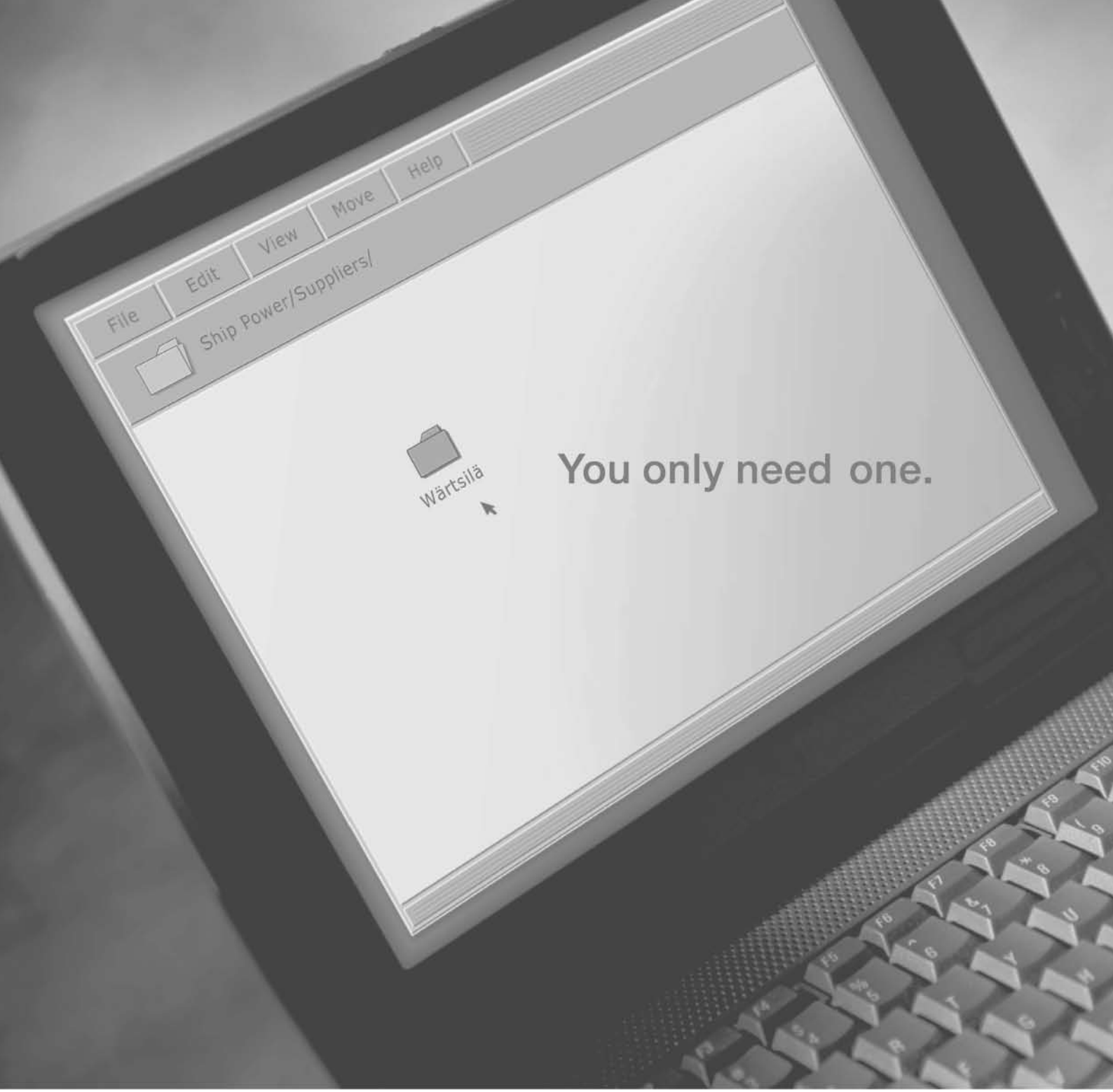
THE AUSTRALIAN NAVAL ARCHITECT

Volume 9 Number 4
November 2005



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THE AUSTRALIAN NAVAL ARCHITECT

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

Volume 9 Number 4
November 2005

Cover Photo:

The Armidale-class patrol boat *Larrakia* during sea trials off the Western Australian Coast (Photograph courtesy Austal Ships)

The Australian Naval Architect is published four times per year. All correspondence and advertising should be sent to:

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The deadline for the next edition of *The Australian Naval Architect* (Vol. 10 No. 1, February 2006) is Friday 27 January 2006.

The Australian Naval Architect
ISSN 1441-0125

Editor in Chief: John Jeremy
Technical Editor: Phil Helmore

Print Post Approved PP 606811/00009
Printed by B E E Printmail
Telephone (02) 9437 6917

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on the
World Wide Web
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From the Division President

Well here we are and, before we know it, we're looking down the barrel of the end of another year.

I'm sure that most who've been able to attend in recent years would agree with me that the SMIX (Sydney Maritime Industry Christmas) Bash is one of the highlights of the year. Its success is such that last year the NSW Section had to put up the "house full" sign a week or two before the event. It is an ideal opportunity to catch up with old friends (indeed practically the entire Sydney maritime community) and with what is happening in the industry — all brought together on board *James Craig* by the NSW Section. As an event, it really doesn't need any promotion, and for anyone still thinking about it at the time you receive this issue of *The ANA,* it's too late; but there's always next year!

While I don't intend making this column into my annual report to the Division, there are a couple of matters on which I need to update you from the last issue of this journal.

As you may recall, I mentioned that RINA would soon be signing a Memorandum of Understanding with the Defence Materiel Organisation to provide "chartering services" in relation to members employed by the DMO. This agreement, which recognizes CEng registration obtained through RINA as fulfilling DMO's requirement for their professionals to have "chartered" status, was finalized on 5 September. The importance that the Institution as a whole places on this agreement is indicated by the coverage given to it in the most recent issue of *RINA Affairs*. We are now seeking to have these arrangements extended beyond DMO to other Defence employers, while Headquarters in London is holding the agreement up as a model for use elsewhere, including in the UK.

Another item mentioned in the August issue was the outcome of the work done by the Divison's Safety Committee in relation to the NMSC requirements for the Australian Builders Plate for recreational vessels. This outcome was subsequently conveyed to NMSC and the person who had first raised the problem with the Division. A subsequent letter from the Chief Executive of NMSC appears in this issue of *The ANA*.

Once again, Headquarters in London sees these activities as important in fulfilling the Institution's obligations to the community at large. But, given that the Institution is an international body and that more than half of its members are now based outside of the United Kingdom, the sheer volume of national standards on matters naval architectural across countries in which RINA is represented means that the task of contributing to these standards cannot be handled centrally and must be done on a national basis. We are fortunate that our Division was RINA's first, and that its structure and membership keeps it at the forefront in providing the Institution's contribution to standards developed by national authorities.

In fact, earlier this year I recall hearing our Chief Executive describe the Division to a group of students as Australia's national professional body for naval architects. Such a role brings with it the responsibility of expressing a voice on occasions, as outlined above, as well as the more traditional role of a learned society in maintaining, and facilitating advances in, professional standards.

With regard to these standards, another area towards which the Division Council has expended considerable time and effort is our relationship with Engineers Australia and, specifically, in providing those RINA members who wish to with the ability to register on the National Professional Engineers Register (NPER) under "naval architecture" as an "area of practice". While the competencies document to underpin such registration has been completed from a RINA perspective for over a year, I am assured by Engineers Australia as manager of the NPER register, that this area of practice should be opened in the very near future. As action on this item is outside the Division's control, I can only hope that this promise is fulfilled before the end of the year, and that I can include its completion in my annual report.

So, the opening of the Christmas holiday season brings with it a number of reasons for the Division to celebrate, plus one or two more which I hope will materialise before the year is through — if I don't see you at the SMIX Bash, then I trust that you and your families have a happy and healthy Christmas and, beyond that, we all have a New Year to look forward to with whatever it may bring.

And, having started this column with reference to one of the events of the year, I should remind you that the New Year will bring the biennial highlight, the Pacific 2006 International Maritime Congress in Sydney from 31 January to 2 February.

Register now on www.pacific2006imc.com (early-bird registration closes on 30 November) and I look forward to seeing you there.

Finally I would like to thank Phil Hercus for hosting Division Council meetings at Incat Design for so many years, an arrangement no longer possible following the merger of Incat Designs with Crowther Design.

Rob Gehling

Editorial

The next edition of *The Australian Naval Architect* will mark the tenth year of publication of our journal. In June, it will be eight years since Phil Helmore and I took on the task of editing and publishing *The ANA*. In that time we have tried to produce a journal that is interesting and informative. In particular, we see *The ANA* as filling a gap that the UK publications of the Institution cannot reasonably fill — by providing news of local activities of the industry, Institution and profession, as well as the activities of the Universities and their students — with a little history thrown in for good measure.

We could not do it without the support of our correspondents and our corporate sponsors and advertisers. It does not happen by magic, or by some form of osmosis, so keep the information flowing to us. If you feel there is something happening that members in Australia should know about, then tell us about it. This is your journal.

John Jeremy

Letters to the Editor

Dear Sir,

I would like to respond to the comments made by Rob Gehling, Australian Division President of RINA, in the August issue of *The ANA* in relation to the Australian Builders Plate Standard for Recreational Boats (ABP). The NMSC is always appreciative of feedback from groups like RINA.

The NMSC has had long-running correspondence with the person who raised the issues on the ABP with RINA, and our Technical Reference Group (some of whom are RINA members) has assisted in responding to the author.

The ABP is an initiative of all Australian Governments, developed after five years of consultation with the industry to improve boating safety and reduce injuries and fatalities. There is little in the way of regulation of construction standards for recreational boats, and we hope that the plate will encourage boat builders to apply minimum safety standards.

As a result of industry consultation, there have been amendments to the ABP standard which comes into effect on 1 January 2006, and these have largely addressed the concerns of RINA's Safety Committee. For example, the name of the standard used to determine the information on the plate is now required to be displayed on the plate and will allow consumers to better compare ABP information between boats. Further amendments to the standard are detailed on our at website www.nmsc.gov.au.

We understand that there is concern as to why the ABP standard states that boats can be built to a range of standards. During consultation, industry representatives stated that they wanted to choose the standard to which they build, because many boats are built for export and must meet overseas requirements. There has never been an expectation that all the standards would result in identical safety outcomes for every boat. The objective is to provide the flexibility to cater for variations so that manufacturers do not have to make recalculations for the Australian market, provided that they have already complied with another relevant national or international standard. I must also point out that the stability and buoyancy characteristics which are calculated using different approaches still provide much better levels of safety than the current situation, where there is no calculation or testing required.

There are variations in passenger numbers arising from the application of different standards for the same size and type of boat, and this can have competitive implications. However, that is the current market situation and out of the hands of the NMSC. Industry has given a clear message that the benefits of adhering to a single standard for an Australian Builders Plate is not worth the cost implications.

On the issue of person mass, I would like to clarify a number of points:

- The mass of a person is not defined in the body of the ABP standard.
- A mass of 75 kg per person is specified applicable to the person symbol as per the source ISO document.
- If the person symbol is not used (as is the case with a text-only plate), the relevant Australian or international standard can be used to calculate the maximum number of persons allowed.
- The total mass of persons is also limited by the total person mass expressed in kilograms which is marked on the ABP.

To better inform industry, we are in the process of commissioning a naval architect to compare information attained for an ABP using AS 1799, ABYC and ISO standards for a 5.5 m outboard-powered vessel and a 7.5 m vessel. We are also running a public awareness campaign to inform the industry and boating public on the ABP.

We appreciate RINA's feedback on the ABP and look forward to your contributions on other NMSC projects during public consultation phases.

Maurene Horder
CEO
National Marine Safety Committee

Dear Sir,

I feel that the questions raised about passenger mass by Phil Helmore (*The ANA* May 2005) and Greg Cox (*The ANA* August 2005) deserve some background.

The first stability criteria adopted by the Department of Shipping and Transport (as in other countries) were those of Rahola. These did not address the issue of passenger mass.

In November 1968 IMCO (now IMO) adopted Resolution A.167 (ES.IV) *Recommendation on Intact Stability for Passenger and Cargo Ships under 100 metres in length*. As soon as this document became available it was adopted and copies were provided to all interested parties for their immediate use.

Subparagraph 2(6) of Appendix II states that a weight of 75 kg should be assumed for each passenger and that this may be reduced to not less than 60 kg when this can be justified. The weight and distribution of baggage is to be determined by the Administration. The *Code on Intact Stability* published by IMO in 1995 repeats these requirements in paragraph 3.5.2.6.

In 1971, when work on the USL Code commenced, Group 3 was charged with the production of standards for construction, stability and load line.

In subparagraph C.1.1.1(a) of Section 8 of the Code, the values of 65 kg for sheltered water areas and 75 kg for other operational areas were adopted. In subparagraph C.1.1.1(b) the standard crowded-passenger distribution of four persons per square metre was retained. This was first introduced in subclause 2(7) of Appendix II of the 1968 Recommendation, and repeated in paragraph 3.5.2.9 of the 1995 Code.

Before inserting this value in C.1.1.1(b) of Section 8 of the USL Code, it was checked physically by the members of Working Group 3 and found to be appropriate.

I would hope that the standard passenger mass will be reviewed as part of the review of the new proposed texts. If we are all becoming larger perhaps 3.75 persons per square metre may be more appropriate?

One final comment — 75kg is not set in stone; 80 kg or more could always be used if thought more appropriate!

Bob Herd
Melbourne

Dear Sir,

First, I would like to congratulate both John and Phil for continuing to produce an excellent journal each quarter which fully complements the RINA journals received from the UK.

Being a member of SNAME as well as RINA, I also receive the SNAME publication *Marine Technology*, and was particularly interested in the President's column in the July 2005 issue. There, the President suggests that SNAME needs to make sure that *Marine Technology* is highly valued by most members, and some suggested to him that it should look more like RINA's *The Naval Architect!* Another suggestion was that they develop a tractable means of annotating selected local section presentations — read PowerPoint, which have all-but-totally replaced written papers as the technical outputs of the periodic section meetings — for distribution to our broader membership.

If we compare the issues being faced by SNAME with those being faced by the Australian Division of RINA, then there are some similarities. In Victoria, our section technical meetings are almost entirely PowerPoint presentations which are only of benefit to the members who physically attend the meetings. Some of the contributors to *The Australian Naval Architect* summarise the technical presentations, along with an account of what could often be described as a lively discussion. The contributors from the various sections need to be praised for preserving the details of the meetings for the broader Australian membership.

I've thought several times about this, and often asked myself whether we can improve on this situation? One suggestion might be that we ask all presenters to produce a one-page summary of their talk which could be published in *The ANA*. Another might be that we place the presentations on the web, or produce a CD at the end of the year containing all section presentations that the broader membership can access. This would make sure that we fully preserve the information that is being presented locally at our sections. Like all ideas, this would require a significant amount of time by a core group of interested members, and their efforts would need to be recognised by the membership.

I look forward to any comments that other members have on this topic, which is obviously wider than just in Australia.

Stuart Cannon

Dear Sir,

I refer to the column *Classification Society News* in the May 2005 issue of *The Australian Naval Architect*, where the article *Improved Safety for Surveyors* drew my attention.

I am a third-year naval architecture student at UNSW, but I have a background in marine engineering with fifteen years of service at sea. I attended the dry docking of a large crude oil tanker, MT *Eagle Phoenix,* as a Chief Engineer in the Lisnave shipyard in Portugal in late 2003, and witnessed a few incidents where class surveyors were unofficially pressured by owner and yard to go through surveys, even though some short-cut safety procedures were adopted to meet the time constraints set up by the charterer for the next cargo.

I can confirm what Mr Per Linden, DNV Safety Manager, said in the article: "Even experienced surveyors can be put under pressure to carry out their work in a potentially-unsafe location, concerned that failing to do so may result in another class society being used".

The joint initiative by Lloyd's Resister, DNV and ABS to improve the safety of surveyors is a great step forward in this matter, and a similar approach by all parties in IACS would benefit all in future. New naval architecture graduates who would enter this industry overwhelmingly welcome such initiatives taken by these classification societies.

Hasan Farazi
UNSW Student

Dear Sir,

I would like to share details of one of the most important shipwrecks discovered since USS *Monitor* was found off Cape Hatteras in 1973. Nine years ago, a ship was discovered in Beaufort Inlet, North Carolina, which is thought to be *Queen Anne's Revenge*. The wreckage included a dozen cannons and large anchors designed for a 350 ton (365 t) ship. This unique wreckage is one of the best colonial shipwrecks in the world. The history of *Queen Anne's Revenge* includes many famous legends.

In 1710, the ship *La Concorde* was built in England. The vessel had three masts and was about 100 ft (30.5 m) long and 25 ft (7.6 m) wide, making it an impressive ship of its time. After subsequent modification, she became a slave ship of the African nation, Senegal.

Seven years after launching, *La Concorde* was captured by the famous pirate 'Blackbeard', Edward Teach. Blackbeard renamed the ship *Queen Anne's Revenge*. He added to the ship's complement of cannons and used her to successfully attack and plunder merchant ships.

Unfortunately, Blackbeard´s flagship ran aground in Beaufort Inlet in June 1718. This was, perhaps, an intentional strategy to break up his crew and to keep more treasure for himself. Two months after the sinking of *Queen Anne's Revenge*, the Royal Navy at North Carolina beheaded Blackbeard.

The discovery of *Queen Anne´s Revenge* in 1996 has given historians and archaeologists important information about maritime life in the 18th century. The wreck, discovered by a private research firm in Florida, has not been mapped or surveyed, and its exact location is being kept secret for security. It is unlikely that any treasure will be found on the wreck, because Blackbeard had time to remove it before the ship sank. The state will eventually recover the site and show artefacts in a museum.

I believe that this wreckage in Beaufort Inlet should be accessible for the public to explore. I am writing this letter to bring awareness of this famous shipwreck to readers of *The Australian Naval Architect*.

Beate Raabe
UNSW Student

Dear Sir

It is with great interest that I have been watching the development of the new breed of canting-keeled super-maxi yachts, such as Neville Crichton's *Alfa Romeo*, Grant Wharington's *Skandia,* and the yet-to-be-launched *Wild Oats* for Bob Oatley. These yachts are at the absolute forefront of yachting technology, and feature electric winches, complex navigation systems, load cells in many parts of the structure, and many different forms of weather routing to pick the optimum course.

These boats, all approaching 30 m in length overall, can be sailed with a crew of the same size as would normally be found on an 18 m yacht, thanks to their onboard technological systems.

At what point do yachting authorities need to cap the technology in these boats? Will yachting go the way of Formula 1 car racing, where driver skill plays only a small part in the outcome of a race? Sailing has always been a sport where neither the best boat nor the best sailors will win; it must be a combination of the two.

As an example; on these new canting-keel boats it would be possible to have a computer-controlled keel with motion sensors which continually adjust the keel angle to ensure that the boat is sailing as close to upright as possible at all times. Add to this captive winches linked to wind instruments which automatically trim the sails, a fly-by-wire steering system and hydraulic controls for most other settings, and you have what would probably be called the ultimate racing yacht.

This type of futuristic boat is entirely possible today, and several of the yachts in this year's Sydney to Hobart will be approaching this level of complexity. These vessels will be competing directly with 30-year-old boats crewed by amateurs for overall honours. Is this really a level playing field?

Andrew Joyce
UNSW student

NEWS FROM THE SECTIONS

New South Wales

Committee Meetings

The NSW Section Committee met on 2 August and, other than routine matters, discussed:

- SMIX Bash 2005: *James Craig* venue booked; arrangements made for early-bird pricing and credit-card payments for tickets paid for before the end of October. Catering arrangements under discussion.
- ASDE Share of Joint Meetings: The Australian Society of Defence Engineers had agreed to pay the catering costs when they attended joint meetings with us.
- Presentations to Presenters: A dozen bottles of wine had been purchased for presentation to our presenters.
- TM Venue for 2006: Two other venues had been investigated; room hire was comparable, but either catering or equipment-hire costs tended to be high, reducing the attractiveness.
- Membership of NSW Section Committee: Craig Hughes had agreed to join the NSW Section committee.
- Walter Atkinson Award 2004: The AD Council had decided to proceed with the Walter Atkinson Award, and so nominations from NSW would need to be considered at the next meeting.
- Finance: The Section account is currently $323 in the red; however, we are due for reimbursement of $524 from the Australian Division for the technical meeting venues, which will put the social account $201 into the black. The Social account is currently $4513 in the black (including the SMIX Bash accounts), keeping the Section account's head above water.

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

- Membership of NSW Section Committee: Craig Hughes and John Butler welcomed as new members of the committee.
- SMIX Bash 2005: Ticket prices confirmed at $25 per person for 'early-bird' bookings prior to end of October, and thereafter $30 per person; confirmed sponsorships not yet sufficient to cover costs; advertising flyer ready for circulation.
- Walter Atkinson Award 2004: Nominations being considered from *The ANA* and Pacific 2004.
- Finance: Sponsorships for SMIX Bash have started arriving, and deposits have been paid to the Sydney Heritage Fleet and Mode Group for the venue and catering respectively ($4485 in total). Current balances are $302 in the red for the Section (i.e. being kept afloat by the Social Account) and $513 in the black for the Social Account. However we are owed $387 from the Australian Division for reimbursement of Technical Meeting venue hire.
- Venue for Committee Meetings: Incat venue no longer available after this meeting; other venues under consideration.
- Venue for 2006 Technical Meetings: Engineers Australia move still to be finalised, other venues under consideration.
- TM Program for 2006: Possible topics considered.

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

- SMIX Bash 2005: Sponsorships not yet sufficient to cover costs, more possible; advertising flyer to be circulated again; model of *Gretel* completed for raffle.
- Report on Australian Division Council Meeting: see *Membership* column elsewhere in this issue.
- Walter Atkinson Award 2004: Nomination decided.
- Venue for Committee Meetings: This meeting held at Albert's Bar at North Sydney; other venues under consideration.
- Venue for 2006 Technical Meetings: Engineers Australia have decided on move to 8 Thomas Street, Chatswood in the second quarter of 2006, with venue costs likely to remain unchanged. Other venues considered expensive or unsuitable; decision made to

continue with EA venue, including move from North Sydney to Chatswood next year.

- TM Program for 2006: Possible authors and topics considered, especially topic for presentation at the AGM in March next year.
- Finance: Current balances are $111 in the black for the Section and more than $2000 in the black for the Social Account (sponsorships and ticket payments for SMIX Bash have started arriving, and are mounting).
- Pacific 2006: RINA will have a stand at the Pacific 2006 Exhibition, and committee members will be rostered as crew.

Shock Testing of the Collins-class Submarines

Paul Elischer of the Defence Science and Technology Organisation (DSTO) in Melbourne gave a presentation on *The Underwater Shock Testing of the Collins-class Submarines* to a joint meeting with the IMarEST and the Australian Society of Defence Engineers attended by fifty-four on 9 August in the Harricks Auditorium at Engineers Australia, North Sydney.

DSTO

Paul began his presentation with a brief outline of DSTO and their operations. DSTO's mission is "The expert impartial and innovative application of science and technology to the defence of Australia and national assets". The organisational structure extends downwards from the Prime Minister to the Chief Defence Scientist, who controls the operations of the Platform Sciences Laboratories, the Systems Sciences Laboratories, and the Information Sciences Laboratories. The Maritime Platforms Division comes under the Platform Sciences Labs.

DSTO has assisted in the defence of Australia since 1910. It now has a staff of around 2200 people (of whom about 80% are researchers), has three research laboratories and twelve research divisions, and an annual budget of around $300 million. Their workforce is highly skilled, with 30% having doctorates, a further 46% with degrees, 16% technical staff and about 8% administrative/clerical staff.

DSTO has facilities at HMAS *Stirling* in WA, Edinburgh in SA, Cloncurry and Innisfail in Queensland, Scottsdale in Tasmania, Canberra, Melbourne and Sydney.

DSTO provides support to the Department of Defence in ensuring that Australia is a smart buyer and user of defence equipment, developing new and unique capabilities, enhancing existing capabilities and reducing the costs of ownership, and transferring the results of defence research to industry so that industry is better equipped to support defence.

DSTO provides support to national security by providing defence against terrorism, contributing to the Science, Engineering and Technology Unit in Cabinet, and in safeguarding Australia via the national research priority.

Science and technology initiatives include reducing the costs of ownership, experimentation, counter-terrorism, automation of the battle-face, network-centric warfare, smart materials and structures, and missile defence.

The Collins Class

HMAS *Rankin*, the submarine on which the shock trials were carried out, was commissioned into the Royal Australian Navy in June 2001. The principal particulars of the Collins-class submarines are as follows:

Length		77.8 m
Beam		7.8 m
Displacement		3350 t
Diving depth		>180 m
Range		5000–6500 n miles
Speed	surfaced	10 kn
	submerged	20 kn
Motors		diesel-electric
Weapons		Harpoon missiles
		Mk 48 torpedoes

HMAS *Rankin* at Pearl Harbour
(US Navy photograph)

Why Shock Test?

The reasons for conducting shock tests include first-of-class testing to measure the actual shock loadings and the shock-induced motion, to prove that the submarine and the fitted equipment can withstand the specified shock loadings, and to extrapolate the resulting data to structural and equipment design levels. Actual tests cannot be carried out at design levels, because of the risk of serious damage, so tests are done at 40% lower (i.e. 60% of design) levels, and the results extrapolated to design levels using spectrum analysis.

Shock-trial Responsibilities

The Platform Sciences laboratories were responsible for advice to the submarine project at the Australian Submarine Corporation, assisting with the design and conduct of the shock trials, provision and installation of instrumentation for the measurement of shock pressure waves, accelerations, underwater pressures, displacements, velocities and strains, and the analysis and reporting of results.

The Australian Submarine Corporation was responsible for nominating the locations for instruments, inspection and the functionality of tests, strain and on-site support.

The Royal Australian Navy was responsible for the selection of the test site and the mooring configuration, site safety, support requirements, explosive ordnance, arming and firing, and damage control.

Video

Paul then showed a video of the shock trials, firstly from above water, showing the mooring buoys and the geysers resulting from the explosions, and then some of the onboard action and resulting shock and vibration.

Some of the activities leading up to the trials included site evaluation, charge evaluation, charge placement, mooring trial, installation of instrumentation, and the documentation.

Site Evaluation

Site evaluation involved the choice of shallow or deep water for the site, and the determination of the sea-bed characteristics and reflection parameters to minimise the secondary shock wave reflected from the sea bed to the submarine.

The site eventually chosen was about 4 n miles north-east of Thistle Island in Spencer Gulf, near Port Lincoln, SA, in a water depth of 40 m. This water depth was chosen with safety in mind as, in the event of damage, the crew could all be evacuated safely from this depth. The crew were, in fact, given training in emergency escape. A four-point permanent mooring was set up, and this was subject to significant tide movement, and is in an area known for the presence of great white sharks!

The submarine was fully crewed and submerged for the trials, with the Defence Maritime Services support vessel, *Seahorse Standard*, on station and providing accommodation for the DSTO trials crew. The submarine was in constant communication with the support vessel at all times.

Charge Evaluation and Placement

Charge evaluation involved determination of the underwater blast characteristics of the proposed charges in physical tests, validation of the explosive equivalence, proving of the explosive-handling arrangements, proving of the initiation procedures and the range safety procedures.

Different results are achieved by a large charge placed far away (giving an almost-planar shock wave) and a small charge placed closer. Charges 1, 2 and 3 were placed on the port side abeam of the control room, with 1 and 2 (calibration shots) about one shiplength away, and 3 about one-and-a-half beams away. Charges 4–13 were placed around the hull (including directly forward and aft) at various locations to subject different compartments to the same levels of shock.

They then had to prove the charge-deployment procedures, and to measure the positional accuracy of the charges, for which they had to allow the diving team to develop appropriate procedures. The charges were slung on a line below a float at the surface, and maintained in position by a horizontal distance line from the submarine to the charge, and a diagonal bridle line from the submarine to the float.

The firing lead was run from the submarine to the surface via the bridle, and the detonator cord was run to the charge via the vertical line from the float.

Instrumentation

Instrumentation on board the submarine included data-acquisition units, the firing circuits, and motion sensors. There were 74 channels of data acquired for each event, representing about 800 measurements at 230 different locations around the submarine.

The detonation of each charge took 3 ms, and instruments with high rates of data capture were therefore required. These included a Digistar 111 unit with 12 bit resolution, 5 million samples per second and a 4 million separate-sample memory; and a Pacific Instruments unit with 16 bit resolution at 20 kHz for 4 s.

The daily routine for the preparation of instruments included the location of the sensors, configuration of the software for each, testing of the transducers for the entire system, testing the firing circuit, and testing the trigger mechanism and the synchronisation of the system.

Documentation

The documentation required for the shock trials included the Subsafe 9 Manual, the Trials Directive, the Shock Trial Procedure (STP-001), the Instrumentation Plan (PR-ASC-019/020), the Risk Assessment (Rev. 3), the Safety Case (without Kockums involvement, the submarine was used as the firing-control platform), the Environmental Management Plan, and the PSL Firing Sequence.

Measurements

Measurements made during the trials included the following:

- Underwater pressure: To quantify the shock environment, underwater pressure transducers were positioned alongside the submarine and at fore and aft locations.
- Acceleration: To quantify the shock transmission through the submarine, accelerometers were positioned on the hull, on rigid areas on the platform, and on selected items of equipment.
- Displacement: Relative displacements between the platforms and rigid locations were quantified by using displacement gauges.
- Resilient-mounting response: Resilient mounts were generally either spring loaded or rubber footings, and the results were displayed as simultaneous graphs of the responses of the foundation and the item of equipment.
- Equipment response: In general, the response of the equipment to a design load was scaled linearly from the actual applied load; i.e. Scaled response = Measured response × Design load/Actual load.
- Structural response: This was determined by a procedure in which the acceleration response results were integrated using proprietary software to give the velocities, and these analysed to give the peak transitional velocity (PVT) shock loadings. All of these turned out to be well below the design levels.

Other Modelling

In addition to the full-scale shock trials on HMAS *Rankin*, DSTO carried out some smaller-scale testing at their quarry site. There they ran tests on a mild-steel cylinder of length 1.2 m, diameter 271 mm and thickness 2 mm, and firing 25 kg explosive charges underwater alongside to determine the interaction.

They also conducted finite-element modelling of the hull of the Collins-class submarines, and conducted simulations of

the shock tests in 3D analysis. Paul showed animations of some of the FEA simulations, and they were impressive.

Outcomes

The shock trials on HMAS *Rankin* were completed in June 2003 over a two-week period. Ten of the thirteen planned detonations were achieved, and all eight detonations at required shock levels were achieved.

As a result of the trials, the Collins-class submarines are now shock qualified. The trials data has confirmed that the required shock levels were achieved. Compliance with the specification requirements has been determined, and it has been shown that the specified levels of shock do not compromise the operational capability of the submarines.

Acknowledgements

In closing, Paul acknowledged the parts played in the success of the shock trials by the staffs of the Royal Australian Navy, the Australian Submarine Corporation, Defence Maritime Services, and the DSTO's Platform Systems Laboratories.

Videos

Paul then showed two further videos of the shock trials, including some of the daily routine, the support vessel and the RIBs used by the diving and deployment crews.

Questions

Question time lasted for half an hour, and elicited a number of further interesting points.

Equipment and machinery was all in operation for the trial. As in all such shock trials, a number of electrical circuit breakers tripped as a result of the shock, some polycarbonate light covers in the fin casing cracked, and the periscope lens required readjustment. However, nothing happened to anything to impair the operational effectiveness of the submarine, which went out and dived to two-thirds of maximum diving depth at the conclusion of the trial.

They averaged explosion of about one charge per day. They lost three days after the start due to bad weather, when it was simply too rough for the divers to enter the water (more than sea state 3). After that, they got in two shots per day for two days, and got back on track, but that was too tiring and they reverted to one shot per day.

In reply to a query about the assumption of linearity of the scaling of results from measured to design levels, Paul indicated that this was good for large charges placed far away, as it gave a planar shock-wave front, but less so for smaller charges placed closer. However, they had placed three charges at different distances abeam to try and determine these effects.

Equipment is mostly separately tested to higher levels of shock than encountered in the shipboard trials, but it is done on board as a final check. The engines, being of such large mass, are not separately tested, and are only tested during the shock trial.

The Collins-class trials were fully instrumented, and much useful data acquired. However, some other countries do not instrument their shock trials; if the vessel and equipment survives the trial without damage, then it is regarded as being serviceable.

The hulls of the Collins-class submarines were built in three main modules. The Australian Submarine Corporation installed strain gauges during construction to monitor the main hull welds, and these were left in place permanently.

The total cost of the shock trials is not easily assessable. The DSTO contract for the trials ran to about $0.5 million, but if you include the planning, logistics, support vessels, and everything else, then it would run to several millions.

The vote of thanks was proposed by John Elliott and carried with acclamation.

Experiences with Waterjet Propulsion

Greg Seil, Principal Engineer –– Computational Hydrodynamics for Rolls Royce in the UK, gave a presentation on *My Experiences of Working for Rolls-Royce in Scandinavia and the UK* to a joint meeting with the IMarEST attended by twelve on 17 August in the School of Mechanical and Manufacturing Engineering at The University of New South Wales. Greg's presentation wove together his career, his experiences in waterjet design, and issues involved in living and working overseas.

Introduction

Greg began his presentation with an outline of his career. With a degree in mechanical engineering with first-class honours from the University of Sydney in 1993, he took up a position as a mechanical design engineer with BHP Engineering in Newcastle, gaining experience in the drawing office and on-site.

However, he wanted something more high-tech, saw a CANCES (Centre for Advanced Numerical Computation and Experimental Science) advertisement for PhD candidates in the area of computational fluid dynamics, and was excited by the prospect of a higher degree and then management. He moved to The University of New South Wales in early 1994 and commenced his doctoral research on the investigation and optimisation of marine waterjet inlet design. He attended the FAST'95 and '97 conferences, and met people from KaMeWa, and visited NQEA Australia, Austal Ships, Incat, Doen Marine, the Australian Maritime College, KaMeWa, Lips Jets and HSVA, and he dreamed of living and working overseas.

He submitted the dissertation for his doctoral thesis in 1998 and wanted to continue in CFD, and secured employment with KaMeWa AB in Kristinehamn, in southern Sweden, at the northern end of Lake Vanern. He arranged resident visas for Sweden, and the family moved to Kristinehamn in August 1998. In his position as Research and Development Engineer, he pioneered the introduction of successful RANS (Reynolds-averaged Navier-Stokes) CFD capability in Sweden, and managed and developed several successful projects.

In 2002, after the take-over of KaMeWa by Rolls Royce Plc, he transferred to Derby, in the English midlands (close to Nottingham) as Senior Engineer — Computational Methods, where he was seconded to the Aerothermal Methods department in the corporate research and technical structure. In early 2004 he became Principal Engineer — Computational Hydrodynamics, with greater integration of the corporate marine research and technical department. Key roles at Derby have been in the specialist development of RANS CFD methods for the simulation of the hydrodynamic behaviour of marine systems, interfacing of departments,

leading the investigation of propulsor–hull interactions, and managing research projects.

Key Questions

If you are considering living and working overseas, then there are a number of issues which you should consider. These include:

- What does it feel like to be a migrant?
- What challenges will I face?
- How adaptable am I?
- How will the move impact on my wife and children?
- How often will I be able to see friends and family back in Australia?
- How will I change personally?

Greg had considered some, but not all, of these at the time of his move. The answers would not have changed his decision, but may have changed the way he dealt with some issues.

Issues in Sweden

As with most things in life, there are pluses and minuses.

Regarding the lifestyle, a good summer in Sweden is magical. There are many lakes, and good-quality housing is standard. They have a comprehensive social system, quality child care, high social equity, and a very low crime rate. To balance that, the winters can be *freezing* cold, and there is a very high rate of taxation.

On the cultural side, Swedes are what Greg would call collectivist individualists. They speak good English, or "Swenglish". They are honest, cooperative, reserved (even serious) in manner, but responsive to new ideas and technology. It takes time to make friends but, once you do, you have a great friend. They have a consensus culture, and their attitude is that the Swedish system is the right way.

Issues in England

Pluses for the English lifestyle include the beautiful countryside, there being much to see and do in a relatively small area, the place is culturally stimulating, and the pubs have a great atmosphere that Australian pubs simply cannot reproduce. On the minus side, winters can be cold too, and there is simply more rain than in Australia; great if you enjoy it!

Culturally, England is similar to Australia, but there are differences too. There is a diversity of accents, but the English are typically reserved in manner, conservative and resistant to change.

Key Answers

Having been through some of the issues, Greg then proceeded to provide answers to some of the key questions.

Feelings as a migrant can include homesickness and loneliness. Language difficulties will not help, and any cultural issues will be exacerbated by homesickness. Differences in climate and weather can exacerbate everything. This, of course, is easier for single people, as they can move more easily than a family.

How adaptable you are depends a lot on the individual.

How often you can see friends and family depends: possibly every year if you are single and manage your finances well; more likely every few years if you are married and have children.

How you will change personally also depends a lot on the individual. There is no doubt that you will grow and mature. Living somewhere else dispels ignorance, and gives you a new perspective and understanding of Australia.

Would you get all this from a short-term secondment to another country, rather than living and working there? No; but it would be better than not going at all.

Seabus Hydaer

Greg went on to discuss some of the technical projects in which he had been involved. The first was the Seabus Hydaer, a WIG-assisted hydrofoil concept, capable of ultra-high speeds in excess of 100 kn, on which he worked from December 1997 to October 2001. This was a European Union project, initiated by Intermarine of Italy (designers of the Australian minehunters), and with other partners including Supramar, InSean, and KaMeWa, who were responsible for the design of the waterjet system.

The key engineering issues included the avoidance of internal choking of the inlet by cavitation at low speeds, maximising the system efficiency by trading off external drag of the pod and strut against internal losses in the inlet system and mass of entrained water, minimising the inlet drag at high speed, avoiding external lip and nacelle cavitation at high speed, stability of external flow and impact on structure and loading, and the design of the structure itself.

They developed a simple parametric model for estimating the system performance which required several iterations to balance. Using this, they were able to examine the sensitivity of the propulsion efficiency to changes in the jet velocity, inlet drag, etc.

One of the limitations of a fixed-geometry unit is that it must be sized to allow sufficient inlet area to avoid choking at the hump condition. This led to the development of a variable geometry, which allows the inlet to be designed for the operating condition, but can also allow for the additional inflow necessary to avoid choking at the hump speed.

The inlet geometry was then defined by Bezier curves, and set up in a 2D axi-symmetric flow domain. The geometry was then driven parametrically and set up for automatic mesh generation. This was modelled numerically in Fluent v.5 with simple pressure-volume coupling, RNG (re-normalisation group) k–ε turbulence modelling and standard wall functions. Calculations were done for various values of VAF (variable area fraction) and IVR (inlet velocity ratio). The original design was improved to give better performance after three modifications.

In addition to the CFD calculations, a plexiglass model of the inlet with S-shaped ducting was built and tested. The modular design and construction allowed for easy modifications for re-testing, easy installation of static pressure tappings, and installation and removal of tufts for flow visualisation. Tests of the model in the RRHRC (Rolls Royce Hydrodynamics Research Centre) cavitation tunnel in Sweden in late 1999 included cavitation inception, measurement of the outflow from the duct exit, LDA measurements of velocity and turbulence, measurements of static pressures, and flow visualisation using tufts. A key result of the testing program was that the geometry developed would have benefited from redesign of the inlet, and the CFD was beneficial in this area.

The final concept design had two pumps in each rear hull, fed by a single inlet system, using a variable-geometry ram-type inlet. The two-stage mixed-flow pumps had an upstream inducer blade row to develop the high head required, and the suction performance gave an overall efficiency of about 45%.

Waterjet propulsion for Seabus Hydaer was finally abandoned in September 2000 in favour of aerial (air propeller) propulsion, which delivered an efficiency of higher than 45%. However, there were lots of good ideas in the project, and much was learned about how to improve the efficiency of waterjets.

KaMeWa SRU200

Greg was intimately involved in the design of the KaMeWa SRU200 waterjet unit. This is a steering and reversing unit, of 200 cm inlet diameter using a mixed-flow pump. Axial-flow pumps provide high flowrate and low head rise, while radial-flow pumps provide low flowrate and high head rise. In a ship, the thrust from a propeller is all up the shaftline, and provision must be made by way of the thrust bearing to distribute the thrust to the ship's structure. In a waterjet, some of the load comes from the impeller, and some from the inlet ducting. Steering with a waterjet is provided by guide vanes (to direct the jet), and reversing is provided by buckets (to re-direct part or all of the flow down and forward). Key engineering issues in the design of the new waterjet unit were to minimise the size and the weight.

A 1:10 scale model of the proposed unit was built and tested in the cavitation tunnel at the RRHRC in Sweden. It was instrumented with static pressure taps on the nozzle and reversing buckets, force transducers at the hinges, and a six-component dynamometer to measure the total forces and moments on the unit. Experimental results were used to validate the CFD analysis and for input to the structural analysis. Limitations of experimental testing include the facts that it is expensive in time and cost, gives a limited data set, and it is difficult to understand the location of the free surface and the flow internal to the SRU.

The CFD calculations were undertaken by Greg, who worked in concert with Onsala Ingenjörsbyrå AB in Göteborg, Sweden, for the extra hands required. Four configurations of the unit were examined at speed: straight ahead, full reverse, steering at 30°, and steering at 30° with full reverse. For a start, they modelled in 2D flow and developed a feel for the problem. That worked well, so they went straight for the full-blown 3D model. This was done using Fluent v.5.3, with a VoF (volume of fluid) multi-phase model, using hybrid mesh generation in the pre-processor, Gambit, standard k–ε turbulence modelling, standard wall functions, and second-order convective differencing. In the full-reverse case, they had 1 336 000 cells in the initial mesh, and 2 324 000 cells after adaptation. The experimental results provided validation of the CFD calculations, and the CFD calculations, in turn, provided extensive insights into the forces, moments and static pressures.

The first two SRU200 units were then built and installed in the spring of 2001. The vessel was fitted with a CODAG system of 66 MW output, based on LM2500 gas turbines, and achieved the design speed of 42 kn.

KaMeWa High-skew Propeller

Greg was also intimately involved in the design of the KaMeWa 734-B high-skew propeller. It had been decided to conduct an in-house experimental validation study, involving their own choice of geometry, as this would give greater control over the testing. The objectives included development of their own in-house experimental capability on these propellers, and data for validation of the CFD results.

The model propeller was of 250 mm diameter, 75 mm boss diameter, four blades, 0.603 expanded area ratio, 1.20 pitch ratio (at 0.7D) and 48° skew.

The CFD model used flow domain geometry, with a structured mesh for grid generation, and ended up with 2 075 000 hexahedral cells in multi-block terminology. Graphs of the thrust and torque coefficients and the open-water efficiency predicted by the CFD analysis demonstrated good correlation with the experimental measurements. Cavitation predictions were compared with those obtained from the University of Texas' panel code and MPUF (which uses a vortex-lattice method). Graphs were shown of slipstream results at four axial locations, from 0.5R to 1.1R, and these showed good correlation at the inner radii, but showed the tip vortexes disappearing by an axial location of 0.95D downstream, which was not borne out by the experiments.

Opportunities in Europe

Having explored some of the technical challenges, Greg returned to the issues involved in living and working overseas.

The best way to see Europe is to live there and work there. The most cost-effective way to finance a European trip, while seeing and experiencing the most, is to work for a global corporation in a job requiring travel in Europe, such as sales, requiring customer meetings and service, technical meetings as project engineer, and attendance at international conferences. The marine industry is global by nature, and can offer exciting career opportunities, especially in supplier and niche areas, or the major shipyards in Japan, Korea and Europe, such as Chantiers de l"Atlantique in France or Fincantieri in Italy.

Good strategies for finding work within the European Union include checking your possible entitlement to EU/UK citizenship, having a niche skill (possibly a ME/PhD degree) of which there can be an EU shortage, study in the EU and looking for scholarships, developing contacts with key personnel in various companies, and being prepared to move to remote locations (which was how he scored the job with KaMeWa in Kristinehamn).

Australians, generally, are viewed favourably in Europe, and this augurs well for any opportunities you may find there.

Within the Rolls Royce organization there are opportunities for student research projects and industrial training attachments. They have a good training scheme for new personnel, and direct entry is possible via specialist roles.

Conclusion

Time has passed quickly for Greg since departing UNSW with his doctorate. He has been involved in exciting projects and in helping to advance marine technology. The work

has been both technically interesting and challenging, and worthwhile and meaningful. He has grown personally as a result of living and working overseas, and would recommend that current students consider doing the same. They should also consider applying to Rolls Royce!

Questions

Question time elicited some further interesting points.

The waterjet manufacturer generally supplies the waterjet pump and SRU, together with a drawing of the inlet duct to the shipyard. Problems can arise if the shipyard does not follow the drawing of the inlet and lip carefully, as the lip is critical to the performance of the unit; it can create cavitation and additional drag.

Different manufacturers show different information on their waterjet performance charts; some show the thrust and torque curves for no cavitation, some show with the presence of cavitation which decreases performance at lower advance constants.

Most KaMeWa waterjet units have six blades on the impeller and eleven guide vanes. Having fewer blades leads to larger pressure pulses and more loading per blade. Some other manufacturers have three-bladed impellers, but are now tending to follow KaMeWa with six.

Language was not a problem in Sweden. Many Swedes speak English, and all reports at KaMeWa were written in English (this practice is the same in many multi-national companies). The family spoke English at home, and so he was not really fluent in Swedish even when he left. If he had been there for the long haul, then it would have been essential.

The vote of thanks was proposed, and the "thank you" bottle of wine presented, by Prof. Lawry Doctors (Greg's doctoral supervisor), and was carried with acclamation.

The Air-warfare Destroyer Project

Clive King, Platform System Director of the Air Warfare Destroyer Project, gave a presentation on *SEA4000: The RAN's Air Warfare Destroyer Project* to a joint meeting with the IMarEST and the Australian Society of Defence Engineers attended by sixty-seven on 13 September in the Harricks Auditorium at Engineers Australia, North Sydney.

Introduction

Clive began his presentation with an outline of what the AWD project is all about. The primary goals are to define the requirements of the ship and the combat system, and to design, build, test and accept a number of air-warfare destroyers into the Royal Australian Navy.

The missions of the vessels will be primarily to control the air, surface and sub-surface environments, facilitate Australian Defence Force inter-operability, and protect shipping, etc. Secondary missions will include constabulary operations, providing aid to civilian operations, and the like. Clive then showed a slide indicating the main sphere of Australia's operations: a wide sweep of the western Pacific, up to Japan in the north, down through south-east Asia and westward to India, and down into the Southern Ocean.

Project Phases

The phases of the AWD Project are, broadly, as follows:

No.	Name	Duration
1A	Capability definition study)	
1B	Combat system definition study)	2003–05
1C	Whole-of-ship concept studies)	
1D	Combat system integration studies)	
2	Design	2005–09
3	Detailed design and build	2009–17
4	Testing and acceptances	2009–17

It is expected that AWD01 will be delivered in 2013. This date is significant; AWD01 will steam into Sydney Harbour 100 years to the day after the first Australian fleet steamed into Sydney Harbour, and the Royal Australian Navy will be celebrating both events!

In Phase 1C, the basis vessels studied have included the German navy's Sachsen (Meko Type F124) class designed by Blohm + Voss, the Spanish navy's Alvaro de Bazan (Type F100) class designed by Navantia, and the US Navy's Arleigh Burke (DDG) class designed by Gibbs & Cox.

[*For comparison, the following figures have been collected from the web:* — Ed.]

	Sachsen	Alvaro de Bazan	Arleigh Burke
Length OA, m	147	143	154
Length WL, m	133	132	142
Beam, m	17.5	17.4	20.1
Draft, m	4.75		9.4
Disp. (full load), t	5895	5853	9348
Engines	2×GT	1×GT	4×GT
		2×diesel	2×diesel
Power (total), kW	35 420	37 300	74 570
Speed, kn	29	29	31

The proposed acquisition strategy is a design-driven approach, whereby the Commonwealth will contract separately for design and construction. The designer is contracted to produce a ship design to meet specified requirements and then a shipbuilder is contracted to build that design.

During Phase 1:

- August 2004 The Aegis air warfare system was selected as the core of the combat system. This is the backbone of the US navy, and currently in service with the Japanese and Spanish navies, and soon-to-be in the South Korean and Norwegian navies. Aegis is capable of detecting and defeating multiple hostile aircraft and missiles at ranges in excess of 80 n miles.
- September 2004 Lloyd's Register was contracted to provide classification services for Phase 1 of the project. It is expected that LR will continue to provide these services for the life of the project, although services for each phase will be contracted separately.
- April 2005 Raytheon was selected as the preferred bidder for a major electronic engineering contract in support of the combat system design and maintenance for the project.
- May 2005 ASC Shipbuilder was selected as the preferred shipbuilder.
- August 2005 Gibbs & Cox was selected as the preferred designer.

The Meko F124 has been eliminated from further consideration, and the F100 and an Arleigh Burke derivative are now being further evaluated.

Phase 2 — Design

During the concept design development, the commercial trade studies will take place. Then, during preliminary design development, the trade studies will be refined and/or finalised, and the commercial solutions refined. At the Allocated Base Line (ABL) the technical and commercial solutions for Phase 3 will be defined: cost vs capability trade-offs will be finalised, target cost estimates (TCE) and statements of work (SOW) will be finalised, and the final construction schedule will be finalised. The ABTIA (Alliance-based Target Incentive Agreement) will be executed at the commencement of Phase 3; this will be focussed on obtaining the best value-for-money in the given time frame.

Partners

Partners in the AWD Project now include:

- The Department of Defence, Defence Material Organisation, purchasing the vessels.
- Raytheon Australia, the combat systems engineer, whose role is to integrate the non-Aegis elements of the combat system, and work with the USN and the combat systems engineering agent to develop the design of the AWD combat system.
- The US Navy, the owner of the Arleigh Burke class vessels and their combat systems.
- Lockheed Martin, the Aegis combat system engineering agent, whose role is to operate through the US Navy to foreign military states.
- Gibbs & Cox, whose role is to design the AWD hull, and the mechanical and electrical systems.
- ASC Shipbuilder, the shipbuilder, whose role is to undertake the production design for the AWD project, and to construct the vessels. Clive showed an image of the ASC site, with the planned changes in place and how the site will look for production of the AWD vessels. Approximately two-thirds of the modules will be built off-site by other contractors and transported to the yard for assembly.

The Next Stage

The next stage will involve the two remaining designs, the F100 and the Arleigh Burke, in different ways.

The F100 design is being "Australianised", i.e. altered to suit Australian conditions, and exactly what this means is currently being defined. It involves changes for the regulatory requirements governing Australian operations, and changes associated with the way the RAN operates its vessels compared to how the Spanish navy operates its vessels. The Arleigh Burke design is evolving (allowing significant changes to meet the capability requirements) as well as being "Australianised", while the F100 design is not evolving.

Capability vs cost comparisons are being made, as increased capability inevitably means increased cost.

The Next Steps

The AWD System Centre is temporarily based in Canberra. Four locations are currently being considered for its permanent home: Adelaide, Melbourne, Sydney and Brisbane. A decision on the location will be made in October this year, and the System Centre will then be set up there for the duration of the project.

Gibbs & Cox displayed this Arleigh Burke derivative at Pacific 2004. Intended to meet the RAN requirements as known then, this design is 144 m length OA with a full load displacement of 5 875 t (Gibbs & Cox drawing)

The Spanish F100-class frigate *Alvaro de Bazan* with an Arleigh Burke-class DDG in the background (US Navy photograph)

The System Centre is currently developing a website for the project, and this will be found at www.ausawd.com.au [*this does not appear to be operational yet; more details of the AWD project may currently be be found at www.defence.gov.au/dmo/msd/sea4000/sea4000.cfm* — Ed.] The centre may be contacted at awd.program.defence.gov.au.

The System Centre is also currently developing a roadshow to travel around Australia, with the object of alerting companies to the sub-contracting opportunities that there may be for them in the course of the project. This will get under way in October.

Conclusion

The AWD project to deliver three air-warfare-capable destroyers to the RAN is well under way. The capability, combat system and concept definition studies are all complete, and the design phase is getting under way, with the location of the System Centre to be decided soon. The preferred designer and shipbuilder have been selected, and the design focus narrowed to two designs. Detailed design and construction is due to commence in 2009, with the first vessel due for delivery in 2013, and the last in 2017.

Questions

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

The cost is relatively fixed, and the design will be specified tightly.

Nuclear power was not considered for these vessels, for two main reasons; it is financially costly, and it is politically costly, and the Australian Government is interested in neither. It is intended to use the build capability existing in Australia.

The numbers of people involved in the project are growing. The System Centre now has about 35 staff, but this should grow to 70 by the end of the year, and 200 by the end of Phase 2. Gibbs & Cox have about 20 involved on this project at present.

Two helicopters are required to be carried on board for operations, and these must be able to operate in reasonably severe sea states.

Some concern was expressed about whether experienced frigate- and destroyer-drivers were being consulted about the handling characteristics of the vessels, as the Anzac-class vessels were more difficult to drive well than the FFGs, for example, and this could have been addressed at the design stage. Clive assured the audience that experienced drivers were being consulted for their input.

The Arleigh Burke class was designed in imperial units; did that mean that the new vessel would be in imperial units? The short answer was no; the design is not the Arleigh Burke, it is a new design and will be done in metric units. However, the Aegis system is all in imperial units, so anything to do with Aegis will be in imperial units!

One comment was that existing sub-contractors could be asked about maintenance and related issues for their input, as we now have experience from the Anzacs, the FFGs and the LPAs.

One of the lessons learned from the Anzac acquisition project was to manage the GFE (Government-furnished equipment) so that the responsibility for late delivery was taken by the contractor.

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

As a matter of interest, the attendance of sixty-seven was the second-highest since the formation of the NSW Section in 1998, and equalled that for Rob Tulk and Chris da Roza's presentation on *The BC Ferries Catamarans* on 28 October 1998. The all-time highest attendance of 68 is held by Graham Parker's presentation on *The Design and Construction of Sydney's SuperCats*, held on board SuperCat No. 2, *Susie O'Neill*, on 28 February 2001.

Before that, you would have to go back to Trevor Cosh and Ken Ross's presentation on *The Salvage of MT* Kirki, when technical meetings of the Australian Division were held at the Portside Centre; there was standing-room only, but no attendance figure was recorded.

Dolphin Swimming and Drafting

Prof. Daniel Weihs of the Department of Aerospace Engineering at the Technion in Haifa, Israel, gave a presentation on *Dolphin Swimming and Drafting* to a joint meeting with UNSW staff and students attended by twenty-three on 9 October in the School of Mechanical and Manufacturing Engineering at The University of New South Wales.

Introduction

Daniel began his presentation by saying that he has been interested in learning from nature; he started with birds in flight, and progressed from there to various other animals in motion. Swimming of dolphins is an extension of these investigations, and swimming (as a term) is well understood. However, "drafting" is where one dolphin fits into the wake of another dolphin (or vessel) and is helped along by that wake. This effect is well known by bicycle-racing enthusiasts, and the top rider in a cycle team is often made No.2 in the on-road order, so that he/she can save energy.

Dolphin swimming prowess has always been admired and, usually, over-estimated. Aristotle (384–322 BC) discussed the swimming of dolphins. Gray in 1933 defined a "paradox" in which he showed that dolphins, based on their food intake, could not produce enough energy to swim as fast as they do! This, unsurprisingly, led to a large amount of work on dolphin swimming. Kramer in 1945 raised the issue of skin and its flexibility leading to a reduction in drag. Lighthill in 1969 analysed the swimming motion, and this led directly to Daniel's involvement.

When subsequent researchers analysed Gray's "paradox" further, they found that his conclusion was based on two erroneous assumptions. Firstly, Gray had assumed that Dolphin muscle was the same as human muscle, based on the efficiency of rowers in an eight-oared shell. It turns out that dolphin muscle is more efficient than that of humans. Secondly, Gray had not allowed for the fact that, when dolphins were measured swimming at speeds of 40 kn behind vessels, they were, in fact, being significantly drafted by the measuring vessels themselves. Dolphins are unable to swim at 40 kn unaided, but can reach speeds of about 25 kn.

Cetacean Swimming Motions

Dolphins are a member of the order cetacea, the acquatic (chiefly marine) mammals, including the whales, dolphins and porpoises.

Daniel then showed profile views of the centreline of a dolphin throughout a swimming cycle at a speed of about 2.4 m/s or one body length per second for an adult dolphin. These showed the head and tail moving up and down, like part of a sine wave, but the middle remaining almost static. This means that the centre of mass does not move up and down much, conserving energy. The up-and-down movement of the tail provides varying angles of attack, providing a hydrodynamic lift force. The up-and-down components of this force cancel out over a cycle, but there is always a forward component providing thrust. The up-and-down components result in up-and-down movement of the body, and these provide a varying frontal area and, hence, drag. The drag on a swimming dolphin is thus about three times that of a gliding dolphin. Dolphins therefore have a high incentive to save energy.

One way of saving energy is by "surfing" in waves, and Daniel showed a photo of a wave coming into a beach with at least a dozen dolphins riding in. Another way is by "porpoising", or jumping clear of the water into air, which has about one-eight-hundredth the density of water, and a similar reduction in drag. However, there is another consideration, and that is that it takes energy to jump clear of the water, and the energy saved by the jump must be greater than the energy required to jump. Below a speed of 6–7 kn, jumping does not save energy, but above a speed of 6–7 kn energy is saved, with the jump distance and saving increasing with speed.

An interesting side effect of this was that, in US tuna-

fishing operations, they found that dolphin mortality was drastically reduced when the dolphins were chased by a boat while penned by the purse-seine net, as they jumped more and escaped more. Tuna, on the other hand, dive when threatened, so they just went deeper into the net and remained caught. However, chasing had another, *unwanted*, side effect. Dolphin calves typically spend 3–6 years in the company of their mother. However, when chased, they do not jump as far or as fast as their mother and, in the tuna-fishing operations, often became separated from their mothers and died, and the separated mothers sometimes died too. This meant that the population of dolphins has not recovered, as expected, after twenty years of chasing and this is of real concern to the people at the US Marine Fish Service.

Drafting

A three-month-old baby dolphin typically has a body length of about one half that of its mother, and one fortieth of the body mass. Daniel showed a photo of a mother and baby dolphin swimming together, with the baby's centre of mass at about two-thirds of the mother's length from her nose tip.

Drafting, according to the *Oxford English Dictionary* is "drawing of a part or quantity for some special purpose". For our definition, we would take that to mean "locating one body with respect to another for a special purpose".

For the case of dolphin drafting, we go back to basic hydrodynamic principles. Pressures can be obtained directly from Bernoulli's equation:

$$p = p_{total} - \tfrac{1}{2}\rho U^2$$

Forces produced are proportional to the square of the relative speed:

$$F = \tfrac{1}{2}\rho U^2 A C_F$$

As a basic model, we assume the dolphin shapes to be represented by rigid ellipsoids of aspect ratio six for both mother and calf, with no body or tail movement. We also assume motion far from the surface, so that there are no wave effects and no jumping, and potential (i.e. inviscid) flow. The ellipsoid representing the mother, moving through the water with speed U, causes the water flow field to be pushed forward at the front end, and to be pulled forward at the aft end, and Daniel illustrated this with a diagram of the flow field. However, the forward position would not be an ideal position for the calf as, if the mother decided to turn to the right or left, the baby would be left swimming forward on the old track. The best position for the calf we would therefore expect to be towards the aft end.

Having made that decision, we can then investigate the effect of the transverse and longitudinal separations of the centres of mass of the two ellipsoids. We can find a complete solution for the potential from a consideration of the separate flow fields and their interaction using a first-order approximation. A second-order approximation does not change the results very much, except when the transverse separation is less than L/10. Lateral forces, longitudinal forces and yawing moments are produced, and Daniel showed graphs of how these vary with separations. He also showed the peak side force on a non-swimming baby for different mother:calf size ratios vs lateral distance from the mother.

It turns out that, with a longitudinal separation of the centres of mass of $0.35L$, there is no lateral force, but the maximum longitudinal force is generated, making that the best position for the calf. Experimental data from the wind tunnel using two ellipsoids fits the theoretical predctions very well, except for the two bodies in very close proximity (closer than $L/10$), and we would expect that the second-order model would give closer results.

The lateral force produced can be significant as well as the longitudinal force, and this is used in the operation known as "bolting". This where another mother dolphin (possibly one which has lost her own calf) swims fast past a calf swimming alongside its own mother. The longitudinal and side forces drag the calf off with the fast-swimming dolphin.

Improving the Hydrodynamic Model

The hydrodynamic model of two simple ellipsoids can be improved in a number of ways.

The effects of the propulsive movements of the body can be accounted for. The oscillations of the body can be represented by the equation

$$h(x_n) = h_T(0.21 - 0.66x_n + 1.1x_n^2 + 0.35x_n^8)$$

and the pressure field on any cross section changes with the cycle as $1 - 4\sin^2\theta$.

Free-surface effects can be taken into consideration. The drag on the bodies will increase with the formation of waves on the surface. It is therefore advantageous, from an energy point of view, to keep the calf lower than the mother. This position is compatible with the feeding position. As dolphins swim faster, they need to breather more, and so their average depth of immersion decreases, but the calves still remain lower.

Viscous effects can be included. The mother's boundary layer can contribute to the calf's energy budget in two ways. There is a forward-moving annular layer of water, and this produces a vortex wake which induces areas of forward velocity in the wake. These produce both thrust, and lift, both of which can help the calf. It has been shown that, in the energy budget, the mother pays 1.5 for the help that she gives to the calf, and that the calf gains 0.6.

We can take account of the synchronisation of leaping. It is known that there is an attitude effect during water exit and re-entry, with $\pm 45^o$ giving maximum range. However, if the baby lands badly (i.e. at greater or less than 45^o), then the resistance increases significantly, and this can easily lead to separation of the baby from the mother.

Conclusion

Much is now known about the swimming and drafting of dolphins, but there is much still to learn. Daniel currently has PhD students engaged in research on dolphins at the Technion.

The vote of thanks was proposed by A/Prof. Bob Randall.

Zebra Batteries for Marine Applications

Rob Madders of Rolls Royce Australia gave a presentation on *Zebra Batteries for Marine Applications* to a joint meeting with the IMarEST attended by twenty-seven on 11 October in the Harricks Auditorium at Engineers Australia, North Sydney.

Introduction

Rob began his presentation by saying that he had, in a

previous life, been the Chief Engineering Artificer on board a submarine, so he was particularly interested in the possibilities of Zebra batteries for submarine operations.

He also pointed out that there is an article on Zebra batteries in the latest issue of *Marine Engineering Record*.

Rolls Royce is interested in the Zebra technology because they believe that there is a marine market for an efficient and practical means of bulk energy storage. Also, there is a growing need for electrical power, for electric ship propulsion, communications and weapons systems, and this will fill a current gap in the marine systems provided by Rolls Royce.

Any such system for marine applications needs to be a mature, proven technology. It must be commercially viable, suitable for the bulk storage of electrical power, have a high energy density (per unit volume or mass), be robust, safe and have suitable failure modes, be able to work at a wide range of ambient temperatures, have a long operational life and shelf life, need little maintenance, and have low environmental impact. A long list, and not easy to meet all requirements!

Zebra Battery Technology

Rob then showed a slide illustrating the net energy density vs life of current technologies for submarine batteries. Lead-acid batteries have a medium energy density, but relatively short life of, say, five years. Other technologies, such as nickel-cadmium and regenerative fuel cells have lower energy density, but longer lives, of the order of fifteen to twenty years.

The ideal battery, of course, has a high energy density *and* a long life. Looking at the periodic table of the elements, the ideal elements to start with (for light weight) would be lithium and fluorine. However, there are problems with both, being volatile and aggressive. However, just below these elements in the periodic table are sodium and chlorine, and Zebra technology is based on these, with the addition of nickel and iron to stabilise. The cell reaction is

$$2Na + NiCl_2 \leftrightarrow Ni + 2NaCl$$

charged discharged

The cells are each about 2.5 cm square by 20 cm high, hold a charge of 4.58 volts, and come in a stainless steel container, and a cross section of a cell was shown. The cells can be mass produced, chained together, and then assembled into modules to give the required voltage. Lead-acid cells have a small range of ambient operating temperatures, typically less than 50°C, while the Zebra cells can operate up to 250°C.

The Zebra technology arose in the automobile market, and has been under development since 1984. It started in South Africa, and ended up with a factory in Sweden, producing batteries for Mercedes vans. Since then, Zebra batteries have travelled more than 2×10^6 km, lasted more than five years and 100 000 km in one vehicle, performed happily in both desert and Arctic conditions, and been subjected to more than 4000 charging/discharging cycles.

Qualification testing has included shock testing (no damage when subjected to 47*g*), crash (no release of components), penetration impact (small, low-hazard release), full immersion in salt water (safe, restored to service), fire (returned to service), overcharge abuse (tolerant), short circuit (small, low-hazard release), operation when rotated 90° (no problems), operation when rotated 180° at 400°C (shortens life, as the seal at the top begins to leak).

Zebra batteries for automotive use need air cooling and thermal insulation, and have a built-in management system. The air cooling and thermal insulation will not be needed for marine applications, and the management system will be much simpler.

Rob then showed slides of the batteries following the fire and impact tests.

Zebra Batteries for Submarines

Zebra batteries are expected to provide a number of advantages for submarine operations.

There is expected to be a cost advantage. Zebra batteries have a long life: thirteen years has already been demonstrated, and these tests are ongoing. The lead-acid support equipment can be removed (there is no H_2 hazard, so no detection equipment is required; no top-up water is required; and no battery agitation system is required). The batteries themselves have a narrow voltage range, so there are fewer equipment constraints. No direct battery maintenance is required. The batteries are made from benign materials which are fully recyclable. There is built-in redundancy, as operations simply continue if there are cell or module failures.

The submarine maintenance cycle is expected to benefit, as there is no requirement for the traditional auxiliaries, no corrosive releases, and no requirement for rubber deck linings for hull inspection with the batteries in place. The batteries have almost indefinite storage life at ambient temperatures, and they have graceful degradation; this will not drive the maintenance cycle. There will be no requirement for a full battery change-out (as there is for lead-acid batteries).

Operational advantages are expected, as endurance is expected to be longer. The batteries provide a fast, flexible recharge, and have a stable, dependable capacity. They provide accurate state-of-charge and health monitoring, and excellent redundancy, as they can provide emergency power from as low as 2% charge. They are highly reliable, and have a graceful response to damage. They operate independently of Arctic or tropical environments.

Safety advantages include the fact that there are no emissions, and no airborne or liquid hazards. There is double containment, as the cells themselves are sealed, as are the modules. This also provides protection from external fires. There is no fire hazard from the batteries, apart from that of the stored electrical energy itself. They are immune to overcharging, and tolerate extreme abuse in this area. They also have a margin on over-discharging, and can operate at all angles.

Other Features

It is expected that they can be used for conventional submarines, as well as those powered by air-independent and nuclear power systems. The principal application is for the main batteries, but they can also be used for low- or high-voltage energy back-up systems (with AC or DC conversion) and 24 V system backup supply.

By way of comparison, Rob showed a diagram illustrating the performance of lead-acid batteries compared to Zebra batteries:

	Lead-acid	Zebra
Sprint power	20 h/20 n miles	40 h/40 n miles
Low-speed patrol	50 h/200 n miles	60 h/250 n miles

Testing in Australia has been under way for two years in Melbourne, and Rob showed a slide of a cell module under test. While the internal temperature may be as high as 300°C, the external temperature of the case is about 5°C above ambient, and you can happily sit a computer on top of the case in this condition.

Testing in Derby in the UK is also proceeding, and this is sponsored by the Ministry of Defence. Testing there is concentrating on inserting defective cells to see how the unit performs, and testing units to destruction.

Another slide showed a cross section of a reference submarine design, with a central maintenance walkway, a feature of Rolls Royce designs, and with the batteries stacked in racks (i.e. in the horizontal position), giving flexibility in the layout of the battery compartment.

NATO Submarine Rescue System

The first application of the Zebra batteries is to the NATO Submarine Rescue System (NSRS) vehicle. This is a joint project between France, Norway and the UK, and is aimed at being able to rescue the crew from a stricken submarine with 24/7/365 response and a global capability.

The rescue vehicle itself is cylindrical, with two smaller pods which carry the batteries set lower and to the sides of the main chamber. There are four batteries in each pod, three for traction of 258 V each, and one for instrumentation at 258 V with a converter to 24 V DC. There is an umbilical cord from the rescue vehicle back to the mothership, and the main chamber can carry 68 people, transferring them under pressure from the submarine to the rescue vehicle. With this capacity, it is expected that a maximum of two trips would be required to evacuate most submarines.

As for submarines, it is expected that there will be benefits in using Zebra batteries for the NSRS. The batteries are light, and this means that there can be a slightly larger hull, which will improve the space available and ease the equipment fit. Ballast positioning is more flexible, and can be moved to improve stability, etc.

Applications to Surface Ships

In addition to the application to submarines, the Zebra technology can be applied to surface warships and fleet auxiliaries. They are ideal for bulk energy storage an meeting peak load demands. They can be applied to high-voltage systems for uninterrupted power supplies (UPS) on a zonal basis, for example, or 24 V systems with photovoltaic recharging.

Conclusions

Zebra battery technology, which developed from the automotive market, has a raft of advantages for the marine field. It has high energy density, is robust, safe, and environmentally friendly. There are no emissions, and no monitoring is required. The units are fault tolerant, and failure of one does not abort the mission. They have long life; thirteen years ahs been demonstrated, and this is ongoing.

Questions

Question time elicited some further interesting points.

The name "Zebra" is stated in the article in the latest issue of *MER* to be an acronym for Zero-Emission Battery Research Agency. This is, in fact, not correct. The project originated in South Africa, and the director of the project states that it is an acronym for Zeolite Energy Battery Research Africa (zeolite was the original element used to cage the chlorine, but has now been replaced by nickel).

When asked if Zebra batteries would be suitable for the Collins-class submarines, Rob said that they would, and averred that he would like to see them on board the Collins class in the future. However, that was some way off yet. The NSRS project had the Zebra batteries in separate compartments to the people, and they were waiting for results from that first marine application.

Lead-acid batteries are guaranteed for up to 1500 charge/discharge cycles, and need a full battery change-out about every five years. Zebra batteries have been cycling on charge/discharge for 4000 cycles, and still counting. There is no foreseeable reason why Zebra batteries could not be guaranteed for the life of the submarine, with no full battery change-out ever being required.

The failure point of the Zebra batteries is the seal at the top. However, the batteries can operate inverted at a temperature of 400°C for 100 days before failing.

Zebra batteries, having a high energy density, are lighter than lead-acid batteries, and are expected to show a mass saving of about 40% on an application such as the Collins class.

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

Phil Helmore

Queensland

Committee Meetings

Since the last edition of *The Australian Naval Architect* the Queensland Section has held two section committee meetings (on 9 August and 13 September) and one technical meeting (on 13 September). The committee meetings received a report on a meeting with Maritime Safety Queensland on 10 August regarding standards and accreditation of designers. A report was also given on a discussion with Yeronga Institute of TAFE regarding the proposed Certificate IV, the Diploma and the Advanced Diploma of Engineering (Ship and Boat Design). The current listing of Consultant Naval Architects on the Section website and progress with the end-of-year social event were also discussed.

Marine Surveying

The technical meeting on 13 September consisted of a presentation by Toby Blundell of Marine Matters on the subject of *Marine Surveying*. This meeting was well attended and the presentation was well received with questions being competently answered by the presenter.

Toby Blundell is a Queensland Government Accredited Marine Surveyor, AMS/284, with Marine Safety Queensland. He is the Senior Marine Surveyor with Marine Matters, and has been employed by the company for five years where he continues to expand his marine surveying experience with a wide variety of interesting jobs. Toby is a boat builder by trade, serving a four-year apprenticeship with Norman R Wright and Sons, boat builders and designers, at Bulimba

in Brisbane. He stayed with this company for several years before he went out on his own and started a small boat repair business and ran that successfully for seven years before undertaking a Certificate IV in Fisheries Resource Protection. Overall, Toby has spent 20 years working within the marine industry in different roles ranging from driving, maintaining and operating a fleet of commercial ferries in North Queensland to repairing old timber skiffs and doing white-boat fit outs.

Marine Surveyors and Designers

Regarding the important aspect of client service, Toby stressed that marine surveyors and designers must provide their best service for their clients. He said that client service is very important and, if we can't deliver on time and within budget, it may result in a bad reputation. He made the points that "you're only as good as your last job" and "bad news travels fast". Also, "the good jobs are often forgotten in days, while the bad jobs are never forgotten" and "the waterfront gossip is ruthless".

With respect to working with new and innovative products and using the latest technology, he stressed that the key was to be adaptable and the use of high-tech materials and other new products, employing better building techniques and breaking new ground, generates excitement and provides the potential for good publicity. He then raised the issue of the conflict that sometimes arises between quality and profit, saying that, as much as we like our work, we all need to make money to stay in business. Designers and surveyors are constantly juggling the balance between maintaining high standards and not blowing the budget. He said he preferred not to compromise.

Toby stressed the need to continually improve safety standards throughout the marine industry. Workplace health and safety is a priority in all areas of the industry, and safe working practices apply to designing and boatbuilding as well as to marine surveying. He specifically mentioned the need for designers and marine surveyors to liaise with boat builders and maintain good relations with local authorities and government departments. Toby also stressed that we should not forget the satisfaction of the finished product — there is nothing like a good launching party to reward all the people involved.

Marine Surveyors and Boatbuilders

Toby mentioned that his boatbuilding background combined with marine surveying helps him to understanding boatbuilders' concerns during a new build or repairs. In his opinion, marine surveyors must have a thorough understanding of the construction process to enable them to relate to the builder and understand such aspects as time and labour costs when approving payment milestones. He emphasised that the marine surveyor should be available to provide information as required and keep the communication lines open between the builder, designer, client, government departments and government instrumentalities, while still making a profit.

Roles of the Marine Surveyor

The roles of a marine surveyor vary but the basis is always the same, and that is to inspect, evaluate, analyse and report without bias, regardless of whether they are engaged as the owner's representative for a new construction or conducting dispute resolutions, valuations, pre-purchase inspections, condition reports for insurance purposes or, in some cases, extending their role to include expert witness reports, court testimony or appearances. Accredited marine surveyors are also engaged to represent a government department or instrumentality for a commercial vessel application and to provide proof of, or a declaration in relation to, a ship complying with a nominated standard. The marine surveyor may also be involved in recommending or approving construction progress and financial milestone payments to the builder. Project management is also evolving into a full-time specialist field for the marine surveyor in the commercial vessel sector.

Toby then raised the issue that there are many boatbuilders, designers and surveyors trying to survive in the marine industry, so there is always the temptation to under quote and then endeavour to shave costs to the detriment of service and quality. In Queensland, the government audits accredited persons on a regular basis, and this helps the surveyor to refine his current procedures and improve his services. Toby said that approval for the construction of new commercial vessels is becoming a full time job for the marine surveyor because of the need to attend the project on a daily, rather than a weekly, basis throughout the initial stages of construction or repair. The surveyor needs to inspect for the prescribed quality standard, and compliance with the regulations as per the approved drawings, etc., and advise the appropriate parties if there are any anomalies. The construction sometimes varies from the approved drawings and the variation needs to be drawn up and approved. The extra visits have to be at the owner's expense but, if they are not prepared to pay for this level of attendance, then the surveyor is in peril of missing something or running into problems when compliances have to be issued.

Toby also mentioned that the marine surveyor must understand contracts and legal documents. A full understanding of the contract and build specifications as agreed between the parties is becoming more essential to the role of the surveyor. This is to prevent litigious problems later on. No matter what, the marine surveyor must maintain a professional attitude and good business communications, and maintain good relations with all the stakeholders.

Client Expectations and the Marine Surveyor

One of the many expectations of the client is for the marine surveyor to be able to just make everything happen without them having to do anything. Even though marine surveyors try to take the problem away from the client, there is still a great deal of input required from the client. For example, when marine surveyors are engaged to prepare a specification, they need to sit with the client first and get a good feel for what is required. The client has to know exactly what it is he can get for his money but, in many cases, they only have a limited knowledge of what they want, or what is needed for the purpose of the vessel, or the process to follow to achieve what they think they want. Most designers and boatbuilders will be able to relate to this!

Quite often, the client does not understand the complexity of a new build, and they might see a sample of the finished product and say 'make it just like that' but, without a detailed

specification to describe what they are getting, the project is open to differences of interpretation from designers and builders, and disputes easily start.

Toby said that his experience has led him to believe that clients expect advice, consultation, information and counsel. For example, when he does a pre-purchase inspection, it would be great if he could just say to a client "don't buy it mate", but unfortunately the marine surveyor can only present the facts as they see them in a pre-purchase report, and the clients have to use the reports to make their own decisions. He also commented that most brokers can make more money than marine surveyors can, with little or no risk attached. Clients often have other unrealistic expectations, for example when a marine surveyor is expected to produce a 'Condition for Insurance' document with no defects (possible only in a perfect world), and to provide this report on the same day as the request to the insurer, bank and shipbroker. Toby said that it is funny how they can also want it yesterday!

With his tongue firmly in his cheek, Toby went on to list some other client expectations, such as to settle any disputes in relation to a finished product (usually due to the lack of a detailed specification), deal with "I know I only ordered it today, but I wanted it yesterday" (boys and their new toys); or "No I don't like it now, can you change it back?" and "No, I am not paying for that" or "Yeah, but why should I pay for it?". Others included expecting a 24 hour free information service and help crisis line, a signature on a Certificate of Compliance without inspecting the vessel, an approval for changes to a designer's approved drawings, the marine surveyor to tell the builder to add extras without cost variations, submitting documentation to a government department or instrumentality and getting the approval back the same day (a perfect world again), to be at the ready to supply everyone with information, immediately, at no cost and to value an asset to suit their requirements.

Common Problems for Marine Surveyors

Apart from unrealistic client expectations, some causes for problems most likely to confront the marine surveyor include inexperience, stepping outside of their field of expertise, not being provided with all the relevant details or information, being required to work to unrealistic schedules and limited time frames to produce reports, not being on site every day (unless under contract to do so), a lack of the x-ray vision required to inspect inaccessible regions of a vessel, additional and hidden inspection costs, high overheads such as insurance, a highly-competitive field of operation and a lack of communication between stakeholders.

Essential Skills for a Marine Surveyor

The marine surveyor must have a skill complement that includes sound communication skills in areas such as telephone use, listening, writing, report writing, photographic applications, electronic applications, interview techniques, good liaison between stakeholders, dealing with conflict and conflict resolution, analysis, particularly with respect to failure, data and market research analysis, and marketing and promotion. The marine surveyor also needs to understand workplace health and safety regulations and requirements, current materials and products, construction mediums and processes, boatbuilding management and coordination, small business management including basic accountancy, and a good understanding of legal limitations and obligations.

In conclusion, Toby emphasised that the task of the marine surveyor can be a daunting one, and he/she must have an overbearing love of boats and their environment if he/she expects to succeed in the business.

Brian Robson
Brian Hutchison

THE INTERNET

Polar plots

Do you have occasion to plot polar diagrams, such as wind speed vs direction, or speed made good vs heading relative to the wind? If so, then you have probably ground to a halt if you have tried to do such a plot in Excel; the "radar" plots provided are incapable of using independent r and θ coordinates.

Fear not; help is at hand. Go to the AJP Excel Information website at http://www.andypope.info/charts/polarplot.htm. Click on the "add-in" link which allows you to download a zipped file of an add-in for Microsoft Excel and save it on your computer. Unzip the file. Then open Excel, and click on Tools/Add-ins/Browse, and click on the unzipped file. This will install the add-in, and bring up a new item, Polar Plot, under the Tools menu. Highlight your data, click on Tools/Polar Plot, and this will bring up some options for plotting, and away you go!

Nigel Lynch

Dimensionless Numbers

Do you come across dimensionless numbers, and aren't sure of their definitions? Do you know what the Weber Number measures, for example? The Internet can help; type in "dimensionless numbers" to your favourite search or meta-search engine, and a number of websites will come up.

The Wikipedia site at http://en.wikipedia.org/wiki/dimensionless_number includes good definitions, and details of who the number was named after.

The Process Associates of America site at www.processassociates.com/process/dimen/dn_all.htm includes a handy on-line calculator, where you can enter the parameters on which the number depends, in almost any units (either imperial or SI, and less-common multiples thereof), press "Calculate", and up comes the dimensionless number corresponding to your set of data.

Phil Helmore

COMING EVENTS

SMIX Bash 2005

The sixth SMIX (Sydney Marine Industry Christmas) Bash will be held on Thursday 1 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).

Pacific 2006

The Pacific 2006 International Maritime Exposition and Congress will be held at the Sydney Convention and Exhibition Centre, Darling Harbour, Sydney, from 31 January to 2 February 2006. It will include:

The Pacific 2006 International Maritime Exposition, organised by Maritime Australia Ltd.

The Royal Australian Navy Sea Power Conference 2006, organized by the Royal Australian Navy Sea Power Centre Australia. Further information on the conference can be obtained from the conference website www.seapower2006.com or by contacting the conference organizers, Tour Hosts Conference & Exhibition Organisers, GPO Box 128, Sydney NSW 2001, phone (02) 9265 0700, fax 9267 5443 or email seapower2006@tourhosts.com.au.

The International Maritime Conference is being organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia on the theme *Innovations in Maritime Technology — Visions and Progress*. Further information on the conference can be obtained from the conference website www.pacific2006imc.com or by contacting the conference organizers, Tour Hosts Conference & Exhibition Organisers, GPO Box 128, Sydney NSW 2001, phone (02) 9265 0700, fax 9267 5443 or email pacific2006imc@tourhosts.com.au.

Further details of the conference are available on the website www.pacific2006imc.com.

Second High-performance Yacht Design Conference

Timed to coincide with the arrival of the Volvo Ocean Race fleet in New Zealand, the second international conference on high-performance yacht design will be held in Auckland in February 2006 and will showcase the latest developments in yacht research from around the globe. This conference will be a venue where naval architects, engineers, designers and researchers can present and hear papers on the current state of high performance yacht and pwer craft technology.

Advances in high performance yacht design are being driven by a range of factors, including development of new racing classes and demand for increased size and performance of racing and cruising craft. Radical design concepts such as innovative hullforms, moving keels and masts and new approaches to sails and propulsions systems require innovative approaches to analysis, design and experimental verification.

Papers are expected on all aspects relating to the design and performance of high performance power and sailing yachts, including:

- performance prediction and measurement;
- wind-tunnel and towing-tank technology;
- regulations and rating rules;
- computational methods;
- materials and construction; and
- hull and appendage design.

The conference will be held on 14–16 February 2006 and is being organised by The University of Auckland, The Royal Institution of Naval Architects, and Massey University.

For further information visit the website www.hpyd.org.nz.

HIPER 06 at AMC

The fifth International Conference on High Performance Marine Vehicles (HIPER) will be held between 8 and 10 November 2006 at the Australian Maritime College in Launceston. HIPER Conferences are held once every two years. The inaugural conference was held in South Africa in 1999; subsequent ones have been held in Hamburg in 2001, Bergen in 2002, and Rome in 2004. Dr Prasanta Sahoo is the Convenor of the fifth HIPER conference which will be held in late 2006. Watch this space for forthcoming details. In the meantime, for further information contact Dr Sahoo on (03) 6335 4822 or email p.sahoo@mte.amc.edu.au.

THE AUSTRALIAN NAVAL ARCHITECT

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

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

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

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

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Tenix Defence is part of the Tenix Group, the largest Australian-owned defence and technology contractor, and employs more than 2 000 people in Marine, Land, Aerospace and Electronic Systems divisions. Marine Division, with facilities at Williamstown (Vic), Henderson (WA) and Whangarei (NZ), undertakes naval and commercial shipbuilding and repair. For detailed information: www.tenix.com

ASC

ASC Pty Ltd is the home of Australia's high-end skills for naval surface ships and submarines. Having built and delivered six Collins Class submarines to the Royal Australian Navy, ASC is now responsible for the maintenance and enhancement of the class through the 25 year, $3.5 billion Through-Life Support contract. On 31 May 2005, ASC was selected as the preferred shipbuilder for the Navy's $6 billion Air Warfare Destroyer contract.

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GENERAL NEWS

Order for Austal LCS Design Prototype

In October the US Navy announced the award of a construction contract for the Austal-designed Littoral Combat Ship (LCS) project contender. The $US223 million contract for the first of two planned "Flight 0" vessels was awarded to the prime contractor, Bath Iron Works, a General Dynamics company which has teamed with Austal, the designer and builder of the LCS "seaframe". The aluminium ships will be built at the Austal USA yard in Mobile, Alabama.

Approximately half of the contract value will be the Austal component for construction of the ship, representing the company's largest-ever individual contract.

The announcement follows the awarding in May 2004 of a $US78.8 million design contract to the General Dynamics Littoral Combat Ship team to design the "Flight 0" vessel.

The basis of Austal's seaframe design is the 127 m trimaran *Benchijigua Express,* recently delivered as a passenger-vehicle ferry to the leading Spanish ferry operator, Fred Olsen SA. The benefits of this hull in commercial service are better seakeeping, passenger comfort and efficiency. For naval operators these features and a beam of 31.6 m combine to provide a ship with superior speed (in excess of 40 knots), flexibility, shallow draft, payload and significant aviation capabilities over conventional designs. The ship carries two large helicopters which can be operated in adverse sea conditions because of the extremely stable trimaran hull.

The LCSs will be the most advanced high-speed military craft in the world and are intended to operate in coastal areas globally. As a key part of the US Navy fleet, they will be highly manoeuvrable and configurable to support mine detection/elimination, anti-submarine and surface warfare. The trimaran hullform permits the ship to carry a large capacity of weapons packages.

Austal's Executive Chairman, Mr John Rothwell, said that the company's first shipbuilding contract for the US Navy was of great significance for its size, and a solid reflection of the company's and Australia's increasing reputation as a quality naval defence supplier.

"In 1999 as part of our strategy to diversify and expand our operations, Austal combined with a local partner to establish a completely new shipyard in the United States specialising in aluminium construction, known as Austal USA.

"With the potential to outgrow the size of our Australian operations, the future of the US facility will be focused on defence projects, not only with the LCS vessels but also with high-speed cargo and troop vessels as our high-speed vessel technology becomes increasingly relevant to the Army and Marines as well."

Mr Rothwell said he was confident that Austal's unique trimaran hull design, as with the commercial variant, would prove to be a significant step forward for defence applications and will ultimately become the preferred choice for the LCS fleet.

"We believe that the LCS and similar vessels using the trimaran hull design have significant global applications as the relevance and cost of conventional fleets and national security needs continue to come under increased pressure."

Throughout the year, construction work on a new production facility, incorporating two large assembly halls, has almost quadrupled the size of the original Austal USA yard in readiness for production of the LCSs. An official opening ceremony was planned for 17 November 2005 with a keel laying ceremony for the first vessel expected in early December.

While the ships will be built in the United States, there has been a substantial benefit to Australia where much of the final ship design has been conducted. Austal has assembled a dedicated team of over 50 naval architects, engineers and other designers for the design phase, creating internal career opportunities and local employment in the process.

An impression of the Austal LCS design
(Image courtesy Austal Ships)

HMAS Toowoomba Commissioned

The seventh RAN Anzac-class frigate, HMAS *Toowoomba*, is the latest Australian warship to join the Royal Australian Navy's operational fleet following a traditional commissioning ceremony in Brisbane on 8 October.

HMAS *Toowoomba* will be home-ported in Perth.

"The Anzac-class frigates have proven their worth in operations in the Persian Gulf, off the north coast of Australia and in Antarctic waters," Defence Minister Senator Hill said.

"The ships have provided a major capability boost for Navy and have been delivered on schedule and on cost.

"HMAS *Toowoomba* is an excellent addition to the Fleet, capable of air defence, anti submarine warfare, surveillance, reconnaissance and interdiction.

"She is equipped with advanced air-surveillance radars, leading-edge combat-management system as well as the latest communications, navigation and fire-control systems."

Senator Hill congratulated Tenix on successfully building all eight Anzac-class frigates at Williamstown, Victoria, and the Defence Materiel Organisation on reaching this important milestone.

The ceremony was the culmination of Navy Week celebrations in Brisbane. The Christening Lady was Ms Judy Blight, who is the daughter of the late Lieutenant Commander Howard Goodwin, the last Commanding Officer of the first HMAS *Toowoomba*.

The ceremony was attended by the Vice Chief of the Defence Force, Lieutenant General Ken Gillespie, the Chief of Navy, Vice Admiral Russ Shalders, and the Maritime Commander, Rear Admiral Davyd Thomas. The ship's Commission was read by the Commanding Officer, Commander Gregory Sammut.

The first ship's company of HMAS *Toowoomba*
(RAN photograph)

"The formal acceptance of a warship is proud occasion for the Navy and today is no exception," Commander Sammut said.

"It is a special privilege to be involved in the commissioning and I am especially honoured to command the commissioning crew. I am confident that HMAS *Toowoomba* will serve Australia with distinction for many years to come."

HMAS *Toowoomba* is the second RAN warship to bear the name after the Queensland city of Toowoomba. The first HMAS *Toowoomba* was commissioned on 9 October 1941 as one of the 60 Bathurst-class minesweepers. The ship served with distinction during World War II and is known for rescuing 42 survivors from the bombed merchant ship, *Merula,* and for attacking a German submarine during Persian Gulf convoy escort duty.

The last Anzac-class frigate to be built for the RAN, *Perth*, is expected to be commissioned in September 2006.

Anti-ship Missile Capability for Anzac Ships

Canberra-based CEA Technologies has been selected to deliver a cutting-edge high-technology solution to protect the Navy's Anzac-class frigates from the increasing threat of anti-ship cruise missiles.

The Defence Minister, Robert Hill, announced in September that the Federal Government has approved the second phase of a project to provide the world-class anti-ship missile capability.

CEA Technologies has been chosen to provide a lightweight Active Phased Array Radar system designed and developed at its Fyshwick facility in Canberra.

"The CEA phased-array radar system offers the Navy a significant capability boost," Senator Hill said.

"CEA has developed a product that has a genuine competitive advantage in the important criteria of weight, cost, capability and overall value for money.

"These radars have a clear export potential and the market for this technology is estimated in the billions of dollars."

"This new phase of the project is estimated to create up to 130 jobs during acquisition and installation, and 25 jobs to support the capability through the life of the Anzac-class frigates, with around $260 million to be spent in Australia."

The major components of the CEA system are a search and track radar (CEA-FAR) and a phased-array missile illuminator (CEA-MOUNT).

In addition to providing self protection, the Anzac's Anti-Ship Missile Defence system will also be able to protect closely-escorted assets such as amphibious ships, auxiliary support vessels and merchant vessels.

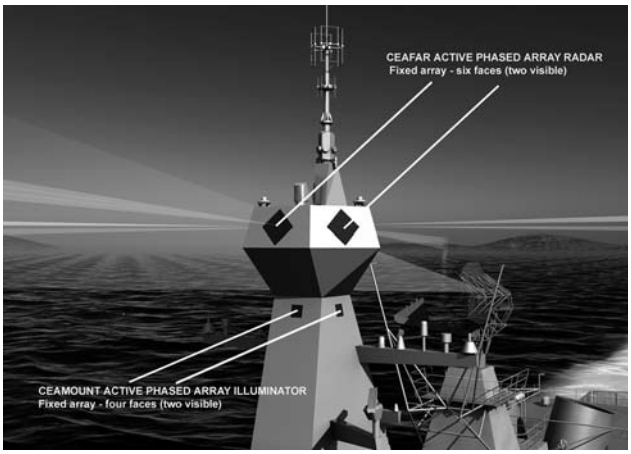
The Anti-Ship Missile Defence system integrates the radars into the eight Anzac-class frigates through Anzac Alliance team members Tenix Defence Pty Ltd and SAAB Systems Pty Ltd.

Both CEA and the Howard Government have committed significant resources towards reducing the risks inherent in such a high-end technology project including conducting sea trials last year.

The selection of CEA further supports the objectives of the Defence Electronic Systems Sector Strategic Plan which includes the development of niche capabilities in radar as being of strategic importance to Australia.

The second phase of the project brings the total investment in the Anzac's Anti Ship Missile Defence system to over $700 million. The Anzac Alliance team has already commenced work to upgrade the ships' command and control system and install an infra-red search-and-track system which will provide improved detection of low-level aircraft and anti-ship missiles when close to land.

The phased-array radar fitted to HMAS *Arunta* for trials
(Photo courtesy Department of Defence)



An impression of the complete installation on an Anzac-class frigate
(CEA image courtesy Department of Defence)

Site Work to Start On SA's AWD Precinct

TheDefence Minister, Robert Hill, announced in September that site work was about to start at the Osborne Maritime Precinct in South Australia — the construction site for the Navy's three air-warfare destroyers.

The Federal Government has granted approval for the South Australian Government to start preliminary site works including land and environmental studies of the area to be known as the Common User Facility (CUF).

"This is another exciting step in the construction of the air-warfare destroyers," Senator Hill said.

"The site works which are about to start include surveys of the area prior to construction of the Common User Facility which is expected to start next year.

"A topographical survey will be done to determine relative site levels and boundaries, a land-based geological survey will evaluate foundation requirements, and a Port River bed geological survey will determine dredging requirements."

The Common User Facility will encompass a new 160 m shiplift capable of handling the air-warfare destroyer, a new wharf, a new hardstand area and a new rail transfer system. In addition to this, ASC will be developing and expanding its production facilities which will include further outfitting halls, warehousing, fabrication facilities and new office accommodation.

"The vessels which are to be introduced into service from 2013 will be equipped with anti-submarine and anti-surface warfare capability.

"I would like to thank the South Australian Government for the excellent infrastructure investment package and its commitment to the air-warfare destroyer program."

Senator Hill said that the construction of the air-warfare destroyers will be one of the most significant shipbuilding projects undertaken in Australia to date, and will provide enormous opportunities for Australian industry.

"The ships will provide significantly-increased protection from air attack for troops being transported and deployed on ADF operations overseas, and can provide long-range air-warfare defence for a naval task group.

"The ship will be equipped with the world-class Aegis combat system and will be inter-operable with the United States and other coalition partners," Senator Hill said.

AWD Headquarters to be Built in South Australia

South Australia will be home to the new headquarters of the Air-warfare Destroyer project, creating up to 200 additional jobs in SA, as well as generating specialised design work for contractors throughout Australia.

The Defence Minister, Robert Hill, announced in November that the new AWD Systems Centre will manage the design schedule, budgets and work breakdown structures of the complex $6 billion shipbuilding project.

The centre will draw together Defence and industry partners to ensure effective and efficient decision making, and will provide a focus for design-related activity.

Senator Hill said that the new centre is expected to create up to 200 high-end jobs in South Australia, including systems engineers and project managers as well as managers of the supply chain and alliance team.

Specific design projects will be carried out where they can be done most economically and productively, with systems nodes expected to be created in Sydney (for combat system design work) and Melbourne (for ship design work).

The centre will include representatives from the Alliance Partners — the Commonwealth, the shipbuilder ASC, the systems integrator Raytheon, and the ship designer Gibbs & Cox. It is also expected to include the United States company Lockheed Martin and the US Navy in support of the Aegis combat system.

The centre may also carry out integrated logistics support, test and evaluation, training and crew preparation.

Earlier this year, the Federal Government chose ASC Shipbuilder, based at Outer Harbour in SA, as the preferred shipbuilder for the Navy's AWDs.

"The advantage of basing the centre in Adelaide is the proximity to the shipbuilder ASC and to the Defence Science and Technology Organisation (DSTO) which is providing the key system integration laboratories," Senator Hill said.

"The AWD Systems Centre is expected to cost approximately $30 million, with the State Government offering an assistance package of more than $10 million.

"The new jobs to be created will be high-end skilled positions, primarily naval architects, engineers and project managers with skills in warship design and systems integration.

"The decision to establish the AWD Systems Centre in Adelaide was supported by the industry alliance partners to the program.

"The construction of the AWDs will be one of the most significant shipbuilding projects undertaken in Australia to date, and will provide enormous opportunities for Australia's shipbuilding industry with important flow on benefits for key sub-contractors throughout Australia."

The shipbuilding project will create more than 1000 direct jobs in South Australia as part of the build contract, as well as creating around 1000 additional jobs throughout Australia at other shipyards subcontracted for up to 70 per cent of the module construction work.

Gibbs &Cox has been selected as the preferred platform systems designer for an evolved design which will be further considered in conjunction with an Australianised version of Spain's existing F100 ship design.

Raytheon Australia has been selected as the preferred bidder for Combat System–System Engineer contract in support of the combat system design and maintenance for the Air Warfare Destroyer.

Skills Investment in Shipbuilding Industry

The Commonwealth Government will invest approximately $4 million over the next three years in a skills partnership program with Austal Ships as part of the Skilling Australia's Defence Industry program.

The Defence Minister, Robert Hill, said on 18 October that the program is the result of the Howard Government's $215 million investment in Skilling Australia's Defence Industry.

Senator Hill said that Austal, the first major participant in the program, will invest more than twice this amount in training, recruitment and retention over the three years.

The Skilling Australia's Defence Industry program was announced as part of the 2005 Federal Budget to address the skills pressures facing Australia's defence industry and will be managed from within the Defence Materiel Organisation.

Senator Hill said that the Austal contract represents a significant investment in workforce growth within the shipbuilding sector as well us up-skilling the existing workforce.

"The Government recognises the need to increase the quality and quantity of specialist skills available to the defence industry," Senator Hill said.

"Under the program, companies bidding for new work will be asked to include proposals in their tender documentation which address the creation of new positions and the retraining and upskilling of existing positions.

"The Austal proposal is a significant milestone towards ensuring a robust shipbuilding industry to support the ADF in delivering new capabilities on time and within budget.

"The proposal will grow the skilled workforce at Austal and the shipbuilding sector generally. It includes the development of highly-skilled engineers, project managers, specialist technicians, key trades people and apprentices."

Over the next three years, the Austal proposal aims to deliver:

- 45 additional apprentices
- 15 additional people undertaking dual apprenticeships
- 15 additional mature-age apprentices
- 45 additional work experience places
- 200 additional on-the-job training places for existing employees
- 75 additional TAFE short-course places for existing employees
- 15 additional places for existing employees on leadership development courses
- 103 additional places for existing employees on supervisor/ coordinator courses
- Initiatives which address both attraction and retention issues.

Austal apprentices
(Photo courtesy Austal Ships)

Changes for NQEA Australia

For the last sixty years the engineering, shipbuilding and ship repair icon in North Queensland, NQEA Australia has been designing and building vessels for local and overseas clients.

The Fry-family owners have recently undertaken a sell-off of property and assets with a renaming of the company as AIMTEK to concentrate on design and project management along with the outsourcing of construction for key projects within the aerospace, industrial and marine technologies.

In the short term, the marine project focus will be for the very-successful ultra-low wash ferries (River Runners), rescue service craft and ore-carrier self-discharge equipment.

In their aerospace activities, NQEA recently delivered a hypersonic test chamber for the Australian Defence Academy in Canberra, and major casings and internal components for the scramjet test vehicle to be launched at Woomera next year. The company has also been awarded the contract to upgrade the launch facilities for these tests.

The main NQEA land and workshops have been subdivided and sold, with the main construction halls leased to Cairns Slipways (Qld).

The Cairns Slipways division has been sold to Brisbane-based Viking Industries, who will continue to operate the repair and refit facility for commercial vessels and luxury yachts.

As well as operating the AIMTEK business, the Fry family will retain the NQEA Safety division, the follow-on-support (FOS) for the RAN Hydrographic ships, and their machine-shop operations.

Within the last 18 months a number of noteworthy vessels has been built by NQEA, including the cruise ship, *Micat,* a 58 m ro-pax, *Opelia,* a 35 m luxury motor yacht, two Crowther-designed 22 m catamarans for the US Army, a 20 m dive boat, and a 50-passenger glass-bottom boat for the local marine tourism industry.

Projects still underway in the NQEA workshops include the major rebuilding of the 1987-built motor yacht ex- *Ilona* which was repurchased by the original Sydney-based owner, and steel stacker/reclaimer components for the Dalrymple Bay and Hay Point coal loading terminals near Mackay.

Marc Richards

Progress with Collins-class Upgrade

Australia's Collins-class submarines are undergoing a major capability boost, with work about to start on fitting out the first submarine with a new tactical combat system and upgraded state-of-the-art heavyweight torpedoes.

On 14 November the Defence Minister, Robert Hill, said the design and installation of the replacement combat system and heavyweight torpedo system are on schedule and on cost.

Senator Hill said that the $857 million capability investment will significantly boost the combat effectiveness of the Collins-class submarines, making them the most capable diesel-electric submarines in the world today.

Senator Hill said the first combat system has been delivered and is currently undergoing integration with Australian components and sensors at HMAS *Stirling* in Western Australia. When complete, the systems will be put through a rigorous testing program before going to sea in the first submarine.

"The first submarine to be fitted out with the new systems will be HMAS *Waller* which is currently docked at ASC's Adelaide facility," Senator Hill said.

"HMAS *Waller* will be ready to start sea trials with the new capabilities in early 2007 after being fitted out with the new systems during the next 12 months.

"Once the trials have been completed, HMAS *Waller* will be at the cutting edge of diesel-electric submarine technology."

The combat system and the new heavyweight torpedo system are to be installed in all Australian submarines by 2010, resulting in a major capability boost to the Collins class.

"The Australian Navy is working together with the United States Navy on the development of the new heavyweight torpedo program.

"The first test firings of the new weapon in Australian waters occurred in September during a joint exercise involving a US Navy submarine and an Australian Collins-class submarine off the Western Australia coast.

"The test firing was a significant milestone in the joint development program between the two navies.

"Cooperating with the US Navy means that we have the opportunity to influence design and development of the systems and to participate in a continuous improvement program to deliver the latest technology advances for Australia's submarine fleet."

Two More Patrol Boats Named

Following the successful introduction of HMAS *Armidale* into Navy service in June, a naming ceremony for the second and third Armidale-class patrol boats was held at the Austal shipyard in Henderson, Western Australia.

The 56 m all-aluminium monohull vessels were named *Larrakia* by Ms Donna Odegaard JP, a member of the Larrakia Nation, and *Bathurst* by Mrs Judeth Bagley, wife of Lieutenant Commander Ron Bagley (RAN Rtd) one of the commissioning crew of the original HMAS *Bathurst*.

The ceremony was attended by approximately 200 senior figures from the Royal Australian Navy, Defence, government and industry, including The Hon. Julie Bishop as representative of the Minister for Defence and the newly-appointed Chief of the Royal Australian Navy, Vice Admiral Russ Shalders.

Austal's Executive Chairman, John Rothwell, commented on the success in operation of the unique Austal patrol boat design.

"Feedback from Navy indicates that, as well as providing personnel with improved levels of comfort and onboard services, these boats are handling and performing very capably in heavy weather," Mr Rothwell said.

David Campbell, Director of Defence Maritime Services, acknowledged the success of the partnership with Austal to date and the ongoing developing relationship with the Department of Defence and Navy.

"We are currently working to finalise the contract for the two additional Armidale-class patrol boats recently announced by the Australian Government for the security of oil and gas assets in Australia's North West. This will make a total of 14 patrol boats" he said.

The new *Larrakia* and *Bathurst* alongside at Austal Ships
(Photo courtesy Austal Ships)

The prime contractor, Defence Maritime Services, teamed with Austal in 2003 to win the $A553 million "output specified" contract to provide, and support through their service lives, a fleet of patrol boats to replace the ageing Fremantle-class patrol boats, which have patrolled Australia's maritime zones for the past quarter century. Austal is responsible for the design and construction of the Armidale-class vessels. DMS is managing the overall project requirements, including the establishment of a fleet-management organisation which will provide integrated maintenance, logistic and crew-training support to the vessels throughout their operational lives.

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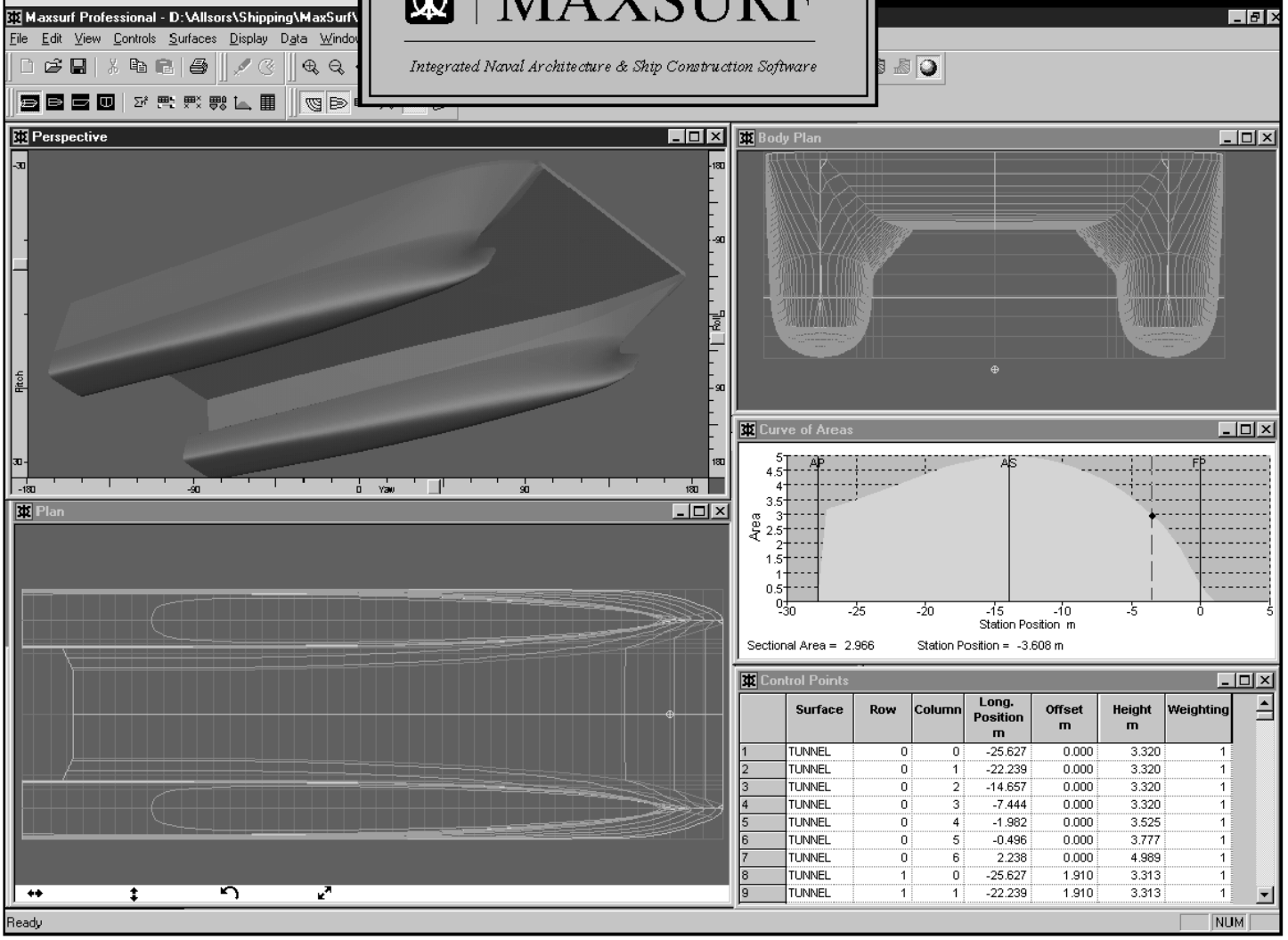
Integrated Naval Architecture & Ship Construction Software



To be based in the ports of Darwin and Cairns, the Armidale-class fleet will primarily operate within Australia's marine jurisdictional zones, carrying out surveillance, interception, investigation, apprehension and the escort to port of vessels suspected of illegal fisheries, quarantine, customs or immigration offences. The ships will also be utilised to protect our valuable offshore oil and gas installations.

The original *Larrakia* was built in 1936 as an air-sea rescue launch for the Department of Civil Aviation. Based in Darwin, *Larrakia* also conducted fisheries and security patrols in northern waters. She served the RAN as a non-commissioned examination vessel after the outbreak of war and was commissioned as HMAS *Larrakia* on 8 December 1941 for service as a patrol boat. She was decommissioned on 16 February 1944 and sold in April 1946.

The first HMAS *Bathurst* was built by Cockatoo Dockyard in Sydney and commissioned in December 1940. She was the name ship of a class of sixty Australian-designed minesweeping and anti-submarine ships. The building of this numerous class re-established the Australian shipbuilding industry during the Second World War. *Bathurst* decommissioned on 27 September 1946 and was sold for scrap in June 1948.

Austal USA Order for Ferries Confirmed

Full contract funding was confirmed on 31 October for the order of two Austal Auto Express 107 m vehicle-passenger ferries for Hawaii Superferry (HSF), making the contract with the Austal USA shipyard unconditional.

Construction of the first ferry has been underway since June 2004 at Austal's Mobile, Alabama, shipyard based on initial funding from Hawaii Superferry and a strategic decision by Austal to advance work on the structure in order to develop the workforce in readiness for the US Navy's Littoral Combat Ship order. On present planning, the first ferry is due for delivery in December 2006. The second ferry will start in the second half of 2006 and is due for completion in first half of 2009.

Greg Metcalf, Austal USA's CEO, expressed excitement about the Hawaii Superferry project. "Austal USA is proud to be building the largest aluminium commercial ships ever constructed in the United States. The advanced catamaran design is based on a similar Austal ferry operated by Euroferrys in the Mediterranean Sea, and is well suited to their operation. We know how these ships have brought people closer and helped create new jobs in other markets around the world, and we are delighted to be part of Hawaii Superferry's programme."

An impression of the Hawaii Superferries vessel
(Image courtesy Austal Ships)

Progress with the expansion of the Austal USA yard in August 2005
(Photo courtesy Austal Ships)

Hawaii Superferry plans to use Austal fast-ferry technology to establish Hawaii's first high-speed vehicle-passenger service. Each catamaran will carry 866 passengers and 282 vehicles and provide services connecting Honolulu to Maui and Kauai in three hours and from Honolulu to the Big Island in four hours.

Principal Particulars

Length OA	107.7 m
Length WL	92.4 m
Beam moulded	23.8 m
Hull depth moulded	9.4 m
Hull draft (max)	3.65 m
Deadweight (max)	800 t
Passengers	866
Crew	As per USCG requirements
Vehicles:	282 cars or 28 x 12 m trucks (342 lane m) with 65 cars
Axle loads: centre lanes	12 t (single axle) 15 t (dual axle)
outer lanes	9 t (single axle) 12 tonnes (dual axle)
Fuel (approx)	215 000 L
Propulsion	
Main engines	4 x MTU 20V 8000 M70 each 8 200 kW
Propulsors	4 x KaMeWa 125 S11
Service speed	37 kn at 90% MCR
Survey	
Classification	Germanischer Lloyd

ShipShape for Sirius

East Coast consulting firm Capability by Design has teamed up with WA's oil and gas engineering specialists PCT Engineers and Teekay Shipping to produce Australia's first Safety Case Report for the Department of Defence utilising an asset-management solution called ShipShape.

The system will be used on the future HMAS *Sirius* (ex-*Delos*). The 35 000 dwt ship was bought eighteen months ago to provide underway replenishment (diesel, aviation and water) for the RAN fleet. The vessel is currently undergoing conversion at Henderson, Western Australia, to meet RAN requirements.

Sea Jet Demonstrator Launched

At a ceremony at the US Naval Surface Warfare Centre, Carderock Division, Acoustic Research Detachment in Bayview, Idaho, the US Office of Naval Research named the Advanced Electric Ship Demonstrator (AESD) on 24 August 2005 .

The ship was named *Sea Jet* by Kathleen Harper, wife of Thurman Harper, Vice President of Engineering for Rolls-Royce Naval Marine, Inc.

The 40 m vessel will serve as a model representing a destroyer-size surface ship and will be launched on Lake Pend Oreille, Idaho, where it will be used for test and demonstration of various technologies. An underwater discharge waterjet from Rolls Royce Naval Marine, Inc., called AWJ-21™, will be among the first technologies tested. It allows vessels to operate in shallow water with increased manoeuvrability and stealth.

Following demonstration of the AWJ-21, the RIMJET propulsor from General Dynamics Electric Boat will be installed in *Sea Jet* for evaluation. The RIMJET is a novel type of podded propulsion system which relies on a permanent-magnet motor to drive the propeller.

The completed *Sea Jet* ready for launching. The seakeeping characteristics of this design could be interesting (US Navy photograph)

US Multi-mission Destroyer DD(X) Successfully Completes Flag-level Critical Design Review

The US Navy successfully achieved a significant milestone for the multi-mission DD(X) destroyer with the completion of a system-wide Critical Design Review (CDR) on 14 September.

The review represents the culmination of years of design effort which encompassed the ship, mission system, human and shore designs that now comprise DD(X).

DD(X) is the US Navy's planned next-generation destroyer, tailored for land attack and inland support of joint and coalition forces. It is designed to meet Marine Corps, Army and special operations requirements for precision strike ashore, but also be able to outmatch current and projected threats in the air, on the surface and under water.

The completion of the CDR marks the end of Phase III development, which resulted in the design, construction and test of ten engineering development models (EDM) that will make DD(X) the Navy's most capable multi-mission surface combatant ever constructed.

"The DD(X) System CDR brings this incredible warship class one step closer from next generation to current generation," according to RADM Charles Hamilton, the Navy's program executive officer for ships. "The Navy and National Team have accomplished the most thorough ship design and integration process in the history of Navy shipbuilding. I am proud of their achievement and believe their accomplishment sets a new standard in acquisition."

"The DD(X) CDR reflects a disciplined, rigorous process of risk mitigation in 10 EDMs. CDRs for each of the ten EDMs have achieved both technical maturity as well as significant cost insight," he said. "Completion of the ship CDR is the culmination of three years of work executed on schedule and within one percent of stated budget," Hamilton said.

"The National Team and Navy have achieved an unprecedented level of system design integration to deliver a balanced design which provides the required war-fighting capability," said RADM Chuck Goddard, DD(X) program manager. "We've matured the systems we need to build this class, and are ready to proceed to Milestone B and begin detailed design and construction."

Under the Navy's proposed dual-yard acquisition strategy, Northrop Grumman Ship Systems and General Dynamics Bath Iron Works will simultaneously build lead ships beginning in fiscal year 2007. Pending final approval of the plan, the Defence Department has authorised the US Navy to award advance contracts to assist both shipyards to prepare to transition into detail design after the Milestone B decision. Development of major ship systems will continue under separate contracts.

Bermuda Order for Austal

Following the recent announcement that Austal Ships had been awarded a contract for six 16 m aluminium monohull boats for the NSW Water Police, the proven design has found favour with the Bermuda Marine Police Service which has ordered a further vessel.

To be based in Hamilton Harbour for general patrol, search and rescue, dive operations and general assistance to Police departments and Government agencies in Bermuda Territorial Waters, the new boat offers a significant range increase over the current vessel which is soon to be retired.

Guadeloupe Ferries Delivered by Austal

The only downside to the exciting delivery of *Gold Express* and *Silver Express* for L'Express des Iles will be the departure of co-owner Bruno Moeson and his massive smile from the Austal yard. Having been in Fremantle with his team since early September, there is a good story behind Bruno's smile, and it now spans over seven years.

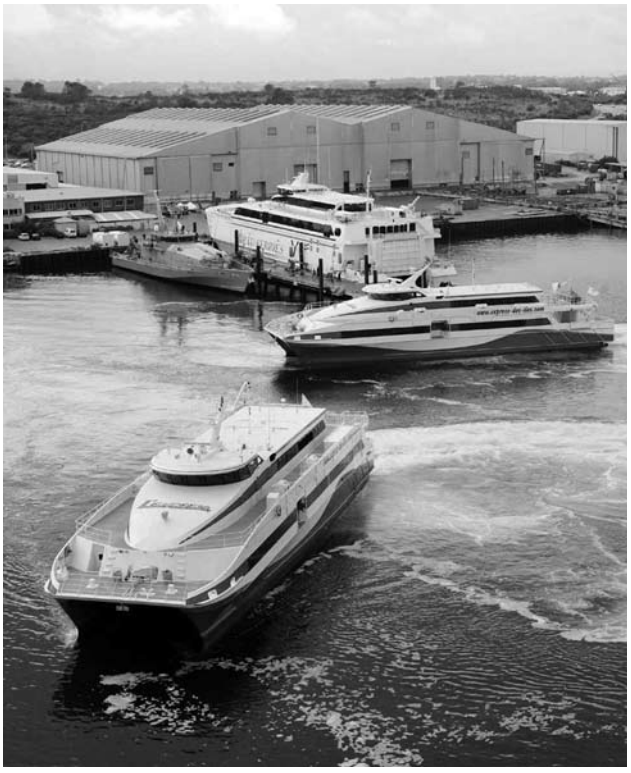
In 1998, Austal delivered the 48 m *Jade Express* followed closely by the delivery in 1999 of the 40 m *Opale Express*. These vehicle/passenger ferries were destined for Guadeloupe, in the French West Indies, and island ferry operator Antilles Trans Express (ATE).

It was in 2001 when the then manager, Dr Roland Bellemare and ship captain, Bruno Moeson decided to buy the company from Groupe Bourbon who owned ATE, giving rise to L'Express des Iles SA or "The Islands Express".

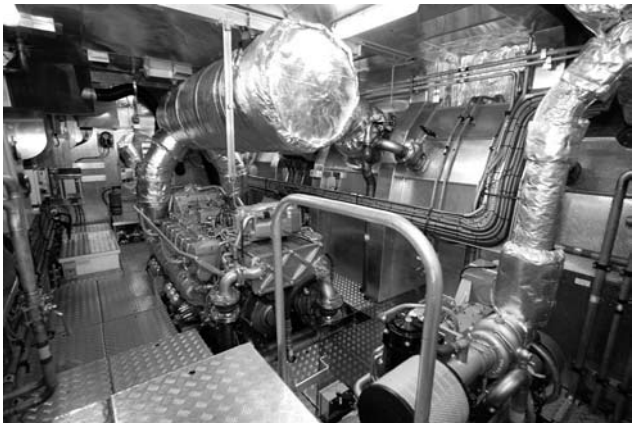
Today the L'Express des Iles ferries operate regular domestic and international services between the harbours of Guadeloupe, Marie-Galante, Le Saintes, Dominica, Martinique and Sainte-Lucia.

It was soon after the 2001 management buy-out that discussions first began for the new ferries. During 2002 the design and performance criteria were established, with much of 2003 and 2004 focused on achieving a flexible finance solution before a contract was signed on October 29. A year to the day later, both boats were handed over prior to them being loaded onboard a heavy-lift ship in Fremantle Harbour, bound for Guadeloupe.

With the boats set to enter service by the end of the year, the entire four-boat L'Express des Iles fleet, following some recent sales, is now composed entirely of Austal-built fast ferries.



The two new ferries for Guadaloupe manoeuvering off the Austal shipyard in Western Australia
(Photo courtesy Austal Ships)



An engine room in one of the Guadaloupe ferries
(Photo courtesy Austal Ships)

Part of the passenger accommodation
(Photo courtesy Austal Ships)

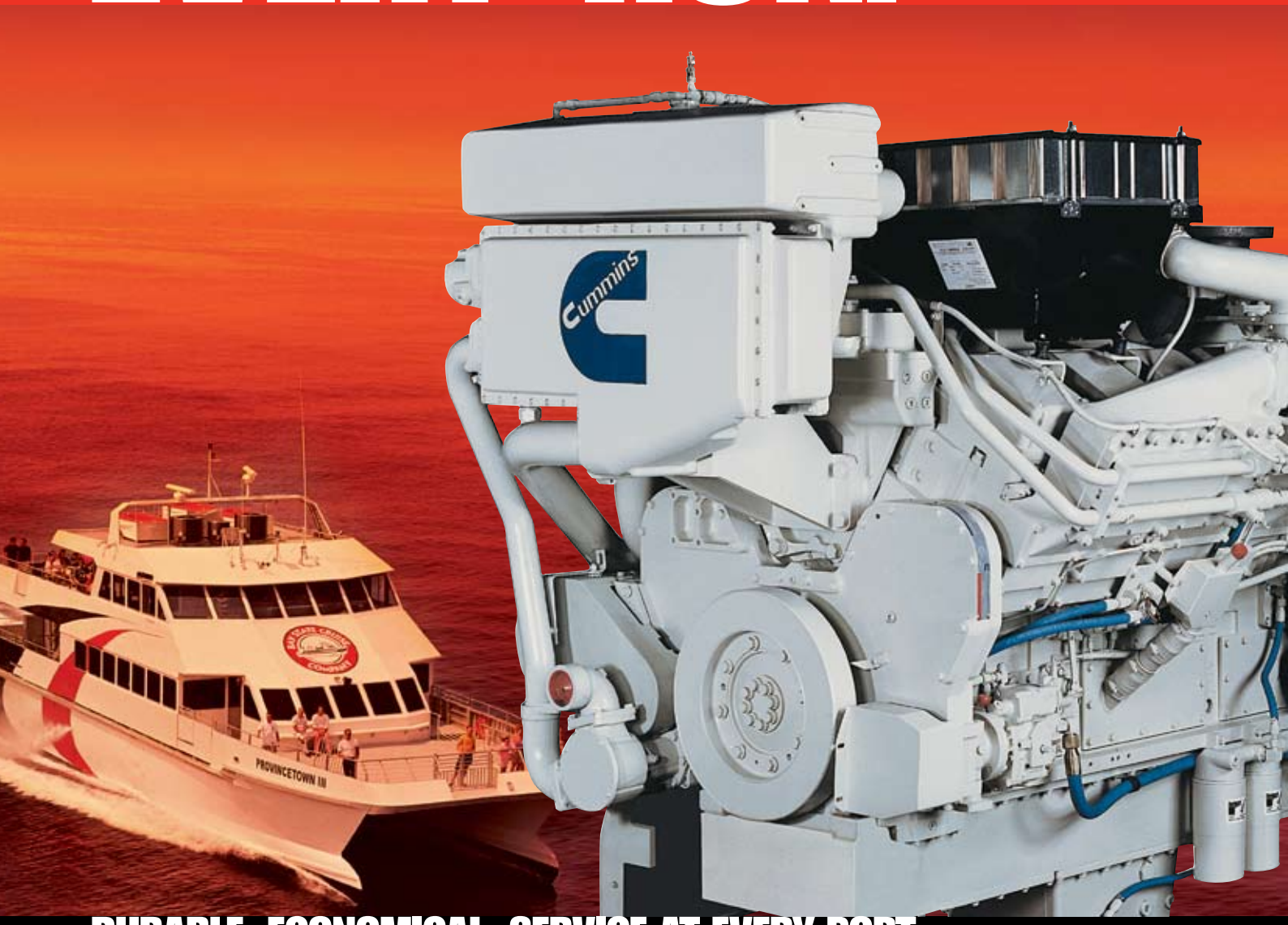
Special features include the use of MTU 396 Series engines to keep commonality with existing fleet, a kids area with dedicated DVD, a passenger GPS system, LCD TVs, a first-aid room and a kiosk and two vending machines.

A crew mess with crew berths for four persons are provided. The ferries are fitted with the Seastate ride control system (interceptors and T-foils) and extensive navigational electronics.

Principal Particulars

	Gold Express	*Silver Express*
Length OA	45.24 m	45.24 m
Length WL	40.2 m	40.2 m
Beam mld	12.3 m	12.3 m
Hull depth mld	4 m	4 m
Draft (max)	1.8 m	1.8 m
Crew	6	6
Passengers	446	360
Vehicles	0	10 cars
Cargo/luggage	4.5 t	4.5 t
Propulsion		
Main engines	4 x MTU 16V 396 TE74L	4 x MTU 16V 396 TE74L
Gearboxes	4 x ZF 7550	4 x ZF 7550
Waterjets	4 x Kamewa 63 SII	4 x Kamewa 63 SII
Speed	38 kn	38 kn
Survey		
Classification	Bureau Veritas	Bureau Veritas

EVERY™ RUN.



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Queensland Industry News

In the Brisbane region the BSC Marine Group's current building projects include a 27 m passenger catamaran designed to Lloyds' SSC G3 class and two 18 m passenger catamarans to Lloyds' SSC G2 class. Principal particulars of the vessels are as follows:

Length OA	27.5 m
Beam max.	9.1 m
Draft (max)	2.0 m
Passengers	276
Luggage	5 t
Construction	Aluminium
Main engines	MTU 10V 2000 M72
Gearbox	ZF 3000A

Length OA	18.3 m
Beam max.	7.5 m
Draft (max)	1.7m
Construction	Aluminium
Main engines	CAT 3406E
Gearbox	ZF 350A

Completion and delivery of all three vessels is scheduled for early 2006.

BSC has also recently been successful in its tender for two 18 m monohulls and three 32 m catamarans for the Union Territory of Lakshadweep Administration in India, with the vessels to be built in Malaysia.

Gold Coast boatbuilders are gearing up for a busy period leading up to the Christmas break. Local Gold Coast City Marina-based company, Blackline Shipping, has a number of large vessels in refit, including a 28 m commercial catamaran which is having an engine change and a complete refit of the internal passenger areas, a 35 m motor yacht which is undergoing modifications to achieve commercial survey, and a 30 m motor yacht undergoing general refit work.

A number of new vessel launches has also occurred recently on the Gold Coast, with Crusader Catamarans celebrating the recent launch of its 17 m catamaran. This FRP constructed vessel features three double cabins, large galley and saloon areas as well as a huge aft entertaining deck. Powered by two 172 kW Yanmar diesel engines, the vessel reached a maximum speed of 21 knots during recent sea trials, a highly-efficient performance due mainly to the semi-swath-style hulls. Crusader Catamarans is offering this vessel as a number of different options — motor sailer, power cat and game fisher versions.

Also recently launched was a 12 m amphibious vehicle bound for the tourist market in Korea. The craft was built by South Pacific Marine on behalf of Gold Coast company Amphibious Vehicles. This craft can carry 44 passengers and is propelled by a jet unit — the design is of similar styling to the amphibious vehicles currently seen operating around the Gold Coast Broadwater. Based on the interest in the local marine industry, manufacturers and builders alike are expecting a busy Christmas rush which will hopefully continue into the New Year.

Progress at Tropical Reef Slipways

Notable refits completed recently at this North Queensland yard include the conversion to a suction sand dredger of the 1990 NQEA-built *John Oxley*, a split-hopper barge owned by Queensland Cement, and the in-water refit of Trimarine's 67 m tuna fishing vessel, *Cape St Vincent.*

Tropical Reef also completed the four-year refit and re-powering of the first of their four contracted refits of the RAN LCH landing ships, HMAS *Labuan*. The twin Detroit 12V-71's are being replaced with Caterpillar 3406E diesels.

Current major projects underway for the US Army's fleet from Kwajalein Atoll in the Marshall Islands include four-year refits of the ocean going tug *Lt 101 Condor,* and the ship *Worthy* which will also have an upgrade to its comprehensive communications equipment and dome mounts.

Tropical Reef Slipways employs about 130 staff and, for the first time, will be taking on boilermaker apprentices in the New Year. Planned yard upgrades include a new fitting-out wharf and an alongside berth.

Activity at Cairns Slipways

Ongoing slipway activities generally remain unchanged since the sale to Viking Industries, with a greater focus on the growing Super Yacht refit market.

With the Cairns Port Authority upgrade of the Marlin Marina yacht-berth facilities and the active marketing by the Super-Yacht Group — Great Barrier Reef, visits by large private luxury yachts have been growing steadily. Cairns Slipways has been the lead company involved with the Super Yacht Group and, through direct overseas marketing, has benefited with large refit contracts.

Recent refits were undertaken on the John Bannenberg-designed Oceanfast-built motor yacht, *Antipodean*, and on *Lionwind*, *Tigre d'Or*, *Blue Star*, *Amnesia* and the 70 m *Boadicea*.

Yachts at the slipway in November are the famous 1903 all-timber three-masted *Shenandoah,* and the 78 m *Lone Ranger*, a converted ocean-going ice-breaking tug. Both vessels are having extensive piping work undertaken.

Lone Ranger in North Queensland
(Photo courtesy Marc Richards)

The refit of the 36 m motor yacht *Hilarium* (ex–*Ilona*) is well underway in conjunction with NQEA project management and trades, as well as the complete internal fitout by FMCA, another Viking Industries company.

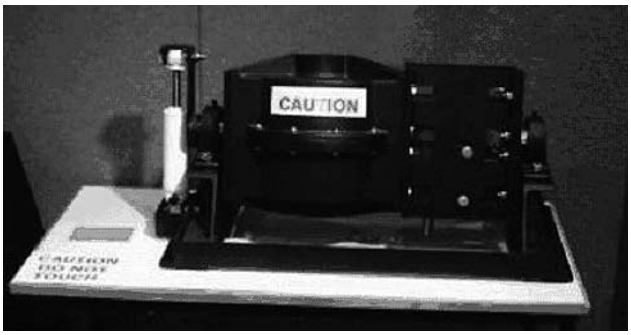
Upcoming commercial work will include a rebuild and upgrade of a 45 m reef pontoon facility for the tourist operator, Sunlover Cruises, the motorisation of a 70 m barge for a Noumea client, and refits of five island-service vessels operated by Cairns-based company, Seaswift.

WA Industry News

Sea Gyro appoints CEO

"With most of the development work on the new Sea Gyro models completed, the time has come to push into the international market" said John Ayres, the new Chief Executive Officer of Sea Gyro. The new "at anchor" stabilisers are now more energy efficient, quieter, and cost effective. It is anticipated that attendance at several of the International boat shows will make the public and boat designers more aware of the new roll control for vessels. The new mini Sea Gyro design is ideal for small (10 m) recreational craft, while custom units can be constructed for ships up to 50 m in length. Interest has also been generated by several navies who believe that they are suitable for patrol boats, which spend most of their time at slow speeds conducting observation tasks. Sea Gyro is a spin-off company, established to commercialise the results of research conducted at Curtin University's Centre for Marine Science and Technology.

Kim Klaka



Sea Gyro "at anchor" stabiliser
(Photo courtesy Kim Klaka)

NSW Industry News

Lightning Naval Architecture

Lightning Naval Architecture are currently working for P&O Maritime on the upgrade of M/S *Oceanic Viking* to a Special Purpose Vessel. This 105.6 m Norwegian cable-laying vessel is on long-term charter to the Australian Customs Service for Southern Ocean fisheries patrol and surveillance. The upgrade work involves installation of additional watertight subdivision bulkheads and cross-flooding ducting to meet the higher stability requirements of the Special Purpose Vessel standard, and the fitting of a new 5 × 4-berth accommodation module for additional customs personnel. LNA have been responsible for all naval architectural tasks including ship modelling and stability calculations, the design of structural modifications and upgrading of safety plans.

In collaboration with SSPA, LNA has also been working for Toll NZ to produce wake-wash calculations for the environmentally-sensitive Marlborough Sounds. LNA has been responsible for producing the ship models of their existing ships, *Arahura* and *Aratere*, and the recently-introduced *Kaitaki*, ex *Stena Challenger*.

Jennifer Knox

Incat–Crowther

Incat Designs and Crowther Design have merged and now operate under the name Incat–Crowther Designs (see separate article elsewhere in this issue). Information on their vessels can be found at www.incatcrowther.com.

Latest launchings for the merged companies include:

Seymour B. Durst, the second of two vessels built by Gladding Hearn to an Incat design, has commenced operation on the waters of New York for operator New York Water Taxis (see *The ANA*, May 2004).

Principal particulars of the two vessels are:

Length OA (excl. sponsons)	72'-0" (21.95 m)
Length WL	68'-2" (20.77 m)
Beam overall (excl. sponsons)	26'-7" (8.10 m)
Beam demihull	7'-6" (2.30 m)
Draft	5'-2" (1.55 m)
Passengers	
Main Deck interior	99
Upper Deck exterior	36
Upper Deck standing	39
Main Engines	2 × Cummins QSK19-M
Gearboxes	2 × Twin Disc MGX-5145
Propellers	2 × Bruntons 5 bladed

Seymour B. Durst in operation on New York Harbour
(Photo courtesy Incat–Crowther Designs)

Five is the new Crowther-designed addition to the fleet of Fantasea Cruises for operation around the Whitsunday Island group in Queensland (see *The ANA*, May 2005).

Principal particulars of the vessel are as follows:

Length OA	34.50 m
Length WL	31.25 m
Beam OA	9.00 m
Draft (prop)	1.80 m
Passenger Seating	
Internal	200 (main deck)
External	100
Crew	5
Fuel	5000 L
Fresh water	900 L
Deadweight	32 tonnes
Engines	2 × Deutz 616 V16 each 1107 kW @ 2200 rpm
Gearboxes	2 × ZF2550A
Speed	28 knots
Gensets	Cummins 60 kVA
Survey	Queensland Department of Transport
Operation	Class 1D
Construction	Aluminium

Steve Coates

Five showing her paces on trials
(Photo courtesy Incat–Crowther Designs)

Stuart Friezer Marine

Aluminium Boats Australia of Brisbane has recently delivered the Stuart Friezer Marine-designed 27 m wave-piercing catamaran, *Evolution*, to her owners, Haba Dive, in Port Douglas in North Queensland. The vessel has introduced a new standard for dive vessels, and is now operating out of Port Douglas for day diving trips to the Great Barrier Reef for 130 passengers.

Evolution looks great in colourful livery, and goes just as well. She has twin MTU engines delivering 743 kW each, achieving a top speed of just over 32 kn, and a comfortable cruise speed of 27.5 kn at 70% engine load. This makes her one of the most efficient vessels with these engines in the region.

The second-generation wave-piercing catamaran's styling differentiates her from her catamaran siblings and delivers a smoother ride with greater safety in big seas. The owner and crew have great confidence in her after a delivery trip in gale-force winds and large seas; they could have sought shelter, but the boat was handling so well that the owner and crew chose to carry on to Port Douglas.

In conjunction with Haba Dive, SFM worked very hard to optimise the boat's layout to maximise their guest's experience when on board. She features a fill-width lifting swim platform which carries a 5.4 × 2.5 m glass-bottom boat, aircraft-style main-cabin seating, large bar/galley/servery and large open areas on the foredeck, a sun lounge and an aft upper deck.

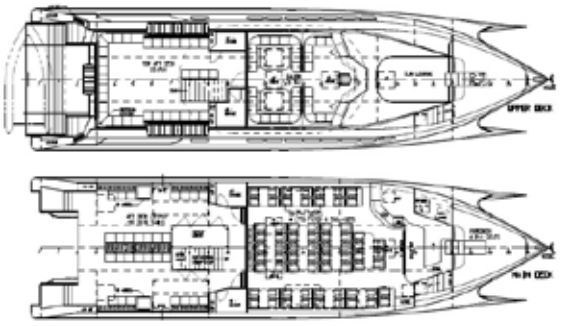
The wave-piercing catamaran design incorporates all that SFM learned over the past thirteen years designing large high-speed wave-piercing catamarans with Incat Tasmania. The long fine hulls have less drag and handle better both manoeuvring and in seas, while the new centre bow delivers greater safety.

The structures are lighter and stronger. A lighter vessel delivers significant fuel savings to the operator. On *Evolution* an extra tonne carried will use approximately 17 000 L more diesel each year. The extra strength delivers at least 40% reduction in twisting deflections when compared to other similar-sized boats in the Cairns region. This additional safety and structural reliability inspires more confidence and pride in her crew.

Stuart Friezer

Principal particulars of the vessel are as follows:

Length OA	27.20 m
Length WL	25.83 m
Beam (moulded)	7.50 m
Draft	1.44 m
Passengers	130
Crew	145
Fuel	3000 L
Fresh water	3000 L
Sullage	2000 L
Engines	2 × MTU 12V 183TE92 each 743 kW
Gearboxes	2 × ZF
Speed	32 kn maximum 27.5 kn cruise
Genset	Isuzu 55 kVA
Survey	Queensland Department of Transport
Operation	Class 1C
Construction	Aluminium



General Arrangement of *Evolution*
(Drawing courtesy Stuart Friezer Marine)

Evolution shows off her colourful livery
(Photo courtesy Stuart Friezer Marine)

Evolution in dive mode
(Photo courtesy Stuart Friezer Marine)

***John Oxley* Update**

The engineers working on *John Oxley* are overhauling all the sea valves and the steam-driven bilge pump, followed by the rudder and propeller shafting, and the team involved is growing. Future work before refloat also includes replacement of the corroded bilge piping system.

Progress here commenced with removal of the sea valves. Fortunately, most of the valves are in good condition; however, all will need extensive descaling and overhaul. Some need replacement and, although the current budget does not extend to new castings, their volunteer patternmaker has commenced production of patterns in advance.

Current hull work requires that we remove gear close to the hull plating – the spare IP and LP piston rings were painted and clamped to the starboard side hull framing before the ship left Scotland, ready to be fitted if needed. Down aft, the emergency steering gear has been removed, along with its crosshead, the quadrant, and the tiller itself.

On the electrical side, while the sparkies are not yet able to work on the ship's new electrical system, they are already hard at work erecting temporary construction wiring and providing switchboards to the hold, forward hold, stokehold and engine room. They are also active in planning shipboard electrical systems and have spent huge amounts of time in planning. This has enabled them to arrive at detailed lists of all electrical components and wiring needed for the rebuild.

The original wiring network was the old lead-sheathing-over-cotton-and-India-rubber insulation. This type of wiring is no longer available, and it does not last. In her last years of service, *John Oxley* was plagued with many short circuits and other problems caused by perished rubber insulation. SHF electricians will use a modern alternative wire which resembles the old wiring and feelers have already gone out to seek donations of suitable wire. The electricians are also gathering other electrical equipment, rebuilding it and putting into store, ready for the day when they can install it and wire the ship.

The old 110-volt switchboard has just been removed ashore for eventual restoration. The team was surprised to find out that this switchboard was made in black marble!

Restoration of *John Oxley*, like all Sydney Heritage Fleet work, is a community-based project which relies on the support of the business and industrial community plus many, many volunteers. Many industries already support the Fleet. However, the following additional items are also sought:

- Use of a crane for half a day to remove some heavy items from the ship
- 3/4 in and 5/8 in nuts and bolts (for securing plates before riveting)
- 10 mm steel plate — ask about the *Donate a Plate* program
- Steel angle and section (for structures)
- Steel pipe (for air and bilge services)
- Air hoses — 1/2 in bore and larger
- Castings in iron and in bronze

If you can donate, or know anyone who would be prepared to donate, any of the above items, then the Sydney Heritage Fleet (02) 9818 5388 would be very pleased to hear from you. Practically all of their machine tools, welders, riveting machines, oxy sets, timber saws and thicknessers were donated.

For further information, check out their website, www.australianheritagefleet.com.au/jorest/jolatest.html.

As a matter of interest, the October 2005 issue of *Engineers Australia* carries a special feature on corrosion prevention, and the lead story is a two-page spread on the restoration of *John Oxley*. This article includes photos of the vessel out of water, the corroded area under a boiler with a new floor plate in place, and part of the triple-expansion steam engine. It also includes comments by John Hayes, a recent graduate of The University of New South Wales, whose thesis project aided the project management of the *John Oxley* restoration.

Cruising

Pacific Sun, operated by P&O Holidays is home based in Sydney, and has been operating cruises over the winter months. However, the summer cruise season has now begun, with recent visits to Sydney Harbour by *Pacific Princess*, *Seven Seas Voyager*, *Clipper Odyssey*, and *Amsterdam*.

An interesting innovation this year has been that some of the cruise vessels have begun calling at Eden, on the south coast of NSW. There they berth at the new multi-purpose/navy ammunitioning wharf on the south side of Twofold Bay, inshore of the chip mill. Those passengers wishing to visit Eden are transported by bus to the town.

Pacific Princess passing the chip-mill en route to her berth at the multi-purpose wharf (RHS) in Twofold Bay, Eden
(Photo courtesy Jennifer Whiter)

EDUCATION NEWS

University of Western Australia

The School of Oil and Gas Engineering at the University of Western Australia celebrated its 10th anniversary in September. The School offers masters and undergraduate courses for the oil and gas industry, and includes a naval architecture and offshore engineering stream in its undergraduate offerings.

Curtin University

Tim Gourlay and Kim Klaka of Curtin University's Centre for Marine Science and Technology have recently completed ship dynamic draft change measurements and analysis for an Asian port authority. The measurements were taken on board sixteen large container ships using high-precision GPS units, and were used to guide the port authority on under-keel clearance requirements. The work was conducted in collaboration with Metocean Engineers.

Kim and Tim are also working on under-keel clearance prediction for an Australian port which requires dredging for larger vessels. This research is being conducted for Fremantle engineering consultants, JFA, and is also being carried out in conjunction with Metocean Engineers.

Two undergraduate students at Curtin University's Department of Imaging and Applied Physics have completed CFD projects, modelling the hull and control surfaces of a small Autonomous Underwater Vehicle. It is proposed to continue the research next year, in conjunction with experimental work at AMC, under the MoU held between Curtin and AMC.

A visiting guest researcher arrived at Curtin's Centre for Marine Science and Technology in September. Lucie Lambert, from Chalmers University in Sweden, will be working at the Centre for six months on ship hydrodynamics and design projects.

The Department of Mechanical Engineering at Curtin University is offering a two-year articulation entry to the Australian Maritime College BEng naval architecture course. Students can enrol for the first two years at Curtin, then transfer directly into the third year of naval architecture at AMC.

The Centre for Marine Science and Technology at Curtin has been running the Design of Small Craft short course again in Semester 2, with more than thirty students attending. The lecturer for the course is Shaun Ritson of Mcalpine Marine Design.

Kim Klaka and Tim Gourlay attended the Maritime Engineering conference and student project presentations at the Australian Maritime College on 20–21 ctober. Kim is an external moderator for the BEng naval architecture course at AMC.

The past twelve months has been a busy time for both CMST postgraduate students and supervisors. The following research theses have recently been completed:

An Investigation into Wave Loads on Catamarans, Stephen Cook, MSc.

The Measurement of Underwater Noise Radiated by a Vessel, Alec Ducncan, PhD.

Prediction of Vessel Motions at Zero Ship Speed, Kim Klaka, PhD.

Performance of Prawn Trawling Gear, Dave Stirling, PhD.

Object-oriented 2D Numerical Acoustic Modelling, Ahmed Zakaria, PhD.

Kim Klaka

Australian Maritime College

AMC Final Year Ocean Vehicle Design Presentations

The fourth-year naval architecture students presented their final-year vessel designs to an audience of staff, students and industry experts in September. Four teams described their designs — a fast monohull crew boat, a 12 m harbour-racing yacht, a reef-tourist catamaran and a military landing craft. Generally the teams described the design brief they had been given by an industry partner (NWBS, Murray Burns & Dovell, Austal Ships and the Department of Defence) and then outlined how their design met the required specifications. The marking panel included Mr John Colquhoun from the Directorate of Navy Platform Systems and Mr Alan Muir, a consultant naval architect. The team judged to have produced the best oral presentation was Carrera Designs comprising Luis Conde, Chris Hutchison and Iain Larkins.

AMC/RINA Seminar Series

A series of seminars continued at the AMC this semester. Presentations included:

- *Water Deformation under a Wing in Ground Effect* by Dr Tracie Barber, The University of New South Wales;
- *Recent Research into the Theoretical Prediction of Resistance of High-Speed Marine Craft* by Professor Lawry Doctors, The University of New South Wales;
- *Circulating Water Channel Overview* by John Wakeford, AMC; and
- *Towing Tank Upgrade* by Gregor Macfarlane, AMC.

In addition, an AMC Showcasing Research Seminar was held on 13 September. This seminar gave AMC researchers, from a wide range of fields, the opportunity to present their work. A total of 21 staff and postgraduate students participated and topics ranged from *Modelling Tropical Cyclones* to *Wave Loads on High-Speed Catamarans* via *The Reproductive Biology and Habitat Selection of Spawning and Southern Black Bream* and *Smoothed Particle Hydrodynamics — An Introduction for Naval Hydrodynamics*.

Final Year Engineering Student Research Thesis Presentations

Fourth-year engineering students presented their final-year research thesis findings on Thursday 20 October. Topics covered included areas of structural optimisation, material and hydrodynamic analysis of high speed vessels, submarines, fishing vessels and off-shore oil rigs. Approximately 20 students from Bachelor of Engineering courses in naval architecture, ocean engineering and marine and offshore systems made their final presentations. The students were judged by Dr Kim Klaka from Curtin University of Technology, Prof. Mike Davis from the University of Tasmania and Mr Sam Abbott from Austal

Ships, with further interactions from experts from industry and academia — including the Defence Science and Technology Organisation, British Maritime Technology (Defence Services —Australia), commercial shipbuilding companies and maritime consultancy organisations. The experts were quite liberal with their praise regarding the variety of topics handled, quality of presentations, and the clear grasp of theoretical and experimental analysis.

Coasts and Ports 2005

Coasts and Ports is a biennial conference convened by Engineers Australia, the National Committee on Coastal and Ocean Engineering and the Permanent International Association of Navigational Congresses. The conference provides an opportunity to bring together professionals associated with the many aspects of coasts and ports. The latest conference was held at the Adelaide Hilton from 21 to 23 May 2005. Jonathan Duffy, an employee of the Australian Maritime College's Ship Hydrodynamics Centre, attended the conference and presented a paper titled *Prediction of Mooring Line Loads on Cape Size Vessels Berthed at Cape Lambert*. This paper summarises research conducted by Jonathan, through AMC Search, to investigate mooring line loads for a number of different proposed mooring configurations for a vessel berthed at the Cape Lambert facility in northwest Australia. The paper was well accepted and generated interest amongst conference delegates.

Annual UNSW Naval Architecture Student Visit to AMC

On 29 and 30 August the AMC was host to 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 eight UNSW students also had a brief tour of AMC's vessels. This was the first year that Dr Tracie Barber, UNSW Lecturer, accompanied the students following the retirement of Lawry Doctors earlier in the year. Tracie gave a presentation on *Water Deformation under a Wing in Ground Effect* to students from both AMC and UNSW and AMC staff.

24th International Towing Tank Conference

The 24th International Towing Tank Conference (ITTC) was jointly hosted by the universities of Newcastle-upon-Tyne, Glasgow and Strathclyde. The conference was held in Edinburgh, Scotland, and was attended by approximately 190 participants from approximately 30 nations. Gregor Macfarlane attended the conference as the representative of the Australian Maritime College.

The International Towing Tank Conference is a voluntary association of worldwide organisations which have responsibility for the prediction of hydrodynamic performance of ships and marine installations based on the results of physical and numerical modelling.

The International Towing Tank Conference was first held in 1932. The total number of ITTC members is 116 organisations from 32 countries. AMC has been a member of the ITTC since 1987 and is the only member from Australasia.

The primary task of the ITTC is to stimulate progress in solving technical problems that are of importance to institutions who are regularly responsible for giving advice and information regarding full-scale performance to designers, builders and operators of ships and marine installations based on the results of physical and numerical modelling.

The conference also aims to stimulate research in all fields in which a better knowledge of the hydrodynamics of ships and marine installations is needed to:

- improve methods of model experiments, numerical modelling and full-scale measurements;
- recommend procedures for general use in carrying out physical model experiments and numerical modelling of ships and marine installations;
- validate the accuracy of such full-scale predictions and measurements for quality assurance;
- formulate collective policy on matters of common interest; and
- provide an effective organisation for the interchange of information on such matters.

The aims of the Conference are pursued by:

- stimulating research into specific topics;
- organising and encouraging meetings to review progress in this research;
- making such recommendations and decisions on joint action and policy as seem desirable to the members of the Conference;
- establishing procedures and guidelines to help member organisations to maintain their institutional credibility with regard to quality assurance of products and services, such as, performance prediction and evaluation of designs by either experimental or computational means; and
- recording and publishing discussions taking place at ITTC meetings.

As usual, a number of technical committees reported on the significant work in their fields which had been conducted since the last full conference of the ITTC (in September 2002) and made conclusions where appropriate and recommendation for future work where conclusions could not be made. The current committee structure of the ITTC is as follows:

Administrative

Advisory Council (representatives from all large organisations)

Executive Committee (one representative for each geographical region)

General Technical Committees (which are continuing Committees)

Resistance
Propulsion
Manoeuvring
Seakeeping
Ocean Engineering

Specialist Technical Committees

Stability in waves
Assessment of ocean environmental issues
Ice
Validation of waterjet test procedures
Cavitation erosion on propellers and appendages on high-

powered high-speed ships
Azimuthing podded propulsion
Powering performance prediction

There is also a Quality Systems Group which is responsible for reviewing the following documents:

- ITTC Recommended Procedures and Guidelines
- ITTC Symbols and Terminology
- ITTC Quality Systems Manual

The specialist technical committees typically last 3–6 years and have specific tasks to accomplish. The specialist committee structure for the 25th ITTC period (2005-2008) is as follows:

Uncertainty analysis
Stability in waves
Vortex induced vibrations
Ice
Wake-fields
Cavitation
Azimuthing podded propulsion
Powering performance prediction

The membership of the general technical committees consists of one member from each geographical region, whereas the specialist technical committee comprises smaller groups of internationally-recognised experts in their field.

Since 1996, Australia has been grouped with Indonesia, Malaysia, India and Japan into the "Pacific Islands" region. As Japan alone has more member organisations than any other region this makes it very difficult for us to be represented on any of the general technical committees. However, it is very pleasing to note that, for the first time, the Australian Maritime College has two representatives within the general technical committees during the 25th ITTC period (the only two Australian representatives). They are Gregor Macfarlane (Resistance Committee) and Jinzhu Xia (Seakeeping Committee).

During the conference, a number of technical workshops were also held, three of which were of particular interest — new experimental facilities, full-scale trials and ITTC guidelines and procedures.

The workshop on new experimental facilities included presentations on two ocean-engineering basins. The first was the Brazilian Ocean Basin in Rio de Janeiro, Brazil. This basin is 40 m by 30 m and has a depth of 15 m, making it the deepest of its type in the world. It also boasts a 5 m diameter pit providing an additional 10 m depth, and wave, wind and current capability. The new Ocean Engineering Basin at the University of Tokyo, Japan, is 50 m by 10 m and 5 m deep. There were also presentations on two new towing tanks, one very large tank in France (545 m long, 15 m wide and 7 m deep) and an ice tank in Finland for modelling the operation of ships for efficient operation in ice regions (75 m long, 8 m wide and 2.1 m deep). Finally, there was a presentation on the new large cavitation tunnel at the Meguro Model basin in Japan (with test-section dimensions of 2 m by 2 m by 10 m long).

Many useful discussions were held with a number of participants at the conference. One topic which received considerable discussion was that of the wave wake generated by high-speed vessels, in particular the prediction of these waves in the far field. Research into this topic is one of the assigned tasks for the Resistance Committee for the coming three-year term.

The proceedings from the past 15 ITTC conferences (back to 1963) are available in the AMC Library.

AMC Maritime Engineering Reunion and Conference

Summary of Events

The Department of Maritime Engineering held a very successful conference and reunion dinner on Friday 21 October. More than 80 delegates attended the conference, which was held in the AMC auditorium, with over 30 representatives from industry making the trip to AMC for these events. A keynote speech on *International Developments in Hydrodynamics* was delivered by former AMC senior staff member, Dr Martin Renilson, who has been with the UK firm QinetiQ for the past four years. All other speakers at the conference were graduates of the AMC Bachelor of Engineering degree which highlighted the many varied and important roles undertaken by our graduates. The list of speakers included Tony Vine (RAN), Samuel Abbott (Austal Ships), Teresa Hatch (Australian Shipowners' Association), Dr Andrew Tuite (Incat-Crowther Design), Dr Dougal Harris (Formation Design Systems) and Suzanne Hayne (AMOG Consulting).

The Reunion Dinner was held in the Grand Ballroom at the Hotel Grand Chancellor in Launceston and was attended by 108 persons. A very informative and interesting speech on the history of the AMC Bachelor of Engineering degree was delivered by Dr Stan Gottschalk, who was instrumental in its development. The success of those graduates in attendance in their respective careers was clear evidence of how far this degree has come in a relatively short timeframe. Those in attendance were also able to view an amusing slide show of more than 500 pictures of AMC students and past and present staff covering the past 20 or so years.

Both events were organised by the Department of Maritime Engineering to celebrate the 15th year since the first Bachelor of Engineering students graduated, and also the 25th anniversary of AMC and the 21st year of operation of the Towing Tank.

The conference delegates
(Photo courtesy AMC)

Summary of Papers Presented

A brief summary of the papers presented at the conference is as follows:

Keynote Address: *International Developments in Hydrodynamics* by Dr Martin Renilson, Technical Manager for Maritime Platforms and Equipment, QinetiQ, UK, AMC senior staff member 1983 – 2001.

The purpose of hydrodynamics activities is to predict, and improve, the performance of a full scale vessel, whether this

is in resistance and propulsion, propulsor design, seakeeping, or manoeuvring. Various tools exist for doing this, including analytical methods, empirical methods, numerical methods and physical model testing. It is always essential that the results from predictions are compared with those from full-scale trials, and the prediction methods are improved, taking the experiences learned into account.

As advances in numerical techniques are being made it is essential to validate these using physical model tests. In addition, detailed physical model tests are required to help to understand the limitations of numerical techniques, and to provide the physical insights necessary to improve them. As a consequence, a larger number of more-complex physical model experiments are being conducted with both these aims in mind.

A number of recent developments were discussed, including a number of specific examples.

The Naval Technical Regulatory Framework — A Shift from Proscriptive Regulation to a Risk Management-based Regulatory System by Commander Tony Vine, Fleet Marine Engineering Officer, Maritime Headquarters, Royal Australian Navy, ACT. Graduated 1991, AMC Bachelor of Engineering (Maritime Engineering).

The fire in HMAS *Westralia* in 1998 exposed flaws in the manner in which the Royal Australian Navy managed the configuration baselines of ships and the way in which maintenance was conducted. As a result of the investigations into the fire, the RAN overhauled its Technical Regulatory System with the focus changing from a proscriptive rules-based system of regulation, to one focussed on managing the risk that will occur as a result of any technical decision.

The paper explores the background to the changes, explains the risk-management system utilised by the RAN and the manner in which engineers in the ADF are now empowered to make change on ADF maritime materiel.

The new system places the onus on each and every engineer to make a self-assessment of their competency for each task they conduct, and the risk that an incorrect decision would pose to the safety of personnel, the fitness of purpose of the equipment, and environmental compliance. This is an approach that ethically all engineers, regardless of where they are employed, should embrace.

The paper concluded with an example where the flexibility of the new system has allowed a major configuration change to be implemented, in a very short time with minimal risk.

FPSO Hydrodynamic Modelling by Suzanne Hayne, AMOG Consulting, Victoria. Graduated 2004, AMC Bachelor of Engineering (Ocean Engineering).

Since leaving AMC in November 2004, Suzanne has been employed by AMOG Consulting, an Australian engineering consultancy offering services in concept development, numerical and scale modelling, naval architecture, structural and hydrodynamic engineering, risk and reliability engineering, subsea-, coastal- and offshore-engineering and advanced analysis. Since Suzanne started at AMOG the company has grown 50% and has employed seven graduates, of whom four have been from AMC. The projects in which Suzanne has been involved during her time at AMOG have included the design of a mooring system for a 24-cage fish farm, a study of a 40 km rope (conveyor) belt, and the design and procurement of moorings for a floating storage and off-loading system (FPSO) and its shuttle tanker. Each of these projects drew on a large number of the skills Suzanne was taught in the course of the AMC ocean engineering degree. Suzanne stated that the course content has enabled her to get a head start in understanding and developing skills that are used every day in the offshore sector.

The FPSO mooring and shuttle-tanker offloading system design in which Suzanne was involved required detailed hydrodynamic modelling of the FPSO and its shuttle tankers. An essential aspect of such numerical modelling is checking and verification. At AMOG this is achieved through a combination of comparison of the results produced by alternate numerical packages, comparison with model test data, sensibility checking and peer review. Once the model of the FPSO and its shuttle tanker has been developed and checked, it needs to be expanded to include the mooring system to allow initial sizing.

Operational constraints on a system impact all aspects of the mooring design. For example, taking into consideration the use of full DP assistance or simple heading control will significantly modify the forces in the mooring system and its reactions on the floating structure.

Other considerations when designing moorings include riser-system limits, horizontal loading on the vessel and winching operations. To encompass all of these aspects requires modification and iteration of mooring configurations and components to match the required excursion and design-load limits.

In her presentation, Suzanne explained some of the subtleties of hydrodynamic modelling which she found interesting during her involvement in these projects, and some of processes followed to achieve operational and structural constraints. Suzanne also discussed what she believes are significant advantages offered by the AMC ocean engineering degree course in relation to the offshore industry.

Austal Ships and the Design Process by Sam Abbott, Naval Architect, Austal Ships, WA. Graduated 1998, AMC Bachelor of Engineering (Naval Architecture).

Operations commenced at Austal Ships in 1988 when they started building small catamarans. By their fifth year, Austal had become the world's leading manufacturer of 40 m catamarans and the dominant supplier into Asia. In December 1998, Austal listed on the Australian Stock Exchange and has since diversified its product base through the acquisition of Image Marine and luxury motor-yacht builder Oceanfast.

To enable entry of their product into the lucrative American market, they formed a partnership with Bender Shipbuilding and Repair to establish Austal USA in Mobile, Alabama. This yard is now currently constructing its ninth vessel. So far, Austal has delivered a total of 138 vessels with a further 18 either on order or currently under construction.

The proven design capabilities and knowledge base Austal have in-house would challenge most shipyards around the world. Austal is constantly striving to develop new technologies and ideas. This development has been proven with the success of the world's largest aluminium ferry, the 127 m stabilised monohull for Fred Olsen and the more-

recent contract with the United States Navy for the Littoral Combat Ship with partner Bath Iron Works, based on the 127 m platform.

The current design team at Austal is over 120 staff with 36 naval architects and a total of 20 engineering graduates from the Australian Maritime College.

The International Shipping Industry and the Role of Ship Design in its Future by Teresa Hatch, Director Maritime Operations, Australian Shipowners' Association, Victoria. Graduated 1996, AMC Bachelor of Engineering (Naval Architecture).

The role of the naval architect in the contemporary Australian context has been largely focused on fast ferries and the smaller vessel sector. Increasingly however, there is a need for expertise in ship design and construction in the commercial shipping sector all over the world, not only in those nations involved in shipbuilding.

Such demand is driven largely by the increased environmental protection demanded of ships, and the issues considered range in scope from structural issues, such as double hulls, to reduced air emissions via hull design improvements involving air lubrication.

The shipping industry globally is responsible for 90% of world trade, and shipping continues to provide the most cost effective and sustainable form of transport. Not only is the shipping industry cost effective, it is also widely considered to be the most energy-efficient transport mode. For instance, shipping supports 28% of the domestic freight task in Australia, consumes 9.6% of the total energy used in freight transport, but contributes to just 2% of the total emissions from the transport sector.

There is always room for improvement, however, and this presentation discussed several recent initiatives and demonstrated how changes in ship design can improve the environmental performance of the shipping industry as well as improving efficiency and reducing costs.

Incat-Crowther: A Naval Architecture Consultancy Group by Dr Andrew Tuite, Technical Director, Incat-Crowther, NSW. Graduated 1993, AMC Bachelor of Engineering (Naval Architecture).

Incat-Crowther is a naval architecture consulting organisation specialising in the design of multihull craft. They design vessels for a number of affiliated shipyards in Australian, Asia and the US. The presentation made by Andrew reviewed vessels recently launched and under construction, the design process used, and the qualities Incat-Crowther look for when selecting employees

Andrew also generated some very interesting discussion by showcasing some examples where vessels were damaged, and the role of the vessel designers in each case.

Software Tools for Marine Design Applications by Dr Dougal Harris, Naval Architect/Software Engineer, Formation Design Systems, WA. Graduated 1997, AMC Bachelor of Engineering (Naval Architecture).

Australia has developed an enviable reputation for innovative ship design and construction. It is now a leader in the market for high-speed aluminium vessels; however, shipbuilding in Australia is not restricted to the high-speed sector. In recent years, a fleet of new frigates has been completed and six diesel-electric submarines have also taken to the water. At the smaller end of the scale, Australia has become a major supplier of patrol boats to a range of countries in Asia and the Middle East.

In this buoyant environment, Australian shipbuilders are looking to CAD technology to maintain their market position and cope with strong forward orders with limited numbers of skilled workers. The combination of the Maxsurf suite of naval architecture software and AutoCAD-based ShipConstructor detailing software is proving to be the CAD system of choice in this environment, with a number of yards adopting the software in the past few months.

Dougal's presentation outlined the use of this software for the complete design cycle and presented some case studies from Australia and abroad.

Froude Water Ceremony

The Conference also included a small ceremony to recognise the recent major upgrade of the AMC Towing Tank.

Haslar, on the South Coast of England, is often referred to as the birth place of hydrodynamics. The hydrodynamic facilities at Haslar were established in 1887 by R. E. Froude, son of William Froude.

It was William Froude who discovered the relationship between the wave pattern produced by a ship and its resistance. It was this discovery that made it possible, for the first time, to predict the resistance of a ship by using scale models.

William Froude and his son started their experiments in the 1860s on the River Dart. They then received a grant from the British Admiralty and built the first-ever model-testing tank at Torquay. Unfortunately, when the lease on the land that this was built on ran out in 1885, the tank was destroyed.

R. E. Froude then moved to Haslar and established the first Haslar tank there in 1887. This is now the oldest existing towing tank in the world. Since then, models of all the ships of the Royal Navy have been tested there.

It has become a tradition to use water from this facility to christen new towing tanks when they are built around the world.

It was very fitting that Dr Martin Renilson, who first developed the AMC Towing Tank in the mid-1980s, was able to return to present this small token from QinetiQ to AMC to mark the re-opening of the recently-upgraded facility.

Giles Thomas, Gregor Macfarlane, Jonathan Duffy, Stuart McDonnell

Martin Renilson presenting the Haslar water to Gregor Macfarlane
(Photo courtesy AMC)

The University of New South Wales

Undergraduate News

UNSW Visit to AMC

On 29 and 30 August the UNSW Year 3 naval architecture students who are studying Ship Hydromechanics visited the Australian Maritime College with their lecturer, Dr Tracie Barber. The visit was paced over two days and was organised by Mr Gregor Macfarlane, assisted by Mr Richard Young, Dr Paul Brandner, Mr John Wakeford, Mr Rob Evans , and Mr Ian Smith. UNSW is grateful for their hospitality and the time that was spent by AMC organising the visit.

The experience they gained by using the towing tank for resistance and motion tests together with the inspection of the other experimental facilities (the shiphandling simulator, the cavitation tunnel, the circulating-water tunnel, the ship-model basin, and the vessels at Beauty Point) was a most valuable addition to their theoretical studies at UNSW.

In return, Dr Barber gave an evening presentation of her CFD work of the prediction of the free surface deformation under a wing flying close to the water surface, to AMC staff and students. This resulted in much discussion and gave Dr Barber many new ideas to try out in this field! The trip also resulted in a new thesis topic for one of the visiting students, which will be an analysis of the AMC Flume Tank using CFD.

Tracie Barber

September Graduation

At the graduation ceremony on 20 September, the following graduated with degrees in naval architecture:

Anthony Brann	H1
John Hayes	H2/1
Jamie Howden	H2/2

H1 = Honours Class 1
H2/1 = Honours Class 2, Division 1
H2/2 = Honours Class 2, Division 2

They are now employed as follows:

Anthony Brann	EMP Composites, Sydney
John Hayes	Holidaying in Israel
Jamie Howden	Austal Ships, Fremantle

Congratulations all!

Thesis Projects

Some of the undergraduate thesis topics recently submitted include:

Transverse Acceleration of Twin-hull Vessels

With the increasing size of twin-hull vessels, designers must now consider the loads imposed by transverse accelerations. Anderson Chaplow has analysed the response of a basis vessel undergoing transverse acceleration. The result is a set of criteria for use by classification societies to enable the design of safer structures.

Finite-element Analysis of the Carbon-fibre B14 Mast

With the introduction of the new carbon-fibre masts to the B14 skiff class, it is difficult to find the optimal rig configuration. Australian national B14 champion, Michael Halkes, has conducted an analysis of the new mast using a finite-element approach. This has enabled prediction and comparison of the mast bend characteristics for given rig settings.

Phil Helmore with Anthony Brann at
UNSW Graduation September 2005
(Photo courtesy Kristen Brann)

Non-linear Analysis of Sandwich Plate Systems Subjected to Ice Loads

Demand for ice-strengthened vessels is at an unprecedented high. Intelligent Engineering's novel steel-elastomer sandwich (SPS) technology appears trenchant under ice loads. Simon Orr used non-linear finite-element analysis to compare the performance of an SPS shell with that of an established steel structure, and found that, for a given weight and cost, the SPS structure out-performed the steel.

The Strength Characteristics of Composite Panels in Sandwich Construction

The strengths of sandwich composite panels depends on the manufacturing process. Ramesh Watson constructed a test frame for the standard four-point bend test, and then conducted flexural tests and finite-element analysis on various sandwich composite panels. The results show the strength characteristics from different manufacturing processes, and will be used to optimise sandwich composite structures for each process.

Thesis Conference

At the School's annual undergraduate thesis conference on 6 and 7 October, fourteen naval architecture students made presentations, more than we have ever had before. Topics were as follows:

Craig Birdsall	*Analysis of a Twin-mast Catamaran*
Aaron Carle	*Performance Optimisation of Foilboards*
Anderson Chaplow	*Transverse Acceleration of Twin-hull Vessels*

Michael Halkes	*Finite-element Analysis of the Carbon-fibre B14 Mast*
Peter Hatton	*CFD Analysis of Centreboard Foil on High-speed Sailing Vessel*
Constantine Ling	*The Application of Fracture Mechanics in Fatigue-life Analysis of Joints in High-speed Craft*
Robert McConachie	*Analysis of the IMO Severe Wind and Rolling Criterion*
Brett Morris	*The Stability of Rigid-inflatable Boats*
Simon Orr	*Non-linear Analysis of Sandwich Plate Systems Subjected to Ice Loads*
Ethan Seah	O*perational Measures of Performance and Effectiveness*
Robert Skerman	*The Influence of Propeller Pitch on Off-design Performance*
Ramesh Watson	*The Strength Characteristics of Composite Panels in Sandwich Construction*
Dan Wupperman	*A Beam Study into Variable and Movable Ballast Systems for Offshore Racing Yachts*
Joon Chee Yew	*Rating System for Displacement/Non-displacement Craft*

Thesis Conference Dinner

The Thesis Conference Dinner was held in the Ceviche Restaurant at the Randwick Rugby Club on the evening of 7 October. Most of the final-year naval architects attended and made up several congenial tables with lecturer Phil Helmore.

Naval Architects at the Thesis Conference Dinner
(Photo courtesy Michael Halkes)

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 was announced by Mr Phil Helmore at the thesis conference dinner and, in view of the number of presentations, the top three were announced:

First place went to Dan Wupperman for his presentation on *A Beam Study into Variable and Movable Ballast Systems for Offshore Racing Yachts*.

Second place went to Simon Orr for his presentation on *Non-linear Analysis of Sandwich Plate Systems Subjected to Ice Loads.*

Third place went to Aaron Carle for his presentation on *Performance Optimisation of Foilboards.*

Dan was so excited by the result that he immediately went to the bar and bought two bottles of champagne to share with all the naval architects.

Congratulations, all!

Dan's award cheque has subsequently arrived, but he is still waiting on the certificate from London.

Dan Wupperman being congratulated on winning the RINA–Austal Ships Award 2005 by Phil Helmore
(Photo courtesy Michael Halkes)

Lecturer of the Year

Also at the thesis conference dinner, the School's 164 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 A/Prof. Richard Willgoss.

Phil Helmore

Post-graduate and Other News

ICMRT'05

The First International Conference on Marine Research and Transportation (ICMRT '05) was held on the island of Ischia, Gulf of Naples, Italy, from 19 to 21 September 2005. The conference was organized by the Department of Naval Architecture and Marine Engineering at the University of Naples "Federico II".

There was a total of 80 papers on all aspects of naval architecture, but with a particular emphasis on high-speed vessels. As is typical with such conferences, there was a large number of papers on hydrodynamics.

There were four invited keynote presentations as follows:

Strongly Nonlinear Flows in Seakeeping, by Odd Faltinson, Xinying Zhu, and Changhong Hu.

Decision Support Techniques in Structural and General Ship Design, by Vedran Zanic.

The Separation of the Flow Past a Transom Stern, by

Lawrence Doctors and Robert Beck.

Balancing Marine Transportation Needs with Marine Research Advances, by Chengi Kuo.

Visit to Chalmers University of Technology

During his overseas conference trip to attend ICMRT '05, Prof. Doctors also travelled to Goteborg, Sweden, to visit Chalmers University of Technology and SSPA. While there, he made a presentation on the topic *Recent Research into the Theoretical Prediction of Resistance of High-Speed Marine Craft* to the Department of Shipping and Marine Technology at Chalmers on September 6, 2005. The presentation was attended by postgraduate students and staff from Chalmers, as well as researchers from SSPA Sweden AB, which is collocated on the same campus.

Visit to AMC

On his return to Australia, Lawry visited the Australian Maritime College in Launceston in order to supervise a new series of tests on the hydrodynamics of high-speed craft which were being conducted in the newly-upgraded towing tank at the college. While there, he gave a similar presentation on his recent research to the students and staff at the AMC.

Lawry Doctors

PSFVIP5 Conference

The fifth Pacific Symposium on Flow Visualization and Image Processing (PSFVIP5) was held on 27 to 29 September on Daydream Island, Qld. Though not strictly naval-architecture focussed, it was on an island surrounded by much beautiful blue water, you had to get a boat to get to it, and one of our naval architecture staff, Dr Tracie Barber, attended.

There was a total of 64 papers presented on all aspects of flow visualization. There were five other representatives of UNSW also present at the conference (Prof. Eddie Leonardi, Ms Victoria Timchenko, Mr Terry Flynn, Dr John Olsen and Em/Prof. Brian Milton), and they presented a wide range of papers on both computational and experimental flow visualization.

Fortunately, the conference did not take all day every day, and there was sufficient time for a swim and a dive!

Tracie Barber

FROM THE CROW'S NEST

Cape Don Restoration

On a walk to Ball's Head, in between soccer matches on Gala Day, MV *Cape Don* was spotted down below at the old Coal Wharf, adjacent to HMAS *Waterhen* at Waverton. While having a reminiscent look (she berthed in Eden a number of times), one of the volunteers came by and asked if we would like to have a look over her? Sure would; sure did!

Many senior naval architects will remember *Cape Don*, *Cape Moreton* and *Cape Pillar*, a unique class of three ships purpose-built to service lighthouses and navigational aids in the Commonwealth Lighthouse Service around the Australian coastline. These vessels were designed by the Australian Shipbuilding Board and built by State Dockyard at Newcastle. *Cape Don,* the first of the class, was completed in 1963 and took up station in Fremantle. *Cape Moreton* subsequently took up station in Brisbane, and *Cape Pillar* in Melbourne.

These vessels were 74.6 m in length OA, 12.8 m beam, 4.5 m draft and had a service speed of 12.5 kn. They carried a LARC amphibian which could transport 5 t of cargo at 8 kn waterborne, or 45 km/h on land. Each carried two 2 t capacity workboats and a dinghy, and cargo was handled with a 12.5 t electric crane on the foredeck. Propulsion was by Australian-made Polar diesels, driving through controllable-pitch propellers for precision manoeuvring for buoy-handling and other services. The vessels had well-fitted workshops, and the high-quality accommodation necessary to carry technicians, buoy-service personnel, relief lighthouse crews and families, and they did sterling service for more than twenty years. They were retired and sold in the 1980s when Australian lighthouses were automated. *Cape Don* has had a chequered career since then, including a part on Sydney Harbour in the film *Low Tide*.

The MV *Cape Don* Society was formed in 2003 with the objective of restoring the vessel to full operational status as a part of the maritime history of Australia, and in accordance with maritime heritage guidelines. When restoration has been completed, the Society expects to maintain the vessel and operate her for fund-raising purposes and for research, community-assistance expeditions, and the benefit of all Society members.

She is currently berthed in Sydney Harbour, and the Society has a working weekend every second weekend. Volunteers (including ex-crew) come from far and wide, many from Canberra, and live on board while carrying out the extensive tasks involved in the restoration.

Visitors are welcome to look over the vessel; just sign the visitor's book.

For further details of the vessel and her restoration, including a host of photos of the vessel both in operation and under restoration, visit the Society's website, www.mvcapedonsociety.org.au/index.html.

AMSA's Annual Report on Port State Control

The Australian Maritime Safety Authority has published its Annual Report on Port State Control statistics for 2004. The document can be downloaded from www.amsa.gov.au/Publications/Shipping/Port_state_control_Annual_reports/PSCReport04.pdf, and makes for interesting reading.

Phil Helmore

CLASSIFICATION SOCIETY NEWS

Meeting of LR's Australian Technical Committee

The Australian Technical Committee of Lloyd's Register met on 14 October 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 2006.

Phil Helmore

Mega Container Carrier

With an innovative design study for a 13 000 TEU container ship, Germanischer Lloyd and the Korean yard, Hyundai Heavy Industries (HHI), are showing just how big container carriers will be in the near future. In front of over 100 customers at the Container Forum, Mr D.S. Cho, Executive Vice President of HHI, and Jan-Olaf Probst, Ship Type Manager for Container Ships at Germanischer Lloyd, presented their new ship design with two main engines and two propellers. All the relevant calculations have been carried out and the design completely approved by GL; the Korean yard is now accepting orders.

The ship is 382 metres long and 54.2 metres wide, and has a draught of 13.5 m. The 6 230 containers below deck are stacked in 10 tiers and 19 rows, while the 7 210 deck containers are stowed in 21 rows, for a total of 13 440 containers. Powered by two 45 000 kW engines, the vessel's speed is 25.5 kn. The design study is characterised by two technical innovations: the cooperation partners decided on a twin-drive configuration and the separation of deckhouse and engine room.

Further details may be found at www.gl-group.com/news/archiv/2005/278_8918.htm.

Georgios Spiliotis

Big Cat Lengthened at NQEA Australia

Marc Richards

Big Cat Green Island Cruises is a ferry operator based in Cairns and has two catamarans operating daily services to the rainforest-vegetated sand cay of Green Island, some 14 nautical miles off the coast.

The smaller of the two vessels is the 24 kn GRP Grahame Parker-designed *Reef Rocket* built by Norman Wright, which makes two return ferry trips daily from Cairns and one from Palm Cove to the island.

The larger vessel is *Big Cat* which was built entirely of marine-grade aluminium in 1986 by NQEA as *Quicksilver III* for Quicksilver Cruises of Port Douglas.

NQEA built six of these very successful 30 m Incat Design ferries between 1986 and 1988 for North Queensland and New Zealand.

Following the introduction of the renowned Quicksilver wavepiercers in late 1988, *Quicksilver III* was sold to a Philippines operator who then later left it abandoned in a sorry state of disrepair.

The founder of Quicksilver Cruises and current owner of Big Cat Green Island Cruises, Jim Wallace, purchased the vessel and set to work repairing, refloating and re-powering the vessel with 447 kW Cummins diesels before the long voyage back to Cairns.

NQEA and Incat Designs (now Incat-Crowther Designs) have had a very long association with Jim Wallace having designed and built six ferries and numerous reef pontoons, reef viewers and glass-bottom boats.

On arrival in Cairns, she was renamed *Big Cat* and soon entered service for the Big Cat Green Island Cruises operation.

In late 2004, NQEA was asked to investigate lengthening and modernising the vessel so as to provide a more-upmarket operation and greater passenger comfort. Big Cat's objective was to increase internal seating to 129% of the unchanged registered passenger numbers of 391, along with improvements to the interior linings, air conditioning and amenities.

To achieve this end, the refit would require a lengthening (jumboising) of the vessel by 4.8 m. NQEA contacted Incat Designs in Sydney for their assistance with structural analysis which was mainly concentrated on solutions to longitudinal strength problems associated with the lengthening.

As these early Incat vessels were designed to the DNV rules of the day, a global review of the structure to the latest rules was required, with any deficiencies highlighted for strengthening. A current lightship measurement and the mass changes for the refit were calculated.

With the vessel restricted to the Cairns to Green Island route within the USL 1D coastal area, the need to withstand the original 1C restricted offshore sea conditions was no longer required, thereby limiting the structural loads.

To achieve the required longitudinal and torsional strength, the keel area of the extension and the aft cross-beam section modulus were increased.

Design work, material purchases and prefabrication of hull and superstructure modules led up to the programmed slipping in early January 2005. From the moment the vessel was taken out of service, the operator and NQEA personnel commenced the strip-out process.

Within two days of being hauled into NQEA's main construction area on 11 January 2005, the hull and superstructure of the vessel was completely cut from top to keel at amidships, separated using the shed floor rail system, and then the prefabricated hull and superstructure modules were inserted.

The hull modules contained new pressure-tested fuel tanks and, along with other tanks in the vessel, were modified for improvement to the vessel's trim characteristics, function and capacities.

Big Cat cut in two to receive the new hull modules
(Photo courtesy Marc Richards)

A new in-hull storeroom was added forward, which necessitated a tricky transition seal with the resiliently-mounted Incat superstructure.

Most of the upper cabin-roof plating was replaced due to cracking from poorly-mounted HVAC units, handrails and

Big Cat being transferred to the slipway after lengthening
(Photo courtesy Marc Richards)

Carley float racks that were added when the vessel was operated in the Philippines.

The upper cabin windows were replaced with direct-glazed glass panes. A new suspended-ceiling system was fitted throughout, seats reconditioned, internal floor coverings replaced and rubberised-cork sheets applied to all public-access external decks.

A lightship measurement was undertaken to allow the preparation of intact and damaged stability data along with assignment of the new loadline.

On returning the vessel to the water on 21 March 2005, finishing touches and trials were completed in short time to allow *Big Cat* to return to service.

Following the first weeks of operation it was reported that there was a marked improvement in vessel speed and trim allowing the main engines to run at lower RPM and saving over 800 litres of fuel per week.

Ship Service Diesel Generator Engine Replacement

Zoran Jakšić and Murray Makin
ADI Limited

As a part of the FFG Ship Upgrade Program undertaken by ADI Limited, the first of four guided-missile frigates (FFG), HMAS *Sydney,* was upgraded with new diesels for the ship service diesel generators (SSDG) at ADI's Garden Island facility. This involved replacing the four existing Detroit 1100 kW diesel engines with four new Caterpillar 1100 kW diesel engines and the overhaul of the generators. It also involved modifications to the ship's structure and services.

The method adopted for removing the four diesel engines allowed the engines and associated generators to be removed as complete units. The new diesel engines were attached to, and aligned with, the generators in the workshop and re-installed in the ship once again as complete units. This approach provided significant cost and time savings against the traditional method.

FFG diesel engines are usually removed from the ship by uncoupling them from the generators and removing the engine complete or broken down into parts through either a small shell opening or via the ship's internal access routes. For the FFG Upgrade, the removal route of SSDG No. 2, No. 3 and No. 4 was transversely out through large openings in the ship's side. For this task ADI designed three access platforms and the associated removal equipment. When the cut out section was removed, the complete SSDGs were rolled out on skates onto the specially-designed working platforms and lifted out of the dock by crane.

Removing SSDG No. 2 through the side of HMAS *Sydney*
(Photo courtesy ADI Limited)

Due to the particular difficulty of removing SSDG No. 1 through the ship's side, the ADI Design team decided to remove the SSDG No. 1 and associated foundation and shell plating through the bottom of the ship adjacent to the keel. According to the US Navy this was the first time in the world that SSDG No. 1 has been replaced in an FFG by this method.

The ADI team designed lifting and removal arrangements and determined the cut-out section at the bottom of the ship which allowed the SSDG to be precisely and successfully removed together with the foundation and the section of the ship hull as one piece to the dock floor.

Reinstalling SSDG No. 1 through the bottom of HMAS *Sydney*
(Photo courtesy ADI Limited)

Hull Infusion at Perry Catamarans

Peter Holmes

Perry Catamarans has recently introduced resin infusion as a production process for their luxury 13.1 m sailing catamarans. Resin infusion is the process where the material is laid on the mould dry and then resin is introduced under vacuum.

Over the past year, Perry Catamarans has conducted extensive research into resin infusion in order to qualify the process as a robust production system. Various flow media, resins and manifold systems were trialled on test panels. These panels were then analysed by the University of Southern Queensland. The results showed that not only were the infused panels significantly lighter, they also had almost double the stiffness and strength of a hand-laminated panel, due to a lower resin-to-fibre ratio.

Vacuum bag and manifold arrangement
(Image courtesy Perry Catamarans)

After particular manifold and media configurations were selected, the process was used on small parts for the vessels. These parts provided new challenges as resin flows differently around features compared with a flat panel. The process was then used on larger parts such as bulkheads, and, recently, the outer hull was infused.

The outer hull consisted of both solid and sandwich sections, and was originally laid up with a combination of chopper gun and hand lamination. When infusion was used for the same job, it could be completed all at one time, which reduced the overall production time for the part. The final weight of the infused part was found to be 40% less than that of the manually-laid hull. The quality of the laminate was excellent and was inspected by an approved ship designer.

Following the successful infusion of the outer hull, Perry Catamarans is planning to infuse the entire hull. Over the following year they plan to infuse all parts used in the production of their 13.1 m sailing catamaran.

The infusion process has proved to produce higher-quality laminates and has increased the work flow at Perry Catamarans. The process has also resulted in a much cleaner work environment. The reduced resin emissions benefit not only the employees but also the environment.

Outer-hull infusion in progress (right)
(Image courtesy Perry Catamarans)

TRAFALGAR — 200 YEARS ON

On 21 October 1805, a British fleet, under the renowned Lord Horatio Nelson, attacked and defeated a more-numerous French and Spanish combined fleet off Cape Trafalgar on the Spanish coast. By the end of the day Nelson's fleet, with 27 ships of the line, had destroyed or captured 17 enemy ships, although Nelson himself died of wounds. The story of this action rapidly grew into a British naval legend which, by the late 19th century, was seen to be the quintessential example of a decisive naval battle; one that resulted in over one hundred years of British naval supremacy. This is the story that has been accepted by innumerable school children and naval strategists alike; however, as with many historical tales, elements of myth and propaganda have had a large influence on how many perceive these events.

The Battle of Trafalgar was only one action during the Napoleonic Wars of 1803–1815 which, themselves, formed the final chapter in the long struggle between the French and the British for maritime supremacy. During 1805 Napoleon prepared to invade Britain, assembling a flotilla capable of transporting 100 000 troops across the English Channel. The British responded with a close blockade of ports along the French Atlantic coast by ships of the Channel Fleet under Sir William Cornwallis. Ships of the line blockaded the major elements of the French fleet at Brest and Rochefort, while gunboats and smaller vessels blockaded the invasion force. For as long as Cornwallis's fleet controlled the Channel, Britain was safe from invasion. The central strategic importance of this blockade has often been lost in public perception, even though it has been well understood by naval strategists:

Never in the history of blockades has there been excelled, if ever equaled, the close locking of Brest by Admiral Cornwallis, both winter and summer, between the outbreak of war and the Battle of Trafalgar [1].

Even prior to 1805, Nelson was a British national hero, and it was his previous experience and daring character that led to his appointment as the commander of the Mediterranean Fleet in June 1803. His task was to blockade the French fleet at Toulon and their Spanish allies at Cadiz, while protecting British sea communications and Britain's allies in the Mediterranean. In March 1805 the Toulon Fleet, under Admiral Pierre Villeneuve, broke out past Nelson's blockade and sailed to the West Indies. The French plan to use what is now described as *manoeuvre warfare* [2] to distract the blockading British fleets, and to combine all available French and Spanish forces in support of the projected invasion of Britain, was unsuccessful. Following Villeneuve's return to Cadiz in August, and the failure of the French fleet to break Cornwallis's blockade of Brest, Napoleon realised that an invasion of Britain was no longer feasible. In a surprise strategic move, he ordered his *Grande Armée* towards the Austrian frontier and began the series of successful land campaigns which ultimately conquered much of continental Europe.

Napoleon now ordered Villeneuve to enter the Mediterranean and land troops near Naples. In naval terms, this order to land an expeditionary force along a coast that was defended by strong naval forces was clearly extremely risky. Napoleon, however, was quite specific on what he required when he ordered Villeneuve 'not to hesitate to attack superior or equal forces and to engage in fights *à outrance.* The Emperor would not count the loss of ships so long as they were lost with Glory!'[3] The combined French and Spanish fleet sailed from Cadiz on 19 October 1805.

A fine painting of Nelson's flagship HMS *Victory* by the late David Davies. The painting was recently presented to the Royal Sydney Yacht Squadron by the artist's widow Mrs Marlene Davies (Reproduced courtesy RSYS)

Maintaining his open blockade of Cadiz, Nelson was promptly informed of the fleet's departure and was able to make all necessary preparations for a fleet action off Cape Trafalgar. The details of the battle, including the subsequent death of Lord Nelson 'at the moment of his greatest victory', need not concern us too much here. It should be recognised that, at the time of Trafalgar, the British nation had been fighting an exhausting and at times bitter war against France for almost twelve years, and was to continue to fight Napoleon for at least another twelve. Nelson's role as a national hero was important for British morale, as was the image of sailors and officers bravely fighting tooth-and-nail against everything that the resourceful enemy could throw at them. Both images must have contributed to the national war effort, as well as helping to counter the economic strain that the war was causing within the civilian community.

The loss of 18 French and Spanish ships of the line — about 20 per cent of the total — would have been significant in the short term, but the French shipbuilding capabilities, when combined with their allies and the increasing economic assets under the Napoleonic empire, allowed these ships to be rapidly replaced. The human casualties of the battle would have been much harder to replace, as the French suffered from a shortage of experienced mariners. The French tried to overcome this shortcoming by the use of marine conscripts who, if somewhat short of marine skills, were mostly enthusiastic. Given such evidence, Brian Tunstall's summary of the outcome of the battle appears more apt than the generally-accepted panegyric: 'superficially, at any rate, the Battle of Trafalgar appears to have been one of the

less important events of the war. Only a small part of Bonaparte's naval forces were destroyed, and only one-sixth of the total British ships of the line were actually engaged.'[4] No single naval battle can be decisive by itself, as it is not possible for naval forces to permanently secure possession of the sea in the way that it is possible to take land in a military context. Control of the sea, including the control of sea communications, is a fleeting condition that enables a maritime force to make use of the sea, but not to possess the sea.

Some past naval strategists suggested that the main aim of naval strategy is to seek out and destroy the enemy, to fight what Nelson called 'a close and decisive battle'. Mahan believed that 'in war the proper main objective of the navy is the enemy's navy', and that 'the fleet should strike at the organised force of the enemy afloat, and so break up the communication between his ports.'[5] Such statements are open to misinterpretation and, historically, may have led some rash naval commanders to take excessive risks by seeking a decisive naval victory. The public's obsession with naval battles is partly due to the works of naval historians who, at least during much of the 19th and early 20th centuries, recorded battles without linking them to the strategy of the war in which they were waged. This was recognised by the 1940s:

'The result has been that the British nation, as a whole, has tended to concentrate its attention and memory on historic battles, and to look on them as having won the war, instead of being mere incidents in the general war strategy. This relation between battles and strategy is amply proved by the fact that, during the war of the French Revolution and the Napoleonic wars, which lasted on and off for twenty years, only six battles of first-class importance took place: the Glorious First of June, Camperdown, St. Vincent, the Nile, Copenhagen and Trafalgar. Yet the same strategy underlay all our dispositions throughout the twenty years of war, and it was due to our unfaltering adherence to that strategy, rather than to battles, that the war was won.' [6]

For modern navies, sea battles are only decisive when they form part of a strategy that utilises sea control to subsequently influence events on land. In modern parlance, the application of one's naval strength directly against an enemy's strength forms the basis of *attrition warfare*.[7] When success in war at the operational and strategic levels depends on the ability to destroy or deny the enemy critical resources faster than they can recover, classic attrition warfare techniques are being employed. In this context the Battle of Trafalgar may be seen as one conflict within the broader naval war of attrition that was waged for many years and ultimately secured British sea communications across the globe.

During the Napoleonic Wars, the Royal Navy successfully implemented strategies for controlling its own sea communications and denying the use of the sea to its enemies. Not shying away from battle when it had tactical advantage, the Royal Navy was able to sustain effective control of the sea for much of the period and ultimately to assist, through maritime power projection operations, the decisive land campaigns that led to Napoleon's overthrow. 'Sea power is attritional, with battles and campaigns forming part of the gradual, cumulative process that wears down an enemy's resources and creates a dominant position at sea that can be turned to strategic advantage.'[8]

This re-evaluation of Trafalgar should not be seen as denigrating the bravery and discipline of the many sailors — British, French and Spanish — who fought and died during the battle itself. The death of the legendary commander, Lord Nelson, along with the fact that Trafalgar was the last fleet action of the Napoleonic Wars, became linked in the imagination of the British nation to the idea that the Royal Navy had effectively gained control of the seas in a single, decisive battle. At long last, and in many minds, the natural destiny for the British peoples had been achieved: Britannia was seen to 'rule the waves'.

In recognition of Trafalgar's place in history, the Royal Navy arranged a number of international activities to mark the 200th anniversary of the Battle of Trafalgar, and the RAN participated in the activities organised during the UK summer. HMAS *Anzac* represented Australia among the 40 navies present at the International Fleet Review (IFR) and subsequent International Festival of the Sea in Portsmouth, UK during June 2005. *Anzac* was also second in the column of six warships which conducted a steam-past of Her Majesty the Queen to conclude the IFR.

1 A. T. Mahan, *The Influence of Sea Power upon the French Revolution and Empire, 1793-1812* - Volume II, Little, Brown and Co., Boston, 1892, p. 126.

2 'A war-fighting philosophy that seeks to defeat the enemy by shattering their moral and physical cohesion — their ability to fight as an effective, co-ordinated whole — rather than by destroying them physically through incremental attrition' Royal Australian Navy, *The Navy Contribution to Australian Maritime Operations* (RAN Doctrine 2 — 2005), Defence Publishing Service, Canberra, 2005, p. 246.

3 P. Padfield, *Nelson's War,* Hart-Davis & MacGibbon, London, 1976, p. 172.

4 B. Tunstall, *Naval Warfare in the Age of Sail: The Evolution of Fighting Tactics, 1650-1815,* Conway Maritime Press, London, 1990, p. 173.

5 A. T. Mahan, *Naval Strategy,* Sampson Low, Marston & Company, London, 1911, p. 199.

6 R. Bacon, *Modern Naval Strategy,* Frederick Muller, London, 1940, pp. 65-6.

7 'A style of warfare characterised by the application of substantial combat power that reduces an enemy's ability to fight through the loss of personnel and equipment. It is a concept which relates to maritime warfare at the operational and strategic levels, since by their nature successful tactical actions in the maritime environment generally achieve destructive effect.' Royal Australian Navy, *Australian Maritime Doctrine* (RAN Doctrine 1 — 2000), Defence Publishing Service, Canberra, 2000, p. 141.

8 A. Lambert, *War at Sea in the Age of Sail, 1650-1850,* Cassell, London, 2000, p. 17.

Reproduced from Semaphore *Issue 15, 2005, published by the RAN Sea Power Centre — Australia.*

THE ROYAL AUSTRALIAN NAVY HERITAGE CENTRE

On 4 October 1913, the ships of the new Australian Fleet Unit sailed into Sydney Harbour for the first time. On 4 October 2005, the Royal Australian Navy reached another major milestone with the opening of the RAN Heritage Centre (RANHC). The need for such a facility has been recognised for many years. In 1922, Vice Admiral Sir William Creswell, the RAN's first professional Head suggested the building of a museum to permanently display the Australian Navy's already rich and unique heritage. Since then, there have been several attempts to establish an international-standard naval museum. The origins of what is now about to become the RANHC date from 2001, when the then Chief of Navy commissioned a Naval Heritage Management Study to examine in detail how the RAN's past might best be used to support the present Navy's goals. One of the most important recommendations was the creation of a facility for the public display of the Naval Heritage Collection (NHC). Once approval for funding was received, a RANHC Project Board was formed and the project began on 24 May 2004.

MISSION AND DESIGN

The RAN believes it is important that all Australians have the opportunity to understand their Navy's valuable contribution to the development and security of the nation. The NHC contains more than 250 000 individual items, and the mission of the RANHC is to display those objects of museum standard to the public and, through these displays, capture something of the Australian naval experience. The Centre is located within the Public Access Precinct at the northern end of Garden Island, Sydney, and makes use of two National Estate-listed buildings: the former Gun Mounting Workshop (1922) and the Garden Island Boatshed (1913). The precinct also includes a landscaped external exhibition space between the two buildings.

In its design, the Centre seeks to retain the industrial and naval feel of the buildings, while providing a museum facility with multi-function capability. In addition to the exhibition galleries, the RANHC includes an indoor/outdoor café, an education and small-conference facility named the *Tingira* Room, and an exhibition space for naval and ship associations to use. Both the *Tingira* Room and the café/Large Technical Item display area will also be available for hire.

EXHIBITION THEMES AND DISPLAYS

The overall theme of the initial exhibition is *Australia's Navy in Peace and War.* The two main exhibition themes are *Business on Great Waters* and *A Sailor's Life For Me.* The first of these emphasises the history of the sea-going Navy, while the second tells the story of the RAN's people and highlights the traditions that still underpin our professional fighting Service.

The Displays

The displays have been developed to provide visitors with a contrasting portrayal of events and elements, ranging over more than 100 years of Australian naval history. Some displays are chronological, but most are thematic and emphasise the uniqueness of naval service. The size and variety of items held by the NHC allows for the rotation of displays over an extended period. The initial displays will include:

The Battle of Sydney: This centres on the conning tower from one of the Japanese midget submarines which attacked Sydney Harbour on the night of 31 May – 1 June 1942, and also includes the Boom Boat belonging

The RAN Heritage Centre at Garden Island in Sydney
(Photograph John Jeremy)

to the Maritime Services Board which first raised the alarm. The display is supported by an interactive audio-visual presentation, *In Which We Serve.* This is a large chronological display of items which tell the stories of famous Australian ships and their battles. Artefacts are included from the colonial era, the First and Second World Wars, the Cold War and more recent operations in the Persian Gulf.

The Professions of a Navy: This is a large thematic display focusing on how the Navy's people have 'done the job' at sea over the years. Branches and categories past and present are used to explain how the naval profession has changed and developed.

Naval Technology and Ordnance: A specific display illustrating how the Navy has developed and applied technology to the sea-fighting environment. It includes precision instruments for navigation and gunnery, in addition to examples of naval ordnance ranging from shells and torpedoes to modern guided missiles.

The Bridge: This is a mock-up of a Battle-class destroyer's open bridge, and is one of the major interactive displays in the Centre. Using original equipment from 50 years ago, *The Bridge* is aimed at helping visitors acquire some experience of what takes place on a warship's bridge at sea.

A Sailor's Life for Me: This main exhibition display uses the entire mezzanine level of the workshop building, and provides visitors with an introduction to a sailor's life at sea. The display includes a mock-up of a WWII mess deck, as well as artefacts highlighting naval traditions and pastimes.

The Periscope: Those who serve beneath the waves have not been forgotten and, in a unique interactive display, a fully-operational submarine attack periscope has been installed to allow visitors an unusual view of Sydney Harbour.

Boats and Dockyards: The 1913 Boatshed has been dedicated as the display gallery for artefacts related to small boats and Australian dockyards, particularly Garden Island.

The RANHC will be open from 0930 to 1530 daily. The Centre and Garden Island Public Access Precinct will be closed on Good Friday, Christmas Day, Boxing Day, New Year's Eve and New Year's Day.

Entry is free to all areas of the RANHC and Garden Island Public Access Precinct except for the Special Exhibition Gallery, where a fee of $5 will be applied. Revenue raised at the RANHC will go directly to conserving, restoring and exhibiting the Collection nationally.

The RANHC shares a fence line with Garden Island Dockyard and the need to ensure visitor safety and maintain the security of the operational areas of the dockyard is a priority. Consequently, there is no direct pedestrian or private vehicle access to the Centre.

Pedestrian visitors can access the RANHC via the Circular Quay-to-Watson's Bay ferry, which will stop at the Garden Island Ferry Wharf during opening hours. Organised tour groups visiting the Centre will be permitted to transit Garden Island Dockyard in their own bus. However, passengers may not disembark until they are inside the Public Access Precinct. Additionally, private vessels will remain prohibited from entering the Naval Waters around Garden Island.

Reproduced from Semaphore *Issue 14, 2005, published by the RAN Sea Power Centre — Australia*

THE PROFESSION

NMSC has Moved

As advised in the August issue of *The ANA*, the National Marine Safety Committee has moved offices. However the new address, [*lifted directly from the June 2005 issue of* Safety Lines - Ed.], turned out to be incorrect. The correct contact details are as follows: Level 5, 9–13 Young St, Circular Quay. The new mailing address is PO Box 1871, Royal Exchange 1225. Phone and fax numbers are (02) 9247 2124 and 9247 5203, respectively. You might like to ensure that your address book is correct.

Taga Faasisila

Australian Builders Plate

NMSC has agreed that all jurisdictions will work to introduce the Australian builders Plate (ABP) for the nation's recreational boats into legislation by 1 July 2006.

Most new recreational boats will be required to carry the ABP, which carries information regarding the maximum number of passengers, engine capacity and flotation. Two types of ABP have been developed, one for boats under six metres in length which includes a buoyancy statement, and one for boats of six metres in length or more which does not include a buoyancy statement. Some manufacturers are already fixing plates to their boats.

Boats excluded from having an ABP include amphibious vehicles, canoes, kayaks or surf skis, pedal-powered boats, rowing shells, sailboards or sail kites, oared surfboats, hydrofoils and hovercraft, sailing vessels, submersibles, aquatic toys, personal watercraft and inflatable boats in certain conditions.

A number of important amendments have been approved after consultation with industry:

- If a build date is detailed in the plate, then it consists of the year in which the boat was built, and no longer requires the month to be shown.
- The name of the standard used to determine the information shown on the plate is also to be shown on the plate, e.g. "Information determined — AS 1799".
- The definition and symbols for maximum load have been clarified. NMSC notes that this is a significant amendment, and industry will need to be advised appropriately.

Only the boat builder, importer, or competent person, who must be legal entities in Australia, can approve details on the ABP.

Safety Lines, September 2005

Public Comment Open on Stability Section of NSCV

The National Marine Safety Committee (NMSC) is seeking feedback from the maritime industry and members of the public on the intact stability subsections of Part C Section 6 of the National Standard for Commercial Vessels (NSCV). The aim of the stability project is to develop a national standard based on performance criteria which can be implemented by all of Australia's marine authorities on a consistent basis.

NMSC's CEO, Ms Maurene Horder, confirmed that this was an opportunity for industry and those interested to have a voice in how the intact stability subsections are further developed. "We are very keen to hear from a wide variety of industry members such as naval architects, engineers, designers, boatbuilders and shipwrights, as well as those involved with operating commercial vessels, since we have had limited external feedback so far," she said. "These NSCV subsections have been developed by a reference group made up of marine surveyors who have drafted the documents with input gained in consultation with industry practitioners."

The NSCV's stability component provides a framework for determining and assessing a commercial vessel's stability characteristics. Ms Horder explained that, since stability tests are applied to new vessels, 650 vessels each year or 5 percent of the total Australian commercial fleet, would be impacted once the new standard was introduced. "The most likely results of vessel instability are capsize or sinking with poor design, poor loading or overloading the main causes. We have limited available data on stability however, one of our studies found that, in the cases of deaths of commercial fishermen, 40 per cent of incidents were classified as being associated with a stability problem," she said.

Ms Horder said that for ease of reference, the compliance criteria have been detailed in a separate subsection from the tests and calculations; however, both must be read as one to gain a full picture of the stability requirements.

Subsection 6A, Intact Stability Requirements, deals with the minimum stability performance criteria for all types of commercial vessels. It also includes specifications for providing draught marks on these vessels and for the presentation of stability information in a stability book, and in a simplified manner for use (when appropriate) on suitable vessels.

Subsection 6B, Intact Stability Requirements, specifies the tests and calculations required to establish compliance with the criteria contained in Subsection 6A, including their associated test reports and the specification of lightweight [*lightship* - Ed.] survey.

Ms Horder explained that the NMSC has highlighted within these documents where comment is particularly sought. "For example, we would like to hear opinions about changes to the categories used to describe how stability criteria and tests are applied to vessels — possibly the single most significant change to the standard. This new standard has consolidated the number of stability categories used, from the USL code's nine, down to three categories that now apply to Class 1, Class 2 and Class 3 vessels."

Ms Horder added that public comment is also sought on the Regulatory Impact Statement, available from 30 October 2005, which identifies the economic and social impact of applying these stability subsections.

The National Standard for Commercial Vessels is the principal technical standard for commercial vessels and will gradually replace the Uniform Shipping Laws Code. It provides a common national standard for the design, construction, crewing and operation of vessels in Australia's domestic fleet.

The draft Stability Section of the NMSC is available for download from www.nmsc.gov.au, or in hard copy (200 pages) by phoning the secretariat on (02) 9247 2124.

For further information, contact CEO Maurene Horder or Communications Officer Ursula Bishop on (02) 9247 2124.

Public comment is open until 10 January 2006; so don't delay, get your copy and comment today!

Public Comment Coming on Fast Craft Section of NSCV

The National Marine Safety Committee (NMSC) will be seeking feedback from the maritime industry and members of the public on a draft standard for Category F2 Fast Craft, part of the National Standard for Commercial Vessels (NSCV). The draft of Part F Subsection 1C for Category F2 fast craft and a Regulatory Impact Statement will be available for public comment early in the New Year.

A fast craft is defined as a domestic commercial vessel, capable of a speed 25 knots or more when fully laden, whilst a Category F2 fast craft is one which carries more than 12 passengers and which does not exceed 35 metres in length.

NMSC CEO, Maurene Horder, explained that the new standard would apply to new vessels operating in services similar to the Manly Jetcats, Rottnest Island ferries, some of the ferries which operate on the Great Barrier Reef, large high-speed diving boats and large thrill-ride boats. "Current standards for domestic commercial vessels in Australia do not address the special risks associated with craft that operate at speed," she said. "The aim of the new standard is to provide levels of safety on fast craft that are comparable with those on vessels which operate at slower speed while, at the same time, minimising the burden on industry."

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

Ms Horder said that Australia is a world leader in the design and construction of high-speed ferries. "An effective and practical Australian domestic standard can maintain and enhance this position. "We are keen to hear from industry on their opinions of this draft fast craft standard," she said.

For further information, contact CEO Maurene Horder or Communications Officer Ursula Bishop on (02) 9247 2124.

Ursula Bishop

NSCV Update

The following summarises where the various sections of the National Standard for Commercial Vessels (which have been worked on recently) are up to in their implementation:

Part C Section 4 — Fire Safety

This section has been completed and is available on CD or for download from the NMSC website.

Part C Section 5B — Electrical (Edition 2)

The revised edition of this section has been referred to the Australian Transport Council for approval prior to publication.

Part C Section 6A/6B — Intact Stability

Available for public comment now.

Part C Section 7A — Safety Equipment (Amendment 1)

An amendment relating to the carriage of liferafts in waters of temperatures below 15°C has bee referred to the Australian Transport Council for approval prior to publication.

Part D — Medical Standards

NMSC is reviewing the AMSA, rail and NSCV requirements to check on common requirements and achieve harmonisation of standards.

Part F Section 1C — Category 2 Fast Craft

This section is due for release for public comment early in the new year (see article above).

Implementation of the NSCV

The NMCS is working on a national regulatory framework for commercial vessels, and this is due out for public comment in early 2006.

Safety Lines, September 2005

INDUSTRY NEWS

Maxsurf Version 11.1 Released

Formation Design Systems, authors of the widely-used Maxsurf ship design and analysis software, have announced the release of Version 11.1 of Maxsurf. In the latest release, FDS has focused on providing additional tools which will enable users to quickly prototype and optimise hullforms.

Hullspeed is the resistance prediction tool in the Maxsurf suite, and includes a comprehensive range of regression-based methods for a variety of monohull vessel types. In the latest version, FDS has added a theoretical wave resistance prediction method, based on Michell's integral and suited for slender monohull and multihull designs. Using the same theory, Hullspeed is now able to predict the waves generated by these vessels and provide effective visualisation of the results.

Computational fluid dynamics (CFD) has become a widely-accepted tool for predicting ship resistance. For users requiring CFD calculations, Maxsurf's Hydrolink data-exchange module now supports export to the ShipFlow (CFD package) file format.

The additional tools and interfaces described above become even more powerful when coupled with the parametric transformation tool in Maxsurf. This enables the rapid generation of a systematic series of hullforms from a parent hull. The series can then be rapidly analysed in Hullspeed and Seakeeper for performance comparisons.

Workshop, the structural modelling program in Maxsurf, continues to be enhanced in Version 11.1 with the ability to define both open frames and frames with varying web depth. A parametric design philosophy is maintained, allowing concurrent design practices. e.g. the primary structure can be defined while the hullform is still undergoing refinement; once the hullform is completed, the frames and other structural elements are automatically recalculated. Another improvement is the way in which longitudinal stringer cut-outs in frames are stretched to take account of local hull shape. Instead of straight scaling, cut-outs are scaled so that circular arcs remain circular (rather than becoming elliptical), which is important for NC cutting.

The Workshop link with ShipConstructor has also been enhanced, with the provision of production-ready frame data and accurate definition of hull stiffener locations

Further details may be found on the FDS website, www.formsys.com.

ShipConstructor to Support STEP Import and Export

It was announced in October that Albacore Research Ltd. (ARL), the creator of ShipConstructor™, the 3D product modeling software for the design and fabrication of ships and offshore structures, and Industrial Planning Technology, Inc. (IPT) are cooperating on the development of a translator that will enable ShipConstructor to import and export STEP files containing pipe, HVAC, and equipment data. This technology will significantly enhance ShipConstructor's interoperability in large shipyard environments, allow organisations to more easily access legacy data, and simplify the long-term storage and retrieval of archival product model data throughout the entire product lifecycle. IPT is developing the translators using the all-new ShipConstructor Application Programming Interface (API) creating intelligent distributed system objects directly in the ShipConstructor Product Model Database.

STEP is an international, non-proprietary standard for the exchange of product model data. Its intent is to help reduce the costs and improve the quality of data translation throughout a product's lifecycle, between different organizations involved in the product's lifecycle, and between physically dispersed sites within an organisation. STEP was first introduced in 1994 and is now widely used by many of the world's largest manufacturers.

Recognizing the importance of STEP to the shipbuilding industry, the US Office of Naval Research and the US National Shipbuilding Research Program awarded a Small Business Innovation Research grant to IPT in May. The goal is to develop a set of software tools which use STEP to help reduce the costs of pipe production for ships. Foremost among these tools is the development of STEP import/export capabilities for ShipConstructor.

Initially, IPT will develop a translator which enables ShipConstructor to import and export STEP files containing pipe, HVAC, and equipment data. IPT will also develop complementary tools that allow pipe shops to use STEP data most effectively. Subsequent development of the translator will focus on additional data types, such as ship hull moulded forms and ship structures.

Unlike other file formats and data transfer mechanisms, the STEP format can support an unlimited range of data, including geometry, topology, tolerances, relationships, attributes, assemblies, configuration, and more. By overcoming the limitations of proprietary CAD formats, STEP can provide a seamless exchange of product model data between design, analysis, and manufacturing systems. STEP can also help an organisation unlock its wealth of legacy data, by acting as a reliable data transfer mechanism between older proprietary CAD systems and modern product-modeling systems like ShipConstructor.

The STEP translator will be released as an integrated component of ShipConstructor in the Northern spring of 2006. Further information regarding ARL and its ShipConstructor software can be found at www.ShipConstructor.com.

Wärtsilä Propulsion for New Zealand Project Protector

Wärtsilä Corporation will supply the propulsion systems for the seven-vessel Project Protector of the Royal New Zealand Navy.

The main contractor for the project is the Australian defence supplier Tenix Defence, on behalf of the New Zealand Ministry of Defence. The project is for the supply of seven vessels: a 131 m multi-role vessel (MRV), two 85 m offshore patrol vessels (OPV) and four 55 m inshore patrol vessels (IPV). They will be delivered from December 2006 onwards.

The vessels are intended for military and civilian roles in New Zealand's Exclusive Economic Zone, in the South Pacific and the Southern Ocean. As well as serving their military roles, they will conduct tasks for and with NZ Customs, Department of Conservation, Ministry of Agriculture and Forestry, Ministry of Foreign Affairs and Trade, Ministry of Fisheries, NZ Maritime Safety Authority and the NZ Police. The vessels will be used for sea-lifting personnel and cargo, emergency response, and fisheries and customs patrols. Both the MRV and OPVs will be strengthened to ice class 1C for service in the Ross Sea off Antarctica, and will also carry helicopters. The MRV will have a ro-ro capability with both stern ramp and side door for light armoured vehicles and other equipment, and will be equipped with two landing craft.

The 131 m-long MRV is being supplied to Tenix by the Merwede Shipyard in the Netherlands. It will be powered by two nine-cylinder in-line Wärtsilä 32 engines with a combined power output of 9000 kW. Wärtsilä is also supplying twin Lips 4D1000 controllable-pitch propellers, two Lips CT175H transverse thrusters, one forward and one aft, and Deep Sea Seals sterntube bearings and seals.

The OPVs and IPVs will be constructed at Tenix shipyards in Australia and New Zealand. To these ships Wärtsilä will supply Lips controllable-pitch propellers, shaftlines and Deep Sea Seals sterntube and bulkhead seals. The 85 m long OPVs will each have two Lips 5C09 propellers and a Lips CT150H bow thruster, along with Deep Sea Seals sterntube seals and bulkhead seals. The 55 m long IPVs will each have two Lips 4D550 propellers and Deep Sea Seals sterntube seals.

The availability of local support both in Australia and New Zealand, and the excellent through-life cost performance and high reliability of the Wärtsilä products were major factors in helping Wärtsilä to win these contracts. Wärtsilä is proud to now be one of the major propulsion suppliers of the Royal New Zealand Navy.

The offshore patrol vessels to be built by Tenix Defence for the Royal New Zealand Navy will be equipped with Wärtsilä propulsion systems
(Image courtesy Wärtsilä)

Incat Designs (Sydney) and Crowther Designs Announce Merger

Two of the world's foremost designers of high speed catamaran vessels are pleased to announce a merger that will see these second generation businesses join forces under the new name of Incat Crowther.

In a joint statement by Ben Hercus and Brett Crowther, both said they were very excited by the merger and could see enormous benefits to their ship owning and ship building customers.

"We believe the merger will provide all our customers with improved service and stronger design expertise", both said.

The history of both companies is long and greatly admired. Incat Designs with Phil Hercus built an industry-leading design firm which has produced over 170 boats for worldwide service. Many of these designs were industry firsts and included the revolutionary wave-piercing catamaran.

Crowther Design traces its roots back to Lock Crowther, who was a pioneer in applying proven catamaran sailing design technology to high-speed catamaran ferries and work boats. Derivatives of his bulbous bow catamaran hull form are now used extensively in the industry. In modern times, Crowther Design has become well known for its large range of successful commercial vessels which number in excess of 130. [*Elders of the tribe also remember with affection his ground-breaking sailing trimarans,* Kraken *and* Bandersnatch*, towing water-skiers* — Ed.]

The key staff from both organisations are being maintained with Brett Crowther as Managing Director, Ben Hercus as Commercial Director, Andrew Tuite as Technical Director and Philip Hercus taking the role of Senior Adviser.

Ship owners and builders will still be able to specify a Crowther or an Incat design depending on their individual tastes; however, over time the best features of both designs will eventually combine, leading to a superior product while still allowing customers to specify individual requirements.

The merged venture is starting with a strong order book, with vessels being designed for North America, Australia, New Zealand and Asia.

For more information contact:

Brett Crowther, Managing Director, tel. (02) 9450 0447 ext 3, mob. (0419) 265 944, or email brett@incatcrowther.com.

Ben Hercus, Commercial Director, tel. (02) 9450 0447 ext 4, mob. (0410) 600 119, or email ben@incatcrowther.com.
or visit their website, www.incatcrowther.com.

Wärtsilä Propulsion Systems for Chilean Coast Guard Patrol Vessels

Wärtsilä Corporation won a contract in August to deliver complete propulsion systems for two 80 m offshore patrol vessels of Fassmer design for the Chilean Coast Guard.
Each patrol vessel will be equipped with two 12-cylinder Wärtsilä 26 main engines having a combined power of 8160 kW at 1000 rpm for a maximum speed of more than 20 knots. The engines will each drive a Wärtsilä Lips controllable-pitch propeller through a single-input Wärtsilä reduction gearbox. Wärtsilä will also supply the control systems for engines and propellers, plus Wärtsilä Deep Sea Seals sterntube seals. The first ship set of equipment is due for delivery to Chile in early 2007.
The patrol vessels will be built at the ASMAR Talcahuano shipyard and are due for commissioning in 2008 and 2009. They will be employed by the Chilean Coast Guard to conduct interdiction and security operations up to 200 n miles from shore. The vessels will be owned and operated by the Coast Guard, a branch of the Chilean Navy.

The offshore patrol vessels for the Chilean Coast Guard will be equipped with complete Wärtsilä propulsion systems.
(Image courtesy Wärtsilä)

Wärtsilä's Sulzer RT-flex50 Engines Successfully Tested

The first two of the latest Sulzer RT-flex50 common-rail marine engine type developed by Wärtsilä Corporation, have successfully completed official shop tests and class type approval tests at Wärtsilä's licensee Diesel United Ltd in Japan.

With five to eight cylinders, the Sulzer RT-flex50 low-speed marine diesel engine covers a power range of 5800 to 13 280 kW at 99 to 124 rpm. It is thus ideally suited to the propulsion of bulk carriers in the Handymax to Panamax size range, product tankers and feeder container vessels.

The Sulzer RT-flex50 is based on the Sulzer RTA50 engine jointly developed by Wärtsilä and Mitsubishi Heavy Industries Ltd in Japan. Instead of the traditional camshaft-controlled systems of the RTA50, the RT-flex50 incorporates the latest electronically-controlled common-rail technology for fuel injection and valve actuation.

Overall, the Sulzer RT-flex50 engine is designed to meet the market needs for outstanding reliability, high efficiency, compactness, optimised industrialisation, and environmental requirements. As with all new marine engines nowadays, it is fully compliant with the NOx emission regulation of Annex VI of the MARPOL 1973/78 convention.

Two six-cylinder engines were involved in the tests at Diesel United's works in Aioi, Japan, each with a contracted maximum continuous power of 9720 kW at 124 rpm. The first engine completed its official shop tests on 21 July 2005 after a comprehensive programme of testing as is usual for a new engine design.

The second engine completed its official shop test on 13 August 2005. In the presence of representatives from the principal classification societies, it also successfully passed the type-approval tests for Sulzer RT-flex50 engines and for the WECS-9520 electronic control system which is now incorporated in Sulzer RT-flex engines.

The first 6-cylinder Sulzer RT-flex50 engine is for export to Korea for a 37 000 tdw product tanker under construction at Hyundai Mipo Dockyard Co Ltd. The second 6-cylinder RT-flex50 engine will be delivered to Shanghai Edward Shipbuilding Co Ltd in the People's Republic of China for installation in a 19 625 tdw cargo vessel.

The new Sulzer RT-flex50 has been well received by shipowners. Altogether there are already 28 Sulzer RT-flex50 engines on order for newbuildings contracted with shipyards in China and South Korea for a variety of owners in China, Greece, Scandinavia, India and the Netherlands. They comprise two seven- and 26 six-cylinder engines, the newbuildings being 20 000 to 53 800 tdw bulk carriers and 37 000 to 52 000 tdw product tankers and LPG carriers.

The RT-flex50 is the latest Sulzer low-speed marine engine type to incorporate the unique RT-flex common-rail technology. A total of 205 RT-flex engines have been ordered, aggregating to some 8.9 million kW. These include all Sulzer RT-flex engine types, from 500 to 960 mm cylinder bore, with individual engine powers up to 80 080 kW. The first RT-flex engine entered service in September 2001 and has accumulated some 21 000 running hours.

Principal characteristics of Sulzer RT-flex50 marine diesel engines are as follows:

Cylinder bore	500 mm
Piston stroke	2050 mm
Stroke/bore ratio	4.1: 1
Power, R1 MCR	1660 kW/cylinder
Speed range, R1-R3	99-124 rpm
Numbers of cylinders	5 to 8
Power range	5800-13 280 kW
BSFC at full-load R1 rating	171 g/kWh

Wärtsilä Diesel-electric Power for Heavy-lift Conversions

Wärtsilä diesel-electric propulsion plants of 11.5 MW were ordered in August for two heavy-lift transport vessels to be converted for Fairmount Heavy Transport NV, an associated company of the Rotterdam-based towage contractor, Fairmount Marine BV.

Fairmount Fjord and *Fairmount Fjell* were originally semi-submersible barges and are being converted to self-propelled heavy-lift transport vessels. When the conversions are completed in the second half of 2006, the vessels will be primarily employed in the transport of offshore equipment such as jack-up and semi-submersible drilling rigs, and floating production units for the offshore oil and gas industry. With this type of vessel, the cargo is loaded and unloaded when the vessel is ballasted down to a semi-submerged condition. The cargo is then floated on and off the vessel's large open cargo deck.

Fairmount Fjord has dimensions of 164.3 m length between perpendiculars, 45.5 m breadth and 9 m depth. *Fairmount Fjell* has dimensions of 146.3 m length BP, 36.0 m breadth and 9 m depth.

For each vessel, Wärtsilä Corporation will deliver three Wärtsilä diesel-generating sets, two Lips steerable thrusters and a Lips bow thruster. The three 8-cylinder in-line Wärtsilä 32 diesel-generating sets each have a maximum continuous power output of 3840 kW at 720 rpm. The sets will supply electrical power to two 4500 kW steerable thrusters having a fixed-pitch propeller of 3400 mm diameter in a high-performance HR nozzle. The 1500 kW bow thruster will have a 2250 mm diameter controllable-pitch propeller. The diesel-electric propulsion plants will give the vessels a service speed of 12 knots.

The choice of a diesel-electric propulsion plant gives freedom in the layout of the plant, with the generating sets being located in a forward engine room distant from the main thrusters. The diesel-electric plant also provides power for the large pumping capacity required during cargo-handling operations. Steerable thrusters aft and the bow thruster forward will give excellent manoeuvrability.

The propulsion plants were contracted in August 2005 from a consortium formed by Wärtsilä and the Dutch company Imtech NV, a specialist in electrical installations and integrated bridge systems. The consortium is responsible for the initial design of the power plant, the supply of the complete generating sets, thrusters, all ancillary systems, electrical switchboards, and the integrated bridge system, including controls for the whole power plant. As part of the comprehensive solution, Imtech will provide the navigation, automation and related electrical systems.

Wärtsilä Power for Six Keppel FELS Offshore Rigs

Wärtsilä Corporation was awarded contracts in October with a total value of over €50 million by Keppel FELS Ltd in Singapore for 32 diesel-generating sets to power four jack-up rigs and two semi-submersible drilling platforms. The combined output of these orders is about 115 MW. Wärtsilä will also supply steerable thrusters for the semi-submersible platforms.

The rigs and platforms are being built at Keppel FELS Ltd for the Danish company A.P. Møller – Mærsk A/S. The first of the jack-up rigs is due for delivery in the fourth quarter of 2007, and the semi-submersible platforms are due to be delivered in 2008 and 2009.

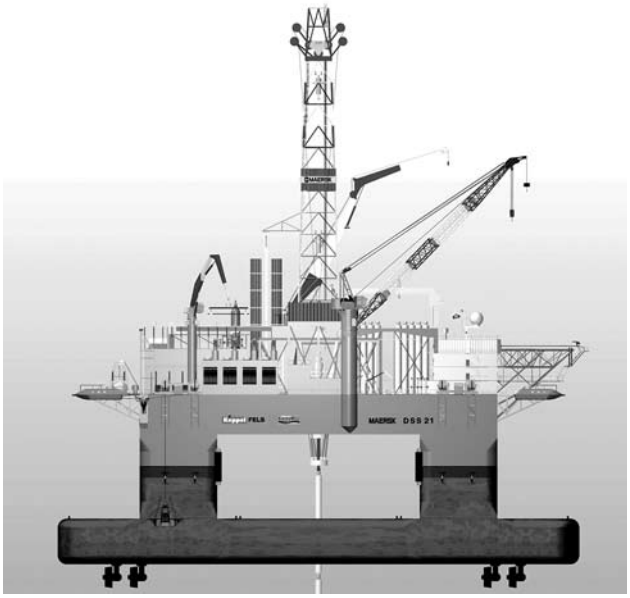
The four jack-up rigs are of the CJ50 design from Marine Structure Consultants. They can operate in water depths of up to 106.7 m, and drill high-pressure wells down to 9144 m. The main power supply on each rig will be provided by four eight-cylinder Wärtsilä 26 generating sets with a combined electrical output of 9600 kWe.

For these jack-up rigs, the Wärtsilä generating sets have the benefits of compact dimensions for their power output and an excellent load-response capability for the rapidly-changing electrical load when drilling.

The two semi-submersible drilling platforms are of the DSS 21 design developed by Keppel and Marine Structure Consultants. They are to be employed for development drilling in deep water up to 3000 m deep and are designed for year-round operation in regions such as West Africa, Brazil, the Gulf of Mexico and South East Asia.

Each semi-submersible will have a dynamic positioning system with eight electrically-driven Wärtsilä Lips steerable thrusters. The platforms will also be able to be attached to a pre-laid mooring system. The semi-submersible platforms will each be equipped with eight 16-cylinder Wärtsilä 26 generating sets having a combined electrical output of 38 720 kWe.

Keppel FELS is already experienced with Wärtsilä generating sets and thrusters in previous rigs and platforms built by Keppel FELS. Four previous jack-up rigs were each equipped with five six-cylinder Wärtsilä 26 generating sets. Also for a previous platform, Wärtsilä supplied five 12-cylinder Wärtsilä 26 generating sets and an outfit of steerable thrusters.



The semi-submersible drilling platforms for Keppel FELS will be equipped with generating sets and steerable thrusters from Wärtsilä
(Image courtesy Wärtsilä)

VALE MICHAEL PEARSON

Michael Pearson BSc FRINA passed away on 7 September 2005 at the age of 83.

Born in St Albans, Herts., England, and educated in Glasgow, Scotland, he served in the Royal Navy during the Second World War. After the war he trained as a naval architect at the shipyard of Barclay Curle on the Clyde. He undertook the engineering course at Glasgow University and graduated in naval architecture in 1948.

He migrated to Australia in 1949 and took up a position in the technical section of the State Dockyard in Newcastle and rapidly rose to be in charge of all technical services. He was responsible for the operation of the design and estimating departments until he left the dockyard in 1977. During this period the State Dockyard built a variety of ships including, among others, the ro-ro vessels *Bass Trader* and *Princess of Tasmania*, *Kooringa* (the first purpose-designed container ship to be built in the world), the BP tankers *BP Enterprise* and *BP Endeavour*, the ro-ro passenger/cargo ferry *Australian Trader* and a number of the Lady-class ferries for Sydney Harbour. The State Dockyard closed in 1983.

Michael continued to practise as a naval architect, joining the marine consultancy firm of Barnes and Fleck in 1977. He subsequently became a director. Barnes and Fleck designed a variety of craft including tugs and offshore service boats. He finally decided to retire in 1996, but always continued to take an interest in maritime affairs.

Michael joined the Royal Institution of Naval Architects when he was employed at Barclay Curle in Scotland and continued his membership up until his death. He became a Fellow of the Institution, was on the Council of the Australian Branch, (now Division), and was President of the Australian Branch for three years. He also qualified as a Chartered Engineer.

He married his wife Pam in 1951 and they have two children — a son Tim and daughter Jayne — and have two grandsons. Michael celebrated his 80th birthday in 2002 at a party in the Blue Mountains.

Michael was also very active over the years with the Mission to Seamen, helping in a voluntary capacity to assist in their activities to promote the welfare of seamen visiting the port of Newcastle.

Michael was a professional who undertook the extensive and varied tasks demanded of a naval architect with dedication and efficiency, and was always available for assistance when asked. He will be sadly missed by his many colleagues, both locally and Australia wide.

Bob Campbell

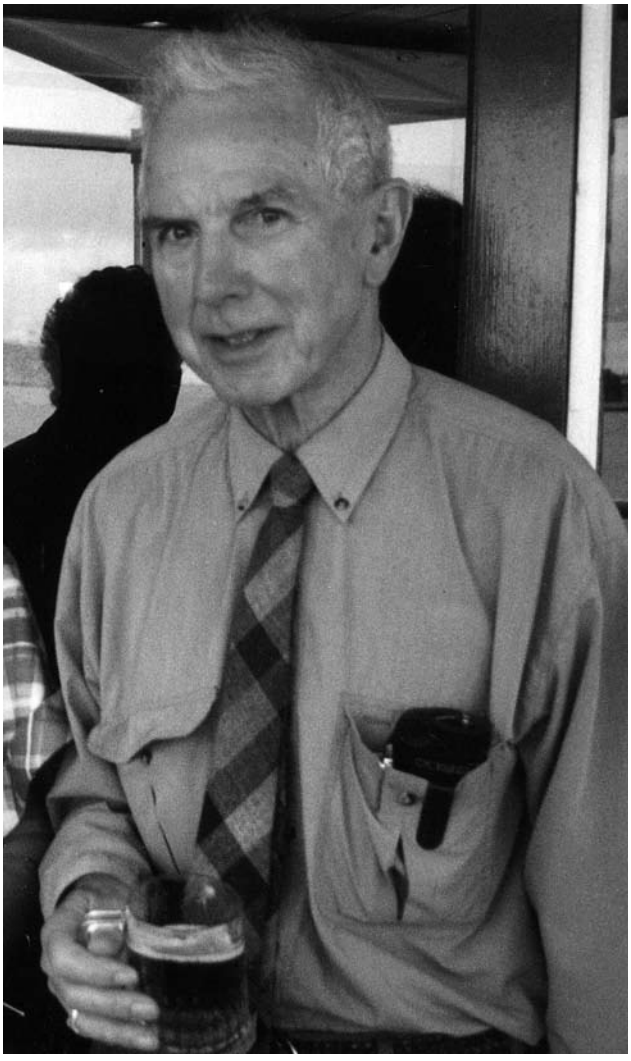
Michael Pearson's funeral service was held on Monday 12 September and was attended by a large gathering including members of RINA and IMarEST.

By courtesy of Mr Ron Sorensen, Newcastle Manager of Adsteam Towage Services, and at Mrs Pearson's request, I arranged for a small group of family and close friends to scatter Michael's ashes on the morning of Tuesday 20 September. This was done in perfect weather from one of the former Fenwick tugs, built by Carrington Slipways at Tomago, to a design by Barnes and Fleck of Newcastle during Michael's period as a director of that company.

The tug paused in the main shipping channel off Dyke Point and the former State Dockyard offices, where Michael had been the Naval Architect and Commercial Manager.

It was a most appropriate ending to the life of a very courteous and professional gentleman. I was on board and represented RINA and IMarEST.

John McCarlie



Michael Pearson
(Photograph courtesy Pam Pearson)

MEMBERSHIP NOTES

Australian Division Council Meeting

The Australian Division Council met on 12 September, with teleconference links to all members and the President, Robin Gehling, in the chair. Twelve AD Council members were present and the President welcomed Mr John Lord, appointed to Council by the ACT Section. He noted also that Mr Roger Best had been appointed to Council by the Western Australian Section; however, Mr Best had tendered an apology for the meeting.

Matters, other than routine, which were discussed included:

- The Walter Atkinson Award: Council noted the call for nominations for the award for 2004 published in the August issue of *The Australian Naval Architect*. Mr Brian Hutchison was appointed as Chairman of the Award Sub-committee, with responsibility for coordinating and promoting the award. A new timetable for future nominations and decision on the award was agreed by Council. The timetable is:
  - First call for nominations to be published in the first issue of *The ANA* each year (usually February).
  - Nominations to be received by Sections by the last day of March.
  - Sections forward nominations considered suitable for consideration for the award to Chairman of the Award Sub-committee by the last day of May.
  - Chairman of the Award Sub-committee to forward the recommendations of the committee to Council by the last day of August.
  - Council to consider the recommendations and decide the winner/s at its first meeting after August (usually September).
  - The Award to be announced in November issue of *The ANA*.
- The Australian Builder's Plate for Recreational Boats: This subject received further consideration by Council, with Council agreeing that its comments be forwarded to the National Marine Safety Committee. The President will have more to say on this matter in the next issue of *The ANA*. Council was of the opinion that members of the Institution and members of Council should be free, and encouraged, to express their personal opinions when a call is made for public comment. However, when Council or one of its members is asked for an opinion, say as a member of a Reference Group, that opinion should not express a personal view but rather a belief or view of Council on what is best for the profession. Council will, on behalf of the Division, offer its assistance to the NMSC by way of representation on future Reference Groups dealing with naval architecture matters.
- RINA/IEAust Joint Board: Mr Chapman, Chairman of the Joint Board, said there had not been a meeting recently. As the question of the NPER had not, as yet, been resolved, the President would pursue this as a matter of urgency.

The next meeting of the Council of the Australian Division is scheduled for Thursday 1 December 2005.

Keith Adams
Secretary

The contrast between ship designs separated by over 200 years was displayed at Garden Island in Sydney recently when the motor yacht *Boadicea* berthed ahead of the replica *Endeavour* undergoing refit in ADI's floating dock before taking her place as a major attraction at the Australian National Maritime Museum
(Photograph John Jeremy)

NAVAL ARCHITECTS ON THE MOVE

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

Dion Alston has moved on from Sea Transport Solutions in Qld and has taken up a position as a Surveyor with Lloyds Register in Fremantle, primarily involved in new construction.

John Benjamin has moved on within ADI Limited at Garden Island, Sydney, and has taken up the position of Ship Design and Engineering Manager.

Warwick Benn moved on from Oceanfast a couple of years ago, and has taken up a position with Austal Ships in Fremantle in the design office, working mainly on structural design.

Anthony Brann has moved on from ADI Limited at Garden Island in Sydney, and has taken up a position as a naval architect with EMP Composites in Sydney.

Grant Brunsdon has moved on within the Austal Group and has taken up a position with Austal USA in Mobile, Alabama.

John Butler has moved on from International Catamaran Designs — Sydney, and has taken up a position as a naval architect with Sensation Yachts, who are busy setting up on the ADI Limited, ex-Carrington Slipways site, in Newcastle. He has recently joined the committee of the NSW Section of RINA.

Graeme Collins has put down an anchor in London, where he has been living for the last twelve months. He says that there is a distinct lack of opportunities for graduate employment in naval architecture in the UK, similar to Peter Holmes' experience before he returned to Australia. Graeme has taken up a position as a senior design technician for a property developer, where he is working in mainstream architecture and interior design, and developing skills which he can carry over into naval architecture. He says that he is not homesick, apart from missing the Sydney sunshine now that he is about to enter another long, gloomy English winter!

Steve Davies moved on from ADI Limited at Garden Island, Sydney, about a year ago and has taken up a position with Worley Parsons in North Sydney.

Glen Davis moved on from consulting as Shiptech (Australia) some time ago, and is now consulting as Glen Davis Marine Design in Sydney, with a range of clients extending from Sydney to Yamba to China.

Tom Dearling has moved on in BMT, from the Bath, UK, office where he was working mainly on in-service support, and has taken up the position of Naval Architect with BMT Defence Services (Australia) in Melbourne.

David Ellery moved on from North West Bay Ships in Hobart about four years ago, and has taken up a position with Austal Ships in Fremantle in the Research and Development section, specialising in seakeeping.

Brad English has moved on from consulting as Brad English Yacht Design, and has taken up the position of General Manager of Sensation Yachts in Newcastle. Sensation is the NZ-based manufacturer of luxury super yachts who have signed a 20-year lease on the ADI Limited, ex-Carrington Slipways site, where they are busy setting up to take advantage of the existing infrastructure, which includes an 800 t marine railway platform and modern construction hall.

Geoffrey Fawcett has moved on from Bureau Veritas Australia, and has taken up a position as a surveyor with ABS Pacific in Sydney. He has recently joined the committee of the NSW Section of RINA.

Craig Gardiner has returned from his year's exchange at Defence Research and Development Canada (Atlantic), based in Halifax, Nova Scotia, where he worked on extreme and non-linear loadings and structural response, and has resumed his position as a research scientist with the Maritime Platforms Division of the Defence Science and Technology Organisation in Melbourne.

Gillian Gray (nee Fisher) has taken up a position as a naval architect with Austal Image in Fremantle.

James Gutherson has moved on from the NSW Maritime Authority and has moved to Orange, NSW, where he has set up his own business, Blue Core Consulting, advising the mining and agricultural industries in the field of quality management. Check out the range of services or contact him via www.bluecore.com.au.

Ben Healy has moved on from Commercial Marine Solutions and has taken up a position as a naval architect with Ringprop Ltd in Melbourne, working on the design of propellers.

Tim Holt moved on within Det Norske Veritas about a year ago, from the Sydney office to the Fremantle office, where he is busy looking after the survey of the Armidale-class patrol vessels.

Rodney Humphrey has moved on within Det Norske Veritas, from the position of Head of Section/Classification Coordinator in Bristol, UK, and has returned to the Sydney office as Head of Approval Centre, Sydney.

Belinda Jones has moved on in BMT, from the design office in Bristol, UK, where she was working on the new CVF aircraft-carrier design, and has taken up the position of Senior Naval Architect with BMT Defence Services (Australia) in Melbourne.

Kim Klaka has completed his PhD degree at Curtin University in Perth on *Prediction of Vessel Motions at Zero Ship Speed*, and has taken up the position of Director of the Centre for Marine Science and Technology at Curtin University. Kim is also a director of the spin-off company Sea Gyro Pty Ltd, and has previously sat in the director's chair for the CMST in 1991, 2000 and 2002, so he knows how it feels.

Matt Klingberg has moved on from New Westcoaster and has taken up a position as a project naval architect with Austal Image in Fremantle.

Percy Lentin moved on within Det Norske Veritas about two years ago, from the Fremantle office and has taken up the position of Station Manager in the Xiamen Shipyard Site Office, in Xiamen, China.

Josh Lepine has taken up a position as a naval architect with Austal Ships in Fremantle, on secondment from Austal USA.

Magnus Lindgren has moved on within Det Norske Veritas, from the position of Head of Approval Centre, Sydney, and has taken up a position in plan approvals and hydrodynamics in Pusan, Korea.

Stuart McDonnell has moved on from the Australian Maritime Hydrodynamics Research Centre to become Director/Sales Manager with Almasts Australia Pty Ltd in Launceston, Tasmania.

Vesna Moretti moved on from Oceanfast about three years ago and has taken up a position with Austal Ships in Fremantle in the marketing support department.

Boris Ostojic joined Austal Ships in Fremantle about five years ago, and is now a senior project naval architect.

Ian Peacock has moved on from Marine Safety Victoria and has taken up a position as a surveyor with Det Norske Veritas in Sydney.

Bernie Phelps has moved on from Australian Marine Technologies and has taken up the position of Senior Defence Scientist — Naval Architecture with the Defence Science and Technology Organisation in Melbourne.

David Pryce has moved on and is now skippering the yacht *Westernaustralia.com Clipper* in the Clipper 05–06, the world's longest circumnavigation race. The ten yachts, designed by Dubois Naval Architects, and built by Shanghai Double Happiness Yachts in China, are each crewed by international teams of 17, with a professional skipper. They set sail from the Albert Dock in Liverpool, UK, on Sunday 18 September and face some 35 000 miles of competition on the high seas. The course starts by following the traditional tea-clipper route via South Africa to Western Australia, then heads for Singapore and mainland China, across the northern Pacific to the west coast of Canada and the United States, the Panama Canal, then the Caribbean, the east coast of the United States, across the northern Atlantic to the Channel Island of Jersey, and home to Liverpool. Further details of the race and progress can be found at www.clipper-ventures.co.uk/n05_06/homepage.php.

Frank Ryan has moved on within the Austal Group and has taken up a position with Austal USA in Mobile, Alabama.

Tom Ryan, a recent graduate of the Australian Maritime College, has moved on from G.A. Glanville and Co. (Naval Architects) in Cairns and has taken up a position as a naval architect with Sea Transport Solutions in Runaway Bay, Qld.

Ian Sargeant has moved on from International Catamaran Designs — Sydney, and has taken up a position as a naval architect with Incat-Crowther Designs in Sydney.

Claudia Schaefer moved on within Det Norske Veritas about a year ago, from the Sydney office and has taken up a position as a surveyor in the Conversions, Ro-Ro, Offshore Support and Special Ships Department of the Oslo office.

Ruben Spyker has moved on from Transport SA and has taken up the position of Senior Structural Engineer with the Submarine Branch of the Department of Defence, based at ASC Limited in Adelaide.

Lachlan Torrance has moved on from SP Technologies in Southampton and has taken up the position of Engineering Manager with Reichel Pugh Yacht Design in San Diego, USA.

Rob Widders has moved on, and has taken up a position as an Associate with WBM Consulting Engineers in Sydney, where he has been for nine years. Check out WBM and their services at www.wbmpl.com.au.

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

Phil Helmore
Tony Armstrong

Australian Wooden Boat Festival to Sponsor Design Competition

The Tasmanian Festival '07 will offer $1000 prize money for the winning design of a recreational rowing skiff. Entries must be received by the Festival Director by 31 January 2006.

The Derwent Skiff Design Competition calls for expressions of interest from designers to submit sketches or drawings and explanatory notes for a recreational rowing boat. It should be designed to be built out of timber or ply and carry one or two people.

The expressions of interest will be reviewed by a judging panel with the winning designer being required to complete the lines and all construction details to qualify for the prize to be presented in 2006.

A prototype of the design will be built and displayed at Festival '07 on 9–12 February 2007. The designer will collaborate with the builder of the prototype. The drawings, sketches and information submitted must be sufficient to enable the judging panel to understand the basic concept of the boat and discuss it with the designer.

The winner will be chosen after all entrants have had an opportunity to discuss their design with the panel.

The winner will be required to complete the lines and all construction details to the satisfaction of the judging panel before receiving the prize. Detailed building instructions must also be written after the construction of the prototype and finalised before Festival '07.

"The boat should be of simple construction and inexpensive to build with the capacity for one rower and a passenger or two rowers," Festival Director Andy Gamlin says. "We are looking for a boat that can be built by a home handyman with basic tools and which has reasonable performance in estuary conditions such as are experienced on the Derwent. It should be light enough for car-top transport and have unique Tasmanian characteristics."

"As an example, a competitive rowing shell would be too light and not sufficiently stable while a Whitehall type boat would be too big and heavy."

To enter the Derwent Skiff Design Competition or obtain more information contact Andy Gamlin well before 31 January 2006.

HMAS CANBERRA DECOMMISSIONED

HMAS *Canberra*, with paying-off pennant flying, sails up Cockburn Sound to HMAS *Stirling* for the last time on 7 November 2005
(RAN photograph)

On 12 November HMAS *Canberra* became the first Adelaide-class Guided Missile Frigate (FFG) to be decommissioned from the Navy after proudly serving Australia for 24 years.

The Defence Minister, Robert Hill, joined Maritime Commander Rear Admiral Davyd Thomas, and the ship's Commanding Officer, Commander Ray Leggatt, to officially farewell the ship in a traditional ceremony at Fleet Base West, south of Perth.

HMAS *Canberra* has sailed nearly 800 000 n miles, has seen active service in the Persian Gulf and conducted operations in areas as diverse as the Southern Ocean and Solomon Islands, east of Africa and south of Russia.

Senator Hill said that the Government has decided to offer the ship to be sunk and used as a future diving attraction off the coast of Australia.

"Decommissioned ships *Swan*, *Perth*, *Hobart* and *Brisbane*, which have been sunk off the Australian coast, have proven to be an economic and tourism boom by creating great dive sites," Senator Hill said.

At the ship's decommissioning ceremony at Fleet Base West, Commander Ray Leggatt RAN walks ashore for the last time as Commanding Officer of HMAS *Canberra*, carrying the ship's White Ensign.
(RAN photograph)

FROM THE ARCHIVES

The FFG upgrade programme is now well underway at the ADI facility at Garden Island in Sydney and the four ships of this class to be modernised will serve the RAN for many years to come. Nevertheless, the decommissioning of HMAS *Canberra* perhaps marks the beginning of the end of an era for these ships which were selected for the RAN after the cancellation of the light destroyer (DDL) project in 1973.

The original concept of the FFG 7 class patrol frigate was rather similar to that of the DDL, although at the 'low end' of capability in the US fleet. Fifty-one ships were built for the US Navy, six for Australia, six for Spain and eight for Taiwan.

The first four Australian ships were built by Todd Pacific Shipyards at Harbor Island in Seattle, in a yard that had a long history of warship construction but which had to be ramped-up from a low level of activity for the programme. Their first ship, USS *Duncan*, was followed by HMAS *Adelaide* and *Canberra*. *Sydney* and *Darwin* came later in the series of thirteen FFGs built at Seattle.

One unusual feature of the construction of these ships at Todd Seattle (Todd also built eighteen at San Pedro in California) was the practice of launching the ships bow first. This was done because of the high tide range in Seattle which would have prevented work on the aft end of the ships for considerable periods and potentially damage stern tubes, 'A' brackets and the rudder. There were no gates at the end of the Seattle slipways.

A similar practice had been adopted for cruiser and liner construction at Tacoma some sixty years earlier, for the same reason.

HMAS *Adelaide* after her launching (bow first) at Harbor island in Seattle on 21 June 1978
(US Navy photograph)

The first Todd Seattle ship, *Duncan*, was laid down in 1977. The Australian ships were launched in June and December 1978, September 1980 and March 1982. Todd Seattle built 13 FFGs — the last, USS *Carr*, was completed in July 1985.

In 1986 Todd Shipbuilding Corporation filed for bankruptcy protection, and a period of reconstruction followed which saw the closure of several of the company's shipyards. Today only the Harbor Island yard survives. Todd employs about 800 people and is mainly engaged in ship repair, mostly for the US Navy.

John Jeremy

FFG 7 class guided missile frigates under construction with bows to the water at Harbor Island in Seattle in July 1982. The ship fitting out on the left is HMAS *Darwin*. The ship nearly ready for launching is USS *Vandegrift* (FFG48) and the ship with a unit being placed on the slipway is USS *Carr* (FFG52)
(Photograph John Jeremy)

We are where you are.

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

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