THE AUSTRALIAN NAVAL ARCHITECT

Volume 11 Number 4
November 2007

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Cover Photo:

Wellington, the second offshore patrol vessel built for the Royal New Zealand Navy by Tenix, ready for her launching at Williamstown on 27 October 2007 (Photo courtesy Tenix)

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RINA Australian Division
on the
World Wide Web
www.rina.org.uk/aust

From the Division President

For this edition of *The Australian Naval Architect* I have decided to reflect on some activities that I have undertaken in the last few months or for the last few years for one particular project. Many of us choose employment within the maritime industry because of some form of childhood interest in the sea or boats. This interest in our profession tends to stay with us throughout our working lives and often continues well into our retirement years. It may be in the form of sailing, fishing or, in my particular case, the need to understand more about the shipwrecks on which I was diving off the Cornish coast. My extra-curricular activities now centre on preserving our maritime heritage so that future generations can understand their past and, hopefully, entice them into our profession.

One particular project which has taken up much of my time in recent months has been *Project AE2: The Silent ANZAC*. As part of the Gallipoli campaign in 1915, HMA Submarine AE2 was the first allied submarine to 'wreak havoc' on enemy shipping after penetrating the Dardanelles on 25 April. However, after five days operating in the Sea of Marmara, AE2 experienced control difficulties and inadvertently surfaced close to a Turkish gunboat. The submarine was fatally damaged by shellfire. Her commanding officer, Captain Henry Stoker, scuttled her to prevent her falling into enemy hands.

AE2 lay undisturbed until a group of divers relocated her, resting upright in 73 m of water on the silty bottom of the Sea of Marmara. Once she was located many questions were raised about the long-term management of the submarine, but little was known about her current condition and the nature of her surroundings. In 2004 the Submarine Institute of Australia (SIA) became involved in the project with the aim of protecting and preserving AE2 and to tell the story of her brave crew. Under the guidance of retired Rear Admiral Peter Briggs, a group of enthusiastic volunteers was brought together to further these objectives. A major expedition to record and collect data on the current status of AE2 occurred in September this year. The team involved maritime archeologists, retired naval officers, scientists with interests in underwater imagery and corrosion, divers from all walks of life and naval architects. Both the individuals and their respective employers had donated significant amounts of time and resources to ensure that this project moved ahead. There were also the government and commercial sponsors of the project who must not be forgotten. Much data was collected during the expedition, which included video and photography, corrosion potential measurements, ultrasonic thickness measurements, damage identification, soil sediment analysis and water profile measurements to name a few however, my particular highlight was the imagery obtained from inside the submarine, showing clear details of control-room equipment. The data are now back in Australia being analysed so that a report can be produced to make the recommendations on future management of the site. Once again, enthusiastic volunteers are being used to complete this. To present the story to the public, an ABC documentary is due to be shown on Anzac Day next year. I'm sure you will see a lot more of this little submarine in the future.

Whilst I was overseas I took the opportunity to revisit SS *Great Britain*. My interest in this particular ship started whilst studying in Plymouth. The bridge over the River Tamar introduced me to the name of Brunel and I soon set off to see her. I learnt about Brunel's entrepreneurial ways and how the ship was one of the first with a modern propeller. Although she was halfway through the restoration project her grandness was obvious. My interest grew further when I was employed as a graduate naval architect at Burness, Corlett and Partners in the UK. Ewan Corlett had an interest in preserving our maritime heritage and was heavily involved in the salvage of *Great Britain*. During my employment I had opportunities to work on other projects such as HMS *Warrior* and MV *Yavari*. After completing my doctorate at Brunel University I moved out to Australia and lost track of the SS *Great Britain* restoration project. My recent travels took me to Bristol and provided an excellent chance for an update. A thorough survey was completed in 1998 when it was discovered that the humid atmosphere of the dry dock was contributing to her corrosion rate. Scientists suggested that she may corrode away to nothing in about 20 years if left this way. Extensive conservation work has included a glass waterline plate across the dry dock and two huge dehumidifiers in the space beneath, which keeps the relative humidity down to 22% to preserve the hull material. Once again this project relies on the enthusiastic volunteers who dedicate so much of their own time.

The two projects discussed above are certainly not the only ones where dedicated people offer their time to preserve our maritime heritage. In Victoria there are a groups of people, some of whom are members of the RINA, who offer their services to restore and maintain some of our maritime past. These include those associated with *Polly Woodside*, HMAS *Castlemaine* and HMVS *Cerberus*, to name a few. Last year I visited the Hibbard Heritage Boatyard which forms part of the maritime heritage centre at Port Macquarie in NSW, and spend several hours discussing some of the projects currently being undertaken by the group of volunteers. I am sure that there are similar groups across all states in Australia. Sometimes individuals set themselves personal projects which aim to capture knowledge of the past. One particular example that comes to mind is the Register of Australian and New Zealand Ships and Boats that is operated and maintained by a member of RINA.

Without the dedication of those involved in recording and preserving our past, the details of these ships, boats and submarines may be lost forever. I believe that this is important for all of us and our thanks and appreciation must go to all of those involved. More often than not, it is a young person's visit to one of these sites that sets them off into their chosen career path. Let us make sure that such projects benefit from the skill sets that we can provide.

Stuart Cannon

Readers will be familiar with most of the historic ships named by the President in his column, but not all may have heard of *Yavari*. *Yavari*, now preserved on Lake Titicaca in Peru, is said to be the oldest working single-screw propelled ship in the world.

Ordered in 1861 as one of two small cargo-passenger 'gunboats' *Yavari* was built in England by the Thames Ironworks and Shipbuilding Company and was shipped to Peru with her sister ship *Yapura* in parts in October 1862. The Peruvian Navy then transported the 2766 parts of the two ships up to Lake Titicaca, 3810 m above sea level. This job took years and *Yavari* was finally launched on Christmas Day 1870. She was then powered by a two-cylinder steam engine powered by dried Llama dung! She is now fitted with a 1914 Bolinder hot-bulb semi-diesel engine,

Yavari was rescued by The Yavari Project and bought from the Peruvian Navy in 1987. Now restored, the ship is operable and open to the public.
(Photo www.yavari.org)

Editorial

The Australian Naval Architect needs correspondents! Readers will notice that there is no news in this edition from the ACT, Victorian, Tasmanian, Queensland or Western Australian Sections. This is not the result of some New South Wales plot to exclude the other states, it is simply because we have not received any. Here in Sydney we do not have the resources to keep track of all the Section activities around this large country and we rely on keen correspondents who will put aside a bit of time from their busy schedules to write a regular quarterly report for us. One of the main aims of *The ANA* is to provide news and information to Australian members which they could not expect to find in journals like *The Naval Architect* which serves a much larger constituency. So come on all budding writers out there, power up the computer and send us your reports. This is one drought we have the power to end!

The general news section of *The ANA* receives most its material from the press releases of Australian governments and companies. That is fine, but we know there is more happening out there as a result of the efforts of Australian naval architects and their colleagues in industry. For example, the Queensland reports of Brian Robson (he has now retired from that duty) gave us an insight into activities in that state which might not otherwise have been possible for *The ANA*. Perhaps members in organisations with PR departments should remind them that they should put *The ANA* on their distribution list. They are missing out otherwise.

Phil Helmore and I look forward to being deluged in late January with news from all over the country.

John Jeremy

Letters to the Editor

Dear Sir,

One of my mechanical engineering colleagues recently posed me the question "How much does a single-shaft ship list due to shaft torque (without the stabilizers counteracting the list)?"

He went on to give an example of a guided-missile frigate with a full power of about 30 000 kW and a propeller shaft speed of 180 RPM, thereby giving a torque of 1583 kN-m. In the case of this vessel, the beam is about 13.7 m, so this torque is equivalent to placing around 23.7 t on the deck edge. Using a representative displacement and fluid *GM* for the vessel, it was therefore straightforward to determine that the heel angle induced by such a torque would be around 2.6 degrees.

Another colleague subsequently advised us that, several years ago, the DMEO on a guided-missile frigate had said that they would list about 3 degrees due to torque reaction when he had asked the same question. It was encouraging to see the general correlation between the analysed assessment of heel and the shipboard observation.

In practice, the heel could be countered by the transfer of fuel from one side to the other, or by the action of the fin stabilisers if they could be used in that manner (although that would be an inefficient use of the fin stabilisers). As a result of the discussion we realised that, in theory, in very calm wind and sea conditions and with precise instrumentation, it should be possible to use the heel of the ship (in a known load condition) as a simple torsion meter!

Martin Grimm

Dear Sir,

In February this year, Sydney was lucky enough to witness the incredible sight of *Queen Mary 2* and *Queen Elizabeth 2* crossing paths in our harbour whilst on their world tours. Being a keen naval architecture student, I dragged some not-so-enthused friends around the city from dawn until dusk to take in the sights. Obviously, standing up close to the two liners was exciting, and their sheer size and brilliance was remarkable. However, the most amazing part of the day became evident in the early hours of the morning to those caught in the unexpected traffic. The whole of Sydney appeared to have had the same idea, and all day thousands flocked to the harbour foreshore to get glimpses of the vessels. The roads in and out of the city were jammed and the public transport system turned chaotic.

In more recent months we all witnessed the media frenzy which lasted for days obsessing over the stranded *Pasher Bulker* on the NSW mid-north coast. Thousands made the pilgrimage to Newcastle simply to marvel at the grounded bulk carrier. *Pasher Bulker* was a common ship caught in an unfortunate predicament, and Sydney could not get enough of her.

I find it incredible how people with little interest in the marine industry will go so far out of their way just to check out a big boat. If a nice car drives past, heads turn; if a bridge opens, people like to walk over it; but, if a big ship comes into port, then thousands turn out to just stare at her.

As a young student, I am honoured to be part of this small

industry which has the power to incite such passion and excitement in the hearts of entire cities. Although many of us may never design a super liner, we should be proud to be members of the naval architecture community. It is exciting to know that we're not just engineers building infrastructure, we are engineers building "queens of the seas" which will be admired by millions for years to come.

Ryan Ayres
UNSW Student

[*Hear Hear! A chief executive of a consumer electronics company once said to me 'We just build boxes, but you build icons!'* — Ed.]

Dear Sir,

My first experience in a boat was when I joined a rowing club at age thirteen. I consider that this experience was the beginning of my naval engineering career, as it is called in Brazil, where I come from. However, my main interest is not in rowing boats, but in motor yachts. Unfortunately, the naval architecture programs at universities in Brazil are concerned mainly with the design of FPSOs, tankers, oil rigs, and other displacement-type ships.

Knowing that my Brazilian experience would not be enough to work in a motor-yacht design company around the world, I started looking for an exchange which would allow me to be closer to the well-developed motor yacht industry. Australia certainly fits this requirement, since it is one of the best countries for working with and learning about high-speed boats.

Currently I am in Australia, studying at UNSW on an exchange program, and I am sure that I will reach all the objectives that have always dreamed of and pursued, coping with all the difficulties provided by living in another country. You may not know me yet, but certainly in the near future you will hear my name as a great motor-yacht designer, and then you will remember the letter of a "Brazilian dreamer".

Ricardo Ferreira
UNSW student

Dear Sir,

The recently-run 32nd America's Cup regatta was arguably the tightest, closest and, some may say, best America's Cup event ever. This was due in no small part to the International America's Cup Class Version 5 rule. This rule, governing the design aspects of the boats, allowed even the smallest teams to design, build and run competitive yachts. The narrow scope for optimisation under the Version 5 rule meant that all the boats were very closely matched. This was shown nowhere more than when the French *Areva* team, who finished the regatta in 8th position, was able to win a race from the eventual winners, *Alinghi*.

In a bid to "cut costs", the defenders of the Cup, the Swiss, have now decided to change the boat being sailed for the next (33rd) running of the event. They have also restricted entrants to building only one boat. The idea that this will save money is preposterous! The amount of money which will now need to be spent on tank testing and computational fluid dynamics will far outweigh the money saved by having less boats built. This move by the defender has also had the effect of making all the current boats obsolete and, since the Swiss have not yet released the parameters for the new design rule, given them a significant head start over the challenging teams on the design front.

After running such a successful event, one would imagine that the Swiss would stick to the same formula and run the 33rd America's Cup in a similar fashion. Unfortunately, nothing could be further from the truth. They have accepted the Challenge of Record from a Spanish yacht club which is more concerned with keeping the regatta in Valencia than in the event itself. As a result, the challenger has handed over all power to the Swiss, to the extent that the defender of the America's Cup is now allowed to race in the Challenger series up to and including the semi-final stage.

In addition to this gross abnormality, the defender has also given themselves more power than any defender has ever had before, such that they now have the right to impose any rule on any team, or reject any team's entry whenever they so desire. They have removed all voting rights of the challengers and effectively made the America's Cup a dictatorship.

Before the 32nd cup, the last great event was in 1983. Let's hope that we don't have to wait another 24 years to see another close, exciting America's Cup regatta.

Andrew Baglin
UNSW Student

Dear Sir,

I recently attended the Sydney International Boat Show in Darling Harbor; I try to go every year, and am amazed by the boats that are exhibited. It seems that, every year, the number of boats increases in such a small confined area. It is obvious from the show that the boating industry in Australia is growing each year. There are many boats produced in this country; for example, ski boats, sailing yachts, and some luxury yachts, by companies such as Riviera, Maritimo and Warren Yachts.

Many marinas in Australia are in need of renovation and expansion to allow for the growth in the boating industry in Australia. For example, the super marina proposed in Rose Bay, which is currently being debated in Council, will allow for moorings for many more boats in the bay. The need for this marina shows the increase in the boating industry in Australia.

Although the industry itself is booming, there are still very few builders of recreational boats in Australia for a country of this size. The quality of Australian boats is up there with those of the rest of the world and yet, in general, Australians are demanding European or American boats. It's a shame to see the wasted talent of boat builders in Australia.

The success stories of Maritimo, which has come to the fore from pretty much nothing over the space of a few years, Warren Yachts and Riviera, should inspire people to buy Australian-made boats. By purchasing an Australian boat, more money is kept in Australia, allowing for the industry to increase, and the Australian economy to grow. This, in the long term, will help our country as a whole. Buying Australian-made boats is a win-win situation for everyone involved.

Greg Laanemaa
UNSW Student

NEWS FROM THE SECTIONS

New South Wales

NSW Section Committee Meetings

The NSW Section Committee met on 3 September and, other than routine matters, discussed:

- SMIX Bash 2007: Sponsorship level not yet up to last year last year's, and so budget will need to be refined; models for silent auction under discussion.
- TM Program 2007: Presentations for September and October arranged.
- TM Program 2008: Presentations proposed, and one to be confirmed for AGM in March.
- TM Venue 2008: Possible venues discussed.
- Registration of Professional Engineers in Queensland: It is now a requirement that professional engineers in Queensland be registered, see www.bpeq.qld.gov.au.

The NSW Section Committee also met on 8 October and, other than routine matters, discussed:

- SMIX Bash 2007: Sponsorship now close to last year's; model lines plans obtained and under construction; registrations now about half capacity; SMIX newsletter sent.
- TM Program 2008: Presentation confirmed for AGM in March; other presentations proposed.
- Pacific 2008: Arrangements for crewing RINA stand at exhibition; discussion of Maritime Australia's proposal to hold an information day for high school and TAFE teachers, as Air Australia does at the Avalon Air Show, and possible RINA involvement.

Australia's Air Warfare Destroyer

Ray Toman, Principal Naval Representative of the Defence Materiel Organisation for the AWD Systems Centre in Adelaide, gave a presentation on *Australia's New Hobart-class Air Warfare Destroyer* to a joint meeting with the IMarEST attended by forty-two on 5 September in the Harricks Auditorium at the Institution of Engineers, Australia, Milsons Point.

Ray's presentation will appear in the February Edition of *The ANA.*

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

Design of Composite Yachts

Rozetta Payne, Design Engineer with Gurit Australia, gave a presentation on *Design in the Face of Uncertainty with Application to Composite Yachts* to a joint meeting with the IMarEST attended by 28 on 3 October in the Harricks Auditorium at the Institution of Engineers, Australia, Milsons Point.

Rozetta's presentation appears elsewhere in this issue.

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

Phil Helmore

The Chinese destroyer *Haerbin* arriving in Sydney on 28 September for a five-day visit. The destroyer was accompanied by the replenishment ship *Hongzehu* and, after the visit to Sydney, the ships participated in trilateral search and rescue exercise with the RAN and RNZN in the Tasman Sea, the first time such an exercise has been conducted with China
(RAN Photo)

COMING EVENTS

NSW Section Technical Meeting

RINA and IMarEST will hold a Special Technical Meeting on Wednesday 28 November at 5:30 pm for 6:00 pm in Room 101 in the School of Mechanical and Manufacturing Engineering at the University of New South Wales, where Prof. Alon Gany will make a presentation on *Two-Phase Marine Ramjet Propulsion.*

Prof. Gany is Head of the Propulsion and Combustion Laboratory and Head of the Sylvia and David I.A. Fine Rocket Propulsion Center in the Faculty of Aerospace Engineering at the Technion — Israel Institute of Technology in Haifa.

The presentation reviews and discusses research on non-conventional marine propulsion based on an operating principle which is parallel to that of the aeronautical ramjet. In this marine derivative, the main working fluid is water as compared to air in the aeronautical ramjet.

The unique feature of the marine ramjet is that energy needed to form a high-speed exhaust jet for thrust generation is provided via the introduction of compressed air bubbles into the water, which transmit their expansion work to the accelerating jet without any moving parts (for example, pumps) in contact with the water. Analysis and testing of the two-phase marine ramjet power cycle reveal high efficiency over a very broad vessel speed range, absence of cavitation problems, and noticeable thrust increase with increasing cruise speed. These features make the two-phase marine propulsion particularly attractive for high-speed cruise vessels.

Professor Gany is visiting the School between 28–30 November 2007. He would be pleased to meet other persons with similar research interests, including those in the area of aerospace engineering.

SMIX Bash

The eighth SMIX (Sydney Marine Industry Christmas) Bash will be held on Thursday 6 December aboard the beautifully-restored *James Craig* alongside Wharf 7, Darling Harbour, from 1730 to 2230. This party for the whole marine industry is organised jointly by RINA (NSW Section) and IMarEST (Sydney Branch).

Tickets are available from Adrian Broadbent on (02) 9262 1424 at $35 per head (cash or cheque payable to RINA NSW Section).

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

Pacific 2008

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

- The Pacific 2008 International Maritime and Naval Exposition, organised by Maritime Australia Ltd, will be held on Tuesday 29 January to Friday 1 February.
- The Royal Australian Navy Sea Power Conference 2008, organised by the Royal Australian Navy and the Sea Power Centre Australia, will be held on Tuesday 29 to Thursday 31 January. Further information on the conference can be obtained from the conference website, www.seapower2008.com, or by contacting the conference organisers, Tour Hosts Conference & Exhibition Organisers, GPO Box 128, Sydney NSW 2001, phone (02) 9265 0700, fax 9267 5443 or email seapower2006@tourhosts.com.au.
- The International Maritime Conference, organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia on the theme *Meeting the Maritime Challenges*, will be held on Tuesday 29 to Thursday 31 January. Further information on the conference, including the conference and social programs, can be obtained from the conference website www.pacific2008imc.com or by contacting the conference organizers, Tour Hosts Conference & Exhibition Organisers, GPO Box 128, Sydney NSW 2001, phone (02) 9265 0700, fax 9267 5443 or email pacific2008imc@tourhosts.com.au. Online registration is available at www.pacific2008imc.com.
- The Autonomous Unmanned Vehicles Symposium, organised by Maritime Australia Ltd, is the second Australian AUV Symposium, and will be held on Thursday 31 January and Friday 1 February within the halls of the Pacific 2008 Expo. Further information on the Symposium can be obtained from the organiser by email at expo@maritime.net.au.

Marine Safety Conference 2008

The National Marine Safety Committee will host the next national Marine Safety Conference at the Hilton Adelaide Hotel in Adelaide from 27 to 29 May 2008. This is the fifth two-yearly Marine Safety Conference organised by NMSC. In 2006, the event attracted 350 delegates and 50 national and international speakers.

The Conference will deal with a wide range of current issues impacting on the marine industry, and covering the following sectoral interests:

- Recreational Boating
- Commercial Operations
- Seafood Industry
- Engineering
- Boat/ship Design and Building
- Training
- Safety and Environmental Management
- Surveying
- and more specialist topics — depending on papers submitted.

Key dates are as follows:

- February 08 Early-bird bookings open
- March 08 Submission of papers
- March 08 Conference program finalised

For further information, visit the NMSC website at www.nmsc.gov.au and follow the links, phone the NMSC Secretariat on (02) 9247 2124, or email secretariat@nmsc.gov.au.

The PACIFIC 2008 Congress

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Pacific 2008 Maritime Congress Comprising:
Pacific 2008 International Maritime Conference
RAN Sea Power Conference 2008
In association with the Pacific 2008 International Maritime Exposition
Organised by Maritime Australia Limited

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MEETING THE MARITIME CHALLENGES

For further information visit
www.pacific2008imc.com

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29 - 31 January 2008

AUSTRALIA AND ITS MARITIME INTERESTS: AT HOME AND IN THE REGION

For further information visit
www.seapower2008.com

Organised by
Royal Australian Navy
Sea Power Centre - Australia

To express your interest in attending either Conference please visit the website as indicated above and complete the online form. Registration information will then be sent to you when it becomes available.

For further information on either of the above Conferences contact:

Tour Hosts Conference & Exhibition Organisers
GPO Box 128, Sydney NSW 2001 AUSTRALIA
Tel: +61 2 9265 0700 Fax: +61 2 9267 5443

Email:

Pacific 2008 International Maritime Conference:
pacific2008imc@tourhosts.com

Royal Australian Navy Sea Power Conference 2008:
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IMAREST

NAVY

HPYD 2008

The third High Performance Yacht Design conference will be held on 2–4 December 2008 in Auckland, New Zealand. Following on from the success of the last two conferences, papers are now invited on a broad spectrum of topics covering the design of high performance yachts and power craft:

- Performance prediction and measurement
- Wind tunnel and towing tank technology
- Regulations and rating rules
- Computational methods
- Materials and structural analysis
- Hull and appendage design

Abstracts of no more than 500 words should be submitted to technical@hpyd.org.nz by 31 March 2008 in either PDF or MS Word format. In addition to the abstract of your work, the document should also include the proposed title of your paper, the names and affiliations of all authors and the contact details of the principal/corresponding author.

The conference organiserswill be sending out regular updates by email, so you may subscribe to their update list now to keep up to date with progress.

Check out all the current information, including details of previous conferences, at www.hpyd.org.nz.

CLASSIFICATION SOCIETY NEWS

Meeting of LR's Australian Technical Committee

The Australian Technical Committee of Lloyd's Register met on 21 September to consider proposed changes to Lloyd's Rules for Ships and Lloyd's Rules for Special Service Craft. Comments from the Australian Technical Committee will be considered, along with comments from other LR Technical Committees around the world, by Lloyd's Technical Committee in London in November, and the changes will be promulgated in 2008.

ABS Issues Guidance for Protective Coatings

ABS is assisting shipbuilders, ship owners and operators prepare for the new IMO-mandated Performance Standard for Protective Coatings (PSPC), IMO MSC 215(82), by issuing a completely revised and expanded edition of its *Guidance Notes on Inspection, Maintenance and Application of Marine Coatings*. The IMO standards take effect on 1 July 2008 and will apply to the dedicated seawater ballast tanks on all ships of not less than 500 gross tons for which the building contract is placed on or after 1 July 2008; or, in the absence of a building contract, the keels of which are laid on or after 1 January 2009. The standards also apply to the double-side-skin spaces of bulk carriers of 150 m in length and upwards.

The guidance provided by ABS covers both the technical requirements of the new regulations and the role which coatings play in contributing to the longevity of the structure. They also take into account the International Association of Classification Societies (IACS) Procedural Requirement (PR34) which specifically addresses the application of the new IMO standards.

The ABS *Guidance Notes* are recognized by NACE International as being quality introductory training material for marine coating inspectors. NACE is globally recognized as the leading professional technical society dedicated to the prevention of corrosion and governs the NACE Coating Inspector Program, which sets the benchmark for other coating inspection programs and is referenced in IMO MSC 215(82).

"Coatings comprise a significant proportion of the cost of a new ship", says Todd Grove, ABS Senior Vice President and Chief of Staff. "Both IMO and class have recognized that the quality of the coatings directly affects the structural integrity of the ship, its environmental performance and, ultimately, the value of the asset. Although the new standards place the primary responsibility for the proper application of the coatings on the shipyard, these new guidelines should help clarify the issues, and potential pitfalls, for all parties while clearly delineating the responsibilities of class for verifying that the applicable processes are complied with."

Shipyards are already gearing up to meet the new IMO standards, as the ten members of IACS late last year jointly agreed to advance the 1 July 2008 implementation date for tankers and bulk carriers subject to the new IACS Common Structural Rules (CSR). The new coating standards apply to all CSR ships for which the orders have been placed on or after 8 December 2006. Construction of the first CSR vessel ordered to ABS class to which the new standards apply is expected to begin in the second quarter of 2008.

The updated ABS *Guidance Notes* address the fundamentals of coating technology as applied to ship structures, and the regulatory requirements for coatings in ballast tanks, void spaces, cargo tanks, cargo holds and outer-hull anti-fouling systems. The chemistry and mechanics of corrosion are explained, and methods of surface preparation are introduced along with safety guidance and a matrix detailing the advantages or disadvantages of each method.

Factors such as human error, environmental conditions, surface preparation, contaminants, film thicknesses and the method of application all play a role in determining a coating's effectiveness. To aid in the assessment of how coatings perform, the ABS *Guidance Notes* illustrate typical failures and provide advice on appropriate repair and maintenance strategies.

Recognizing that the auditing of coating inspection procedures is an extension of class responsibilities into a new area, ABS has initiated a comprehensive training program (also recognized by NACE,) for its surveyors with the initial participants being those currently assigned to the major shipbuilding centres.

ABS offers a class notation (CPS) for those ships complying with the PSPC standards and procedures during the coating application process. This notation is explained in detail in the newly released *Guidance Notes.*

Still under discussion at IMO is the extension of the coatings regulatory regime to cover cargo holds/tanks as well as void spaces and the through-life maintenance of coatings.

Lloyd's Register launches RuleOutlook Live

Lloyd's Register has announced the introduction of RuleOutlook Live, a new interactive online service to keep ship owners and operators informed and up-to-date with the regulatory environment affecting the maritime industry.

RuleOutlook Live presents comprehensive and timely information on future legislation emanating from such bodies as the International Maritime Organization (IMO), the International Association of Classification Societies (IACS) and the European Union (EU). It highlights the impact of proposed legislation on various sectors of the industry, such as shipyards, ship owners and flag administrations, and it will track relevant changes to legislation already in force.

Robert Smart, Head of External Affairs at Lloyd's Register, says, "In the increasingly complex regulatory environment in which the maritime industry operates there is a clear need for all industry sectors to understand the impact of new and proposed legislation so that they can plan in advance for the impact of regulatory changes. RuleOutlook Live will enable the industry to know what it has to do, and by when, in order to comply. We believe it will offer significant benefits to both our clients and our own surveyors."

The RuleOutlook Live database contains synopses of proposed and forthcoming legislation together with in-depth impact analysis from our relevant knowledge experts. The synopses are updated on a regular basis to give an overview of all the issues surrounding a piece of legislation, advice to clients on specific work programmes and the application of the legislation to different ship types and sizes.

Users are able to search the database using a number of different search criteria, such as new and existing vessels, deadweight, length and gross tonnage. The system is designed to be easy to access around the clock from anywhere in the world. RuleOutlook Live also includes an invaluable database of frequently asked questions.

Available initially to existing Lloyd's Register's ClassDirect Live clients and flag states, the service will be rolled out to shipbuilders this autumn.

Lloyd's Register Issues Green Passport to New Crowley Barge

Lloyd's Register North America, Inc. has issued a Green Passport to the Crowley Petroleum Services barge 650-3 which was recently christened in Mobile, Alabama, for entry into the company's US coastwise service. The International Maritime Organization (IMO) issued *Guidelines on Ship Recycling* to improve the standards of safety and reduce environmental pollution resulting from the scrapping of ships in 2003. The guidelines introduced the concept of the Green Passport, which is essentially an inventory of materials present in a ship's structure, systems, and equipment which may be hazardous to health or the environment.

With environmental issues a priority in the minds of port authorities and governments, obtaining a Green Passport is one way in which responsible shipowners can demonstrate a proactive stance on ensuring safety and preserving the environment. The Green Passport for the 650-3 is among the first to be issued to a vessel in the US fleet. The Green Passport is also the first to be issued to a tank barge by Lloyd's Register in North America.

The Green Passport is a historical record of the materials onboard a vessel which may be hazardous to human health or to the environment and is an valuable tool for developing a hazard management strategy and assessing liability from shipbuilding to ship breaking. One of the biggest advantages of the Green Passport is improving safety in operations, by ensuring that the ship's crew are aware of the potentially hazardous materials onboard, and that proper attention is paid to hazard and safety management systems. The Green Passport is regularly updated and maintained and is eventually passed by the owner to the ship recycling yard at the end of the ship's life, to enable the yard to formulate a safe and environmentally-sound way of breaking the ship.

"We enrolled the barge 650-3 in the Green Passport program to demonstrate Crowley's core value of safety; specifically, the company's commitment to safeguarding the environment and recognizing potential hazards," says Captain Victor Goldberg, Vice President of Operations for Crowley Petroleum Services. "The Green Passport ensures that the vessel will carry a history of the materials that were used in its construction and subsequent operations throughout its working life."

"Lloyd's Register is pleased to work with diligent shipowners to ensure that their vessels remain safe for the environment and for human life," says Rick Ferraro, Business Development Manager for Lloyd's Register North America and Account Manager for Crowley. "We applaud Crowley for its decision to obtain the Green Passport for the barge 650-3 and look forward to being part of its ongoing commitment to the safety of human life and good environmental stewardship. Through such actions, the company clearly demonstrates that protection and conservation of the environment are high priorities in managing its business."

Lloyd's Register and OSC's Research Identifies Significant New Container Trade Oportunities

Following last October's confirmation that the planned Panama Canal expansion will be going ahead, significant new opportunities and trading patterns are now likely for container ships, according to in-depth research commissioned by Lloyd's Register and carried out by Ocean Shipping Consultants Ltd (OSC). The increasing demand for the economies of scale offered by large post-Panamax ships has already led to a large leap in orders for ships with declared capacities of over 8000 TEU. As a consequence, the expansion of the Panama Canal by means of new and larger locks is now likely to lead to a complete redefinition of container trades, the research indicates.

The research suggests that US east-coast ports will benefit substantially from the changes, and will form a vital element in the likely reshaping of trade patterns. With larger ships able to transit Panama, routes between Asia and the US east coast will be the most cost-effective means to move freight in and out of the American midwest. Central to the success of the revitalised trades will be the ability of ships to call at New York.

A concern highlighted in the study is that ships entering the most important of the New York and New Jersey container

terminals will need to pass under the Bayonne Bridge. With an air draught of 46 m, this bridge currently poses a problem for nearly all post-Panamax ships currently in service and on order. It is understood that the 75-year-old bridge will eventually be raised, but this will be an expensive and lengthy operation. In the meantime, the height restriction imposed is a serious issue for the container trades.

"This is a very significant issue that must not be overlooked," says OSC Director, Andrew Penfold. "On the one hand, a new Panamax ship (NPX) delivered today would create significant employment prospects — on a competitive cost basis — in the Asia-Europe trades, and this could drive operators towards committing to larger ships, as many have done to date. On the other hand, however, operators might very well see an inability to enter New York as a significant limiting factor."

David Tozer, Business Manager — Container Ships for Lloyd's Register, says "As the timescale for the possible raising of the bridge is uncertain, Lloyd's Register is proposing interim design solutions which will help operators to provide a competitive service from Asia to the US east coast — including New York — while the air draught under the Bayonne Bridge remains at 46 metres, which can then be enhanced once the bridge has been raised."

There are now more than 350 post-Panamax ships on order. The Panama Canal Authority (ACP) has advised that an NPX vessel would have dimensions of 366 by 49 metres on a 15 m draught. The new research suggests that this would enable ships with a capacity of 12 500 TEU to transit the new canal locks, carrying seven or eight tiers of containers on deck. To meet the current air-draught restrictions in New York, however, a post-Panamax container ship would need to be limited to five tiers on deck. This requires a new approach to design — probably incorporating a 'one third forward' bridge arrangement to maximise the ship's container capacity.

"The air draught restriction has come as a surprise to builders," continues Tozer, "but Lloyd's Register has now developed NPX design solutions to give ships with water draughts of over 15 m the flexibility to trade into ports worldwide while also being able to comply with the current New York and New Jersey air-draught restriction. In the future, when the Bayonne Bridge is raised, it will be a relatively simple matter to convert these ships to carry seven or eight tiers on deck by increasing bridge and funnel heights."

The design solutions proposed by Lloyd's Register, which it has been exploring with the ACP and with shipyards in China and Korea in conjunction with OSC, assume that other restrictions, such as terminal water depth, are improved and that the current channel-deepening programme is expedited.

LR Marine Business Growth

Lloyd's Register's Marine business, which accounts for around 50% of LR's total income, grew its revenues by 12% in 2006–07. Over 7 million gross tonnes (mgt) was added to the Lloyd's Register classed fleet which, at the end of June, stood at 134.5 mgt, another all-time high for the group. The number of ships on order to Lloyd's Register class increased to 1214 totalling in excess of 46 mgt over the same period and, since then, the order book has gone past 50 mgt.

The Marine business won 114% more new construction orders in China in 2006–07 than in the previous financial year, underlining Lloyd's Register's status as the leading classification society in China.

Lloyd's Register also won the majority of the contracts awarded for the extra-large Q-max liquefied natural gas carriers, consolidating its position as the market leader for the classification of LNG ships. Today, Lloyd's Register classes twice the number of LNG ships as its nearest rival.

Lloyd's Register is also at the forefront of large container ship design support, providing answers to design and operational issues posed by increases in size. In July the 10 000 TEU container ship, *COSCO Asia*, became the latest large container ship to join the Lloyd's Register fleet. Lloyd's Register has also developed new container ship concepts to meet the dimensions of the proposed expansion of the Panama Canal.

LR's Education Trust

Lloyd's Register has donated £6m to the Lloyd's Register Educational Trust (LRET). This charity has become such an active body in support of education in the areas of engineering, science and technology that the trustees of the charity have elected a full time Director to handle effectively all new applications and monitoring of existing grants. The LRET is also now much more international in terms of the institutions it supports, with significant new grants made to educational establishments in Korea, the United States of America, Singapore, Canada and Greece.

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 with a minimum resolution of 150 dpi. A resolution of 200–300 dpi is preferred.

GENERAL NEWS

Contract Signed for Air-warfare Destroyers

On 4 October the Minister for Defence, the Hon. Brendan Nelson, announced the signing of the final contracts to build three air-warfare destroyers (AWD) for the Royal Australian Navy. At a total cost of approximately $8 billion, it is the largest naval shipbuilding project ever undertaken in Australia.

The signing follows two years of hard work by the AWD team in the design selection phase of the project which resulted in the Australian Government choosing the Spanish Navantia F-100 warship as the platform for Australia's next generation Hobart-class destroyers.

The first ship will be delivered in late 2014, followed by the second and third ships in early 2016 and mid 2017 respectively.

The project will provide enormous opportunities for Australia's shipbuilding, electronics and engineering industries, creating 1500 shipbuilding jobs in South Australia. Another 1500 jobs will be created throughout Australia.

The Aegis-equipped F100 will provide the Navy with one of the world's most capable warships. The Australianised F100 will be capable across the full spectrum of joint maritime operations, from area air defence and escort duties, right through to peacetime national tasking and diplomatic missions.

Since entering service with the Spanish Navy, F100s, among their many other tasks, have worked alongside the United States Navy (USN) as the first foreign Aegis-equipped ship to be fully integrated into a USN Carrier Strike Group.

The principal contract, signed on 4 October, was the three-way Alliance Based Target Incentive Agreement between the Defence Materiel Organisation, ASC AWD Shipbuilder Pty Ltd and Raytheon Australia Pty Ltd.

This contract does not include the Commonwealth contract for the Aegis combat system, which is a separate agreement between the Australian and United States Governments.

The other contract signed was the Platform System Design contract between the Commonwealth and Navantia S.A.

Australian Industry will play a pivotal role in the success of the AWD project by providing specialised skills and equipment to the AWD Alliance. Australian Industry is expected to deliver products and services for around 55 per cent of the AWD Program over the next 15 years. This will be followed by high-value through-life support contracts into the middle of the century.

Contract Placed for New Shipyard

South Australian Premier, Mike Rann, announced in August the awarding of the largest contract in the construction of Techport — Adelaide's emerging defence hub.

The $170 million contract to construct world-class shipbuilding facilities at Osborne, as part of the Common User Facility, has been awarded to a McConnell Dowell/ Built Environs joint venture.

"Today's announcement confirms our position as the defence capital of Australia and brings us one step closer to delivering Australia's largest defence project — the $8 billion air-warfare destroyer program," Mr Rann said.

"We are investing more than $300 million in state-owned infrastructure to support the air-warfare destroyer program and provide a home for future naval shipbuilding, systems and sustainment at Techport Australia.

"Part of this investment includes design and construction of a world-class Common User Facility — including a 210 m-long wharf, transfer system and Australia's largest ship-lift, which will be 156 m long and capable of lifting ships of displacement up to 9300 t.

"This facility will be the hub for movement and assembly of large ships and modules, and will become a national strategic asset and integral to the successful delivery of the AWD program.

"And following this week's announcement by federal Labor leader Kevin Rudd — later supported by Defence Minister Brendan Nelson — that the next generation of submarines will be built in Adelaide, this publicly owned multi-user facility assures our future at the very centre of Australia's naval defence and ship construction industry, and provides strong justification for the investment the state has made.

"By investing in this infrastructure, we are providing opportunities to a range of companies, contractors and subcontractors and, indeed, a range of projects well beyond the AWD — we are creating and supporting an industry for generations to come."

Construction on the facility is expected to be completed by early 2010.

CEO for AWD Alliance

Dr Stephen Gumley (CEO Defence Materiel Organisation) and LTGEN David Hurley (Chief Capability Development Executive) announced on 22 August the selection of Mr John Gallacher as the Chief Executive Officer of the Air Warfare Destroyer (AWD) Alliance Management Team. Mr Gallacher, the chief executive of ASC Shipbuilding, will now be responsible for the team which will deliver the next generation AWDs to the Royal Australian Navy.

The AWD Program is utilising an alliance-based contracting strategy that is widely recognised as an international standard for major Defence acquisitions. The Alliance participants, which comprise the Defence Materiel Organisation, ASC AWD Shipbuilder and Raytheon Australia, will work together to deliver the warships to the RAN.

Mr Warren King (DMO), who will continue in his role as chairman of the Alliance Project Management Board has welcomed the appointment. "Mr Gallacher has great integrity, vision and leadership, and he is the right man to lead the Alliance into the future," Mr King said.

Contract Signed for Canberra-class LHDs

On 8 October 2007 the Prime Minister witnessed the signing of the contract to build Australia's new amphibious ships on board HMAS *Kanimbla* at Tenix in Williamstown, Victoria.

This contract, costing about $3.1 billion over eight years, will draw on the strengths of Australian industry to provide two of the most advanced ships of this type in the world. The first ship, HMAS *Canberra*, will be delivered in 2013 and the second, HMAS *Adelaide*, in 2015.

These 27 000 t ships will greatly enhance Australia's ability to deploy forces when necessary in our region or beyond, and to provide assistance in time of natural disaster. Using their integrated helicopters and watercraft, each vessel will be able to land approximately 1000 personnel, along with their vehicles, the new Abrams tanks, artillery and supplies. They will also be equipped with medical facilities, including two operating theatres and a hospital ward, and will be capable across the full spectrum of maritime operations, including aid to the civil community in times of natural disaster at home or abroad.

Additional jobs and economic benefits will be created, not only during construction, but in supporting the vessels throughout their life.

The construction of the superstructure and the majority of the fit-out, worth approximately $500 million to Australian industry, will occur in Melbourne. At its peak, the Tenix workforce will grow to over 1500 from its current 1000. Combat system work in Adelaide will bring up to $100 million to the South Australian economy. Other states will also benefit.

As well as providing the Australian Defence Force with valuable enhanced capability, this major investment will offer Australian defence firms unparalleled prospects in the areas of electronics, design development, systems engineering and integration, employing Australians in a range of high-value engineering, shipbuilding and project-management roles.

The contract-signing ceremony for Australia's new LHDs on the flight deck of HMAS *Kanimbla* in Williamstown on 8 October

(RAN Photo)

HMAS Sydney Departs for North America

The RAN frigate HMAS *Sydney* left Fleet Base East at Garden Island on 17 September for her first visit to mainland North America since her launch on 26 September 1980.

The purpose of the deployment was to complete testing of the functionality of the Adelaide-class frigate upgrade (FFGUP). While off the coast of Hawaii, Sydney participated in Evolved Sea Sparrow Missile firings at the Barking Sands Pacific Missile Range Facility.

The firing demonstrated the integration of the Baseline Build 2 combat system software and the MK41 vertical launch system recently installed as part of FFGUP.

The ship now is equipped with two missile systems to combat anti-ship missiles and aircraft.

While deployed, *Sydney* was also to conduct underwater trials using facilities at Nanoose Bay, Vancouver. The trial was to test the capabilities of the Torpedo Decoy System, installed during the FFGUP.

The FFGUP is scheduled to complete in December 2009.

HMAS *Sydney* sailng from her home port of Sydney for her first visit to the USA since she was built
(RAN Photo)

Boost for HMAS Sydney II Search

In August the Minister Assisting the Minister for Defence, Bruce Billson, confirmed that the Government had approved a further $2.9 million grant to assist HMAS Sydney Search Pty Ltd to locate the missing Royal Australian Navy cruiser HMAS *Sydney*.

The grant is in addition to an initial Commonwealth grant of $1.3 million approved in August 2005 to assist the Western Australian based not-for-profit search group.

"The Australian Government's commitment to support a large-scale search for HMAS *Sydney* is underlined by the $4.2 million in funding which it has now committed to the task," Mr Billson said.

HMAS *Sydney* was tragically lost in November 1941 in the Indian Ocean off WA with its full crew of 645, following a fierce engagement with the German raider *Kormoran*.

"The location of the ship's final resting place remains our nation's most enduring maritime mystery. The *Sydney* tragedy has had a profound effect on our nation, as it and its crew were sources of great pride as a result of their earlier World War II triumphs in the Mediterranean Sea against enemy forces," Mr Billson said

HMAS Sydney Search Pty Ltd, with the support of the

RAN's Seapower Centre — Australia, has painstakingly researched the sinking of HMAS *Sydney* and has formed a relationship with world-renowned shipwreck investigator David Mearns.

"We are hopeful that the additional funding will enable a meaningful search to commence on the water in the near future, drawing on the extensive knowledge and expertise of HMAS Sydney Search, our own Royal Australian Navy and Mr Mearns," Mr Billson said.

"Mr Mearns has an outstanding track record of locating shipwrecks and was successful in finding the celebrated Royal Navy battle-cruiser HMS *Hood* and German battleship *Bismarck*."

Mr Billson said a 'team Australia approach' in alliance with the best the world has to offer in terms of underwater sonar technology, which has advanced greatly over the last decade, offered the best chance yet of finding both *Sydney* and *Kormoran*, which also sank as a result of the fight.

"Success in finding HMAS *Sydney* would not only solve a great mystery, but would also help bring a sense of closure to the families of the 645 crew members lost," he said.

Ted Graham, chairman of HMAS Sydney Search said that, while the large search area and water depth meant this was an extremely challenging assignment, advances in technology greatly improved the chances of success.

"We now have a remarkable search capability in the form of state-of-the-art wide-swath side-scan sonar technology to cover this large area where we believe the wrecks of both *Sydney* and *Kormoran* have sunk," he said.

"This proven and highly-efficient sonar technology has been used to find other significant shipwrecks, like HMS *Hood*, *Bismarck* and *Derbyshire*, as well as many other smaller wrecks sunk in much deeper water.

"We also know more about the seabed in the search area, thanks to the efforts after the kind donation of ship time made by Perth-based Geo Subsea Pty Ltd, which provided its multi-beam survey vessel to conduct a preliminary survey through the area. Fortunately, the survey showed that the seabed was clear of major geologic features which could complicate our sonar search," Mr Graham said.

Research Vessel Named at Tenix

A marine research vessel built by Tenix Marine for the Australian Institute of Maritime Science (AIMS) was named in a ceremony at Fremantle on 8 October by The Hon. Julie Bishop MP, Federal Minister for Education, Science and Training.

AIMS was established in 1972 by the Federal Government and is one of the world's leading tropical marine science and technology research laboratories.

RV *Solander*, built at Tenix Marine's Henderson Shipyard in Western Australia, will be based at Townsville, Queensland, for use on the Great Barrier Reef, and waters extending from Brisbane to Exmouth in Western Australia.

The 35 m ship will join *Cape Ferguson*, which was also built at Henderson by Tenix Marine in 2000. Together, these vessels will provide the operational capability to allow AIMS to undertake its extensive field research.

Tenix CEO, Greg Hayes, said that the ships consolidated the company's capability in building smaller research and patrol vessels.

"The construction of the two research vessels has generated significant economic benefits for Western Australia, whilst also supporting the work of the institute," Mr Hayes said.

"Tenix is proud to have been chosen to build these two vessels, which will play an important role in increasing the scientific community's understanding of Australia's marine environment."

AIMS CEO, Ian Poiner, said that the new vessel significantly increases AIMS' ability to explore and study Australia's vast tropical marine territory.

"This area is home to much of Australia's unique, but poorly understood, biodiversity and some of the most iconic marine habitats on earth," Mr Poiner said.

"It also supports some of Australia's key marine industries, including offshore oil and gas, and tourism."

"The launch of RV *Solander* is an important milestone in both AIMS' history and the development of Australian marine science."

RV *Solander* is capable of supporting multi-disciplinary marine research and will act as a mother ship for smaller vessels, and provides a stable work platform for diving operations and collecting marine samples.

In addition to efficiently deploying scientific equipment, the vessel contains dry and wet laboratories to allow on-board scientific analysis.

The construction of RV *Solander* adds to the long list of projects Tenix Marine has undertaken at Henderson, including search-and-rescue vessels for the Philippines Coast Guard, and patrol boats for the Hong Kong Water Police.

US Navy Cancels Fourth LCS

US Secretary of the Navy, Donald C. Winter and Chief of Naval Operations, ADM Gary Roughead announced on 1 November 2007 that the US Department of the Navy was terminating construction of the fourth littoral combat ship (LCS 4) for convenience under the termination clause of the contract, because the Navy and General Dynamics could not reach agreement on the terms of a modified contract.

The Navy had not yet authorised construction on LCS 4, following a series of cost overruns on LCS 2. The Navy intended to begin construction of LCS 4 if the Navy and General Dynamics could agree on the terms for a fixed-price incentive agreement. The Navy worked closely with General Dynamics to try to restructure the agreement for LCS 4 to more equitably balance cost and risk, but could not come to terms and conditions that were acceptable to both parties.

The Navy remains committed to the LCS program.

"LCS continues to be a critical war-fighting requirement for our Navy to maintain dominance in the littorals and strategic choke points around the world," said Secretary Winter. "While this is a difficult decision, we recognise that active oversight and strict cost controls in the early years are necessary to ensure that we can deliver these ships to the fleet over the long term."

"I am absolutely committed to the littoral combat ship," said ADM Roughead. "We need this ship. It is very important that our acquisition efforts produce the right littoral combat ship capability to the fleet at the right cost."

Second NZ OPV Launched by Tenix

The second of two Offshore Patrol Vessels (OPV) being built by Tenix for the Royal New Zealand Navy was officially launched at Williamstown on 27 October by the Chief Justice of New Zealand, Dame Sian Elias GNZM, QC.

The vessel, named *Wellington*, is one of seven ships Tenix is building for the Royal New Zealand Navy under the NZ$500 million Project Protector.

"*Wellington* has taken five months from keel laying to launch, and involved around 300 people working on the project. This vessel is another example of the world-class product which Tenix produces and this is due, in no small part, to the outstanding work of our employees and subcontractors," said Tenix Group Managing Director Greg Hayes.

As well as the two OPVs, four Inshore Patrol Vessels are being built at Tenix's Whangarei facility in New Zealand. The third part of the Project Protector, the 8500 t Multi-Role Vessel HMNZS *Canterbury*, was delivered in May this year.

"The launch of *Wellington* continues the successful trans-Tasman industrial co-operation established for the Anzac-ship project, under which Tenix built eight frigates for Australia and two for New Zealand.

"Tenix's naval shipbuilding program provides jobs for over 1100 people in Australia and New Zealand, and involves another 2000 small-to-medium enterprises as sub-contractors and suppliers," Mr Hayes said.

"Over the past 20 years, Tenix has built over 100 ships and exported around 60 per cent of them.

"I want to thank all the men and women who have worked so hard on this project to deliver to the Royal New Zealand Navy a world-class vessel that I know will serve the people of New Zealand for many years to come."

Wellington, the second offshore patrol vessel built by Tenix for the Royal New Zealand Navy, enters the water at her launch on 27 October 2007
(Photo courtesy Tenix)

Proud shipbuilders — a group photo at Austal to celebrate the launching of the last Armidale-class patrol boat built for the Royal Australian Navy, HMAS *Glenelg*
(Photo courtesy Austal Ships)

Last Armidale-class Patrol Boat Named

The successful completion of Australia's 14-vessel Armidale-class patrol boat fleet was celebrated during an historic naming ceremony held at Austal's Henderson facility on 6 October.

Austal designed and built all 14 vessels during the past four years, so the event was a major milestone in the company's 20 year history, which now includes the delivery of state-of-the-art patrol boats destined to protect Australia's waters for decades to come.

The naming ceremony included an address by the Chief of Navy, VADM Russ Shalders, and the Federal Minister for Justice and Customs, Senator David Johnston. The new 56 m, all-aluminium patrol boat was named *Glenelg*. She is the second ship of the name in the RAN — the first HMAS *Glenelg* was one of 60 Australian minesweepers of the Bathurst-class built in Australia during World War II.

More than 200 dignitaries attended the ceremony, including senior figures from the Royal Australian Navy, State and Federal Governments and local industry. With a total contract value of approximately $550 million, the patrol boats will primarily carry out surveillance, interception, investigation, apprehension and the escort to port of vessels suspected of illegal fisheries, quarantine, customs or immigration offences.

Austal, in partnership with prime- and service-contractor Defence Maritime Services (DMS), won the contract for 12 Royal Australian Navy patrol boats in 2003. The first vessel was delivered less than two years after signing the contract, with the remaining vessels meeting a similarly tight delivery schedule. An additional two patrol boats were ordered in 2006 for a total of 14 vessels.

Austal Executive Chairman, John Rothwell, said the naming ceremony was a significant milestone for the company, having successfully provided the Royal Australian Navy with a state-of-the-art patrol boat capability.

"This project has demonstrated Austal's ability to design, build and deliver an important fleet of naval ships on budget, on time and with modern capabilities," Mr Rothwell said.

"These modern, capable and stylish vessels have, without doubt, enhanced our credibility in the eyes of foreign navies," he said.

"For our staff, it is a very proud moment, not only because each one was involved in meeting the demanding delivery schedule, but also because the pride of Austal's fleet is now protecting Australia's waters."

The Armidale-class patrol boats have already received positive reviews from serving members of the Royal Australian Navy, including Commanding Officer, LCDR Mark Taylor who described the Austal-built HMAS *Wollongong* as like a "Ferrari sports car".

The fleet, which replace the ageing Fremantle-class patrol boats, will be principally based in the ports of Darwin and Cairns, primarily operating within Australia's Marine Jurisdictional Zones.

LCM2000 Trials Suspended

At the end of August the Department of Defence suspended trials of the fleet of six Landing Craft Mechanised (LCM2000) watercraft pending further investigation into structural issues which became apparent during testing.

The watercraft were designed for use by the Army to transfer personnel and supplies from ship to shore. Defence is working with the builder, ADI Limited (trading as Thales Australia) to investigate the situation. Testing of the watercraft was suspended pending the outcome of the technical investigation as a safety precaution.

World's Fastest Diesel-powered Vehicle Ferry Launched

The first of two Multi-Purpose Auto Express 65 m high-speed ferries built for the Sultanate of Oman was launched at the Austal Image Henderson shipbuilding facility on 27 September. With a top speed in excess of 50 kn, the vessels will be the fastest diesel-powered vehicle ferries ever built.

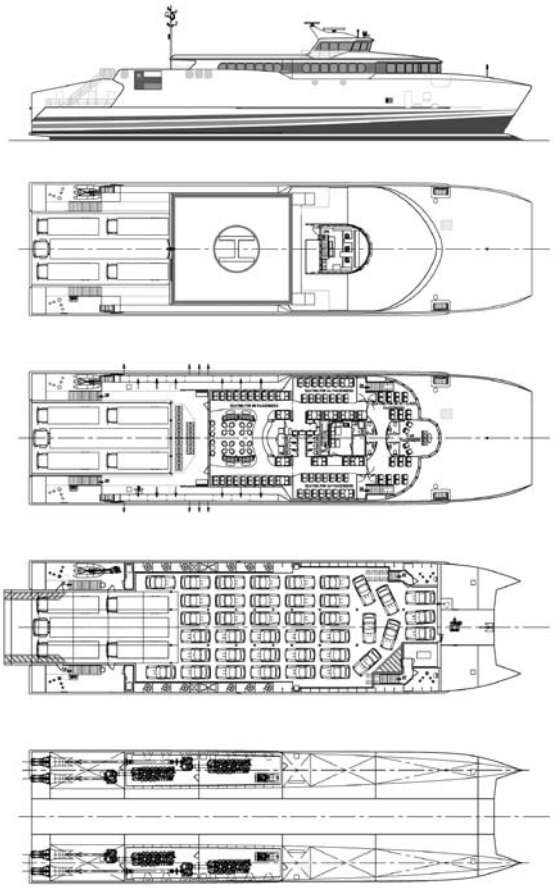
The first Omani ferry ready for launching
(Photo courtesy Austal Ships)

Scheduled for delivery in 2008, the two catamarans will provide a new tourism service to Oman's magnificently rugged Musandam Peninsular and will be the flagships in the Sultanate's expanded marine transport network. Once delivered, the vessels will set new standards for the Middle East region, not only in terms of performance but also in safety, comfort and quality of finish. As well as reaching speeds of over 50 kn, the ferries will carry 208 passengers and 56 cars along an intended 180 n mile route.

Passengers will experience unparalleled comfort across three classes — Tourist Class, First Class and VIP. High-quality seating and catering facilities are all located on a single deck, with seakeeping comfort enhanced by the Austal SeaState Motion Control System.

Onboard features also include a helicopter landing facility suitable for a medium-class helicopter, which will be capable of assisting in search-and-rescue and medivac operations.

Both vessels are powered by four MTU 20 cylinder 1163 series diesel engines, each producing 6500 kW and driving a Rolls Royce/KaMeWa waterjet. The vessels are being built in accordance with the requirements and under the survey of Det Norske Veritas, conforming to the International Maritime Organisation High Speed Craft code (HSC 2000).



General Arrangement of the Omani ferries
(Drawing courtesy Austal Ships)

Austal Executive Chairman, John Rothwell, said the contract for the Sultanate of Oman's two high-speed vessels is of extreme strategic importance, as it demonstrates Austal's leading design and construction capabilities in one of the fastest-growing markets in the world.

"With 15 of our company's commercial and military ships now operating in the Middle East and 10 in nearby Turkey, the two Sultanate of Oman ferries further reinforce Austal's commitment to the region and its understanding of the unique needs of the Middle East," Mr Rothwell said.

The first vessel will arrive in Oman early next year.

Principal Particulars

Length OA	64.8 m
Length WL	61.1 m
Beam mld	16.5 m
Hull depth mld	6.2 m
Hull draft (max)	2.1 m
Deadweight (max)	146 t
Passengers	208
Crew	12
Vehicles	56 cars or 54 truck lane m plus 40 cars
Axle loads	
aft main deck	9 t (single wheel) 12 t (dual wheel)
remainder of main deck	3 t (single wheel)
Vehicle deck clear height	3.1 m

Helideck capacity	Augusta Westland AB139 or equivalent
Fuel (approx)	44 000 L
Propulsion	
Main engines	4 × MTU 20V 1163 TB73L each 6500 kW
Propulsion	4 × Kamewa 90SII
Gearboxes	4 × Reintjes
Service speed	50 kn
Survey	DNV IMO HSC 2000

Australian Industry boosted by US Defence Treaty

An Australia-US Treaty on Defence Trade Cooperation was signed during the APEC Leaders week in Sydney in September. The improved access resulting from the Treaty for Australian industry to sensitive US technology and the removal of bureaucratic barriers will simplify the process for sharing equipment, information, spare parts, services and technical data.

This is expected to deliver cost savings by reducing the time and resources required when dealing with the US defence industry. It will provide more opportunities for increasing trade and more jobs by enhancing the competitiveness of Australian companies.

Last year 2361 export licences and 312 technical data agreements were approved for Australia. At a conservative estimate, at least half of these approvals, which can take 90 days or more, will no longer be required under the Treaty. This will save hundreds of person-years of processing time and, through certainty, reduce delays to project schedules by months each year.

The Australian Defence Force (ADF) and US armed forces will benefit from increased cooperation in technology application in areas such as counterterrorism and information sharing.

One of the significant benefits expected for industry will be certainty with regard to workforce planning. Previously, with companies having to wait for licenses to be approved, some elements of the industry workforce may have been in limbo for long periods of time. Another significant benefit is in relation to 'retransfers' of technology. The new arrangement means that, once equipment has been received it will be transferable between companies who are part of Australia's approved community without the need for further US Government approvals.

Award for Incat Chairman

Incat Founder and Chairman Robert Clifford was recognised in October for his personal and his company's significant contribution to the Tasmanian Export Industry

Making the Tasmanian Award for Export Leadership at the 2007 Tasmanian Export Awards at the Launceston Country Club, Tasmania's Deputy Premier, Mr Steve Kons, said that Mr Clifford was recognised not only for this significant contribution to industry, but also to the economy, the Tasmanian brand, and to Tasmania's reputation around the world.

"As founder of catamaran builder Incat, Robert has been an important part of our export industry for more than 40 years and Tasmania has benefited greatly from his passion and commitment.

"His world-class catamarans are being developed and produced here in Tasmania and are recognised the world over.

In the past 13 months Incat has delivered two of its largest vessels to date to opposite sides of the world. Delivered in September 2006, the latest 98 m catamaran *Milenium Tres* is the sixth Incat high-speed catamaran to join the Spanish fleet of Acciona Trasmediterránea, while last August saw the handover to Japanese customers of the largest Australian-built high-speed catamaran yet, the 112 m *Natchan Rera*.

Speaking from London, Robert Clifford commented "While it is always nice to have one's efforts recognised, to receive recognition from Tasmania is even more special, not least of all as it really serves to pay tribute to the skills and dedication of the staff who put so much into ensuring that Incat really does build and export world-class ships.

"This endeavour continues in 2008 with the delivery of a second 112 m vessel to our Japanese customer, and further tremendous potential for future orders."

As Robert Clifford was not in Australia for the event, the trophy for Export Leadership was collected by his son Craig and daughter Kim Clifford.

Underlining Tasmania's status in the growing maritime industry, Incat supplier and neighbour, Liferaft Systems Australia, was also recognised, receiving the Aurora Energy Small to Medium Manufacturer Award and the prestigious Minister's 2007 Exporter of the Year Award.

The 2007 Tasmanian Export Awards were run by the Tasmanian Government's Department of Economic Development. Winners of the Tasmanian Export Awards will progress as national finalists to the Australian Export Awards presentation in November.

Kim and Craig Clifford collecting Robert Clifford's award
(Photo courtesy Incat)

Submarine for Malaysia

The first of two Scorpene-class submarines ordered by the Malaysian Navy was officially named *Tunku Abdul Rahman*, after the country's first Prime Minister, at DCNS's Cherbourg shipyard by Malaysian Minister for Defence, Najib Tun Razak, in October at a ceremony attended by Malaysian and French officials.

The ceremony was an important milestone in the execution of the contract signed on 5 June 2002 by the Malaysian government and DCNS as it marks the completion of the construction phase. In a few weeks' time, after completing equipment quay-side testing, the boat will be ready to start its sea trials. *Tunku Abdul Rahman* is scheduled to be handed over to the Royal Malaysian Navy (RMN) in January 2009, and the second boat by October 2009.

With an endurance of 45 days and a displacement of 1550 t for a length overall of 67.5 m, these Scorpene-class submarines will be manned by Malaysian crews of just 31. Crew training is on schedule to enable the RMN to provide complete crews from delivery.

With ten units ordered (two for Chile, two for Malaysia and six for India), the Scorpene-class is now an internationally-accepted SSK design.

The Scorpene-class was designed by DCNS and developed jointly by DCNS and Spanish naval shipbuilder Navantia. Each boat is built partly in France and partly in Spain according to the same industrial process. Benefiting from the latest innovations developed for other programmes, the design features a range of advanced technologies, particularly in hydrodynamics, acoustic discretion and automation. The modular design can be readily tailored to each client navy's specific mission profiles and requirements.

Award for HMAS Waller FCD

HMAS *Waller's* full-cycle docking project (refit), an effort which included the installation of technologically-advanced torpedo and combat systems, was announced as national winner of the Australian Institute of Project Management's Project Management Achievement Awards (PMAA) in Hobart in October.

The award, presented at AIPM's annual conference, recognises excellence in project management across a wide variety of industries. HMAS *Waller's* full-cycle docking (FCD) was chosen from more than 90 other entries.

Commenting on the winner, newly-elected national president of the AIPM, Bill Young, said "I delight in seeing projects that deliver great outcomes. This is a project which, according to our judges, has overcome many difficult challenges to deliver such outcomes. I congratulate the HMAS *Waller* FCD project team for this outstanding achievement."

Earlier this year, ASC Pty Limited in Adelaide completed work on the Collins-class submarine consisting of platform enhancements, maintenance and the addition of torpedo and replacement combat systems. It is all part of an $857 million program which will serve as a blueprint for the upgrade of all six Collins-class submarines in the Navy's fleet.

"A lot of unexpected issues arose during the project which had to be (and were) dealt with in a timely manner," said David Farwell, chief judge for South Australia's PMAA, where the *Waller* project took top honours as well.

Among the unexpected were problems with the submarine's main propulsion motor which is too large to be removed from the vessel. Instead, a workshop was set up inside the submarine to complete the task, Farwell said.

ASC has the life-cycle maintenance contract for Collins-class submarines and HMAS *Waller* is the third in the fleet to undergo full-cycle docking. The project was conducted at ASC's Port Adelaide facility and featured the addition of the replacement combat system and ADCAP/CBASS heavyweight torpedo systems, the Navy said. HMAS *Waller* is the first submarine to be equipped with both systems.

Garden Island Docks a Series of Ships

Thales Australia Naval Marine Services has been busy at Garden Island, Sydney, with three back-to-back dockings in its 1000 t capacity floating dock. The ships docked included:

SV *Bounty*

This ship is a replica of Captain Bligh's 18th century tall ship, built in New Zealand for the film *Bounty*, starring Mel Gibson and Anthony Hopkins. The ship was docked on 30 August, to be surveyed and prepared for sale to new owners, and undocked on 6 September. Work was undertaken on the propellers, shafting and hull valves while the underwater hull was repainted.

SV *Bounty* on the floating dock at Garden Island

(Photo courtesy Thales Australia)

HM Bark *Endeavour*

Now owned by the Australian National Maritime Museum, the HMB *Endeavour* replica was built in Fremantle and completed on 2 October 1994. The ship was dry docked on 12 September this year for survey and analysis as well as underwater painting, and undocked on 27 September.

HMB *Endeavour* on the floating dock at Garden Island

(Photo courtesy Thales Australia)

Wato

Svitzer Australia's A-class tug *Wato* was dry docked on 28 September, where she remained whilst at Garden Island for two weeks for repair and maintenance activities.

HMAS *Melbourne* Provisional Acceptance

The FFG Upgrade Project achieved another milestone this week with Provisional Acceptance of the second upgraded vessel, HMAS *Melbourne*, on Monday 5 October. Provisional Acceptance is a contractual arrangement to facilitate the return of HMAS *Melbourne* to the Defence Materiel Organisation.

A ceremony was held on the ship during which the Commanding Officer, CMDR Stephen Hughes, thanked the employees of Thales Australia. He credited the personal relationships with Thales and the flexibility of the team for enabling the ultimate outcome — the transformation of HMAS *Melbourne*. HMAS *Melbourne* has now commenced Navy activity. Further Navy trials over the coming months will assess the operational performance of upgraded systems.

Provisional acceptance ceremony on HMAS *Melbourne*, from L to R: Mal Adams, Director FFG System Program Office, CMDR Stephen Hughes, Commanding Officer HMAS *Melbourne*, and David Sippel, Thales Australia, Director FFG Upgrade Project (Photo courtesy Thales Australia)

Members of the FFG Upgrade team Steve Hatch, Trainee Design Drafting Officer (Structural), and Rhys Williams, Design Drafting Officer (right) (Photo courtesy Thales Australia)

The FFG Upgrade Project provides for the upgrade of four Adelaide-class frigates for the Royal Australian Navy. HMAS *Sydney* was the first FFG to achieve Provisional Acceptance on 15 December 2006, and is currently conducting operational trials of the newly-fitted Evolved Sea Sparrow missile system in Hawaii.

HMAS *Darwin* is currently in the production phase at Garden Island, Sydney, and will commence sea trials early in 2008. HMAS *Newcastle* is the last of the four FFGs to be upgraded and commences her upgrade this month.

Peter Swain

New South Wales Industry News

22 m Catamaran Ferry from Incat Crowther

Inside Passage was delivered by Canadian boatbuilder Sylte Shipyards in early August 2007 and was put straight into service running wilderness cruises from Prince Rupert on Canada's west coast for British Columbian operator, West Coast Launch Ltd.

The vessel is a 22 m catamaran ferry carrying 100 passengers at a service speed of 23 knots. The main cabin, furnished with Beurteaux Contour and Lounge seating, accommodates 80 passengers in an open, bright environment. The main aft deck features two toilet spaces, a storage space and the staircase leading to the next deck. On the upper deck there is further Beurteaux seating for 24 in the cabin and 20 Beurteaux Outdoor seats on the aft deck. The vessel provides excellent viewing opportunities on all decks and even includes a flying bridge, allowing passengers to take in the impressive scenery which the British Columbian coastline has to offer.

Powered by twin Cummins QSK19M engines, each producing 596 kW brake power, the vessel will have a service speed of 23 knots at full load.

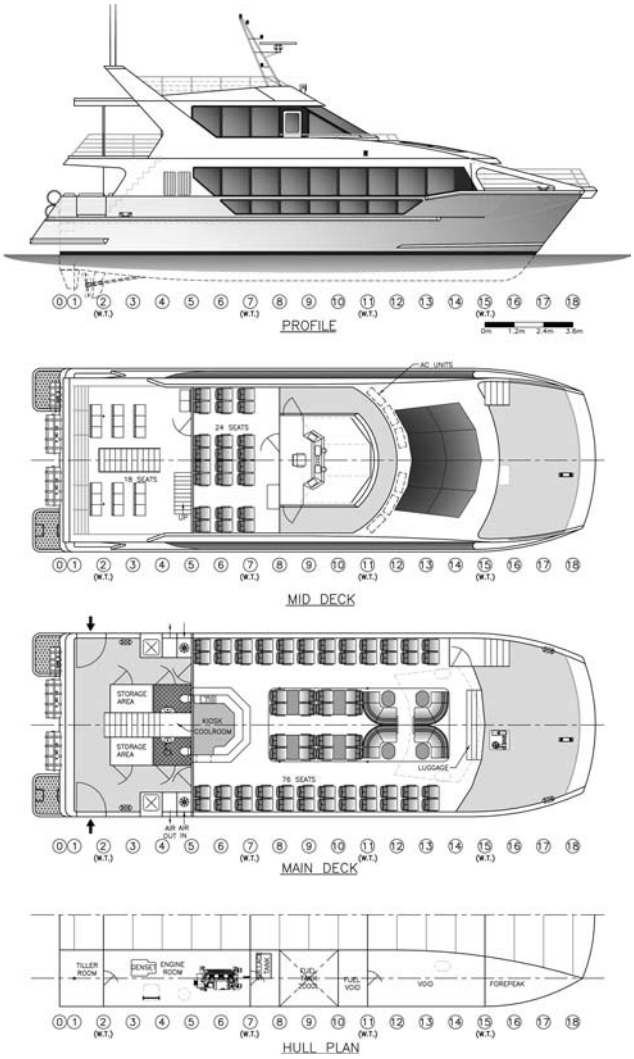
The vessel as built locally in British Columbia by the long-established Sylte Shipyard. This was the first aluminium catamaran built by the yard, well known for building high-class aluminium sailing yachts.

West Coast Launch Ltd is the parent company of Prince Rupert Adventure Tours who operate local wildlife tours for spotting bears, whales, seals and eagles. They have been operating year-round since 1988 out of their Prince Rupert base. The company expanded in 1997 to service shipping agents, Pacific Pilotage Authority, BC Ferries, Prince Rupert Airport Society and the local School District. West Coast Launch has become diversified in its business with both commercial and tourism ventures.

Principal particulars of *Inside Passage* are as follows:

Length OA	22.00 m
Length WL	19.57 m
Beam OA	7.50 m
Draft (approx)	1.20 m
Passengers	
Main Deck internal	80
Upper Deck internal	24
Upper Deck external	20
Deadweight	12 t
Fuel	4000 L
Fresh water	400 L

Engines	2 × Cummins QSK19M each 596 kW @ 2100 rpm
Gearboxes	2 × ZF 655
Propulsion	2 × propellers
Speed	27 kn max 23 kn at full load
Construction	Aluminium
Survey	Canadian Home Trade Class III



General arrangement of *Inside Passage*
(Drawing courtesy Incat Crowther)

Inside Passage on trials
(Photo courtesy Incat Crowther)

View from the wheelhouse on *Inside Passage*
(Photo courtesy Incat Crowther)

Seating in cabin on main deck on *Inside Passage*
(Photo courtesy Incat Crowther)

Inside Passage at work
(Photo courtesy Incat Crowther)

32 m Catamaran Ferry from Incat Crowther

Incat Crowther recently completed negotiations for the design and construction of a 32 m catamaran ferry for Ishigaki Dream Tours in Japan. The vessel will be built by Richardson Devine Marine at their new facility in Hobart, Tasmania.

The vessel will be a 32 m high-speed catamaran ferry capable of carrying 257 passengers. The main cabin contains seating for 165 passengers and a fully-functioning kiosk for selling snacks and souvenirs. The main cabin toilets will be located in the port hull. There is seating for 40 passengers in the mid-deck cabin, with kiosk and toilet facilities as well. In addition there are a further 40 exterior seats behind

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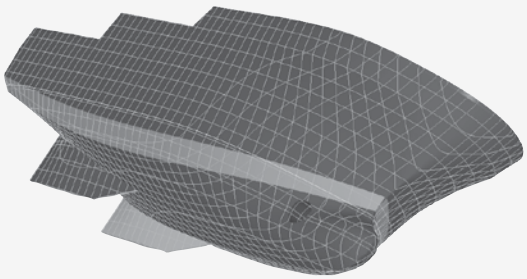

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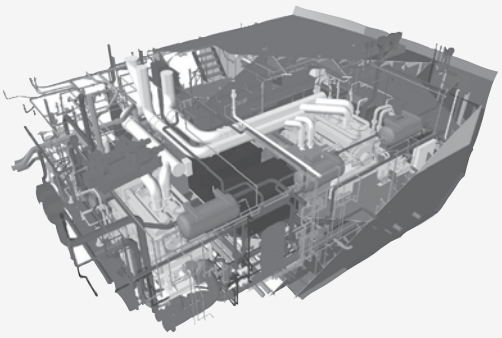

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the mid-deck cabin and on the upper deck. The aft deck has been arranged with a passenger access ramp, a single disabled toilet space, vending machines and the staircase leading to the mid deck.

Powered by twin Caterpillar C32s, each producing 1044 kW, the vessel will have a service speed of 28 knots at full load, and a top speed of 31 knots.

Ishigaki Dream Tours is located in the Ryukyu group of islands on the very southern tip of Japan, about a hundred miles to the east of Taiwan. The islands are a favourite getaway for Japanese tourists, with tropical temperatures year round. Based in the port of Ishigaki, Ishigaki Dream Tours operates a large fleet of ferries to a number of the surrounding islands which each offer a differing variety of fun and activities.

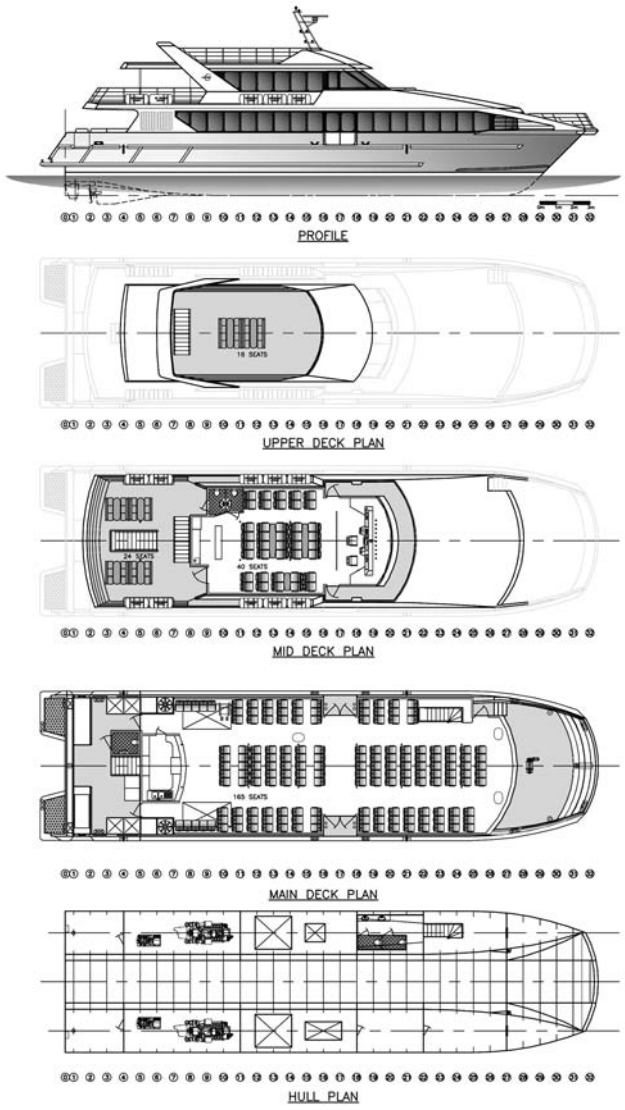
Unfortunately, their current fleet of vessels fails to maintain year-round operation due to the seasonal sea conditions experienced in the area. With the purchase of the new vessel, the operator will be able to maintain services year round due to the excellent seakeeping characteristics of the Incat Crowther hullform. In addition, the new vessel will provide a significant increase in passenger amenities, providing spacious open decks, comfortable reclining seats, kiosks and toilets on each deck.

Incat Crowther's Managing Director, Brett Crowther, is confident that "the foresight of Ishigaki Dream Tours and the high construction quality of Richardson Devine Marine will result in a highly successful project."

Principal particulars of the new vessel are as follows:

Length OA	32.00 m
Length WL	28.62 m
Beam	8.50 m
Draft hull	1.70 m
Passengers	245
Deadweight	25.54 t
Fuel	2 × 4000 L
Fresh water	2000 L
Service speed	28 kn
Main engines	2 × Caterpillar C32 each 1044 kW
Propulsion	Propellers
Construction	Marine-grade aluminium
Survey	Japanese Government

Ben Hercus



General arrangement of 32 m catamaran for Ishikagi Dream Tours
(Drawing courtesy Incat Crowther)

Sydney Heritage Fleet Website Update

The Sydney Heritage Fleet's website, www.shf.org.au, has recently been re-organised and updated. For example, the pages for *John Oxley* now include the port and starboard shell expansions, and progress on plating (with just 29 plates still to be replaced), more than a dozen of the original drawings of the ship, and many photos from all stages of the restoration, including the 80th birthday party back in July. Well worth another look if you are interested in the work of the SHF or any of their historic vessels.

Cruising

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

Phil Helmore

Statendam at the Overseas Passenger Terminal on 4 November
(Photo John Jeremy)

New Queen Elizabeth Ordered

Cunard, a unit of Carnival Corporation, has signed an agreement with Italian shipbuilder Fincantieri for the construction of a new 2092-passenger ocean liner, which will be built at Fincantieri's Monfalcone yard in Italy at a cost of approximately €500 million.

The vessel will be the second largest Cunarder ever built. In making the announcement, Cunard's President and Managing Director, Carol Marlow, said: "Cunard already owns and operates the two most famous ocean liners in the world, *Queen Elizabeth 2* and *Queen Mary 2*, and a third — *Queen Victoria* — is due to be named by HRH The Duchess of Cornwall, in the presence of HRH The Prince of Wales, in December.

The decision to order another ship for Cunard Line has been taken as a result of the strong booking response to the new *Queen Victoria*, and we are extremely pleased that Cunard will once again become a three-ship fleet so soon after the departure of the much-celebrated *Queen Elizabeth 2* in November next year. Furthermore, we are delighted that Her Majesty the Queen has given her blessing to our naming this new Cunarder *Queen Elizabeth*, after our first vessel of that name. " Speaking for Fincantieri, Chief Executive Officer, Mr Giuseppe Bono said: "It is a particularly special moment for Fincantieri to have secured a second order from Cunard at a time when we are nearing the completion of *Queen Victoria*. Cunard is the most famous name in passenger shipping and we are honoured to have been chosen to build *Queen Elizabeth* and to continue the tradition and heritage of that great company".

Queen Elizabeth will offer the very best of Cunard's values and traditions, blended with every conceivable modern luxury that today's discerning travellers expect. Through her opulent public rooms and impeccable service, the new ship will reflect the grandeur which has been associated with Cunard ships since the introduction of *Mauretania* in 1907; and from the outside, her black hull, gleaming white superstructure and distinctive red funnel will echo the classic characteristics of the company's distinctive liner heritage. *Queen Elizabeth* will fly the Red Ensign, with her homeport Southampton, as is the case with the other ships in the Cunard fleet.

Patron for City of Adelaide

His Excellency the Governor of South Australia, Rear Admiral Kevin Scarce AO CSC RANR, has announced that he has accepted an invitation to become Patron of the "Clipper Ship City of Adelaide Preservation Trust", the project that is endeavouring to bring the world-heritage clipper ship, *City of Adelaide*, back to Adelaide.

The Governor said "I am very pleased to be able to serve as Patron for the campaign to save this historic vessel which is so important to our heritage. Our capital city's own coat of arms, which include a three-masted sailing ship, are testimony to how important sailing ships were to the economy and growth of the colony of South Australia. This clipper is the very last survivor of those international merchant sailing clipper ships that carried passengers to South Australia, and wool and copper from Port Adelaide and Port Augusta to the London Markets. Now, one and a half centuries later, we are again seeing South Australia's economy flourishing through shipbuilding and mining."

The Governor noted that HRH the Duke of Edinburgh has a passion for maritime history and, several years ago, convened a conference in Glasgow focused on the plight of *City of Adelaide*. A post-conference statement approved by HRH Duke of Edinburgh's office stated: "*City of Adelaide* is one of the most important historic vessels in the UK and every effort should be made to ensure the future of the vessel." The Governor is pleased to be able to continue the task initiated by HRH.

The clipper ship *City of Adelaide* was purpose-built to serve South Australia in 1864 and for nearly a quarter century brought hundreds of English, Scottish, Irish and German migrants. Nearly a quarter of a million South Australians today are descendants of her passengers. *City of Adelaide* is the world's only remaining migrant sailing ship. She and *Cutty Sark* are the world's last two surviving composite clipper ships — *City of Adelaide* being nearly six years older. *Cutty Sark* suffered a devastating fire in May this year, increasing the world heritage importance of *City of Adelaide*.

City of Adelaide is presently located on a slipway on private land in Irvine, Scotland. Although the ship is owned by the Scottish Maritime Museum, the owners of the slipway have served notice on the Trustees of the Scottish Maritime Museum to quit the site by 2007 and terminated their lease.

The Scottish Maritime Museum does not have the funds to move, restore or display the ship and, with the demand to vacate the site, applied to the local North Ayrshire Council to deconstruct the ship.

On 18 April 2007, the North Ayrshire Council reluctantly consented to the clipper's deconstruction. An urgent race against time is now back on to secure the world heritage clipper ship *City of Adelaide*. Demolition is due to commence later this year.

Colourful Catamarans from Austal

The first of ten 47.5 m passenger catamarans to operate as The Cotai Strip™ *CotaiJet* was launched in August at Austal's Henderson shipyard — unveiling the fleet's flamboyant livery for the first time.

Finished in exciting electric blue, with a fountain flowing with gold and sparkling stars, the paint scheme will ensure that the high-speed ferries make a strong impact when servicing the entertainment, gaming, convention, and hotel facilities on The Cotai Strip™ in Macao.

With the 10th hull currently on the production line, Austal is on track to meet its challenging delivery schedule for all vessels to be in operation in 2007 and 2008.

Since signing the contract last November, the speed of the project is evidence of Austal's commitment to implementing advanced ship building design and construction techniques. The Cotai Strip™ vessels incorporate the highest proportion of these methods compared to previous deliveries.

To enable ferry transport support to be made available as soon as the Pac On Ferry Terminal is available in Macao, the first vessel was to make the journey from Austal's Henderson

CotaiJet ready for launching at Austal
(Photo courtesy Austal Ships)

shipyard to Macao ahead of the remaining vessels, which will follow in multiples.

The passenger catamarans will capitalise on the rapidly-growing demand for the Hong Kong to Macao service, currently the world's largest route in terms of passenger numbers. Indeed, Macao is not only the largest ferry route but is likely to double in the next three years, driven by the Las Vegas Sands Corporation's development on The Cotai Strip™.

Macao's emergence as an entertainment, shopping, conference and convention, gaming and mega-resort epicentre has seen a remarkable increase in tourist arrivals, with last year's passenger numbers from Hong Kong to Macao rising more than 13 per cent to 14.3 million passengers.

With The Venetian Macao Resort Hotel on The Cotai Strip™ due to officially open on 28 August, Austal Chief Operating Officer, Steve Murdoch, said that the company was extremely proud to be able to launch the first vessel so soon after winning the contract.

"It is a great example of the highly-efficient production facilities now available at Austal, one of the key reasons for winning the original tender. We wish them all the best with their exciting business in Macao," Mr Murdoch said.

Powered by four MTU 16 cylinder 4000 series diesel engines, the 47.5 m passenger catamarans have an operating speed of 42 kn carrying more than 400 passengers.

The first vessel was scheduled to leave Austal's Henderson shipyard on 24 September 2007.

Principal Particulars

Length Overall	47.5 m
Length Waterline	43.8 m
Beam Moulded	11.8 m
Hull Depth Moulded	3.8 m
Maximum Draft	1.6 m
Maximum deadweight	70 t
Passengers	411
Crew	8
Fuel (maximum)	20 000 L
Propulsion	
Engines	4 × MTU 16V 4000 M70, each 2320 kW at 2000 rpm
Gearboxes	4 × Reintjes VLJ 930
Waterjets	4 × Kamewa 63 SII
Speed	42 kn @ 90% MCR
Survey	
Classification	DNV ✠1A1 HSLC Passenger R2 EO

CotaiJet on trials
(Phtot courtesy Austal Ships)

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EDUCATION NEWS

University of New South Wales

Undergraduate News

UNSW Students Visit AMC

In early September Tracie Barber made the annual sojourn to Launceston, with the third-year naval architecture students to visit the Australian Maritime College. The visit was part of the Ship Hydrodynamics course and allowed the students to see some relevant facilities. The visit took two days, though the students came down for the weekend prior and also toured Hobart in a sporty mini-van. UNSW is grateful to Gregor Macfarlane, who organised the trip, as well as the many other AMC staff who took the time to explain the AMC facilities to the students. The experience the students gained by using the towing tank for resistance and motion tests, together with the inspection of the other experimental facilities, was most valuable and was a great addition to their theoretical studies at UNSW. The students were also able to see the ship-handling simulator, the circulating-water tunnel, the ship-model basin and even a quick tour of the new very-impressive cavitation tunnel under construction.

On the Monday evening, Tracie gave an evening presentation on a topic with a tenuous link to naval architecture, *The Aerodynamics of Pelicans* (well, they do fly over water!), after which staff and students enjoyed an evening at the local pub.

UNSW Year 3 naval architecture students visiting AMC
(Photo courtesy Tracie Barber)

Graduation

At the graduation ceremony on 18 September, the following graduated with degrees in naval architecture:

Peter Hatton	
Jun Ikeda	Honours Class 1
Mate Ostojic	Honours Class 2 Division 2

They are now employed as follows:

Peter Hatton	One2Three Naval Architects, Sydney
Jun Ikeda	Schlumberger Oilfield Australia, Perth
Mate Ostojic	Austal Ships, Fremantle

Congratulations, all!

Thesis Conference

At the School's annual undergraduate thesis conference on 20 and 21 September the following presentations by naval architecture student projects were made:

Rowan Curtis	*Hydrodynamci Improvement of Frigate Hullforms*
Daniel Wong	*Regression Analysis of Resistance of Hard-chine Catamaran Hullforms*
Joshua Bolin	*CFD Analysis of Offshore Racing Powerboats*
Kristofer Rettke	*Air Lubrication of Ship Hulls*
Sam Shepherd	*Calculating the Resistance of Rowing Hulls*
Matthew Stevens	*Ship Design Project*

RINA/Austal Ships Award

RINA and Austal Ships jointly offered an award of $500 and a certificate for the best presentation at the conference by a student member on a naval architectural project. Assessment was made on the basis of marks awarded by School staff, with marks being standardised to remove the effects of marker variability. The award went to Sam Shepherd for his presentation on *Calculating the Resistance of Rowing Hulls*, and was announced by Mr Phil Helmore at the thesis conference dinner at the Maroubra Seals Club on the evening of 21 October. The certificate and cheque have subsequently arrived from London, and have been presented. Congratulations, Sam!

Sam Shepherd receiving the RINA-Austal Ships Award 2007
(Photo courtesy Henry Morgan)

Lecturer of the Year

Also at the thesis conference dinner, the School's 147 final-year students made their annual award for Lecturer of the

Year, inaugurated in 1995. This year the Lecturer of the Year award went to Mr Erik van Voorthuysen.

Phil Helmore

Post-graduate and Other News

Influential Dean

Engineers Australia, in celebrating the Year of Women in Engineering, recently published an inaugural list of Australia's 25 most-influential female engineers. Included on the list is Prof. Dianne Wiley, Acting Dean of the Faculty of Engineering at UNSW. Her citation reads (in part):

"In her duties as Acting Dean of the Faculty of Engineering and professor in the School of Chemical Sciences and Engineering, Professor Dianne Wiley is responsible for over 200 academic staff, over 7000 students and an annual revenue of around $150 million.

Her interest in finding solutions to practical problems led her to study engineering. Throughout her career she has worked in male-dominated settings. "This has been the case since high school, where I was one of two girls in a class of fourteen doing Maths II. When I was studying for my PhD in chemical engineering, I was the only woman among 100 doctoral students." However, she said that her gender did not bar her from success, and she counts her appointment as full-time lecturer and professor among the highlights of her career.

Wiley believes having good role models and mentors, and companies which are prepared to alter working arrangements to provide flexible working conditions, are the keys to attracting more women to the engineering profession.

Engineers Australia, October 2007

Ninth International Conference on Numerical Ship Hydrodynamics

The series of conferences on numerical ship hydrodynamics differs from the parallel series of symposia on naval hydrodynamics in that they are more specific to the application of numerical techniques, that is sophisticated computer programs. In a similar way, analytic techniques are employed less. Both series of events are supported by the US Office of Naval Research.

The Ninth International Conference on Numerical Ship Hydrodynamics took place in Ann Arbor, Michigan, on 5 to 8 August 2007. The three-day conference had two parallel sessions and was attended by 89 participants. A total of 60 technical papers was presented. Most of these papers dealt with the matter of the accurate prediction of powering, motions, and manoeuvring of marine vehicles. A number of papers was more specific in that the methods were particularly suitable for high-speed vessels — an area of great interest to Australia, which leads in this field.

Two papers had an Australian contribution: The first paper was written by Dr Kevin Maki, Prof. Lawry Doctors (UNSW), Assoc. Prof. Shin Rhee, Dr Wesley Wilson, Prof. Bob Beck, and Prof. Armin Troesch, who presented a detailed analysis on the topic *Resistance Prediction of a High-Speed Sealift Trimaran*. In short, two approaches were used, one involving a computational fluid dynamics (CFD) approach and one employing an enhanced version of the thin-ship theory. Extremely accurate predictions for the resistance were obtained using CFD. However, this accuracy was achieved at the expense of about six or seven orders of magnitude more computational effort than the more reliable and simpler thin-ship technique.

The second paper constituted an in-depth study by Dr Maki, Prof. Doctors, and Prof. Beck, with the title *On the Profile of the Flow behind a Transom Stern*. In this work, the water flow immediately aft of a high-speed ship stern was the subject of the work. Three approaches were considered and compared: experimental measurements, CFD (both with and without viscosity), and a simpler idealised boundary-element method (BEM). Close agreement between CFD (without viscosity) and the BEM was demonstrated. A surprising outcome of the research was the strong influence of viscosity; the predictions of the profile of the water surface by CFD (with viscosity) agreed very well with the experimental measurements but differed somewhat from the BEM predictions.

The date and location of the next conference in the series has not yet been decided. Readers of *The Australian Naval Architect* can obtain further information on the technical content of the conference from Prof. Lawry Doctors at L.Doctors@unsw.edu.au

Lawry Doctors

Curtin University

Inaugural Innovator-in-residence with RINA Connections

CMST will host the inaugural recipient of the newly-created award of Curtin Innovator-in-Residence. Dr Nigel Gee, Royal Designer for Industry, and immediate past-president of the Royal Institution of Naval Architects, will be hosted by CMST for four months in late 2008. Dr Gee was the founder of BMT NGA, designers of high-speed ships, and is perhaps best known for his ground-breaking pentamaran ship design. The activities planned for his visit will address the following community issues:

- How should we engage industry and academia 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 programs need to be put in place to meet expectations?
- How do we link the science and arts components of marine design?

Dr Nigel Gee

Australian Maritime College

***Bluefin* Voyage**

Things were looking good for the BEng naval architecture students' voyage in the AMC's 35 m fisheries training vessel, *Bluefin*. The weather forecast was favourable and Chef Tony was back onboard. There had been concern that "Deep-fried Eric" would be making an appearance for those with a fondness for English boarding-school food. Tony certainly came up with the goods and waistlines expanded rapidly over the week-long trip. The voyage, organised by Giles Thomas and Paul Furness, gave students a unique opportunity to put theory into practice and learn about life on board a vessel. The students embarked at Beauty Point, after which *Bluefin* headed north to Deal Island, then to the east coast of Flinders Island and back to home port.

The students conducted a series of activities whilst on-board:

- Speed and manoeuvring trials were planned, performed, analysed, and results presented by the students.
- Structural investigations to increase understanding of how the vessel was designed and constructed.
- Structural investigation and redesign of the jetty at Deal Island.
- Design exercises, where aspects of the vessel such as the bridge, aft working deck and accommodation/mess area were redesigned after consultation with the crew.
- Hydrostatic analysis was carried out to determine the vessel's trim and stability characteristics given her loading conditions; this led to an estimate of her rolling behaviour.
- Seakeeping measurements were performed, including a sea-sickness survey.
- A number of fishing activities were undertaken, including trawling and setting craypots

AMC naval architecture students performing structural investigations onboard FTV *Bluefin*
(Photo courtesy AMC)

Ocean Vehicle Design Presentations

In their final year of study, BEng naval architecture students undertake a design project in the unit Ocean Vehicle Design working in teams to a specification supplied by an industry 'client'. In September, five teams presented their designs to an audience of staff, students and industry experts. The designs and their industry 'clients' were:

- 40 m day-trip catamaran — One2three Naval Architects
- High-speed ferry — Austal Ships
- Oil recovery and workboat — Strategic Marine
- Frigate — Department of Defence
- Fast response craft — BMT

The marking panel included Mr Sam Abbott from Austal Ships, Ms Belinda Jones from BMT and Ray Duggan and Joe Cole from the Directorate of Navy Platform Systems. In the evening a dinner was held at Me Wah Restaurant, hosted by Professor Tom Hardy, for staff, students and the industry panel.

Giles Thomas

Final Year Engineering Student Research Thesis Presentations

Fourth year engineering students presented their research thesis findings on Friday, October 26. There was a vast range of topics covered, as can be seen in the list of students and theses titles provided below. Thirty-one students from

AMC's Fisheries Training Vessel *Bluefin* off Deal Island in Bass Strait
(Photo courtesy AMC)

Bachelor of Engineering courses in Naval Architecture, Ocean Engineering and Marine and Offshore Systems made their final presentations. The students were judged by

- Dr Paul van der Schaaf, Naval Platform Vulnerability, Maritime Platforms Division, Defence Science and Technology Organisation (DSTO)
- Mr David Simcoe, Defence Materiel Organization (DMO)
- Mr Wayne Murray, Austal Ships
- Mr Stuart Wales, Naval Architect, AMOG Consulting

The presentations were followed by a very lively dinner attended by all final year BE students, AMC Maritime Engineering staff and moderators. Prizes were awarded to those students who the moderators thought gave the best overall presentations: There were two First Prizes, awarded to Ms Katrina de Graaf (naval architecture) and Mr Trevor Dove (naval architecture). The two Second Prizes were awarded to Mr James Kirbky-Jones (ocean engineering) and Mr Andrew Davies (naval architecture).

The presentations were:

Development of a Motion Sickness Incidence Measurement Device, Stewart Wells, naval architecture, supervisor Giles Thomas.

Optimising Electrical Vessel Propulsion, Including Systems and Electrification of a High Performance Hull, Aaron Daldy, marine and offshore systems, supervisor Alan Belle.

Design, Optimisation and Environmental Consideration of a Rock Berm for a Submarine Pipeline, Alfan Abdul Rahman, ocean engineering and marine and offshore systems, supervisors Irene Penesis and Aji Pal.

Upgrading a High Performance Hull for Electrical Propulsion, Including Development of Drag Creators to Mimic any Hull Form, Nathan Atkinson, naval architecture, supervisor Alan Belle.

Fixed Boundary Effects on the Hydrodynamic Properties of a Suction Can, Toby Roe, ocean engineering, supervisors Gregor Macfarlane and Yuriy Drobyshevski.

Slamming of Catamarans, Trevor Dove, naval architecture, supervisor Giles Thomas.

Ethanol as an Alternative Fuel in Marine Diesels, Stephen Stothart, marine and offshore systems, supervisor Laurie Goldsworthy.

An Investigation of Finite Element Modelling Techniques for Ship Structures, Trent Adams, naval architecture, supervisor Norman Lawrence.

Application of Driving Force and Loss Terms from Theoretical Energy to Establish Practically Extractable Energy, Scott Jones, marine and offshore systems, supervisor Alan Belle.

An Investigation into Wave Resistance for Trimaran Hull Forms, Thomas Mynard, naval architecture, supervisor Prasanta Sahoo.

Design and Development of a ROV/AUV, Daniel Whitehead, ocean engineering, supervisor Dev Ranmuthugala.

Resistance of NPL Hull Series, Sidong Liu, naval architecture, supervisors Christopher Chin and Prasanta Sahoo.

Roll Motions of Catamarans, Thomas Magnuson, naval architecture, supervisor Giles Thomas.

An Experimental, Theoretical and Finite Element Study into the Pressure Loading of Stiffened Glass Epoxy Composite Panels, (Andrew) Jay Williams, naval architecture, supervisor Norman Lawrence.

The Effect of Appendages on the Roll Damping of a Surfaced Submarine, Andrew Davies, naval architecture, supervisor Dev Ranmuthugala.

Optimisation of Offshore Structures using Finite Element Techniques, Mathew McEwan, ocean engineering, supervisor Norman Lawrence.

Smoothed Particle Hydrodynamics of Underwater Explosions, Katrina de Graaf, naval architecture, supervisor Irene Penesis.

An Experimental and Analytical Study of Added Resistance Characteristics for Mono and Multihulls, Jo Morgan, naval architecture, supervisor Prasanta Sahoo.

Analysis of Hydrodynamic Forces on an Articulating Mattress System, James Kirkby-Jones, ocean engineering, supervisor Irene Penesis.

Dual Fuel Operation of a High Speed Diesel Engine with LPG, John (Leonard) McKenna, marine and offshore systems, supervisor Laurie Goldsworthy.

Resistance of High-speed Catamarans, Tom Watson, naval architecture, supervisor Giles Thomas.

An Experimental Investigation of the Performance of a 'T" Hydrofoil in the Vicinity of the Free Surface, Misha Merzliakov, naval architecture, supervisors Paul Brandner and Jonathan Binns.

CFD Modelling and Validation of the AUV Mullaya, Mathew Pride, ocean engineering, supervisor Dev Ranmuthugala.

Roll Stabilisation of Vessels at Zero Forward Speed using Flopper Stoppers, Mathew Artis, naval architecture, supervisor Jonathon Duffy.

Design and Experimental Investigation of an Ocean Current Turbine Test Pontoon, Alina Herrmann, ocean engineering, supervisors Christopher Chin and Dev Ranmuthugala.

Modelling and Control of Underwater Vehicles, Elizabeth Harrison, ocean engineering, supervisors Hung Nguyen and Christopher Chin.

Catamaran Resistance Validation, Sean Mason, naval architecture, supervisor Prasanta Sahoo.

Hydrodynamics of AUV through Experimental and CFD Investigations, Leon Brady, ocean engineering, supervisor Dev Ranmuthugala.

The Impact of Mesh Size and Spatial Extent on Embedded Detailed Stress Analysis in Maestro, Glen Avard, naval architecture, supervisor Norman Lawrence.

The Prediction of Wave Wake Characteristics for Vessels Operating in Finite Water Depths, Jordon Glanville, naval architecture, supervisor Gregor Macfarlane.

Powering Systems for Optimised Fuel Consumption for Small to Medium Sized Vessels, Drew Landes, naval architecture, supervisor Laurie Goldsworthy.

Irene Penesis

Marine Engine Projects

Marine Engine Research at AMC aims to provide research capability in support of sustainable sea transport, with emphasis on fuels and exhaust emissions. Current projects include:

Combustion and exhaust emissions for marine diesel engines using heavy fuel oil

Marine propulsion engines use low-quality fuel and produce significant emissions of oxides of nitrogen (NOx), oxides of sulphur (SOx) and particulates. Our research aims for accurate modelling of the combustion and emissions formation processes using computational fluid dynamics. Such software is used for the design of engine combustion systems. The work aims for improvement of the models used for diesel spray dynamics, fuel evaporation and combustion, and thus improved prediction of the effects of variable fuel quality as well as the production of exhaust emissions. Validation of the models utilises published data as well as data obtained from AMC's instrumented spray chamber. Future implementations of Marpol Annex VI, the IMO convention governing ship pollution, are likely to lead to the use of water injection for control of NOx emissions from the larger propulsion engines. The dynamics of water sprays and their interaction with fuel soprays are of importance in this context.

PhD student Chin Bong is working with the models used for spray atomisation, coalescence and secondary breakup, as well as turbulence models. PhD student Vikram Garaniya is developing a fuel model which uses continuous thermodynamics and chemical kinetics to predict evaporation rates and formation of carbonaceous residue in the burning fuel spray. The formation of carbonaceous residue is an important source of particulate emissions peculiar to heavy fuel oil that is not currently modelled by engine designers. Current measurements in the spray chamber include spray penetration and angle, droplet velocities and droplet sizes for non-evaporating sprays. Measurements on evaporating sprays will follow.

Collaborators include Prof. Takasaki and A. Prof. Tajima at Kyushu University in Japan, Dr Paul Brandner at AMC and A. Prof. Don McWilliam at University of Tasmania.

Alternative Fuels for Fishing Vessels

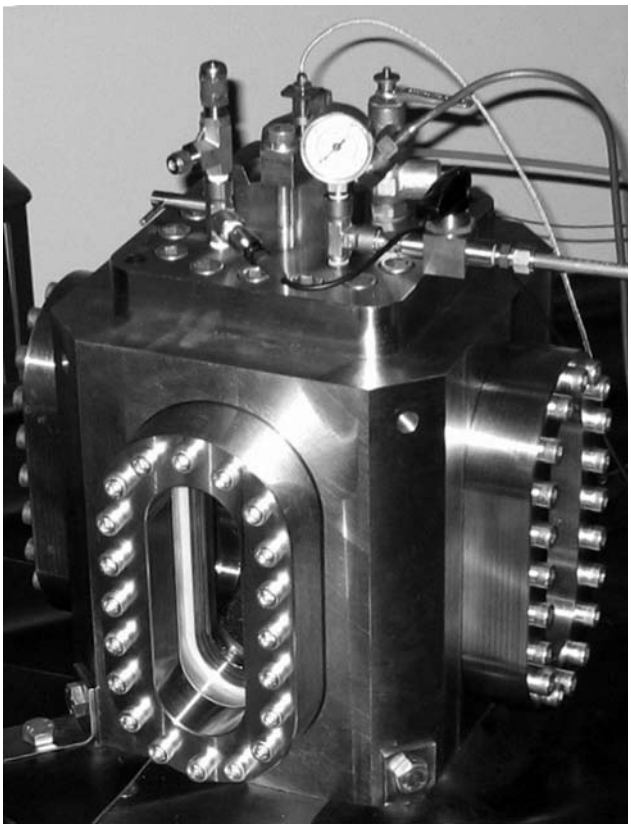
Fishing vessel engines are relatively small and, consequently, they burn high-quality distillate fuel. Fuel costs are significantly impacting the viability of fishing businesses. Reduced greenhouse gas emissions could improve market access for seafood products. AMC is investigating alternative fuelling options under a $137,000 grant from the Fisheries Research and Development Corporation (FRDC). Options under investigation include biofuels such as fish oil, biodiesel and ethanol. Further options include the use of fossil fuels such as Liquefied Petroleum Gas (LPG) or natural gas, both of which offer potential for reduced exhaust emissions and reduced fuel costs. Natural gas can be stored as a liquid (LNG) or in compressed form (CNG).

Generic systems for the storage and safe handling of natural gas and LPG on vessels are being designed. Conversion systems to allow use of gases in existing engines are being evaluated. Natural gas can replace around 90% of normal diesel fuel requirements. CNG occupies too much volume for extended voyages. LNG infrastructure is expanding to service the road transport industry, and fishing vessels may be able to utilise this infrastructure.

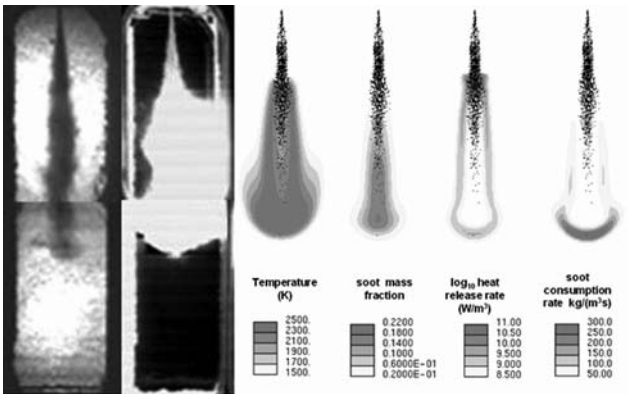
The potential for engine efficiency improvement by addition of small quantities of LPG or ethanol to the engine air is being studied experimentally using AMC's marine engine test bed. Ethanol is a biofuel and can replace up to 30% of normal diesel fuel. Ethanol mixed with water can reduce both NOx emissions and fossil carbon emissions.

The findings of this work will be relevant to many different types of small-to-medium size vessels, as well as fishing vessels.

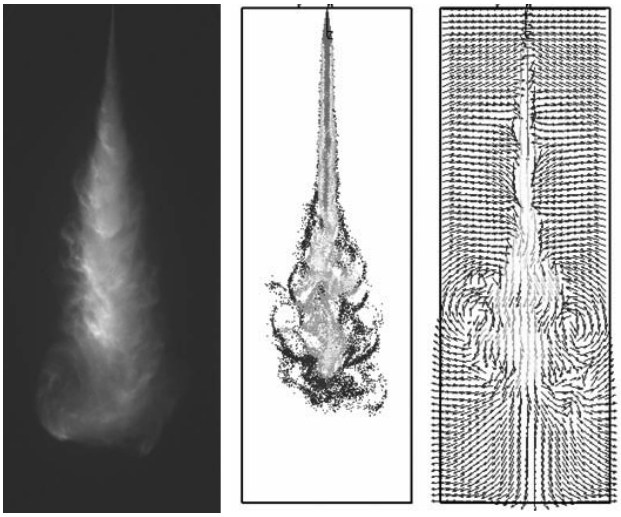
Laurie Goldsworthy



AMC spray chamber
(Photo courtesy AMC)



Measured spray/soot extent and flame extent in Kyushu University's visual combustion chamber compared with CFD simulations using the current AMC fuel model, for a good quality heavy fuel oil



Spray of diesel fuel measured with a laser light sheet and laser-induced fluorescence (left panel), compared with a simulation of a spray at the same conditions using CFD and large eddy simulation (middle panel) and background fluid velocity vectors (right panel)

Inaugural Hybrid Propulsion Day

The inaugural Hybrid Propulsion Day featuring the Trybrid Project was run by the Australian Maritime College on Tuesday 23 October 2007 in response to a perceived need to achieve increasing environmental, social and economic objectives. These are the challenges faced by marine engineers and naval architects across maritime industries. The event was sponsored by IMarEST and promoted by RINA and Engineers Australia.

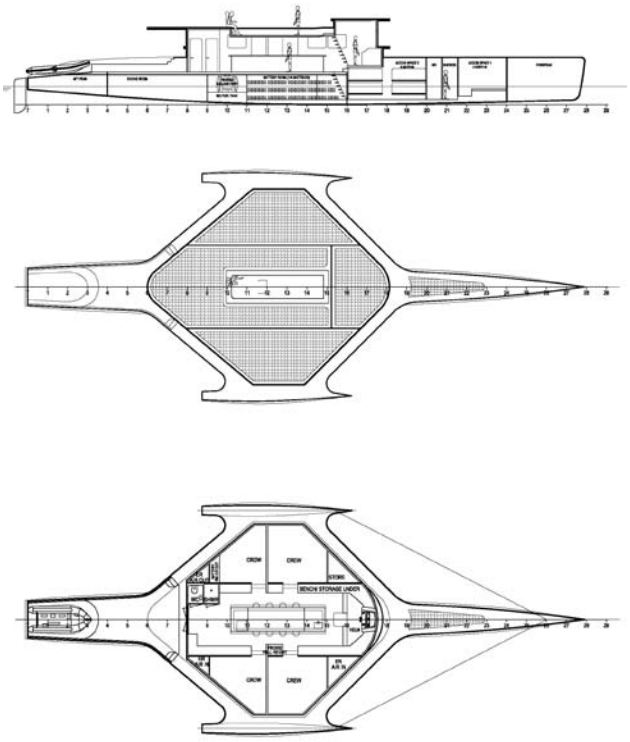
This year focused on the vision presented by opening speaker, Councillor Rod Davies from Port Douglas, Project Manager of Team Trybrid. Their plan is a build a multi-capability 28 m trimaran featuring state-of-the-art alternative propulsion as can be seen in the accompanying general arrangement.

The day was deemed so important that Jodie Campbell (Federal Labor Candidate for Bass) and Senator Kim Carr, Shadow Minister for Industry, and Shadow Minister for Innovation, Science and Research, spoke with both the President and Vice President of the AMC, Prof Malek Pourzanjani, and Prof. Tom Hardy, before listening to the Trybrid presentation.

Hard-learned aspects of solar propulsion were presented by Dr Robert Dane, designer of *Solar Sailor*, and leading research into alternative fuels and combustion was explained by AMC researcher Dr Laurie Goldsworthy. Other technologies from water jets in non-conventional applications (Tim Udvary, Doen Pacific), electric vehicle propulsion (James Massey, Industrial Technik), hullform design (Rob Tulk, One2three Naval Architects) and the AMC's own GreenLiner propulsion project (Alan Belle) were presented.

The key objective of the day, i.e. to establish links and identify what can be done by the AMC to support the Trybrid Project, was met. Team Trybrid plans to provide an 8.5 m MiniTrybrid for propulsion system development by the AMC in August 2008. The event was so successful that it is hoped to make it a biannual event.

Alan Belle



The Trybrid vessel developed by Team Trybrid (Drawing courtesy AMC)

***GreenLiner* Meets River Endurance Goal**

The AMC *GreenLine*r has met its first challenge: "To traverse the Tamar River, from Rosevears (about half way down the river) up to Home Point (Launceston) by electrical power alone". *GreenLiner* is an 8 m LOA low-resistance, low-wash research hull, donated by naval architect Greg Cox, which has been electrified by final-year AMC students Nathan Atkinson and Aaron Daldy (see article on Page 40 of the August 2007 edition of *The ANA*). The attempt was made possible by the support of sponsors, Industrial Technik Pty Ltd and Doen Pacific.

The attempt commenced at 9 am on Friday 12 October after the battery capacity was nearly doubled by fitting extra batteries in the engine, helm and watertight instrumentation bays. This was decided after final calculations indicated we would be 20 minutes short of our destination due to the underdeveloped electrical motor for powering by the 48 V DC system which had been adopted for safety.

Once the AMC's *Sea Horse* support vessel arrived *GreenLiner* set of in earnest — directly towards a dead end and across mud flats where the support vessel couldn't follow. The low seating position of *GreenLiner* made it impossible to see the river path! Luckily, along with complete support and rescue gear, we had VHF radio communications, so what could have ended in disaster before it started was corrected by a stream of directions issued from the attempt coordinator, Nathan Atkinson.

The overcast morning turned into a glorious day. Everything was running smoothly and *GreenLiner* was happily cruising at 4.2 kn while drawing 100 amps. The problems encountered by the half-way mark were boredom and the cramped helm. The seating was never designed with endurance testing in mind, resulting in sideways sitting or standing for the coxswain for most of the journey.

Perfect conditions were experienced by *GreenLiner* for most of the attempt
(Photo courtesy AMC)

When everything was going too perfectly, *GreenLiner* slowed, coasting by its own inertia and we heard over the VHF the worst-case news "Current is dropping and is down to 80 amps and speed is 3.4 kn". Our hearts sank because everyone knows that, as batteries discharge, their voltage and ability to provide current wanes. But how could this be? We had at least 50% to 100% excess capacity. How could we get our predictions so wrong that we had flat batteries at half way? After 15 minutes checking the motor, batteries and wiring, checking voltages and general head scratching, we were none the wiser. We decided it couldn't be flat batteries, so soldiering on was the option chosen. *GreenLiner* sped off at 3.7 kn and 90 amps. Clearly something had cooled down, but what?

After another half hour, *GreenLiner* again coasted to a stop with a 'down in the dumps' Aaron at the helm. Speed had dropped to 2.1 kn and he could no longer counter the dropping current by increasing the throttle. After another 15 minutes of checking we were about to throw in the towel, when a mobile phone call to Industrial Technik suggested checking the controller temperature. We didn't need to check, as it was all-too-obvious as soon as we were reminded. The power controller, an EV1 thyristor chopper from GE, generates heat. We had neglected to fit the cooling fins we had made because, during testing, very little warmth had been detected in the controller. Worse than that, we had put it in a sealed wooden box to protect it and keep it dry! Solution — take off the rear cover and open the controller box lid.

After sorting out the overheating problem, confidence soared as completing the distance was almost assured; however, one final challenge still awaited us. As we approached Launceston a tourist catamaran generating a large wake sped past. The largest waves topped across the rear engine deck of *GreenLiner*. As part of our risk assessment, we had foreseen water across the deck, so each deck opening, except at the helm, was fitted with a coaming. What we did not foresee was that this would occur in a river with the very 'stiff' *GreenLiner* riding low with additional batteries!

The attempt was completed just before midday, a three-hour voyage for a distance of 20 km. Not a spectacular feat in itself, but a triumph for the hardworking students and staff involved. Checking remaining battery capacity revealed that one of the fuses fitted for safety had been on open circuit, meaning that one bank had not been available during the run and was still fully charged. The other bank was at 10%, with the remainder at 60%. The good news was that, allowing for Peukert's effect, it suggests that the proposed 2008 goal is achievable.

In 2008, students at the AMC will develop *GreenLiner* and attempt to traverse the complete length of the Tamar (26 n miles) from Beauty Point to Home Point in central Launceston. The hands-on experience with real vessel propulsion has significantly enhanced undergraduate appreciation of naval architecture, marine design, and engineering projects in general. The strong consideration of safety and environmental concerns adds real merit. The overall project represents an outstanding educational success for the AMC.

Alan Belle

GreenLiner crosses the finish line. Home Point is astern in this picture. Cataract Gorge (the discharge of the South Esk River) can be seen in the background. The Launceston Yacht Club is in the mid-ground.
(Photo courtesy AMC)

Model Test Basin Update

2007 has been a productive year for the development of new capabilities within the AMC model test basin. The facility, first opened in 2001, is Australia's only commercially-operating facility for conducting hydrodynamic experiments with an emphasis on maritime operations in shallow water environments such as ports, harbours, rivers and coastal regions.

AMC has recently secured approximately $200 000 from research collaborators and by conducting commercial consultancies which has allowed the development of the following new capabilities for the model test basin over the past 12 months:

- The installation of a high-quality video motion-capture system.
- The installation of a wind generator.
- The development and commissioning of a ship towing system in oblique seas.
- An upgrade of the towing winch control system.

The video motion-capture system has provided the capability to track all six degrees of motion of up to two models at a time for any wave conditions without the use of any contact-type sensors or gyroscopes and accelerometers. The motion-capture system, supplied by Swedish company Qualisys, consists of a set of eight digital motion-capture units (cameras) and a Windows-based acquisition software package.

The new wind generator consists of a bank of twenty 600 mm diameter fans, arranged in two rows of ten fans which, spans a test area approximately 6.5 m wide. A maximum air speed of approximately 5 m/s is obtainable — which represents a full scale wind speed of ~50 knots at a scale of 1:25. This capability has recently been used (in combination with waves) to investigate the loads on a hawser between a large bulk carrier and a single-point mooring.

The basin has always had the capability to tow ship models in a straight line, however, it has only recently been made possible to undertake captive towed-model experiments at oblique angles to the oncoming waves. The primary aim of a recent project was to investigate the roll motions of a catamaran in oblique seas to compare against commercially-available prediction software. The control system for the ship model towing winch has also had a recent rebuild, which has provided the ability to alter the start and finish points as well as the desired acceleration and deceleration rates in a safer

One of the banks of digital cameras in the AMC model test basin that make up the new video motion-capture and analysis system
(Photo courtesy AMC)

A 4.2m scale model of a bulk carrier experiencing both wind and waves in the AMC model test basin
(Photo courtesy AMC)

and more user-friendly manner than previously available.

When the AMC first developed the model test basin six years ago, it was planned that the facility would be very versatile and this has proved to be the case. The following list gives some examples of the types of studies completed recently:

- Measurement and prediction of the wave wake generated by vessels travelling at speed.
- Motions and mooring line loads experienced by wave energy converters.
- Relative motions while a landing craft is being lowered from the deck of a military support vessel in a seaway
- Motions of landing craft within the well dock of an amphibious ship.
- Dynamic stability of ships in severe seas (using remotely-operated ship models).
- Assessment of green water on the bow of an FPSO.
- Berthed ship to passing ship interactions within a number of shipping ports.
- Ship-bank interaction studies.
- The effects of channel geometry on ship operation in ports.
- Relative motions between an FPSO and shuttle tankers.
- Quantification of the bore between catamaran hulls when operating at trans- and super-critical speeds.
- Investigation into the operability of cantilevered float over installations of platform topside modules.
- Asymmetric and nonlinear unsteady loads on high-speed catamarans.
- Parametric roll of containerships operating in head seas.
- A study of the interactions between vessels during replenishment-at-sea operations.
- Roll motions of catamarans.
- Fishtailing of FPSOs in a seaway.
- Stability of surfaced submarines in damaged and intact states.
- Reduction of roll motions of ships.
- Design and operation of rock berms for submarine pipelines.

Whenever possible, AMC Bachelor of Engineering students are given working demonstrations of the above experiments. In addition, the facility has been very useful for undertaking a number of student-based laboratory sessions in the areas of wave mechanics (e.g. wave shoaling, refraction and reflection) and hydrodynamics of offshore structures and moorings.

Annual UNSW Naval Architecture Student Visit to AMC

On 10–11 September AMC again hosted the third-year naval architecture students from the University of NSW for a series of laboratory sessions in the towing tank, cavitation tunnel, model test basin, ship-handling simulator and circulating-water channel. The nine UNSW students were accompanied by Dr Tracie Barber, UNSW Senior Lecturer. Tracie gave a presentation on *The Aerodynamics of the Pelican* to students from both AMC and UNSW, and AMC staff.

Gregor Macfarlane

THE INTERNET

Online Freeware

At www.structural-engineering.fsnet.co.uk/free.htm there is a very long list of truly free engineering software (no demos). A lot of it is for structural engineering, but there's also a lot of free CAD stuff and mathematical programs.

I have downloaded and used one called *Framework* to design a portal frame building and it works very well, with good graphic output. You just need a degree to work out how to drive it! The results are within a few percent of hand calculations, and much quicker.

Greg Cox

Conversion of Units

Can't remember the factor for converting psi to kPa? Fear not; OnlineConversion.com has the answer. Point your favourite browser to www.onlineconversion.com, and the home page will give you a choice of methods of proceeding: In the dialogue box, you can type "convert psi to kPa", click on GO or simply press the Enter key, and up will come the answer, "psi = 6.8947573 kPa".

Alternatively, you could scroll down to Pressure, click on the hotlink, and a dialogue screen will come up. In the quantity box, type "1" (or any other quantity); in the left-hand pane select "pound per square inch", and in the right-hand pane select "kilopascals"; and then click on Convert. Up will come the answer "1 pound/square inch = 6.894 757 28 kilopascal"

All the usual physical conversions are there, but so also are some more unusual ones, such as conversion of clothing sizes between countries, astronomical units, cooking units, and some fun stuff, like converting your message into Morse code, a typing speed test, roman numerals, and finding how old you are in dog years! Very useful.

Integrals

Having difficulty in finding a definite integral to solve your latest technical problem? Wolfram (authors of the Mathematica software package) have very kindly provided an online version of the basic integration tool. Visit http://integrals.wolfram.com/index.jsp, type in the function that you would like to have integrated, press the Compute button and, if there is a definite integral, it will come up (in four different formats, on different tabs). Very handy.

Positions Vacant

Naval architecture positions vacant are advertised on the web at www.seek.com. Visit the website, type in the keyword "naval" and click Seek, and about a dozen jobs for naval architects will come up (among some others which have the word "naval" somewhere in the title). You can, of course, refine the search by location, type of job, etc. Jobs are listed in date order of being received, most-recent first.

Phil Helmore

Design in the Face of Uncertainty with Application to Composite Yachts

Rozetta Payne

Two problems encountered when evaluating and developing conceptual design solutions are uncertainty and that the features of the design are usually loosely defined. Uncertainty is usually overcome by applying safety factors, chosen based on the designer's experience and level of confidence in expected values when there is variation in design-driving parameters such as loads, geometric tolerances and material properties.

Today's yachts are generally lighter, getting larger and going faster. The question arises as to how far the design envelope can be pushed, particularly with highly-uncertain loads on the structure? Also, what are the effects of this uncertainty and what trade-offs in the structural design will best meet the overall design objectives? Therefore, it is of interest to find ways to better accommodate uncertainty and predict overall conformance to design objectives in the face of uncertainty.

A tool has been developed to provide structural composite designers, such as yacht designers, with a means of developing innovative structural solutions whilst accommodating high levels of uncertainty, but still focuses on best meeting design objectives constrained by trade-offs in weight, safety and cost.

This tool uses a global approach to determine structural placement, costing and safety all of which are brought together by a fuzzy decision application. Central to this is the use of non-discrete variables along with new measures of structural reliability based on load-path algorithms and topological, or shape, optimisation.

This paper discusses this tool and its underlying features, with applications to the structural design of composite yachts.

Introduction

There is a general trend towards using 'design space' analysis to better simulate reality and accommodate uncertainty directly into the design process. Two popular methods include stochastic analysis and spatial optimisation schemes, such as genetic algorithms. However, these methods are computationally demanding, as they require the development of many different solutions. In this tool, the design space is truncated by using fuzzy numbers to represent sets of possible solutions. It is recognised that this method is not as rigorous as applying a full stochastic analysis; however, its level of accuracy is suitable for use in the conceptual design environment, Figure 1.

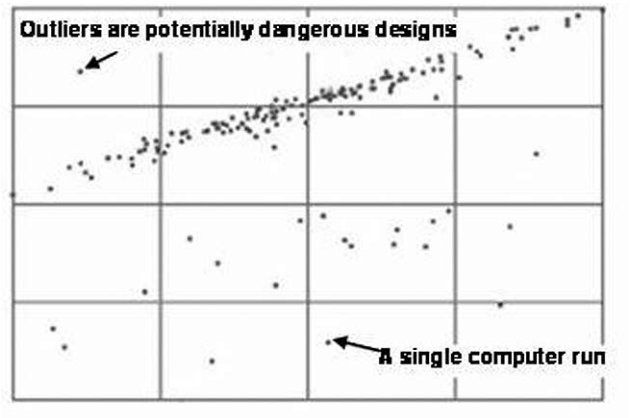


Figure 1 — Stochastic Analysis Results, 'clouds'

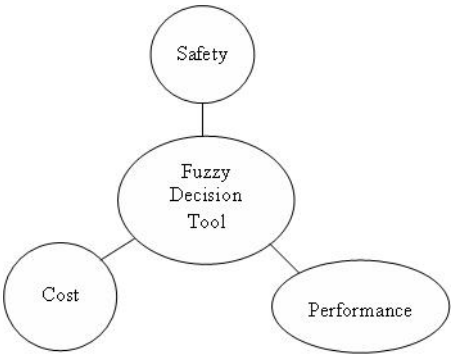


Figure 2 — Tool Set

This research then focused on building a tool set whose core component is a fuzzy decision-making algorithm which, in the process, establishes a design knowledge-database which allows designers to navigate through different possible solutions in the presence of uncertainty.

The designs are positioned into a 3D decision space based on a design's relative safety, performance (weight) and affordability, see Figure 3, which can be determined using an underlying tool-set base which uses:

- FEA applications such as topological optimisation and load paths, to determine appropriate structural layout and quantify safety.
- Genetic optimisation algorithms for laminate specification and, hence, allowing weight estimation.
- (PCAD) composite manufacturing database integrated with 3D CAD software for cost estimation.

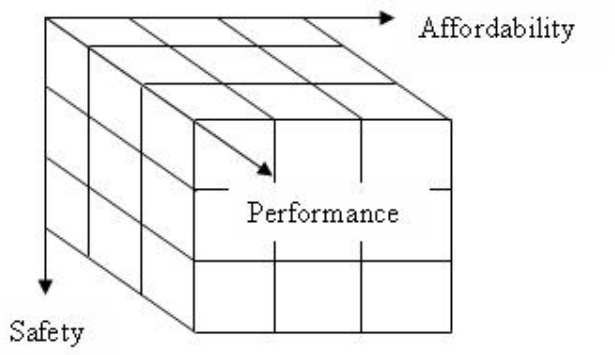


Figure 3 — 3D Decision Space

Concept Development and Topological Optimisation

To test the system, a decision database for evaluating structural placement in composite yachts was developed. Concepts were developed using CATIA v5, a 3D CAD software package, and applying topological optimisation techniques to determine suitable placement of internal structure. Topological optimisation is a shape-optimisation technique, and works on a material removal process by applying pseudo densities to elements within a finite element mesh. The pseudo densities of elements which do not contribute to overall stiffness are slowly reduced to zero, effectively removing material from the model as shown in Figure 4.

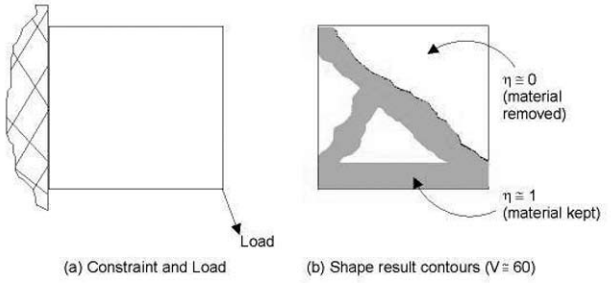


Figure 4 — Shape Optimisation with 60% Material Removal

Finding the most effective placement of internal structure requires the models to be overpopulated with structure, from which the material is removed via topological optimisation. For instance, it was evident that it is more efficient to use multiple frames than multiple bulkheads, see Figure 5.

As a result of topological optimisation, three concepts were developed, with distinctly-different features, as a base population for the decision space:

- Monocoque.
- Stiffened gunwale and sparse bulkheads.
- Multiple frames.

The topological analysis was performed for varying degrees of material removal, ranging from 20% to 80%, from which it was possible to see which components of the structure were effective in transferring the different load mechanisms acting on the hull.

The finite element models were set up so that the models were 'floating' in equilibrium trim. To each yacht, rigging loads and a slamming pressure were applied. The slamming pressure was applied to the forward portion of the hull bottom. Under these conditions there are effectively three main load-bearing mechanisms in the structure:

- shear;
- hull bending; and
- slamming – keel effects.

As more volume is removed, different load mechanisms dominate the material placement. It was found that, in most structures (except the monocoque), slamming and keel failures are predominant, followed by hull bending and, lastly, the shear transfer. In the monocoque hull, bending appears to dominate the material placement, followed by the shear.

It may be for this reason that we see more keel-related failures in conventional yachts, and hull-bending failures in classes such as the America's Cup.

In keeping with classical beam theory, we find that the vertical surfaces are most active in transferring shear, whereas the hull bottom and deck are most active in transfer of bending loads. The keel loads are most effectively distributed into the hull via a 'butterfly'-like arrangement of structure, as depicted in Figures 7 to 9.

Measuring Affordability, Performance and Safety and Uncertainty

One of the greatest uncertainties in yacht design is the magnitude of the dynamic loads seen by the yacht structure. Hence the slamming load is defined here as a triangular fuzzy

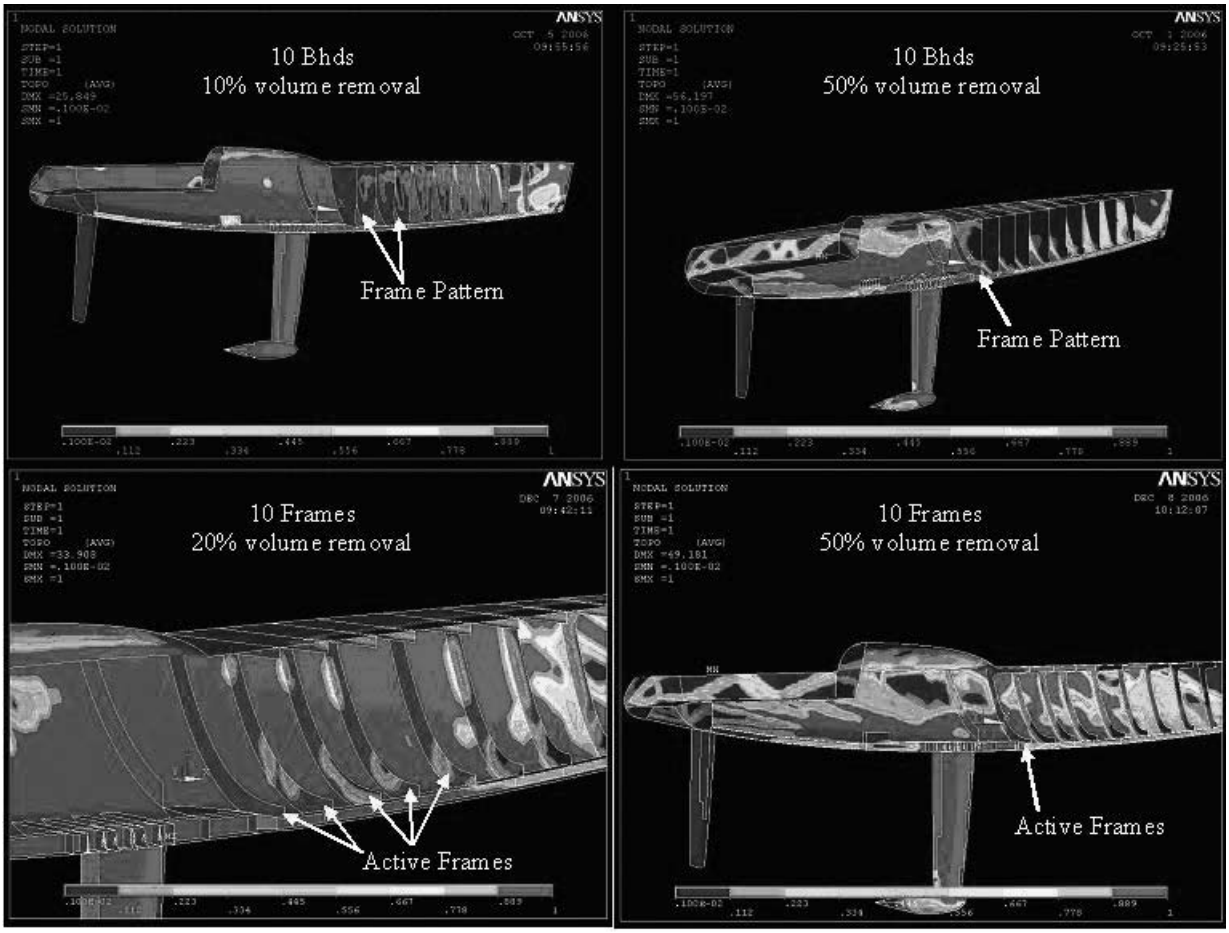


Figure 5 — Topological Results for over populated model

Figure 6 — CAD Models for the Overpopulated and Resultant Base Population Alternatives
Overpopulated model (left), Monocoque model (centre) and Multiple frames model (right)

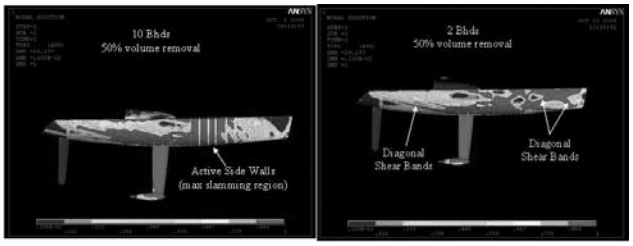


Figure 7

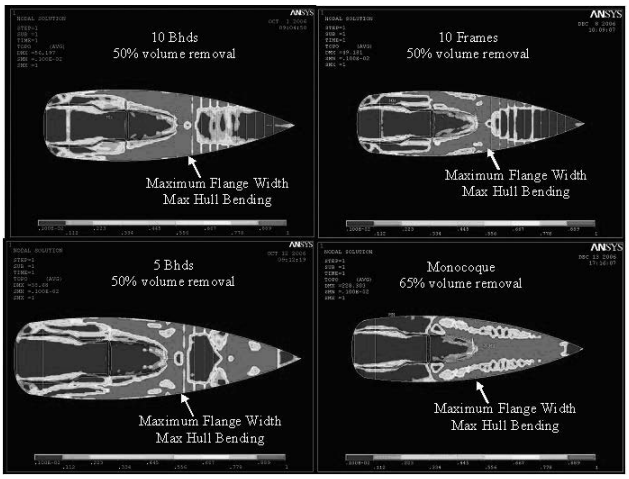


Figure 8

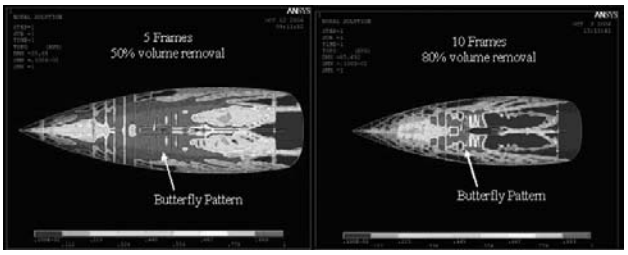


Figure 9

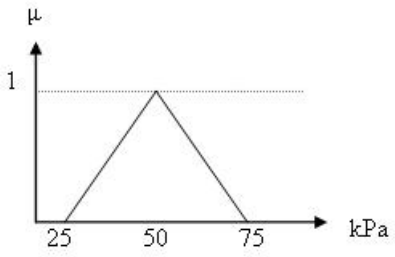


Figure 10

number, ranging between 25 and 75 kPa, see Figure 10. Each alternative is then analysed to determine its affordability, performance and safety at the lower limit, most, expected and upper supremum, to give an indication of the possible variation through the range of possible solutions.

Before the cost and weight (affordability and performance measures) can be calculated, the laminate needs to be specified. This tool set uses a genetic optimisation algorithm developed by the CRC for Advanced Composite Structures and modified to incorporate buckling by Salmonsen, a student at UNSW, to efficiently search through the large possible-solution domain resulting from multiple inputs. In this case, inputs such as different materials, different ply orientations and different numbers of plies, to tailor the laminate. The genetic optimisation algorithm assigns a fitness based on the laminate's buckling characteristics (here the foredeck is analysed to provide a basis laminate for the yacht) and weight. The 'fittest' solution is then that which, after successive generations, remains the lightest solution which exceeds the imposed buckling limit.

The cost and material weight of the structures are then determined by applying a process-based costing tool developed by Jin Woo Choi as part of his PhD candidature at the University of New South Wales. This tool is based on the PCAD database, originally developed by MIT, and directly interacts with the 3D CAD model and a knowledge base to determine input parameters for the costing algorithms. Testing of this costing tool has shown significant improvements in the accuracy of cost estimation in the conceptual design phase when applied to composite aerospace structures.

A challenge of this research was finding a way to measure safety as related to global arrangement of structures. Traditionally, safety is evaluated by looking at reserve factors, but this is applicable when considering individual items such as chainplates, beams, panels etc. In this research 'load paths' are used as a means of measuring safety by quantifying the change of redundancy in a structure in the presence of damage. Load-path analysis fits into the idea of 'robust' design, where robustness is achieved by allowing loads to be diverted around damaged components, spreading the load and reducing the degradation in performance. Load-path analysis is useful when trying to optimise redundancy. It is not practical, especially in high-performance yachts, to carry inefficient alternative load-carrying structure because of the penalty in weight. Generally, complexity provides a link between fragility and robustness where, if complexity is reduced to a minimum, the number of load paths and redundancy is minimised. However, the structure becomes more fragile and is more prone to failure, particularly catastrophic

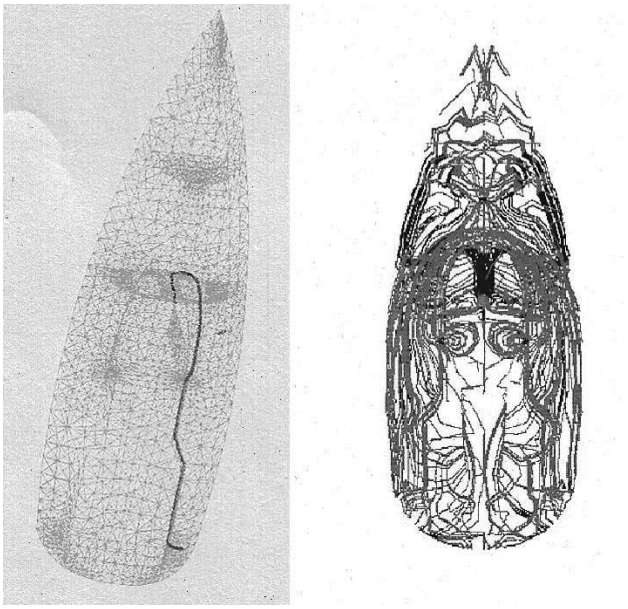


Figure 11 — Load Paths Through a Yacht Structure

or cascading-type failures. For example, most catastrophic failures occur in high-performance racing yachts such as America's Cup yachts, where the rule encourages the internal structural weight to be minimised which is achieved by using a monocoque-style structure. Examples of load path traces are provided in Figure 11, where a single trace as well as a populated trace is shown.

Load-path interpretation is a powerful new tool because it is visually engaging and can be used to better understand how a structure is responding to an applied load. A designer can quickly quantify how efficiently the different components of the structure are reacting to the applied loads by looking at load path densities — or the magnitude of load transfer. Interpretations can be made, similar to those obtained from topological analysis, except that the level to which a component is actively used can be measured rather than just represented by 'material' which has no physical meaning. Again, different patterns represent different modes of load transfer. We find that the deck, hull bottom in way of the centreline, and the gunwales are effective means of resisting bending, and the vertical surfaces are efficient in transferring shear, as in Figure 12. In addition the load paths can be used to decide on where to place internal structure by optimising based on the load-path density and removing areas of re-circulation. Figure 13 shows a bulkhead which could be better represented as a ring frame. The figure shows that the bulkhead sides are active; however, there is recirculation in the central portion of the bulkhead indicating that it does not actively participate in the transfer of load. The central portion of the bulkhead is therefore a candidate for material removal.

The measure of safety is based on a 'safety index'. The safety index uses the change in the degree of failure to change in the level of damage. The slope of this curve then quantifies how sensitive a structure is with regard to damage, and provides a measure of how effectively the structure dissipates its load into the surrounding structure, i.e. the structure's robustness, which is reflected in the load paths and the changes in load-path density.

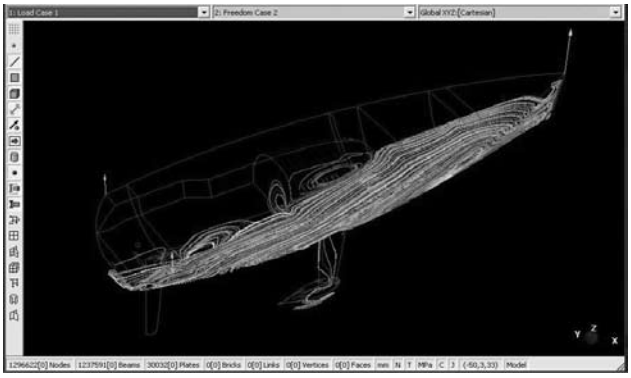


Figure 12 — Load Path Densities Resisting Hull Bending

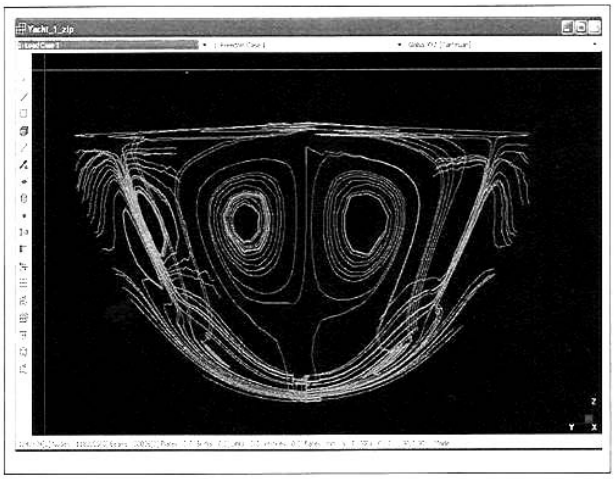


Figure 13 — Load Path Recirculation Pattern in a Bulkhead

The result of applying these underlying tools are fuzzy inputs, placing the designs in the 3D decision space, for the decision-making tool, see Figure 14.

The three alternatives showed the following results with regard to affordability, performance and safety.

Alternative	Affordability	Performance	Safety
Monocoque	Low	High	Low
Gunwale Stiffened	Low	Medium	High
Multiple Frames	High	Low	Low*
* Includes in the measure an account for quality of manufacture which is also accounted for in the measure of cost and weight			

Table 1 — Alternative Placement in Decision Database

Decision Maker's Preferences, Trade-offs and the Preferred Alternative

Central to this tool set is the decision-making tool. This tool allows the designer to navigate his/her way through the decision space to look for structural solutions which best meet their preferences when there are conflicting requirements, e.g. trade-offs between performance and cost. The tool set was tested using the three base designs previously described; however, by continually developing new concepts, the database would evolve and capture design knowledge. The designer can use this information to efficiently move through the database, e.g. is it better to have multiple frames or a thicker sandwich laminate when trying to both minimise weight and minimise cost?

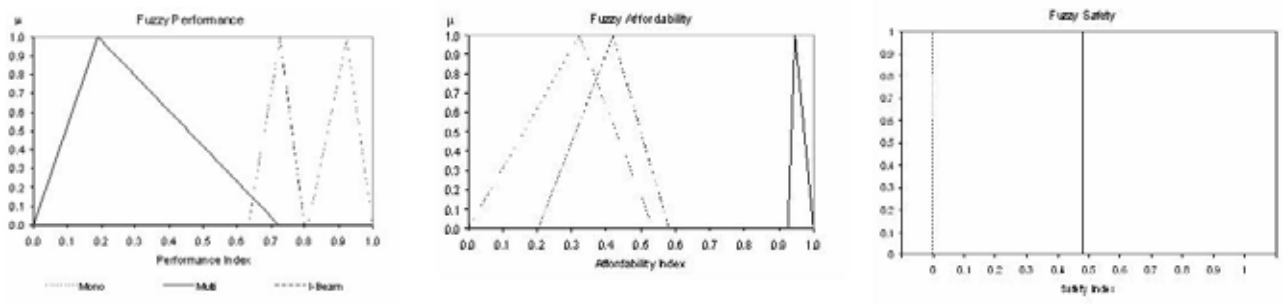


Figure 14 — Fuzzy Decision Tool Input

To use the decision-making tool the following needs to be defined:

- Alternative measures with respect to affordability, safety and performance.
- Criteria objectives – minimise, maximise, less than, greater than, indifference.
- Criteria preferences – relative importance between criteria, e.g. affordability three times more important than performance; these can be defined either as crisp or linguistic fuzzy numbers

The decision tool filters and weights each alternative based on the decision maker's objectives and preferences. These results are then ranked, because fuzzy decision results can be hard to interpret, to indicate the preferred alternative. It was found that the decision maker's preferences can have a large effect on the structural arrangement chosen as the preferred alternative.

The decision-making tool was tested for various preference and objective scenarios, based on groupings such as:

- Offshore cruiser.
- Offshore racer.
- Inshore racer.
- IAAC, etc.

In general, it was found that if you want to push the limit on affordability at the expense of quality it is better to reduce the complexity and go for an I-beam solution. For offshore racing the I-beam solution was clearly preferred, where as the monocoque was preferred for IACC yachts. In the case of coastal and inshore production racers there is more leeway for compromises between safety, affordability and performance.

Conclusions

Through the development and application of this tool set we have shown that it is possible in the presence of uncertainty, to quantify cost, weight and structural redundancy, as well as perform trade-offs and select preferred design alternatives. Further expansion of this research includes looking at what trends and fast-track trade-offs appear when the decision space is more densely populated.

This research would not have been possible without the support from the University of New South Wales, the Co-operative Research Center for Advanced Composite Structures and Gurit (Australasia) Pty Ltd.

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AMPHIBIOUS SHIPS FOR THE RAN

On 20 June 2007, the Australian Government announced plans for the Royal Australian Navy to acquire two amphibious assault ships based on the Spanish Navantia Strategic Projection Ship [1]. Designated as Landing Helicopter Dock (LHD) ships, they will be named *Canberra* and *Adelaide* and are expected to enter service in 2012 and 2014 respectively. They form part of Joint Project 2048 (Amphibious Deployment and Sustainment — ADAS), with a further 'sealift' capability — which is yet to be defined — to be acquired in a later phase of the project. Tenix was selected as the preferred tenderer to build the LHDs and it is expected that the hulls will be constructed in Spain, the equipment fit-out will be completed in Melbourne, and the combat-system integration will occur in Adelaide.

The LHDs will be amongst the largest ships to serve in the RAN and will be the biggest warships ever built by Australian industry. While some media commentators have focused on their size [2], the reality is that size brings flexibility — and flexibility is the key benefit that the ships will provide to the Australian government. In times of increased strategic uncertainty, the LHDs will be able to respond to a wide variety of situations across the span of maritime operations. They will form the core of Australia's response to natural disasters, humanitarian aid, evacuation operations, peace-keeping tasks and, where necessary, the projection of combat force ashore.

The Canberra class will be a major advance on the capabilities provided by the current amphibious transports (LPA), HMA Ships *Kanimbla* and *Manoora*, ships that have proven versatility across a wide range of situations. These vessels have deployed to Iraq, acting as a sealift ship; command and control platform; a forward base for boarding operations (including embarking foreign navy boarding teams and boats); and provider of logistic support to smaller vessels — many of these roles simultaneously. The LPAs have also been deployed to the Solomon Islands, East Timor and Fiji to lead the Australian Defence Force (ADF) response in potential periods of instability as well as participating in humanitarian operations, including after the 2004 Boxing Day tsunami in South East Asia. *Kanimbla* hosted the Sea Combat Commander and his staff during RIMPAC 2006, proving the ship's ability to support a coalition command staff during war-fighting exercises and operations. The inherent flexibility in ships of this type means that they are extremely adaptable and, despite not being built for the RAN (they were purchased second-hand from the United States Navy and were modified by Forgacs in Newcastle), *Kanimbla* and *Manoora* have become key components of the RAN's broad capability. The Canberra class will build significantly on this already flexible and adaptable capability.

As the 2007 Update to the Defence White Paper states, we must recognise that our interests must often be secured in places distant from Australia [3]. Additionally, as an island nation, any major Australian military activity will need to be deployed across, and supported from, the sea. This reality has driven the need for amphibious deployment and support and the ability to project land forces in support of Australia's national interests, wherever they may be [4].

Amphibious ships capitalise on all of the attributes of maritime forces, as articulated in *Australian Maritime Doctrine* [5]. Without the need to negotiate basing and/or over-flight rights with other countries, warships are often the only choice available to government to respond to a developing situation, and the LHDs will provide unique response options. They will carry a substantial quantity of equipment, stores and personnel and will be fully operational as they enter an area of operations. They do not need any external support or approval to deploy, and can physically operate wherever there is enough water to float. The LHDs will be flexible and able to undertake a large range of tasks while exploiting the attributes of reach, access, flexibility, poise and persistence [6].

One of the key roles of maritime forces is power projection. In high-end combat operations, power projection is usually visualised as ordnance fired against land targets — naval gunfire support, land attack missiles and the like. Land forces projected from ships have the advantage of being able to deploy, operate, and be extracted and re-deployed once their job is done. The ability to base and deploy land forces from the sea brings considerable advantages to operations. For example, sea basing reduces the logistics, command and administrative footprint ashore and, consequently, the risk of attack against personnel and their equipment and the need for additional force-protection personnel and equipment. At the other end of the operational spectrum — such as when providing disaster relief — sea basing means that those deployed do not become a burden on an already-damaged and fragile infrastructure. A good example of this was the deployment of a naval task group, led by the aircraft carrier HMAS *Melbourne*, to Darwin after Cyclone Tracy in 1974 [7]. The sailors deployed ashore provided critical assistance to the city, without drawing on Darwin's very limited relief supplies. The sailors' own needs, such as food and accommodation,

A cut-away impression of the future LHDs
HMA Ships *Canberra* and *Adelaide*
(Image courtesy RAN)

were provided by their ships. For similar reasons, many nations sent predominantly maritime forces to assist countries in South East Asia after the Boxing Day 2004 tsunami. Maritime forces are often the only option to reach affected areas when land-based infrastructure is destroyed.

While the LHDs will be useful across the full spectrum of operations, their utility derives from the capabilities necessary to conduct combat-related amphibious operations. The ability to move forces by sea means that any adversary defending against a possible amphibious operation must spread their resources across their entire coast or concentrate on certain areas, leaving others undefended. The initiative is thus with the maritime-based force that can easily manoeuvre to where the opposition is least.

Each of the Canberra-class ships will be able to transport and support up to 1000 embarked forces, some of which can be landed ashore via a mix of embarked watercraft and aircraft, to conduct operations. Others will remain onboard the LHD providing command, aviation, medical and logistic support. The mix of those deployed ashore and remaining onboard will vary, depending on the circumstances.

Each ship will carry landing craft which are transported in a well-dock, which can be flooded when they are required. The ship ballasts down to flood the well-dock, allowing the watercraft to float and exit the dock. This can be done while underway and in conditions up to Sea State 4 — a significant increase on the RAN's current capability. The LHDs will also have six helicopter spots on a large flight deck which can support a range of helicopters. The ability to base aviation facilities afloat is a particular benefit, as it removes the need for maintenance, support facilities and personnel ashore, and allows the airbase to move to wherever it is required.

Of course, the introduction of the LHDs will bring significant challenges to the ADF. Without a dedicated marine force, such as the UK Royal Marines or US Marine Corps, the Australian Army will provide the landing force transported by the LHDs. The Army has a core of amphibious experience; however, the LHDs represent a quantum leap in capability, and one that the ADF must understand fully to maximise their potential. To that end, an RAN-Army Joint Amphibious Capability Implementation Team (JACIT) was established in September 2006 to identify and resolve issues associated with introducing this capability into the ADF. The Chief of Navy is the capability manager for the LHD, but the JACIT is responsive to a wide range of stakeholders involved in delivering ADF amphibious capability.

Work is also underway to identify the necessary port infrastructure required to support LHD operations, in their home port (Sydney), primary ports of Darwin and Townsville, and secondary ports of Brisbane, Gladstone and Adelaide, where they might be expected to operate in support of the Army.

The LHDs will be significant national assets. While they will be capable of operating at the high end of the conflict spectrum, their capabilities and inherent flexibility mean that the ships can be used for a wide range of tasks in support of Australia's national interests. They will prove to be incredibly useful in a wide range of military, diplomatic and constabulary operations, and will form the backbone of the ADF's ability to deploy to meet the requirements of the Australian Government.

Principal Particulars of the Canberra-class LHDs

Complement	243 (plus 36 additional)
Embarked Forces	978 (plus 146 additional)
Accommodation	1403
Length OA	230.8 m
Maximum beam	32 m
Draft at full load	7.18 m
Full load displacement	27 851 t
Maximum speed	20.5 kn
Range	8 000 n miles at 15 kn 9 250 n miles at 12 kn
Propulsion	Electric drive
Pods	2 × 11 MW
Power source	Combined diesel and gas turbine (CODAG)
Gas turbines	1 × GE LM 2500 (17.4 MW)
Diesel engines	2 × 7.2 MW diesels
Vehicle capacity	830 lane m (3290 m^2)
Heavy vehicle deck	1410 m^2
Light vehicle deck	1889 m^2
Helo hanger capacity	990 m^2
Landing craft operations	Up to and including Sea State 4
Aviation	8 × MRH90/Tiger helicopters and can operate Chinook helicopters
Medical Capacity	Two operating theatres high/medium/low dependency

Notes

1. The 'Strategic Projection Ship' is the term used by the Spanish and highlights the flexibility inherent in the design.

2. See Hugh White, 'Big ships: too costly, too cumbersome', *The Sydney Morning Herald*, 12 July 2004. For the contra argument, see B. McLennan and G.P. Gilbert, 'Amphibious Ships — Bigger is Better', *Quadrant*, September 2006, pp. 52–59.

3. Department of Defence, *Australia's National Security. A Defence Update 2007*, Defence Publishing Service, Canberra, 2007, p. 29. Importantly, even most ADF operations on the Australian mainland will require forces to be deployed by sea.

4. Royal Australian Navy, *Australian Maritime Doctrine*, Defence Publishing Service, Canberra, 2005, pp. 49-51. These attributes are mobility in mass, readiness, access, flexibility, adaptability, reach, poise and persistence, and resilience.

5. *Australian Maritime Doctrine*, pp. 49-51.

6. See Brett Mitchell, 'Disaster Relief — Cyclone Tracy and Tasman Bridge' in G.P. Gilbert and R. Davitt, *Australian Maritime Issues 2005: SPC-A Annual*, Sea Power Centre — Australia, Canberra, 2005, pp. 89–94.

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NSCV Stability

A major milestone has been achieved, with the completion of the NSCV's intact stability sections. Subsection 6A — Intact Stability Requirements specifies the minimum stability performance criteria and intact stability calculations for all types of commercial vessels.

"The criteria for transverse stability are now much more flexible and are dependent on vessel operations and characteristics rather than vessel type," explained NMSC Principal Technical Advisor, Mori Flapan. "This subsection also clearly identifies criteria for maximum displacement and longitudinal stability which were previously implied but not specified. "This is likely to improve the clarity of the requirements and allow for better matching of the need for stability with the circumstances in which a vessel operates."

Part of the standard specifying the tests and stability information included in Subsection 6B will be redesignated Subsection 6C — Stability Tests and Stability Information. "The stability tests used to establish vessel lightship parameters are also required for verifying compliance against buoyancy and stability after flooding. Hence, the stability tests and stability information section of the NSCV is a companion for both the intact stability subsection and the buoyancy and stability after flooding subsection."

Subsection 6C specifies the tests and calculations required to establish compliance with the criteria contained in Subsection 6A. These include: associated test reports and the specification of lightship survey; the requirements for applying draft marks to vessels, and the presentation of information on the vessel's intact stability and buoyancy, and stability after flooding characteristics.

NMSC will develop generic templates for use in producing simplified stability books and once complete, these templates will be made available for use by industry.

NSCV Anchoring Systems

NSCV Part C, Subsection 7D — Anchoring Systems will replace the current USL Code Section 13 — Miscellaneous Equipment (Appendices H and I only). In the new standard, the method for the calculation of anchor mass has been simplified and the formula takes into account various types of hulls such as catamarans and trimarans.

Under the standard, a 45 percent reduction in mass is now permitted for super-high-holding-power anchors, and the use of wire ropes, natural-fibre ropes and synthetic ropes is allowed for heavier anchors. Also, the need to carry two anchors has been relaxed. To ensure that the anchoring systems are strong and reliable, testing methods for various components have been included in the standard. The standard encourages performance-based solutions.

Safety Lines, September 2007

NMSC Issues Paper on the Effects of Flooding

The National Marine Safety Committee is inviting feedback on an Issues Paper which reviews the buoyancy and stability after flooding provisions of the current USL Code, in order to develop a new section of the National Standard for Commercial Vessels (NSCV). The NSCV Part C Subsection 6B Issues Paper also discusses developments in equivalent international standards and considers the approaches taken for domestic vessels overseas.

NMSC CEO Ms Maurene Horder explained that the review of standards for buoyancy and stability after flooding aims to bring Australian domestic commercial vessel standards into line with modern technologies and current community expectations. "Most vessels are provided with buoyancy or bulkheads that help to keep the vessel afloat in the event of flooding through collision, grounding, swamping or some other misadventure. Making all commercial vessels unsinkable would be the ultimate solution, but this is too expensive and/or impractical for all but the smallest of craft. So the standard has to find the right balance between its capacity to withstand flooding and the viability of the vessel as a commercial concern."

Ms Horder went on to say that, in addition to providing comment on the overall content of the issues paper, stakeholders are being encouraged to identify any areas that have missed in the issues paper. "In order to develop a draft standard, we would like to know what people think are the buoyancy and stability after flooding issues applicable to Australian domestic commercial vessels."

Submissions may be provided on any issues that stakeholders feel are relevant to buoyancy and stability after flooding requirements within the USL code, including, errors or problems, obsolete or redundant provisions and safety issues, as well as technological changes in the design, construction or operation of vessels;.

The NSCV Part C Subsection 6B — Buoyancy and Stability After Flooding Issues Paper can be downloaded directly from the NMSC website at http://www.nmsc.gov.au/yoursay_2.html or call (02) 9247 2124 to request a copy by post. Further information may be obtained from Communications Officer, Ursula Bishop, on (02) 9247 2124.

Comments close on 27 November 2007, so get your copy today and comment away.

NMSC Media Release, 3 October 2007

INDUSTRY NEWS

Prototype Wärtsilä Fuel Cell starts Operation

In October the Wärtsilä Fuel Cell Programme reached a significant milestone in its development of solid-oxide fuel cell (SOFC) technology. The first Wärtsilä WFC20 fuel cell, a 20 kWe alpha-prototype, was warmed up for the first time in the Wärtsilä Fuel Cell Laboratory in Espoo, Finland. A small starting ceremony was held to celebrate this event which is seen as a concrete advance in the development of Wärtsilä fuel-cell systems. After the unit has reached its operating temperature of 750ºC it will start generating electricity.

During the past year that the WFC20 unit has been manufactured, various subsystems such as fuel reformer, automation and control systems have been tested and verified. Now the Wärtsilä fuel-cell development programme has finally reached this important milestone, where stacks are installed and the first prototype is ready for operation. The unit will be operated at the Wärtsilä Fuel Cell Laboratory in Espoo, and will provide electricity and heat to the power and heat grids respectively. The WFC20 alpha-prototype developed by Wärtsilä is the first SOFC power unit ever build in Finland and, globally, one of the first units based on planar SOFC technology in the given power range.

Wärtsilä has been developing fuel-cell technology for decentralized power generation and marine applications since the year 2000. In 2004, Wärtsilä started the operation of a 5 kW SOFC test system which provided results as a reference point for the WFC20 alpha-prototype. The WFC20 alpha-prototype is an integrated power unit which uses natural gas as fuel. The cell and stack technology used in the unit is based on the planar SOFC technology developed by Wärtsilä's long-term collaboration partner, Topsøe Fuel Cell A/S (TOFC). TOFC is a fully-owned subsidiary of Haldor Topsøe A/S and one of the leading SOFC technology companies fully dedicated to development, manufacturing and marketing of solid-oxide fuel-cell technology.

For reaching this important milestone, the Wärtsilä fuel-cell development team acknowledges its closest development partners, Topsøe Fuel Cell A/S and Technical Research Centre of Finland (VTT).

Wärtsilä's fuel cell
(Photo courtesy Wärtsilä)

New 20-cylinder Wärtsilä 46F Engine

In September the Wärtsilä Corporation introduced the new 20-cylinder 46F engine for power plant installations burning heavy fuel oil. The new engine develops 23 000 kW at 600 rpm, suitable for both 50 and 60 Hz electricity generation. It offers more power and lower emissions than the existing 18-cylinder Wärtsilä 46 engine, while maintaining the high energy efficiency. Therefore the Wärtsilä 20V46F offers more value for money, with lower lifecycle costs.

The new Wärtsilä 20V46F engine develops 1150 kW/cylinder compared with 975 kW/cylinder from the Wärtsilä 18V46, at 600 rpm (50/60 Hz) as opposed to 500 rpm (50 Hz) and 514 rpm (60 Hz) respectively.

The Wärtsilä 46F is especially environmentally friendly. It has low NOx emissions, down to 710 ppm NOx at 15% oxygen, which is the required level in India today. The Wärtsilä 20V46F will also be able to comply with the World Bank environmental requirements, which are becoming increasingly stringent. However, as it is a known fact that reducing NOx emissions has an adverse impact on fuel consumption, the Wärtsilä 20V46F incorporates design features which enable optimizing the fuel consumption while meeting the required NOx emission levels. Additionally, the engine can minimise the fuel consumption adaptively according to prevailing ambient conditions.

Though visually similar to the original Wärtsilä 46 launched in 1987, the new Wärtsilä 20V46F engine is packed with new features, including twin injection pump and scalable control, for high performance and low exhaust emissions, regardless of fuel quality. It is ideally suited to applications which place a premium on savings in operating and maintenance costs, superior environmental performance and fuel adaptability.

The complete Wärtsilä 20V46F diesel generating set measures 21 m long with an extreme width of 6.275 m and height of 6.2 m above the underside of the baseframe, and has a total mass of 413 t. It is designed to be dismantled to three discrete units, namely the engine with baseframe, generator with baseframe, and the turbocharger module, for separate transport to site. The separate elements are designed for easy assembly on site with minimum installation time. The largest unit is the engine unit, which weighs less than 300 t, conveniently enabling transportation with a heavy lift ship.

The Wärtsilä 46F engine was initially introduced for marine applications in 2004 when a six-cylinder engine began running on the test bed in Vaasa. The first Wärtsilä 46F marine engines entered service at the beginning of 2007 and the longest-running engines now have some 3100 running hours. To date 14 marine engines have been delivered. The 20-cylinder Wärtsilä 46F launched today began running on the Vaasa test bed in November 2006, and has accumulated 1250 hours of test running.

Manufacture of the Wärtsilä 20V46F engine will be undertaken in Wärtsilä's Delivery Centre in Trieste, Italy. The first engines are expected to be shipped in the later part of 2009.

MEMBERSHIP

Meeting of the Australian Division Council

The Australian Division Council last met on Wednesday 10 October 2007. The meeting, as usual, was conducted as a teleconference.

The following matters were discussed or brought to the attention of Council:

- **NMSC Industry Advisory Committee**

  It was reported that, in response to a request received from the NMSC, the names of several members had been submitted for consideration for appointment to this committee.

- **Maritime Advancement Australia Award**

  The Australian Naval Institute had advised that nominations were now called for this Award. The Award is in the form of a two year grant for research and development in a maritime activity. $22 000 each year is made available to the winning project. All Sections were advised of the call for nominations.

- **Most Influential Female Engineer**

  Engineers Australia had advised of the establishment of an award for the Most Influential Female Engineer and for its call for nominations. This, too, was communicated to Sections for appropriate action.

- **Pacific 2008 International Maritime Conference**

  The Chairman of the Organising Committee reported that 120 papers had been offered but unfortunately only 78 were able to be included in the program. It was advised that it was now proposed to include in the Exposition a Careers and Skills Showcase. This event would be aimed principally at those intending to leave school later in the year and could offer assistance in their selection of a career for the future. Council was of the opinion the Institution might well be in a position to offer independent professional advice to students should they wish to pursue a career in naval architecture.

- **The Australian Naval Architect**

  Mr Jeremy reported that the next issue of *The ANA* was proceeding well, although he would like to see more input from the Sections. Council expressed their ongoing appreciation of the efforts of the Editor-in-Chief and the Technical Editor which result in the production of a first-class professional journal acclaimed so highly in Australia and overseas. Council decided that the advertising rates for 2008 will continue as for the current year.

The next meeting of the Council of the Australian Division will be held on Thursday 6 December 2007.

Keith Adams
Secretary

NAVAL ARCHITECTS ON THE MOVE

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

Gary Goetz has moved on from Tenix Marine and has taken up a position as Lead Engineer Marine Structures with AMOG Consulting in Melbourne.

Tim Hall has moved on within Lloyd's Register from the Korea Management Office in Busan to take up the position of Manager Hull Structures in the Research and Development Department at Head Office in London.

Matthew Harman has moved on from the Anzac Ship Project Management Office and has taken up a position as Senior Naval Architect at Tenix Marine in Williamstown.

Peter Hatton has moved on from Jittery Joe's Zero Gravity professional mountain biking team in the USA and has taken up a position as a naval architect with One2three Naval Architects in Sydney.

Scott McErlane has moved on and has taken up the position of Chief Engineer on a new 50 m motor yacht, *Mine Games*, built by Trinity in the USA. The vessel has five staterooms for twelve guests with a crew of nine, and will provide luxury dive/cruise charters in the Caribbean and the Mediterranean Seas. Friends can check out pictures of Scott's latest home-away-from-home at www.yachtportfolio.com/yacht.cfm?yid=445.

Joanna Mycroft has completed her tour of Europe following the Tour de France, attended the RINA conference on *The Modern Yacht* in Southampton, and has now taken up a position as a naval architect with SeaTec in Glasgow, Scotland. SeaTec also has offices in Europe and Asia, and provides naval architecture, engineering and safety services to the shipping, offshore and defence industries. Friends can check out the company at www.seatec-services.com.

Simon Orr has moved on from Thales Australia (Naval) and has headed for the UK, looking for employment.

Greg Seil has moved on from WBM Consulting Engineers and has taken up a position as Senior CFD Specialist and the Practice Leader for Computational Fluid Dynamics at Sinclair Knight Merz in Sydney.

Robert Skerman has moved on from Sea Speed/New Wave Catamarans in Brisbane and has taken up a position as a naval architect with Demat Marine in Dubai, UAR, a company designing and building aluminium vessels up to 50 m in length.

Evan Spong has moved on from the Italian Luna Rossa team following this year's America's Cup challenge, and has taken up a position as a naval architect with Team New Zealand in Auckland to start preparing for New Zealand's next challenge.

Ruben Spyker has moved on from Gibbs & Cox and has taken up the position of Senior Naval Architect with ASC Shipbuilding in Adelaide on the AWD project.

Jude Stanisalus has moved on from Transport SA and has taken up a position as a Surveyor with Det Norske Veritas in Fremantle, working primarily on new construction.

Dominic Worthington has completed his latest rounds of training at HMAS *Creswell* and *Cerberus*, been posted to HMAS *Darwin* as AMEO, and has recently been promoted to LEUT, RAN.

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 (see *Missing in Action).*

Phil Helmore

MISSING IN ACTION

There is only one member missing in action — Mr Nicholas Kyprianidis whose last known address was 49A Adrian Street, Palmyra, WA 6157.

If anyone knows his present location, please let Keith Adams know on (02) 9878 4140, fax (02) 9878 5421 or email kadams@zeta.org.au.

VALE

Peter James

It is with sadness that *The ANA* records the passing of Peter James on 8 September 2007.

Peter James
(Photo courtesy Irene James)

It would be a virtual impossibility for anyone familiar with the southern region of Australia and its fisheries not to have seen the works of well-known and respected Adelaide naval architect, Peter James.

Peter James originated on the Isle of Wight, surrounded by sea and close to the busy Solent with its many boat and shipbuilding yards, and famous for its craftsmen and seamen alike. On leaving school, he obtained an aircraft apprenticeship at Cowes, the yachting Mecca, and completed his apprenticeship at Saunders-Roe, working on flying boats and amphibious float planes. This apprenticeship included three years' workshop time and two years in the drawing office, during which he achieved his engineering qualifications with time spent at Southampton University.

He spent the next 15 years at the company's model/ship research tank, testing all types of seaborne craft including twelve-metre yachts, hovercraft and special projects such as preliminary work on Donald Campbell's record-breaking *Bluebird*, including some of the initial design work. Due to the phasing out of flying boats in the early 1950s, Saunders-Roe became involved in building jet fighters and hovercraft, and Peter stayed on, working in ship research and design.

Moving to Australia in 1965, Peter joined Adelaide Ship Construction at Birkenhead as Assistant Naval Architect. However, the yard sadly (to the detriment of South Australia) closed it doors in 1973.

He then worked for various local ship builders in the 1970s and 80s, including Eglo Engineering in 1986–87, concurrent with designing fishing vessels and work boats since 1970 in his own business. In 1994 a well-known Port Lincoln fisherman decided to upgrade his prawn fishing activities and asked Peter to produce a new design vessel, to a specific length, 22 metres, to be built by Adelaide Ship Construction International. This vessel was the forerunner of his highly-successful design, which has now seen more than twenty vessels built to it. Many other vessels have subsequently come from Peter's drawing board, including purse seiners, fish-farm tow vessels and dive boats.

Professional Fisherman, November 2003

Peter designed a total of 27 vessels which were built by Adelaide Ship Construction, and many more which were built by Tony Franov and others.

Peter is survived by his wife, Irene, and three sons, Nigel, Steven and David.

Neil Cormack

FROM THE ARCHIVES

DOCKYARDS WHICH MIGHT HAVE BEEN

John Jeremy

Nearly 100 years ago, in June 1910, the Commonwealth Government invited Admiral of the Fleet, Lord Fisher, to advise on Australian naval defence. Fisher was unable to accept the invitation, and proposed Admiral Sir Reginald Henderson in his place. Henderson accepted the redirected invitation and arrived in Western Australia in August 1910 to begin his task. Admiral Henderson's report was submitted on 1 March 1911, when the construction of the Australian Fleet unit, comprising one armoured cruiser, three protected cruisers, six torpedo-boat destroyers and two submarines was well underway. However, there was much more to be done to establish the new navy and Henderson's recommendations were intended to set the course for the future Royal Australian Navy.

In 1910 Britain was the dominant world power, and Henderson's plans for the Australian navy were developed within the concept of Empire sea power. His report's introduction set the tone:

'Australia heretofore has trusted to the Mother Country for her protection, which has depended on the Command of the Sea, or, in other words, upon Sea Power, and this Sea Power has enabled Australians to remain undisturbed in their magnificent country and allowed them to arrive at their present condition of great prosperity. Australia has now determined to take her share of the defence of her own territory, and it is certain that it must still rest on the Sea Power of the Empire' [1].

Henderson's recommendations for the Australian navy were extensive. Speaking in London after his return to Britain, Henderson outlined his proposals:

'The complete scheme covers a period of 22 years, and is based upon the population and commerce of the Commonwealth in comparison to the rest of the empire. It provides for a fleet of 52 vessels and personnel of 15 000. The proposed fleet is to be divided into two divisions, with four bases for the eastern and three for the western division.

'As to the naval bases, the chief will be in Sydney and Fremantle. Fremantle is, of course, new. The actual naval base would be at Cockburn Sound, the approaches to which will have to be dredged' [2].

It is obvious that Henderson's recommendations for the fleet were optimistic — they would have provided the RAN by 1933 with eight battle cruisers, ten cruisers, 18 destroyers and twelve submarines. Equally, his base proposals were bold. In addition to the main bases in Sydney and Fremantle, he proposed secondary bases in Darwin, Thursday Island, Townsville, Brisbane, Port Stephens (NSW), Western Port (Victoria), Hobart, Port Lincoln (South Australia), Albany and King Sound (Western Australia) [3].

Despite the grandiose nature of these proposals, work was begun in Sydney (Cockatoo Island was acquired from the NSW Government and negotiations for the transfer of Garden Island from the Admiralty were pressed forward), at the Flinders Naval Base in Victoria, the Henderson Naval Base on Cockburn Sound and at Port Stephens in NSW. Land was acquired at Port Lincoln, Albany, Brisbane and Hobart [4]. In 1913 the Navy appointed civil engineer Sir Maurice Fitzmaurice, senior partner of the London firm Coode, Son and Matthews, and chief engineer to the London City Council, to advise on the design of the new bases [5].

Two plans hidden in the Cockatoo Dockyard archives at the National Archives in Sydney reveal just how ambitious these dockyard plans were.

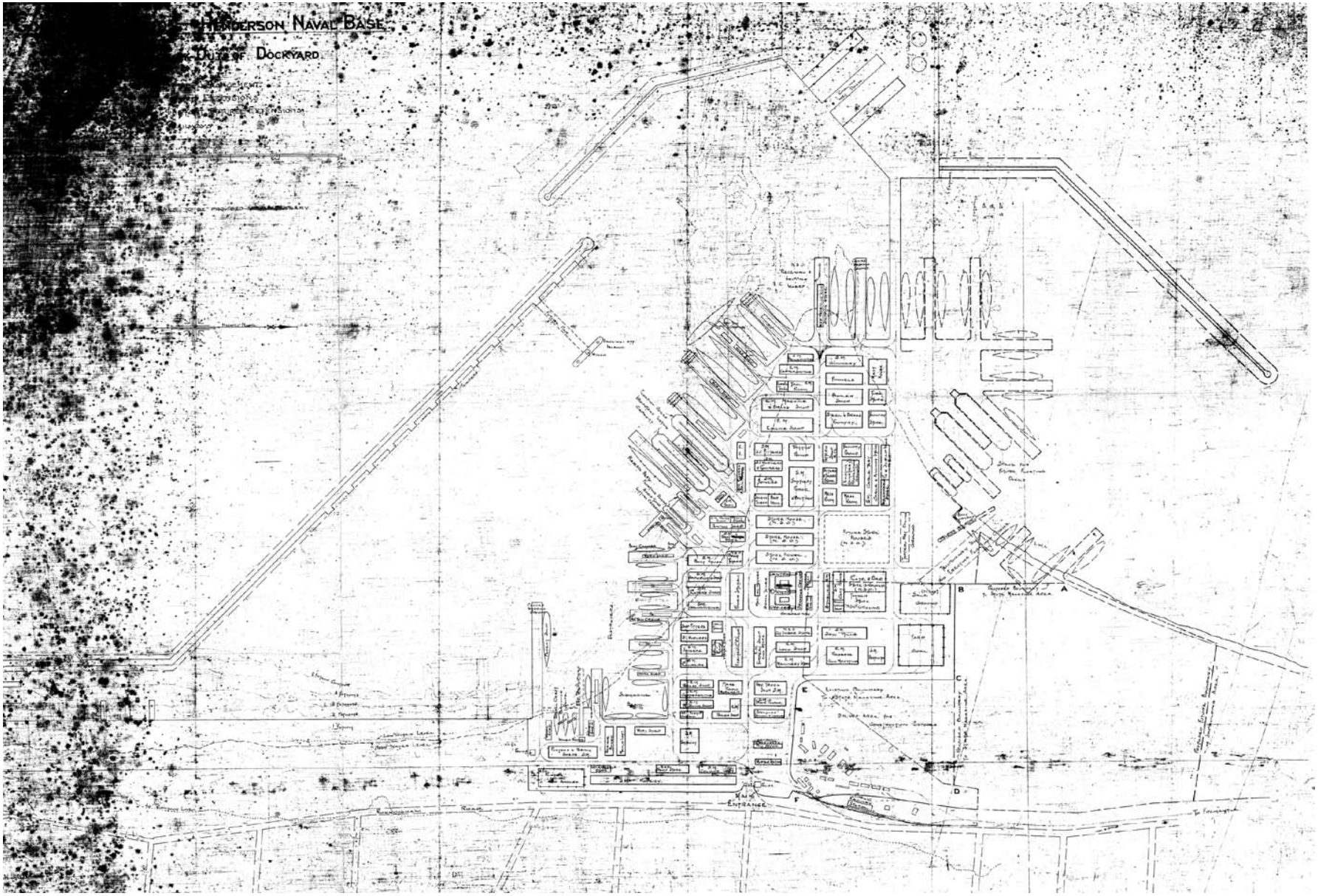
The plan for the Henderson Naval Base reveals a very capable dockyard occupying Woodman Point south of Fremantle. More than simply a base, the plan shows slipways for the construction of small ships, submarine and destroyer berths, capital ship and cruiser berths, a 250 t crane (which would have been very noticeable on the skyline of east Cockburn Sound), two 3000 t floating docks and two 35 000 t floating docks. Provision was also made for considerable further expansion.

Work on developing the base was begun in 1914. Early that year, two bucket dredgers were ordered, one from Cockatoo Dockyard and one from Poole and Steel in Sydney, for the dredging work required on access channels through the shallows west of Woodman Point. Operated by the Commonwealth Navigation Department, Nos. 33 and 19 (the numbers refer to the relevant Navy Office project numbers) were towed to Western Australia in September 1915.

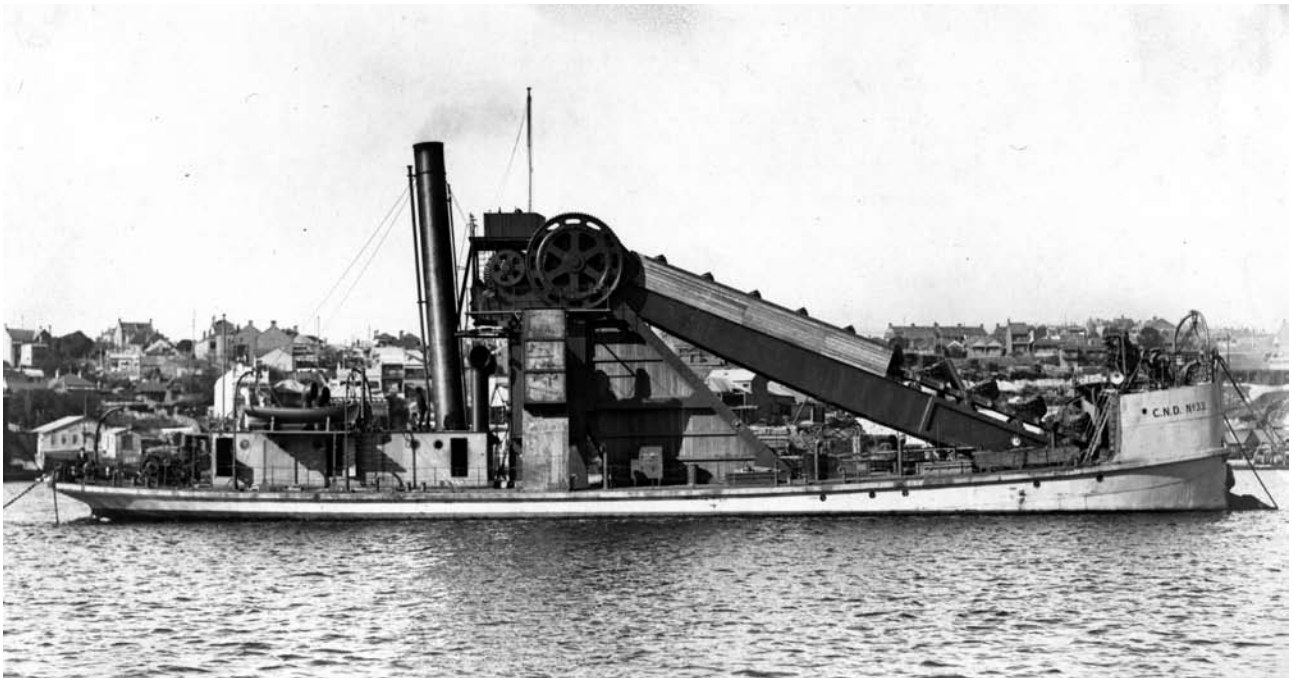
Sir Maurice Fitzmaurice's report on the Henderson Naval Base was completed on 21 October 1914 and, on 2 February 1915, the Naval Board decided to recommend to the Minister that dredging work, the construction of the destroyers and submarine basin, the first stage of the main basin and the permanent slipway, be taken in hand immediately [6].

By early the following year the Naval Board was becoming concerned about the cost of construction of the base and, on 14 February 1916, decided to consider a more compact plan concentrated on Woodman Point which had been proposed by the General Manager of Cockatoo Dockyard, Mr John King Salter [7]. Perhaps that is the plan in the Cockatoo Dockyard archives (it is dated 1916, and there is another which shows a reduced scope of work described as '1st Instalment Plan' which also shows graving docks rather than floating docks [8]).

The permanent slipway originally included in the 1914 plan was dropped in March 1916 when the General Manager of Cockatoo Dockyard was directed to design a self-docking floating dock capable of lifting 3000 tons, to be built at Cockatoo Island and shipped to Western Australia for re-erection at the Henderson Naval Base (space for that purpose had been reserved on King Salter's plan) [9].



The 1916 plan of the proposed Henderson Naval Base in Western Australia
(NAA: C3456, 380)



Built by the Commonwealth Naval Dockyard, Cockatoo Island, CND No. 33 left Sydney under tow on 16 September 1915 for duties in Cockburn Sound
(Photo John Jeremy Collection)

A year later, the Naval Board directed work at the base towards the dredging of 91 m wide channels through the Parmelia and Success Banks, oil storage, a floating dock of 6000 tons capacity, temporary workshops and stores, water supply and breakwater protection as required for those facilities and the destroyer basin [10]. The scope of work was becoming more modest.

After the end of the war, the future of the Henderson Naval Base was under review, with work slowed down until decisions on its future were made. Finally, on 5 October 1921, all work was suspended [11], and in due course stores and plant associated with the project were disposed of.

Construction of the Flinders Naval Base fared better, and is today the home of HMAS *Cerberus*, but the Port Stephens Naval Base was also abandoned.

In May 1915 the Naval Board had generally agreed that Port Stephens was suitable for a primary fleet base, and recommended that £25 000 be provided in the 1915–1916 estimates for the base [12]. A large area of land on the southern shore of Port Stephens was acquired later that year. In March 1916 the Naval Board examined a plan for the Port and recommended that work on road access and foreshore work be commenced.

The plan of the base in the Cockatoo Archives is clearly conceptual, but ambitious, like those for the Henderson Naval Base. Spread over a large area of Soldiers Point and the shore of Salamander Bay, the plan shows shipbuilding facilities and berths for submarines, destroyers, cruisers and capital ships, and even two graving docks, the largest of which (at 279 m long by 36 m wide) would have rivalled the size of the WWII-built Captain Cook Dock in Sydney.

Progress at Port Stephens was slow, and little work was completed and the project was also abandoned in 1921.

Today, after the construction of HMAS *Stirling* at Garden Island in Western Australia and the development of shipbuilding and ship repair facilities at Henderson, south of Woodman Point, Admiral Henderson's plan for a major fleet base in Western Australia has been achieved. An amphibious warfare training base, HMAS *Assault*, was established in Port Stephens during World War II but, today, the Port is devoted to more peaceful pursuits. Like the more-recent plans for a naval base in Jervis Bay, a revival of naval plans for Port Stephens would be likely to meet substantial environmental road blocks!

[1] Macandie, G. L., *The Genesis of the Royal Australian Navy*, Government Printer, Sydney, 1949, p. 265.

[2] *The New York Times*, 7 May 1911.

[3] Nichols, Bob, *Statesmen and Sailors, Australian Maritime Defence 1870–1920*, Sydney, 1995, pp. 184-185.

[4] Macandie, p. 293.

[5] Sir Maurice Fitzmaurice CMG, MA, MAI, LID, FRS (1861–1924), President Institution of Civil Engineers 1916–1917.

[6] Minutes of Meeting of Naval Board held at Navy Office on Tuesday 2 February 1915.

[7] Minutes of Meeting of Naval Board held at Navy Office on 14 February 1916.

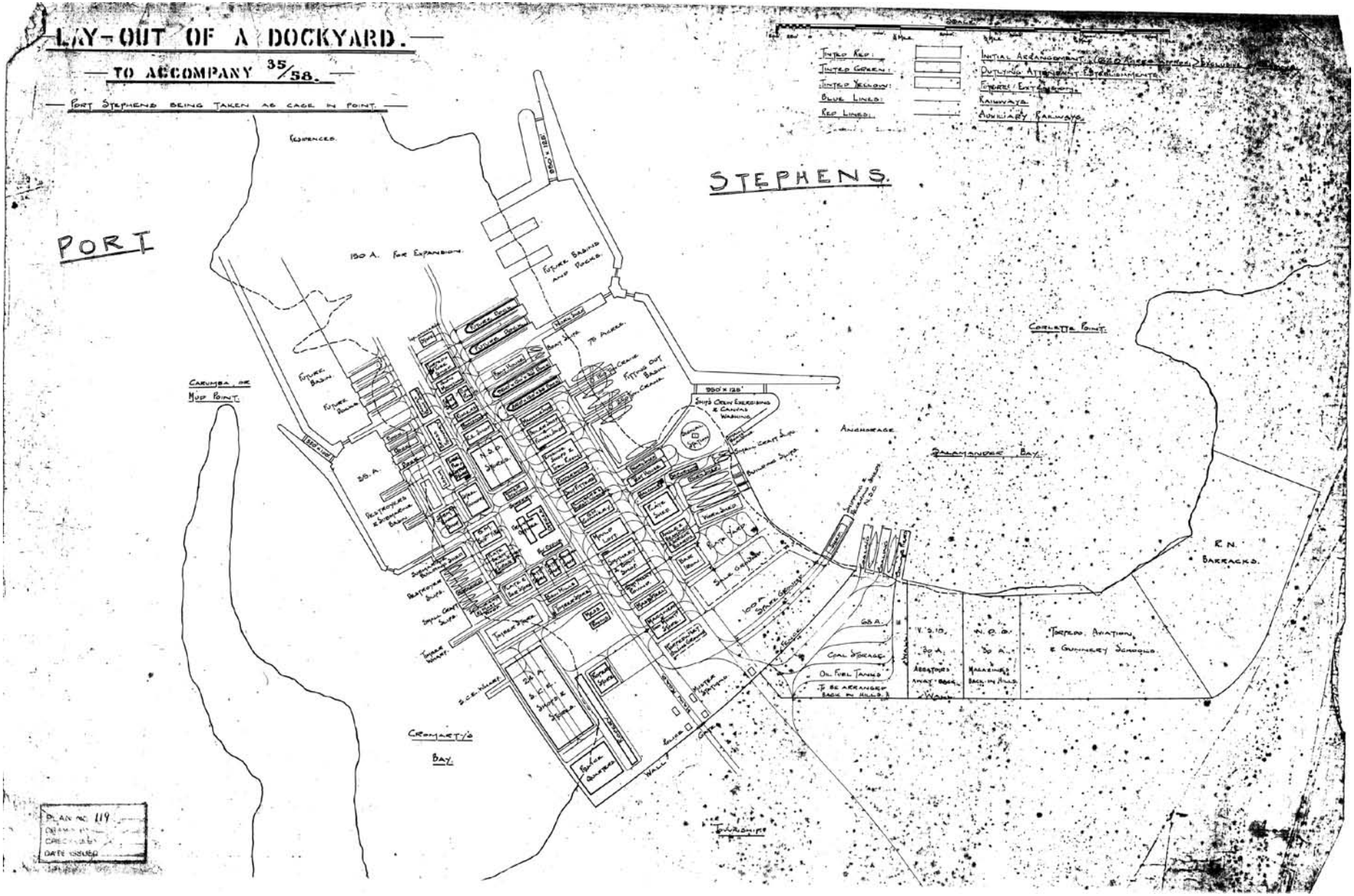
[8] NAA: C3456, 380a

[9] Minutes of Meeting of Naval Board held at Navy Office on 14 March 1916. There are contemporary plans for two floating docks in the Cockatoo Archives, not yet examined by the author, which may be the Henderson Naval Base docks.

[10] Minutes of Meeting of Naval Board held at Navy Office on 16 March 1916.

[11] Navy Office letter of 5 October 1921 to The Secretary, Naval Works and Railways Department.

[12] Minutes of Meeting of Naval Board held at Navy Office on 17 May 1915.



The concept plan for a naval base in Port Stephens, New South Wales
(NAA: C3368/, 233)

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