paul has contributed to curriculum design and the development and delivery of a number of units in the engineering program.

In his teaching, Paul uses a variety of strategies. He is confident, clear and articulate and presents his material in a logical, well-structured and effective manner. He encourages a team approach to learning, and models it to the students in his own collaborative style of working. An important initiative was the development of a high-quality study book and two supplementary study guides for hydrostatics. In addition, he developed laboratory equipment to assist students in their understanding of concepts associated with ship stability.

The students give positive feedback on Paul's approach to teaching and his willingness to assist the students in their learning process.

AMC Council Award for High Achievement in Research — Dr Laurie Goldsworthy

Dr Laurie Goldsworthy is an accomplished teacher and researcher who has played an active role in the Department of Maritime Engineering since its formation in 2002. He was responsible for the establishment of the Marine Engines Research Group, whose research encompasses fuels, combustion and emissions, the use of renewable fuels and the reduction of greenhouse gas emissions.

Having modelled the combustion process, using the machinery-space simulator and computational fluid dynamics programs, Laurie developed equipment for the validation and calibration of the computer models. Subsequently, data has been collected during voyages of MV *Goliath* on exhaust emissions, fuel consumption, cylinder pressure and injection timing. A high-pressure fuel-spray chamber has also been developed.

As well as attracting funding for the development of experimental research engine facilities, Laurie is working in collaboration with researchers from Japan, Norway, Finland and Helsinki and has published a number of papers, made presentations at relevant international conferences and is supervising postgraduate research students.

AMC Prizes

The Connell Medal — Best AMC Graduate in 2006 (AMC wide): Joel Ireland, BE (Ocean Engineering).

AMHRC Research Award — Significant contribution to the Australian Hydrodynamics Research Centre (AMHRC) by an individual or team from participating organisations (AMC, UTAS, DSTO): David Clarke.

Department of Maritime Engineering Prizes

Captain Thomas Swanson Prize — Best student over the duration of any engineering course in 2006: Joel Ireland, BE (Ocean Engineering).

Engineers Australia Award, Norman Selfe Prize — Best achievement and attainment of professional skills in the final year of a Bachelor of Engineering course: Joel Ireland, BE (Ocean Engineering).

Teekay Shipping Project and Technology Management Prize — Highest marks in technology and project management related subjects in any program in the Departments of Maritime Engineering or Maritime and Logistics Management: Joel Ireland, BE (Ocean Engineering).

Technip Oceania Prize — Year 4 Bachelor of Engineering (Ocean Engineering) student with the highest marks is subsea and deepwater engineering: Joel Ireland.

J Ray McDermott Asia Pacific Prize — Best achievement by a graduating student in the unit Offshore Operations in the Bachelor of Engineering (Ocean Engineering) or Bachelor of Engineering (Marine and Offshore Systems) degrees: Daniel Atkins and Joel Ireland.

Royal Institution of Naval Architects Prize — Best research project by a final year student in the Bachelor of Engineering (Naval Architecture): Tristan Andrewartha.

RINA/Austal Ships Student Naval Architecture Award — Best team project in Ocean Vehicle Design in the Bachelor of Engineering (Naval Architecture) degree: Russell Brice, Peter Tomic and Ryan Watts.

Baird Publications Prize — Best achievement in design related subjects (Year 2): Kim Chamberlin.

Technip Oceania Prize — Year 3 Bachelor of Engineering (Ocean Engineering) student with the highest aggregate mark in Project Engineering and Hydrodynamics of Offshore Structures: Bodie Mallett.

New AMC staff

Professor Neil Bose

Professor Neil Bose joined the Australian Maritime College on 1 May 2007. Neil obtained his BSc in naval architecture and ocean engineering from the University of Glasgow in 1978 and his PhD, also from Glasgow, in 1982. During the period 1974–1980 he was a partner in the Cape Wrath Boatyard, a builder of wooden and fibreglass boats and yachts. In 1983 he was appointed as a "new blood" lecturer in naval architecture and ocean engineering at the University of Glasgow, a post which was sponsored by the Science and Engineering Research Council and heavily research based. He moved to the Memorial University of Newfoundland in 1987 as an Assistant Professor; was promoted to Associate Professor with tenure in 1989 and to full Professor in 1994. At Memorial, he was the Director of the Ocean Engineering Research from 1994–2000 and the Discipline Chair of Ocean and Naval Architectural Engineering from 1998 to 2003. In 2003 he was appointed to a federally-funded Tier 1 Canada Research Chair in Offshore and Underwater Vehicles Design and he has been instrumental in the purchase and commissioning of an International Submarine Engineering Explorer class AUV with a 3000 m depth rating. His research interests are in marine propulsion, autonomous underwater vehicles, ocean environmental monitoring, ice/propeller interaction and aspects of offshore design. He has served on four, and chaired two, technical committees of the International Towing Tank Conference. He presently chairs an Engineering Committee on Oceanic Resources, international Specialist Panel on Underwater Vehicles.

Neil will take on the dual role of Professor in Maritime Hydrodynamics at AMC and Centre Manager of the Australian Maritime Hydrodynamics Research Centre, based at AMC's Launceston campus.

Professor Martin Renilson

Martin Renilson has now returned to the Australian Maritime College as a part-time Professor in Hydrodynamics. He is also running his own consulting company, Renilson Marine Consulting. Martin originally started work at AMC in 1983, where he developed the Ship Hydrodynamics Centre. He was also the Head of the Department of Naval Architecture and Ocean Engineering, and led the development of the professional degrees there. He left AMC in 2001 to take up the position of Technical Manager, Hydrodynamics, for DERA in the UK. This was then privatised to become QinetiQ, and he held various positions there, cumulating as Technical Manager and Deputy General Manager for the Maritime Platforms and Equipment Group. In addition to hydrodynamics, this group, of about 100 staff, also specialised in ship design, marine engineering, waste management, fire research, submarine atmospheres and the marine environment. Martin also has a Visiting Chair position in the Department of Naval Architecture and Marine Engineering at the Universities of Glasgow and Strathclyde.

Industry Liaison Committee Meeting

The Bachelor of Engineering degree course teams for both the naval architecture and ocean engineering disciplines each held one of their regular Industry Liaison Committee (ILC) meetings at AMC on 2 and 3 May. The primary aim of each committee is to conduct a thorough review of the course content for each degree. The industry representatives, all of whom provided excellent input throughout the meeting, included:

ILC Naval Architecture

Mr Ray Duggan (Department of Defence, ACT)
Mr Derek Gill (Austal Ships, WA)
Mr Gordon MacDonald (BMT Defence Services Australia, Vic)
Mr Steve Quigley (One2Three Naval Architects, NSW)
Dr Yuriy Drobyshevski (Intec Engineering, WA)

ILC Ocean Engineering and Marine & Offshore Systems

Tim Nicol (WA Conservation Council)
Christopher Bonay (Worley Parsons, Vic)
Cedric Morandini (AMOG Consulting, Vic)
Also providing input to the ILC, but unable to attend this meeting were Greg Miller (Clough Engineering), Neil Lawson (Lawson & Trelor) and David Cooper (DNV, Tas).

The AMC would like to express its appreciation to all ILC participants for their contributions.

Final Year BE Research Theses 2007

A large variety of final-year projects are being undertaken by naval architecture and ocean engineering students at present. A selection of these projects is briefly described below:

Hydrodynamic Properties of a Suction Can in Subsea Lifting and Lowering — Toby Roe, BE (Ocean Engineering)

Suction cans are a common type of foundation structure, widely used in the offshore industry. During offshore installation when the suction can is lowered onto the seabed (or retrieved from depth to surface), the structure is usually handled by a crane or a winch on an installation vessel.

Due to vessel motions, the dynamic load on the crane is affected by the heave added mass and damping of the submerged structure, as well as by the stiffness of the lifting rigging. As the heave added mass of a suction can is usually very large (much higher than its own structural mass), dynamic loads experienced by the crane and the lifting rigging may be substantially higher than the submerged weight of the can. These dynamic loads govern selection of the installation vessel, design of the lifting rigging and define the allowable sea state, under which the operation can be conducted safely.

Therefore, information on the hydrodynamic properties of the suction can is important to make sure that the installation operation is conducted safely and without unnecessary expenses incurred. Currently, such information is not available to offshore engineers in the systematic form. The objective of this research project is to determine the heave added mass and damping of a typical suction can when close to the sea floor by the use of physical scale model experiments. The dependency of both properties on the frequency and amplitude of heave motions are being assessed. Toby completed a comprehensive series of experiments in April and is now undertaking the post-processing of the collected data. The conduct of the experiments was enhanced by the attendance of Toby's industry supervisor, Dr Yuriy Drobyshevski.

This project is co-supervised by Gregor Macfarlane (AMC) and Dr Yuriy Drobyshevski of Intec Engineering, Perth, WA.

The Prediction of Wave-wake Characteristics for Vessels Operating in Finite Water Depths — Jordan Glanville, BE(Naval Architecture)

Research at AMC into the prediction of wave-wake characteristics using empirical and semi-empirical techniques has been active for over a decade. Recent work included the development of a framework for a wave-wake database for vessels operating in finite water depths, and the conduct of a comprehensive series of scale model experiments within the model test basin to acquire relevant data for inclusion within this database. These two primary tasks have been successfully completed, as has the preliminary analysis of the comprehensive data set. Experimental data for over 75 different hull-form configurations, covering a wide range of typical hull forms, has been acquired.

During the process of analysing the wide range of data acquired, it became apparent that the differences in the primary wave characteristics between the wave patterns generated at each of the sub-, trans- and super-critical depth- Froude-number regimes were occasionally greater than previously expected. The result was that the intended analysis process would not provide a suitably accurate representation of the primary wave characteristics generated for all conditions experienced.

This student research project is concentrating upon the determination and verification of a more-appropriate analysis technique. This will be followed by the analysis of the entire data set, ready for inclusion into the finite water depth wave wake database. The development of the appropriate analysis technique will be undertaken in consultation with AMC PhD student, Alex Robbins, whose research is in a similar field.

This project is supervised by Gregor Macfarlane.

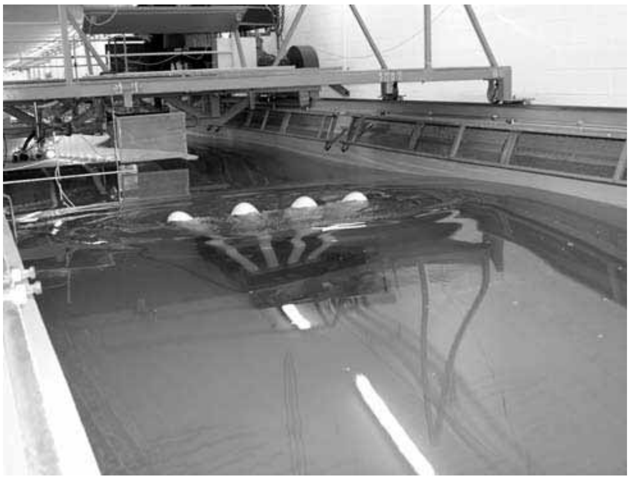
BioPower Systems use AMC Towing Tank

BioPower Systems Pty Ltd is an Australian company which is commercialising award-winning biomimetic ocean-energy conversion technologies. They have adopted nature's mechanisms for survival and energy conversion in the marine environment, and have applied these in the development of their proprietary wave, and tidal, energy systems.

The inherently simple bioWAVE and bioSTREAM devices are designed to supply utility-scale grid-connected renewable energy using lightweight modular systems. These systems will reside beneath the ocean surface, out of view, and in harmony with the living creatures that inspired their design.

BioPower Systems have recently undertaken physical scale model experiments on both the bioWAVE and bioSTREAM devices within AMC's towing tank. The wave-energy conversion system, bioWAVE, is based on the swaying motion of sea plants in the presence of ocean waves. The tidal-energy conversion system, bioSTREAM, is based on the highly-efficient propulsion of thunniform swimming species, such as shark, tuna, and mackerel. Systems are being developed for 500 kW, 1000 kW and 2000 kW capacities to match conditions in various locations.

This information was provided by BioPower Systems and further details can be found at www.biopowersystems.com.



A scale model of bioWAVE during testing in the AMC towing tank (Photo courtesy AMC)

RINA CEO Visit to AMC

As part of his Australian tour in March, Trevor Blakeley, Chief Executive of RINA, visited the Australian Maritime College. He met with academic staff of the Department of Maritime Engineering and members of the Tasmanian Section Committee to discuss a wide range of issues. In addition, Trevor gave a presentation to BE students outlining what RINA does and what it can do for student members. The presentation was followed by a lunch attended by local members of the Tasmanian Section. Trevor also met with AMC research staff and postgraduate students who provided Trevor with the opportunity to view the latest developments and activities within many of AMC's facilities.

Maritime Engineering Industry Day and Careers Fair

The inaugural AMC Maritime Engineering Industry Day and Careers Fair, held on 4 May, was a resounding success. Representatives from 17 companies and organisations visited the AMC to present the opportunities they can provide to engineering students. This was of great value not only for Year 4 students looking for a job when they graduate, but also for students investigating work experience possibilities.

Proceedings began on Thursday night with an informal gathering at the Royal Oak Hotel for students, staff and industry representatives. On Friday the industry representatives set up trade stands in an Expo Show and also gave short presentations to an audience of students. With the ship design and building and offshore oil and gas industries experiencing a boom period in Australia, graduates have many opportunities available to them.

Companies and organisations represented were:

- Austal Ships
- ASC
- Department of Defence
- DMO
- DSTO
- Tenix Marine
- Technip
- Intec
- J Ray McDermott
- Soros

- DNV
- Lloyd's Register
- Sea Strut
- AMT
- Clough
- AMOG
- BMT Defence Services

The efforts of industry in attending the Industry Day and Careers Fair were greatly appreciated, and it is hoped that it will become an annual event. Anyone who is interested in attending in the future, please contact Giles Thomas (gthomas@amc.edu.au) to ensure that they are on the mailing list.

The Careers Fair at AMC
(Photo courtesy AMC)

University of New South Wales

Undergraduate News

Visit by Chief Executive

The Chief Executive of RINA, Trevor Blakeley, visited UNSW on Friday 2 March, and made a presentation on RINA, its aims, and the benefits of becoming and remaining a member, to the naval architecture students and staff.

Student–Staff Get-together

The naval architecture students and staff held a get-together on Thursday 15 March. This was to enable the students in early years to meet and get to know the final-year and post-graduate students and the staff on a social level, and to discuss the program and matters of mutual interest. Pizza, chicken, beers and soft-drink were provided and, after a slow start, conversation was flowing pretty freely an hour later! This year we have eleven students in the third year and ten in fourth year (with two expecting to complete in mid-year), many of whom attended. Two post-graduate students came along as well as the three full-time staff. A broad mix, and some wide-ranging discussions ensued.

Graduation

At the graduation ceremony on 22 March, the following graduated with degrees in naval architecture:

Hasan Farazi	H2/1
Andrew Joyce	H1
Regina Lee	H1
Joanna Mycroft	H1 and UM
Hiroki Sunayama	

H1	Honours Class 1
H2/1	Honours Class 2 Division 1
UM	University Medal

A further few students have only their industrial training report or one course to complete and should graduate in May or October.

Joanna Mycroft's University Medal deserves special mention. The medal is awarded for an average mark for all subjects in all years of the degree course (weighted more heavily towards the later years) of 85% or more. To put this in perspective, of our 300 graduates in naval architecture, fifty-two have been awarded Honours Class 1, and just eight have been awarded the University Medal: Joanna Mycroft (2007), Craig Singleton (2006), Tony Sammel (2004), Nigel Lynch (2002), Michael Andrewartha (2000), Steve Davies (1980), Brian Morley (1974) and Phil Helmore (1970).

Hasan Farazi, Andrew Joyce, Joanna Mycroft, Regina Lee and Hiroki Sunayama at UNSW Graduation Ceremony on 22 March
(Photo courtesy Joanna Mycroft)

Prize-giving Ceremony

At the prize-giving ceremony on the same day, the following prizes were awarded in naval architecture:

The Baird Publications Prize 1 for the best performance in Ship Hydromechanics A to Rowan Curtis.

The Baird Publications Prize 2 for the best performance in Ship Structures 1 to Rowan Curtis.

The Royal Institution of Naval Architects (Australian Division) Prize and medal for the best ship design project by a student in the final year to Joanna Mycroft for her design of a 20 m composite cruising/racing yacht for a Port Douglas owner for voyages to Australian and international destinations.

The David Carment Memorial Prize and Medal for the best overall performance by a student in the final year to Joanna Mycroft.

The Computer-based Engineering Design Prize for the best undergraduate thesis making a contribution to computer-based engineering design in the School to Joanna Mycroft for her thesis on *Structural Analysis of a J/24 Rudder*.

Congratulations to all on their fine performances.

Graduates Employed

Our 2007 graduates are now employed as follows:

Hasan Farazi	Det Norske Veritas, Singapore
Andrew Joyce	Bain and Co., Melbourne
Regina Lee	Diploma of Education program, Bond University, Gold Coast
Joanna Mycroft	World tour
Hiroki Sunayama	Austal Image, Fremantle

Joanna Mycroft receiving the Royal Institution of Naval Architects (Australian Division) Prize from Phil Helmore
(Photo courtesy John Barron)

Thesis Projects

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

Parametric Rolling

Mate Ostojic is carrying out an investigation of parametric rolling of merchant vessels.

Air Lubrication

Kris Rettke is carrying out an investigation of air lubrication for ships. Apart from an extensive literature search, Kris is re-activating the two-phase flow rig in the Hydraulics Laboratory for some experimental work, and will be backing this up with CFD calculations.

Resistance Analysis

Following on from Felix Scott's (2004) project on round-bilge catamaran hullforms, Daniel Wong is investigating the resistance of a systematic series of hard-chine catamaran hullforms. A good parent hullform has been obtained, from which the series will be generated, the resistance run in Lawry Doctors' program *Hydros*, and a regression analysis made on the results.

Post-graduate and Other News

Engineering Alumni Dinner

The Faculty of Engineering Alumni Anniversary Dinner for 2007 will be held at 1900 on Friday 14 September 2007 for the graduates of 1957, 1967, 1977, 1987 and 1997 (the year in which you received your testamur). So, if you graduated with Paul O'Connor or Jacqui Rovere (1997), David Lyons or Chris Norman (1987), Alan Main or Keir Malpas (1977) or David Hill, John Jeremy or Conan Wu (1967), then you should be dusting off the tux, polishing your shoes and asking your partner to keep the evening of 14 September free. The dinner will be at the Roundhouse on the UNSW Kensington campus at 7.00 pm for 7.30 pm. The cost will be $75 per person.

Phil Helmore

IWWWFB Conference

The twenty-second International Workshop on Water Waves and Floating Bodies took place in Plitvice, Croatia, on 15–18 April 2007. A total of 52 papers was presented at the 22IWWWFB on all topics associated with water waves, with most of the papers devoted to the matter of wave impact on floating structures. However, some of the papers dealt with waves generated by ships and the influence of waves upon ships.

There were just two Australian contributions to the meeting: Professor Lawrence Doctors from UNSW discussed his research on the topic *A Test of Linearity in the Generation of Ship Waves*. In this paper, Lawry dealt with the prediction of the waves generated by a catamaran in water of finite depth. Different demihull separations were also studied. The theoretical model included the effect of the hollow behind the transom stern. The effect of this is to increase the virtual hydrodynamic length of the vessel and it is particularly significant in the low-speed range. The tests involved three catamaran models possessing differing demihull beams. The tests and the theory are in close harmony with each other. The research indicates that the wave height is almost perfectly proportional to the vessel demihull beam.

The other Australian paper was written by Dr Fabrizio Pistani and Associate Professor Krish Thiagarajan from the University of Western Australia. The topic of their work was *Experimental Campaign on a Moored FPSO in Complex Bi-directional Sea States*. The subject of this research was a floating production storage offloading (FPSO) structure. In this case, the structure had a ship-like form and was tested in a model basin in seas consisting of two wave components from different directions. This situation relates to a real-life case in which storm(s) and/or wind provide sources of two independent wave systems which impinge on the floating structure. The experiments were executed in the ocean basin at the Institute of Ocean Technology, National Research Council of Canada. The results for the motions from the model, such as the accelerations, can be applied to a full-scale structure by making use of the usual Froude-scaling laws.

Readers of *The Australian Naval Architect* can download the papers presented at the conference from the RINA website. Indeed, the papers from the proceedings of all twenty-two workshops have now been uploaded to this website, thus providing a most useful and beneficial tool for naval architects and ocean engineers.

The twenty-third International Workshop on Water Waves and Floating Bodies is scheduled to take place in Jeju, Korea, on 13–16 April 2008.

Lawry Doctors

Defence Cadets at Fleet Base West

Twenty Defence Maritime Systems Division cadetships were offered to those successfully selected from the 119 applications from students in the second or third years of their courses in naval architecture, engineering or science around Australia.

As part of the first phase of their training, the cadets undertook industrial experience between 15 January and 20 February 2007, five of them being allocated to Fleet Base West (FBW).

They were Clara Lee from UWA, Graham Bennet from the University of Melbourne, Matt Artis from AMC, Rowan Curtis from UNSW, and Drew Landes from AMC. Graham is studying mechanical engineering, and all the others are enrolled in naval architecture.

Clara, Graham, Matt, Rowan and Drew at Fleet Base West, with two Collins-class submarines, HMAS *Sirius* and ex-*Westralia* in the background (Photo courtesy Hugh Hyland)

Graham and Clara were placed in the Collins Systems Program Office (COLSPO), and also spent some time with the Defence Science and Technology Organisation becoming familiar with diesel exhaust gas analysis and a FLIR IR camera. Matt, Rowan and Drew were placed in the Anzac Systems Program Office (ANZSPO). Three Defence naval architects were their mentors, Nick Whyatt from the COLSPO, Rigby Gilbert from the ANZSPO, and Hugh Hyland from the Centre for Maritime Engineering (CME).

At the end of each week there was a combined meeting between the cadets and mentors to run over the previous activities and to finalise those for the week ahead.

Projects were allocated by each SPO to their respective cadets. The major facilities at FBW were inspected including the small-boats compound, magnetic-treatment facility (to minimise the magnetism on vessels), the diesel-engine training facility, and the DSTO. Also a number of visits were made to vessels (where they inspected most compartments over the course of several inspections in rather hot conditions) and industry as follows:

- HMAS *Adelaide* (frigate) in refit at FBW.
- HMAS *Anzac* (frigate) in refit at FBW.
- HMAS *Rankin* (submarine) in dock at Henderson.
- HMAS *Sirius* (replenishment vessel) at sea for one day.
- Ex-*Canberra* (frigate) to determine the pitch and roll while moored at a buoy.
- Twice to Austal Ships, firstly to inspect patrol boats and ferries under construction and, secondly, to attend the naming ceremony for two patrol boats, HMAS *Childers* and HMAS *Wollongong*.

Rowan, Clara, Graham, Matt and Drew, in the Steering Gear Compartment of a frigate (Photo courtesy Hugh Hyland)

- Tenix Shipyard, where the cadets first had to study and pass an induction, and where they saw the design office, a research vessel under construction, and two merchant vessels in dock.
- The Common User Facility at Henderson.
- Germanischer Lloyd.

Presentations given by the SPOs included stability of the Anzac frigates, and night-vision capabilities. The CME gunnery section provided some interesting insights regarding all sizes of weapons from side arms up to the 127 mm mounts.

The mentors conducted sessions on the roles of professional engineers, and continuing professional development leading to CPEng status. A visit to the FBW library gave an introduction to the various classes of warships and their capabilities around the world.

In order to experience the other, social, side of a naval base, the Wardroom was attended for one morning tea and one buffet lunch.

At the conclusion of the period, each group made a presentation which summarised their experiences.

We wish them all success with their remaining studies, and look forward to offering them worthwhile and interesting careers after graduation.

Hugh Hyland

THE INTERNET

America's Cup 2007

The America's Cup races are under way in Valencia, Spain, for Switzerland's Alinghi team to defend the title against the eleven challengers. The challengers are:

Team	Country
BMW Oracle Racing	USA
Emirates Team New Zealand	NZL
Luna Rossa Challenge	ITA
Masalzone Latino-Capitalia Team	ITA
+39 Challenge	ITA
Desafino Español 2007	ESP
Victory Challenge	SWE
Team Shosholoza	RSA
Areva Challenge	FRA
United Internet Team Germany	GER
China Team	CHN

By the time you read this, the semi-finals of the Louis Vuitton Cup (to determine the ultimate challenger) will be nearing completion, with the finals scheduled for 1–12 June, and the races for the America's Cup scheduled for 23 June–7 July.

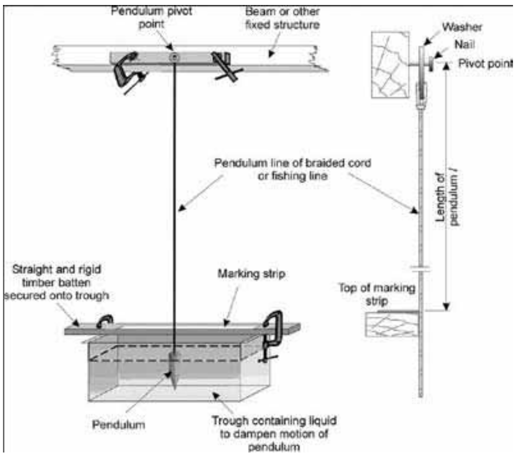
Check up on the teams, the boats, the scoring, the results, the lot, at www.americascup.com.

Phil Helmore

Revised NSCV Stability Subsection 6B Released for Comment

The National Marine Safety Committee (NMSC) released the draft National Standard for Commercial Vessels (NSCV) Part C Construction, Section 6B — Intact Stability Tests and Stability Information, for a second round of public comment on 2 April.

NMSC's CEO, Maurene Horder, explained that the document is being released for a second time due to the extent of changes made to the initial draft document following consultation with the Stability Working Group in 2006, comprising both industry and government stakeholders. "The new draft standard has been fine-tuned and incorporates some of the previous content from its accompanying draft standard NSCV Part C, Section 6A — Intact Stability Requirements for instance, information on draft marks and the presentation of stability information", Ms Horder said. The standard's updated diagrams will also clarify some of the issues raised by the stakeholder working group. For example, the diagram illustrates a typical pendulum arrangement for an inclining experiment."



Typical Pendulum Arrangement for an Inclining Experiment (Diagram courtesy NMSC)

"There is a strong emphasis on providing vessel operators with the relevant information on stability under the whole range of operating conditions. The draft standard will ensure that tests and calculations provide a true picture of the vessel's characteristics and that stability information is presented for ready reference by those responsible for maintaining the vessel's stability," she said.

To assist in this practical process, the document includes methods for establishing and verifying lightship particulars, methods for conducting simplified stability tests, and specification for the format, positioning and marking of draft marks.

NSCV Part C, Section 6B must be read in conjunction with NSCV Part B — General Requirements.

For further information, contact NMSC CEO, Maurene Horder, or Communications Officer, Rosemary Pryor, on (02) 9247 2124.

To obtain a copy of the draft standard, contact the NMSC Secretariat on (02) 9247 214, email secretariat@nmsc.gov.au, or download directly from www.nmsc.gov.au/yoursay_2.html.

The public comment period closes on 8 June 2007, so get your copy today and comment away!

NMSC Media Release, 2 April 2007

Fast Craft Safety Standard Approved

The National Standard for Commercial Vessels (NSCV) Part F, 1C, Category F2 — Fast Craft is now available for adoption by maritime safety authorities around Australia following its recent approval by the Australian Transport Council. The National Marine Safety Committee developed the Fast Craft standard in response to changing technology, the increasing use of high-speed or fast-craft passenger services and subsequent manufacture of such vessels within Australia.

A fast craft is defined as a domestic commercial vessel capable of 25 kn or more when fully laden, whilst a Category F2 fast craft is one which carries more than 12 passengers, but excluding vessels that do not exceed 35 m in length, if seagoing.

NMSC's CEO Maurene Horder said that Australia is a world leader in the design and construction of high speed ferries. "The emerging standard has already been noticed on the maritime industry's 'world stage', with articles appearing during the consultative phase in *Ferry Technology* and *Fast Ferry International* journals, and a paper presented to the high-performance craft conference held in Tasmania late last year," she said.

The new standard will apply to new vessels operating in services similar to the Manly Jetcats, Rottnest Island ferries, some of the ferries which operate on the Great Barrier Reef, large high-speed diving boats and large thrill-ride boats. Until now, standards for domestic commercial vessels in Australia have not addressed the special risks associated with craft which operate at speed.

"The new standard specifies requirements additional to the standards for conventional vessels," Ms Horder said. "These requirements vary according to key risk parameters of speed, passenger number, area of operation, size and operational characteristics. The additional requirements are based on the International Maritime Organisation's High Speed Craft Code, but modified for differences in risk associated with domestic operation."

For further information, contact NMSC CEO, Maurene Horder, or Communications Officer, Rosemary Pryor, on (02) 9247 2124.

Copies of the Fast Craft standard are available from the NMSC secretariat on (02) 9247 2124, email secretariat@nmsc.gov.au, or can be downloaded from the website www.nmsc.gov.au.

NMSC Media Release, 4 April 2007

Anchoring Systems Standard Released for Comment

The National Marine Safety Committee (NMSC) has released the draft of a new standard on anchoring systems for public comment. The new standard will form part of the

JetCat *Sir David Martin* is a Category 2 Fast Craft under the new standard
(Photo courtesy Mori Flapan)

National Standard for Commercial Vessels (NSCV). NSCV Part C, Subsection 7D — Anchoring Systems will replace the current USL Code Section 13 — Miscellaneous Equipment (Appendixes H and I only).

In the new standard, the method for the calculation of anchor mass has been simplified and the formula takes into account various types of hulls, such as catamarans and trimarans.

NMSC's CEO, Maurene Horder, said that that the scope, objective, and required outcomes are clearly defined in the draft standard and that it encourages performance-based solutions. "Anchoring systems can save lives and not just vessels — particularly when other factors may prevent a vessel from slowing or stopping in an emergency," Ms Horder said. "The requirement to carry a second anchor is based upon risk-mitigating factors, and the length of the cable is no longer based on the length of the vessel, but on the depth of the water". Ms Horder explained that a 45% reduction in mass is permitted for super-high-holding-power anchors and the use of wire rope is permitted as anchor cable for anchor masses up to 130 kg. The draft standard permits both natural-fibre ropes and synthetic ropes for heavier anchors. The testing requirements for various components of the system have also been included to ensure that the anchoring system is strong and reliable.

Public comment is now sought on the draft Anchoring Systems Standard and its accompanying Regulatory Impact Statement. Copies of both documents can be obtained by contacting the NMSC Secretariat on (02) 9247 214, email secretariat@nmsc.gov.au, or downloading directly from www.nmsc.gov.au/yoursay_2.html.

For further information, contact NMSC CEO, Maurene Horder, or Communications Officer, Rosemary Pryor, on (02) 9247 2124.

The period for public comment closes on 13 June 2007, so get your copy today and comment away!

NMSC Media Release, 16 April 2007

RIS for NSAMS Section 4 Released for Comment

The National Marine Safety Committee is responsible for the development of the National Standard for the Administration of Marine Safety (NSAMS). NSAMS Section 4 — Surveys of Vessels will replace Section 14 of the Uniform Shipping Laws Code. The draft of the new standard has been available for some time, but the Regulatory Impact Statement has only been available since early April.

Public comment is now sought on the draft Surveys of Vessels Standard and its accompanying draft Regulatory Impact Statement. Copies of both documents can be obtained by contacting the NMSC Secretariat on (02) 9247 214, email secretariat@nmsc.gov.au, or downloading directly from www.nmsc.gov.au/yoursay_2.html.

For further information, contact NMSC CEO, Maurene Horder, or Communications Officer, Rosemary Pryor, on (02) 9247 2124.

The period for public comment closes on 5 June 2007, so get your copy today and comment away!

Rosemary Pryor

Guidance on Vessel Trials

The National Marine Safety Committee is considering preparing a Guidance Circular or a new section of the National Standard for Administration of Marine Safety for the conduct of sea trials for new vessels. Trials are currently conducted on new and newly-modified vessels to ensure that the essential safety systems function as intended and that the vessel as a whole can achieve the safety outcomes required by the vessel standards.

Sea trials can impact on the liability of marine administrations and the training of marine surveyors (or the alternative use of deck-command-qualified crew during trials). Such concerns have arisen during the development of rules for High Speed Craft, namely NSCV Part F, Sub-part 1C, Category F2 Fast Craft.

Technical Advisory Panel

The National Marine Safety Committee has received over 50 eminently-suitable nominations for its Technical Advisory Panel which is being established to assist with the technical interpretation of all new and revised national marine standards for both commercial and recreational vessels. Successful nominees will be called upon according to the subject matter under review from time to time.

Construction and Stability Workshops Success

A national audience of more than 150 attended a series of workshops on *Construction* and *Stability Standards,* covering the draft revisions of NSCV Part C3 — Construction, and NSCV Part 6A — Intact Stability in February. The workshops (held in Brisbane, Cairns, Sydney, Hobart, Melbourne and Perth) helped to elicit comment on the drafts before the public comment period closed on 28 February.

The stability workshop provided invaluable feedback on the draft stability standard on a wide range of issues including the stability of barges, tankers, trawlers, rigid inflatable boats and the consistency of wind pressure assumed across criteria.

The draft standard on construction, which effectively references the use of Lloyd's Register class rules as well as a number of other standards, was generally well received.

Concerns expressed mostly related to:

- definitions of "robust" and "light" operations;
- training which designers and surveyors will require, and
- referencing of the yet-to-be-published international standards ISO 12215.5 and ISO 12215.6.

Safety Lines, March 2007

The 21st Century Passenger Ship — *Queen Mary 2*

John Jeremy

This is an edited and updated version of the presentation given to Engineers Australia, RINA and IMarEst in Sydney on 20 February 2007.

The arrival in Sydney harbour of the Cunard liners *Queen Mary 2* and *Queen Elizabeth 2* on Tuesday 20 February 2007 evoked memories of the several visits of their famous predecessors *Queen Mary* and *Queen Elizabeth* during World War II, and prompted a full range of superlatives in the press about the visit of 'the World's largest passenger ship' and the 'biggest ship to visit Sydney Harbour'. To those of us who understand something about the size of ships, those claims and others comparing the size of the ship to so many Manly ferries or Boeing 747s became a bit tedious. Nevertheless, *Queen Mary 2* is, without question, an outstanding ship and the occasion was well worth celebrating.

Queen Mary 2
(Aker Yards photo)

Of course, many outstanding ships have visited Australia in the last 200 years or so. With Australia's remoteness from Britain and the rapid development of the Colony, it is perhaps not surprising that some of these ships were also record-breakers in their time. Brunel's iron ship *Great Britain* was completed for north Atlantic service in 1845 at the then extraordinary cost of £117 295 6s 7d. However, on her seventh voyage to New York (with 180 passengers, the largest number carried by a single ship on the transatlantic voyage until then) she ran aground in Ireland — and, whilst the ship eventually survived, her owners collapsed. After nearly a year ashore *Great Britain* was refloated and sold in December 1850 for £18 000.

Refitted by her new owners for the Australian run, *Great Britain* visited Sydney only once, arriving on the morning of 20 November 1852 when 'the shores were lined with enthusiastic crowds who cheered and hurrahed her up the harbour'. The ship was very successful on the Australian run (Melbourne was her usual antipodean port of call) making some 43 voyages before her last return to Liverpool in February 1876.

The growth in the Australian passenger trade prompted the construction of a fine vessel for the Orient Line which was specifically designed for the service. The liner *Orient* was completed in 1879 and was, apart from *Great Eastern*, the largest ship in the world at the time. She was also the first vessel to be equipped with electric light and the first in the Australian trade with refrigeration facilities.

Orient measured 5386 tons gross and was 460 feet (139.4 m) long overall with a beam of 46.3 feet (14 m). She was propelled by a compound steam engine and coal-fired boilers and could carry 3000 tons of coal, sufficient for the voyage to Australia without refuelling. Her top speed was 17 kn. Masts and sails were fitted as a backup to the steam plant and in 1898 she was fitted with a triple-expansion engine which increased her service speed from 15 kn to 16.5 kn. Passengers included 120 in first class, 130 in second class and 300 in third class.

The arrival of *Orient* drew attention to the lack of suitable docking facilities for her in Sydney. When the Fitzroy Dock at Cockatoo Island was lengthened for the last time in 1880, Mr E. O. Moriarty, Engineer in Chief of the Harbours and Rivers Branch of the NSW Public Works Department noted that the dock: 'is now long enough to take any ship in the world but one, but the depth of water on the sill is not sufficient for very large vessels such as the *Orient* and others of her class'. The construction of a larger dock was approved later that year.

Orient's last voyage to Australia was in 1909 shortly before she was sold for scrap. Her reign as the world's second largest ship was short lived, as even-larger passenger ships were built for the Australian run and, in particular, for transatlantic service. The Atlantic trade was very competitive, and seeking to compete with the Cunard Line and others, the Inman line ordered, in 1880, the liner intended to be the world's fastest ship. *City of Rome* was built in Barrow and launched on 3 July 1881. She has been described as one of the most beautiful liners ever built. Her tonnage, at 8415 tons gross, was 55% bigger than *Orient*, and she was much longer at 586 feet (177.6 m) long overall with a beam of 52 feet 3 inches (15.8 m). She was designed for 520 saloon passengers with 810 in steerage, a relatively small number for the size of the ship. Her enormous machinery was largely responsible for this — she was propelled by three tandem compound engines with a height of 47 feet 8 inches (14.4 m). The engines consisted of three 43 inch (1.1 m) diameter high pressure and three 86 inch (2.2 m) diameter low pressure cylinders with a common 6 foot (1.8 m) stroke developing 11 890 IHP (8866 kW) on steam at 90 psi (620 kPa). Her four-bladed 24 foot (7.3 m) diameter propeller was designed to give her a speed of 18 kn.

She was beautifully fitted out but as the world's fastest ship she was a spectacular failure. Built of iron rather than the intended steel to save time, her displacement was much higher than designed and the boilers could never develop the designed power. Her best top speed was only 12.75 kn. She was provisionally accepted by the Inman line but, after five voyages, she was returned to her builders. After extensive modification she was finally operated successfully by the Anchor Line.

City of Rome never came to Australia but she has a link with our maritime heritage. As the longest ship then in service in the world, she was used as a benchmark for the design of the new Sutherland Dock on Cockatoo Island.

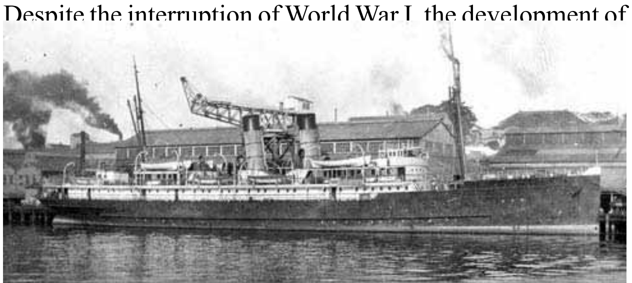
The design of passenger ships and their machinery developed rapidly during the last two decades of the nineteenth century. Atlantic competition ensured larger and ever-faster ships. Completed in 1893, Cunard's magnificent *Campania* was 622 feet (188.5 m) long overall, had a gross tonnage of 12 500 tons and a speed of nearly 22 kn. The ambition to cross the Atlantic in less than five days was, however, still to be achieved, and it was not until Charles Parsons developed his marine steam turbine that it became possible. As new technology, the elegantly-simple marine steam turbine was adopted with remarkable speed after *Turbinia's* startling demonstration of speed at the 1897 International Naval Review at Spithead.

Conceived in 1901 and completed in 1907, the Cunard liners *Lusitania* and *Mauretania* introduced the steam turbine to the north Atlantic with spectacular results. Elegant ships, they were some 790 feet (239.4 m) long and 88 feet (26.7 m) in beam. Gross tonnage was about 31 550 tons but the displacement was about 44 000 tons — a huge proportion of the ship was occupied by the machinery and coal necessary to achieve the desired speeds.

Lusitania and *Mauretania* has a designed speed of 25 kn and were propelled by direct-drive Parsons turbines of 76 000 shp (56.7 MW) driving four propellers. *Mauretania* was to hold the Blue Riband of the Atlantic for twenty years.

In the later years of her long life, *Mauretania* became one of the world's early cruise ships, operating out of New York and visiting Bermuda or Nassau with American passengers thirsty for easy drinking in the age of prohibition. She never came to Australia, but the first ocean-going merchant ship to be powered by the new steam turbine certainly did. Designed for Bass Strait service, *Loongana* was built in Scotland and completed in August 1904 for the Union Steamship Company of New Zealand. She was propelled by Parson's direct-drive reaction turbines on three shafts and achieved 19.76 knots on trials at 6384 shp (4760 kW). She remained in service for 32 years. Even before *Loongana* was completed, the Union company ordered another turbine powered ship, *Maheno*, the remains of which can still be seen on Fraser Island today.

Despite the interruption of World War I, the development of



Loongana, the first ocean-going merchant ship powered by steam turbines, saw many years service in Australian Waters
(Photo John Jeremy Collection)

the passenger liner continued, until the Depression forced many of the older grand liners out of service. However the inter-company and international rivalry continued throughout the twenties and thirties, resulting in the construction of several grand ocean liners which remain amongst the greatest passenger ships ever built. No description of the magnificent *Queen Mary 2* would be complete without the background of three great ships — *Normandie*, *Queen Mary* and *Queen Elizabeth*.

Of the three, *Queen Mary* and *Queen Elizabeth* were the most conventional, being evolutionary rather than revolutionary in design. They were designed to provide a weekly five-day crossing of the Atlantic, both ways. To do this they needed an average speed of 28.5 kn and, to ensure commercial viability, early design work, which was begun in 1926, suggested a gross tonnage of about 80 000 and an overall length of 1000 feet (303 m), although the choice of length was somewhat arbitrary. Ships of this size would require new dry docks and berthing facilities which presented a problem that needed to be resolved before Cunard could place an order for the first ship. After long negotiations, the Southern Railway Company, owners of Southampton Docks, agreed to build the King George V graving dock to accommodate the ship. The order was finally placed with John Brown & Co. on 1 December 1930. As the Depression took hold, construction was suspended for a time, but the ship was finally named *Queen Mary* and launched on 26 September 1934. She was completed in May 1936 and soon regained the Blue Riband for Britain and set a further record in 1938 with a crossing at an average speed of 31.69 kn.

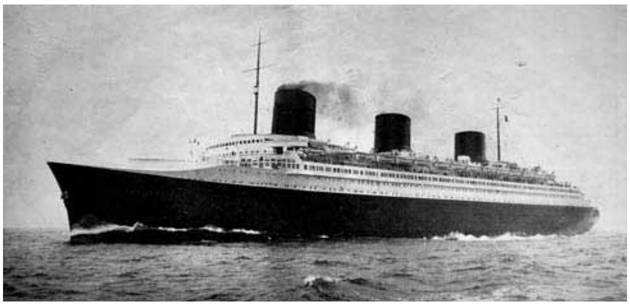
As built, *Queen Mary* measured 81,237 tons gross and was 1019 feet 6 inches (308.9 m) long overall with a beam of 118 feet (35.75 m). Her draught was 38 feet 10.5 inches (11.8 m) — worth noting in view of her later visits to Sydney where the entrance channel was dredged to a minimum of 40 feet (12.2 m). She carried 1358 passengers (704 in first class, 751 in cabin class and 583 in tourist class) and had a crew of 1285. She was powered by four sets of single-reduction geared turbines developing 160 000 shp (119.3 MW) and driving four 18 feet (5.45 m) diameter propellers. Steam was supplied by twenty-four water tube boilers burning oil fuel in four boiler rooms supplying steam at 400 psi (2758 kPa) and 700° F (371° C). Fuel capacity was 8630 tons and she consumed some 1020 tons every 24 hours at her cruising speed of 28.5 kn. All this machinery occupied a remarkably large proportion of the ship.

The second ship, *Queen Elizabeth*, was of rather more advanced design with 12 boilers instead of 24, a flush deckline and cleaner appearance. Construction began in 1936 and she was launched on 27 September 1938 with her maiden voyage planned for 24 April 1940. Of course, the war intervened and on 26 February 1940, still incomplete, she began her famous escape voyage across the Atlantic to join her laid-up sister *Queen Mary* in New York.

The most interesting of these three great ships, particularly as a comparison to *Queen Mary 2*, is the magnificent *Normandie*. Construction was begun for the Compagnie Generale Transatlantique (the French Line) in St Nazaire in January 1931. She was launched before an enormous crowd on 29 October 1932 — an impressive performance considering the size of the ship — and was completed in May 1935. She was a little larger in dimensions than *Queen Mary* but with a smaller gross tonnage of 79 280. To restore her position as the world's largest ship, an enclosed tourist lounge was soon added on the boat deck increasing her gross tonnage to 83 423. She was 1029 feet (311.8 m) long overall and had a beam of 119 feet 5 inches (36.2 m). Her draught at a displacement of about 71 300 tons was 37 feet (11.2 m).

She could carry 1972 passengers and had a crew of 1345.

Normandie was a very graceful design with a bulbous bow. She was beautifully fitted out, with no expense spared to create an art-deco show piece of French design and industry. Her magnificent first-class dining room, for example, was 305 feet (92.4 m) long, 46 feet (13.9 m) wide and 28 feet (8.5 m — or three decks) high, the largest room in any ship. It could seat 700 at one time at 150 tables. The room was panelled entirely with cast glass tiles and vertical strips of hammered glass. Lighting was partly provided by twelve tall internally-lit decorative glass pillars by Lalique. It must have been a stunning sight.



Normandie
(Shipbuilder & Marine Engine Builder, June 1935)

Perhaps the most interesting feature of *Normandie* was her propulsion plant. In keeping with the French Line practice of ensuring 'smooth, silent-running vibrationless propelling machinery', steam-turbine electric propulsion was selected. At the time it was suggested that the design of reduction gears had not advanced sufficiently far to ensure a lack of noise and vibration.

Normandie was fitted with four three-bladed propellers driven by three-phase synchronous motors capable of developing a maximum 40 000 shp (29 MW) per shaft at 243 rpm, for a total power of 160 000 shp (119.3 MW). At cruising speed the power was 32 500 shp (24.2 MW) per shaft at 225 rpm. Each propulsion motor was supplied by an Alsthom turbo alternator supplied with steam from 29 water-tube boilers at 335 psi (2310 kPa) at 617° F (325° C). Each alternator generated a maximum of 6 kV at 81 Hz at 2430 rpm. The speed reduction ratio between the turbo alternator and the propulsion motor was fixed and equivalent to 10: 1. The frequency of the power supplied to the motors could vary between 0 and 81 Hz at up to 6 kV, although the voltage at cruising speed was 5.5 kV. The speed of the propellers, and hence the ship, was varied by varying the speed of the alternator turbines. Reversing was by means of throw-over switches with a capacity of 3600 A at 5.5 kV.

Auxiliary power was provided by six turbo-generators each rated at 2200 kW (a total of 13.2 MW) with distribution at 220 V DC.

Despite claimed advantages in machinery layout as a result of the choice of turbo-electric propulsion, the machinery in *Normandie* still occupied an enormous proportion of the volume of the ship.

Normandie took the Blue Riband from the Italian liner *Rex* on her first crossing but was soon to loose the honour to *Queen Mary*. She vibrated badly in service and her three-bladed propellers were replaced by four-bladed propellers to reduce the vibration.

Normandie was laid up in New York after the outbreak of World War II and was seized by the United States after the fall of France. During conversion to serve as the troopship USS *Lafayette,* she caught fire and ultimately capsized at her berth on 10 February 1942. It was the removal of some pillars which had been installed in an attempt to cure her chronic vibration problems which resulted in the fire. It was a tragic and needless loss and the ship was finally broken up in 1946.

Meanwhile *Queen Mary* left New York in March 1940 for Sydney. She was converted into a troopship to carry 5000 men in April 1940 in fourteen days while moored in Athol Bight in Sydney Harbour. *Queen Elizabeth* followed her to Sydney via Singapore for docking. Her conversion was also quickly completed in Sydney. Both ships gave marvellous service as transports during the war. *Queen Elizabeth* finally entered commercial service on 16 October 1946, with *Queen Mary* following on 31 July 1947. At last Cunard had the five-day each-week transatlantic service envisaged so many years before.

Other magnificent liners joined them on the Atlantic including, in 1952, the United States Line's *United States*, the fastest liner ever built, and in 1961 the French Line's beautiful *France*, also built in St Nazaire. The early years after the war were very profitable on the North Atlantic, but the advent of cheap and readily-available air travel soon reduced the number of passengers prepared to spend five days at sea when the crossing could be achieved in hours.

Queen Elizabeth departing New York in November 1967,
near the end of her life
(Photo John Jeremy)

Nevertheless, when the replacement of *Queen Mary* was first considered, it was to be by another North Atlantic ferry. Q3, as she was known, was abandoned as losses with the older ships mounted and a new smaller design, Q4, was developed which could spend part of the year cruising and would be capable of transiting the Panama Canal. Construction of this ship was seen as essential if Cunard was to survive and, with the aid of a substantial government loan, she was ordered from John Brown on the Clyde in December 1964.

Construction of the new ship took longer and cost more than anticipated, and she ultimately replaced both *Queen Mary* and *Queen Elizabeth* on the Atlantic run. *Queen Mary* was taken out of service in September 1967 and *Queen Elizabeth* in 1968. Q4 was named *Queen Elizabeth 2* by the Queen and launched on 20 September 1967.

Queen Elizabeth 2 entering the waters of the Clyde
on 20 September 1967
(Photo John Jeremy)

QE2 was built with steam turbine machinery of 110 000 shp (82 MW) for a speed of over 30 kn. With a steel hull and aluminium superstructure she could carry over 2000 passengers in two classes on the five-day Atlantic crossing at 28.5 kn. 294 m long with a beam of 32 m and a draft of 10 m she measured about 65 863 gross tons. Her completion was delayed by problems with the steam turbines and she was not delivered until May 1969.

QE2, who has been a regular visitor to Sydney on her world cruises, has become a very successful ship in her dual roles of liner and cruise ship. Like her illustrious predecessors, she has also been a troopship, during the Falklands War of 1982. She has been modified many times since construction, increasing her gross tonnage to 70 327. Her owners claim to have spent fifteen times her original construction cost on modernisation refits. The most radical change was the replacement of her steam machinery with diesel-electric propulsion in a $250 million refit in 1987. The new power plant delivers 88 MW and reduced the fuel consumption from around 500 t per day to some 350 t per day. She now has a maximum speed of 32.5 kn but operated a six-day trans-Atlantic schedule at a service speed of 25 kn until 2003. She is now a full-time cruise ship.

Queen Elizabeth 2 during one of her regular visits to Sydney
(Photo John Jeremy)

QE2 is undoubtedly one of the best-known passenger ships in the world. She has completed 795 Atlantic crossings and 24 world cruises, steaming more than 5.3 million n miles and has carried nearly three million passengers. Apparently she can also steam *astern* at 19 kn, one of the interesting statistics revealed in Cunard's publicity material, no doubt with the rudder locked firmly amidships! After some changes in ownership after 1971, the Cunard Line became part of the Carnival Group in 1998. *QE2* was then 29 years old and Cunard had not built a passenger ship on its own account since she was completed. Carnival initiated a design study, under the name Project Queen Mary, to develop a modern design as an eventual replacement for *QE2*.

Many famous liners have ended their days cruising, including those well known to Australians, like *Canberra* and *Oriana*. The use of these ships in this way was always a compromise — they were never designed for cruising. Newer cruise ships typically have less draught to open more ports for visits and lower service speeds than the traditional liner. However, during the study period, *QE2* was frequently fully booked on her Atlantic crossings and this helped the decision that the Project Queen Mary ship should be a proper liner, capable of economic high-speed Atlantic crossings during the summer, with cruising during the winter.

The size of *QE2* had been substantially determined by the requirement to transit the Panama Canal. This also meant an aluminium superstructure for stability reasons, but many years of North Atlantic fatigue has meant high maintenance costs as the ship aged and the aluminium work-hardened and cracked. The Panama requirement was dropped, and the increased beam made possible (40 m) meant all-steel construction could be adopted, a more satisfactory start for the planned 40-year life. Port restrictions in New York and Southampton suggested a maximum length of about 350 m.

In terms of layout of passenger accommodation and public rooms, the design developed the best features of *QE2* with the maximum possible number of balcony cabins. The 'tween deck height of the public room decks was increased to 4.5 m to help recreate the grand liner style. Restaurants were moved further aft than in *QE2*, closer to the longitudinal centre of motion for comfort, a change helped by the choice of propulsion. Historical touches appear in the design — like the clear forward deck reminiscent of *Normandie* and the superstructure front adapted from the old *Queen Mary*.

Weight estimates were based on an 'all steel' *QE2*, and her hull lines were used as the basis for the new ship. Powering estimates were based on *QE2* and Carnival's extensive database from their fleet of cruise ships, leading to an estimate of 80 MW for 29.5 kn. Initial concepts were for a central controllable-pitch electrically-driven propeller with two azimuthing pods of about 20 MW each for steering. The likely loads on the highly-skewed central propeller and the risk of vibration changed the design direction to four Alstom/KaMeWa Mermaid pods of equal power, two fixed and two azimuthing. Early plans for a single rudder for high-speed straight running were later dropped when tests revealed it would increase resistance 2.2%. The hotel load of 16 MW increased the total power requirement to some 96 MW.

After a tendering process begun in June 1999, Alstom Chantiers de l'Atlantique at St Nazaire (now part of the Aker Group) was selected as the builder of *Queen Mary 2* in March 2000, and the contract was signed on 6 November that year.

QM2 is classed by Lloyd's Register and longitudinal framing was adopted throughout her structure. Whilst mild steel would have been adequate, high-tensile steel was adopted for several upper passenger decks and part of the side shell plating. Critical areas of the bottom plating are constructed of steel with high notch-toughness properties. To satisfy the requirement for a 40-year life at a utilisation of 60%, extensive fatigue analyses were carried out based on 24 years of exposure to the North Atlantic, during which the ship was expected to encounter 90 million waves. Lloyd's provided the builder with a detailed report indicating those areas prone to fatigue damage, and proposed suitable fatigue-tolerant detailed-design alternatives.

Similarly, particular care was taken with the design of the structure in way of the pods aft and areas exposed to green water, for example the upper decks forward.

The design of *QM2* was a major task in itself. Some one million manhours were required to prepare over 80 000 detailed drawings for her construction. Unlike her famous predecessor, *Queen Mary*, which had been built in the traditional frame-by-frame, plate-by-plate method used for riveted ships since the mid-nineteenth century, *QM2* was constructed from 94 partially-outfitted steel blocks, built from more than 300 000 individual components assembled into 580 separate panels. Over 1448 km of welding completed the job. The ship was assembled in the building dock at St Nazaire, initially in the shallow section of the dock with the partially-completed hull being moved aft into the deeper section when it was free of other new construction. At float-out, the completed hull displaced 52 000 t and the ship was moved to a fitting out dock adapted from an incomplete construction dock originally built in the 1970s for one-million-ton tankers.

The first steel was cut on 16 January 2002 and the official 'keel laying' in the building dock was on 4 July 2002. Float out occurred on 21 March 2003 and sea trials were carried out in September 2003. The ship was delivered in Southampton on 26 December 2003 and began her maiden voyage on 12 January 2004. It was a remarkable achievement for such a large and complex ship. The job is said to have required some 8 million manhours, but I suspect that that may not include the effort of specialist sub-contractors.

The machinery layout in *QM2* is unusual. The original design configuration was based on four 12-cylinder Wartsila 64-series medium-speed diesel engines split between two engine rooms. The uptake casings from these spaces consumed a lot of internal space and Carnival was concerned about adopting an engine with which they had no experience. Following suggestions by the builder based on their experience with two cruise ships, *Coral Princess* and *Island Princess,* built by them for P&O Princess Cruises, the machinery was reconfigured to four Wartsila 16V46C common-rail medium-speed diesel engines in a single engine room with two General Electric LM2500+ gas turbines in an engine room on Deck 12 just aft of the funnel. The arrangement also widely separated the two engine rooms providing power supply assurance in the event of problems in one engine room.

To compensate for the additional top weight high in the ship, the waterline beam was increased to 41 m with tumblehome introduced to maintain the beam of 40 m at the boat deck level.

The Wartsila diesels have a continuous output of 16.8 MW at 514 rpm and drive ABB alternators. The 25 MW LM 2500+ gas turbines drive Brush alternators and all electrical power is controlled by two ABB switchboards which are linked but in separate compartments for redundancy. Power from each is led to two of the Mermaid pods, each port and starboard. Similarly, the cooling system for the pod motors is split into port and starboard sections. The two forward pods are fixed while the two aft pods are able to turn through 360 degrees for steering. A Mermaid pod room located above each pod houses the slip rings, the steering gear (for two pods) and the ventilation system for the propulsion motor. Synchroconverters are used to supply the four synchronous propulsion motors inside the pods.

Power is generated and distributed at 11 kV 60 Hz, including throughout the accommodation where it is transformed to lower voltages where required. Shore power connections for 11 kV are provided and, during outfitting, the ship even supplied power briefly to St Nazaire!

Special precautions were taken to reduce noise from the gas turbines and the limit on the upper deck next to the funnel was set at 85 dBA.

QM2 is fitted with three bow thrusters and a dynamic positioning system which aids berthing but can also enable to ship to avoid anchoring in sensitive areas. On trials the ship proved to be very easy to manoeuvre and all pods and thrusters can be controlled by one joystick using manual or auto-heading.

Emergency power is provided by two 1500 kW diesel alternators in separate rooms with separate switchboards and there is a 15 t battery pack as a back-up for emergency lighting.

The machinery arrangement on *QM2* has been designed to be environmentally friendly, with all fuel tanks located inboard and the double bottom used mainly for ballast and other water.

Fresh water is provided by three Alfa Laval evaporators, each producing 630 t of water daily. Two units use hot water from the four diesel cooling-water system, and one uses steam from the gas turbine economisers and the waste-heat boilers on the diesel exhausts. The ship can produce about 62 t of steam per hour this way, and this steam is also used for fuel tank heating, air conditioning and for the laundry.

As would be expected in a modern ship of this size, the air-conditioning plant is large. The 122 air-handling units can supply 1800 t of treated air per hour. The ABB plant is believed to be the largest ever designed for a passenger ship. It is designed to maintain internal conditions of 24° C at 60% RH in summer and 22° C in winter with a RH of between 30 and 60%. The system has a maximum heating power of 9 MW and cooling power of 20 MW, 204 fans, 80 zone heaters, 2400 dampers and 50 000 m of ducting.

Waste handling in the ship is also complex. There are two large holding tanks to receive the effluent from the Evac vacuum toilet system (waste pipes are stainless steel) which is processed by two Rhodia membrane bio-reactor treatment plants with a total capacity of 1100 m^3 per day, which provides considerable redundancy. One plant will normally treat grey water and the other black water. The treated water is technically potable, but the water is only used for purposes like window washing and deck cleaning.

Treated grey water is used in the laundry. Sludge volume is only 1% and this is dried and incinerated in the ship's two high-temperature multi-chamber incinerators. The incinerators are used to dispose of shredded dry waste and can handle 40 m^3 per day.

Wet waste from galleys and restaurants is collected in hoppers at 20 stations throughout the ship from where it is removed by vacuum along large-diameter pipes for shredding and collection in a vacuum tank. A large diameter of piping was needed to prevent objects like whole chickens and pineapples blocking the system! There are twin lines for redundancy and water is only used for rinsing the piping. The waste is dewatered in a screw press and stored in two 5 m^3 tanks prior to being passed through steam dryers which produce dry pellets like coffee granules. Theoretically it could then be sold as fertiliser but, because of the likelihood of plastic in the waste, most will be incinerated.

The bridge of *Queen Mary 2* is equally complex, with a navigation and ship-control system supplied by Kelvin Hughes. A great contrast to the brass and teak of the bridge of her namesake, *Queen Mary*, the manoeuvring, display, communications, safety and navigation consoles incorporate flat-panel displays.

The passengers in *Queen Mary 2* are accommodated in 1310 cabins in 25 grades. They are designed around a basic cabin module 2.8 m wide, or four frame spaces. The standard cabins are 18 m^2, the largest in any British registered ship. Junior suites are 1.5 times the standard module, suites double and penthouses triple the module. 77.6% of the cabins are outside with either a balcony or window, and 955 cabins, or 72.7% have a private balcony. All feature the use of sycamore timber with detailed colour schemes varying across the grades. Duplex two-level suites have a personal gym space and a bed overlooking the stern. Four Royal suites can be combined to form one super suite of 370 m^2, including balcony.

Cabins have interactive flat-panel televisions with keyboards and email access. Computer dataports for personal laptops and dual 110/220 V sockets are provided, and refrigerators, mini-safes, direct-dial telephones, individual thermostat control and king-size beds convertible to twin beds are all standard. There are more than 3000 telephones throughout the ship connected to an automatic telephone exchange.

Public rooms and spaces in *QM2* are lavishly fitted out and deserve a presentation of their own. The most impressive space in the ship is the Britannia Restaurant which is one of the largest public rooms afloat, with seating for 1300 people on the lower level and the three tiered-mezzanine levels. It extends the full width of the ship and has a height of nearly 12 m. The ship's entrance lobby area is also large at the base of an atrium trunk which rises 17 m, or five decks. Twelve cabins overlook this space.

Statistics are impressive wherever one looks. For example, there are about 76 000 power outlets, including 27 000 lighting points in the public spaces and 25 000 lamps in passenger cabins. Lighting in the public spaces is computer controlled.

High-standard accommodation is also provided for a crew of 1292, although the normal complement will be 1238. It includes extensive mess and recreation spaces, gymnasium, library, shop, cinema and internet café.

The difference between *Queen Mary 2* and her predecessor

Queen Mary 2 approaching her berth at Fleet Base East in Sydney on 20 February 2007
(Photo John Jeremy)

Queen Mary is dramatic. That so much can be achieved in a hull which, although of nearly twice the gross tonnage, is not very much bigger in length, breadth and draught is a tribute to modern engineering and naval architecture. The traditionalists amongst us may not entirely approve of some of *QM2's* features, like the casino for example, and may find her decoration a bit over-the-top at times, but she is a truly remarkable ship. Twenty years ago, few of us could have imagined that she would ever be built.

What of the future? *QM2* will soon be joined by another high-class Cunard cruise ship, *Queen Victoria*. Somewhat smaller at 90 000 gross tons, 294 m long with a beam of 32.25 m, she was recently floated out of her building dock in Italy and will visit Sydney on 23 February 2008 during her inaugural world cruise.

The cruise ship industry has enjoyed spectacular growth in recent years, with many purpose-designed ships being built to satisfy a growing demand, particularly from the United States. Large cruise liners of this type are also becoming regular visitors to our shores.

These ships are rarely of the standard of *QM2*, in my opinion, with a style of outfit and decoration which may not be to everyone's taste; however, they satisfy a growing demand from thousands of like-minded people for a holiday in a ship rather like a Las Vegas hotel where you might have trouble detecting that you are actually at sea.

When she was completed, *Queen Mary 2* was the world's largest passenger ship. In terms of gross tons she has been overtaken by the Royal Caribbean Cruise Line's *Freedom of the Seas*, completed in April 2006. At 154 407 gross tons, she is slightly smaller in dimensions than *QM2* with a length of 338.8 m and a beam of 38.6 m. Diesel electric, she has three 14 MW electric pod drives, one fixed and two azimuthing, giving a service speed of 21.6 kn. She can accommodate a maximum of 4375 passengers with a crew of 1365. Her sister ship, *Liberty of the Seas,* was completed in May 2007.

Larger ships are to come. Royal Caribbean Cruise Lines has ordered a 220 000 gross tons cruise ship, known as Project Genesis, for delivery in late 2009. A second ship was ordered in April 2007 for delivery in August 2010. 360 m long with a beam of 47 m these ships will accommodate 8400 passengers and crew. They will also be diesel electric and powered by six Wartsila 46 common-rail diesel engines which will provide power for all propulsion, auxiliary and hotel services.

If negotiations for finance can be successfully completed, a 370 000 grt cruise ship, *Princess Kayuga*, could be in service by 2012. Designed by Aker Yards for Japanese owners, the 500 m long ship will have a capacity for 8400 passengers and 4000 crew. The ship will be powered by a 137.6 MW diesel-electric power plant, with 68 MW for propulsion. The service speed will be 20 knots.

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Freedom of the Seas approaching completion with *Liberty of the Seas* under construction in the dock astern of her (Aker Yards photo)

Wärtsilä Propulsion Systems Ordered from Vietnam

Wärtsilä Corporation is gaining an increasing volume of business from Vietnam for ship propulsion systems. The latest contract to be awarded in April by Vietnam Shipbuilding Industry Corporation (Vinashin) is for propulsion systems to be installed in five chemical tankers to be built for Iason Hellenic Shipping Co. Ltd, Greece, at the Pha Rung shipyard in Haiphong. The equipment will be delivered during 2008–2010.

Each vessel will be equipped by Wärtsilä with a five-bladed fixed-pitch propeller of 4.3 m diameter, shafting, stern-tube including seals and bearings, and an intermediate shaft bearing.

A greater scope of supply will be delivered by Wärtsilä to Vinashin for eight car carriers to be built for Ray Car Carriers Ltd, Israel. For each vessel, Wärtsilä will deliver a five-bladed Wärtsilä fixed-pitch propeller of 6.45 m diameter, together with shafting, stern-tube seals, shaft bearings and two Wärtsilä transverse thrusters with capacities of 1000 kW each. The contract for these propulsion systems was signed at the beginning of the year.

The car carriers will each have a capacity of 4900 cars and the car decks will have a total area of about 41 000 m^2. The car carriers will have an overall length of 185.6 m, a beam of 32.26 m and design draught of 8.4 m. The ships will be delivered from September 2008 onwards.

First propeller order in Vietnam

Wärtsilä's first order for fixed-pitch propellers from Vietnam was awarded in November 2006. It was for 5.6 m-diameter propellers to be fitted to a series of five Diamond 34K bulk carriers under construction at Vinashin's Pha Rung shipyard for the UK-based shipowner Graig Group. The propellers will be delivered complete with shafting and Wärtsilä's JMT Sternguard seals. Graig Group will receive the first vessel in November 2007.

"Wärtsilä had previously supplied propulsion equipment for Graig's award-winning Diamond 53 bulk carriers built elsewhere, but these are the first of a series of Wärtsilä fixed-pitch propellers contracted by a Vietnamese shipyard. Vietnam is increasingly becoming an important player in the global shipbuilding market and we are pleased that Vinashin has offered Wärtsilä this opportunity to supply our propulsion equipment to this emerging shipbuilding force," said Jaakko Eskola, Group Vice-President of Wärtsilä Ship Power Business.

Wärtsilä fixed-pitch propellers

Wärtsilä's fixed-pitch propellers are custom designed and made for each application. They vary in diameter from 1 m to 12 m and from several hundred kilogrammes to more than 100 tonnes.

Given the complex geometry of modern propellers, the casting process is monitored from start to finish, ensuring high-quality castings. Wärtsilä's patented Cunial material provides excellent casting, machining and fatigue properties with optimum efficiency and reduced noise and vibration levels. In addition, Wärtsilä offers a worldwide service network that ensures reliable and efficient support and the quickest possible solution to any propulsion problem during the full operational lifetime of the vessel.

Wärtsilä low-speed engines

Wärtsilä is also delivering low-speed main engines to Vinashin for installation in ships contracted at its shipyards. During 2006, orders were received for 6-cylinder Wärtsilä RT-flex50 common-rail low-speed engines for a series of three 56 000 dwt handymax bulk carriers to be built at the Nam Trieu shipyard for Dutch owners. In addition Vinashin ordered 6-cylinder Wärtsilä RTA62U-B low-speed engines for a series of four 1700 TEU container vessels contracted by Vietnamese owners.

Wärtsilä set up a representative office in Ho Chi Minh City in 1994 and a business licence was obtained to operate a 100% foreign-owned service company in 1998. Wärtsilä Vietnam Co. Ltd has a fully-equipped workshop for overhauling diesel engine components which enjoys complete access to the resources and support of Wärtsilä Singapore as well as the Group.

Vietnamese Engine-builder joins Wärtsilä's Licensee Family

At a ceremony in Hanoi, Vietnam, on 8 May Vietnam Shipbuilding Industry Corporation (Vinashin) and Wärtsilä Switzerland Ltd, a subsidiary of Wärtsilä Corporation, jointly signed a licence agreement for the manufacture and sale of Wärtsilä low-speed marine diesel engines in Vietnam.

The agreement was signed by Mr Pham Thanh Binh, Chairman and CEO of Vinashin and Mr Martin Wernli, President of Wärtsilä Switzerland Ltd.

"With this agreement, Vinashin is welcomed into the Wärtsilä family of licensees building Wärtsilä low-speed engines. We look forward to many years of fruitful co-operation", emphasised Mr Wernli.

The agreement grants Vinashin the right to manufacture certain types of Wärtsilä modern low-speed engines between 48 and 82 cm bore size at their works in Vietnam. The first delivery of a Wärtsilä engine is scheduled for the beginning of 2010, with production building up to a targeted annual output of 30 to 40 engines.

This licence agreement provides the growing Vietnamese shipbuilding industry with the latest technology for low-speed diesel engines including the most modern electronically-controlled common-rail technology.

Support for the manufacture of Wärtsilä low-speed engines will be provided by Wärtsilä's Switzerland company which is the group's centre-of-excellence for the design, development, research, marketing, licensing, servicing and support of Wärtsilä low-speed engines.

Prior to this licence agreement, Wärtsilä low-speed engines had already been ordered by Vinashin for import from Japan and Poland. Two 56 000 tdw bulk carriers are being built by Vinashin for Dutch owners, with each vessel being powered by a six-cylinder Wärtsilä RT-flex50 engine. They are due for delivery in 2008.

Small Craft on the Harbours in Days Gone By

Hugh Hyland

Auckland

Prior to the opening of the Auckland Harbour Bridge in May 1959, access from the north shore to the city was provided by six passenger ferries on four runs servicing five northern wharves, plus six vehicular ferries on two runs. The shortest runs were 10 minutes, and the longest 20 minutes. In 1959 there were eight double-ended passenger ferries, built between 1904 and 1925. Each had two passenger decks with a machinery deck below. They ranged in size from 100 feet to 131 feet (30.3 m to 40 m) in length, 138 to 342 gross tons, and were registered to carry 738 to 1364 passengers. Each steam ferry had a skipper, deckhand, engineer and fireman. On cold winter's mornings, schoolboys would sit on the engine room gratings on the lee side in relative comfort. When two were converted to diesel, the fireman positions were removed.

There were also seven double-ended vehicular ferries. The four steam ones were built between 1909 and 1926. They ranged from 105 feet to 138 feet (31.8 m to 41.8 m) in length, 203 to 291 gross tons, were able to carry 20 to 36 cars of that era and had a skipper, deckhand, engineer and (in all except the smallest) a fireman. A diesel boat was added in 1937 — 118 feet (35.7 m) long, 279 gross tons, with a crew of three and able to carry 33 cars. The last two diesel ferries had originally been used where the Pacific Highway crossed the Hawkesbury River in NSW before US Navy service during World War II. They started service in Auckland in 1946. They were 138 feet (41.8 m) long, 385 gross tons, could carry 48 cars, and had a skipper, deckhand and two engineers since they each had a separate diesel engine driving each of the two screws.

On the rare very rough days, only one passenger ferry could operate, *Ngoiro*, as her design was more suited to such conditions. No ferry had radar, and on the occasional thick foggy mornings, the skippers would steer by compass, at half power for a couple of minutes, and then stop the engine and blow the whistle and step out of the wheelhouse to listen for any return signals. After the harbour had been successfully crossed, the skipper would work the vessel along from one wharf to the next until the entrance to the ferry terminal was reached. Both ends of the upper and lower decks were roped off for passenger safety — on one occasion shortly before the bridge opened, one of the passenger ferries groped its way into the naval base just as a minesweeper was leaving, with a resultant collision that destroyed the stem and jammed the rudder at that end of the ferry. She remained that way for many weeks until the bridge was opened, operating as a single ended ferry.

Once the bridge opened, only the Devonport run continued with two passenger ferries plus one in reserve. Under the terms of compensation to the private ferry company, all other ferries were withdrawn. All four services to the five wharves have since been restored — and the prices of tickets doubled! After a while the two newest diesel vehicular ferries were sold to Tasmania for the 15 minute run between the mainland and Bruny Island, south of Hobart; however, one sank during the tow across the Tasman Sea. The remaining ferries were used as floating restaurants or entertainment centres for a while or were broken up. I continued to use the Devonport ferries before coming to Australia, and got to know a couple of the skippers who would invite me into the wheelhouse to steer once we were out of sight of the ferry building on the way home from school.

Sydney

In the early 1970s I worked on Cockatoo Island. We could catch the ferry from there to the city with stops at various wharves along the way, or take the dockyard workboats to some of the smaller local wharves. At the end of work each day, there were two workboats to Cove St at Balmain, so it sometimes became an unofficial race to see which boat could be the first to load and deposit her passengers on the mainland. Of course, the second boat had to wait for the mainland berth. Sometimes the boats would be racing neck and neck, but the one on the approach side was always given the right of way. At times there was some friendly bumping on the way over. There were routine boats every 30 minutes during the day and when, they had to pass through the occasional propeller wash of a submarine tied to a wharf undergoing basin trials 100 m away, it felt like the boat was being pushed sideways as fast as it was travelling forwards. The boats were usually just placed against the wharves while passengers embarked and disembarked, and they were not tied up. On one occasion a naval overseer took ill and had to be taken off the island by stretcher. When the launch arrived at Elliot Street wharf in Balmain, the person holding one end of the stretcher made it onto the wharf but, unfortunately, the other was still on the boat when it drifted out, and the patient dropped into the harbour. [*The patient survived; he swam to the wharf and walked to the ambulance, dripping wet — Ed.*]

Sydney Harbour in the early 1970s was very interesting, particularly if you were involved in trialling support craft. Speed, engine RPM and fuel-consumption trials were often carried out on the measured course between Clark Island and Vaucluse. Sometimes it was a bit difficult getting an uninterrupted run. Occasionally the mechanical trials officer insisted that we stop off at Watson Bay while the engine cooled. One day we were running trials in a 63 foot (19 m) sea-air rescue (SAR) boat, with two 630 HP (470 kW) Hall Scott petrol engines — as a precaution, we stood by with CO_2 extinguishers every time we started them! As we came around Clark Island in a clockwise direction at full speed of about 26 kn we noticed a commercial cruise boat coming the other way between us and the island, and the crew were waving. Friendly, we thought, so we waved back. Very shortly after, we saw their boat leaping over our bow wave! We guessed their drinks got spilt. On another trial with the SAR vessel, we were proceeding up harbour at full speed off Rose Bay when the flying boat from Lord Howe Island roared overhead and landed a few hundred metres in front. Apparently the safety boat, which normally kept the landing area clear when required, couldn't catch us and, being in peacetime, we weren't looking back and up.

Another interesting incident happened with one of the three

83 foot (25 m) torpedo-recovery vessels (TRVs). These small ships had three engines and an unmanned engine room. It had almost finished its refit when I took some leave. When I returned we went on trials and we noticed some smoke coming from the centre engine. The mechanical foreman concluded that this was just the adhesives in the exhaust insulation burning in but, by the time we were off Vaucluse, it had worsened and visible flames could be seen through the hatch. We returned quickly to the dockyard where the fire was extinguished. Apparently, while I had been away, the bilges had been flooded through a missing hull fitting when the boat was fuelled. All had been rectified, but the oil in the bilges had soaked the exhaust insulation of the centre engine, which was lower than the outboard engines. So, after full power for a while, the oily insulation caught fire. Fortunately the damage was not serious, and a lesson was learned. These TRVs are still in service.

Another incident with a TRV a few years later involved a Manly hydrofoil, on which a fuel line had broken, spraying diesel onto a hot engine and catching on fire. Fortunately a TRV was close by. This had a naval crew under a Warrant Officer. They pulled alongside the ferry, extinguished the fire, transferred the passengers to the TRV and took them to Circular Quay.

During the 1970s a Floodboat Advisory Committee was tasked with choosing the next additional or replacement boats to be used in flood emergencies. Members were made up from various areas with relevant expertise, including Defence (Navy), Water Police, and Harbours and Marine. They met twice a year. Every year or two, in the Georges River off the Water Police depot at Sans Souci, trials would be conducted on a range of contending boats fitted with outboard motors. One of the large police boats would take the observers, while operating at speed to create the largest possible waves. Then two intrepid water police would do everything possible to overturn each contender while turning sharply at speed through the waves. This was not without injuries. In the several years I participated, only one boat did not overturn, and this was selected for floodboat duties at that time.

NAVAL ARCHITECTS ON THE MOVE

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

Campbell Baird has moved on from prawn trawling and, after spending time on a longliner working out of Cairns and a charter vessel working out of Airlie Beach to the Whitsundays, passed his coxwain's ticket, and has returned to Melbourne to take up a position at Baird Publications before heading overseas.

Craig Boulton has moved on from Burness Corlett Three Quays Australia and is now consulting with Matt Duff as Australian Ship and Offshore in Sydney. Friends can check out their operation and services at www.asomarine.com.au

Nick Browne has moved on from BMT Defence Services (Australia) Pty Ltd and has taken up a position as an Assistant Surveyor in the Design Support Office of Lloyd's Register Asia in Sydney.

Anderson Chaplow has moved on within Lloyd's Register from the Design Systems Division in London and has taken up a position as a surveyor on new construction in Koje, Korea.

Jan de Kat has moved on from MARIN in Wageningen, The Netherlands, after eighteen years, and has taken up the position of Head of the Marine Technology Department of A.P. Moller–Maersk in Copenhagen, Denmark.

John Donovan has moved on from Det Norske Veritas in Aberdeen, Scotland, and has taken up a position with Poseidon International in Aberdeen.

Matt Duff has moved on from Burness Corlett Three Quays Australia and is now consulting with Craig Boulton as Australian Ship and Offshore in Sydney. Friends can check out their operation and services at www.asomarine.com.au

Chris Hughes has moved on from BMT Seatech in Southampton and returned to Australia, where he has taken up a position as a Naval Architect in the Design Support Office of Lloyd's Register Asia in Sydney.

Regina Lee, a recent graduate of the University of New South Wales has moved on from the NSW Maritime Authority and has enrolled in a Diploma of Education program at Bond University on the Gold Coast in Queensland.

Joanna Mycroft, a recent graduate of the University of New South Wales, has moved on from waitressing and taken a year off to go travelling. A keen yachtie and cyclist, Jo expects to schedule her globe-trotting to see the America's Cup races in Valencia, and to see the whole Tour de France up close.

Trevor Rabey moved on from Tracey, Brunstrom and Hammond some moons ago and has taken up a position as Project Manager for the Clifton Croney Group in Perth, one of the largest project-management outfits in the country. In addition, he has gone into partnership, consulting as Perfect Project, supplying project-management training courses to the industry. Friends can find out more at www.perfectproject.com.au.

Peter Randhawa has moved on from McAlpine Marine Design and has taken up a position as a naval architect with Australian Marine Technologies in Melbourne.

Ray Toman has moved on from consulting, and has taken up the position of Shipbuilding Director with the Defence Materiel Organisation on the Air Warfare Destroyer project, and commutes between Sydney and Adelaide.

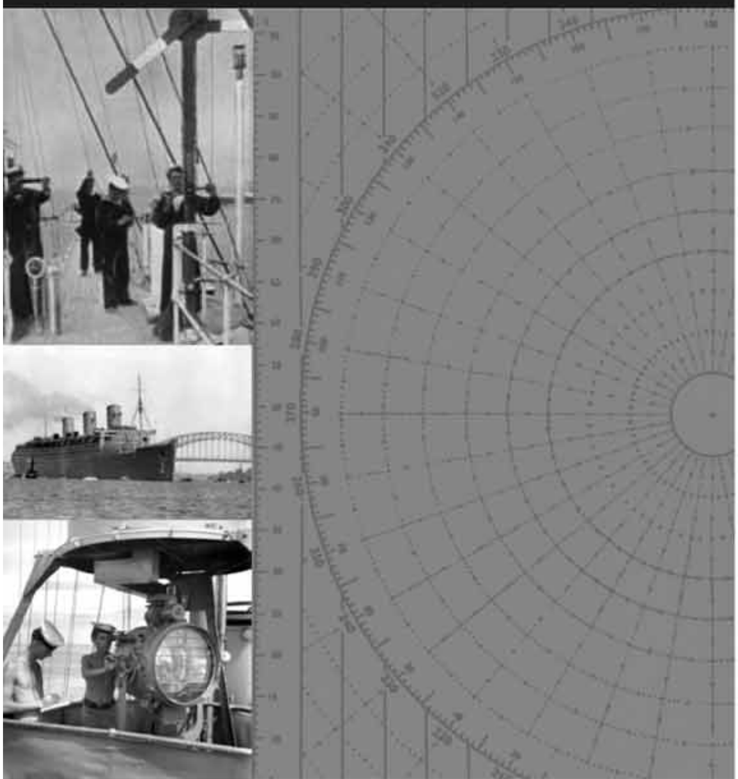
Shaun Yong has moved on from the Yantai Raffles shipyard and has taken up a position with the Maritime Production Division of Det Norske Veritas in Singapore.

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 Keith Adams when your mailing address changes to reduce the number of copies of *The Australian Naval Architect* emulating boomerangs.

Phil Helmore

Naval Networks: The Dominance of Communications in Maritime Operations

2007 King-Hall Naval History Conference



NAVAL NETWORKS: THE DOMINANCE OF COMMUNICATIONS IN MARITIME OPERATIONS

The Royal Australian Navy's Sea Power Centre - Australia, with the assistance of the School of Humanities and Social Sciences, University of New South Wales at the Australian Defence Force Academy, is hosting the fifth biennial King-Hall Naval History Conference, 24 July and 26-27 July 2007. This will be a major international conference with distinguished speakers from Australia, Canada, the United Kingdom and the United States of America. The keynote speaker will be Professor N.A.M. Rodger, author of the much acclaimed multi-volume *A Naval History of Britain*.

The conference program will address the shifting demands facing both national and combined international sea power, together with case studies of command, control, communications and intelligence taken from the ancient world through to the 21st century. The conference will offer new insights into the future face of maritime strategy, the changing nature of global connections, and the continuing nexus between communications and command at sea.

GENERAL INFORMATION

Venue:
24 July: ANZ Theatre, Australian National Maritime Museum, Darling Harbour, Sydney NSW
26-27 July: Rydges Lakeside Canberra, London Circuit, Canberra ACT

Registration:
Sydney: $100.00 per person
Canberra: $200.00 per person
(Registration includes lunch, morning tea and afternoon tea)

Proceedings:
Conference proceedings will be published and forwarded to all attendees at no cost.

Conference Dinner:
A dinner will be held on the evening of 26 July in the Anzac Hall, Australian War Memorial, Anzac Parade, Campbell, ACT.
Cost will be $90.00 per person.

CONTACT

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SEA POWER CENTRE AUSTRALIA

THE UNIVERSITY OF NEW SOUTH WALES

AUSTRALIAN DEFENCE FORCE ACADEMY

AUSTRALIAN NATIONAL MARITIME MUSEUM

NAVY

MEMBERSHIP

Meeting of the Australian Division Council

The Council of the Australian Division of RINA met on Wednesday 14 March 2007. The following matters of significance to all members, in addition to other matters, were discussed by Council:

RINA/IEAust Agreement of Cooperation

The President, Mr Rob Gehling, was pleased to advise Council that the Agreement in the form proposed by Council had been signed on behalf of Engineers Australia by two members representing EA and by the President of the Australian Division and the Chief Executive of RINA on 1 March 2007. Council appointed Dr Stuart Cannon, the incoming President of the Division and Mr Rob Gehling to the Joint Board, as provided in the Agreement. Council awaits the names of the two members appointed by EA to the Joint Board when it is expected that an early meeting will be convened to consider, in detail, the implementation of the Agreement.

Naval Architects and Complex Project Management

After considering the arrangements put in place by the Defence Materiel Organisation (DMO) it was considered that the appropriate action was to keep a watching brief on future developments from DMO. Mr Rob Gehling would write to the DMO Executive responsible for the project emphasising the ability of naval architects to act in matters of complex project management and offering the services of the Institution whenever appropriate.

Pacific 2008 International Maritime Conference

Mr Jeremy as Chairman of the Organising Committee reported that arrangements for the Conference were progressing satisfactorily. An excellent relationship had been established with the Sea Power Centre of the Royal Australian Navy and a meeting with their representatives would be held shortly. The Program Committee continues to receive offers of papers at a satisfactory level for the Conference.

Appointments to Council

In response to the call for nominations to Council, the Secretary reported that four nominations had been received by the time nominations closed. A ballot had not been necessary to fill the vacancies and Mr Peter Crosby, Mr John Jeremy, Mr Graham Taylor and Mr Tim Lyon were deemed to have been elected to Council.

The outgoing President of the Division, Mr Rob Gehling, thanked all members of Council for their support and friendship during his term of office and wished the incoming President, Dr Stuart Cannon, every success for his term of office. Mr Jeremy, on behalf of all members of the Division, expressed the thanks and gratitude of all to Mr Rob Gehling for his leadership and guidance over the past few years.

The next meeting of the Council of the Australian Division is scheduled to be held on Wednesday 13 June 2007.

Keith Adams
Secretary

FROM THE ARCHIVES

WATER BUSES FOR SYDNEY

Following two recent tragic accidents, the operation of Sydney Ferries is again the subject of inquiry. At almost any waterfront gathering in Sydney these days, talk soon turns to the Sydney ferry fleet and the most appropriate type of craft for the various routes. This debate is, of course, not new. Nor is the introduction of new types of ferries, each with the prospect, at the time, of solving the problems the service faced. In 1934 three new ferries, known as water buses, were built for harbour service. Past President of the Australian Branch, the late Cecil Boden, then a young naval architect, wrote an article describing the new ferries for The Australian Motor Boat and Yachting Monthly *of 10 July 1934:*

What's in a name? An old question with a new application.

Australia has not had much to do with high-speed water transport as yet, but the launching of the three new ferries for the Sydney Ferries Co. on Thursday 21 June marks a distinct advance in marine transport. These new ferries have been popularly described as water 'buses. The origin of the name has to do with a movement which originated in London to ease the London's ever-increasing road traffic by making use of the silver highway of the Thames.

In 1924 Sir Samuel Instone, after much expenditure of time, money, and trouble upon research, and the preparation of plans, etc., presented a scheme to the London County Council for a service of 25 entirely new twin-screw motor vessels, using 25 piers between Hammersmith and Woolwich. The scheme involved a capital expenditure of £200 000 on the part of Sir Samuel's company, and a capital expenditure of £50 000, approximately, on the part of the London County Council. The London County Council were not then persuaded to adopt the scheme.

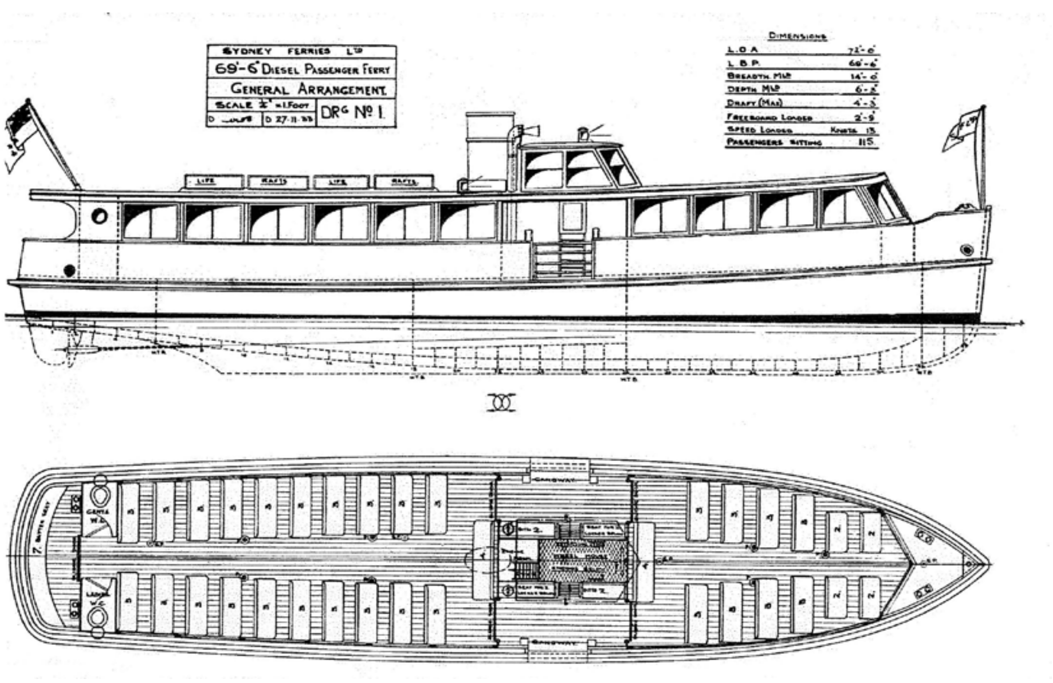
Idea Gains Ground

Five years later, in 1929, Mr A.P. Herbert, in an endeavour to move public opinion towards this excellent enterprise, wrote to *The Times*. He wrote persistently, until, at last, there followed much correspondence and considerable discussion in that great paper. The enthusiasm displayed by this writer has awakened in many a desire to see the scheme carried out. In 1932 Mr J.H.O. Bunge heard the call, and worked out a scheme of his own, which is recounted under the heading, *The 1932 Water 'Buses*, which appears in a recent publication entitled *No Boats on the River*, by Mr A.P. Herbert.

The Thames Taxi Service Ltd was also inspired by the same enthusiasm, and by 1932 their swift little craft had become a familiar sight between Chelsea and Greenwich.

Vessels for Sydney

The most interesting reverberation of this effort is the fact that we have in Sydney, now about to be completed, three vessels which are intended to perform a service similar to that planned for the Thames and which, up to a point,



The General Arrangement of Sydney's Water Buses

(From *The Power Boat & Aquatic Monthly*, February 1934)

have much in common with the type of vessel proposed overseas.

In the case of Sydney's 'water 'buses', the hulls have been built of steel by the Mort's Dock and Engineering Co. Ltd, which firm will complete the outfit and accommodation.

Three vessels — *Pelican*, *Swan*, and *Crane* — have been launched in a period of 24 weeks.

Though the word 'launched' is used, this is not strictly true, for the unusual method was adopted of lifting the boats bodily from the stocks and lowering them into the water by means of a large crane. When these vessels are completed, which it is expected will be within a month, it is hoped to obtain with them a speed of between 13 to 15 kn, according to the loading.

Gleniffer Engines

The motor power that has been adopted consists of two 8-cylinder, 160 hp (119 kW) Gleniffer Diesel engines of the DC series. These engines have been built by Gleniffer Engines Ltd. at Anniesland, Glasgow, under the special survey of the Board of Trade. They are designed to develop their maximum horse-power at 900 rpm and possess certain distinctive features. Among these might be mentioned the special air-starting motor, which up to very recently was unique to the Gleniffer Diesel engine. This separate air motor is geared to the main flywheel, and has proved so successful as a starting mechanism that other companies are now making it under license from Gleniffer Engines Ltd and incorporating it with their own type of engine.

Reserve Power

For a ferry service in which starting and stopping is frequent, this motor will prove its efficiency in that it is most economical in its use of air in each manoeuvre. In their desire to provide the travelling public with transport which can be relied upon under the varying demands of traffic, the Sydney Ferries are to be congratulated in asking for the Board of Trade to carry out special overload tests, and it is interesting to know that these engines have been certified to maintain a 10% overload for four hours, 15% overload for two hours, and 20% overload for 10 minutes. The question of weight is an important feature in vessels designed to travel at high speed, and in this instance it is believed that the total weight loaded will be approximately 47 tons, and consequently it was important that the engines should be as light as practicable. The total weight of each engine and reversing gear is 3 tons.

Simplicity of Control

In the present ferry service, control is in the hands of a master and an engineer. Orders are communicated by means of a telegraph system. In the water 'buses control will be entirely in the hands of the master, who will be able to start and stop the engines, as well as manoeuvre the vessel, from the steering position, which is placed above the awning deck.

Pelican in service

(Photo Graeme Andrews collection)

The new ferries, actually named Pelican*,* Crane II *and* Swan III*, had only a brief career. The machinery gave problems and their wake caused damage around the bays and rivers. They were used occasionally during World War II and for a few years thereafter. They were all laid up by the early 1950s.*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