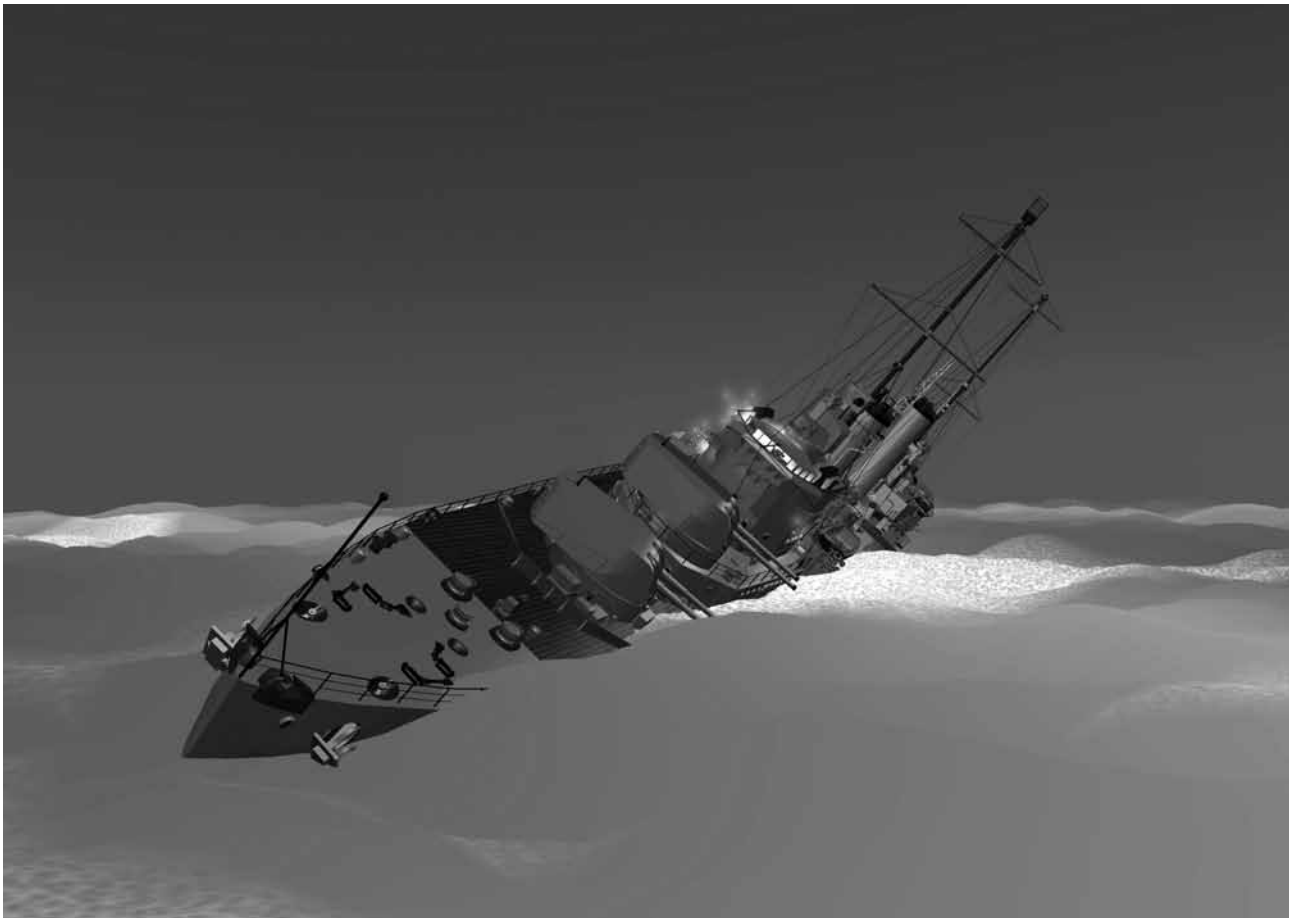
THE AUSTRALIAN NAVAL ARCHITECT



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February 2009

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THE AUSTRALIAN NAVAL ARCHITECT

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

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Cover Photo:

A visualisation of HMAS *Sydney* on the evening of 19 November 1941 shortly before she sank after her battle with the German raider HSK *Kormoran* off the coast of Western Australia (Image courtesy DSTO)

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From the Division President

The February edition of *The Australian Naval Architect* is the first of the New Year and it has become usual to use this column as the President's report for the Division's annual general meeting which will be held in Sydney on 4 March.

There has been a large number of highlights in the year 2008 and I would like to start my report by reflecting on some of these activities. An 'even' year always starts with the Pacific International Maritime Conference and Exhibition. Much of the ground work is carried out in the 'odd' years to ensure the success of this event and this should not be forgotten. A significant amount of effort is also required during the event itself. Members of the Australian Division donated many hours to ensure that visitors could access our members when visiting the stand at the exhibition. In particular, I would like to thank Sam Tait, Aminur Rashid, Linsday Emmett, Peter Crosby, Craig Boulton, Adrian Broadbent and Graham Taylor for the valuable time they donated during this event. A number of new members resulted from their efforts. John Jeremy was presented with a Certificate of Appreciation by Trevor Blakeley at the Pacific 2008 IMC cocktail party. Although this certificate was not just awarded for his contribution during this year, it certainly was a highlight for me to be able to provide John with formal recognition of his dedication to the Australian Division over many years and, hopefully, many more to come. Overall the Pacific 2008 event was a great success and I certainly look forward to many more.

The second achievement for the year was the formation of the South Australia and Northern Territory Section, which now means that every member residing within Australia can be associated with a local section. My thanks go to Peter Crosby, Rubin Spyker and their team from Adelaide for putting in the ground work to form the section. The number of members in this region is certainly likely to grow as the Hobart-class ships start to be built, and it is extremely important that we have a presence.

The third notable achievement for the Division was the work which a number of members gave to support the HMAS *Sydney II* Commission of Inquiry. In May the COI commissioned both DSTO and the Australian Division of RINA as experts to provide technical evidence on the loss of HMAS *Sydney* and HSK *Kormoran*. Although the DSTO and RINA evidence was not presented until January 2009, a tremendous effort was sustained during 2008 to ensure that our findings were presented on time. This involved the identification and retrieval of relevant documents from the archives, reviewing the photographic and video evidence from the wreck sites and, finally, presenting our findings in a detailed technical report. Those of us involved worked many hours long into the night to ensure that the findings represented our best advice. In particular, I would like to thank John Jeremy and Tim Lyon for their assistance. The team from DSTO also needs to be thanked, as they also put many hours in, over and above their required work hours. They include Michael Buckland, Grant Gamble, Pat McCarthy, Brett Morris, Roger Neill, Michael Skeen, Brigitta Suendermann and Terry Turner. Both Brett and Terry are RINA members and their efforts for the Division are much appreciated. The outcome certainly provided a lot of publicity for RINA and has ensured that records can be put straight about the final moments of HMAS *Sydney*.

Turning now to the management of the Division, four Council meetings were held during 2008. The first of these, just prior to the AGM, was hosted by the ACT Section and we must thanks the Directorate of Naval Platform Systems for providing the room for the meeting as well as hosting the AGM. My thanks go to Keith Adams for his continual support of the Division and ensuring that all our Council paperwork and records are kept in place. The Division Council members also needs to be thanked for their time and enthusiasm in keeping the Division active. I will not list all of their names as these can be found on the RINA web pages. However, I would like to acknowledge Werner Bundschuh for his support over the last few years. Werner will be ineligible for re-election at the AGM and so has completed his last full year as a member of council. Ruben Spyker was elected to represent the South Australian and Northern Territory Section and we have certainly welcomed his input. Finally, Allan Soars has continued to ensure that all our finances are in place and I would like to thank him for his tireless work.

There has been a number of issues to be dealt with over the year and many members of Council have spent a large amount time resolving them. In particular, Graham Taylor spent a vast amount of time communicating with Engineers Australia to ensure that RINA technical presentations are marketed by them and that we are treated as equivalent to one of their technical sections. Sam Tait took on some extra work to ensure that there was a market for the Basic Dry Dock Training course. Although the course was run from London, Sam identified the numbers and location to ensure that Australian members could benefit from a locally-run course.

Several members of Council and of the Australian Division represent RINA on various local committees and it is important to thank them all. They include Rob Gehling as Chair of the Joint Board of RINA and EA, David Gosling, who represents RINA on the Standards Australia Small Pleasure Craft Committee, and Ian Laverock, who agreed to chair a sub-committee of Martin Renilson and Craig Boulton with the object of reviewing the proposals for a unified system for vessel safety. Kim Klaka and members of the WA Section have been involved in assisting RINA headquarters with the hosting of a conference to be held in Perth during January. I would like to thank them for their work during the year as well as Austal for sponsoring the conference.

John Jeremy and Keith Adams have continued with their work on the organising committee of the Pacific 2010 International Maritime Conference to be held in January next year. During the year, Laurie Prandolini retired from the organising committee, on which he represented IMarEST, and as Chair of the Program Committee after many years' service. Laurie was awarded the Medal of the Order of Australia in the 2008 Queen's Birthday Honours in recognition of his long contribution to the management of professional organisations. His place as representative of IMarEST has been taken by Tauhid Rahman, and Adrian Broadbent has taken over as Chair of the Program Committee.

I must also thank all the members who have provided input to *The Australian Naval Architect* during the year. The journal has continued to be an authoritative source on maritime activities in Australia. I would like to thank everybody who

has contributed in some way and in particular John Jeremy and Phil Helmore for pulling everything together — including editing my words! I would also like thank the industry which provides important sponsorship for *The ANA* — we could not produce the journal without the long-term support of companies like Wärtsilä, Formation Design Systems and others.

The Australian Division has continued to support students at the University of New South Wales and the University of Tasmania (Australian Maritime College). Prizes are an important to recognise the students' excellent work. The AMC RINA Australian Division prize awarded in 2007 went to Tristan Andrewartha and he later went on to win the RINA Wakeham prize in 2008 for the best publication written by a member under the age of 30. Austal Ships have also continued their support for the RINA/Austal prizes and we are indebted to them for this.

In my role as president of the Division I attend the RINA Council meetings in London. These usually occur in the early hours of the morning via telephone link. John Jeremy and Bryan Chapman also attend these meetings in their own right and they ensure that our views are presented. My thanks go to both these members and, in particular, to the support from Bryan who will be ineligible for re-election after the RINA AGM.

Finally, I would like to say thank you to all the members, whether on Council or not, who have supported me as President over the last year. I have enjoyed working with you all and I'm particularly pleased that you have shown confidence in me by nominating me to continue as P resident for a second term. I therefore look forward to working with you all again in 2009.

Stuart Cannon

Editorial

If we were to judge the future from the newspapers in recent times, then we are all doomed. First it was global warming and climate change and then the global financial crisis. The tragic bushfires in Victoria added to the sense of horror and wonder where everything is going.

I won't attempt to suggest where climate change is going, but financial crises and bushfires pass in time. They do, unfortunately, have a habit of recurring but, even in recessions, life goes on and business continues even if at a reduced pace. The 'recession we had to have' in the 1990s passed and so will the present downturn (the recession we are determined 'not to have'). Its extent and global nature may make it worse, of course, but eventually it will become history to be forgotten like previous troubles.

Economic downturns can have uncertain outcomes and business will be hard for some and challenging for most. However these times also present many opportunities for productive and innovative businesses. We now have many of those in Australia's maritime industry.

The theme of the Pacific 2010 International Maritime Conference to be held in Sydney at the end of January next year reflects those challenges and opportunities. The call for abstracts will be issued shortly, so now is the time to get writing so that we can have another great conference focussed on the future.

John Jeremy

Letters to the Editor

Dear Sir,

It is good to read letters from Mr Martin Grimm, because they are always technically interesting and thought provoking. This particular article raises matters which are mainly related to the hydrodynamics of the motion of a vessel (without forward speed) responding to sea waves which he discussed in his second letter in *The ANA* in November 2008.

In this case, the standard slender-ship approach of Salvesen, Tuck, and Faltinsen (1970) for ship-motion analysis is particularly effective, and appears to be even more accurate than for the case of forward speed. The analysis assumes that the hydrodynamic effects of the three-dimensional ship can be approximated by simply summing the effects of each two-dimensional cross section.

These hydrodynamic effects essentially include the hydrodynamic added mass and damping, as well as the exciting forces from the incoming waves. A particularly accurate method for the two-dimensional analysis has been developed by Doctors (1988). This method can be employed for any shape of ship section and it also avoids the serious deficiency of other methods, when the wave frequency is close to a so-called "irregular frequency".

As an example of the high predictive accuracy of these theories, three figures are reproduced from the recent paper by Thomas, Doctors, Couser and Hackett (2007). The experiments and the theoretical predictions were performed on a 1.500 m catamaran model which was tested in the Model Test Basin at the Australian Maritime College (AMC). The demihulls are similar in shape to the Series 64 hull and the demihull-centreplane spacing was 0.204 of the model length.

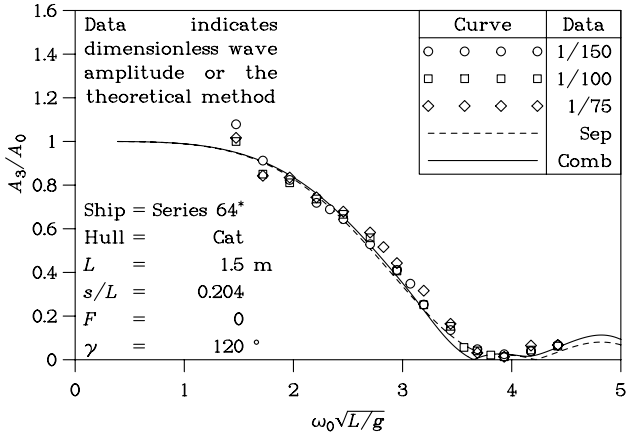
Figure 1 shows the heave response-amplitude operator RAO (ratio of heave amplitude to sea-wave amplitude, on the vertical axis), as a function of the dimensionless sea-wave frequency (on the horizontal axis). The direction of the sea waves is 120 degrees, measured from the stern of the model. Three sets of experimental data are plotted, corresponding to three different ratios of the sea-wave amplitude to the model length. The fact that the three sets of experimental data collapse together in such a consistent manner is a strong vindication of the experimental methods established by the AMC. This data collapse also demonstrates the strongly linear nature of the hydrodynamics. That is, the motion response of the vessel is linearly proportional to the wave amplitude.

Two theoretical methods are also shown, based on the theories described in the accompanying references, and implemented in computer software developed at the University of New South Wales (UNSW). The dashed line (indicated by "Sep" for separate) represents the computation assuming no hydrodynamic interaction between the two demihulls. The continuous curve (indicated by "Comb" for combined) includes these hydrodynamic interactions. It is observed that there is extremely good correlation between the theory and the experiment, particularly for the latter case.

In this example, the RAO approaches 1.000 as the wave frequency approaches zero (the hydrostatic case). The very strong influence of the frequency on the ship motion can be seen. For example, at dimensional frequencies between

3.6 and 4.2, the heave response approaches zero. This emphasizes the point that pure hydrostatic theory cannot be used at all.

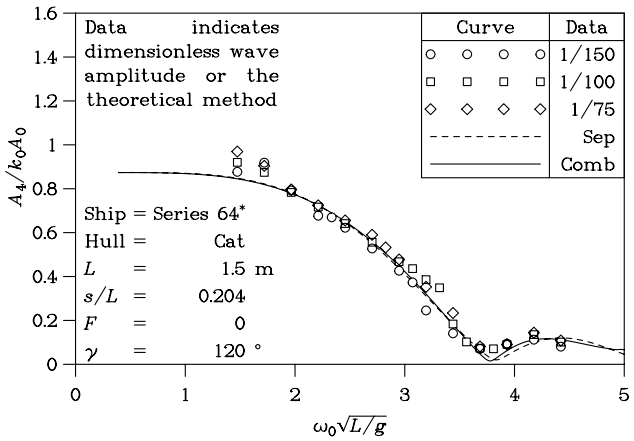
Figure 1 Heave Response of Catamaran



(Diagram courtesy Lawry Doctors)

Figure 2 shows the roll RAO, which again reinforces the necessity of considering the hydrodynamics, as well as the hydrostatics. In this case, the hydrostatic result (zero frequency) yields a roll RAO of 0.8660.

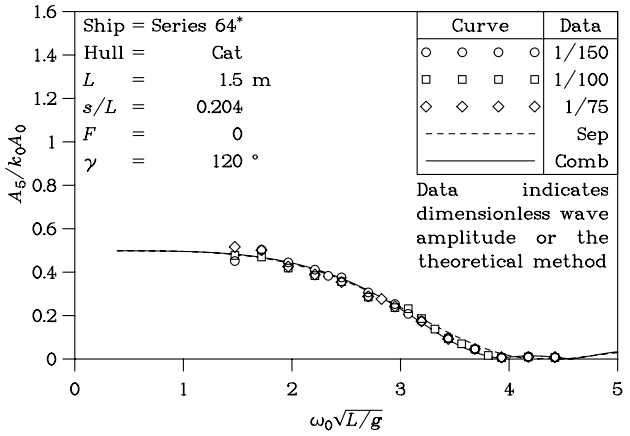
Figure 2 Roll Response of Catamaran



(Diagram courtesy Lawry Doctors)

Finally, Figure 3 presents the corresponding results for the pitch RAO. In this example, the roll RAO approaches 0.5000 at zero frequency.

Figure 3 Pitch Response of Catamaran



(Diagram courtesy Lawry Doctors)

With respect to the particular scenario of interest to Mr Grimm, the hydrodynamic analysis would be identical to that described here. However, there is the additional complication in that the "sea-wave forcing terms" on the right-hand side of the equations of motion would have to be supplemented by the forces imposed by the lifting cables. The cables themselves should, no doubt, be analysed as a continuous system. This system would be highly nonlinear because of the geometry of the cables (almost, but not exactly straight) and the nature of their extensibility. Finally, the response of the helicopter would play a major role in the analysis, particularly if one accounted for the behavior of the pilot or the autopilot, as the case may be.

The hydrodynamics of an otherwise stationary vessel responding to sea waves could also be analyzed by a three-dimensional version of the abovementioned slender-ship theory. It seems highly unlikely that any improvement in accuracy would be achieved because of various numerical difficulties related to the computer program. There is also the possibility of a complete computational fluid dynamic (CFD) analysis. In this writer's opinion, following his own experience, there might possibly be some gains in predictive accuracy, but only for some very extreme cases and at considerably increased computational expense. These extreme cases would include situations where viscous effects are significant, such as for vessels with vortex-shedding bilge keels.

It is curious that the hydrodynamic aspects of this problem are probably better understood by the maritime-engineering community than the other aspects, relating to the cables and the helicopter.

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Lawry Doctors

NEWS FROM THE SECTIONS

South Australia and Northern Territory

General

The new SA & NT Section has continued to participate in the joint technical meetings held with the SA Branch of IMarEST. The meeting schedule for this year will include several offsite technical meetings which promise to be exciting.

Membership numbers are continuing to grow as potential members see the benefit of participation in a local RINA Section.

Annual Dinner

The Section held an Annual Dinner on 28 November at the Glenelg Golf Club. The dinner was held jointly with the SA Branch of IMarEST and the local chapter of the Company of Master Mariners of Australia. The dinner was also attended by visiting international guests participating in the AWD Project, and is a regular event in the South Australian Maritime Professional Associations' calendar. There was a very good turnout, with approximately 70 guests taking part in the dinner.

Presentation on *City of Adelaide* Project

At the annual South Australian Maritime Professional Associations' dinner on 28 November, attended by members of RINA, IMarEST, and CMMA, a presentation was given by Peter Roberts MRINA on *The Clipper Ship* City of Adelaide *Project*. Peter's presentation was very well received and addressed the historical and technical aspects of the project. As well as the naval architectural and logistic considerations associated with the proposed relocation of *City of Adelaide* from Scotland to Adelaide, Peter also covered the commercial and demographic importance of *City of Adelaide* to the settlement and development of South Australia.

Peter Roberts making his presentation on the *City of Adelaide* Project at the SAMP Dinner on 28 November 2008 (Photo courtesy Ruben Spyker)

Visit by Chief Executive

Members of the Section hosted a visit to Adelaide by the Chief Executive of RINA, Trevor Blakeley. Trevor visited the Marine Survey Branch in the Department of Transport, Energy and Infrastructure, met current and potential members at ASC, and toured the Maritime Skills Centre and the AWD shipyard development.

Ruben Spyker

ACT

The ACT section has been quite active in the last quarter of 2008 with two technical meetings and an end-of-year barbeque dinner. Two technical meetings are planned for early 2009.

The first of the two presentations, *The WWI Australian Submarine AE2*, was given by Captain Ken Greig RAN (Retd), at Engineering House, Barton, ACT, was organised in conjunction with IMarEST, EA, and MESA and was attended by about 30 people fairly evenly spread across the four institutions.

In the early hours of 25 April 1915, as Allied forces, including the Australian and New Zealand Army Corps (ANZAC), prepared to invade the Gallipoli Peninsula, the Australian submarine HMAS *AE2* entered the Dardanelles on the surface. Her mission was to create a diversion to the landings by 'running amok in the narrows' and then to enter the Turkish inland Sea of Marmara to cut the supply lines of the Ottoman army. Despite fierce Turkish opposition and against all odds, *AE2* succeeded. A characteristically-Australian approach, encompassing skill, bravery, fortitude and luck, meant that she was the first of the Allied submarines to penetrate the Straits. *AE2* paved the way for a number of other Allied submarines, causing great disruption to Turkish reinforcements moving on and around the Sea of Marmara. Her campaign ended five days later on 30 April 1915. *AE2* was lost, scuttled by her crew without loss of life, after being fatally damaged in an engagement with the Turkish torpedo boat *Sultan Hisar*. *AE2's* crew of three officers and 29 sailors were saved and became prisoners of war**.**

AE2 was recently discovered and has been the subject of a film documentary. Ken's presentation gave great insight into the difficulties in documenting a historic wreck in overseas waters.

At the second meeting on 16 December, the subject was *Towards a Single National Maritime Jurisdiction* by Mr Bob McKay. The meeting was very well attended by RINA, IMarEST and Nautical Institute members.

Bob McKay, of the Commonwealth Task Force, outlined recent developments following the agreement on 25 July by Commonwealth and State Transport Ministers to move towards a single national maritime jurisdiction for commercial vessels.

The proposed single jurisdiction will cover all statutory safety aspects including design, construction, equipment, vessel operation (e.g. safety management systems) and crew certification and manning.

The impact of the proposed single jurisdiction was seen to have a positive impact for the small commercial-craft industry and aid the crewing of many small vessels (such as customs vessels).

After Bob's presentation, an informal end-of-year dinner was held at the Kingston Hotel. Many steaks were cooked on the barbeque while all aspects of the marine industry were reviewed over a few beers. Overall, the presentation and dinner was well attended with several requests to return to the Kingston Hotel for future dinners.

On a sporting note, the current RINA ACT Secretary, Glen Seeley, and past RINA ACT Secretary, Keir Malpas, both crewed in the 17th Flying Fifteen World Championships held in Melbourne in early January. The Flying Fifteen was designed by the legendary Uffa Fox in the UK in 1947, and the class is still going strong (80 boats qualified for world titles) with approx 40 overseas boats travelling from England, Ireland, Spain, Hong Kong and New Zealand. The pre-worlds and world titles were won by a WA crew sailing their WA built sail-power hull. This put an end to the many previous titles won by English crews. Overall it was a great regatta hosted by the RYCV.

Glen Seeley

Bob McKay during his presentation on 16 December
(Photo courtesy Glen Seeley)

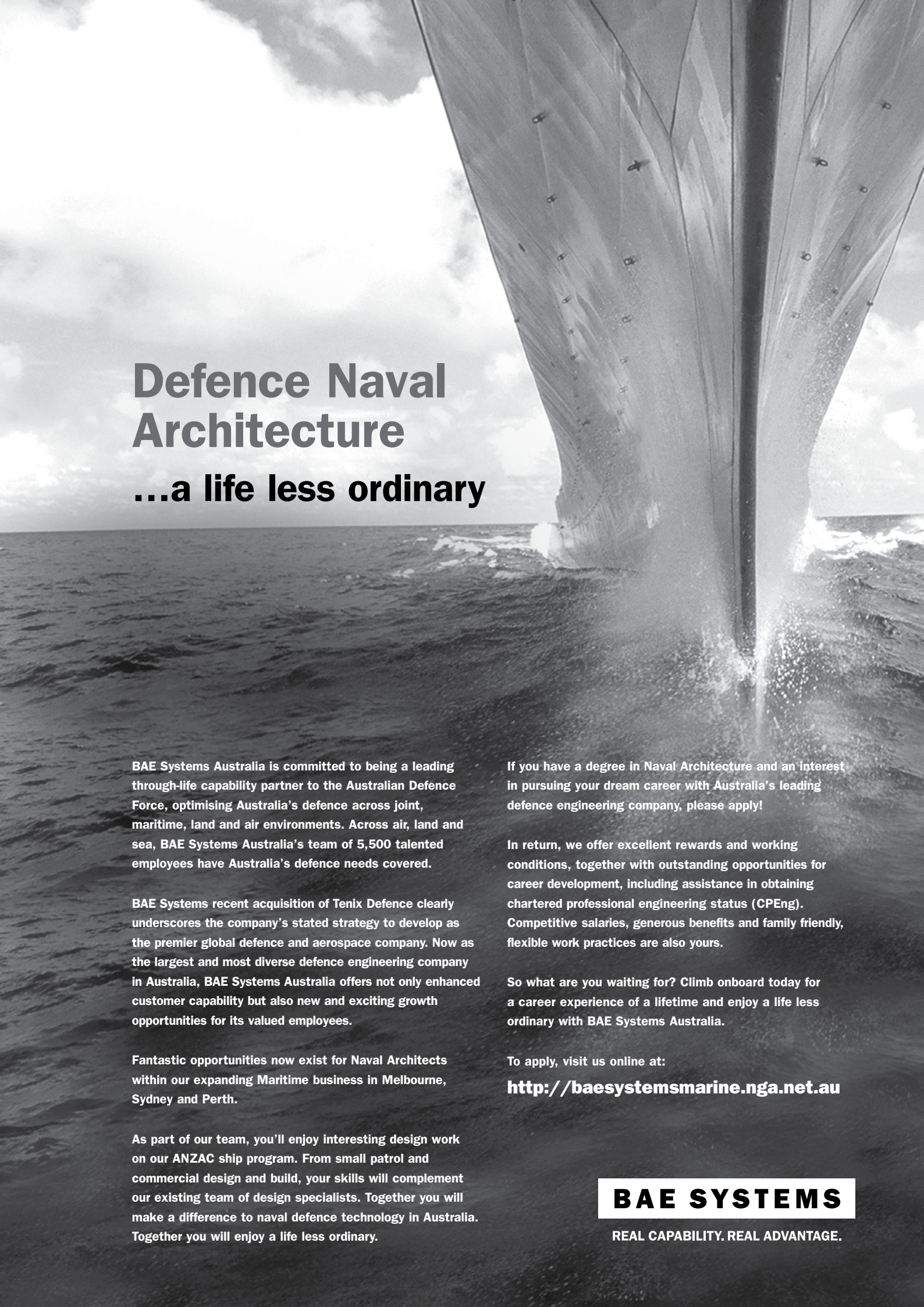
A start in the Flying Fifteen World Championships
(Photo courtesy Sherriden McDonald)

New South Wales

Committee Meetings

The NSW Section Committee met on 26 November and, other than routine matters, discussed:

- SMIX Bash 2008: Now fully-subscribed, and with a waiting list; menu, table arrangement and catering timing confirmed; TV display to be hired for PowerPoint presentation.
- Interview for CEng Registration: This interview has been conducted.
- Pacific 2010 International Maritime Conference Papers Committee: Adrian Broadbent has been appointed as Chair, has formed the committee and has met with organisers, Tour Hosts.
- Membership Database: Phil Helmore and Craig Boulton have been (and continue) working on updating and have advised some changes to AD and HQ.
- Technical Meeting Program for 2009: Dates for meetings in 2009 have been confirmed with EA by Laurie Prandolini; RINA meetings have mostly been



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lined up, and an invitation will be extended to Nigel Gee to make a special presentation on *Innovation* in Sydney.

- National Approach to Maritime Safety Reform: AD has submitted a letter on behalf of RINA; the COAG website indicates that there will be a second round of public comment in January–February.

The NSW Section Committee also met on 9 February and, other than routine matters, discussed:

- SMIX Bash 2008: Generally considered successful; accounts still to be finalised.
- SMIX Bash 2009: Booking of *James Craig* for Thursday 3 December confirmed with Sydney Heritage Fleet.
- Technical Meeting Program: Availability of one presenter to be checked and program re-arranged to suit; possibility of further presentations canvassed.
- NMSC has requested RINA NSW representation on the Reference Group for the Accommodation Arrangement and Personal Safety section of the NSCV; a representative will be fielded.

The next meeting of the NSW Section Committee is scheduled for 16 March.

Phil Helmore

SMIX Bash

The ninth SMIX (Sydney Marine Industry Christmas) Bash was held on Thursday 4 December aboard the beautifully-restored *James Craig* alongside Wharf 7, Darling Harbour, from 1730 to 2130. The Bash was organised jointly by the IMarEST (Sydney Branch) and RINA (NSW Section). Over 200 guests came from the full spectrum of the marine industry, including naval architects, marine engineers, drafters, boatbuilders, machinery and equipment suppliers, regulators, classifiers, surveyors, operators, managers, pilots, navigators, researchers, and educators. Equally importantly, the full spectrum of age groups was represented, from present students to the elders of the marine community.

It was also great to see intrastate, interstate and international visitors in the throng and many tall tales and true were told.

Sydney turned on a beautiful evening, and many partners in attendance enjoyed the view from the decks of *James Craig*. Drinks (beer, champagne, wine and soft drinks) and canapes were provided. A delicious buffet dinner was served in the 'tween decks, and there have been many compliments forthcoming for the new caterers, Earth Catering, who did such a good job.

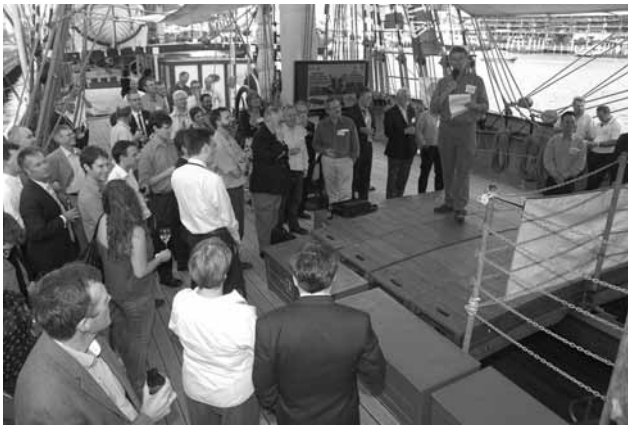
"Early bird" pricing and credit-card facilities for "early bird" payments continue to be successful, and all tickets were sold before the event — you really do have to be early!

Formalities were limited to one speech from the Chair of the NSW Section of RINA, Graham Taylor, who welcomed the guests and thanked the industry sponsors.

The lucky-door prize winner was Nikkie Allen from Advanced Ship Designs who scored a $50 gift voucher to the Australian National Maritime Museum's shop.

The raffle was drawn by Mrs Anne O'Connor, and the winners were:

Third	Glen Campbell	$50 gift voucher to the ANMM shop



Graham Taylor, Chair of the NSW Section oif RINA, addressing of the crowd on board *James Craig*

(Photo John Jeremy)

Second	Richard Sandeman-Gay	$75 gift voucher to the ANMM shop
First	Hans Stevelt	$150 gift voucher to the ANMM shop

Bill Bollard had built a magnificent half-block waterline model of the Sydney Heritage Fleet yacht *Boomerang*, which was designed by Walter Reeks and built by W. Holmes at Lavender Bay, Sydney, in 1903, and the model was put up for silent auction. John Hoskin submitted the winning bid and the model was presented to him by Mrs Anne O'Connor. Our thanks to Bill for his expertise in building and generosity in donating this model.

Bill Bollard's beautiful model of *Boomerang*
(Photo courtesy Bill Bollard)

Boomerang was built as *Bona* for Charles Wallace, a Melbourne businessman, member and one-time commodore of the RYCV. She retained her name under her next two owners, Harry Howard-Smith (son of Captain William Howard-Smith, founder of the shipping company Howard Smith) and Charles Lloyd Jones (grandson of David Jones, founder of the company David Jones). Her next owner, Michel Francoise (Frank) Albert was the owner of the Albert Music company whose symbol was the boomerang (elders of the tribe will remember Boomerang harmonicas), and he changed the vessel's name to *Boomerang*.

This year's event was sponsored by the following organisations:

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- Shearforce Maritime Services
- Twin Disc (Pacific)

Our thanks to them for their generosity and support of SMIX Bash 2008.

Some of the stayers, who were shown the gangplank late in the peace, rocked on to other venues and continued to party until the wee small hours.

Development of Hovercraft

Brian Russell, Editor of *Hovercraft Society* and a Trustee of the British Hovercraft Museum, gave a presentation on *Fifty Years of Hovercraft Development* to a joint meeting with the IMarEST attended by 27 on 4 February in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Brian began his presentation by asking "Why fifty years?" It is because it is now 50 years since the unveiling of Saunders-Roe Nautical 1 (SRN1) on 11 June 1959. 2009 is the Year of the Hovercraft, and the international launch of the year took place in Fremantle last week.

Proposals for hovercraft (or air-cushion vehicles) go back a long way. Brian showed a slide of a proposal by Cuthbertson in 1987 to reduce the skin friction on a vessel (looking similar in profile to *Lady Hopetoun*) by pumping and piping air under the vessel. The wheel has now come full circle because, in the January 2009 issue of *The Naval Architect*, there is a current proposal to reduce skin friction on a vessel using the same system of piped air, but now it is called captured air-bubble CAB) technology.

Sir Christopher Cockerell in the mid-1950s came up with a practical solution to the problem of getting the dream of an air-cushion vehicle (ACV) to work. Brian showed a slide of Cockerell's model (now in the British Hovercraft Museum) which still works. Convincing sceptical ministers of state was hard, but he was able to do it with his model hovering around on the carpet of their offices!

The concept was for a fan, driven by an engine, to create air flow into ducts and annular jets around the periphery of the craft. Cockerell's jets were angled inwards, and these sustained the air cushion created by the ducts — it was this part which Cockerell patented, not the air support.

Cockerell convinced Saunders Roe (Aviation), the flying-boat manufacturer at Cowes on the Isle of Wight, to build the first ACV under commission from the British National Research and Development Corporation. Unsurprisingly, Saunders Roe used the technology with which they were familiar, riveted aluminium. The craft flew, ahead of schedule, on 31 May 1959, but was not unveiled to the public until 11 June 1959. The intention for the public unveiling had been to hover the craft only on the hard stand. However, such was the interest in this new form of transport that the press refused to leave until she was demonstrated in the water, and SRN1 was manoeuvred down the stand and out onto the water of the Solent, to the delight of all.

SRN1

Principal particulars of SRN1 are:

Length OA	30 ft (9.14 m)
Beam	25 ft 7 in (7.80 m)
Height (in hover)	10 ft 7 in (3.26 m)
Height (landed)	10 ft 1 in (3.08 m)
Mass	7 tons (7.74 t)
Main engine	Alvis Leonide aircraft piston engine
Power	324 kW
Speed	35 kn maximum
	20 kn cruise

SRN1 was an experimental craft, and had cabin space for two people (in comfort) and was fitted with a single vertical lift fan. She was shipped across to France and then crossed the English Channel from Calais to Dover on 25 July 1959 under the command of chief test pilot, Capt. Peter Lamb, with navigator John Chaplin, and Cockerell himself on board as "movable ballast" (his own words), in a time of 2 h 3 min. This flight proved the hovercraft's capabilities, but also showed the limitations of the initial design, i.e. that a lack of skirts provided little in the way of clearance for waves (1 ft 6 in — 0.45 m) or obstacles (9 in — 0.23 m). It wasn't until Cecil Latimer-Needham invented the flexible skirt (and subsequently sold the patent to Westland, the parent company of Saunders Roe) that air cushion technology really became useful.

In 1962 SRN1 was fitted with skirts, which increased the maximum obstacle height to 3 ft 6 in (1.07 m), and a Rolls-Royce Viper jet engine for forward propulsion, which increased the maximum speed to 50 kn.

SRN1 now rests at RAF Wroughton at Swindon, England, an extension of The Science Museum.

[*Photographs (past and present) and diagrams of SRN1 can be found on the Hovercraft Museum's website, www.hovercraft-museum.org/srn1.html* — Ed.]

Brian then proceeded to illustrate the development of hovercraft and some of their myriad applications with photographs and stories about each one.

SRN2

Saunder Roe's next vessel, designated SRN2, was the first reasonably-successful commercial application of the new

hovercraft technology. The vessel was provided with two drive fans driven by Bristol Siddeley Nimbus gas turbines, and was able to carry 48 passengers. Two experimental services were tried, one across the Solent to the Isle of Wight, and another across the Severn Estuary.

SRN3

SRN3 was a military version, launched in December 1963 and delivered to the IHTU (Interservice Hovercraft Trials Unit) at their facility at HMS *Daedalus* near Gosport in June 1964. The IHTU evaluated SRN3 (and many subsequent hovercraft) for military potential.

SRN4

Seaspeed, operating out of Dover, set up cross-channel services to Calais and Boulogne using the massive SRN4s, *Princess Margaret* and *Princess Anne.* Hoverlloyd, operating out of Ramsgate, set up similar services to Calais and Boulogne with SRN4s, *Swift* and *Sure.*

Principal particulars of SRN4 in original configuration were:

Length OA	130 ft (39.68 m)
Beam	78 ft (23.77 m)
Height (landed)	37 ft 8 in (11.48 m)
Mass	165 tons (167.6 t)
Passengers	254
Cars	28
Engines	4×Rolls Royce Proteus gas turbines each 3400 shp (2535 kW shaft)
Speed	65 kn maximum

Both companies subsequently reconfigured, upgraded the gas turbines to 3500 shp (2610 kW shaft) each, and slightly increased capacity on their vessels (Mk 2). They then stretched them (Mk 3), by cutting and inserting 56 ft (17.06 m), which increased the carrying capacity to 418 passengers and 60 cars, increased the mass to 320 t (325 t) and the four engines were replaced with Proteus gas turbines of 3800 shp (2834 kW shaft) each, increasing the maximum speed to 70 kn.

The two main commercial operators (Seaspeed and Hoverlloyd) merged in 1981 to form Hoverspeed, which operated six SRN4s. The last of the craft was withdrawn from service in October 2000 and Hoverspeed ceased operations in November 2005. The two remaining craft (*Princess Margaret* and *Princess Anne*, both in Mk 3 configuration) now reside at the Hovercraft Museum at the HMAS *Daedalus* site, Lee-on-the-Solent, UK.

BH7

The Royal Navy used craft commercially available from manufacturers, and included a number of BH7 vessels. The BH7 was essentially one-quarter of an SRN4, 77 ft (23.5 m) long × 30 ft 6 in (9.3 m) beam, mass 37 tons (37.6 t), carried four crew, powered by four 900 shp (671 kW shaft) Bristol Siddeley Gnome engines, two for lift via 9 ft (2.74 m) diameter fans, and two for propulsion via 21 ft (6.40 m) fans, and was capable of a maximum speed of 80 kn.

In the year that the RN did weather trials on BH7, they took the craft to the Baltic Sea. However, that year was the warmest on record, and so they had to move operations to the far north of the Baltic. They operated 1500 n miles from home base, supported by three 3 t lorries. They found that the craft worked well on the ice fields.

BH7 was subsequently transported to the USA on board a UN Navy ship, toured the east coast of the USA extensively, and impressed the US military forces.

BH7 was used extensively for mine counter-measure trials, because the acoustic pressure and magnetic signature were found to be significantly less than for conventional vessels. The ability of the air cushion to absorb the energy of an explosion also made the craft less vulnerable to damage.

SRN3 was also used for mine counter-measure trials, with explosions being let off progressively closer to the vessel. The last one was set off very close and led to minor structural damage, but the vessel was able to get home following a blast which would have broken the back of a conventional vessel.

VT2

VT2 was built by Vosper Thornycroft and was handed over to the Royal Navy for trials in April 1979. The vessel was 99 ft (30.2 m) long × 43 ft 6 in (13.3 m) beam, powered by two Rolls Royce Proteus gas turbines of 3800 shp (284 kW shaft) power, and capable of 60 kn maximum speed. The vessel was provided with a large bow ramp, and was used extensively for mine counter-measure work.

Zubr

The Russians have a full range of military hovercraft, and the giant *Zubr* is the largest military type ever built. The vessel is 57.6 m long × 25.6 m beam with a full-load displacement of 535 tons (544 t). Power is provided by five Type NK-12MV gas-turbines of 11 836 hp (8826 kW) each, two for lift and three for propulsion, providing a maximum speed of 63 kn, or 40 kn with full load. The vessel has a bow door and a 30 mm cannon, and is used for amphibious assault and logistic support.

LCAC

The US military have their LCACs (landing craft, air cushion) which can carry a 150 t main battle tank, which they use for amphibious assault and can carry on the well deck of their new San Antonio-class LPDs (landing platform dock). They have so far produced 153 of these LCAC craft and deploy them with the LPDs.

During the first Gulf War, the LCACs were not used in anger. However, there was a build up of amphibious assault capability in the region, as if the assault were going to be made by sea, but the assault came over the desert as a surprise ("Desert Storm").

Griffon 2000

The Griffon 2000 is used by the Royal Marines (among others) who have four of these craft and use them for amphibious assault. The craft are 12.7 m long, carry 20–25 personnel, and a payload of 2200 kg.

PACSCAT

The Independent Maritime Assessment Associates (IMAA) has developed a novel form of craft able to carry substantial payloads at relatively high speeds. The Partial Air Cushion Supported CATamaran (PACSCAT) embodies specially-shaped catamaran sidehulls with partial air-cushion support. The air cushion is generated by installed fans and is retained between fore-and-aft seals. These limit the air loss and result in the vessel having a shallow draught and reduced resistance. This vessel is able to utilise the berth on a landing dock support ship, and is able to carry the same payload as

a conventional Mk 10 landing craft, but at twice the speed.

River Rover

The River Rover is a lightweight, simple, bolt-together design of hovercraft with a revolutionary control system which allows precise control of an air-cushion vehicle along river systems, up rapids, and across swamps, by banking the vehicle. The River Rover design was evaluated by the Royal Navy, and adopted for use by the Joint Services expedition to Nepal in 1978–79 which used hovercraft to provide a mobile clinic — or hoverdoctor service — to people living next to the raging torrents and multiple rapids of the Kali Gandaki River as it descended through the Himalayas. Patients could be carried to a central hospital in 3 h on the River Rover along the river, where the journey would take 3 days overland. These craft are now being used in the Amazon, Irian Jaya, Papua New Guinea, etc. They are also being used for flood rescue operations in Zambia and Madagascar.

Rescue Services

Many rescue services now use hovercraft for their operations.

Gosport Rescue employs hovercraft, especially for operations over mudflats.

The Royal National Lifeboat Institution (RNLI) has six hovercraft based around the coast of the UK, especially for operation over mudflats.

The Avon and Somerset Fire and Rescue Service have two Griffon 2000 hovercraft for their operations, and Gloucester Fire and Rescue Service have now acquired two.

Griffon

Griffon, based at Southampton in the UK, is the main manufacturer of hovercraft, and they have an extensive range of sizes and applications [*see www.griffonhovercraft.com* — Ed.].

One example is the Griffon 8100 hovercraft, which is used extensively for patrol activities by navies in Sweden, Norway, Poland, etc. The versions for the Indian Navy are the first to have a brig (the compartment where prisoners are confined) on board! Hovercraft can accomplish any task performed by a fast boat, but will operate where no boat can venture; over land, sand, mud, ice, snow, rocks, weeds, logs, debris and rapids.

BHT130

The latest vessel designed in the UK is the British Hovercraft Technology 130, designed and built by Hoverwork to carry 130 passengers. The first vessel, *Solent Express*, completed trials and received Maritime and Coastguard Agency approval, and entered cross-Solent service on 14 June 2007, 40 years to the day after the launch of SRN1 by Saunders Roe at Cowes. However, the BHT130 has all-welded aluminium structure, not rivetted, and uses high-speed marine diesels. The noise problem has been overcome by using ducted propulsion fans (rather than open, as this damps out the tip noise). This has the potential to open up new routes in the UK. An example is the Firth of Forth crossing where, if the bridge were to go out, there would be massive disruption, but this could be overcome with a bus–hovercraft–bus connection.

There is a lot of interest in Europe in services which can take passengers off roads, and a good candidate for doing so is hovercraft.

A cargo/passenger version of the BHT130 was built by Kvichak Marine Industries in Seattle USA and launched in 2006. It is "one bay" longer than the standard BHT130. Designated *Suna-X*, the vessel was designed as a high speed ferry for up to 47 passengers and 21.5 t of freight with a well deck forward to serve the remote Alaskan villages of King Cove and Cold Bay.

Australia

Mariah Hovercraft, based ay Hastings, Vic., and Turbo Hovercraft, based at Boronia, Vic., Australian Hovercraft, based at Lesmurdie, WA, All Surface Vehicles Australia based in Victoria, and Viper Hovercraft all manufacture hovercraft in Australia.

Interestingly, Australia held the world's first hovercraft race on Lake Burley-Griffin in Canberra in 1964, just five years after the unveiling of SRN1.

Conclusion

Hovercraft have come a long way in fifty years, and have proven successful in many applications where conventional vehicles cannot be used. There is potential for further uses, as ways are sought to ease traffic congestion. The hovercraft is the first *truly* amphibious vehicle, able to maintain the same speed on land and on sea. Brian has seen their development from start to finish on one lifetime.

Questions

Question time was lengthy, lasting for nearly half an hour, and elicited some further interesting points.

The British Hovercraft Museum has a wide range of hovercraft on display, from single-seaters up to the two SRN4s, *Princess Margaret* and *Princess Anne*, a total of about 60 craft.

Typical speeds of hovercraft are in the range of 45 kn for a single-seater, up to 70 kn for the SRN4s (60 kn operating across the English Channel); 50–60 kn is typical.

Manoeuvrability is achieved by having two propellers for propulsion, or by having rudders behind a single-propeller installation.

Hovercraft have been used as ice breakers, and there are two possible modes of operation; firstly by using the air cushion at the ice edge, which cantilevers the ice over the cushion and it breaks off, and secondly by hovering into the ice field and the wave breaks the ice.

Spray is not a problem; there is an extra skirt forward to trap the spray before the cushion skirt.

The operating pressure is of the order of 15 lbf/in^2 (103 kPa), and this is not of concern to the environmental groups.

If a hovercraft settles on water, it behaves like a boat, but is very manoeuvrable. The BHT130 actually has two thrusters, and this vessel can be used at low speed for fire control. The thrusters are usually directed fore-and-aft and locked in position.

Surface-effect ships (SES, or side-wall hovercraft) were used extensively in Scandinavia because, although they have the efficiency of a hovercraft, they do not have the same speed limitation which gives an extra 10 kn to the SES. There are now few significant operators anywhere except one or two in Scandinavia.

The wear on the skirts is now limited because of the

development in materials which has taken place. Rubber is bonded to both sides of a woven substrate; the substrate provides the strength and the rubber takes the wear.

The vote of thanks was proposed by Adrian Broadbent and carried with acclamation.

Phil Helmore

COMING EVENTS

Australian Division AGM

The Annual General Meeting of the Australian Division of RINA will be held on Wednesday 4 March immediately following the scheduled technical meeting of RINA (NSW Section) and IMarEST (Sydney Branch) at 6:00 for 6:30 at Engineers Australia, 8 Thomas St, Chatswood.

NSW Section AGM and Technical Meetings

The Annual General Meeting of the NSW Section of RINA will be held on Wednesday 4 March immediately following the AGM of the Australian Division of RINA which, in turn, follows the scheduled technical meeting of RINA (NSW Section) and IMarEST (Sydney Branch) at 6:00 for 6:30 pm at Engineers Australia, 8 Thomas St, Chatswood.

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

The program of meetings for 2009 (with exceptions noted) is as follows:

4 Feb	Brian Russell, Editor *Hovercraft Society Fifty Years of Hovercraft Development*
24 Feb	Nigel Gee, Marine Consultant (NB Tuesday) *Innovation in Marine Technology — Fundamental or Fashion?*
4 Mar	Jim Phillips, CSL Australia *Spencer Gulf Trans-shipment Facility* NSW Section Annual General Meeting
1 Apr	Lars Grünitz and George Spiliotis, Germanischer Lloyd *Rules for and Classification of Naval Submarines*
6 May	Simon Robards, NSW Maritime Authority *Resistance of High-speed Transom-stern Craft*
3 Jun	Rex O'Connor, Wärtsilä Australia *Boosting Energy Efficiency*
1 Jul	Forum/Panel Discussion *Harbour Ferries*
5 Aug	Defence Science and Technology Organisation *The Results of the HMAS* Sydney *Investigation*
2 Sep	Chris Nicholson, Puma Ocean Racing *The 2008–2009 Volvo Ocean Race*
7 Oct	Rodney Humphrey, Det Norske Veritas *Investigaton of the Hull Girder Collapse of Containership MSC* Napoli
3 Dec	SMIX Bash 2009

Summit Down Under

The NMSC is holding a summit on recreational boat standards to coincide with this year's International Boat Show at Sanctuary Cove, Qld. The *Summit Down Under* will be held on 21–22 May on the Gold Coast, and will give marine industry delegates the chance to hear international experts discuss how the latest developments in recreational boating standards around the world can impact on exporters. Many of those experts will be in Australia for a meeting of the international standards committee on small craft (ISO/TC188).

Some further information is given in *The Profession* column elsewhere in this issue.

For further details or to obtain a registration form, contact NMSC's Communications Officers Ursula Bishop or Rosemary Pryor on (02) 9247 2124 or email ubishop@nmsc.gov.au or rgpryor@nmsc.gov.au, or visit the NMSC website www.nmsc.gov.au.

Basic Dry Dock Course

Following the success of the course held in Melbourne in 2008, RINA has announced its intention to hold the Basic Dry Dock training course again in Australia in August 2009.

This unique four-and-a-half day course covers the fundamentals and calculations of dry docking. The course begins with the basics and safety concerns, and progresses through all phases of dry docking: preparation, docking, lay period, undocking, and ends with a discussion of accidents and incidents.

The course is presented through classroom lectures, student participation in projects and practical application exercises. The course addresses the deck-plate level of practical operation needed by the dock operator and the universally-accepted mathematical calculations required to carry out operations in accordance with established sound engineering practices.

The course is designed to be relevant to dockmasters, docking officers, engineers, naval architects, port engineers and others involved in the dry docking of ships and vessels.

The course topics and program may be downloaded from www.rina.org.uk/c2/uploads/topics and programme.pdf.

To register your interest in the course visit www.rina.org.uk/drydockaustralia2009.

THE LOSS OF HMAS SYDNEY

On 6 May 2008, the HMAS *Sydney II* Commission of Inquiry appointed the Defence Science and Technology Organisation and the Australian Division of the Royal Institution of Naval Architects to examine and report on the technical aspects of the loss of HMAS *Sydney* and HSK *Kormoran* following their encounter off Western Australia on 19 November 1941. The technical report prepared following these investigations was presented in evidence to the Commission on 12 January 2009. The executive summary of that report is reproduced below.

On 19 November 1941, the Royal Australian Navy Modified Leander-class light cruiser HMAS *Sydney,* en route to Fremantle, intercepted the disguised German raider HSK *Kormoran* about 100 nautical miles west of Steep Point off the coast of Western Australia. In the ensuing battle, *Sydney* was sunk with the loss of the entire crew of 645 men. *Kormoran* was subsequently scuttled with the loss of 81 men.

Following the discovery of the wrecks of *Sydney* and *Kormoran* in March 2008, the Chief of the Defence Force, Air Vice Marshall A.G. Houston AC AFC, established a Commission of Inquiry (COI), charged with the following Terms of Reference:

To inquire into and report upon the circumstances associated with the loss of HMAS Sydney *(II) in November 1941 and consequent loss of life and related events subsequent thereto.*

In support of these Terms of Reference, the Defence Science and Technology Organisation (DSTO) of the Department of Defence in collaboration with the Australian Division of the Royal Institution of Naval Architects (RINA) were appointed to provide expert advice and opinion.

The wreck sites of *Kormoran* and *Sydney* were extensively surveyed by SV *Geosounder.* The footage was extensively analysed by DSTO and RINA to assess the extent and type of damage to both *Kormoran* and *Sydney.*

The analysis of the action between *Sydney* and *Kormoran* was bound by a number of assumptions concerning the battle sequence, the environmental factors and other operational aspects. These assumptions were provided by the COI.

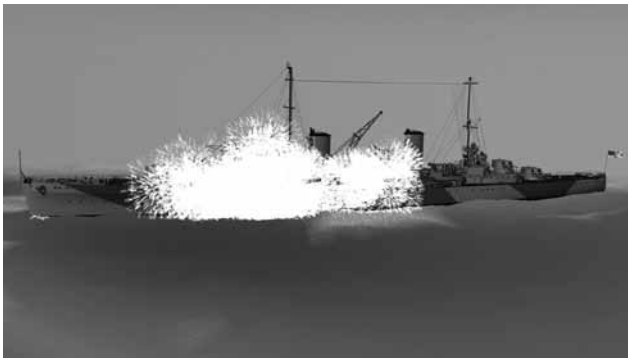
In the provision of expert advice and opinion, DSTO and RINA used a number of scientific analysis tools. Aside from the physical examination of the video imagery, and a large number of historical documents, photographs and other publications, the analysis utilised modern computer codes. More importantly, advanced analysis techniques including a series of visualisations have been used to determine the effects of the weapons damage on *Sydney.* Naval architectural assessments have been made to determine the probable final demise of *Sydney*.

The evidence from the wreck site of *Sydney* has been interpreted using not only factual evidence from the wreck but also from a consideration of evidence from similar events to other ships.

Observations made at the *Sydney* wreck site confirm *Kormoran* survivors' accounts of *Sydney* being hit in the bow by a torpedo and peppered by a large number of shells on both the port and starboard sides of the ship.

Observations of the footage of the wreck site of *Sydney* identify 87 individual 15 cm shell hits. Each of these shells

HMAS *Sydney* berthing in Circular Quay on her return from the Mediterranean on 10 February 1941
(Photo courtesy Australian National Maritime Museum, Sam Hood Collection, Negative 20357-1)



A visualisation showing an aggregation of the hits on HMAS *Sydney's* port side by 15 cm shells from *Kormoran* (DSTO Image)

weighed 45.3 kg, which represented a total weight of 3900 kg hitting *Sydney.* Each of these shells is designed to splinter on impact, generating a minimum of 200 000 individual steel fragments and thousands of secondary fragments as they smashed through *Sydney*. It is reasonable to suggest that a significant number of hits to the upper deck regions cannot be identified due to the condition of the ship in its present state, so these numbers should be viewed as conservative.

It was not possible to identify the damage to *Sydney* from the smaller-calibre shell impacts from the photographs. However, *Kormoran's* survivors' accounts state that both the 20 mm and 3.7 cm guns peppered the upper decks and the bridge structure of *Sydney*. *Kormoran* could bring to bear three of her five 20 mm guns at a time, each with a conservative firing rate of 100 rounds per minute (the design firing rate is stated as 240 rounds per minute). It would be reasonable to suggest that they would have sprayed *Sydney* with between 500 to 1000 rounds per gun during the encounter. These rounds would have been directed towards the exposed personnel and equipment on the upper decks.

Kormoran's survivors have also stated that they fired their 3.7 cm guns towards the bridge and superstructure regions. These guns had a more effective range than the 20 mm gun and had a rate of fire of 80 rounds per minute for the 0.7 kg AP shell. It is reasonable to suggest that *Kormoran* may have hit *Sydney* at least 400 times during the encounter, which would have added another 300 kg of steel fragments distributed around the upper decks, and further added to the number of personnel critically wounded.

The battle between *Sydney* and *Kormoran* was a unique sea battle in that *Sydney* was not only hit by a torpedo, but was also pounded by accurate and sustained gunfire from close range for an extended period of time. Other WW2 ships had survived torpedo hits and others had survived shell hits from larger calibre shells. However, *Sydney* had to endure the sustained attack at close range from 15 cm shells smashing into the sides of the ship, raking the upper decks with 20 mm shells at a rate of fire of more than 100 rounds per minute and sustained shelling with 3.7 cm guns. As *Sydney* sustained hit after hit, the damage to both equipment and crew multiplied along with the loss of numerous capabilities. Figures presented propose that at least 70% of the crew were incapacitated or trapped in spaces due to fires and escape passages being blocked.

Fires broke out in many areas of the ship and choking smoke and toxic gases engulfed the upper decks and was drawn into the lower decks. The torpedo hit to the bow resulted in

The base for the director control tower on HMAS *Sydney* showing hits on the port and starboard sides by 15 cm shells from *Kormoran*
(Finding Sydney Foundation photo by David Mearns)

The aft end of the upturned bow section of HMAS *Sydney* showing the indentation of the shell plating caused by the torpedo hit
(Finding Sydney Foundation photo by David Mearns)

extensive forward flooding. The loss of the ship's electrical power and the physical blockage to passageways for egress would have made any damage-control operations extremely difficult to conduct. Firemain and main suction lines would have been significantly damaged, and the ability to pump water to fight the fires would have been further limited due to the lack of electrical power. This is particularly true for all areas forward of the machinery spaces. Although the initial action resulted in damage to the port side of *Sydney*, the turn to port after 5 minutes exposed *Sydney* to shelling on its starboard side and magnified the damage with as many shell hits on the starboard side as on the port side. The boats and Carley floats on the port and starboard sides were either blown overboard or were directly damaged by shells or the thousands of fragments that were spraying around the upper decks. The boats and Carley floats were rendered useless for evacuation or lifesaving.

Given the torpedo strike to the forward part of the ship, the extensive weapons and fire damage to the midships and aft regions of the ship, it is highly likely that the only survivors were in the stern of the ship and possibly the aft engine room. The remaining crew would have been trying to save the ship by bringing it under control, and possibly trying to carry out limited damage control. The surviving able-bodied crew were likely to have been attempting to control the ship from

One of *Sydney's* 35-foot motor boats lying on the sea floor
(Finding Sydney Foundation photo by David Mearns)

HMAS *Sydney's* port set of torpedo tubes
(Finding Sydney Foundation photo by David Mearns)

the machinery spaces and steering compartments, provide electrical and fire fighting services, as well as assisting and treating the injured.

After the engagement, the sea state increased as *Sydney* travelled to the south east at approximately 5 kn. At this time *Sydney* was severely damaged, with a very large number of casualties, several major fires, many small fires, much of the upper and lower decks filled with smoke, flooding occurring in the bow area and electrical power gone for much of the ship. The weapons holes were fuelling the fires by allowing air to ingress from outside. The damage-control crews would have been overwhelmed at this stage and any damage control that was being conducted was simply to try to save the ship.

Any slight deviation from the beam-seas heading would have significantly changed the time the vessel remained afloat. As the sea conditions deteriorated to sea state 4, *Sydney* began to roll and more water flooded in through the weapons holes in the hull and deck openings. It is probable that the roll became significant and increased with flooding and increased sea state, rolling from 15° up to 40°. At these roll angles, immersion of the edge of *Sydney's* deck was likely, and any attempt at damage-control operations or movement around the ship would have been virtually impossible. Any survivors trapped below decks would simply have been trying to stop being thrown around. Eventually, *Sydney* is likely to have rolled to an angle beyond which she could not have recovered, lost buoyancy, and sank rapidly. It is possible that this process was also accompanied by the sudden collapse of one or more watertight bulkheads which further contributed to the sudden and catastrophic loss of buoyancy and sinking. For the damage extents considered, the analysis indicates that for all other headings considered, the time after the battle that *Sydney* could potentially remain afloat was somewhere between 2 to 4.5 hours. This is consistent with reports that the glow on the horizon from the fires onboard *Sydney* disappeared approximately 4.5 hours after the battle. As *Sydney* sank, the weakened bow was violently torn off and plunged towards the sea floor.

It is not possible to factually state that there were any survivors from *Sydney* who entered the water. However, it is possible that some crew from *Sydney* entered the water at some stage during or after the engagement. Those during the engagement were likely to have been blown off the deck as a result of blast or fallen overboard. Those after the engagement were possibly swept off the decks when *Sydney* went down, or entered the water if an abandon ship order was given. There is no evidence to support any of these statements and they must be seen as supposition. It should be noted that any survivors who did make it into the water would most likely have been affected by injuries, shock, burns and possibly the effects of smoke and/or inhalation of toxic fumes.

There is little doubt that the ship's boats were either damaged or were not able to be lifted off *Sydney* due to the aircraft crane being damaged. The Carley floats would have been either blown off during the engagement or damaged with shell hits, fragments or fire. They would have been of little use. If any Carley floats did survive and floated, then it is possible that some survivors may have reached a float. Any other survivors would not have had anything other than their life belts to help them survive.

The survival time of someone wearing a life belt was hours. Although the Carley float provided a degree of survival capability, Royal Navy data suggests that a person in a Carley float would only survive for three to five days. Contemporary data and modelling of survival of people at sea show that at a water temperature of greater than 20 °C, hypothermia is not a critical factor. Data suggests that a person can survive for greater than 12 hours at 25°C and possibly up to 40–50 hours. It should be noted that none of this data can be validated.

Since neither *Sydney* nor *Kormoran* were accompanied by any other ships, nor were there any other ships in the immediate vicinity which were aware of the encounter, there was little possibility of survivors being picked up quickly. Once in the water, the major problem for survivors was drowning, dehydration and the presence of sea creatures, particularly sharks. The water temperature in this area was approximately 23–24 ºC, so hypothermia was not a significant factor in survival. If the survivors were supported only by a life belt, then the constant breaking of waves over the head could result in the ingestion of salt water leading to drowning. During the battle and the sinking of *Sydney,* the sea states were 3 to 4. Given the limited support and buoyancy of the life belts, any survivors would most likely to have drowned and their bodies would have sunk.

As a body sinks into deep water, the pressure of the water tends to compress gases in the abdominal and chest cavities,

with the result that it displaces less water as it sinks deeper and consequently becomes less buoyant. Once a body sinks, it also commences to decompose due to the action and growth of anaerobic gas-forming organisms in the intestines. The growth of these organisms causes the abdomen, followed by the whole body, to bloat and to swell with gases. The critical factor in this process is the water temperature. The lower the water temperature the slower is the rate of putrefaction. Once the body swells, it then rises to the surface where it floats. Typically, the time for a body to rise is between 3 and 10 days but can take much longer in cold waters and never at all if the water is very cold and/or if the body is lying at a great depth. In this case the survivors from the encounter would have sunk to a depth of approximately 2500 m. Given the significant water pressure on the body at this depth, it is likely that the putrefaction process would not result in enough gas generation to make the body buoyant. If, however, any bodies did rise to the surface, given the water temperature at 2500 m of approximately 2.5º C, they would have taken longer than the typical 3–10 days to rise. Based on this scenario, the searchers would not have found any bodies as they would not have risen to the surface, if at all, during the search period.

The authors of the report are Michael Buckland (DSTO), Stuart Cannon (DSTO and RINA), Leo de Yong (DSTO), Grant Gamble (DSTO), John Jeremy (RINA), Tim Lyon (RINA), Patrick McCarthy (DSTO), Brett Morris (DSTO and RINA), Roger Neill (DSTO), Michael Skeen (DSTO), Brigitta Suendermann (DSTO) and Terry Turner (DSTO and RINA). The complete report can be downloaded from www.defence.gov.au/sydneyii/exhibits.htm. The report is Exhibit 106 and the visualisations are Exhibit 107.

A visualisation of HMAS *Sydney* shortly before she sank on the evening of 19 November 1941. The smoke and steam which would have enveloped the ship on the moonless night have been omitted
(DSTO image)

CLASSIFICATION SOCIETY NEWS

First Ship Built to Winterisation Rules at STX Shipyard in Korea

The first vessel built to comprehensive new global standards for ice-class vessels was unveiled in November when the Primorsk Shipping Corporation (PRISCO) named MV *Prisco Alexandra*, a 51 000 deadweight tonne product tanker built in Korea to rules developed by Lloyd's Register.

Prisco Alexandra, the first of seven sisterships being built for PRISCO at STX Shipbuilding Corporation's yard in Jinhae, Korea, was built to a new winterisation notation which dramatically extends the coverage of current standards beyond basic hull structures to include the products and equipment which are essential for safe and reliable operations in frigid temperatures.

"We are proud to witness the naming of *Prisco Alexandra* and the first application of our market-leading winterisation notation," said Luis Benito, Country Manager — Korea, Lloyd's Register Asia. "There is a growing requirement for our clients to operate vessels in the harsh conditions of the Arctic, so it is essential to have clear and comprehensive minimum standards of performance to protect seafarers and the delicate marine environments in which they operate. These winterisation notations provide clear guidance for all parties."

PRISCO was instrumental in the formation of the new rules, making available the experience and knowledge accumulated by all of its employees during the more than 35 years that the company has been operating in cold and extreme climates.

According to Konstantin Globenko, the Director of PRISCO's Technical Department, having a more comprehensive set of common winterisation rules helps to streamline the process of establishing — with groups such as chartering companies, international oil firms, insurance organisations and port authorities — whether a vessel is technically equipped to trade in temperatures of –25ºC. "We believe that being the first to build to this class notation is only the first step. Eventually, all oil companies, charterers, flag and port authorities and terminal operators working in Arctic waters will realise the importance of the proper winterisation of

vessels," says Globenko. "This co-operation between class and owner—between theoretical and practical people — has promoted the development of a very practical tool that is useful to all parties and safer for those at sea."

The new notation, known as Winterisation 'D' (–25), covers everything, from the paints used in ballast tanks and the sealing materials for valves, to the location of water heaters, store rooms and steam lines. And with shipowners having to sail to increasingly remote areas to source and deliver the raw materials which are required to fuel global energy demands, establishment of the rules is well-timed.

"As the first ship ever built to our winterisation rules, *Prisco Alexandra* will serve as a testament to the potential of quality relationships. We worked very closely with PRISCO to bring these rules to the market at precisely the right time for the marine industry," says Benito. "It is our business to support the construction of vessels. So it is also important to recognise the contribution of STX Shipbuilding, whose employees were innovative and responsive enough to adapt to the new requirements for the construction of these ships."

STX is expected to deliver to PRISCO four more of the precedent-setting product tankers in 2009, with the final two units expected in 2010. The first vessel underwent sea trials in November.

LR Press Release, 10 November 2008

Managing the Human Element: Balancing Competent People and Usable Systems

Ensuring a balance between competent people and usable systems is vital to meeting the crewing challenge currently facing the shipping industry, said Willem Pols, Lloyd's Register's Manager, Marine Management Systems, in Dubai. Addressing the "Manning Challenge" session at the Seatrade Middle East Money and Ships conference in Dubai in December, Pols told delegates that, when faced with the current challenging crewing situation, the natural reaction is often to focus only on crew competence.

He said: "This is undoubtedly important, but looking only at this misses another significant opportunity for risk management. There are also things that can be done to support the people and ensure that their needs are met. Especially, to ensure that systems are usable. Having usable systems means having vessels, equipment, procedures, training and manuals that can be used in the conditions in which they are required to be used.

"It comes down to ensuring fitness for purpose. Are the people fit to do the job with the systems available, and are the systems fit for the available people to do the job with? Maintaining this balance is the approach that Lloyd's Register takes in its human-element products and services.

"It's always important to get an appropriate balance between the two, at any time and in any situation. But it is especially critical in shipping at the moment, given the current crewing challenges. More-usable systems are quicker to understand, so less training is needed, and people with lower experience can operate them sooner. The risk of errors in using them is lower. The risk of deliberate violations is also lower—people are more likely to violate procedures if they feel like they are the wrong way to do something. Faster familiarisation, faster operation and lower rate of mistakes also means higher productivity.

"Ensuring a balance between competent people and usable systems may seem like common sense. Indeed, it probably is. But it isn't commonly done. It is a strategy which brings benefits to risk management. It will also help ship operators to maintain a competitive edge in a trading environment where all companies are faced with the same crewing challenges, but most are concentrating their efforts only on the 'competent people' side of the balance."

Willem Pols' comments come as Lloyd's Register cemented its human element presence in the Middle East by carrying out a human-element gap analysis (HEGA) review for Dubai-based Gulf Energy Maritime (GEM).

HEGA is based on a Lloyd's Register guide called *The Human Element—Best Practice for Ship Owners*, and is designed to identify gaps between what a company does and what it aims to do based on industry best practice.

GEM, the Middle East's largest independent commercial product-tanker operator, is the first Middle East based shipping company to undergo a HEGA review. Ahmed Hareb Al Falahi, GEM's CEO, said "The HEGA review of our organisation will enable us to set a higher benchmark, not just for ourselves but also for the industry in this region." GEM is also certified by Lloyd's Register Quality Assurance to the ISO 9001: 2000 Quality Management System and ISO 14001: 2004 Environment Management System for the operational and technical management of its fleet.

LR Press Release, 16 December 2008

LR Helps South Korean Navy to Deep-dive Record

Lloyd's Register has chalked up a hat-trick of firsts in co-operation with the Republic of Korea Navy. *ROKS DSRV II*, a rescue submersible built by UK underwater defence systems specialists, James Fisher Defence (JFD), based at Renfrew in Scotland, is the first submarine in Korea to be classed with Lloyd's Register, marking the first involvement by Lloyd's Register Asia with the ROK Navy. Also, the submersible's final dive during its sea acceptance tests — to a depth of 507 m — is the deepest recorded dive in the history of the Korean Navy.

ROKS DSRV II was built to a design based on the Glasgow-based JFD's Deep Search and Rescue (DSAR) 500 Class submarine rescue-vehicle platform. Its construction, which draws on JFD's experience in global submarine-rescue operations and participation in submarine rescue, was overseen by Lloyd's Register. Surveyor Paul Marshall, from the Glasgow office, dealt with most of the production and testing during construction and Liz Kennedy, from the Hull office, coordinated the global involvement of Lloyd's Register in the project.

The test dives, from *Chung-Hae-Jin*, the ROK Navy's multipurpose salvage and submarine-rescue ship, were monitored by Lloyd's Register Asia's Korean surveyors, Jae Sun Kim and Hein Leemhuis.

The DSAR 500 Class rescue submersible is light, manoeuvrable and highly capable, incorporating several significant advances in rescue technology. The submersible is capable of locking onto the escape hatch of a disabled submarine and transferring up to 16 submariners under pressure, recovering them to the surface where they are

then transferred into the decompression facility onboard *Chung-Hae-Jin*. Alistair Stubbs, Lloyd's Register Asia's Business Development Manager in Korea, said "The tests proceeded smoothly and in an excellent controlled matter, despite the relative danger of this test, thanks to the very professional team of James Fisher Defence and the diving team of the Korean Navy. This job shows the strength of Lloyd's Register in applying its knowledge and expertise to a novel project and to effectively manage our service delivery from our offices and staff in different parts of the world."

Commenting on the successful delivery of the project, Alan Green, the Project Manager for DSAR-5 on behalf of James Fisher Defence, said "Since the award of the contract in late 2006, JFD has worked closely with the Republic of Korea Navy, Lloyd's Register and Lloyd's Register Asia to deliver a world-leading rescue submersible. Lloyds Register's participation throughout all phases of the project proved to be a critical contributory factor to our success, by setting an exemplary standard, and so driving each of the participants to achieving a remarkable standard."

LR Press Release, 19 January 2009

Potential use of New Technologies to Help Reduce Marine Fuel Consumption and Greenhouse Gas Emissions

Fuel cells will be a long term sustainable-energy solution for ships but, for immediate fuel savings, reduced environmental impact and reduced operational costs, many options are available now for incorporation in new designs.

At the recent Shipbuilding Machinery and Marine (SMM) technology trade fair in Istanbul, Lloyd's Register explored in detail the potential use of new technologies to help in reducing both marine fuel consumption and greenhouse gas (GHG) emissions. Dr Zabi Bazari, Ship Energy Services Manager for Lloyd's Register Marine Consultancy Services, said that energy savings as high as 40% can be achieved by incorporating new systems and approaches into the design of new ships. Looking ahead, he said that fuel cells could eventually become the main energy unit in commercial ships when low-carbon technologies and renewable sources of energy are firmly in place. In his speech, Zabi reviewed existing and potential technologies in two main categories: hull and propulsors, and engines and auxiliary machinery.

Hull and propulsors

To achieve a reduction in a ship's hydrodynamic resistance, Zabi advocated options such as optimised hullforms, latest foul-release paints, the use of air-cavity or air-bubble systems, the use of sails for capturing wind, and solar energies. He underlined how the energy lost in propulsors can be mitigated by the use of contra-rotating propellers, flow-wise integrated propeller-rudder systems and propeller-boss cap fins as well as hull-mounted fins upstream of the propeller for streamlining flow at entry to the propeller.

Engines and auxiliary machinery

Zabi identified the use of waste-heat-recovery systems, alternative fuels and electronically-controlled common-rail fuel-injection systems as the most effective and immediate means of reducing fuel consumption and emissions with existing engines. But he considered fuel cells as the most-important and most-likely long-term low- and zero-carbon alternative. He brought the audience up-to-date with developments in fuel-cell technologies and the likely timeline for practical shipboard application. He said that, after a further three-year period of research and development, we will see a period of adoption of fuel-cell technology—primarily to gradually replace auxiliary power-generation engines. But full replacement of existing engines/fuels combinations to fuel cells would not be likely for 20–30 years yet, he advised. He reviewed options for rotating machinery including high-efficiency electric motors and variable-speed drives.

Zabi also advocated improvements in measurement and monitoring, especially wide-scale shipboard energy metering to facilitate subsequent operational energy management. The wider use of smart sensors and control systems, in particular for heating, ventilation and air-conditioning systems (HVAC) and lighting systems, are now appropriate for new ships.

In a reference to current IMO initiatives on ship's 'energy efficiency design index', Zabi stated that regulatory changes will be the main driver for the use of energy-efficient and clean technologies. New technologies will support future compliance and will deliver financial benefits if energy efficiency is taken into account at the design stage.

On the previous evening at Lloyd's Register's new-year reception for Turkish shipowners, Zabi had introduced the ways by which fuel consumption and GHG emissions can be reduced on existing ships. He explained how Lloyd's Register's Ship Energy Services can help its clients to deal with these challenges. As part of the Ship Energy Services, Zabi outlined the scope and benefits of services, including energy audits, performance monitoring and benchmarking, energy management training, CO_2 indexing and emissions footprint, sulphur emission control areas (SECAs) fuel change-over plans and slow-steaming advisory services.

David Barrow, Lloyd's Register's EMEA Country Manager, Turkey, said "These new services have put Lloyd's Register in a strong position to support shipowners and operators in complying with environmental regulations and best practice as well as saving money and reducing their environmental impact."

THE AUSTRALIAN NAVAL ARCHITECT

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

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

Photographs and figures should be sent as separate files (not embedded) with a minimum resolution of 150 dpi. A resolution of 200–300 dpi is preferred.

Boost for SA Defence Industry

On 2 December Greg Combet, Parliamentary Secretary for Defence Procurement, and Mike Rann, Premier of South Australia, outlined a significant program of investment in South Australia to help build skills within the Australian defence industry sector.

To help support the Defence industry meet the skills challenge it faces, the Commonwealth Government recently announced a $61 million investment in Defence Industry Skilling, with South Australia set to benefit from up to a third of that expenditure.

During a visit to the University of South Australia, Mr Combet and Mr Rann outlined four of these initiatives, totalling up to $20 million over the next six years. They include a Schools Pathways Program, a Professional Doctorate Program, a Master of Systems Support Engineering and an expansion of the Master of Military Systems Integration.

Greg Combet said that the Government was committed to dealing with the skills challenge within the defence industry. "Over the next decade the Government will be investing over $100 billion to equip and sustain our ADF. We will also be replacing over 80% of the ADF's warfighting equipment," said Mr Combet. "To help achieve this ambitious program it is essential that we address current industry constraints including the provision of skilled labour," he said.

Mr Combet also acknowledged the work that had been done by the South Australian Government in encouraging and fostering a vibrant defence industry.

Premier Mike Rann says the fact that South Australia has won a third of this defence training funding is an acknowledgement of the State's growing strength as a defence capital. "The State Government has worked hard to establish South Australia as the nation's hub for major defence projects," Mr Rann said.

"We've won $14 billion worth of defence projects over the past four years, including the $8 billion Air-warfare Destroyer contract. That project is the centrepiece of the defence industry's growth based at Techport Australia, near Port Adelaide, where we're investing more than $300 million.

"The AWD project alone is expected to create more than 3000 direct and indirect jobs, and this training package will help ensure that South Australia can provide the skilled workforce needed for this growing industry."

School Pathways Program

Up to $6 million will be available to establish the South Australian Advanced Technology School Pathways Program to provide career pathways to defence industry for young people in South Australia.

This initiative is designed to increase the pool of young people in South Australia interested in and able to join the local defence industry by making them aware of the career opportunities in defence industry in the state. It will also ensure that participating schools are providing the right

studies and are maintaining close relationships with defence industry.

While funded by the Federal Government, the program will be developed and administered by the South Australian Government.

Professional Doctorate Program

Up to $5.9 million will also be available to establish a Professional Doctorate Program in Systems Engineering. This initiative seeks to increase the Australian defence industry's capacity and capability in the area of systems engineering.

The program will ensure that PhD candidates receive the most up-to-date coursework and research in systems engineering and ensure that they have a clear appreciation of its application to defence industry and the military.

The Defence Systems Innovation Centre (DSIC) will coordinate the development of the course and administer the scholarship program. The professional doctorate degree will be initially offered by the University of South Australia (UniSA) which will work with defence industry to develop an appropriate program.

The first round of scholarships will be offered nationally in early 2010 with an annual intake of five PhD candidates.

Master of Systems Support Engineering

The Commonwealth will invest up to $6 million to establish a Master's Program in Systems Support Engineering which will equip senior engineering and project managers with the knowledge and understanding to develop and deliver integrated support solutions.

Adelaide-based company, BAE Systems, will co-ordinate the development of the course with RMIT, and with substantial input from the University of South Australia, Saab Systems and ASC.

The result will be a multi-disciplinary master's degree program covering systems engineering, supply-chain management, maintenance, logistics operations, logistics engineering, information coherence, engineering enduring systems and architecting of support solutions and business-process modelling.

Design and development of the program will commence in the first half of 2009.

Master of Systems Integration

The Commonwealth Government will also invest up to $2.5 million with the University of South Australia to convert the existing Master of Military Systems Integration program to flexible delivery mode.

The master's program was developed by a partnership of UniSA and three defence industry companies — BAE Systems, Saab Systems and ASC.

The additional funding provided under this initiative will increase participation in the master's program especially by industry, Defence civilians and ADF members.

Design and development of the program will take place in the first half of 2009, with testing and delivery scheduled for the second half of next year and UniSA anticipating up to 50 enrolments in the program per semester by 2011.

These initiatives will help to further position South Australia as a hub of advanced defence industry, particularly in systems engineering and integration.

LHD Order for Siemens

Siemens Marine Solutions has been commissioned by the Spanish shipyard Navantia S.A. to equip two new RAN amphibious ships (LHD) *Canberra* and *Adelaide* with pod propulsion units and power-supply equipment. Both ships will be built in Ferrol in the north-west of Spain and the final equipment will be installed at the Tenix shipyard in Australia. The order is worth some $67.5 million.

Siemens is responsible for all the electrical propulsion and power-supply equipment for the two ships. The main propulsion systems consist of two pod propulsion units per ship, each with an output of 11 MW, the associated converters and electronic-control units, the medium-voltage switchgear and the generators for producing electricity. The propulsion pods, which are located outside the ship's hull and can be turned, make the ship extremely manoeuvrable and are characterised by high efficiency as well as low noise and vibration levels. The fact that the pods are fitted outside the ship's hull also increases the ship's transport capacity and allows a more-flexible design of the engine room and stern.

"Both ships for the Australian navy are replicas of an LHD which Navantia is currently building for the Spanish navy", said Heinz Waschin, who is responsible for navy business at Siemens Marine Solutions. This ship was launched in Ferrol, the north Galician shipyard location, in spring 2008 in the presence of the King of Spain. In addition to the system, engineering and project management, the order includes commissioning of the equipment.

Saab Systems (Adelaide) part of Canadian Project

The Canadian Government has entered a $C2-billion contract with Lockheed Martin Canada which will see Australians assisting in the modernisation of 12 Halifax-class frigates of the Canadian Navy.

Saab Systems in Sweden is the principal subcontractor for the command-and-control system and radar upgrade, having signed a contract with Lockheed Martin Canada on 23 November 2008. Saab Systems will provide fire-control directors and other combat-system capabilities, and will utilise Australian systems-integration expertise on the project.

Lockheed Martin was attracted to Saab's combat-management system because of its open-architecture design and because of the performance of Saab's highly-developed fire-control directors. The system to be installed on the Halifax class will be known as Canadian Advanced Command and Control System-9LV (CanACCS-9LV) and will involve the integration of Saab's 9LV combat-management system with Canadian command-and-control systems.

"The partnership with Lockheed Martin Canada proves that the modular design and open architecture of 9LV Mk4 is successful and can be integrated with a variety of other systems," said Mr Peter Wimmerström, President of Saab Systems ,business unit.

Saab Systems in Australia will provide significant support

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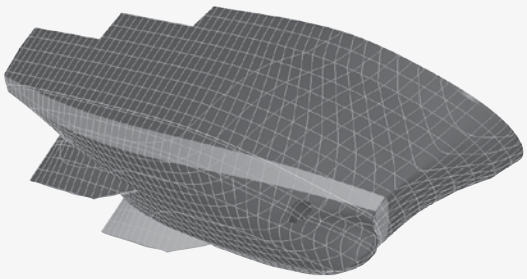

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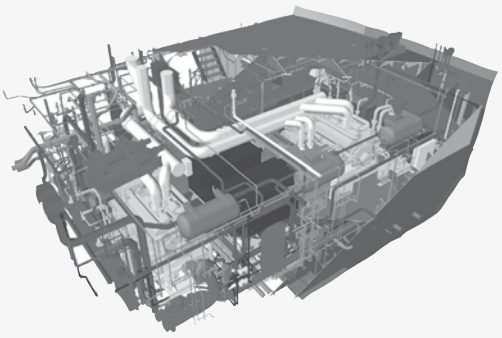

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under the sub-contract because of the local company's leadership in combat-systems design and integration as demonstrated on the Anzac-class frigates. The Saab 9LV combat-management system is installed on the Anzac-class ships and will be installed on Australia's new LHD amphibious support ships. Both the Anzac and Halifax-class frigates are of similar design and capability.

The Canadian contract comes at a time when the Anzac Anti-ship Missile Defence upgrade contract has achieved Critical Design Review of the combat system. Recently sea trials of the CEA phased-array radar have also concluded successfully.

HMCS *Ottawa*, a Halifax-class frigate
(US Navy photo)

CEAFAR Trials Milestone

Parliamentary Secretary for Defence Procurement, the Hon. Greg Combet MP, announced in December that the Anzac Anti-Ship Missile Defence (ASMD) Project has successfully demonstrated CEA Technologies' CEAFAR active phased-array multi-function radar in a ship at sea.

The ASMD project involves a comprehensive upgrade of the Anzac-frigates, including the addition of new phased-array radar technology designed by local Australian company, CEA Technologies.

The phased-array radar was temporarily installed in HMAS *Perth* for undertaking aircraft-tracking trials off the coast of Western Australia.

"This sea demonstration of the CEAFAR capability is an early part of the Commonwealth's risk-mitigation strategy to ensure the integrity and maturity of the active phased-array radar system in advance of the first ship installation in 2010," said Mr Combet.

"The radar performed beyond expectations and the success of the sea trial is a very encouraging outcome in the development of this high-technology high-capability radar system."

The sea demonstration followed a successful land-based demonstration of the same production hardware at CEA Technologies' Canberra facilities on 6 November 2008. The radar faces used in the demonstration were from the first production run, and had been delivered on schedule from the company's production line in July 2008.

The first Anzac frigate to undergo the upgrade will be HMAS *Perth,* with work scheduled to start in January 2010 and sea trials to be completed in July 2011.

"The ASMD Upgrade Project will ensure that the Royal Australian Navy's Anzac frigates have an enhanced level of self-defence against modern anti-ship missiles. It will also enhance the Anzac frigates' ability to provide close-in protection to an amphibious maritime task group, supporting the Royal Australian Navy's future Air-warfare Destroyer area air-defence capability.

"This project has experienced delays so it is pleasing to see this milestone achieved. However, much work remains to be done and the Government will continue to closely monitor the progress of this project."

Ceremony Welcomes Austal Catamarans to Middle East

In December the Kingdom of Saudi Arabia welcomed the delivery of its two Austal-built 88 m high-speed vehicle-passenger catamarans, *Riyadh* and *Cairo* during a handover ceremony in Jeddah attended by King Abdullah bin Abdulaziz Al Saud and the Egyptian President, Mohammed Hosni Mubarak.

Ordered by the Saudi Arabian Ministry of Finance in 2007, the vessels are a gift to the Egyptian Government, and will assist in improving the standard of ferry services across the Red Sea.

Operating on a 100 n mile route between Dibba in Saudi Arabia and Safaga in Egypt, the vessels are intended for Pilgrims travelling to Mecca, and Egyptian workers travelling to and from Saudi Arabia, as well as business and leisure travellers.

Both vessels carry 1200 passengers, 120 cars and 15 trucks and recorded impressive service speeds of 37 knots during recent sea trials, 3 kn in excess of contract requirements.

Each vessel is powered by four MTU 20V8000 M71R engines at the reduced maximum rating of 7200 kW at 1150 rpm, allowing low engine stresses, increased fuel efficiency and longer intervals between engine overhauls.

The car deck features both port and starboard mezzanine levels 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.

Passenger seating is situated on a spacious upper deck with panoramic window views, with a private VIP cabin offering exclusive views from the vessel's bow.

Both 88 m ferries made the 15 day, 5700 n mile journey from Western Australia to Jeddah, via the Maldives and the Gulf of Aden, under their own power.

Construction is continuing on an additional two 69 m vehicle-passenger catamarans at Austal's Western Australian shipyard, which are to be owned and operated by the Kingdom of Saudi Arabia and are scheduled for delivery by mid 2009.

SATCOM Terminals for AWD and LHD Ordered

On 16 December the Hon. Greg Combet MP, Parliamentary Secretary for Defence Procurement, announced that the Defence Materiel Organisation (DMO) had signed a contract with BAE Systems Australia Ltd for the joint supply of five maritime satellite communications terminals.

Mr Combet said that the maritime satellite communications terminals contract for the Air-warfare Destroyer (AWD) and Landing Helicopter Dock (LHD) Amphibious Ships programs would result in an estimated direct saving of $20 million to the Commonwealth.

"The $52.9 million deal is an extension to an existing contract which has already seen the successful delivery of 14 satellite terminals, on-time and on-budget," Mr Combet said.

"The concurrent purchase of terminals for both major ship programs and utilisation of the existing supply chain generates major savings and lowers the risk of the procurement, achieving a win-win situation for all parties.

"The DMO has worked exceptionally hard together with BAE Systems and AWD Alliance partner, Raytheon Australia, to ensure the requirements of the two major ship programs are met, and to lock-in these significant savings within a limited timeframe," Mr Combet said.

The maritime satellite communications terminals, known as MASTIS, provide a major enhancement to the Royal Australian Navy's operations and life at sea through the delivery of vastly-increased bandwidth.

FFG Contractual Acceptance

In November the Minister for Defence, the Hon. Joel Fitzgibbon MP, announced that the Defence Materiel Organisation (DMO) had agreed to Contractual Acceptance from the prime contractor, Thales Australia, of two upgraded guided missile frigates, HMA Ships *Sydney* and *Darwin*.

"Upon coming to office a year ago, the Adelaide-class Frigate Upgrade Program was one of several projects which we had inherited from the previous Government, and which had serious difficulties, running over four years behind schedule, and a $150 million over budget," Mr Fitzgibbon said.

"We have now managed a significant milestone in this program, and come one step closer to having these ships on operational activities. This demonstrates this Government's commitment to working with Defence and industry to resolve the outstanding issues associated with this project to ensure that the Australian Defence Force receives high-quality equipment and that Australian taxpayers receive value for money."

Mr Fitzgibbon recognised the key role the Parliamentary Secretary for Defence Procurement, the Hon. Greg Combet MP, played in resolving outstanding issues with the project.

"Greg invested a lot of time and effort in getting the parties to the contract — Defence, Thales Australia and Raphael — to sit down and talk about the issues impeding the project. This has resulted in much greater collaboration between the parties than has previously been experienced during the project's history."

The Royal Navy's latest addition to its Type 45 destroyer fleet, the future HMS *Dragon*, slipped into the Clyde from BVT's shipyard at Govan recently, complete with an 18 m long Welsh Dragon on her bow. As well as providing air defence over a wide area, including for the future aircraft carriers, the Type 45s will be highly versatile and able to conduct a variety of operations. They will be able to carry up to sixty Royal Marine Commandos and their equipment and operate a Chinook-sized helicopter from the flight deck. *Dragon* was named and launched by Mrs Susie Boissier in front of several thousand members of the public, including over 2000 school children wearing dragon masks.
(MOD(N) photo)

Mr Fitzgibbon said that continued collaboration between DMO and Thales Australia has resulted in much-improved progress with trials, delivery and support for the upgraded ship systems.

Upgraded software for the Australian Distributed Architecture Combat System has now been delivered. The acceptance milestone also includes the new FFG Warfare Systems Support Centre at Garden Island.

Contractual acceptance of HMAS *Melbourne* was expected by the end of 2008, and provisional acceptance of the fourth FFG to upgraded, HMAS *Newcastle*, is now expected by

Research Facility for Future Submarines

A new underwater test facility was launched on 21 November at the Defence Science and Technology Organisation (DSTO) in Melbourne by the Hon. Warren Snowdon MP, Minister for Defence Science and Personnel.

The new facility will assist research into Australia's next generation of submarines.

"The Government has invested one million dollars in this new facility to ensure that our scientists are able to bring their expertise to the development of the new class of Australian submarines," said Mr Snowdon.

"Submarines offer a unique and powerful strategic impact to the maritime domain, particularly for a nation so heavily reliant upon seagoing trade and security.

"A key Defence commitment for this Government is carefully planning for our next generation of submarine, and that means getting the science right.

"The new water tank will be primarily used for experiments to control underwater noise."

"Noise-radiation problems can be tested and evaluated in the tank before remediation measures are implemented with actual submarines. This work would not be possible without this test facility," said Mr Snowdon.

The new facility also allows unmanned underwater vehicles to be tested in the laboratory. A winged autonomous glider was released into the water tank to demonstrate the collection of data in the maritime environment.

"Autonomous systems are becoming a cost-effective option for handling difficult operational situations, and this DSTO facility makes it possible to conduct a range of underwater experiments involving such robots before they enter service."

AWD Systems Centre on the Way

The Minister for Defence, the Hon. Joel Fitzgibbon MP, announced on 13 November that the $8 billion Air-warfare Destroyer (AWD) project is a step closer, following the signing of a contract for its new headquarters in Adelaide, South Australia.

"The AWD Systems Centre will integrate Defence and industry partners to ensure effective decision making and provide a focus for design and project management for the delivery of Air-warfare Destroyers to the Royal Australian Navy," Mr Fitzgibbon said.

ASC, on behalf of the AWD Alliance, also signed the Systems Centre Assistance Deed with Defence SA, cementing South Australia's commitment to the location of the Systems Centre in Adelaide.

As the new high-tech hub of the AWD project, the AWD Systems Centre at Techport Australia will provide accommodation for 300 staff including personnel from the Commonwealth, ASC, Raytheon Australia, Navantia, Bath Iron Works, Lockheed Martin and the US Navy. The state-of-the-art facility will also be designed and constructed to achieve a 5 Star Green rating from the Green Building Council of Australia.

In early 2010, staff including project managers, systems engineers, naval architects, combat systems engineers, planners and procurement specialists will move from their current location in Felixstow to the new purpose-built facility adjacent to the shipyard.

The AWD Alliance is made up of the Defence Materiel Organisation, ASC as the shipbuilder and Raytheon Australia Pty Ltd as the combat-system systems engineer.

US Naval Historical Center Renamed

Those who have an interest in naval history should know that the US Naval Historical Center was renamed the Naval History and Heritage Command on 1 December 2008 to reflect the importance of naval heritage to the US Navy's mission.

The renaming was precipitated by the consolidation of 12 major US Navy museums under the Naval Historical Center, which doubled the centre's personnel and greatly increased its financial responsibility.

The Naval History and Heritage Command traces its lineage to 1800 when then-President John Adams asked Benjamin Stoddert, the first secretary of the Navy, to prepare a catalogue of professional books for use by secretaries of the Navy.

Today, the command's management centre, located in the historic Washington Navy Yard in Washington, is the principal repository of the United States Navy's institutional memory for the operational fleet. At the command is the Department of Navy Library, a research institution, a reference service, publishers of Navy historic books, and the curators of Navy artifacts and historic documents.

The maintenance and repair of USS *Constitution* at the Boston Navy Yard is a Naval History and Heritage Command responsibility. *Constitution* is the oldest commissioned warship afloat in the world and boasts 450 000 visitors per year.

The command has also an underwater archaeology program involved in research, including the science and technology used to locate and study shipwrecks. The team has dived on and recovered many historic artifacts now on display at the Navy museums.

Most archival and photographic collections are open to researchers. Official duties permitting, staff historians and archivists advise researchers on naval history at the command.

For more information about the US Naval History and Heritage Command, visit www.navy.mil/local/navhist/.

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Gemini from Incat Crowther

Incat Crowther's latest design was officially christened *Gemini* in a ceremony recently held in San Francisco, USA. The 35 m catamaran ferry is the first of four vessels to operate with the Water Emergency Transportation Authority in the San Francisco Bay area.

The Incat Crowther design was selected following four years of intensive research into the latest and most-practical environmental products available for a water-borne mass-transit system. The result is now the nation's most environmentally-friendly ferry.

Gemini's environmental features include:

- 85% cleaner than EPA emission standards;
- the use of blended fuels;
- efficient sleek hull design providing reduced fuel consumption and minimizing wash;
- forward-facing sonar to protect whales and reduce log strikes;
- solar-panel feasibility study to measure future solar-power capabilities; and
- low sound emissions.

In addition, the vessel was designed to provide the passengers with all the modern conveniences and comfort available. There is room for 34 bicycles complete with fresh water wash system, wide aisles and seats to facilitate fast loading and unloading, and the vessel has high-speed internet connection available throughout. The vessel has also been developed around the rules regarding Americans with disabilities. These rules affect the size and arrangements of aisles, seat, toilets, staircases, kiosks and entranceways.

The vessel seats 149 passengers indoors, with 122 passengers on the main deck and a further 28 seats on the upper deck. The main deck features a mix of individual seats, dining settees, lounges and tub chairs. At the aft end of the cabin there is a kiosk with bar stool and tables. The upper cabin is a private, quiet cabin with a small number of individual seats and two lounges. Behind this cabin is an extensive open-air sheltered aft deck with seating for up to 50 patrons. The seating has been arranged to take advantage of the spectacular San Francisco skyline and surrounding areas.

Powered by twin MTU 16V2000 M71 main engines, each producing 1050 kW, the vessel will have a service speed of 25 kn. These engines are the first to be installed in the USA which have been designed to operate on blended fuels and incorporate catalytic reduction in the main exhaust system.

Principal particulars of *Gemini* are:

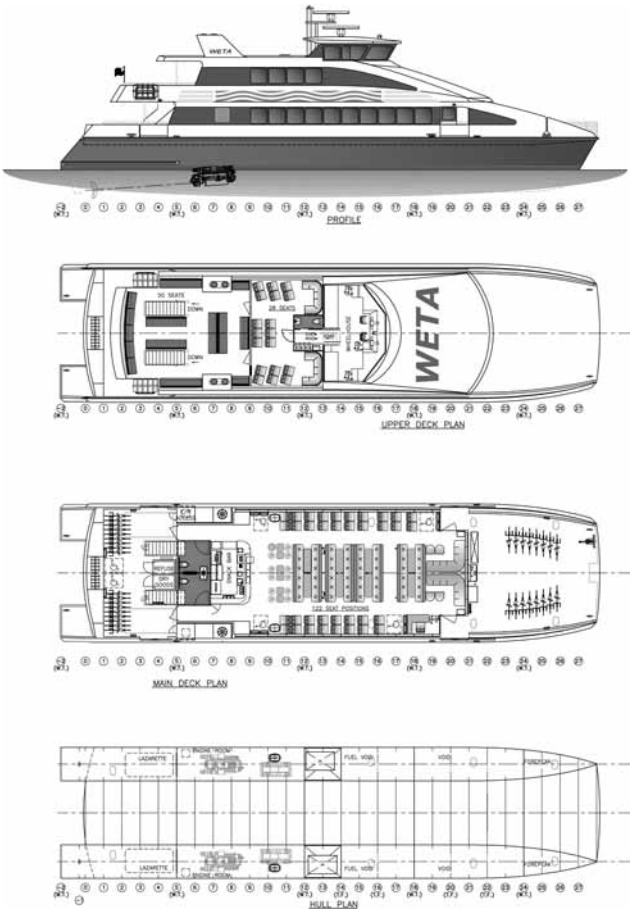
Length OA	118 ft (35.97 m)
Length WL	113.5 ft (34.59m)
Beam OA	28.7 ft (8.75 m)
Draft (approx)	6.2 ft (1.89 m)
Passengers	149 internal 46 external
Fuel	2 × 1200 US gallons (2 × 4542 L)
Fresh water	500 US gallons (1893 L)
Deadweight	51 t
Engines	2 × MTU 16V 2000 M71 each 1050kW @ 2100 rpm
Gearboxes	2 × ZF 3050
Propulsion	Propellers
Speed	25 kn
Construction	Marine-grade aluminium
Survey	USCG Sub Chapter T

Gemini will initially operate from San Francisco to Alameda/Oakland and Tiburon. The vessel will also be on standby in the event of any disruption to the city's transport infrastructure.

The vessel was built by long-time Incat Crowther licensees, Nichols Bros Boat Builders and Kvichak Marine Industries at their shipyards in the Seattle WA region. Together, these yards have built over 43 Incat Crowther vessels which are operating all over North America and the Pacific.

The second vessel, to be named *Pisces*, is set for delivery in March 2009, with the third and fourth vessels currently under construction and set for delivery by the end of 2009.

Ben Hercus



General arrangement of *Gemini*
(Drawing courtesy Incat Crowther)

Gemini on Trials
(Photo courtesy Incat Crowther)

Main deck saloon on *Gemini* looking forward
(Photo courtesy Incat Crowther)

Bar on *Gemini*
(Photo courtesy Incat Crowther)

Wheelhouse on *Gemini*
(Photo courtesy Incat Crowther)

Upper deck saloon on *Gemini* looking aft
(Photo courtesy Incat Crowther)

19.9 m Catamaran from Kamira

In September 2008 the newly-established Malaysian builder, Marlin Marine Sdn Bhd, secured a contract to build a 19.9 m passenger catamaran designed by Kamira Holdings for domestic service in Malaysia. The vessel will run island services on the east coast as well as services on the Straits of Johor.

The Marine Department in Malaysia requires all new vessels carrying more than 12 passengers to be built to class and to comply with the DSC Code. The HSC Code is considered to be too onerous for domestic service, but the Marine Department has decided to implement it as a reasonable bridge between very limited local rules and the HSC Code.

The vessel is being certified by Bureau Veritas. There is capacity for 96 passengers in a simple, single-cabin arrangement, with the upper deck available for passenger recreation.

The owner runs a substantial fleet of small craft, ferries and tugs, and is very aware of operating costs. This has driven the design to a large degree, making it as simple and efficient as possible. The waterline length has been maximised within the limits of the maximum overall length (driven by crewing) and the passenger arrangement is simple. The vessel does not have any on-board AC power, with all of the air conditioning being driven off the main engine. Apart from the weight saving, maintenance is reduced and many vessels in the owner's fleet have similar systems.

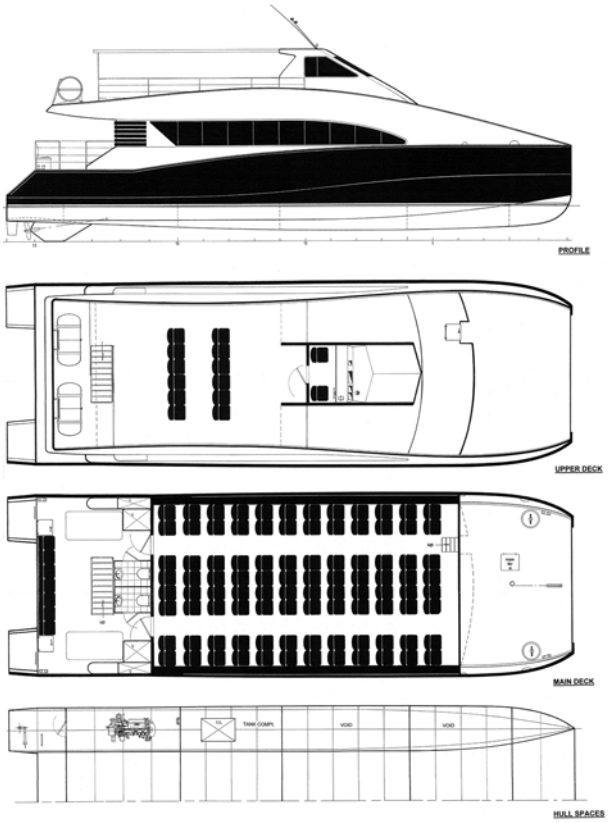
The owner currently has other vessels running with the Daewoo L126 engines and they are a reliable, cost-effective engine. The L126 is a copy of the MAN D2866, which is probably MAN's most-reliable small engine, and the Daewoo is essentially the same. The propellers are housed in rectangular-section tunnels and protected by skegs due to constant grounding at river entrances on the east coast of Malaysia.

A second vessel will follow once the first is in service. Handover is expected in July.

Principal particulars of the vessel are:

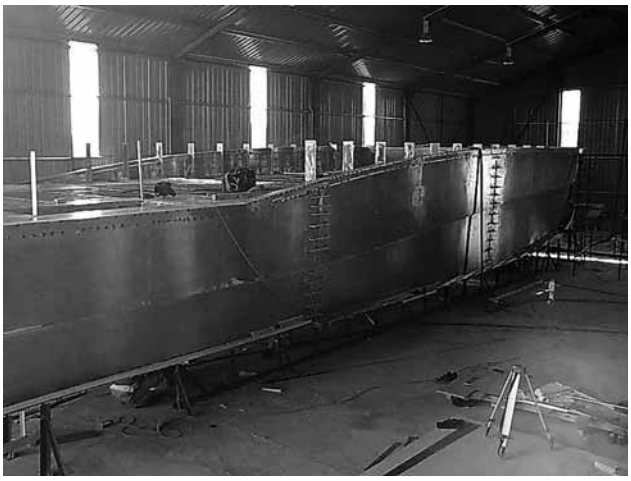
Length OA	19.90 m
Length WL	19.80 m
Beam	6.40 m
Depth	2.15 m
Draft	1.20 m
Displacement	31.3 t at full load
Fuel	1600 L
Water	500 L
Main Engines	2 × Daewoo L126TIM each 294 kW at 2100 rpm
Gearboxes	2 × ZF 305-2A, RR 1.733:1
Speed	22.5 kn at full load
Range	210 n miles

Greg Cox



General arrangement of Kamira's 9.9 m catamaran
(Drawing courtesy Kamira Holdings)

Framing on Kamira's 9.9 m catamaran
(Photo courtesy Kamira Holdings)



Plating on Kamira's 9.9 m catamaran
(Photo courtesy Kamira Holdings)

Sunferries Catamaran from One2three

Following the successful introduction of two 30 m One2three-designed catamarans at the beginning of 2007, Sunferries have recently taken delivery of their third One2three-designed 30 m catamaran for use on the longer 40 n mile Palm Island route along the lines of their Magnetic Island ferries.

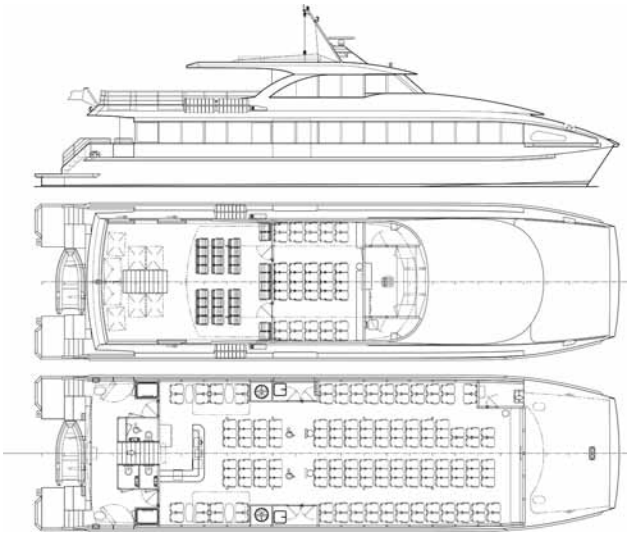
Maggie Cat and *Sun Cat*, built by Brisbane Ship Constructions, were introduced in February 2007 as part of Sunferries' $A7.8 million upgrade on the Townsville–Magnetic Island run. After 12 months of tracking fuel usage of the new vessels on the route, Terry Dodd, Managing Director of Sunferries, reports "*Maggie Cat* and *Sun Cat*, in addition to reducing travel time from 25 to 18 minutes, have produced significant fuel savings over our existing fleet vessels. These savings highlighted a compelling economic case for the replacement of Incat Designs' 24 m *Sunbird*, previously running to Palm Island at 22 kn." Following a government-funded dredging and wharf-modification programme, Sunferries have scheduled a return trip to Palm Island three days per week to greatly enhance the service provided to the island community, with increased services to be brought online as public demand increases. *Sunbird* was built by NQEA Australia in 1987, and acquired by Sunferries in 1998.

The 60 n mile Palm Island run requires greater interior seating capacity and, to meet this demand, and an enclosed passenger cabin has been added to the upper deck behind the wheelhouse to accommodate 40 interior seats. Part of the seating on the lower deck will be allocated for police and ambulance service requirements, providing a cost-effective alternative to current air transport. Other major changes include provision of an hydraulic crane on the upper deck to support cargo and baggage handling, and provision of a rescue boat at the stern for offshore operations.

Whilst the existing Sunferries 30 m hull was suitable, One2three have optimised the hull to suit the additional deck cargo and increased route length. The new hull has a modified hull shape to suit the offshore nature of the route, and is slightly longer in order to deliver the highest fuel savings possible. It has also been fitted with an MDI interceptor ride-control system to provide the highest level of comfort available.

Principal particulars of the new vessel are:

Length OA	30.76 m
Length WL	28.97 m
Beam moulded	8.00 m
Depth	2.70 m
Draft	1.34 m
Deadweight	31 t
Fuel	2 × 2500 L
Fresh Water	1 × 1200 L
Sullage	1 × 1,200 L
Passengers	
Main Saloon	138
Upper Saloon	40
External	44
Total seats	222
Total certified	300
Main Engines	2 × Cat 3412E each 895 kW brake at 2300 rpm
Service Speed	28 knots at full load and 85% MCR



General arrangement of One2three's *Palm Cat*
(Drawing courtesy One2three Naval Architects)

Palm Cat on trials
(Photo courtesy One2three Naval Architects

One2three Atomic 45 Express Cruiser

One2three Naval Architects have further refined their design of the Atomic 45 Express Cruiser. The first Atomic 45 was sold to Hamilton Island Enterprises for use as the resort tender to their exclusive 6-star Qualia resort, where she ferries VIPs to island hideaway beaches and to/from their accommodation. The second and third boats are currently under construction at Atomic Marine in Sydney. While the first boat was configured for 12 passengers and 4 crew and was brought into Queensland survey, the following boats are destined for the pleasure-boat market, where this platform has found appeal as a motor yacht tender and for upmarket high-speed fishing charters and dive and reef trips for up to 20 passengers.

The Atomic 45 features a variable deadrise hull, with construction consisting of a fully-cored structure and vinylester layup. The laminate design was produced by Gurit Australia. The design is centred around the extensive cockpit deck. Flexible lounge seating allows the deck to be re-organised for sun-baking, formal dining, snorkelling and everything in between. A set of retractable stairs forms a "beachfront" at the rear of the vessel, allowing easy access into the water or directly onto the nearest sandy cay. The helm station boasts a bench seat for four, with the servery and fridge located immediately behind.

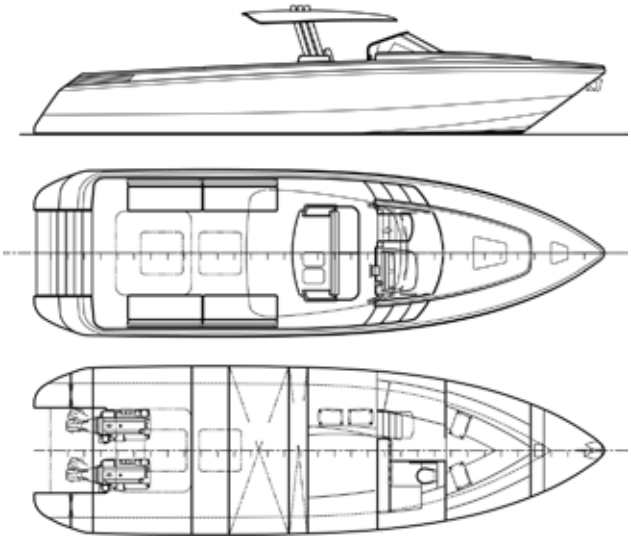
Retained from her pleasure-vessel heritage, a full-size double berth is located under the cockpit floor. On entry downstairs, a galley is provided to port, with toilet and shower facilities to starboard. Moving forward, interior seating for six guests converts into a V-berth.

Powered by twin Volvo Penta D6-350 stern drives producing 261 kW brake power, the first Atomic 45 exceeded 37 kn on trials at 100% deadweight. The new Atomic 45 will offer speeds up to 45 kn with a choice of stern drive, Volvo IPS or conventional waterjet drive units.

Principal particulars of the new Atomic 45 are:

Length OA	13.38 m
Length WL	11.00 m
Beam moulded	4.00 m
Depth	2.60 m
Draft	0.5 m hull
Fuel	2000 L
Fresh Water	500 L
Sullage	300 L
Passengers	12
Main Engines	2 × Volvo D6-350 each 261 kW @ 3500 rpm
Drives	Duo-prop stern drives
Service Speed	37 kn @ full load

Atomic 45 from One2three
(Photo courtesy One2three Naval Architects)



General arrangement of the Atomic 45
(Drawing courtesy One2three Naval Architects)

One2three 23 m Police Patrol Catamarans

Following the announcement of One2three as the successful tenderer for the design of three Queensland Police Service patrol vessels, Austal Ships was confirmed as the builder of the vessels after a similarly-exhaustive tender process for the construction contract.

Features of the design include rapid deployment and recovery of a 6 m RHIB via a sliding platform located between the demi-hulls. The main deck includes a secure communications centre, a command centre, galley and mess facilities. The wheelhouse is located on the upper deck, which can also store a second RHIB as required. Below decks, each hull has two double cabins, and an engine room containing a MTU Series 60 engine with conventional propeller drive in each hull.

Principal particulars of the new vessels are:

Length OA	22.89 m
Length WL	21.80 m
Beam moulded	7.80 m
Depth	3.10 m
Draft	1.40 m

Rob Tulk

Progress on *John Oxley*

The success of the restoration is now very visible in the progress of the hull plating, which is now about 75% complete. The A-strake (closest to the keel) has been completely riveted to the keel, and the mass of the 600 ton (610 t) ship has now been largely transferred back off B-strake onto the keel blocks by means of steel shoes and wedges. Work is now progressing with the re-plating of

the C- and D-strakes which were obstructed by the bilge docking blocks.

The top quarter of the rudder plate was rusted and has been removed, replaced and butt welded to the lower section. Riveting the new blade to the arm will take place early in 2009, and the rudder will be reinstalled after the aft deck and rudder trunk have been restored.

The propeller is original and consists of a cast iron hub onto which are bolted four bronze blades. The fastenings for the blades were heavily coated with cement, which was fashioned by hand into a roughly spherical shape to minimise drag. The cement linings must be chiselled away to fully survey the fastenings.

Most of the engines and pumps from the engine room have been restored and need to be returned to the engine room before plating closes in this compartment.

A group has been formed to undertake the design stage of a new electrical installation, because a replicated 110 V DC system would not satisfy today's codes. Modern safety rules require provision of 415 and 240 V AC with many safety provisions to power lighting, fire-and-bilge pumps, radios, fire-detection systems, emergency systems and the like.

For all the latest news, visit www.shf.org.au/JO-restoration/JO-latest-news.html.

Cruising

The summer cruise season has moved into high gear, with visits to Sydney in December by *Pacific Sun, Rhapsody of the Seas, Clipper Pacific, Volendam, Dawn Princess, Millennium, Pacific Dawn, Diamond Princess,* and *Silver Whisper*.

In addition to returns by most of these vessels, January added visits by *Nautica* and *Astoria,* and February added visits by *Asuka II*, *Rotterdam*, *Europa*, *Seven Seas Voyager*, *Pacific Venus*, *Columbus*, *Oriana*, *Amadea*, *Queen Victoria*, *Tahitian Princess*, *Arcadia*, *Black Watch*, *Royal Princess*, *Saga Rose*, *Queen Mary 2* and *Crystal Serenity*.

Phil Helmore

Sydney Harbour is now short of berths for large cruise ships and consequently some visiting ships have to secure to buoys in the harbour to disembark and embark passengers. In January *Millennium* spent a day anchored in the harbour with her stern secured to the Athol buoy. The photo shows her attended by a tug after she had slipped from the buoy in preparation for departure that evening. The tug was used to prevent the ship from swinging head-to-wind in the fresh summer north-easterly breeze and blocking the inbound shipping channel.

The lack of berths in Sydney will require several more liners to secure to buoys in the harbour this summer— on 1 March *Millennium* will return to the Athol Buoy and she will be joined by *Aurora* at Point Piper. *Crystal Serenity* will be berthed at the Overseas Passenger Terminal at Circular Quay and *Pacific Dawn* will be at Darling Harbour passenger berth, Wharf 8.

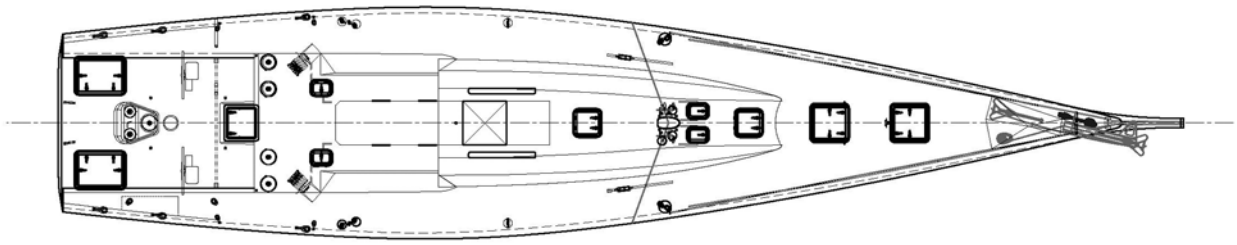
The New South Wales Government recently announced plans for a new passenger terminal at White Bay but it is intended as a replacement for the Darling Harbour berth which will be redeveloped

(Photo John Jeremy)

Lutra 80

Rozetta Payne
Design Engineer
Gurit (Australasia)

Gurit (Australasia) is currently engineering an 80 ft (24.38 m) canting-keel performance cruising yacht called *Singularity*. The vessel was designed by Lutra Yacht Design in the Netherlands with a slant towards that of a performance racer coupled with a luxurious and comfortable interior, a vision made possible by the use of lightweight materials. She is currently under construction at McConaghy Boats' Mona Vale factory, which is located practically next-door to the offices of Gurit (Australasia).



Deck layout of *Singularity*
(Drawing courtesy Gurit Australasia)

Gurit is a global leader in the development and manufacture of advanced composite materials and solutions. The Australian division, formerly known as SP Systems, offers services including composite material sales and composites engineering to support both local and international clients in a wide range of areas, including wind energy, transportation, architectural and marine. Gurit's engineering support ranges from reliable commercial craft through to high-spec one-off racing yachts. Some recent marine projects in which Gurit (Australasia) has been involved include the Azzura-built performance cruiser Marten 49, McConaghy Boats' STP65, *Moneypenny*, and the 40 m Turkish Cyrus power boat.

The principal particulars of *Singularity* are:

Length OA	24.40 m
Length WL	22.50 m
Beam	5.33 m
Draft	5.15 m
Keel	Single-ram canting keel

Gurit's engineering team has been working closely with the builder to produce manufacture-friendly structural details, whilst maintaining a focus on the naval architect's and owner's expectations for level of performance and comfort. From a structural perspective, the main challenges have been in the engineering of the canting-keel reinforcements and the structural details to meet the styling and objectives of the design team. An accurate finite-element model has been built to validate and optimise the structural components supporting the canting keel.

Lead times have allowed the engineering to be ahead of the build schedule and, with all the main laminates already specified, the engineering office is now working predominantly on structural details. *Singularity*'s hull is carbon sandwich with prepreg carbon skins and Corecell SAN foam core to provide insulation and noise attenuation. The deck and internals are also sandwich laminates with carbon prepreg skins, but utilises Nomex core to reduce weight but maintain strength and stiffness.

McConaghy Boats is well under way with the build, with the hull already released from the mould and bulkheads being installed. When launched, *Singularity* will be a sleek-looking, high-spec performance yacht, with flush-deck fittings, hidden halyards and sheets, and a spacious modern interior.

The boat will be sailing predominantly in the Mediterranean, but is capable of ocean passages and has all the attributes necessary to catch the eye of the European sailing community.

Starboard-bow rendering of Lutra Yacht Design's *Singularity*
(Image courtesy Lutra Yacht Design)

Singularity's hull being lifted off the mould at McConaghy Boats
(Photo courtesy McConaghy Boats)

What Future for Fast Ferries on Sydney Harbour?

Part 1

Martin Grimm and Garry Fry

New Year's Eve 2008 marked the end of an era for fast-ferry operations on Sydney Harbour when the final JetCat services were operated by Sydney Ferries. The intention of the NSW Government is to have any future fast-ferry services operated on a private basis.

To mark the occasion of the withdrawal of the JetCats, we review the history of fast-ferry operations from Circular Quay to Manly, before reflecting on the difficulties experienced by the various boat types. Stimulated by the proposal by Stuart Friezer [1, 2], in the next issue we will propose another alternative for re-establishing a cost-effective fast-ferry service.

History

Australia's first hydrofoil, the Supramar-designed PT 20 *Manly*, built by Hitachi Zosen, arrived in Sydney in December 1964. The Port Jackson and Manly Steam Ship Company Limited (PJ&MSC) had purchased her at a cost reported to be around £140 000 [3, 4].

On the morning of 7 January 1965 the hydrofoil commenced its scheduled commuter service between Circular Quay and Manly. With a speed of around 34 knots [3, 5], the 72-seat *Manly* could complete the 6n mile journey from Manly to Circular Quay in 13–15 minutes.

Hitachi Zosen PT 20, *Manly*, the first hydrofoil to operate in Australia and sole PT 20 which served from 1965 to 1978
(Photo Bill Thomas)

Up to that point, PJ&MSC had operated a number of traditional ferries on the route. These were between 27 and 55 years old and, while still maintained to an acceptable standard, patronage on the service had fallen away in the face of improved road links, prompting a look at other alternatives.

Despite the additional fare of three shillings [4, 6], *Manly* was an attractive alternative for some businessmen who arrived at their destination around 15 to 18 minutes earlier than with the traditional ferries, which took around 30 minutes to complete the trip.

As much as anything, *Manly* was intended to trial the suitability of operating hydrofoils on Sydney Harbour. The Managing Director of PJ&MSC, John Needham, indicated that larger hydrofoils would be imported if *Manly* proved to be a success. In the following years, several larger hydrofoils were indeed purchased, while the conventional ferries slipped into decline with only *Baragoola* and *North Head* remaining in operation.

While *Manly* continued in service, a PT 50 hydrofoil with almost double the passenger capacity of *Manly* at 140 seats, was ordered from Rodriquez Cantiere Navale at a cost of $A500 000. *Fairlight* arrived in Sydney and entered scheduled service in November 1966. In May 1970 a further PT 50, *Dee Why*, was commissioned, followed by the similar RHS 140 *Curl Curl* in April 1973. *Manly* then became a reserve craft.

Rodriquez RHS 140 *Curl Curl* and four similar PT 50s served between 1966 and 1991
(Photo Bill Thomas)

In the intervening years, the conventional ferry operations of PJ&MSC had been struggling, even though the hydrofoil service was profitable. This led to a $A2.1 million takeover by Brambles Ltd in 1972. However, by 1974, following public demand, the NSW Government took over most harbour ferry services including purchase of the hydrofoils.

In May 1975 the Public Transport Commission purchased a further PT 50 for $A700 000, this time second hand from Hong Kong. Modifications were carried out to configure the boat similarly to those already in service, and she was re-named *Palm Beach* and commissioned in August 1975. A further second-hand PT 50 was subsequently obtained from Italy at a price of more than $A1 million. This boat arrived in April 1978 before a refit and similar modifications. Re-named *Long Reef*, she finally entered service in September 1978 [9]. With five 140-passenger hydrofoils now in the fleet, the smaller *Manly* was sold to a Queensland operator in 1979.

At this time, the peak-period schedule had a hydrofoil departing from Circular Quay and Manly every 10 to 15 minutes. It would take about three minutes to depart the berth at Circular Quay, turn, and proceed at eight knots until rounding the Opera House when full power was applied. Take-off usually occurred between 30 seconds and 90 seconds depending upon load and the cleanliness of the hull. Flying time was typically around 11 minutes before reducing power and settling quickly to hullborne operation close to Manly Wharf.

Finally, in the 1980s, there was a significant investment to renew the conventional Manly ferries. Four Freshwater-class double-ended ferries with a capacity of 1100 passengers (815 seated) were built by Carrington Slipways and introduced between 1982 and 1988. A new generation of larger hydrofoils was also ordered from Rodriquez. The RHS 160F seated 235 and had a service speed of around 37 kn (although 40 kn was achieved with light loads). The first of these,

Manly 4, which had been purchased for $A8 million, commenced service in September 1984. The second, *Sydney*, purchased for $A8.75 million, entered service in July 1985. Both were initially delivered to Carrington Slipways for fit-out to conform with a 33% local-content requirement. A third RHS 160F was to be built entirely at Carrington Slipways, but this never eventuated.

Rodriquez RHS 160F *Sydney* in refit at the Balmain shipyard. This type served from 1984 to 1990
(Photo Martin Grimm)

Manly 4 and *Sydney* were the first boats built to the RHS 160F design. These were second-generation surface-piercing hydrofoils with a 'W' bow-foil configuration instead of the original 'V' arrangement. They were equipped with a Seakeeping Augmentation System developed by Rodriquez and Hamilton-Standard. An analogue computer, with input from gyroscopes, controlled hydraulically-actuated flaps on both the bow and stern foils to greatly reduce pitch, roll and heave motions as the boat encountered waves. The disadvantage of this system, when operating on the congested harbour, was that there was no provision to use flaps to aid foilborne manoeuvring. In comparison, the PT 50s had manually-controlled bow-foil flaps which could be used in coordination with the rudders to execute banked turns.

By the late 1980s, the strain imposed on the hydrofoils by regularly applying full power to become foilborne, running for 8 to 10 minutes, and then returning to idle power again was starting to show as maintenance costs climbed. Eventually the unreliability and cost of the service became a public issue. A collision with a seawall whilst manoeuvring in back-up control effectively put *Manly 4* out of service for around two years from late 1986 and the impression created for the casual observer, perhaps even within the State Transit Authority, was that the hydrofoils were unreliable and needed a lot of maintenance. Poor industrial relations during the 1980s further contributed to the lack of availability of the hydrofoils, which again may have been attributed to problems with the boats themselves.

In 1988, NSW Liberal opposition politicians made the promise that, if elected, they would introduce wave-piercing catamarans to operate the service. When they won the state elections that year, the new Minister for Transport, Bruce Baird, announced that catamarans would replace the hydrofoils "within two years" [10]. One of the reasons that wave-piercing catamarans were not finally selected was because they were too wide to be accommodated in the Balmain dock.

A design by International Catamarans of Sydney, to be built by NQEA Australia in Cairns, was eventually adopted and three JetCat catamarans were built. The first, the 250-seat *Blue Fin*, was introduced into service in July 1990, followed by *Sir David Martin* in December 1990 and finally *Sea Eagle* in March 1991. The latter two both seated 280 passengers with the inclusion of 30 outside upper-deck seats. These catamarans were purpose-designed to replace the larger hydrofoils to the point of matching the existing hydrofoil wharf infrastructure.

Some years subsequently, *Blue Fin* was upgraded to also include upper-deck seating while the main-deck seating on all three catamarans was re-configured to cater for wheelchairs, resulting in permanent seating for 268 passengers. In their current configuration, JetCats have 14% greater seating capacity than the largest hydrofoils which served on the route.

For a time, depending on maintenance schedules, the JetCats and hydrofoils operated side by side. However, following the introduction of the third JetCat the hydrofoils were 'officially' withdrawn on 29 April 1990. The four remaining hydrofoils, *Sydney*, *Manly 4, Curl Curl* and *Long Reef* were eventually sold to an Italian company for $A3.35 million in October 1991. In February 1992 they were shipped to Italy and all, except *Long Reef* which was cannibalised, were refurbished and introduced on various northern hemisphere routes. Only *Fast Blu* (ex-*Sydney*) still remains in service. While *Curl Curl* is laid up as *Spargi*, she remains in good condition pending sale. *Fairlight*, *Dee Why* and *Palm Beach* had already been withdrawn from service in 1985–86 and were scrapped in 1988.

The JetCats ran into mechanical troubles almost immediately. *Blue Fin* required an engine replacement at an early stage of her trials, and attracted adverse comment on the waves she generated. Less than a year after their introduction, one of the hydrofoils had to be brought out of retirement because all three JetCats were out of service [10]. The fuel consumption was also greater than for the largest of the hydrofoils and, just as with the hydrofoils, JetCats were encountering mechanical problems and high operating costs on this run. By 1997, when there was only one operable JetCat available on several occasions, the State Transit Authority admitted that they were unsuited to the short-haul Manly run and consideration was given to replacing them [10].

Incat Designs/NQEA Australia JetCat *Sea Eagle* on the last day of service with Sydney Ferries. The type served from 1990 to 2008
(Photo Chris Verdich)

In 1999, a significant vessel replacement strategy, including for the JetCats, was announced whereby twelve 250-passenger vessels, to be known as SuperCats, were to be built by ADI Ltd to serve almost all Sydney Ferries' routes from Rydalmere to Manly. On the face of it, the objective of utilising a single design for the diverse routes made good economic and operational sense, due to economies of scale and more-efficient use of spare vessels [10]. However this placed conflicting requirements on the design from low wash to seaworthiness for operation across Sydney Heads, while also catering for a range of different wharfs. Compromises were inevitable.

An initial contract for two vessels was signed, and the first SuperCat, *Mary MacKillop*, entered service in 2000 on the Circular Quay-to-Manly run. However with a service speed of 24–26 knots and only one passenger door able to be aligned with the existing wharf gangways, this boat was unable to maintain the tight timetable operated by the JetCats [10]. Concerns were also raised by crews over the vessel's ability to handle heavier seas, as the 2.1 m wave height limit appeared generous. When the second vessel, *Susie O'Neill,* entered service, the vessels were utilised on inner harbour routes when not required on the Manly run.

On 28 March 2001, *Mary MacKillop* was operating a morning peak service from Manly when a large wave came over the bow, smashing a Perspex visor and soaking a large number of passengers on the forward deck. Thereafter, the swell at the heads resulted in further cancellations [10]. The SuperCats entered service with 1D survey, allowing operations to Manly; however, a more-serious incident occurred in 2001 when a large wave broke over the bow of *Susie O'Neill* at night and damaged the forward cabin bulkhead and flooded the cabin. As a result of this incident, certification was reduced to 1E and Sydney Ferries withdrew the SuperCats from the Manly run and chose instead to re-engine the JetCats during 2002–03 (the estimate to do so was $1.3 million per boat) to continue on the Manly run.

The un-christened SuperCat 4 departs Circular Quay. The type served from 2000 onwards however only until 2001 on the Manly run
(Photo Chris Verdich)

Today, the only permanent operating area for the SuperCats is the eastern suburbs between Circular Quay and Darling Point, Double Bay, Rose Bay and Watsons Bay. This they do remarkably well, and they are a major reason for the success (in passenger numbers) of this service. SuperCats have always been popular with passengers. They are comfortable, have a good balance of inside and outside seating, and are generally reliable.

In the November 2008 NSW Government mini-budget, the decision to withdraw the JetCat service was announced. The last scheduled JetCat services were run by *Blue Fin* and *Sea Eagle* on the morning of 31 December 2008 [10].

Hydrofoil Operational Problems

On the morning after she commenced her scheduled service, the bow foil of PT 20 *Manly* hit the wharf at her depot while going astern. The damage was minor with the foil ram being torn from its mounting and the boat was back in operation a couple of days later [7, 8]. Perhaps this was an omen that operation of fast ferries on Sydney Harbour would be problematical.

Debris floating in the harbour was a hazard for hydrofoil operations. In the early years, the craft were subject to significant propeller damage as a result of debris strikes, usually from timber, but also one report of *Manly 3* striking a large sunfish resulted in the hydrofoil being out of action for several days. As were all early PT 20s, *Manly 3* was fitted with a single centreline rudder and a propeller mounted forward of the aft foil. In this configuration, the propeller was frequently damaged by debris (at one stage 50 times in only two years of operation [8]). When fully loaded, the boat was also reluctant to turn to port, and *Manly* was sometimes unable to round Bradley's Head foilborne, requiring a speed reduction to execute a hullborne turn before taking off again on the required heading. To address these problems, in 1970 the rear foil was modified to a twin-rudder arrangement and the propeller was repositioned aft of the foil on an extended shaft [8]. This configuration was standard on the subsequent hydrofoils; however, the propellers remained susceptible to damage from driftwood. Ropes, timber and tyres could all become jammed between the propeller shafting and rear foil and would typically require a diver to clear the obstruction [8].

All the Sydney hydrofoils were equipped with propellers directly driven via inclined shafts, resulting in a flow angle into the propellers of about 12 degrees. This leads to a severe variation in inflow angle for the propeller blades through a full revolution. Consequently, the propellers suffered from cavitation erosion damage, mainly on the pressure face, leading to a propeller life as short as three months on the PT 50s. This had been partly addressed with two holes drilled through the root of each blade which extended propeller life to about two years, notwithstanding the need for ongoing propeller balancing during this period. Trials with alternative propeller diameter and pitch were also undertaken on a PT 50 in an effort to address this shortcoming. Propeller cavitation persisted on the RHS 160Fs, requiring regular propeller removal and repair. Propeller life before refurbishment on this type was as short as six to eight weeks of service. Repair of cavitation erosion could typically only be done up to three times before propellers became too weak as a result of the repeated welding. In contrast, RHS 160Fs on long-haul routes required propeller changes only once a year.

Plastic bags would also block the small cooling water intakes at the base of the rudders, resulting in engine overheating and seizure in as little as 30 seconds when running at full speed. Once a temperature rise was observed, power needed to be reduced quickly. The bag could usually be cleared by reversing the hydrofoil a short distance. Several engines were lost as a result of such blockages, simply as a consequence of the lack of an appropriate alarm.

Fairlight struck an unidentified object which partially sheared the dowel pins connecting the foil to the hull and resulted in a 5 degree rearward deflection of the foil. This necessitated repairs before the boat would fly again. This particular hydrofoil, originally intended for a private owner and so built with heavier scantlings, was also consistently sluggish during take-off until the bow foils were extended by 10 inches (212 mm) at their tips and the chord of both bow and stern foils was increased by 2% following advice from the designers [8].

When acquired, *Palm Beach* had consistent difficulty taking off with passengers in the forward cabin. Bricks were added in an aft space to re-trim the vessel [12]. Clearly, it would have been preferable to correct the apparent foil misalignment than to add such ballast weight to a fast ferry!

It was found from experience with operating the hydrofoils on Sydney Harbour that it became necessary to dock them every three months for hull cleaning. Beyond this timeframe, a fall-off in performance was apparent, resulting in a reduction in the number of passengers that could be carried and an increase in take-off time (with corresponding high engine loading and temperatures during that phase). Difficulty had also been experienced in finding a suitable antifouling paint system for application to the foils. The antifouling tended to be eroded from the leading edges of the foils and rudders, with a consequent increase in the rate of weed growth. The quality of the paint application to the foils also had a significant impact on performance, with spray-painted coatings noticeably reducing take-off times [8].

One critical point in the design of the PT 50 on the Manly run was the lack of engine-room air-supply fans. Air induction into the engine room was by a single small forward-facing vent located near the base of the mast, which relied on the forward motion of the vessel to direct air into the engine room. The only time the engine room had positive pressure was when the boat was travelling at 32 kn into a 30 kn headwind. This ram effect caused the engine room hatch to rise up and down like a relief valve blowing off excessive pressure. When the boats were struggling to take off with full loads, the engineer would lift the engine room hatch to allow more air into the engine room. The negative pressure in the engine room was such that it required a significant amount of force to lift the hatch.

Due to limited accessibility for maintenance of engines in the machinery space, it was found to be more cost effective to remove the engines from the hydrofoils at 6000 hour intervals. Normally, with better accessibility, engine removal could have been avoided until 12 000 hours. Exchange of engines with refurbished spares required four to five days compared to 10–11 days to attempt a top overhaul with the engines in place and the resulting loss in availability and revenue earning capacity [8].

At least up until 1975, holing of the cylinder liners was a common problem worldwide for hydrofoils fitted with Maybach Mercedes turbocharged V12 diesels, with failures occurring at intervals between 3000 to 5000 hours. The pin-hole failures through the liners resulted in loss of engine cooling water and subsequent overheating [8].

The gearbox originally fitted to PT 20 *Manly* and PT 50 *Fairlight* were engaged electrically. The coils on these failed at times varying between 40 and 2000 hours. Subsequent hydrofoils employed electro-hydraulically engaged gearboxes, which were more reliable and the initial two were subsequently also converted to this design. This also resolved a problem on *Manly* in which the clutch would engage or disengage as a result of the operation of the radio telephone [8]!

Failures with fuel pumps, governors and fuel racks, and splitting of the compressor wheels and subsequent overall failure of turbo-charger units, also caused problems at least into the 1970s. At one stage, several breakages of shaft-support brackets occurred on one hydrofoil and a shaft broke on another. This is likely to have been a result of striking larger debris with consequent shaft misalignment. Due to the light construction of the hydrofoils, their hulls were relatively flexible. Shaft re-alignment therefore required the boats to be supported on their rear foil and as-near-as-possible to the bow foil before six tons of ballast was added throughout the cabin to simulate the passenger load [8].

Supramar design charts indicate that the PT 50 is capable of operation at full power in waves of up to 1.7 m height and up to 2.7 m foilborne at reduced speed. In practice, the hydrofoils were able to operate in up to 6 m beam seas for the relatively short crossing of Sydney Heads. However, they had more difficulty coping with the larger following seas which could be encountered approaching Manly. If the hydrofoil was operated at near to the speed of waves, care was required controlling the vessel in such a surf-riding condition. Alternatively, if the hydrofoil was allowed to slow down too much, it would tend to fall off the waves and become hull-borne again [8].

In 26 years of operation, the hydrofoil service was cancelled only a handful of times due to sea conditions at the heads. Surge motions at Manly wharf had a larger impact on the conventional ferries than they did on the hydrofoils and later JetCats.

Manly 4 and *Sydney*, the RHS 160Fs built by Rodriquez, suffered from cracking in the aft superstructure, rear hull and fuel tank regions. This was, in part, attributed to a lack of longitudinal continuity of structural elements in these areas and the generally-inadequate structural design at the rear of the boats [11].

The standard RHS 160F design offered by Rodriquez, with seating for up to 210 passengers, had the wheelhouse on top of the belvedere cabin. The decision to incorporate the wheelhouse on the main deck on the non-standard Sydney RHS 160Fs was due to the belief that it was too far for the engineer to reach the engine room from the wheelhouse in the event of emergency. The consequence was that 235 passengers were crammed into a smaller space which was normally provided to accommodate 15 less passengers. This necessitated a fairly-narrow seat pitch and spartan seats by hydrofoil standards. Thankfully, this was only for a 15 minute trip. A decision was also taken by the UTA to specify non-standard Reintjes gearboxes for these vessels, instead of the standard specification ZF gearboxes. Needless to say, early problems with the non-standard gearboxes resulted in some of the first cancellations of the new boats.

With hindsight, the RHS 160Fs were not the most-suitable hydrofoils for the demanding Manly run. The PT 50s were better suited, due to their simplicity, manouvreability and robustness.

We would like to stress that, at the height of the hydrofoil service, it operated 15 600 scheduled trips per year which over time, for various reasons, was reduced to 5928 at the time when JetCat services were withdrawn. We are disappointed that, when reliability comparisons are made with other vessels, the heavy workload of the hydrofoils is never taken into consideration.

JetCat Operational Problems

The primary concern with the JetCats in the early years was the occurrence of engine room fires. Between July 1990, when the first JetCat went into service, and April 1992 there were five engine room fires, the result of a faulty fuel line that, at one stage, put the entire fleet out of service for nearly two months [10]. This problem was apparently due to rubber connections in fuel lines becoming worn due to vibration.

The original MWM TBD 604B V16 engines fitted to the JetCats were undersized (1675 kW each). An engine in *Blue Fin* failed even before the boat was introduced into service. The JetCats were ultimately re-engined with larger Deutz MWM diesels de-rated to 1840 kW each.

The JetCats were designed to allow quick engine changes, but Sydney Ferries did not hold any spare engines to allow this facility to be used. There were insufficient stocks of major JetCat equipment items held, which reduced boat availability and reliability.

Initially, the waterjets suffered blockages from debris. Grills were subsequently added to the inlets, and the harbour has become progressively cleaner over recent years so that debris is no longer a significant problem. Garry has experienced some three to four blockages over the 19 months he served on JetCats and these blockages were cleared by back flushing.

Apart from mechanical problems, there were also complaints that the JetCat wash was damaging boats, moorings and seawalls in Manly Cove, and that the smell of engine fumes gave shopkeepers on Manly wharf headaches [10].

SuperCat Operational Problems

Teething problems were initially encountered with the SuperCats, the most serious being stray voltages causing control failures. After correction, the vessels settled into service.

A significant shortcoming of the SuperCats on the Manly run was their low freeboard [10]. It was claimed that the vessels' maximum operating sea state of 2.1 metres would only be exceed on 2% of days. However two incidents where the boats impacted heavily with waves relatively early in their operations suggest that seaworthiness may have been an ongoing problem on the Manly run. The success of this class could have been very different with more freeboard and buoyancy forward; however, this would have prevented operation to many inner-harbour wharves.

The SuperCats were also criticised for their speed on the Manly run, taking 20 minutes to complete what is supposed to be a 15 minute run. One night, when a SuperCat and JetCat were on same run, the JetCat remained on its departure timetable and eventually caught up with the SuperCat which was falling behind its schedule due to speed loss in waves and longer embarkation and disembarkation times. Unlike the JetCats, the design of the SuperCats wasn't compatible with the berthing arrangements at either end due to the positioning and arrangement of the board areas.

Due to their small original rudders, the SuperCats had poor low-speed control, especially in windy conditions. Larger rudders were subsequently fitted which improved slow speed manoeuvring.

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Authors

Garry Fry is a Master with Sydney Ferries, most recently having commanded JetCats; however, at various times has commanded all vessel types in the current fleet with the exception of the RiverCats and HarbourCats. He operated the last scheduled Sydney Ferries JetCat service with *Blue Fin* on 31 December 2008. He commenced his career with the Urban Transit Authority in 1981 as a deckhand on the hydrofoils. He retains a passion for hydrofoils to the extent that in 1995 he purchased ex-New Zealand PT 20 *Manu Wai* in partnership and oversaw the repair of this hydrofoil for commercial use around Sydney Harbour. Garry is a member of the International Hydrofoil Society.

Martin Grimm is a naval architect engaged with Navy Systems Branch of the Department of Defence in Canberra. His has mainly dealt with ship hydrodynamics, but also concept design and design evaluation. He has likewise had a longstanding passion for hydrofoils and maintains this interest as a hobby. He is a Member of RINA, Associate Member of SNAME and member of the International Hydrofoil Society.

EDUCATION NEWS

Curtin University

Short course on Ships in Shallow Water

The Centre for Marine Science and Technology, in conjunction with Australian Maritime College, will be running a one-day course on ship under-keel clearance on 30 March 2009. Dr Tim Gourlay (CMST) and Dr Jonathan Duffy (AMC) will be presenting this specialised course covering the state-of-the-art in squat prediction, model tests and full-scale trials, wave-induced motions in shallow water and overall grounding risk. The course will focus on containerships, bulk carriers and tankers in shallow water, and is recommended for pilots, harbour masters and those interested in shipping channel design. Further information about the course is available from www.waera.com.au.

Underkeel Clearance Research

CMST has a new postgraduate student, Nina Ribbat, who will be analysing meteorological effects on tidal heights and streams in Torres Strait. The aim of the project is to develop methods for predicting tidal height and stream residuals in the short term, which will increase the accuracy of the overall tidal predictions, helping to ensure sufficient under-keel clearance for ships transiting the strait. These methods will be built into CMST's "KeelClear" software which is currently being used by Australian Reef Pilots to plan ship transits through Torres Strait.

Innovation in the Marine Industry

RINA past-President, Nigel Gee, occupied the position of Innovator-in-Residence at Curtin University from October 2008 to February 2009. His brief covered the following points.

- How should we engage industry and academe for maximum benefit of the marine community?
- What are the future needs and expectations for marine technology research?
- How do these needs impact industry and the wider WA community?
- What education and training programmes need to be put in place to meet expectations?
- How do we link the science and arts components of marine design?
- How do all these issues affect the broader community at street level?

Nigel gave a highly-acclaimed public lecture at Curtin in December, addressing many of these issues, and met with industry and government stakeholders in WA, Canberra and Tasmania. The net outcome was a report with recommendations for the marine industry, which will be followed up by Curtin in the coming months. Further information on the report findings are available from Dr Kim Klaka at the Centre for Marine Science and Technology, Curtin University, email k.klaka@curitn.edu.au or telephone (08) 9266 7380.

Schools Outreach Program

As part of his activities whilst at Curtin University, RINA past-President, Nigel Gee, developed a naval architecture road show and travelled around Western Australian schools, introducing naval architecture to over 600 high-school students.

Part of the road show included the use of possibly the world's smallest suite of transportable towing tanks, built at Curtin. This comprised four tanks, each 1500 mm long and 150 mm diameter of semicircular cross section. Cardboard boats were built by the students and tested using falling-weight dynamometers. Thin and fat ships of the same displacement were compared at different speeds, as were catamarans, trimarans and some more exotic hull forms (dragon boat, space shuttle, drink bottle, etc.). The enthusiastic response of the students indicates that we can expect a glut of naval architects over the next decade!

Kin Klaka

Students at work with the tiny towing tanks
(Photo courtesy Curtin University)

University of New South Wales

New Programs Complete Rollout

The new degree program structure, which commenced rolling out for Year 1 students in 2006, rolls into Year 4 this year and completes the new structure. Under the new structure, all courses are worth six units of credit (6 UoC), where, previously, there had been a combination of 3 UoC and 6 UoC courses. The resulting lower number of courses means that students have fewer exams at the end of session, but a heavier reliance is placed on in-course assessment and the consequences of a failure in a big course are more serious.

Feedback from students in Years 1, 2 and 3 so far has generally been positive, especially for the Year 1 introduction to design, ENGG1000 Engineering Design and innovation.

Thesis Projects

Among the interesting undergraduate thesis projects recently completed are the following:

Twelve-Foot Skiff Hullform Resistance Investigation

Toby Austin-Fraser investigated the resistance characteristics of the two principal twelve-foot skiff hullforms, using a

range of resistance-prediction methods. The bulk of the time was spent on using computational fluid dynamics for the resistance prediction. However, this was backed up with Lawry Doctors' program *Hydros*, the Savitsky planing equations, and a home-grown method, finding reasonable agreement between the methods, and that the hullforms differed in their optimal points of sailing.

Free-wheeling vs Locked Propellers

Rebecca Dunn investigated the case for and against locking the propeller on a sailing yacht. Using the four-quadrant data for the B-series propellers (which had been cross faired by Roddy, Fess and Haller 2007), she found similar results to Cox (1985), i.e. that for each forward speed of the vessel, there is a rotational RPM above which it is better to free wheel, and below which it is better to lock. Much depends on the rotational resistance of the gearbox/shafting combination. However, a practical test of sailing at different speeds and measuring the rotational speed achieved by the propeller, and then comparing with the calculated critical speed for that propeller can resolve the issue. The gearbox characteristics themselves may determine whether free wheeling is permitted. A point of particular interest is that the maximum resistance is not achieved by a locked propeller, but by a propeller which is allowed to rotate slowly!

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Post-graduate and Other News

Head of School

Professor Eddie Leonardi, Head of the School of Mechanical and Manufacturing Engineering, lost a four month battle with melanoma and died in a German hospital on Sunday 14 December 2008, aged just 56. He obtained his BSc (Eng) in mechanical engineering and his PhD (supervised by John Reizes) at UNSW.

Many will remember Eddie for their solid grounding in thermodynamics, and the many honours and awards he obtained for his research and involvement with industry.

He is survived by his parents Giuseppe and Bice, his wife Victoria, his sons Christopher and Adam, and his sister Julie and brother Stephen.

A/Prof. Philip Mathew is Acting Head of School until the appointment of a new Head.

Engineering Alumni Dinner

The year of graduation is taken as the year in which your testamur was awarded. For most graduates, this is usually in the year following that in which their last coursework requirements were completed. For example, if you completed your coursework requirements at the final exams in November 2008, then you would expect to graduate in April 2009, and 2009 would be the year of your graduation. The Engineering Alumni Anniversary Dinner for 2009 will be held on Friday 21 August 2009 at 1900 in Leighton Hall, Scientia Building, for the graduates of 1959, 1969, 1979, 1989 and 1999. So, if you graduated with Matthew Cleary (1999), Glenn Williams (1989), Dave Beresford (1979), or Laurie Prandolini (1969), then you should be dusting off the tux, polishing your shoes and asking your partner to keep the evening of Friday 21 September free.

Prof. Eddie Leonardi
(Photo courtesy School of Mechanical and Manufacturing Engineering)

The latter class is distinguished by being UNSW's fourth graduating class of naval architects, the first having been Brian Robson in 1963.

Watch this space for updates, or check the Engineering website www.eng.unsw.edu.au/news/index.htm.

Phil Helmore

Australian Maritime College

Honorary Degree for Maritime Education Pioneer

A pioneer of maritime education in Australia has been recognised for his contribution to maritime training and education with the conferment of the honorary degree of Doctor of Laws.

Foundation principal of the Australian Maritime College, Danny Waters, was awarded the Honorary Doctor of Laws at the Australian Maritime College's section of the University of Tasmania's graduation ceremonies on 13 December 2008.

In conferring the degree, the University of Tasmania's Vice Chancellor, Daryl le Grew, told Chancellor, Damien Bugg, that Dr Waters had made an enormous contribution to maritime education in Australia and overseas.

"As the architect of tertiary education for mariners and those in maritime-related professions in Australia, he

(Dr Waters) was responsible, almost single-handedly, for bringing maritime education in this country into the 20th century," Vice Chancellor Le Grew said.

"Danny Waters' contribution to education has been both substantial and without parallel. Mention his name anywhere in maritime circles throughout the world and you are likely to be met with nods of approval and recognition of his role as a doyen amongst maritime educators. He has been recognised for his achievements through his appointment as a Member in the General Division of the Order of Australia. It is fitting that the University of Tasmania should recognise his contribution in this year in which the AMC has affiliated with UTas, through the conferral of the honorary degree of Doctor of Laws."

Dr Waters, now retired, welcomed the recognition, but stressed that he was only part of a collective achievement in the early 1970s that led to the foundation of AMC in 1974. "The Hon. LLD bestowed upon me by the University of Tasmania is greatly appreciated, particularly at this time of integration of the Australian Maritime College into the university structure — consolidating, as it does, the transfer of maritime education and training into the national education system at the highest level.

"It is not often that one gets the opportunity to be involved in establishing an institution such as the AMC. I was fortunate to be 'in the right place at the right time' as were all my colleagues who worked so hard to make it happen. I look upon the award as the recognition of what we collectively achieved."

Dr Waters spent 11 years as Principal of AMC and, among his achievements, he is credited with developing it into an internationally-regarded training organisation.

On leaving AMC he became Rector (Vice-Chancellor) of the UN World Maritime University in Malmo, Sweden, where he spent another six years. According to Vice Chancellor le Grew, Dr Waters introduced academic rigour and structure to the courses of the University and established research capability, placing it on an entirely new footing and allowing it to be recognised in its own right as a university worthy of note.

Though he retired aged 67, Dr Waters continued as a consultant to the International Maritime Organisation (IMO) and guest lecturer at WMU for several years. He is presently living in Queensland.

Doctor of Philosophy Awarded to Jonathan Duffy

After many years of hard work, Jonathan Duffy was recently awarded his Doctor of Philosophy (PhD) degree for his dissertation on the *Modelling of Ship-bank Interaction and Ship Squat for Ship-handling Simulation*. As part of his PhD thesis, Jonathan developed a technique to predict the real-time manoeuvring behaviour of a ship operating close to the sea floor and/or lateral banks. This can be used to assist with port channel design, ship operation training and to establish safe port operating procedures. This research is very complementary to the work Jonathan undertakes as part of his role as a Research Engineer within the AMC's National Centre for Maritime Engineering and Hydrodynamics, where he regularly collaborates on projects with facility staff of the AMC's Towing Tank, Model Test Basin and Ship Handling Simulator. Congratulations Dr Duffy!

Maritime Engineering Staff Changes

The past couple of months has seen a few changes to key staff within the National Centre for Maritime Engineering and Hydrodynamics. Our respected leader, Professor Tom Hardy, has resigned from AMC for personal reasons after four years at the helm. Also departing in December 2008 was Dr Prasanta Sahoo after almost 17 years of service. We would like to take this opportunity to thank both Tom and Prasanta for their very considerable service to the AMC and the major role they have both played in delivering a valuable service to the College.

Joining the team in November 2008 was Dr Shuhong Chai. Dr Chai earned her Masters degree in marine hydrodynamics in 1992, specialising in the area of interactions between ship hull and propeller. She then became a lecturer, teaching in the Department of Naval Architecture and Ocean Engineering at Dalian University of Technology in China, until 2000 when she began a doctoral program at the Universities of Glasgow and Strathclyde in Glasgow, UK.

Her PhD research work focused on *Experimental and Theoretical Investigation of the Hydrodynamic Properties of Damaged Ships*. She was also involved in the development of model-testing methods for ro-ro ferries for intact stability, damaged stability, and survivability. She worked on the EU projects *Time-Based Survival Criteria for Ro-Ro Vessels* and *First Principles Design for Damage Resistance against Capsize*.

Dr Chai joined Oceanic Consulting Corporation, an engineering consulting corporation based in Canada, in late 2003 as a senior hydrodynamicist. She worked on a variety of marine performance evaluation projects for ships and different types of offshore structures. Dr Chai gained several years of experience in marine hydrodynamics and ship-performance evaluation by means of model testing and numerical prediction during her time working with Oceanic. She became an Associate member of the Society of Naval Architects and Marine Engineers in 2005.

Dr Chai joined the Australian Maritime College as a Senior Lecturer in November 2008. Her research interests are in the area of marine hydrodynamics and offshore engineering, such as wave dynamics, hydrodynamics of offshore structures, dynamics of marine cables and risers, and vortex-induced vibration.

Innovative Cat Sets New Course in Gas Industry

The future of offshore gas has been put to the test at the Australian Maritime College — and the results are promising. The project calls for two 330 m tankers to be joined together as a catamaran. The vessel would then be fitted out as a gas-processing facility to be used offshore in the gas fields, replacing pipelines and onshore facilities. At around 640 000 t, it would be the largest operational vessel in the world and point out a new direction in the gas industry.

A fully-painted, four-metre long "visualisation model" has recently been undergoing testing at AMC's Model Test Basin to see how the vessel performs in a range of weather conditions, including 20 m high waves and 100 kn winds.

In a research project between WA Energy Research

Alliance, Woodside Energy and the Australian Maritime College, the gas cat first underwent testing in July 2008 and more testing is planned over the next three years.

Originally the idea of WA ERA chief executive Dr Ian Finnie, the project was taken on by fourth-year maritime engineering students Landon Kibby and Alexandra Ford. Things have moved ahead and the project has now been joined by Prof. Andrew Deeks, a structural mechanics specialist from the University of Western Australia, who will have major involvement in the next phase. "Being able to link the structures together with the behaviour of the vessel — I think there are some unique challenges there," Prof. Deeks said at AMC's Model Test Basin.

According to Dr Finnie, the project has already been successful on two major fronts — student engagement and awareness of AMC's facilities. "Woodside sponsors the project, not so much because of the technology, but because of the engagement with AMC and its students. So the project is already a success because it has made people over in the west aware of this facility and it has also made students here aware of the oil and gas companies over there and vice versa," he said.

Woodside's original plan to engage students in some problematic engineering projects has now developed a life of its own. "The project lives on. The reason, I think, why these obvious ideas don't exist in reality, is because people reach the too-hard basket and it doesn't go further. But what we're doing is just getting the fundamentals there and doing some reality checks. The next critical one for us is structure and that's where Andrew comes in," Dr Finnie said.

Senior lecturer, Dr Giles Thomas from AMC's National Centre for Maritime Engineering and Hydrodynamics, also believes the project has been a fantastic vehicle for students. "It's an amazing project and an incredible opportunity for our students to be involved in something like this," he said.

Visiting Researcher from University of Osaka

Dr Atsuo Maki, from the University of Osaka, recently spent some time as a visiting researcher at AMC, predominantly to work with Professor Martin Renilson on a collaborative research project into the broaching-to of marine vessels.
While at AMC, Dr Maki made a presentation to staff and students titled *How to Avoid Broaching-to — in Light of Non-linear Dynamical System Theory and Optimum Control Theory*. When a ship runs in following and quartering seas, it is in danger of broaching-to, bow-diving and pure loss of stability. Among them, broaching-to is well-known as a very-dangerous phenomenon. Once broaching-to happens, ships can experience large roll angles, and even capsize due to violent yaw motion. In this seminar, Dr Maki explained this dangerous phenomenon and then presented operational criteria based on a non-linear dynamical system theory. The effect of steering with an optimum control theory was also discussed and video footage of capsize model tests was shown.

While in Australia, Dr Maki also attended the RINA conference on *Innovation in High-speed Marine Vessels*, where he presented a paper which he co-authored with Professor Naoya Umeda (also of the University of Osaka) and Professor Martin Renilson of AMC.

AMC launches National Campaign with Careers Advisors

More than 50 school Careers Advisors (CAs) from Tasmania and interstate spent a day at AMC to get a first-hand experience of careers in the marine and maritime industries.

It is the first in a series of national events which will also see AMC play host to CAs in Melbourne, Brisbane and Cairns.

The CAs enjoyed guided tours by students and staff, and workshops on courses and careers as well as getting the chance to actually use the facilities, including the maritime engineering and hydrodynamics facilities and the aquaculture centre. A lunchtime forum with industry figures was led by Regional Industry Career Advisor, Sam Cawthorn. After a trip to the Beauty Point campus in the afternoon, the day finished with an evening cruise on the Tamar River.

According to the manager of AMC's Marketing and Brand Management, Rob Palmer, the event is an acknowledgement of the crucial role which careers advisors play in steering students towards the right choices as they leave school. "The research we undertook last year pointed to the fact that CAs play a crucial role in leading students into tertiary education," Mr Palmer said. "A very large number of students look to their CAs for critical advice, so we think it's crucial that we do all we can in acknowledging their importance in the process. The program we've launched today is all about giving CAs a very personal experience of what AMC offers in terms of teaching and future careers. We see this as a fresh approach to student recruitment which could have a really positive effect for numbers on the University's northern campus," Mr Palmer said.

Gregor Macfarlane

Research Activities within the AMC National Centre for Maritime Engineering and Hydrodynamics

The National Centre for Maritime Engineering and Hydrodynamics (NCMEH) has an outstanding suite of maritime hydrodynamic experimental facilities which compares favourably with those of any university anywhere in the world. These facilities are an important component of what makes AMC a National Institute with importance in education, consulting and research.

The Cavitation Tunnel is an advanced experimental facility for fluid mechanics research which enables basic research into the performance of naval platforms and high-speed craft, and naval hydrodynamics generally. It is in the final stages of the completion of a redesign and development of a brand new facility which will be fully operational by mid-2009. The facility was conceived to be the most sophisticated medium-sized variable-pressure water tunnel worldwide for experimental modelling of cavitation physics. Its principal capabilities include precise control of dissolved and free gas in the test flow, which are critical for modelling of nucleation and diffusion processes. Knowledge of the hydrodynamic performance, including noise signatures, of surface and sub-surface naval platforms is essential in the early design process of any acquisition program. The Royal Australian Navy, in conjunction with the Defence Science and Technology Organisation and Australian defence industry, has made significant use of the facility over previous years, and the need to do further work is anticipated with planned Defence acquisition projects. This facility also plays a key role in skill development in support of naval acquisition programs, operational studies and training of personnel in associated government and industry sectors. AMC has a research facility which is unique in Australia (in fact, in the southern hemisphere) and will have some features that are the best in the world.

AMC's Towing Tank and Model Test Basin are productively committed in teaching, industry interaction and research. In total, research projects in 2008 generated over $500 000 worth of gross income. Two examples are as follows:

(a) Significant work was undertaken for export mining companies to investigate berthed ship motions and mooring loads for a proposed major port expansion. This involved physical scale-model experiments within the Model Test Basin to predict the effects of ship-ship interaction. The studies also included a series of numerical predictions to predict the effects of wind, waves, current and swell on the berthed ship motions and mooring loads.

(b) Physical modelling projects were conducted for Australian companies to investigate the performance and viability of a number of marine renewable-energy concepts. Several ocean-wave and tidal-energy concepts have been investigated, with at least two of these now having progressed sufficiently that prototypes are expected to be deployed in Australian waters during 2009.

The Circulating Water Channel is a recirculating open-water channel used to study the dynamic motions of surface and underwater vessels, bodies and appendages, such as fishing gear and offshore oil pipelines, as well as the changing geometry and external loads associated with flexible structures, such as fishing nets and sea-cage nets. The CWC has growing importance as a test facility for components for the offshore oil and gas industry and, in particular, those which show hydrodynamic instabilities over long test periods. Control of dynamic motions of surface and underwater vessels in the channel flow is achieved using a Horizontal Planar Motion Mechanism developed by the research partners, in particular DSTO. This facility is the largest of its type in the southern hemisphere.

The Diesel Spray Chamber is an optically-accessible pressure vessel and ancillary instrumentation for studies of diesel-engine spray dynamics, which has been designed and implemented at AMC. The chamber is designed for relatively-long sprays relevant to marine engines. The aim is to produce high-quality data to enhance understanding of the dynamics of sprays and to calibrate the complex computer models which are used to design engine-combustion systems. The data will aid design of engines for reduced emissions of oxides of nitrogen, particulate matter and greenhouse gases.

AMC's Computer Cluster (33 linked PCs) is undergoing a complete upgrade, replacing the array of computers with an equal number of four-processor machines with substantial increases in memory. This will allow increased capacity for existing NCMEH research, such as in the marine modelling of tropical cyclone winds, waves and water levels, CFD modelling in fluid mechanics, including multi-phase flow in cavitation and diesel engine injector research, smooth particle hydrodynamic solutions to fluid-structure interactions, as well as many other applications which our staff and students will now find possible.

NCMEH is committed to revitalising and strengthening its research performance to become one of the premier research groupings in the University of Tasmania, and to establish recognition that NCMEH is among the best maritime engineering research organisations worldwide. In order to achieve these goals, AMC recognised that it did not have the critical mass of researchers which was necessary to fully utilise AMC's outstanding suite of research equipment. With some funding from the Integration of AMC and the University of Tasmania, NCMEH has been able to recruit three additional researchers.

During 2008 AMC has established a strong presence in several of the technical committees of the International Towing Tank Conference (ITTC) during its recent gathering in Fukuoka, Japan. The ITTC forms international policy and standards associated with experimental practice on ship resistance and powering, seakeeping and ocean engineering, propulsors and cavitation, and high-speed marine vehicles and manoeuvrability. Professor Neil Bose now sits on the Advisory Council with more than 30 other organisations, representing the world's leading maritime hydrodynamic facilities. In addition, AMC was successful in gaining two technical committee appointments, meaning that it is now heavily represented in the international body. While AMC's towing tank manager, Gregor Macfarlane, stepped

down from his three-year appointment to the Resistance Committee, Professor Martin Renilson was appointed Chair of the Stability in Waves committee, and Dr Giles Thomas was appointed Secretary of the High-speed Craft committee. These positions give AMC a voice in an important forum at the core of its activities.

Examples of Some Current AMC Research Projects

Autonomous Underwater Vehicle missions in Newfoundland 2008

The AUV missions described here are preparatory missions to enable a planned project to assess sea-ice mass balance and habitat assessment in the Southern Ocean in East Antarctica. The plan is to use an autonomous underwater vehicle (AUV) for the under-ice component of measurements. The proposal involves international collaboration between researchers at the Australian Maritime College and the Antarctic Climate and Ecosystems Co-operative Research Centre of the University of Tasmania; the Memorial University of Newfoundland, who own the Explorer-class AUV; the Australian Antarctic Division; the underwater systems laboratory of IFREMER, France; the National Oceanography Centre, Southampton, UK; International Submarine Engineering Ltd., Vancouver; the University of Southern Mississippi; and the University of Cambridge. The ultimate goals are to quantify the size and shape of ridge-keel structures and their contribution to the sea-ice mass balance over a study region; to understand the processes which link sea ice with the distribution of ice algae and krill; to provide the necessary field measurements, over sufficiently large areas, for the calibration/validation of satellite and aircraft-based measurements of the sea ice and snow cover thickness; and to provide baseline measurements of sea ice thickness for future climate monitoring.

Preparatory Missions in Newfoundland, Canada

Dives were undertaken to investigate the navigational accuracy and reliability of the AUV in its current configuration.

The current acoustic communications configuration involves deploying the acoustic modem on an aluminum standoff three metres beneath the keel of the support ship, CCGS *Shamook*. The AUV was programmed to complete circles of approximately 40 m diameter at the surface and various depths up to 150 m. The ship was repositioned at standoff distances of 200 m, 500 m and 1 km. The experiments resulted in a greater understanding of the shallow-water acoustic communications reliability of Memorial University of Newfoundland's Explorer AUV system.

Figure 2 — Neil Bose with hydrophone at IFREMER, La Seyne-sur-mer, France, June 2008
(Photo by Michèle Drogou)

Further dives were designed to evaluate the AUV navigational accuracy. These were based on a straight line transect with a 180° turning point in the middle of the dive. Each dive commenced with the AUV circling a start point A on the surface for several rotations with the global positioning system (GPS) aiding the inertial navigation system (INS). The GPS was turned off and the vehicle continued to circle point A several more times. It was then programmed to proceed to a point B which defined the end of the transect, then turn around and return to point A. Upon its return to A the vehicle circled A several times before GPS input to the INS was re-established. It was possible to define a point A' that is the centre of this circle. The difference between A and A' was the INS error and this was determined for transect lengths of 1, 2, and 4 km. The experiment was conducted at the surface with bottom lock (i.e. DVL input to INS), at the surface without bottom lock, at constant depth with bottom lock, at constant depth without bottom lock and beneath the surface in bottom-following mode. A similar dive was prescribed for an equilateral triangle geometry with legs measuring 333 m, 1 km and 2 km. Longer dives mimic the Antarctic mission navigational requirements.

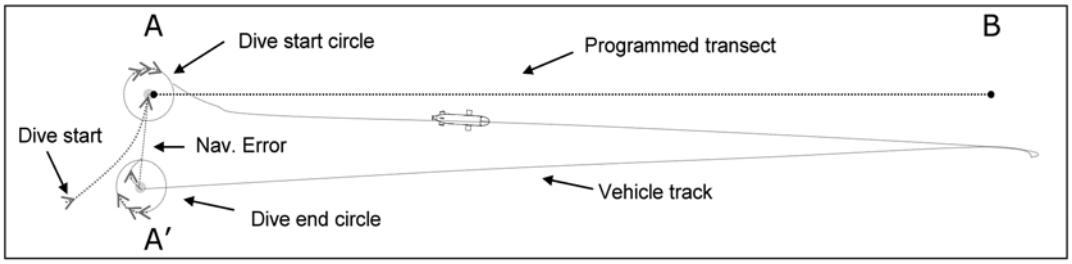


Figure 1 — Dive to measure navigational error for straight-line transect mission

Emergency AUV Location

A mission requirement is a low-frequency acoustic beacon for emergency location of the AUV. Such a beacon will be important if the Explorer finds itself lodged under ice, blocked by ice keels, off-course, or in some temporarily-misplaced state. Moreover, an acoustical heartbeat will enable some ability to range from the vehicle and maintain contact with the AUV during the mission. Several manufacturers are supplying acoustic hardware to address this capability. These hardware systems were examined using similar methods as were employed to quantify the AUV's acoustic communication-system reliability.

Experimental and Computational Research into the Hydrodynamics of Sailing Yachts

Participants: Dr Jonathan Binns (AMC), Dr Paul Brandner (AMC), Prof. Greg Walker (UTas), Mr Timothy Lilienthal (AMC), Dr Frank Albina (BMW Oracle Racing SL) and Mr Ian Burns (BMW Oracle Racing SL)

Funded by: AMC IRGS, in-kind contributions from BMW Oracle Racing.

This project aims to increase the effectiveness of small-scale testing (such as done at the AMC) for the performance-prediction of sailing yachts. This will be achieved through investigation of the flow physics around a sailing yacht. Advances will be made in flow visualisation techniques applicable to all testing facilities at the AMC, with correlation provided by computational fluid dynamics (CFD).

Extrapolation of experimental fluid dynamic (EFD) drag results to full scale for marine craft has traditionally involved attributing components of the total force to "viscous" and "inviscid" regimes. However, this division of forces does not correlate with shear and normal pressures on a body due to fluid flow, which sum to give drag. The traditional approach is therefore not rigorous in its methodology; rather it is an engineering approximation that has been made to work through empirical analysis.

State-of-the-art hot-film probes were loaned to the project from BMW Oracle Racing, as well as access to full-scale data produced by the probes for publication purposes. An initial result was the submission of the paper Binns, J.R., Albina, F.O. and Burns, I.A., 2008, *Looking for "Laminars": Measuring Intermittency on the America's Cup Race Course*, to the Journal *Experimental Thermal and Fluid Science*. The experimental setup used for these experiments is shown in Figure 3. The same hot-film probes have been used to investigate the detailed flow on a sailing Moth T-Foil; the vessel is shown in Figure 4 and the test set-up in the towing tank is shown in Figure 5. This work was due for publication in December 2008 in the paper Binns, J.R., Brandner, P.A. and Plouhinec, J., 2008, *The Effect of Heel Angle and Free-Surface Proximity on the Performance and Strut Wake of a Moth Sailing Dinghy Rudder T-Foil*, Proc. Third High Performance Yacht Design Symposium, Auckland, NZ.

Figure 4 — A Moth dinghy on hydrofoils. The centerboard and rudder T-Foils can be seen beneath the water surface. (Photo courtesy of Thierry Martinez, © www.thmartinez.com)

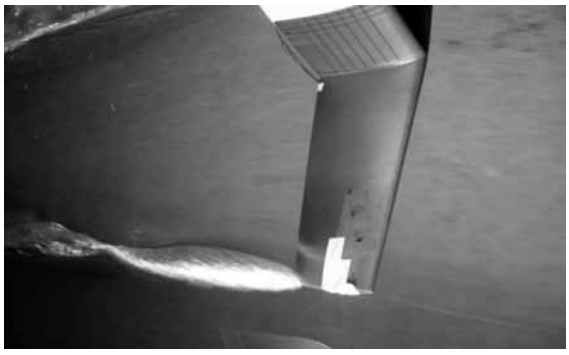


Figure 5 — The T-Foil being tested in the towing tank. The stick on hot-film probes can be seen just inboard of the tip of the ventilating foil. Complete foil ventilation follows shortly afterwards.

Figure 3 — Experimental set-up using the hot-film probes for full scale work in 2006. Stick-on hot-film probes shown in-situ on the keel in the centre image.

Enhancing the Fidelity of Human-in-the-loop Physical Sailboat Simulators

Name of participants: Dr Jonathan Binns (AMC), Dr Chris Chin (AMC), Prof. Neil Bose (AMC), Dr Chris Manzie (University of Melbourne), Prof. Malcolm Good (University of Melbourne), Prof. Norman Saunders (Virtual Sailing Pty Ltd), Dr Mark Habgood (Virtual Sailing Pty Ltd), Mr John Mooney (Virtual Sailing Pty Ltd), Dr Karsten Hochkirch (Friendship Consulting GmbH), Mr Frank de Bord (Chesapeake Marine Technology LLC), Mr Ian Burns (BMW Oracle Racing SL)

Funded by: Research contract with Virtual Sailing Pty Ltd, an AusIndustry Commercial Ready Grant and an ARC Linkage-Projects grant LP0883825.

The safe and effective control of vehicles by human operators generally requires a long period of skill development under supervision by experts in a controlled environment. The aim of a Human-in-the-Loop (HiL) physical simulator is to provide a human operator with a sufficiently-convincing replication of the real-world system to allow effective development and maintenance of relevant skills. In addition, computer-generated sailing simulation provides an effective method of assessing racing decision alternatives. Sailors, from beginners to world-class professionals, have used results developed and reported within this project.

For this project the AMC has engaged in collaborative arrangements with Virtual Sailing (VS) and the University of Melbourne (UoM). AMC brings extensive hydrodynamic experience essential for the realistic simulation of a sailing vessel, UoM has experience in control-systems engineering, and VS produces the world's only commercially-available physical sailing simulator.

2008 has also seen Dr Binns publish sailing simulator work conducted in 2006 in the paper Binns, J.R., Hochkirch, K., de Bord, F. and Burns, I.A., 2008, *The Development and Use of Sailing Simulation for IACC Starting Manoeuvre Training*, Proc. Third High Performance Yacht Design Symposium, Auckland, NZ. The results of this work were to predict the effects of varying pre-start manoeuvres during the America's Cup competition, and some results are shown in Figure 6.

A final dimension to this project is in the development of computer-controlled artificial intelligence. The aim here is to produce computer-controlled predictions for alternative manoeuvres such as those demonstrated in Figure 6, and to provide an automated opponent for race training. For this purpose, a final-year project has been conducted in 2008 by Mr Robert Maher at the AMC under the supervision of Dr Chin and Dr Binns. The culmination of this project was to produce a simulation controlled by Matlab which could then be raced against by a human operator on the main VSail-Researcher simulator which is jointly owned by AMC and VS.

Figure 7 — Robert Maher sailing the VSail-Researcher against his Matlab simulation running on the laptop in the left of the picture.

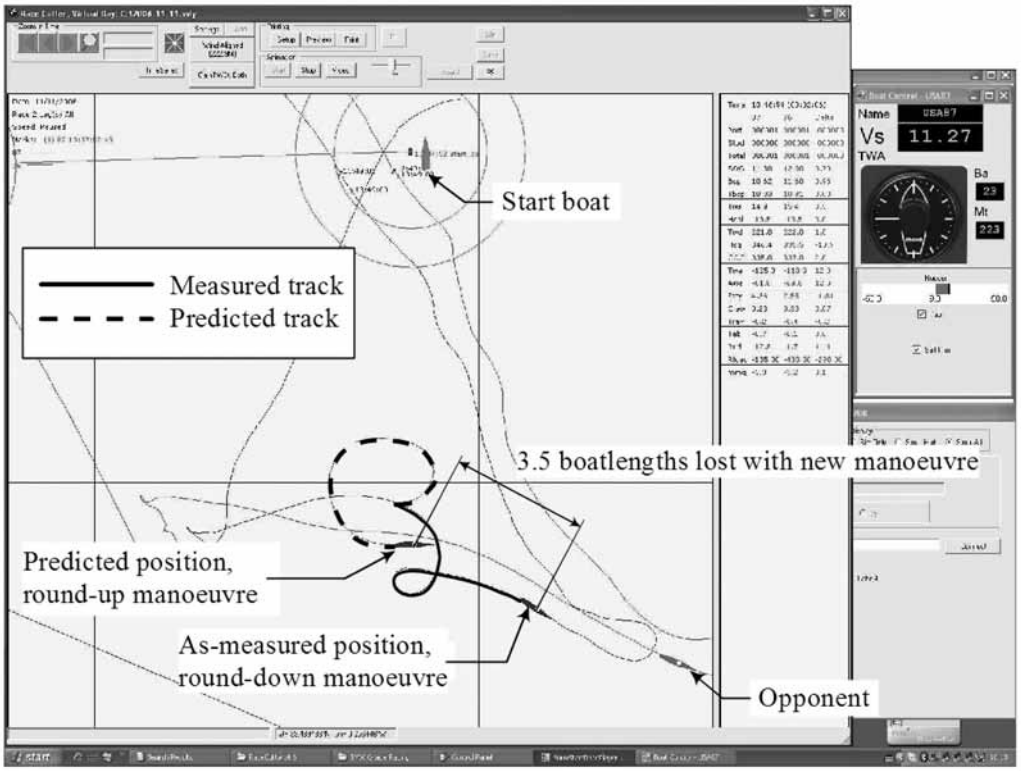


Figure 6 — Screen capture and annotations of the final simulation program. Measured round-down evasive manoeuvre shown (————) with the predicted round-up manoeuvre (- - - - - -). A potential additional loss of three boat lengths is predicted.

Simulation of Underwater Explosion Phenomena using Smooth Particle Hydrodynamics (SPH)

Names of Participants: Dr Irene Penesis (AMC), Dr Paul van der Schaaf (DSTO), Dr John Brett (DSTO)

Funded by: DSTO Maritime Platforms Division

The underwater detonation of an explosive generates a shock wave and a rapidly-pulsating gas bubble, formed from the products of the detonation process. The strong and sudden pressure loading exerted by the shock wave is the first effect felt by a nearby structure. The pulsating gas bubble is a source of additional structural loading. Pressure waves are emitted each time the bubble collapses to its minimum volume. These are of smaller magnitude than the shock wave but can have comparable impulse. As for the shock wave, these bubble pulse-pressure waves can affect a structure positioned over a range of distances from the point of detonation. Where the bubble forms in close proximity to the structure, its dynamics are affected by the presence of the structure. This can lead to migration of the bubble towards the structure and the possible violent collapse of the bubble onto the structure.

Understanding these events and being able to predict their behaviour is vital for the prediction of warship survivability. Accordingly, DSTO is engaged in the experimental and computational study of underwater explosions, with the ultimate aim of developing a realistic simulation capability for their effects on naval vessels.

A grant has been obtained from DSTO to show that the smooth particle hydrodynamics (SPH) technique is suited to underwater explosive modeling. We have conducted a preliminary assessment of this possibility, restricting the simulation to the modeling of explosives without structures but with a hydrostatic pressure gradient to generate realistic bubble-collapse dynamics. Results in 2D and 3D have been obtained for a single bubble, the interaction between two explosive bubbles pulsating out of phase, and a bubble near a boundary. The success of the simulation has been assessed by comparison with DSTO experimental results.

Further work looking at the particle interaction, particle search method, updating of the smoothing function, particle types and boundary conditions is currently being investigated.

Projected outputs will include several publications to international journals and refereed conference proceedings. Collaborations with staff from AMC facilities, such as the cavitation tunnel and postgraduate work (PhD), are also being considered for 2009–2010.

THE PROFESSION

NSCV Navigation Equipment Standard

The Australian Transport Council (ATC) of Ministers in November 2008 approved the new national safety standard for navigation equipment. The National Standard for Commercial Vessels (NSCV) Part C, Subsection 7C — Navigation Equipment replaces those parts of USL Code Section 13 — Miscellaneous Equipment, pertaining to navigation equipment. The National Marine Safety Committee (NMSC) technical team developed the standard in consultation with the marine industry over a two-year period, often covering innovative equipment introduced since the last update of the USL Code in 1984.

NMSC's Acting CEO, John Henry, noted that much has changed in the field of electronic navigation equipment since the USL Code was published. "To some extent, this standard is simply recognising the type of equipment currently on the market and current navigation practices," he said. "The new standard specifies the minimum requirements for the carriage of navigation equipment to ensure the safety of the vessel, recognising that many vessels may go beyond that minimum for operational reasons — for example, to keep to the most-economic course or to assist in locating fish. And because watchkeeping is such an important element of safe navigation, the standard includes an additional requirement for the carriage of binoculars".

The requirements for the carriage of radar equipment have been extended, compared to the USL Code, and the draft encompasses the navigation equipment needed for collision avoidance — equipment such as sound signals, navigation lights and navigation shapes.Mr Henry said that the new standard also acknowledges Automatic Identification Systems (AIS) as a new technology with important safety applications for vessel-to-vessel collision avoidance and traffic management. "AIS has been in place within SOLAS for a number of years and its usefulness in the commercial fleet cannot be ignored," he said. "The introduction of AIS into the standard is timely, considering that it is already being fitted voluntarily in many instances — and it is acknowledged as a valuable tool in conjunction with radar for collision warning and avoidance".

A copy of the final standard and the final Regulatory Impact Statement can be obtained by visiting www.nmsc.gov.au (click on Publications/Standards) or by phoning the NMSC Secretariat on (02) 9247 2124.

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

New National Marine Pilotage Guidelines Approved

The Australian Transport Council (ATC) of Ministers has approved a new set of national safety guidelines on marine pilotage. The revised guidelines were developed by the National Marine Safety Committee (NMSC) in conjunction with Ports Australia, the Australian Marine Pilots Association and Marine Safety Queensland. The project delivers Federal, State and Territory Authorities with a set of guidelines to facilitate a national approach to marine pilotage safety.

NMSC's Acting CEO, John Henry, said that the standards referenced are appropriate for the individual ports and pilotage areas within their jurisdiction's waters. "In providing these guidelines, it is recognised that the

characteristics of the ports and pilotage areas around Australia vary significantly and, therefore, so will their pilotage requirements," he said. "The NMSC recognised the need for a uniform approach to pilotage safety as practices have also varied markedly. Marine pilotage is critical to the safe operation of vessels and the revised guidelines take into account the latest developments in approaches to safety management and in the recognition of competency of pilots. The new guidelines also take into account developments in approaches to risk management and other aspects affecting the safe conduct of vessels under pilotage since the first edition of the guidelines was published in the year 2000".

The revised guidelines include sections on pilot licences, safety management systems, fatigue management in the case of shiftwork, the keeping of audit records, and the survey and manning of pilot vessels. "They also contain annexes on medical fitness, competency training and pilot vessel design," Mr Henry added.

A copy of the National Marine Guidance Manual — Guidelines for Marine Pilotage Standards in Australia, Edition 2, can be obtained by visiting www.nmsc.gov.au (click on Publications/Guidance Manuals) or by phoning the NMSC Secretariat on (02) 9247 2124.

For further information, contact NMSC's Communications Officer, Rosemary Pryor, on (02) 9247 2124.

Update of AS1799.1 Small Craft Standard

The National Marine Safety Committee (NMSC) announced in November that the draft revised standard for AS1799.1 Small Craft — General Requirements for Power Boats had been released by Standards Australia and was available for public comment. Industry had since requested an extension to the public comment period because of shutdowns over the summer season.

NMSC's Acting CEO, John Henry, subsequently announced his agreement that the dates originally proposed by Standards Australia for the comment period were inadequate, and stated that NMSC had taken the decision to continue to accept comment on behalf of Standards Australia up until 1 March 2009.

In response to queries regarding potential costs to the industry in times of economic downturn, Mr Henry stressed that the draft standard simply proposes an update of an existing technical standard and nobody is suggesting any additional regulation. "AS 1799.1 is a publication of Standards Australia Ltd which is voluntary by nature — it is used by many local builders when determining information to go onto an Australian Builders Plate (ABP), but boat builders can use any recognised national or international standard they choose for the ABP," he said.

"Unfortunately, the current edition of AS 1799.1 has not been revised since 1992 and has become out-of-date in a number of areas, like the masses of outboard motors and the maximum power which a tiller-steered outboard can safely handle. Last year NMSC took the decision to provide some resources to Standards Australia so that a revision could take place in accordance with Standards Australia's new business model.

"This is one of the first standards to be revised under Standards Australia's new model and a few teething problems — such as the dates for the comment period — have arisen," he added. "However, NMSC remains committed to the need for a more up-to-date and relevant Australian Standard, and we will work with Standards Australia to resolve any issues with the process as they arise".

The draft standard for AS 1799.1 Small Craft — General Requirements for Power Boats can be obtained directly from Standards Australia's publisher, SAI Global, via the website www.standards.org.au; click on Drafts for Public Comment and follow the leads to document reference DR 08224. If you encounter difficulties in obtaining a copy, then please feel free to contact the NMSC Secretariat by emailing secretariat@nmsc.gov.au or phoning (02) 9247 2124.

Comments can be emailed direct to NMSC's Acting CEO, John Henry, at jhenry@nmsc.gov.au or returned to the NMSC Secretariat. The closing date for comments is now 1 March 2009.

For further information, contact NMSC's Communications Officer, Rosemary Pryor, on (02) 9247 2124.

Summit Down Under

The National Marine Safety Committee (NMSC)'s summit on recreational boat standards will provide an insight into how the standards used in the world market are changing to meet today's challenges. The Summit Down Under, to be held on 21–22 May on Queensland's Gold Coast, will feature speakers from the International Standards Committee on Small Craft (ISO/TC188), which is meeting on the Gold

Coast just prior to the Summit.

The Summit coincides with the Sanctuary Cove International Boat Show and gives marine industry delegates the chance to hear international experts discuss the latest developments in recreational boating standards and how they will affect the industry. NMSC CEO, Margie O'Tarpey, said that the NMSC has worked hard to improve basic safety standards for recreational boating in Australia and that the next step is to take a more-prominent role in the international standards arena.

"The Summit's seminar planned for 22 May will look into the harmonisation of standards as well as emerging safety issues affecting the design and construction of recreational boats and the impact of those issues on standards," Ms O'Tarpey said. "Aligning the standards used in the USA and Europe would make life a lot easier for everyone — including Australian companies which use both sets of standards. The Summit is a way of engaging our local recreational boating industry in discussion with their world counterparts".

Australian-based ISO Small Craft Committee Chairman, Nik Parker, explained that TC188 is currently working on standards covering safety topics including structure (specifically keels), stability (with a focus on multihulls and smaller boats), fire protection (including CO detection) and new technologies such as 'fly-by-wire' steering systems and engine emissions. "The latter is a key subject for a recreational marine industry keen to play its part in understanding and, if necessary, reducing the impact of boating on the environment," he added.

Australian recreational-boat manufacturer, Mustang Marine, will join local stakeholders at the summit. Mustang's Design Manager, Graham Langdown, is on the Australian Mirror Committee to ISO. "We are familiar with both the EU and US requirements and all boats leaving the factory, irrespective of whether local or EU bound, are CE Certified," Mr Langdown said. "However, the interpretation and application of both European and US requirements is challenging, to say the least. "The Summit will help explain how best to move forward to a common set of world standards".

Delegates can also attend the Summit Down Under dinner on the preceding night (21 May), as it is an ideal opportunity to meet with the ISO experts.

Register now! The early-bird offer closes on 31 March.

For further information, contact NMSC Communications Officer, Ursula Bishop, on (02) 9247 2124, or visit www.nmsc.gov.au.

Ursula Bishop

New CEO for NMSC

The National Marine Safety Committee (NMSC)'s Independent Chairman, Mr Neil Aplin, has announced the appointment of New Chief Executive Officer, Ms Margie O'Tarpey.

In welcoming Ms O'Tarpey, Mr Aplin said that she brings to the role a wealth of experience in the public sector, with past management roles in fields as diverse as health, community

Nik Parker, Chair of ISO's Small Craft Committee
(Photo courtesy NMSC)

Margie O'Tarpey, new CEO of NMSC
(Photo courtesy NMSC)

justice and local government — and from her most-recent role as CEO of the Institute of Public Administration Australia (IPAA), New South Wales. Ms O'Tarpey topped a long list of highly-competitive candidates for the position. "Margie's expertise in managing projects and forming effective partnerships with industry is well recognised", he said. "She has spent the last 20 years building her professional and leadership skills, and NMSC is delighted to have her head our team".

Ms O'Tarpey said that she was looking forward to working

with the committee and staff. "I am particularly interested in raising the profile of marine safety as it is such an important social and community issue", said Ms O'Tarpey.

She took up her new appointment on 6 January 2009.

Ausmarine, January 2009

New CEO for MIA

Ms Maurene Horder retired from the position of CEO of the National Marine Safety Committee (NMSC) in early October 2008, and took up a new position as CEO of the Migration Institute of Australia on 7 October 2008. A former member of the Migration Agent's Registration Authority (MARA)'s professional standards committee, Maurene is also now taking on the role of MARA CEO.

Prior to working at the NMSC, Maurene held senior positions with Dames & Moore Ltd, the Plastics and Chemicals Industries Association Inc. and Census Applications Pty Ltd. She began her career as a teacher and has worked in diverse industry sectors, for both private corporations and government. She has worked as a Ministerial Consultant in ethnic affairs, in the Commonwealth Department of Education, and was Minority Leader of the ACT House of Assembly. Maurene is a former Chair and board member of Commonwealth Accommodation and Catering Services Ltd, which managed Australia's migrant centres prior to their privatisation.

http://mia.org.au/latest-news

Upskilling

The role of the National Marine Safety Committee (NMSC) is not limited to just producing national standards — it includes ensuring that officers in Marine Safety Agencies who will be applying standards have a good working understanding of the requirements.

One of the most significant changes from the USL Code is NSCV Section C3 — Construction. This standard references the Lloyd's Rules for Special Service Craft (SSC) as a deemed-to-satisfy solution. This section will come into general use around Australia in October 2009. NMSC has engaged Lloyd's Register (LR) to conduct workshops on the application of the Rules in relation to NSCV Section C3 as part of a general agreement with LR. Over 80 participants have attended the courses which have so far been held in Brisbane, the Gold Coast and Sydney.

LR's Sydney Design Support Office Manager, Kevin Porter, who led training in Brisbane, said that the course proved both positive and practical for the people attending. "The course provided a background to the origin of LR's SSC Rules, their development and application as well as the use of the supporting software as referenced under the new standard," he said.

Western Australia is set to host the next NSCV training session and NMSC anticipates that, over the next two years, further sessions will take place. Future training plans include the application of the Rules for those involved in routine vessel survey and other sections of NSCV.

Safety Lines, December 2008

HMA Ships *Maryborough* and *Albany* sailing from Darwin on a glassy sea. The Armidale-class patrol boats were taking part in a recent minor-war-vessel concentration period in northern Australian waters
(RAN photograph)

INDUSTRY NEWS

Progress with the New European Research Icebreaker *Aurora Borealis*

In Berlin in early December, Wärtsilä and The Alfred Wegener Institute for Polar and Marine Research, part of the Helmholtz Association, presented the technical design of the European research vessel, *Aurora Borealis*, a multi-purpose icebreaker, deep-sea drilling and research ship for polar sea conditions.

The Alfred Wegener Institute carries out research in the Arctic and Antarctic as well as in the high- and mid-latitude oceans. The institute coordinates German polar research and makes available to international science important infrastructure, for example the research icebreaker, *Polarstern,* and research stations in the Arctic and Antarctic. AWI is one of 15 research centres within the Helmholtz Association, Germany's largest scientific organisation.

Aurora Borealis will be a unique vessel — a combination of heavy icebreaker, scientific drilling ship, and multi-purpose research platform which can operate year round in all polar waters. When completed, she will be the world's most sophisticated research vessel.

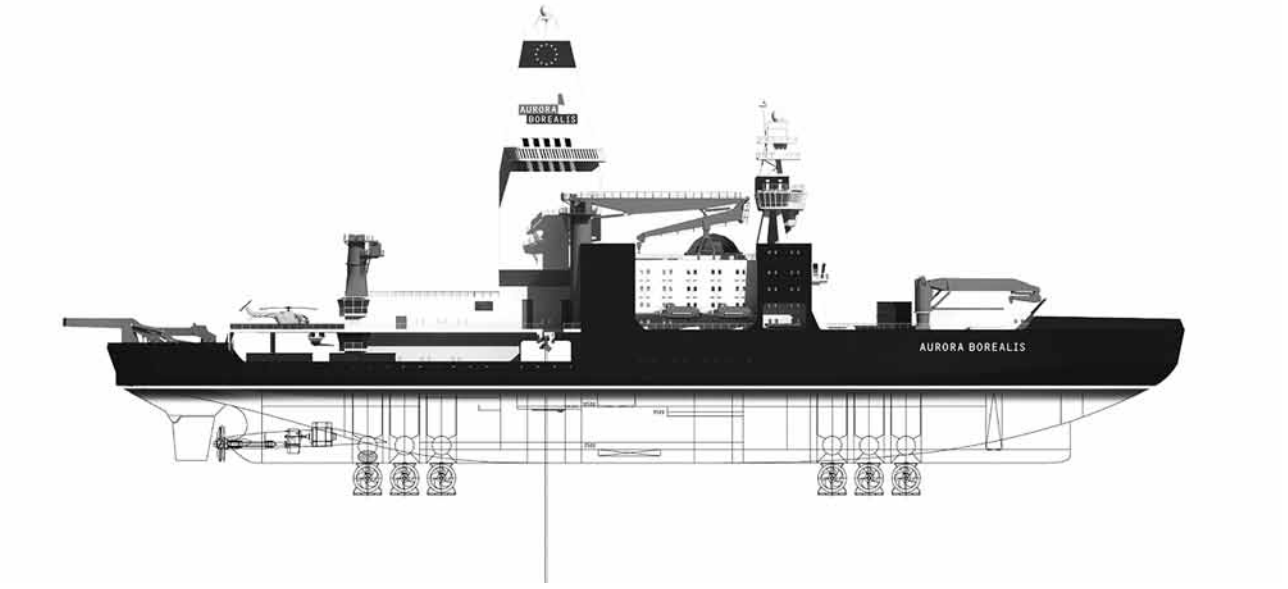
Because of European interest in and proximity to the Arctic environment, the *Aurora Borealis* project was included in the priority list of the European Commission's European Strategy Forum on Research Infrastructures (ESFRI) within the 7th Framework Programme as one of only seven projects in the Environmental Sciences section. Following up on this process, 15 institutions and agencies from ten European nations, including Norway and the Russian Federation, founded the European Research Icebreaker Consortium (ERICON). The European Commission has funded the preparatory phase with €4.5 million.

In 2006, the German Science and Humanities Council recommended construction of *Aurora Borealis,* and the German Federal Ministry for Education and Research has funded the technical design process and planning works with €5.2 million as a precondition for later construction. The anticipated construction costs as of 2008 are around €650 million. Germany has been active in polar research for more than 25 years, most notably with its research icebreaker *Polarstern*. The Alfred Wegener Institute is also globally connected, by more than 74 co-operational agreements, to the most-important international research centres for polar and marine research.

Subject to sufficient financial support, preparations for the construction of the vessel should be completed by 2011, and construction could start as early as 2012. This would enable the first scientific operations to be undertaken in 2014 or thereabouts.

Aurora Borealis will further strengthen the operational capabilities of the European scientific community. Since there are currently no research icebreakers of comparable size and capacity for year-round autonomous operations in polar waters, this project promises to facilitate, for the first time, year-round expeditions into some of the most extreme realms of our planet, thus helping to gain new insights into the history, climatic variability, and the present environmental conditions of the polar regions.

Access to the Arctic Ocean and the ability to cope with pack ice are essential in order to perform scientific drilling, so that the unresolved questions of climate change and variability can be answered. *Aurora Borealis* will thus be equipped with a drilling rig which enables researchers to drill more than 1000 m into the sea floor, in water depths between 100 and 5000 m. For the first time, scientific deep-sea drilling will become possible even in drifting pack ice, without the need of support from additional icebreakers. To perform these drilling operations, the ship has to be kept exactly in position in the floating ice. A dynamic-positioning system capable for manoeuvring in ice — an absolute novelty in the shipping industry — is mandatory for this task. Extensive model tests in the ice tanks of the Hamburg Ship Model Basin (HSVA) and Aker Arctic Research Centre in Helsinki,



Profile of *Aurora Borealis*
(Drawing courtesy Wärtsilä)

An impression of Aurora Borealis
(Drawing courtesy Wärtsilä)

Finland, have proven that *Aurora Borealis* will, indeed, be able to dynamically position in ice cover of two or more metres thickness.

Another unique characteristic of *Aurora Borealis* is the two 7 × 7 m moon pools. These are continuous vertical trunks on the centreline of the hull, going into the water below the vessel and enabling scientists to deploy their equipment into the ocean without being subject to wind, waves and ice. The aft moon pool is mainly dedicated to drilling operations, while the forward moon pool is reserved for most other scientific works. This allows, for the first time, deployment of very sensitive and expensive equipment, such as remotely-operated or autonomous underwater vehicles, within closed sea-ice cover. Scientific laboratories are located on several decks around the moon pools, which are designed in an atrium-like shape with circular walkways and preparation areas. In order to optimally equip the ship for all kinds of specialised expeditions, containerised laboratories can be also loaded here and become fully integrated into the scientific workflow on board.

Wärtsilä's new Upgrade Kit for Slow Steaming

Wärtsilä has introduced a new upgrade kit for slow steaming for RTA and RT-flex low-speed engines to enable shipowners and operators to make major savings in fuel costs while slow steaming their ships. The upgrade kit allows Wärtsilä low-speed marine engines to be operated continuously at any power in the range of 20% to 100%. This means that, with the upgrade-kit, ships can sail continuously at sea speeds down to some 60% of full speed.

High bunker prices have put fuel efficiency high on the agenda of charterers, shipowners and ship operators. There is thus considerable interest in slow steaming — operating ships for long periods at reduced sea speeds. Yet without modification with this upgrade kit, there is increased risk of engine fouling and excessive component temperatures when operating continuously below 50% engine load. The upgrade kit overcomes such problems, enabling the engines to operate continuously at powers down to 20% of their full installed power. The modified engine is not permanently de-rated but can operate at any time up to its full installed power. Owing to the characteristic power versus speed relationship of ship propellers, this extended operational power range enables ships to be sailed at sea speeds down to some 60% of full speed.

The first upgrade kits were ordered in November 2008 by the German owner Koepping Shipping Company for two container vessels, each with a single 8-cylinder Wärtsilä RTA62U engine. The two ships, *Aglaia* and *Lantau Arrow*, are 1200 TEU fast-feeder container vessels. They have a maximum speed of about 22 kn at design draft with the main engines delivering 15 000 kW at 107 rpm.

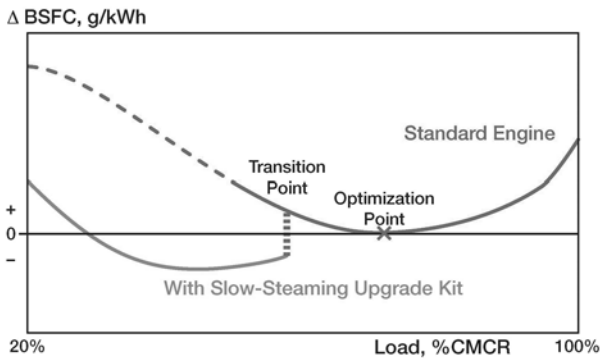
Joerg Koepping, Managing Director of Koepping Shipping, said "The Slow-Steaming Upgrade Kits will give these ships considerable flexibility to adapt to the present difficult market conditions, allowing great cost savings while slow steaming, but retaining the capability for full speed whenever necessary."

The upgrade kit is available for all RTA and RT-flex engines with multiple turbochargers. For ships which must comply with the IMO NO_X emission regulations, the restrictions imposed by the emissions limits will be evaluated in each case and a customized turn-key package may be offered. RTA and RT-flex engines can be safely operated continuously at loads above 50% of the contracted maximum continuous rated (CMCR) power without any modifications.

The concept of the upgrade kit is to cut out a turbocharger when the engine is to be operated at low load. This increases the scavenge air delivery at low load for better combustion and more optimum temperatures of engine components. The cut-out point depends upon the engine configuration.

The upgrade kit involves fitting shut-off valves in the exhaust duct before the turbocharger turbine and in the scavenge air duct after the compressor, together with a bypass line to keep the turbocharger rotor spinning at a preset constant speed. The valves are remotely operated and the kit includes fitting a control system to operate the valves.

The upgrade kit is delivered by Wärtsilä on a turn-key basis and includes engine performance analysis, cabling and installation, all materials and their transport, service engineers to undertake the whole installation and commissioning, and emission measurement and certification. The installation and commissioning of the upgrade kit can be completed during normal commercial operation of the ship and during normal port calls.



A typical brake specific fuel consumption (BSFC) curve for RTA and RT-flex engines as standard and with the upgrade kit for slow steaming
(Drawing courtesy Wärtsilä)

More Details of Austal's JHSV

The ANA reported in the November 2008 edition that Austal had won the contract to design and construct the prototype of a new-generation high-speed transport ship for the US Navy and US Army, known as the Joint High Speed Vessel (JHSV). The contract includes options for nine more ships, all of which would be built at Austal's US shipyard at Mobile, Alabama.

The Joint High Speed Vessel program is a US Navy-led acquisition of a vessel intended to support users in the US Department of the Navy and Department of the Army. The JHSV program is a cooperative effort for a high-speed, shallow-draft vessel intended for rapid intra-theatre transport of medium-sized cargo payloads. The JHSV will reach speeds of 35–45 knots and allow for the rapid transit and deployment of conventional or special forces as well as equipment and supplies.

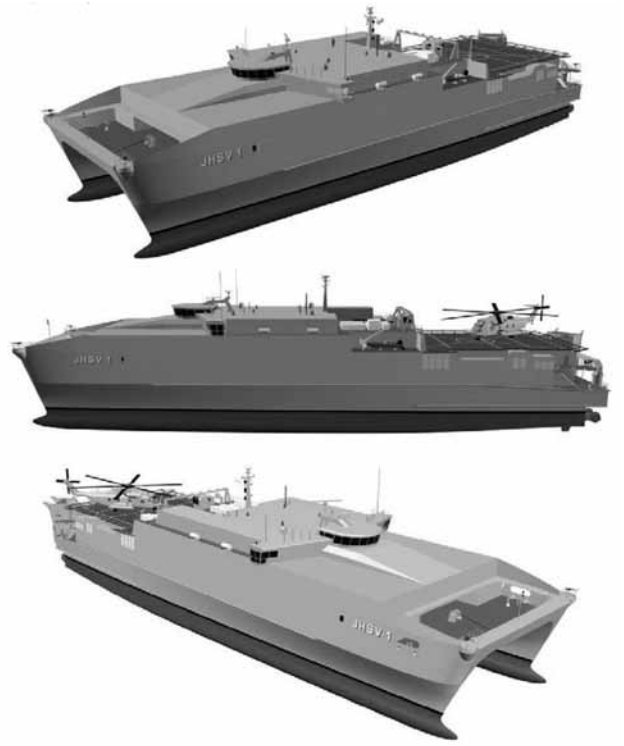
The JHSV will be capable of transporting personnel, equipment and supplies over operational distances in support of manoeuvre and sustainment operations. The JHSV will be able to transport Army and Marine Corps company-sized units with their vehicles, or reconfigure to become a troop transport for an infantry battalion.

The JHSV will include a flight deck for helicopter operations and an off-load ramp which will allow vehicles to quickly drive off the ship. The ramp will be suitable for the types of austere piers and quay walls common in developing countries. The JHSV's shallow draft will further enhance littoral operations and port access.

At first, both the Department of the Army and the Department of the Navy pursued separate programs to meet their requirements however a decision was made to combine efforts, as collaboration between the Army and Navy would offer increased cost savings for both armed services. The JHSV program combines the Army's Theatre Support Vessel (TSV) program with the Navy and Marine Corps High-speed Connector (HSC) program.

Four high-speed vessels, (HSV-X1 *Joint Venture*, HSV-2 *Swift*, TSV-1X *Spearhead*, and *Westpac Express*) have been employed for experimentation and demonstration of high-speed vessel technologies as well as for logistics support. *Joint Venture* and *Swift* have already been used to support operations in the Middle East and have been deployed to the Horn of Africa, Persian Gulf and Southeast Asia. *Swift* also supported relief operations in Indonesia after the 2004 tsunami and in the US Gulf Coast region following hurricane Katrina. In both cases, *Swift's* high speed and shallow draft combined to make her an ideal vessel for the delivery of relief supplies and support of other vessels operating in the area. During operations following Katrina, *Swift* was able to access ports inaccessible to other ships in the logistics force, and therefore played a critical role in the early delivery of supplies. *Westpac Express* has been used extensively for support to the Third Marine Expeditionary Force (III MEF) in the western Pacific.

Austal's JHSV design will be similar to the well-proven *Westpac Express*. Constructed of aluminium, the JHSV will have a round-bilge bulbous-bow hullform. Designed to cope well with high following-sea conditions with significant reserve buoyancy forward, the ship will be powered by commercial machinery for a maximum unloaded speed of 43 kn and 35 kn with a 635 t payload.



Impression of the JHVS
(Austal image)

A stern view of the JHSV with the stern ramp deployed
(Austal image)

The 41 crew of the JSV will be accommodated in single, double and four-berth cabins and berths will be provided for a maximum of 150 troops. Seats to accommodate 312 troops will also be fitted.

An open-plan deck space will provide for the carriage of vehicles, boats, containerised and palletised cargo. This mission deck will be able to be off-loaded via a 45° slewing articulated quarter ramp. A crane will also be fitted to handle cargo and boats, and the flight deck will be qualified for Level 1, Class 2 operations for H-35/H60 helicopters and Class 4 VertRep operations.

Construction of the first JHSV is expected to begin during 2009.

www.austal.com
peos.crane.navy.mil/JHSV

General Particulars

Length	103 m
Beam	28.5 m
Draught	3.83 m
Mission Bay	
Area (with tie-downs)	1863 m^2
Clear height	4.75 m
Turning diameter	26.2 m
ISO TEU stations	6
Accommodation	
Crew	41
Single berth cabins	2
Double berth cabins	6
Four berth cabins	7
Troop seats	312
Troop berths	
Permanent	104
Temporary	46
Propulsion	
Diesel engines	4 × MTU 20V 8000 M71L each 9.1 MW
Gearboxes	4 × ZF 60000NR2H
Waterjets	4 × Wartsila WLD 1400 SR
Performance	
Speed	35 kn at 90% MCR 43 kn max. unloaded
Range	
Maximum transit	1200 n miles
Self-deployment	5600 n miles
Max Sea State	7

Aviation facilities

NAVAIR Level 1 Class 2 Certified flight deck for 1 helicopter
NAVAIR Level 1 Class 4 Certified VertRep
Helicopter control station

Auxiliary systems

Active ride control
- Transom interceptors
- Foils 3.24 m^2 each, on inboard sides of hulls

Vehicle ramp
- Articulated slewing stern ramp, aft to 45° starboard

Telescoping boom crane
- 12.3 t at 15 m, 18.2 t at 10 m

Wärtsilä and Mitsubishi renew Co-operation Agreement

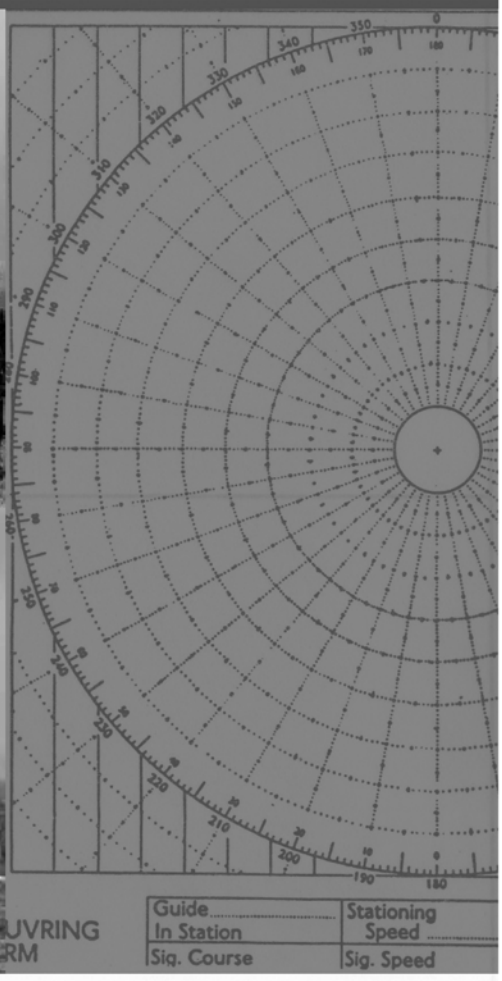
Wärtsilä and Mitsubishi Heavy Industries Ltd have signed a ten-year renewal of the existing co-operation agreement for the sale, manufacturing and servicing of Wärtsilä low-speed marine diesel engines. Mitsubishi is the longest-standing member of the Wärtsilä family of low-speed engine licensees. The renewal was signed on the 84th anniversary of the signing of the first licence by Mitsubishi for Sulzer low-speed marine engines on 14 January 1925. Sulzer diesel engines were incorporated in the Wärtsilä engine programme in 1997.

The licence co-operation agreement is a basis for the exchange of diesel engine technology between Wärtsilä and Mitsubishi, defining and regulating intellectual property rights, and the delivery and feedback of technical information and support.

The Commonwealth Navies: 100 Years of Cooperation

2009 King-Hall Naval History Conference

30-31 July 2009



THE COMMONWEALTH NAVIES: 100 YEARS OF COOPERATION

The sixth biennial King-Hall Conference will be held in Canberra on 30-31 July 2009. The conference will be organised by the Sea Power Centre - Australia with assistance from the School of Humanities and Social Sciences, University of New South Wales at the Australian Defence Force Academy. The King-Hall Conference has become a significant event in the national and international sea power communities for its wide-ranging discussion of topical naval historical and maritime strategic issues. The conference is open to the public, and previous events have attracted a wide range of naval historians, academics and retired and serving military personnel, as well as interested lay people from Australia and overseas.

The theme of the 2009 conference is 'Commonwealth Navies: 100 Years of Cooperation'. In 1909, Australia, with the encouragement of of the British Admiralty, decided to acquire a modern ocean-going fleet; one which would not only protect local ports and shipping from enemy incursions but also support the Royal Navy in its determnation to retain command of the sea. Other members of the Empire followed, and over the next 100 years the various Commonwealth navies have routinely sailed together in both peace and war and with a remarkable degree of interoperability. Arguably the most successful international grouping of its type, Commonwealth naval cooperation can also be seen as the precursor to more recent intitiatives such as the US Navy's Maritime Partnership.

GENERAL INFORMATION

Venue:

Adams Hall, Australian Defence Force Academy, Canberra ACT.

Registration:

Registration will be at no cost, however, the number of delegates will be limited by the size of the venue. Early contact with the Sea Power Centre - Australia is recommended.

(Registration includes lunch and light morning tea)

FURTHER INFORMATION

Sea Power Centre-Australia
Conference Co-ordination Cell
Department of Defence
CANBERRA ACT 2600

Tel: (02) 61276514
Fax: (02) 61276521
Email: Seapower.conferences@defence.gov.au

SEA POWER CENTRE AUSTRALIA

THE UNIVERSITY OF NEW SOUTH WALES

AUSTRALIAN DEFENCE FORCE ACADEMY

Australian Naval Institute

NAVY

MEMBERSHIP

Australian Division Council

The final meeting of Council for the year was held on Thursday 4 December 2008 with the President, Dr Stuart Cannon, in the chair. The following matters, other than roputine, were discussed by Council:

Standards Australia — Status of Standard Projects

It was reported that, following discussions with NMSC and Standards Australia, Mr David Gosling had been nominated to Standards Australia as the Division's ongoing representative to Committee Number CS-001 Small Pleasure Boats.

National Unified System for Vessels Safety

Council expressed in-principle support for the initiative outlined in the Consultation RIS on *A National Approach to Maritime Safety Reform* as it has the potential to provide improvement in the uniformity of maritime safety implementation across Australia in relation to commercial vessels.

In view of the importance of this national venture, a small sub-committee was set up to examine the matter further and they would provide proposals for examination by Council.

Financial Matters

During consideration of the accounts for payment, it was noted that Mr R. Manoharan had been awarded the Division's prize at the Australian Maritime College for 'the best research project by a final year student in the Bachelor of Engineering (Naval Architecture) course'. The prize would be presented during the forthcoming graduation ceremony.

Council was asked by Dr Thomas to consider extending the prize to include students in the Ocean Engineering and Marine and Offshore Systems courses. After carefully examining the proposal Council agreed to the extension as proposed.

The Treasurer tabled and introduced the proposed budget for 2009. The Budget was adopted by Council.

Election of President of the Australian Division

Dr Stuart Cannon signified his willingness to serve for a further term should Council agree. Council was pleased to elect Dr Cannon to the position of President of the Australian Division for a further term of two years to commence from the conclusion of the next Annual General Meeting of the Division.

The next meeting of the Council of the Australian Division is scheduled for Wednesday 4 March 2009.

Keith Adams
Secretary

New Corporate Partner Member

The RINA is pleased to welcome ASC Pty Limited as a Corporate Partner member of the Institution.

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

AUSTRALIAN DIVISION

NOTICE OF ANNUAL GENERAL MEETING

Notice is hereby given that the Annual General Meeting of the Australian Division of the Royal Institution of Naval Architects will be held at the offices of Engineers Australia, 8 Thomas Street, Chatswood, NSW 2067 on Wednesday 4 March 2009 and will commence immediately following the conclusion of the Joint Technical Meeting of the New South Wales Section of RINA and the Sydney Branch of IMarEST commencing at 6.00 pm for 6.30 pm (Sydney time).

AGENDA

1. Opening
2. Apologies
3. To confirm the Minutes of the AGM held in Canberra ACT on Wednesday 19 March 2008
4. To receive the President's Report
5. To receive, consider and adopt the Financial Statements and Auditor's Report for the year ending 31 December 2008
6. Announcement of appointments to the Australian Division Council
7. Other Business

Keith Adams
Secretary
1 February 2009

NAVAL ARCHITECTS ON THE MOVE

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

Zia Ahmed has moved on in the Defence Materiel Organisation from the Air-warfare Destroyer Project and has taken up the position of Whole-of-Ship Manager in the Anzac Systems Program Office in Fremantle.

Andrew Baglin, a graduand of the University of New South Wales has converted his part-time position as a naval architect with One2three Naval Architects in Sydney to a full-time position.

Hamish Bush, a graduand of the University of New South Wales, has taken up a position as a naval architect with Burness Corlett-Three Quays at North Ryde.

John Butler has moved on from Sensation yachts and has taken up a position as a naval architect with Burness Corlett–Three Quays at North Ryde.

Levi Catton has moved on from the Directorate of Naval Platform Systems, and has taken up a position as a naval architect in the Design Services Group of Thales Australia at Garden Island in Sydney.

Kim Chamberlin, a graduate of the Australian Maritime College, has taken up a position as a naval architect with BMT Defence Services (Australia) in Melbourne.

Sasha Ford, a graduate of the Australian Maritime College, has taken up a position as a naval architect with BMT Defence Services (Australia) in Melbourne.

Rigby Gilbert has retired from his position as Whole-of-Ship Manager in the Anzac Systems Program Office of the Defence Materiel Organisation in Fremantle and has home renovations and exploring the north of WA on the agenda.

Matthew Gudze has moved on from the Defence Science and Technology Organisation in Melbourne, taking a leave of absence to pursue charity work overseas.

Peter Holmes has moved on from Clubb Marine Design and has taken up a position as a naval architect with Sharaf Yachts, a new builder of luxury yachts, in Sharjah, UAE.

Ruth Jago has moved on within the Lloyd's Register organisation and has moved from the London office to take up a position as a surveyor in Shanghai, PRC.

Nick Kitching, a graduand of the University of New South Wales, has moved on from Spear Green Design and has taken up a position as a naval architect with BAE Systems in Williamstown.

Henry Morgan, a graduand of the University of New South Wales, has moved on from the NSW Maritime Authority and has headed for South America in commencing his world tour.

Alex Robbins has moved on from BMT SeaTech on the UK and has taken up a position as a naval architect with Burness Corlett Three Quays at North Ryde.

Sam Shepherd has moved on from One2three Naval Architects and has taken up a position as a naval architect with BMT Defence Services (Australia) in Melbourne.

Hossain Simcik has taken up a position as a naval architect with Burness Corlett Three Quays at North Ryde.

James Smithers graduated in naval architecture from UNSW many moons ago and initially worked as a business analyst in London and travelling. He returned to Australia and worked as a project manager in the construction industry, and then as a management consultant in infrastructure. He has now taken up a position with Parsons Brinckerhoff in general, power and transport engineering design in Sydney.

Alexander (Sandy) Tickle moved on from a full-time position with Forgacs many moons ago, but remained contracting to them for some time before moving on to take up a position as a manager in a family health-care business.

Max van Someren has moved on from Austal Ships and has returned to the UK after a happy two years of hands-on experience.

Bruce Watkins has taken up a position in communications, IT and business intelligence, and recently worked on proposals for the national broadband network.

Cameron Whitten, a graduate of the Australian Maritime College, has taken up a position as a naval architect with BAE Systems in Williamstown.

Adrian Woodhouse has moved on within the Department of Defence, returning from the position of Generation Manager for the Patrol Boat System Program Office in Darwin to take up the position of Engineering Manager for Navy Minor Capital Equipment Projects in Canberra.

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
Samantha Tait
Martin Grimm

THE INTERNET

Digitising 35 mm Slides

Do you have boxfuls of 35 mm slides, and wondered if you can convert them to digital format so that they aren't lost forever as slide projectors become fewer and further between? The answer is yes; many modern scanners are able to do the job for you with a special attachment which comes with the scanner. There is a good guide to the procedure at www.which.co.uk/advice/how-to-scan-a-slide/index.jsp

Phil Helmore

The A-class 9000 dwt standard cargo ship *River Glenelg* passing Kirribilli inbound to Sydney. Thirteen A-class cargo ships were ordered during World War II by the Australian Shipbuilding Board, which was formed in March 1941, as part of a merchant shipbuilding programme in support of the war effort. The design of the A-class was based on *Scottish Monarch*, a 9000 dwt ship the plans for which had been obtained from Great Britain.

River Glenelg was the first of five A-class ships built by BHP at their new Whyalla shipyard. The yard's ship number 3, she was ordered on 20 October 1941. Her keel was laid on 27 March 1942; she was launched on 28 October 1943 and completed on 16 March 1944. Her machinery was built by Australian Iron & Steel at Port Kembla in New South Wales.

River Glenelg was broken up in Japan in 1963.

(Photo Bob Campbell collection)

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Wärtsilä is the world's leading supplier of complete ship power solutions and a major provider of turnkey solutions for distributed power generation. In addition Wärtsilä operates a successful Nordic engineering steel company. More than 10,000 service oriented people working in 50 countries help Wärtsilä provide its customers with expert local service and support, wherever they are.

WÄRTSILÄ

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