THE AUSTRALIAN NAVAL ARCHITECT

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THE AUSTRALIAN NAVAL ARCHITECT

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Cover Photo:

Sir James Hardy's beautiful gaff-rigged cutter *Nerida* celebrated her 70th birthday by winning her division during the Sydney Amateur Sailing Club's Gaffers' Day on Sydney Harbour on Sunday 19 October. (Photograph John Jeremy)

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CONTENTS

RINA Australian Division

on the
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From the Division President

An increasingly important part of the career development of a naval architect is Continuing Professional Development (CPD), particularly to fulfill the ongoing requirements of the National Professional Engineers Register. What better way for anyone at any level in the profession to satisfy CPD and catch up on what is happening in the wider world of ship design and construction than by attending the Pacific 2004 International Maritime Conference next February. The organizing committee has assembled an outstanding and exciting program, detailed in a spectacular brochure released in recent weeks — if you haven't received one, details are available on the net at www.tourhosts.com.au/pacificimc2004/invit.asp.

Not only does the program contain something for everyone, but the event promises to be a resounding start to the year in which we celebrate 50 years since the establishment of the Australian Branch of RINA and 25 years as a Division. I look forward to meeting you there!

Since writing my column for the August edition of *The ANA*, I have had the privilege of being a member of a panel of naval architects viewing the Ocean Vehicle Design project presentations by final year students at the Australian Maritime College. It was a rare opportunity to view the students' projects and to attempt to relate my knowledge and experience to their contemporary ship designs.

And a varied bunch of designs they were too, including in no particular order an offshore supply vessel, arctic cruise ship, large offshore patrol vessel, trimaran superyacht, very fast interdiction vessel, charter cruiser, escort icebreaker, coastal patrol vessel, landing craft and an offshore wind-generator base structure.

Now, I have to say that I embarked upon this project with rather rusty and outdated design knowledge and skills, developed painfully from many years of redesigning regulations rather than ships. As is to be expected, each of the designs and presentations had their strong points and some had weaknesses, I came away with a strong impression that our profession must be strengthened by an annual injection of fresh ideas and enthusiasm as has been exhibited by these students. Based on what I saw, the innovative reputation of Australian naval architects looks certain to be continued for many years.

Many thanks to the staff of AMC for including me in the review panel and to the students for their efforts. I hope my input contributed to successful completion of these projects and to the overall experience of the final year design project exercise.

This brings me to a final reflection on my own design project experience about thirty years ago which served as an invaluable "dry run" for my later work in a design office.

I was privileged to have John Tuft as lecturer and supervisor for my project during his 30 years or so educating the naval architects of the future at Sydney Technical College and the Universities of Technology and New South Wales. He passed away in early October after a long illness. In recognition of the many naval architects whose careers he kick-started similarly to mine, together with some of his other former students and as your President, I attended his funeral to pay my respects. I'm sure that all who knew him will join with me in offering our condolences to his widow and family.

Rob Gehling

Editorial

It is over five years since Phil Helmore and I 'volunteered' to take on the task of editing and producing *The Australian Naval Architect*. It seems like yesterday. In those years *The ANA* has grown in size but continues to concentrate on local Australian news — the achievements of our industry, the students in our Universities, and RINA members throughout the country. Every three months we enjoy the familiar sense of anxiety that we will never fill the next edition or have the time to do it — but it happens, not least because of the support of our correspondents. If there are gaps they are an opportunity for members to help us fill them.

The Royal Institution of Naval Architects is increasingly an international professional institution with active branches and divisions throughout the world. We all benefit from the high-quality publications and technical papers published in London. *The ANA* does not pretend to compete with these publications, but they can never have the space for all the local news that appears in *The ANA*. We see our Australian journal as complementary to the RINA's international publications, helping to keep a sense of professional community alive and well amongst the members in Australia.

Next year we will be celebrating the fiftieth anniversary of the foundation of the first-ever Branch of RINA, the Australian Branch. Twenty-five years ago the Australian Branch became the first Division of RINA, and I was proud to be the first President of the Australian Division. Participation in RINA activities has always seemed a natural part of my professional life. The RINA gives us the means of keeping in touch with the development of naval architecture and related industries throughout the world through meetings, conferences and publications, and it helps us with that age-old process we now call continuing professional development.

I joined the RINA in 1963, when the Australian Branch was only nine years old. In 1971 Jack Coleman called me into his office and said: 'It is time you did some work for the RINA — I am going to propose you for the Branch Council.' 'Yes Jack,' I replied, regarding the suggestion as a natural extension to my job. That work has continued ever since, and I have found it to be interesting and rewarding.

Much has changed in Australia since I joined the Institution forty years ago, and particularly in the industries in which we work. When I studied naval architecture with John Tuft in the brand-new Mechanical Engineering building at Kensington, our biggest class was three; Conan Wu, David Hill and me. I recall a time when I even had John Tuft and Owen Hughes entirely to myself. Since those early days there have been over 260 graduates in naval architecture from UNSW. Naval architects are no longer largely limited to a few drawing office positions but are active throughout all levels of industry from design to production, marketing and general management, just as they should be.

We no longer build large steel ships in Australia, but we have an innovative export-oriented industry proving every day that the wish 'wouldn't it be great if…' can be made to come true with hard work and enthusiasm. Whilst work pressures today are considerable, I hope that RINA members everywhere will remember that there is further reward in contributing to their profession as a whole by active participation in the Institution's activities. Go to the meetings, stand for election to section committees, and *find* the time — it is worth it. Remember, the next editorial team for *The Australian Naval Architect* is out there somewhere!

John Jeremy

Letters to the Editor

Dear Sir,

The Chairman of our Ship Committee, Bob Herd, has forwarded a copy of your magazine to me. I would like to draw your attention to an omission in the section 'Around and About'.

Phil Helmore rightly mentions other ships around the world which have received the prestigious Maritime Heritage Award. However, missing from this list of world-class ships is *Polly Woodside*. In 1988 she became the first merchant ship in the world to receive the World Ship Trust Medal.

Australia should be justly proud that two of our restored ships have been recognised in this way. It is a great achievement, and congratulations are extended to all who contributed towards making *Polly Woodside* and *James Craig* the magnificent ships they are today.

Ann Gibson
Public Programs

Dear Sir,

For those who have not heard of me, I am a naval architect employed by the Waterways Authority NSW within the Commercial Operations Branch. Through my work there I have had the privilege of being involved in the commercial survey process for many vessels that showcase the top end of the Australian maritime manufacturing industry. Unfortunately it is not this end of the market that has caused me to put pen to paper.

Since I began work with Waterways in early 1999 I have noted an increase in the use and variety of computer-generated submissions for plans and stability books. Currently I am only aware of two consultants who still practice the dying art of hand-drawn plans and the last stability submission calculated by hand was received before my time.

While computerisation undoubtedly has made a major impact on time and therefore cost savings for consultants, I have observed an equal decrease in the quality of submissions which I have been asked to review. This results in the need for repeat submissions and repeated reviews, all causing delays for the vessel owner who ultimately foots the bill for the work.

Unfortunately I have seen this problem manifest itself in both construction plans and stability submissions. While it is very nice to receive general arrangements and construction plans in multi-colour, I feel that the quality of the information supplied is more important than the colour scheme. Additionally, when preparing stability submissions I know that many of the computer packages out there can generate enough printouts to require the deforestation of half the Amazon, but I am unsure why such superfluous information is included in the book. It has been surmised that some consultants may be setting the fee scale for the submissions by weight of paper used, instead of the quality of the information contained.

I do not want my comments to be taken and used to taint the many high quality submissions that Waterways receives, but for those that who are bringing the standard down I would be delighted to see this trend reversed. Of particular note is the inverse relationship I have noted between the age of the consultant and the quality of the submission.

During my time at university I recall a knowledgeable lecturer standing before our class and telling us that before going and hanging our prospective shingles out, that we should go and work for an experienced person and learn the ways of a professional industry. It has been my observation that many people who advertise as consulting naval architects should consider taking some of that advice to look to the wealth of knowledge that is out there and try to learn from it.

It is not my intention to point fingers at any company or individual; however, some examples of this growing problem are:

- A consulting company who took four attempts to calculate a vessel's lightship displacement and LCG from a set of measured freeboards and a hydrostatic table. It appeared to me that the person operating the computer package was not sufficiently familiar with basic geometry to be able to cross check and ensure the output results were consistent with the input data.
- A structural submission that gave pages of NC milling templates and assembly order instructions but omitted to give the basic particulars of the vessel, what grades of aluminum were to be used, or any drawing showing the final structural arrangement to determine simple items such as panel sizes.
- A significant number of FRP plans are being received where there is great detail of the tile patterns in the toilet area, but many of the connection details are omitted. One reason I was given was that the consultant didn't know how to draw them on the CAD system; unfortunately the thought of a pencil and paper appeared foreign, and simply stating that the connections are to be to the attending surveyor's satisfaction does not bode well.
- A consulting company who submitted a damaged stability assessment proving that the vessel's final trim angle was around 45° by the stern with only the forward quarter of the vessel left out of the water. It appeared that since the program didn't give an error that the vessel was sunk that they assumed it was satisfactory. The fact that the margin line aft was around 12 m under water was simply ignored.
- For FRP vessels many plans arrive without basic drawings of the frames or a profile and deck plan. As such, it is often impossible to determine what is being used to support the vessel's shell.
- With regard to the policy of deforestation for the production of stability books, I am yet to understand

the necessity to include the vessel's hydrostatic particulars at 5 degree heel intervals around the GZ curve. The significance of the prismatic coefficient in the departure condition when heeled to 45° is one thing I have yet to comprehend.

Many may scoff at these examples and think that they are only being made by an inexperienced newcomer to the industry, however the majority have been made by people who advertise their qualifications with honors and masters degrees.

David Gosling

Dear Sir,

May I draw to your attention the Sydney-to-Hobart yacht race of 1998? Organisers knew of the coming storm on 26 December of that year, and yet the Sydney-to-Hobart went ahead with the subsequent loss of six lives. Not only were the lives of many sailors put at risk due to their determination to get to Constitution Dock as quickly as possible, but other vessels and rescue crews, directed to search for those who were in trouble, put their own lives at risk. Much of this rescue effort was at taxpayers' expense, so why did so many yachts get into trouble? Were the vessels safe? Were the wrong decisions made?

On board our yacht, which avoided the worst of the weather and got there second last and undamaged, we listened to the mayday calls over the radio during the night of the storm and the next morning, but it was not until we arrived in Hobart and bought a newspaper that we realised the tragedy of what had transpired. I enjoy nothing more than beating to windward through massive swells with forty knots of breeze, but there surely must be some over-riding decision that prevents the likes of myself from heading off into conditions of almost certain severe risk in an ocean race.

At the moment, anyone with the money to buy a yacht can sail out of the heads and into trouble. It's only a matter of time before we have a repeat of the conditions of 1998. Can we not have a situation whereby a race director of some description can call for the start to be delayed or for the fleet to turn back?

What has changed to stop history repeating itself?

Sean Cribb
UNSW Student

Dear Sir,

It is apparent that a pressing issue for the International Marine Organisation (IMO), under Resolution A.900(21), is the improvement of the quality of merchant vessels. The conundrum with an international organisation such as the IMO is centred on the fact that implementation of its conventions is based on the co-operation of the member states. The IMO itself does not have enforcement powers. Regulations are only effective if all flag states fulfill their duty to ensure that codes are applied to all registered vessels. Combine economics, politics and sociology with the principle of self-regulation and the loophole is established for flags of convenience. Several nations have developed a large portion of their national merchant fleets under foreign flags offering cheap registration, taxes, labour and relaxed implementation of IMO Conventions.

The challenge for the IMO is to encourage all members to effectively implement regulations with equal thoroughness. This will promote safer, fairer shipping and reduce catastrophes. Until recently, the main method of regulation was the reliance on port states to ensure that berthing ships meet IMO requirements. Ports have the jurisdiction to inspect and, if necessary, to detain vessels found in an unsatisfactory condition. This program is only effective to the extent of the responsibility of the individual port. Moreover, resolution would be better reached with the old doctrine of 'prevention rather than cure.' To this end it would be more advantageous to change the attitudes of flag states, rather than increase enforcement.

The voluntary Self-Assessment Form (SAF) has predictably proven to be a failure. From the Flag State Implementation Sub-Committee meeting held in April 2003, of the 163 member states only 50 have completed the SAF and, of those, only 16 have bothered to follow with an update.

A more proactive agenda is the International Safety Marine (ISM) Code. It aims to disperse the responsibility for safety of the vessel beyond those on board. The owner, manager, stakeholders, master, and crew are all encouraged to take an active role in ensuring that the vessel meets regulations. It is by increasing the circle of accountability that the IMO will have the most success in eradicating unsafe vessels. Since economics is the driving force behind modern shipping, fostering an attitude of safety in those immediately running the vessel is not enough. The forces that truly create unsafe vessels are those economic rationalists that are pushing to maximise profits. A true solution would be to directly include the insurer, financiers and cargo owners in the push towards safer shipping, preferably by a change of attitude and, if not, by an increase in liability.

Ruth Jago
UNSW Student

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Contributions from RINA members for *The Australian Naval Architect* are most welcome. Material can be sent by email or hard copy. Contributions sent by email can be in any common word processor format, but please use a minimum of formatting — it all has to be removed or simplified before layout. Many people use Microsoft Word, but illustrations should not be incorporated in the document. Photographs and figures should be sent as separate files with a minimum resolution of 150 dpi. A resolution of 200–300 dpi is preferred.

NEWS FROM THE SECTIONS

ACT

Technical Meetings

Offshore Oil and Gas Safety

There was a combined technical meeting on 17 September between the IMarEST and RINA ACT Sections. The speaker was Peter Wilkinson from the Offshore Safety Section of the Department of Industry, Tourism and Resources. Peter spoke of the need for the Australian offshore oil and gas industry to have a formal regulatory body to improve standards of safety within the industry.

He spoke of the small, but expanding, Australian industry and outlined a proud history with no major incidents, yet highlighted some disastrous incidents in other parts of the world from which we can surely learn. The *Piper Alpha* tragedy was one incident that was examined. On 6 July 1988, an explosion occurred in the gas compression module on the *Piper Alpha* platform, 176 km north-east of Aberdeen, Scotland. In studying this incident and others worldwide, Peter had noted that the major causes were a breakdown in systems and processes, rather than a specific technical fault. He spoke of the need to have a safety committee which conducts formal safety assessments, rather than the traditional approach of companies complying with prescriptive rules.

He explained a bill which was introduced to the House of Representatives on the day of the presentation which complements the vision Peter has for the future of Australia's offshore petroleum industry regarding safety.

The SSP Podded Propulsion System

There was a combined technical meeting on 14 October between the IMarEST and RINA ACT Sections. The guest speaker was Ken Grieg who is the Manager Marine Systems of Siemens Australia to talk on recent developments in diesel-electric podded propulsion.

Ken outlined some significant advantages which diesel-electric podded propulsion of ships has delivered to both owners and operators, such as performance, cargo handling and capacity, redundancy, availability, manoeuvrability, efficiency, course stability, noise, value (lower investment cost per cargo unit carried) and flexibility. Examples of this propulsion system were examined and the savings throughout the ship's life-cycle were quantified. In particular, costs accrued during the construction phase, including equipment procurement and installation, were examined.

In seeking to optimise the owner's investment and to reduce the costs of ownership throughout the life cycle, one innovation was to integrate podded propulsion in the ship's design, rather than add it to an existing, conventional design. This was shown to deliver even greater benefits to both owners and operators.

Michael O'Connor

Queensland

The Queensland Section met on 2 September at the offices of Brisbane Ship Construction in Brisbane. A section committee meeting was held prior to a technical meeting and in the absence of the Queensland Section Chair Brian Robson, Committee Member Dion Alston assumed the chair for both meetings.

The subject of the technical meeting was *An Introduction to Using Finite Element Analysis (FEA) in Marine Structures*. The presenter was Peter Schwarzel BE (QUT), Reg. Prof. Eng. (Qld), Approved Engineer for Light Vehicle Modifications and Compliance (Department of Transport), and a Registered Mast Engineer (Australian Yachting Federation) who operates under the business name CarbonWorks .

Peter commenced his presentation by stating that FEA was a numerical solution to most real world problems, increasingly being called simulation as programs become easier to use and computers become faster and less costly. He pointed out that the full spectrum of FEA tools is required to solve the many marine problems of today as the marine environment is a complex one. FEA is not only solving structural problems but is becoming an important research tool that provides real-life visualisation about the marine environment, such as what happens when huge waves and winds strike a vessel or how we keep a mine from colliding with a minesweeper. And how do projectiles penetrate military armour?

Peter went on to discuss the main features and toolkit of the FEA analyst. Using PowerPoint animations and colourful graphics, he addressed not the underpinning mathematics but illustrated the applications and solutions available today. He pointed out that from davits to supertankers to America's Cup attempts, FEA is an important part of modern naval architecture. Peter posed and fielded many questions from members, demonstrating his FEA passion, and made available a CD of his presentation.

Members joined in acclamation with the acting Chair and thanked Peter for a thought-provoking, well-prepared and presented address. The meeting expressed its appreciation to Mike Hollis and his team from Brisbane Ship Construction for their efforts in hosting the meeting, contributing to its success and for their generous hospitality.

The Queensland Section hosted a RINA Stand at AusMarine East in Brisbane on 29 and 30 October. The stand was crewed by Queensland Section members Brian Hutchison, Bill Barlow, Alan Prigg and Brian Robson. Many inquiries about RINA were made and a number of handouts were collected by potential members. In all the RINA presence was worthwhile and appropriate at such an exhibition, although the exhibition itself was rather limited in scale. The associated conference was apparently very successful and attracted some high-profile industry and political personalities.

The Queensland Section Technical meeting held at the end of the conference was attended by twenty members and visitors. The subject of this meeting was *The Development* *and Application of Maritime Standards*. The presenters were Werner Bundschuh, Violta Gabrovska and Antony Krokowski from Queensland Transport and Peter Murrell from Murell Stephenson, Solictors and Attorneys of Brisbane. The two sides of design approval, designer accreditation and the insurance business, were presented and resulted in some lively discussion. Our thanks go to the presenters.

Brian Robson

Victoria

The Victorian Section Annual General Meeting was held on 6 May at the Keepers Arms Hotel in North Melbourne. The Chair, Stuart Cannon, summarised some of the ongoing activities and thanked Samantha Tait and Ken Hope for their contributions as Honorary Secretary and Treasurer. Some highlights noted for the year included hosting the Australian Division AGM, hosting the visit and social function with the Chief Executive of RINA, Trevor Blakeley, and the ongoing successful technical program. The following Victorian Section committee members were elected:

Chair	Craig Gardiner
Treasurer	Ken Hope
Honorary Secretary	Samantha Tait
Aust. Division Council Nominee	Stuart Cannon
Committee member	Mark Smallwood

The May technical presentation was given by Mr Roy Goodwin on the topic *Marine Anti-foulings*. His presentation provided a clear explanation of how anti-foulings actually work as well as covering the various types currently available, methods of application and why they are used. The role of the IMO in the banning of the use of TBT anti-foulings was also discussed.

In June Dr Robert Phillips gave a presentation on *The Refurbishment of the RAN's FFG Superstructures*. Dr Phillips described the use of weld repairs and the application of carbon fibre reinforcing for overcoming cracking problems in the FFG superstructure.

In July Dr Kristian Slack gave an interesting talk on *Corrosion and Electromagnetic Signature Control for Ships and Submarines*. At this meeting the Pieter Bossen Memorial Award was presented to Mr Mathew Gudze. The award is presented annually for the best technical presentation. Mathew was awarded the prize for his technical presentation describing research he is undertaking for his master's thesis at the DSTO and the University of Newcastle on the modelling of corrosion in naval surface ships in relation to condition-based fleet management.

Mr Trevor Griffett presented a talk entitled *IMO Safety/ Security Regulations — the ISPS Code* at the August technical meeting. Trevor is the Manager for Policy Development and Labour with the Australian Shipowners Association. The implementation of the International Ship and Port Facility Security (ISPS) Code was discussed with emphasis on the inter-relation with existing safety management systems and how to achieve an implementation that doesn't impinge on existing commercial advantages, Australian operators or intended security outcomes.

The intriguing topic of *Machinery Failure Analysis* was addressed by Dr Geoff Goodwin of DSTO at the September meeting. It was highlighted that while microscopic investigation of a failure is necessary to determine the failure mode, the determination of why a failure has occurred requires understanding of the operating regime and the applied loads. The presentation discussed some cases where metallurgical examination provided key clues to the cause of failure, but a wider study was needed for a full diagnosis. It was shown that when knowledge of how a system works is combined with detailed knowledge of the failure mode, strategies can then emerge for preventing repeat failures, and the process can lead to significant reliability enhancement of equipment and systems. A combination of metallurgist and materials scientist, engineer and computer modeller can make a powerful investigative team!

New South Wales

The NSW Section Committee met on 11 September and, other than routine matters, discussed:

- SMIX Bash: More sponsors are needed to make the event successful. A model of *James Craig* in a bottle, made by Bill Weaver, will be raffled and drawn on the night. Costs of printing new raffle tickets versus recycling unused ones will be investigated.
- Ship Visit: Inspection of FFG at ADI Garden Island confirmed in principle for 28 October.
- Technical Meeting Program: Presentation for October to be revised, and topics proposed for 2004 were discussed, including composites and cutting-edge designs.
- Visit of Chief Executive in February: NSW Section Committee meeting planned for Pacific 2004 to coincide with the Chief Executive's visit.

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

- SMIX Bash: Sponsorships have started to come in, more are needed. Publicity to members and IMarEST members to be arranged. Catering can now be discussed directly with the new caterers.
- Ship Visit: Arrangements for inspection of FFG at ADI Garden Island confirmed; names of those attending required by dockyard security before visit.
- Technical Meeting Program 2004: Two presentations arranged, three to go on crowd-pulling topics.
- Pacific 2004 Exhibition: RINA will have a stand at the exhibition, and a crewing roster of Committee members for the duration will be drawn up. ID tags will be arranged for entry for all Committee members.
- Ken Fisher Presentation: RINA NSW will offer to help Fisher Maritime run a seminar in Sydney.

The next meeting of the NSW Section Committee is scheduled for 18 November.

The SSP Pod Propulsion System

Ken Grieg, Manager Marine Systems of Siemens Australia, gave a presentation on *The SSP Pod Propulsion System* to a joint meeting with the IMarEST attended by twenty-nine on 27 August in the Harricks Auditorium at the Institution of Engineers, Australia, Milsons Point.

Introduction

Ken began his presentation with the background information that Schottel and Siemens, two German companies, joined in 1997 in a complementary consortium to come up with a technically-superior pod with significant economic benefits. They had the advantage of hydrodynamic design provided by Schottel and electric drive provided by Siemens, both experts in their respective fields. They claim a 10% improvement over previous systems.

Azimuthing pods have been around for some time, up to 8 MW. Since the early 1990s integrated electrically-driven pods up to 20 MW have been available. The European Union supports research and development projects, e.g. Fastpod (which has a logo of a pod attached to a turtle). The aim is to take 20 kn vessels up to 30 kn. In general, pods are as efficient as shaftline systems. [*Not all would share this view of the drive train alone*— Ed.] The SSP with its slim body and advanced hydrodynamics is more efficient. The electric drive is by permanent-magnet motor and this saves 2% as it does not require electrical excitation or fan cooling. The twin propellers (forward and aft on the pod) save 10% over others and maximise the propulsion effect. The two fins and the strut gain swirl energy from the propeller, and the pod housing to propeller diameter ratio has been reduced by 40% from previous units. The weight has been reduced by 15%. The propulsion module is cast with flanges for connection to the upper module at the hull line. The fins (P&S on each unit) are flanged on. Inside each pod is the motor, propeller shaft, locking and braking mechanism, bilge pump and alarm and monitoring system.

Azipod and Mermaid are the principal competition to the SSP Units.

The Drive System

The permanent magnets in the motor are composed of alloys, and are attached to the rotor so that no slip rings are required. This gives volume and weight savings, continuous excitation, low losses, cooling direct to the sea, and the rotor structure is mounted directly on the propeller shaft.

In the stator, the electrically-active parts are similar to conventional. The stator current is transferred by slip-rings for azimuth turning, and unlimited torque is controlled by the stator current. The permanent-magnet motor diameter is about half that of a conventional electric motor.

Ship generator sets usually deliver power to the switchboard at 6 kV (medium voltage), and transmission lines with converters transfer power to the rotor. This means that it is a low-noise drive train.

The principal benefits of the diesel-electric system are as follows:

- Operational: The construction is modular, with a high level of redundancy, and is reliable. Mean time between failures is significantly longer than for a fixed-pitch propeller installation.
- Economical: The cost of maintenance and repairs is reduced.
- Design: The modular design permits flexible, more practical distribution of the system on board. Less space is needed for ballast, and less space and area needed for the unit itself. There is also more flexibility in the choice of diesel engine speeds.

Testing

Testing of the first unit, at Howaldtswerke Deutsche Werft (HDW) in Kiel, Germany, did not go altogether smoothly, and they met with resistance to acceptance of the system. Various designs were tested in Gdansk and Potsdam, but results lacked acceptance by shipbuilders, especially the Dutch. Effective technical results indicated 10% savings, but these were met with scepticism. The prototype testing was most convincing, because there were no scale effects. A full-size 7 MW unit was suspended from a gantry crane in the (wet) drydock at HDW. Results showed an azimuth rate of 1–2 RPM, but 2 RPM in a crash stop, and 15 s to go from full ahead to full astern. Further tank tests were carried out at HSVA in Hamburg, and these were finally accepted by the industry due to the prestige of the institution.

Applications

There is a growing number of SSP pods operating worldwide. Some of the first include:

- Chemical products tanker *Prospero* — SSP7
- TT Line ro-pax ferries — 2 x SSP10
- Cosco heavy-lift ships for PRC — 2 x SSP5
- Costa (modification) — SSP7

The number following SSP indicates power in MW.

Another success story is that of the TT Line ro-pax ferries, such as *Nils Holgersson,* which has 2 x SSP10 units fitted. She manoeuvres nimbly in harbour twice each day, turning in about 1.5*L*. Despite the adverse publicity associated with a bearing failure which necessitated an emergency docking during trials, she has been very successful. The advantages for ro-pax vessels are outstanding manoeuvrability, reduced noise, and flexibility. There are two engine rooms, two fuel systems, etc., giving high redundancy which means that the vessel meets all sailings on time, every time.

In heavy-lift ships it is important to have unrestricted deck space, and the Cosco ships have a clear deck of 125 m x 32 m. These vessels have two small SSP5 units installed aft, with the superstructure and engine room forward and connected to the pods by cables. The transformer and converter are modular, and this can reduce the labour in installation at the shipyard. They can all be popped into the construction at a very late stage.

However, it has not all been plain sailing for pod units. Carnival Corp. in the USA had problems with their Azipod units, and cruise ships *Elation* and *Paradise* had to cancel cruises while the vessels were docked to repair bearings and seals. More recently, Celebrity Cruise Line has lost confidence in pods and has had them removed from their vessels. These cases are bad news for pods!

Design Considerations

Diesel-electric drive can give greater flexibility to designers since, in general, having a shaftline dictates the aft end shape. The electric drive gives flexibility, and the designer has greater scope in the aft section. In an LNG tanker, for example, the tanks usually occupy 65% of the length.

However, by moving the engine room and superstructure forward, 85% of the length can be utilised, and this will allow the fitting of an extra tank.

Pods were originally fitted to standard ship hulls as an afterthought. Seatrade (a Siemens company based in Oslo) have sought to find hull shapes which are suited to the SSP, and find that the twin-skeg design is best. It avoids cross flow and is better for the pods. Pressure pulses on the pods are avoided, and cavitation bubbles at the top of the strut are also avoided. Other benefits of the twin skeg arrangement are better manoeuvrability, course stability [*You can usually improve one or the other, but not both* — Ed.] and seakeeping.

Conclusion

The SSP pod is a significantly better propulsion unit than the first-generation pods. It offers advantages in the areas of efficiency, flexibility, redundancy, manoeuvrability, course stability, reduced noise, and lower life-cycle costs.

The vote of thanks was proposed by Don Gillies.

The Evolution of Australian Tug Design

Noel Riley, Managing Director of Commercial Marine Design, gave a presentation on *The Evolution of Australian Tug Design* to a joint meeting with the IMarEST attended by forty-four on 24 September in the Harricks Auditorium at the Institution of Engineers, Australia, Milsons Point. Noel has written up the presentation, and it is expected that this will be published in the February issue of *The ANA*.

The World Water Speed Record

The twenty-fifth anniversary of Ken Warby breaking the World Water Speed record on Blowering Dam, NSW, in *Spirit of Australia* was marked by a champagne-and-nibbles evening on 8 October at the Australian National Maritime Museum, Darling Harbour. Ken and his son, David, were present, complete with the new boat which Ken has built to raise his own record. Following the champagne and nibbles, Ken screened the movie *The World's Fastest Man on* Water, filmed by Rob Macauley when Ken was busy raising the record twenty-five years ago, and then gave a presentation on *The World Water Speed Record* to a meeting attended by fifty-six.

The Way to the Top

As a youngster, Ken had made a model of Donald Campbell's *Bluebird*, and later built and raced hydroplanes, and won some titles. His real introduction to high speed came when he found that some J34 jet engines were available ex-air force in Dubbo, and he picked up two engines for the princely sum of $200.

The first boat he built had no cowl, no tail plane and no windscreen, and was trialled on Blowering Dam, with disappointing results. So he went to Prof. Tom Fink at the University of NSW, who recommended air scoops for the engine on either side of the cockpit, and a T-plane on the tail to prevent end-for-ending. They built a model, and this was tested in the wind tunnel by Dr (now Prof.) Lawry Doctors. Tom Fink's opinion was that Ken's boat was better than *Bluebird*! If the boat reached 7° above horizontal, then it would be in trouble (as *did* happen to *Bluebird*), but the T-tail would prevent that ever happening on Ken's boat.

They took the boat to Lake Munmorah and set a new Australian record of 166 mph (267 km/h), but the boat sank after he stepped ashore. They then put the air scoops on and fitted a windshield, as this meant that Ken would not need to keep holding the visor on his helmet down at speed! The second engine objected to having a screwdriver lost down the intake. However, they found more J34 engines on auction at Regents Park, and picked up two more for $65 each. After installation, they took the boat to Blowering, where they missed out on the world record by 20 mph (32 km/h). A new record, to stand, must beat the existing record by at least three-quarters of one percent. Tom Fink, who was on the scene, did some calculations with a pad and pencil, and said that the drag on the rudder at 300 mph (483 km/h) was about 200 lbf (890 N), and that the boat would go 20 mph (32 km/h) faster if he cut 2 in (50 mm) off the bottom to reduce the drag. Ken promptly cut off 2.5 in (65 mm) went out, and ran 288 mph (463 km/h), thereby achieving the world record.

Two months later he was in Wagga Wagga to receive an award from the Australian Sportsmen's association. At the presentation, Commander Bob Barker invited him on a tour of the apprentice training facilities at the Royal Australian Air Force base at Wagga Wagga, where they used J34 engines in the aircraft and for training the apprentices. On the tour, Bob offered to have the apprentices overhaul the engine as part of their training on the only J34 test bed in the country. When they stripped the engine down, they had to replace about 30% of the turbine blades, and the fuel nozzles. After her trip to Wagga Wagga, *Spirit of Australia* had a much more powerful engine than when she arrived.

Back at Blowering Dam, Ken's aim was to break 300 mph (483 km/h), and leave the 500 km/h (311 mph) record for something to do the following year. However, on the first run the boat did 305 mph (491 km/h), and on the return run she did 329 mph (529 km/h), giving an average speed of 317.6 mph (511.1 km/h) and a new world record.

Since Then

However, that left Ken with nothing to do the following year! Fortunately, Malcolm Fraser and the Australian Government had other ideas. They provided the money and promotional material, and Ken bought a 40 ft (12 m) motorhome, and took *Spirit* on a promotional tour of North America's shopping malls and the like. He happened to be in Newport, Rhode Island, when Jim Hardy had *Australia* there to challenge for the America's Cup. Jim asked him if he had ever been on a twelve-metre yacht? No, he had never been on any yacht! So he went out on *Australia* when they sailed against *France*.

Following that episode, Ken became interested in drag racing on jet-powered cars and trucks. The Australian National Maritime Museum wanted *Spirit of Australia* and so, with that arranged, Ken went to the USA to live, set up a business in mini-mix concrete, and pursue high-powered drag racing.

Previous Challenges

Donald Campbell's *Bluebird* had a 15° angle on the sponsons, which was far too much. *Spirit of Australia* and the new boat have about 1°. They did wind-tunnel tests on *Bluebird*, and found that she would not plane, so they added 400 lb (180 kg) of lead to the transom. That cured one problem but created another, increasing the susceptibility to end-for-ending. This was exacerbated by Campbell's decision *not* to refuel before the return run; he just turned around and came back, and that decision turned out to be fatal. They have recently found *Bluebird* in Coniston Water, and she has been raised and Campbell is now buried at Coniston. They have done fundraising for the restoration of the boat, which they intend to do.

Lee Taylor, from whom Ken took the record, was killed in 1980 while trying to beat Ken's record in a reverse three-pointer at Lake Tahoe. Craig Arfons went to the Firebird Dragway in Arizona, built a boat, and was killed at 260 mph (418 km/h) while trying to beat Ken's record. The British at the moment have *Quicksilver*, another reverse three-pointer, and she has so far not performed. Ken's considered opinion is that reverse three-pointers don't work.

The New Boat

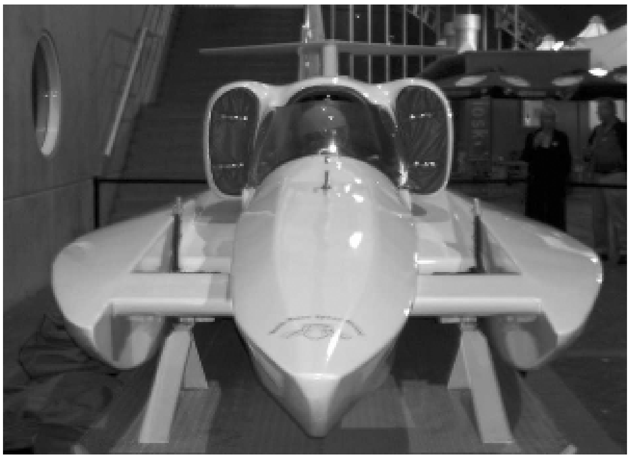
There is nothing magic about the new boat, which is similar in concept to *Spirit of Australia*, but about 8 in (200 mm) longer and 500 lb (227 kg) heavier. However, the secret weapon is the power, which is about 3000 hp (2200 kW) more. The running surfaces are the same, and they have cleaned up the aerodynamics. Safety-wise he has built in a moly-chrome cage and reinforced the cockpit, but accidents at high speed tend to be very unforgiving. He has fitted a Nascar 16-channel radio, and the tail plane is from an F20 Tiger Shark. Both *Spirit* and the new boat are plywood over spruce frames, and sheathed in 6 oz/yd^2 (203 g/m^2) Dynel. The following week they would be taking the boat to Taree on the Manning River to commence the test program. His son, David, has been driving hydroplanes for years, and is keen to get the feel of the new boat. There is insufficient room at Taree for the record, so they will be testing fuel systems and getting "seat time".

Going for the record is not a Saturday afternoon job; it takes months and months of working up to speed, getting everything right at each increment along the way. Blowering Dam is the favoured location because, with the right water level, the run is 9 miles (14.5 km) long, there are mountains all around, and the winds are predictable. The record itself depends on sufficient water in Blowering Dam. Currently the water level is at about 52%, after having been at 1% a week after Easter this year. However, the dam doesn't need to be full for testing. They can do 200 mph (321 km/h) runs on Blowering for "seat time". Good snow this year and next year will bring the level in Blowering up sufficiently for the record attempt, and they will have done all their testing by then.

In reply to a question about what it felt like to go so fast on water, Ken replied "It is the next best thing to sex!"

The vote of thanks was proposed by Adrian Adam, Members Manager at the Australian National Maritime Museum, and carried with acclamation.

Ken Warby in presentation mode
(Photo courtesy Dusko Spalj)



Front view of Ken Warby's new boat at the ANMM
(Photo courtesy Dusko Spalj)

Starboard quarter of Ken Warby's new boat
(Photo courtesy Dusko Spalj)

Restoration of the Yacht *Akarana*

David Payne of David Payne Yacht Design gave a presentation on *The Restoration of the Yacht* Akarana to a joint meeting with the IMarEST attended by fifteen on 22 October in the Harricks Auditorium at the Institution of Engineers, Australia, Milsons Point.

Background

David began his presentation by indicating that *Akarana* is important because she is rare; there are very few of her type around, and she may be the oldest of this type on Sydney Harbour. She is a 38 ft (11.6 m) yacht, with 6 ft (1.8 m) draft, and very narrow. She was designed and built by Robert Logan Snr, whose sons became the famous New Zealand boatbuilders, Logan Bros. She was built in New Zealand in 1888 specifically for the Centenary regatta to be held in Melbourne that year.

Akarana was launched in October, and sailed against Logan's own boat before being shipped to Melbourne two weeks before the regatta in November. She won one race, but performed badly in the next two races in rough water, and the press wrote that she was not up to standard. She was, in fact, designed to the length-plus-beam rule, whereby a narrower boat received a lower rating because beam occurs in the formula several times. This rule went out after Dixon Kemp in the UK introduced the sail-area-plus-length-waterline rule. Logan knew that he would be up against this rule change, but wasn't concerned.

The vessel then transferred to Sydney, with a view to attracting a buyer and orders for Logan boats. The first buyer was Abrahams, who raced her at the Royal Sydney Yacht Squadron, and then went cruising. She changed owners several times, and raced at the Cruising Yacht Club of Australia, for which she obtained a Royal Ocean Racing Club rating certificate. Such documents are of inestimable value when researching an older vessel

Many moons later, she was discovered by Bruce Stannard and she was shipped to New Zealand in early 1987. She underwent a restoration lasting four months which, with hindsight, was too short for the research needed to determine what was there originally. *Akarana* was then sent to Australia as a bicentennial gift from the New Zealand Government in 1988, and she was placed in the care of the Australian National Maritime Museum.

The museum started sailing her, and it quickly became apparent that she was not quite right. Compared to *Kelpie*, another recent restoration, and against whom she raced in the 1991 Gaffers' Day Race, she heeled easily, and was not able to hold her head up.

The museum approached Alan Payne, with whom David was working, with a view to improving the sailing qualities. They drew up a quick fix, but there was no money available at the time for work to be done. Then in 1997, NZ Telecom came up with some funds, and the museum asked David (Alan had passed away) how they could go about seriously improving the sailing. David replied that the first thing that he would do would be to find out all he could about Logan and his boats. The next thing was to take the vessel for a sail, and saw the problems for himself. In addition to the helm, the vessel had a "spongy" feel, as if it had insufficient ballast. The 56 ft (17.1 m) yacht *Waitangi* had been recently rebuilt in Melbourne. She came to the RSYS in January of the next year, and sailed well outside the heads in a stiff sou'easter. The museum then gave David a brief to design the restoration of the keel and rudder to the 1888 configuration, and to review all the details of the 1987 restoration.

Hull Research

Research is addictive! David married a Kiwi, and so gets to fly trans-Tasman occasionally. He found, at the Royal New Zealand Yacht Squadron, that they had two half-models of Logan's yachts from this period. In addition, he met and talked to people who had worked on Logan boats.

The vessel was hauled out of the water at the museum, and all work was done on show. The lines plan of the restoration was found to have errors, and David lifted the lines and corrected the plan so that he could do the numbers. He re-drew the profile, showing what he thought the original keel had been like, making extensive notes on what he was doing and why. Then they started pulling the vessel apart to see what was there. The vessel had floors inside which were L-shaped and lapped. The question was whether these were original Logan floors, or whether they had been changed later. They found the original keel bolt holes, but no others, proving that this was the original floor arrangement. He found that if he moved his proposed keel bolt holes by 3 in (76 mm) then they lined up with the Logan originals and lending credence to the proposed shape. New ti-tree floors were rough hewn from trees at Lemon Tree Passage, near Nelson Bay, NSW, and the floors rebuilt as original.

He then drew in a rudder to fit the original style, and the rudder was built from kauri with a tallow-wood stock. The Logan keel style was raised aft and faired into the rudder. The forefoot was hard (compared to a soft Fife-like one), and there was a knuckle at the hull-keel intersection, with the deepest point of the keel being at about $2L/3$ aft. The keel bolts were brass, but may have originally been Muntz' metal (which dezincifies over time). On advice from Crane, who were extremely helpful, these were replaced with bronze.

He discovered a newspaper article of 1925 which indicated that the lead keel had been removed and replaced with rail spikes embedded in cement, totalling 2 tons (2.03 t). This he assumed to be because the life of the original keel bolts was finite and, as they were embedded in the keel, the lot was replaced and some money saved in the process. A complete new keel was cast on-site at the museum, returning to the original 5 tons (5.08 t).

Rig Research

Inspection of the rig showed that the angle of the peak halliards was wrong, the boom was too high in comparison with early photos, and there was more to the problem than first realised. He measured the existing racing and cruising sails. He showed that the mast was too tall above the hounds, the boom was too high, and that there was no racing rig to suit the sails! The cruising rig was slightly too high, and she really needed a smaller rig which could be achieved by repositioning fittings and actually reusing the existing standing rigging. However, they needed to re-do all the running rigging and to slightly recut the existing mainsail. Sydney sailmaker Keith Brown was given the job of working with the old cotton sails, and he came up with new headsails for her.

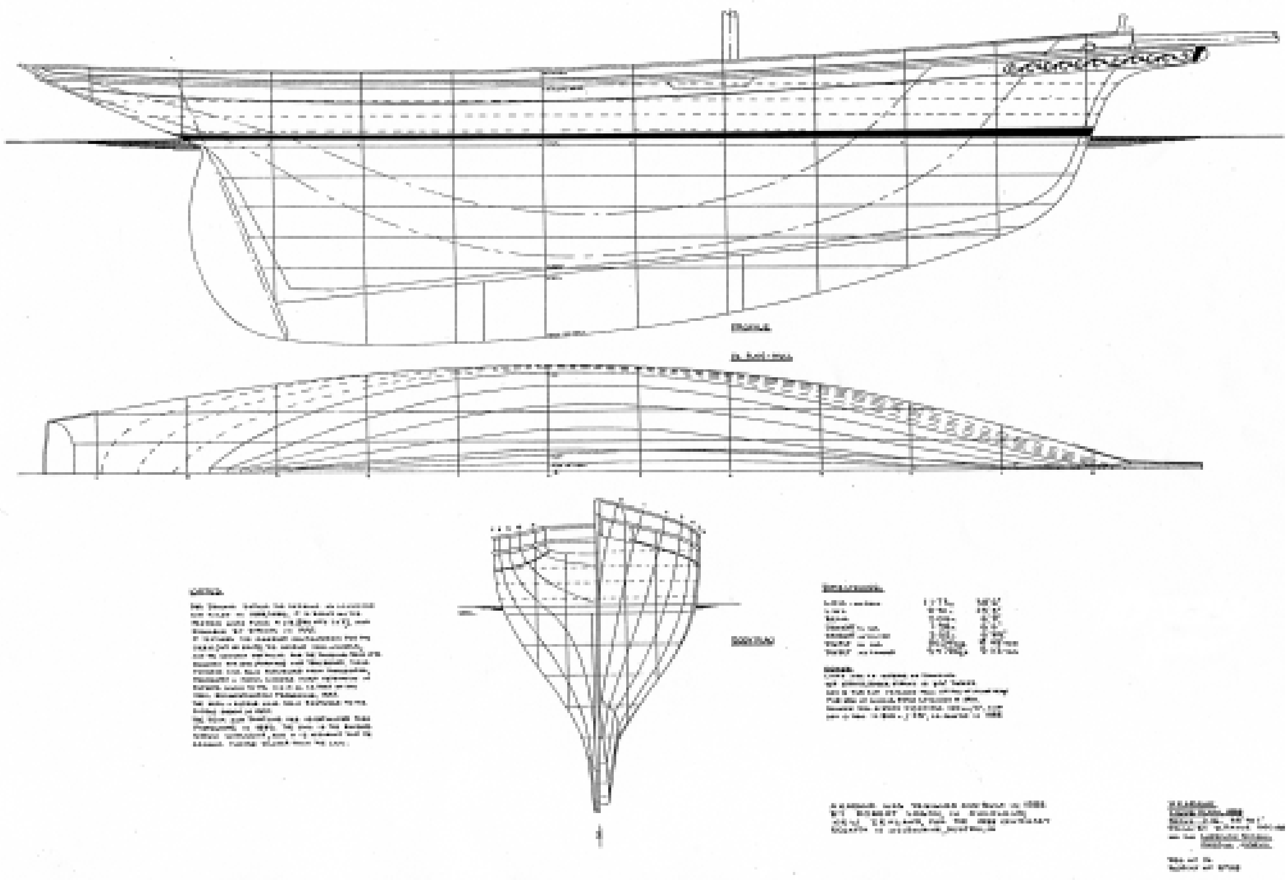
Results

In early 1999 the mast was re-stepped at Berry's Bay at a special ceremony with the New Zealand Consul-General in attendance. For her first sail there was very little wind, but it was apparent that she was now a very different vessel. On the next day out there was a 15 kn westerly blowing, and they sailed her from the museum to Athol Bight and returned, which they would never have been able to do with the previous arrangement. She now heels far less, and has very little helm on any heading. In a subsequent promotional race against *Kelpie* on Sydney Harbour, she performed far better than in the 1991 Gaffer's Day race.

Akarana is a true replica, in comparison to *Waitangi* who has been rebuilt with a hollow mast, Dacron sails, an engine, a microwave oven, 1x19 stainless steel rigging and a stainless steel rudder stock, all of which are very practical. On *Akarana*, everything is as authentic as possible, and things corrode and stretch just as they used to.

The vote of thanks was proposed by one of our well-known sailors, John Jeremy.

Akarana on Sydney Harbour
(Photo courtesy Australian National Maritime Museum)



The lines of *Akarana* after her reconstruction
(Drawing by David Payne, courtesy Australian National Maritime Museum)

The profile and sail plan of *Akarana*
(Drawing by David Payne, courtesy the Australian National Maritime Museum)

New Insights into the Nature of Hull Vibration by Propeller Sources

Roger Kinns of RK Acoustics in the UK gave a presentation on *New Insights into the Nature of Hull Vibration Excitation by Propeller Sources* to a meeting attended by twenty-three on 29 October at The University of New South Wales. Roger used two examples to show what could be achieved with vibration analysis, and showed that inward-turning propellers can achieve reductions in vibration compared to the conventional outward-turning propellers.

Aurora

The first example was the 270 m *Aurora*, built by Meyer Werft in Papenburg, Germany, for P&O Princess Cruises. Previous Meyer Werft vessels had ranged from 100 MW with four screws in which passengers or senior crew could never be located near the aperture, to 25 MW vessels to cruise the West Indies at 21 kn. In 1995 there was increased demand for ships to sail around the world, and 25 kn pushed the boundaries on what was known about control of propeller-induced vibrations. The shaft and propeller layout turned out to be critical, and the direction of rotation a key factor, so there was a need for new predictive techniques.

The design for *Aurora* resulted in a length OA of 270 m, 40 MW diesel engines driving two fixed-pitch five-bladed propellers of 5.8 m diameter for a speed of 24 kn. This gave a blade passing frequency of 12 Hz, as potential source of vibration. The hull shape aft was re-entrant, with a single skeg and a very rectangular cross-section for much of the length. The Meyer Werft yard is situated 70 n miles up the River Ems from the sea, so the choice of propulsion had to be right the first time.

Should the propellers rotate inwards or outwards? The textbooks say that it should be outwards. The two principal factors are the vibrations and the propulsive efficiency. However, a 13 m long model of the hull and appendages (including propellers) was tested in the Hamburg cavitation tunnel. This was fitted with a wake rake to determine the nominal wake. Unsurprisingly, the flow aft is inwards and upwards. However the cavitation patterns showed cavitation on the tips if the rotation was outwards, little or none if inwards. Simple geometry arguments show that there is a higher angle of attack for inward rotation, and this is better for reducing cavitation. Five-bladed propellers were chosen for vibration control, with inward rotation.

The cavitation source can change the vibration pattern, so the boundary-element method was used for analysis. They assumed that:

- the hull is rigid;
- the sea surface is a zero-pressure boundary;
- seawater is incompressible; and
- calculations were required for hull pressure distribution due to monopole and dipole sources, and pressure forces were integrated over the hull surface.

In the choice of frequencies, the blade passing frequency was emphasised. The monopole terms were dominant, arising from mass flux, and the dipole terms arise from fluid flow over the monopoles. They used non-dimensional scaling, with beam as the dimension. In the distribution of boundary elements, the elements were concentrated near the stern, and extended to 300 m from the ship.

Roger showed a number of graphs, indicating the results of the analyses. Key insights from the results include the following:

- The source type and strength are key factors for vibration excitation, *not* the maximum pressure on the hull;
- the position of the source in the propeller plane matters little; and
- sources in the wake aft of the propeller plane are suppressed strongly by the free surface.

In the final analysis, inward rotation of the propellers gave much lower vibration in *Aurora* than outward would have done and, more importantly, lower than the limits in the specification. As a bonus, the propulsive efficiency was also slightly greater.

Oriana

Roger's second example was the cruise vessel *Oriana*, also built by Meyer Werft in Papenburg, Germany. This vessel is propelled by geared diesel engines, with a boost from electric motors. She has two "father" nine-cylinder and two "son" six-cylinder diesel engines giving a nominal 36 MW, plus two reversible shaft generators giving an additional 8 MW. She has two controllable-pitch four-bladed propellers of 5.8 m diameter and, when first fitted, these rotated outwards. However, on sea trials it was found that she had broad-band vibration, with the result that the aft restaurant and cabins in the area were unusable at sea speeds.

A combination of a boundary-element analysis of the problem, tests in the depressurised tank at Marin and independent cavitation-tunnel results showed that vibrations would be reduced by turning the propellers inwards. This was done in two stages, but the major changes were:

- changing the engine cams to give opposite rotation on the engines;
- regrinding the gears to give opposite rotation; and
- swapping the propeller blades from port to starboard.

Results have shown that vibration has been significantly reduced, with the vibration velocities at maximum power reduced by a factor of four. The aft restaurant and all the cabins are now fully usable right up to maximum power.

The vote of thanks was proposed by Phil Helmore.

Phil Helmore

Dr Roger Kinns and Prof. Lawry Doctors
(Photo Phil Helmore)

COMING EVENTS

NSW Section

The fifth Sydney Marine Industry Christmas (SMIX) Bash will be held on Thursday 4 December on board *James Craig* alongside Wharf 7, Darling Harbour from 1730 to 2130. All in the marine industry are welcome, and partners are particularly welcome. There will be a nominal charge of $25 per head, and numbers are limited so early booking with payment by cheque (payable to RINA NSW Section) to Adrian Broadbent at Lloyd's Register, PO Box Q385, Sydney NSW 1230 is advisable to guarantee your place. Late bookings with Adrian on (02) 9262 1424 and payment at the gangway will be subject to the numbers limit. So don't delay; post that cheque today!

ACT Technical Meeting

The first technical meeting for 2004 will be on Tuesday 3 February at 1730 for 1800 at a location to be announced later. Ross Emslie will speak on *LPA stern gate stress measurements and other related monitoring tasks.*

Queensland Meetings

A Queensland Section technical meeting will be held at 6.30 pm on 2 December 2003. The subject and location of this meeting was still to be determined at time of going to press. The technical meeting will be preceded by a Section Committee meeting at 5.30 pm.

Western Australia

The Section will meet at 6 pm on 19 November at the Flying Angel Club for a presentation by Kent Stewart on *Salvaging Small Vessels*.

The Christmas social will be held in conjunction with IMarEST on Thursday 4 December at 7 pm at the Flying Angel Club. The cost of $25 will cover entree, choice of two mains (fish or meat), dessert, coffee and cheese.

It is planned to hold the AGM in February 2004 to coincide with the visit of RINA Chief Executive, Trevor Blakeley, from London.

Pacific 2004 International Maritime Conference

The Pacific 2004 International Maritime Conference will be held at the Sydney Convention and Exhibition Centre, Darling Harbour, Sydney, from 3 to 5 February 2004. It will be presented in association with the Pacific 2004 RAN Sea Power Conference as part of the Pacific 2004 Maritime Congress.

The conference, which is being organised by the Royal Institution of Naval Architects, The institute of Marine Engineering, Science and Technology and the Institution of Engineers, Australia, follows the success of the Pacific 2002 event which was held in January 2002.

More information can be found, or bookings made, on the website www.tourhosts.com.au/pacificmc2004, or by emailing pacificmc2004@tourhosts.com.au.

The wishbone ketch *Sana* (David Mathlin) and the Australian National Maritime Museum's *Kathleen Gillett,* a veteran of the first Sydney-Hobart yacht race in 1945, sail past the Australian Heritage Fleet's *Boomerang* on the way to a dead heat for second in Division 2 during the Sydney Amateur Sailing Club's Gaffers' Day on Sunday 19 October.
(Photograph John Jeremy)

Austal delivers *Bocayna Express*

The 66 m Auto Express 66 vehicle-passenger catamaran *Bocayna Express* completed sea trials and was handed over by WA shipbuilder Austal Ships to Spanish ferry operator Fred. Olsen SA during October. During construction of *Bocayna Express* every effort was made to save weight and a significant reduction in displacement has resulted in a fantastic improvement in maximum deadweight, which is in excess of 300 t. Consequently, on sea trials the aluminium fast ferry achieved speeds in excess of 40 kn lightship and just under 36 kn loaded. The originally-stated contract speed was 31 kn.

"This performance translates into transport efficiency that is noticeably higher than previous fast ferries in this size and speed range," said Glenn Williams, Austal's Sales and Product Development Manager.

"With 19 per cent greater car capacity, *Bocayna Express* is less than nine per cent slower than a similarly-sized monohull fast ferry that has 35 per cent more power. The benefits to the operator's bottom line are obvious."

Bocayna Express is powered by two 12-cylinder and two 18-cylinder MAN B&W VP185 diesels which combine to provide a maximum output of 11 600 kW. Located outboard in each engine room, the more powerful diesels drive Kamewa 90 SII waterjets while the inboard engines are connected to Kamewa 80 SII waterjets.

Austal has also developed versions of the Auto Express 66 that feature more powerful engines for even higher speeds and mezzanine vehicle decks to increase capacity up to 129 cars. Glenn Williams says these variants also have significantly superior performance to competing monohulls.

"Under realistic loading conditions, the Auto Express 66 would be 1.5 to 2 kn faster than a monohull that has far less car capacity and more installed power. Overall, that monohull will use 85 per cent more fuel per car per mile while travelling slower – these figures speak for themselves."

Visiting Austal's Henderson shipyard in the early part of September for the final trials of the vessel, Mr Fred Olsen Jnr, Executive Chairman of Fred. Olsen, SA said he was delighted with the new addition to his fleet, which currently consists of three catamaran fast ferries and two conventional monohulls, one of which will be replaced by *Bocayna Express*.

"The new catamaran brings together the experience and expertise of both our company and Austal Ships, and the excellent results achieved in all areas reflect this. We work very hard to be able to succeed in the fast ferry business, and *Bocayna Express* gives every indication that she is able to meet our criteria," he said.

"I am confident that both passengers and cargo operators will be very pleased with the fast, comfortable and reliable service this new ship will provide. These attributes and the comparatively low operating and ownership costs give us an advantage," Mr Olsen explained.

The 450-passenger catamaran will operate across the Bocayna Strait between the islands of Lanzarote and Fuerteventura and replaces a 14 kn monohull ro-pax ferry. Its design was specifically developed taking the route's shallow waters, strong winds and physical ship size restrictions into account. As the crossing is only nine nautical miles, Fred. Olsen SA has opted not to fit a full motion control system to *Bocayna Express*. While the transom-mounted interceptors and Austal hull shape are expected to provide the necessary level of comfort, forward T-foils can be easily installed at a later date if it is deemed necessary.

The introduction of the new fast ferry will enable Fred. Olsen SA to double the frequency of the service. Scheduled crossing time, including manoeuvring in port, is just 20 minutes, and loading and unloading will be completed in just 10 minutes.

Short turnaround times are facilitated by the straightforward layout of the drive-through vehicle deck, which is open at both bow and stern to save weight and reduce construction cost. Rated for axle loads up to 12 t and providing a clear height of 4.2 m, the deck can carry trucks and buses in addition to cars and motorcycles. Maximum capacity is 69 cars and there are 110 lane-metres for heavy vehicles.

Bocayna Express on trials
(Photo courtesy Austal Ships)

Austal designed the Auto Express 66 so that it would seamlessly integrate with Fred. Olsen SA's existing terminal facilities. The ferry's forward vehicle ramp is designed to support the weight of both the shore ramp and the transferring vehicles and is raised and lowered using two hydraulic capstans. The arrangement at the stern is simplicity itself, with the bulwark folding down to allow the shore-based ramp to lock directly onto the vehicle deck.

External stairs lead up to an open aft deck where 80 passengers can sit and enjoy the Canary Islands sun, views over the stern and refreshments from the bar on the short crossing. The passenger deck can also be reached via internal stairs amidships or using the lift installed on the starboard side.

Once inside the cabin it is immediately apparent that passenger comfort and fitout quality have not been sacrificed in achieving the economy and practicality that underpins the

The central lounge in *Bocyana Express*
(Photo courtesy Austal Ships)

operator appeal of the Auto Express 66. The floors are covered with plush wool carpet in combination with other high-quality flooring materials for the wide walkways and other high-traffic areas. Similarly prudent choices have been made in selecting the ceilings and aluminium honeycomb panelling.

One of the cabin's main features. in terms of passenger amenities, is the lounge area located between the bar aft and the shop and transverse walkway amidships. Fitted out with comfortable armchairs arranged around circular pedestal tables, the lounge is the ideal place for passengers to relax, partake of warm or cold beverages from the adjacent bar, and talk with friends.

In contrast to the predominantly blue and cream colour scheme, the tub-style armchairs feature bright red patterned wool covers with leather trims. Flooded with natural light from a large skylight, this area is also delineated from the rest of the passenger cabin by the use of polished metal handrails, a different ceiling style and the bordering walkways.

Outboard of the lounge area are rows of four aircraft-style seats, then another aisle and pairs of seats alongside the windows. The seats come complete with fold-down tables and information pockets and the use of alternating light-and-dark blue covers helps to create a more visually stimulating environment.

The same seating layout is repeated in the forward saloon that surrounds a central utilities block incorporating the shop

Bocyana Express bridge
(Photo courteay Austal Ships)

aft, crew mess in the starboard forward quarter and an electrical compartment and stairs to the bridge on the port side. The central section of seats is again differentiated by using red patterned covers and faces an expanse of aft-raked windows running the full width of the cabin and providing passengers with views over the bows.

"The interiors were designed following the same fundamental patterns that were used on our three other catamarans, since the design has proved to be very pleasing to our passengers, while at the same time being extremely practical," Mr Olsen said.

Bocayna Express will operate with a crew of 16 including a three-person bridge team. Their modern workspace places the Captain on the centreline flanked by the Chief Engineer to port and First Officer to starboard. In a departure from normal Austal practice, but in keeping with Fred. Olsen SA's wishes, the bridge does not have wing stations. Instead, the Captain uses the ferry's CCTV system to monitor position while berthing, controlling the ship from either the main command station or the secondary manoeuvring console which faces aft.

Featured among the array of modern electronics on the carefully arranged bridge is the Marine Link ship control and monitoring system that was developed by Austal Ships and features on most of its contemporary deliveries. This system allows extensive monitoring of machinery and systems throughout the vessel as well as providing a powerful on-line system to manage all user manuals as well as other ship's drawings and documentation.

The Auto Express 66 catamaran also has air-conditioned crew quarters for 13. Three single and one double-berth cabins are located in the port hull and there are four double berth cabins in the starboard hull. Both hulls are fitted with toilet and shower facilities and the starboard hull also includes laundry equipment. Located on the upper deck, the crew mess features comfortable sofa seating around two tables, as well as television and food preparation equipment.

Looking to the future, Glenn Williams said Austal had already benefited from working with Fred. Olsen SA and that this was set to continue with the construction of the ground-breaking 126.7 m Auto Express trimaran cargo-vehicle-passenger ferry which was ordered in June.

"By working together we have achieved a great result with the 66 m catamaran, and I'm sure that, like the trimaran, it will make many operators sit up and take notice. It is a top-quality, yet extremely affordable solution for operators who wish to provide a high-speed alternative to smaller conventional Ro-Pax ferries, and also a great starting point for new fast ferry operations," he said.

For longer, more exposed routes where vessel motion has tended to limit the successful application of fast ferries, Austal is now offering trimarans from 40 m upwards in both passenger-only and vehicle-passenger versions. In addition to enhanced seakeeping performance, these designs also have outstanding operating efficiency.

Principal Particulars

Length overall	66.2 m
Length waterline	59.0 m
Beam moulded	18.2 m
Hull depth moulded	5.9 m
Hull draft (maximum)	2.5 m
Deadweight (maximum)	315 t
Crew	16
Passengers	450
Vehicles	69 cars
	or 37 cars and 110 freight lane-metres
Axle loads	12 / 9 t (dual / single axles) on three central lanes, 2 t on outboard lanes
Vehicle deck clear height	4.2 m
Fuel (maximum)	24 000 L

Propulsion

Engines	Two MAN B&W 18VP185 (3500kW at 1870rpm each) and two MAN B&W 12VP185 (2300kW at 1870rpm each)
Gearboxes	Two Reintjes VLJ 2230 *and* two Reintjes VLJ 1130
Waterjets	Two Kamewa 90 SII and two Kamewa 80 SII
Speed	35.6 kn at 100% MCR with 200 t dwt

Survey

Classification Det Norske Veritas ✠ 1A1 HSLC R1 Passenger Car Ferry B EO

Combat System Contracts for Submarines

The Department of Defence has announced a $54 million contract with Raytheon Australia for hardware and software components in support of the replacement combat system for the Collins-class submarine.

"The contract with Raytheon Australia represents a critical part of the new system. Raytheon will provide hardware infrastructure that will support the US Navy-supplied tactical system as well as key software components," the head of Defence Maritime Systems, Rear Admiral Kevin Scarce, said.

The $400 million-dollar replacement combat system project was agreed by Government last year. It provides for a significant capability enhancement on the existing combat system that will provide state-of-the-art capability.

The replacement combat system will be sourced through the US Navy. It is based on the Raytheon CCS Mark II tactical command and control system that is currently being used by the US Navy. A Foreign Military Sales case to supply the CCS Mark II has been agreed with the US Government.

In October the Defence Materiel Organisation signed a $23 million contract with Thales Underwater Systems in Rydalmere, Sydney, to design, develop and produce sonar hardware and software. Under the contract, Thales will also modify existing sonar cabinets, work on program management and integrated logistic support and incorporate their sea-proven sonar display processing engine, which has already seen service with the Royal Australian Navy in the Collins-class combat system augmentation project.

The replacement combat system is to be introduced progressively as part of the submarines' routine docking program from 2006.

Austal Ships Preferred Tenderer for RAN Patrol Boats

In August Austal Limited's subsidiary Austal Ships, in conjunction with tender partner Defence Maritime Services, was selected as the preferred tenderer to construct and support the Royal Australian Navy's new Armidale-class patrol boats.

Austal's Managing Director, Mr Bob McKinnon, said the team had worked tremendously hard on the project and the tender partners were now looking forward to negotiating final contractual arrangements with the Department of Defence.

The Austal/DMS proposal combines the skills of two Australian companies: Austal Ships' world-renowned vessel design and construction and DMS' proven logistic and maintenance support, which will be provided throughout the new Armidale-class vessels' operational life.

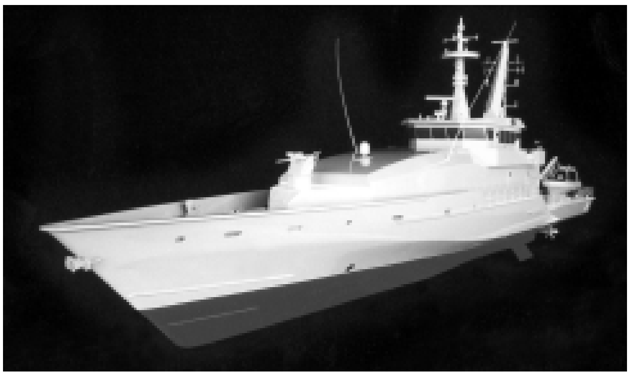
Once a contract is in place, Austal Ships will begin building the first of the twelve 56 m patrol boats which will be delivered to the Royal Australian Navy over a 42 month period.

The announcement of Austal/DMS as the preferred tenderer for the RAN project is expected to add momentum to Austal's push into the international patrol- and military-vessel markets, where it has already had considerable success including securing an order in June for 10 high-speed patrol boats for the Middle East.

Tendering for the RAN contract has also provided Austal with valuable insights into a number of technical and other issues that will be beneficial in developing future proposals for a wide range of vessel types and sizes. "Our capability to pursue projects involving the preparation of large, multi-faceted tender proposals has certainly been enhanced and this will be an extremely valuable asset when pursuing future projects, particularly military vessel orders," Mr McKinnon said.

The potential value of the RAN order is not being released at this time as the contract has not been finalised. The Austal group currently has 23 vessels worth approximately $470 million on order across its four shipyards.

The boats will be named *Armidale*, *Bathurst*, *Bundaberg*, *Albany*, *Pirie*, *Maitland*, *Ararat*, *Launceston*, *Larrakia*, *Wollongong*, *Childers* and *Broome* after Australian regional cities.



A model of the Armidale-class patrol boat
(Photo courtesy Austal Ships)

Queensland Industry News

October was another busy time for the local Gold Coast marine industry. Gold Coast City Marina builder, Innovation Marine, launched their new 18.3 m power catamaran which is to be delivered to Perth. Powered by twin 858 kW MTU diesels, the vessel reached a maximum speed of 32 kn and has a cruising range of 1000 n miles with its 7 500 L fuel capacity. A second vessel has already commenced construction. This vessel will be fitted with a hydrofoil and powered by waterjets and is expected to achieve a top speed of 45 kn. Upon completion the vessel is headed overseas to its Russian owner.

Azzura Yachts will be launching their much-anticipated 30.5 m motor yacht at the end of October. The vessel features six cabins, all with ensuites, separate saloon and dining areas and a gourmet galley. The quality of the interior fitout will be second to none. Even though the vessel has been built to survey standards, it will be operated privately on Sydney Harbour. Following the expected success of this vessel there is a possibility of an order for a 32 m motor yacht.

In North Queensland, NQEA Australia has recently delivered a 43 m luxury motor yacht named *SilverFox* (shown in the photograph). This vessel is classed with the American Bureau of Shipping for an American client. The designer of the vessel was Don Shead Ltd and the interior design was carried out by Claudette Bonville Associates, Inc. The vessel has four passenger staterooms, gym, spa pool, launch tender and a sophisticated audio-visual system. The construction of this vessel was started on the Gold Coast and completed at the NQEA facility in Cairns. *SilverFox* achieved a speed of 28 kn on trials.

Brian Robson

Silver Fox on trials
(Photo courtesy NQEA)

Five Patrol Boats for Indonesia

A new fleet of five patrol boats which will help reduce the impact of transnational crime in the region was recently presented to Indonesian authorities by the Australian Minister for Justice and Customs, Senator Chris Ellison.

Australian Federal Police (AFP) Commissioner Mick Keelty joined Senator Ellison in Fremantle for the official handover of the five vessels to the Deputy Chief of the Indonesian National Police (INP), Commissioner General Kadaryanto.

The custom-built catamarans will be used to patrol Indonesian waters and crack down on crimes crossing international borders such as people smuggling, drug importation and human trafficking.

As part of the $1.5 million patrol-boat package, the AFP will provide familiarisation training for Indonesian marine police who will be using the vessels.

The new patrol boats will greatly enhance the ability of Indonesian authorities to identify and apprehend vessels engaged in criminal activity.

'This is part of the Australian government's ongoing commitment to assist our neighbours and ensure a collaborative and effective approach to fighting transnational crime,' Senator Ellison said.

'The AFP has developed a unique relationship with Indonesian authorities and this cooperation has already proven enormously successful in combating crime and apprehending and prosecuting those responsible.'

The AFP worked closely with INP to design the new vessels and manage their construction by Western Australian boat building company, LeisureCat Australia.

The vessels have been designed to handle the demands of open-ocean patrol work in the Indonesian archipelago. The fibreglass catamaran hull is designed for speeds over 45 kn. The boats are robust enough to operate 15 n miles from the Indonesian coastline but will be equally efficient in shallow waters, close to the shore or reefs.

New Chief Defence Scientist Appointed

On 11 September the Defence Minister, Robert Hill, welcomed the appointment of Dr Roger Lough as the new Chief Defence Scientist to head the Defence Science and Technology Organisation. Dr Lough will replace Dr Ian Chessell, who is retiring after 33 years with Defence. Dr Chessell served as Chief Defence Scientist from 2000.

Senator Hill congratulated Dr Lough on his appointment, announced by the Secretary of the Department of Defence. Dr Lough, a physical chemist, has been Director of DSTO's Platform Sciences Laboratory in Melbourne since January 2002.

He has made an outstanding contribution to many aspects of DSTO's research program during his career, most notably in building research and development programs to support guided weapons and land operations. Most recently he has led the development of the new laboratory providing through-life support to maritime and air platforms. He has also been responsible for the science and technology aspects of the Joint Strike Fighter Program.

Senator Hill thanked Dr Chessell for his distinguished service as Chief Defence Scientist and wished him well in his retirement.

Defence Capability Review

The Government has taken a number of decisions which will lead to some re-balancing of the Defence Capability Plan, Defence Minister Robert Hill announced on 7 November.

Senator Hill said while the fundamentals of the Defence 2000 White Paper remained sound, the Government had indicated in the Defence Update 2003 released in February that such re-balancing might occur.

The Defence Update noted that global terrorism, the spread of weapons of mass destruction and instances of regional deterioration had new prominence.

"After reviewing our Defence capabilities, the Government has decided to provide the ADF with new assets, equipment and capabilities that will ensure it continues to be able to defend Australia and Australian interests in an uncertain and complex environment," Senator Hill said.

The key decisions are outlined in the Government statement reproduced below.

Defence Capability Review 2003

The Government has reviewed Australia's Defence capabilities and considered the Defence Capability Plan (DCP) in the light of changes in the strategic environment (as evidenced by the Defence Update released in February), recent operational experience and more mature costings.

The goal has been to ensure a balanced force able to achieve the objectives of the Defence 2000 White Paper whilst recognising the extra complexity of unconventional threats.

The review reaffirmed that the defence of Australia and regional requirements should be the primary drivers of force structure. Tasks such as the protection of Australia's borders remain as important as ever.

In relation to force structure, the review process identified an increased requirement to strengthen the effectiveness and sustainability of the Army, to provide air defence protection to deploying forces, to enhance the lift requirement for deployments and to position the Australian Defence Force to exploit current and emerging Network Centric Warfare advantages.

In undertaking the review, the Government has drawn heavily on the advice of the Chief of the Defence Force and the Service Chiefs.

The Government has also been mindful to strike the right balance between maintaining near-term preparedness and longer-term capability.

In consideration of the review, the Government has now taken a number of decisions which lead to some re-balancing of the DCP.

Some of the more significant include:

Australian Army

The Government has accepted recommendations which will contribute to the Army becoming more sustainable and lethal in close combat.

The Government has, in particular, accepted the advice of the Chief of Army that the combined arms approach — whereby infantry, armour, artillery, aviation and engineers work together to support and protect each other — remains the best way of achieving rapid success while minimising friendly casualties.

The Government has decided that to provide our land forces with the combat weight they need within combined arms will require the replacement of Australia's ageing Leopard tanks.

A decision on which tank to purchase will be made by the Government in the near future. The Government is considering the Abrams tank and contemporary versions of the Leopard and Challenger 2.

The Government has also agreed to move rapidly to acquire combat identification for our forces, more capable communications and increased provision of night vision equipment.

It is the view of the Army that with these additional capabilities, the introduction of the Tiger armed reconnaissance helicopter (a project which is on time) and additional troop-lift helicopters for amphibious transport, the force will be significantly hardened and better networked.

Royal Australian Navy

Both frigates and amphibious ships have been engaged constantly since September 2001 across a full spectrum of operations. Additionally, the importance to the Government of the ability to safely deploy, lodge and sustain Australian forces offshore has been re-emphasised.

Whilst these deployments have been highly successful, lessons have been learned and government has accepted advice from the Chief of Navy to further improve capability.

Defence and warfare capability

The Government has accepted advice to strengthen the Navy's defensive air-warfare capability. The anti-ship missile defence projects currently being implemented will be complemented by:

- Introduction of SM2 missiles to four of the Navy's guided missile frigates (FFG).
- Acquisition of three air-warfare destroyers.

The FFGs will be improved in Australia and the Government's strong preference is to build the air-warfare destroyers in Australia, which will provide significant work for Australia's shipbuilding industry. The core of the combat system for the air-warfare destroyers will be United States designed — probably a variant of the Aegis air warfare system. This combat system can track large numbers of aircraft at extended range and, in combination with modern air-warfare missiles, can simultaneously destroy multiple aircraft at ranges in excess of 150 km. This capability will significantly increase the protection from air attack of troops being transported and deployed.

To provide offsets, the two oldest FFGs will be paid off from 2006 when the last of the new Anzac-class frigates is delivered. Furthermore, the Government's strategic guidance will enable it to lay up two minehunter coastal vessels which could be brought back into service should the need arise.

Sea lift

The Army and Navy have advised that the deployment requirements of the White Paper would require greater lift capacity than that envisaged in the current DCP.

As a result, the Government proposes to enhance the Navy's amphibious capability by replacing HMAS *Tobruk* with a larger amphibious vessel in 2010 and successively replacing the two LPAs, HMA Ships *Manoora* and *Kanimbla*, with a second larger amphibious ship and a sea-lift ship.

To help offset the costs of larger amphibious ships, the fleet oiler HMAS *Westralia* will be replaced through the acquisition of another operating but environmentally-sustainable oiler which will be refitted in Australia. The substitute oiler, which is expected to be in service in 2006, is a less ambitious replacement than that envisaged by the White Paper.

This is a significant and demanding program for the Navy but one which the Government thinks is warranted by the current and projected strategic environment.

Royal Australian Air Force

The Government has accepted advice from the Chief of Air Force that future strategic uncertainty demands continued emphasis on a balanced and flexible Air Force comprising intelligence, surveillance and reconnaissance, air combat, strike aircraft and combat support elements. Furthermore, the Air Force must be networked, flexible and adaptable with modern versatile, multi-role capabilities that can contribute to joint and combined operations across the spectrum of conflicts.

The Government is of the view that a sound pathway to the future has been laid.

The Air Force already plans for the joint strike fighter (JSF) aircraft, new airborne early-warning and control (AEW&C) aircraft are in production and air-to-air refuelling aircraft are out to tender.

The Air Force also has plans for the acquisition of Global Hawk unmanned aerial vehicles and a replacement for the AP3C under the further maritime patrol and response capability.

In such circumstances, the Air Force has advised that by 2010 — with full introduction of the AEW&C aircraft, the new air-to-air refuellers, completion of the F/A18 Hornet upgrade programs, including the bombs improvement program and the successful integration of a stand-off strike weapon on the F/A18s and AP3C — the F111 could be withdrawn from service. In other words, by that time the Air Force will have a strong and effective land and maritime strike capability. This will enable withdrawing the F111 a few years earlier than envisaged in the White Paper.

Resource Issues

On 18 September the Government announced a number of decisions flowing from the Defence Procurement Review chaired by Malcom Kinnaird. These included measures to strengthen the capability and assessment process, improve project delivery, strengthen the capability development and assessment process, improve project delivery, strengthen the current two-pass system, provide a better basis for project scope and cost, and give greater recognition to the importance of managing through-life support for capabilities. It is the Government's intention that all capabilities set out under the revised DCP will be progressed in line with these reforms, subject to transitional arrangements.

Reform of Defence Acquisition Process

The Government has decided to implement a range of reforms to further improve Defence acquisition processes, Defence Minister Robert Hill announced on 18 September 2003.

Senator Hill said that while the management of major Defence acquisitions had improved significantly in recent years, there was still room for further reform.

"As a result of our reforms, new projects such as the Airborne Early Warning and Control aircraft and the Tiger combat helicopters are running on time and on budget," Senator Hill said.

"But we are committed to making further improvements in our Defence acquisitions processes. We need to be confident that the extra money we have committed to ensure our Army, Navy and Air Force continue to be well equipped to defend Australia and our national interests is being spent well."

Malcolm Kinnaird, Len Early and Bill Schofield were appointed in December last year to review a range of issues associated with major Defence acquisitions. The review team worked closely with the Defence Materiel Organisation and the Department of Finance and Administration to examine the key challenges associated with the development of the Australian Defence Force's capability and the acquisition and support of Defence equipment.

The key government decisions are set out below. They broadly follow the review team's recommendations.

"The Government has decided to implement a range of measures to ensure that we continue to spend taxpayers' money wisely and maintain public confidence in the Defence procurement process," Senator Hill said.

The key decisions flowing from the Government's adoption of the recommendations include:

- Establishing the DMO as a prescribed agency under the Financial Management and Accountability Act to facilitate its evolution towards a more business-like identity. As a prescribed agency, the DMO will be financially autonomous from the Department of Defence and be required to prepare separate and auditable financial statements, improving the financial transparency and accountability of the DMO.
- Strengthening the capability development and assessment process before projects are handed to the DMO. This will be achieved by forming a new Capability Group within Defence headquarters, to be managed by a three-star official (military or civilian) reporting directly to the Secretary and Chief of the Defence Force. The new three-star position will be appointed on merit for an extended tenure and will be solely responsible for capability development and ensuring that project proposals put to Government have reliable cost and schedule estimates.
- Establishing an eight-member Advisory Board to provide advice to the head of the DMO on strategic issues and to report to the Ministers for Defence and Finance and Administration at regular intervals on the implementation of the Kinnaird recommendations. The Advisory Board will comprise four private-sector members (one of whom will be Chair) together with the Secretaries of Defence, Finance and Administration and the Chief of the Defence Force.
- Giving the Chief Executive Officer (CEO) of the DMO an expanded range of powers to make improvements to

the delivery of Defence projects and the management of the DMO, including empowering the CEO to revise DMO staffing and remuneration policies in order that the CEO is able to attract and retain high-quality project managers from the military, industry or public service on the basis of merit and for extended tenures.

- Strengthening the current two-pass approval system to facilitate early engagement with industry and provide a better basis for project scope and cost. This will be achieved by allocating additional funding at first-pass approval to allow Defence to undertake a detailed study of capability options and by mandating the early involvement of Defence Science and Technology Organisation and the Department of Finance and Administration to provide external evaluation and verification of project proposals.
- Establishing cost centres in Defence and the Department of Finance and Administration, which will build on Defence's decision earlier this year to establish a Cost Assessment Group; strengthening the review of project costs and risks; and providing a quality assurance role for the Government.
- Conducting a worldwide search for a CEO to lead the DMO into the future. The CEO will work closely with the Secretary of the Department of Defence to implement the recommendations of the Kinnaird Review.
- Extending the role of Project Governance Boards to advising the CEO of the DMO on through-life support issues in order to provide greater recognition of the importance of managing the whole-of-life of a particular capability.

Multi-billion Dollar Submarine Refit Contract for ASC

The Australian Submarine Corporation has been awarded a contract worth up to $3.5 billion over 25 years to refit the Collins-class submarines, the Minister for Defence, Robert Hill, and the Minister for Finance and Administration, Nick Minchin, announced on 16 October 2003.

The refits of each submarine will be conducted on a 12-month cycle in Adelaide under a long-term maintenance agreement to be signed by the ASC and the Defence Material Organisation.

Senator Hill and Senator Minchin said that the contract reaffirmed ASC's reputation as Australia's pre-eminent centre for submarine construction, modification, repair and maintenance. The skilled ASC workforce at Osborne is integral to our long-term submarine capability. This contract is a significant investment in Australian technology and intellectual capital to ensure the proper service and maintenance of our fleet, which has the most capable conventional submarines in the world.

The initial duration of the agreement is for 15 years, with the option to extend it for a further 10 years. Each refit of a submarine costs about $80 million. The six Collins-class submarines will be refitted every seven years over their 28-year lives. The 25-year contract could be worth up to $3.5 billion, the majority of which will be spent in Adelaide providing full-cycle dockings — a huge boost to the South Australian economy. The remainder will be spent on other submarine maintenance activities, including mid-cycle dockings and other contract work to be carried out primarily in South Australia and Western Australia, where the submarines are home-ported.

The agreement provides significant benefits to Defence, local industry and subcontractors by securing long-term, in-country support for a key strategic defence capability, while providing commercial certainty to ASC. ASC completed the submarine construction contract earlier this year and has been involved in maintenance of the Collins class since 1996.

HMAS *Waller* will be the first submarine to be refitted under the new contract and is expected to commence refit in late 2004. HMAS *Waller* will benefit from the experience ASC has gained on the current refits of HMAS *Collins* and *Farncomb*.

Tenix Defence to Build 31.4 m Research Vessel for Dick Smith

Adventurer and businessman, Dick Smith, has chosen Tenix Defence to build his 31.4 m multi-purpose research vessel. The vessel, to be designed and constructed at Tenix's Henderson shipyard in Western Australia, will feature an aluminium superstructure and steel hull and have a range of 3 000 n miles.

It will be fitted with a portable laboratory and helicopter pad, to be used for research purposes as part of Mr Smith's ongoing work with the Australian Geographic Society. The vessel will be utilised by scientific institutions for research into environmental concerns such as coral bleaching and the implications of environmental change around the Pacific region and sub-Antarctic islands.

Tenix Defence CEO, Robert Salteri, said that although costing almost $6 million, the vessel would be more a utility expedition vessel than a luxury yacht.

"It is not your gold taps sort of yacht. It is designed for functionality, and you won't have to take your shoes off," he said.

"A key for Dick Smith in choosing Tenix to build the vessel was the company's success in building commercial vessels and trawlers, as well as search-and-rescue vessels and patrol boats.

"Tenix has won a high reputation for manufacture of naval, paramilitary and specialist vessels, and its expertise in design and integration of naval systems, sensors and communications. It is also building a presence within the global luxury-yacht market," Mr Salteri said.

The vessel is scheduled for delivery in June 2004.

Tenix Completes Frigate and Submarine Maintenance

The Royal Australian Navy frigate HMAS *Adelaide* returned to the water on 12 November after a 15-week refit and maintenance program at Tenix's Henderson shipyard in WA.

It has been a busy period for Tenix's shiplift, maintenance and support facility, with the Collins-class submarines, *Rankin*, *Dechaineux* and *Sheean* undergoing maintenance and re-certification in recent months.

Tenix-built Search-and-rescue Vessel Delivered to Philippines

Tenix Defence has handed over a 35-metre Search-and-rescue vessel to the Philippine Coast Guard — the fifth of six vessels it is building under a follow-on contract with the Philippines Government. The vessel arrived in the Philippines on Saturday 1 November 2003.

Named BRP *Romblon*, the vessel was formally handed over to the Commandant of the Philippines Coast Guard, Vice Admiral Reuben S. Lista, at an official ceremony in Fremantle.

The Philippines Search-and-rescue Project is the latest success in the long history of Tenix patrol-boat design, construction and export at its Henderson shipyard. Designed entirely by Tenix for rapid emergency response, BRP *Romblon* is equipped for survivor recovery and rescue coordination, and will assist with humanitarian aid in South-East Asia similar to its sister ships.

Tenix delivered two 56 m SAR vessels, BRP *San Juan* and BRP *Edsa II*, to the Philippines Government in 2000, and was then contracted to build six more vessels for the Philippines Coast Guard as part of the follow-on order valued at $A130m.

Tenix has already delivered two 56 m SAR vessels and two 35 m vessels to the Coast Guard with the last vessel from the follow-on order to be delivered in January 2004.

Work on these and other similar vessels has generated employment for an additional 200 personnel at Tenix's Henderson facility and approximately 70 personnel subcontracted over the life of the ships' construction.

BRP *Romblon*
(Photo courtesy Tenix)

Award for Catamaran

Engineers Australia has recognised the radical wing-sail catamaran developed by Australian Catamaran Challenge in the 2003 Western Australian Engineering Excellence Awards. The award judges were impressed by the innovative design and construction solutions developed for the project. The unique vessel has successfully completed its first round of sea trials and is currently being upgraded at the team's Fremantle workshop. The ultimate goal for the award-winning design is the Little America's Cup, which will be sailed at Rhode Island in September 2004 against previous winner Steve Clark's *Cogito* and the British *Invictus* team.

Kim Klaka

Austal Contract for Hong Kong Ferries

Reflecting the high degree of satisfaction with its existing Austal catamarans, Hong Kong-based New World First Ferry Services (Macau) Limited [First Ferry (Macau)] in September signed its third contract with Austal Ships in two years. The latest order is for two 47.5 m passenger catamarans which will take the total number of vessels built by Austal for the group to seven.

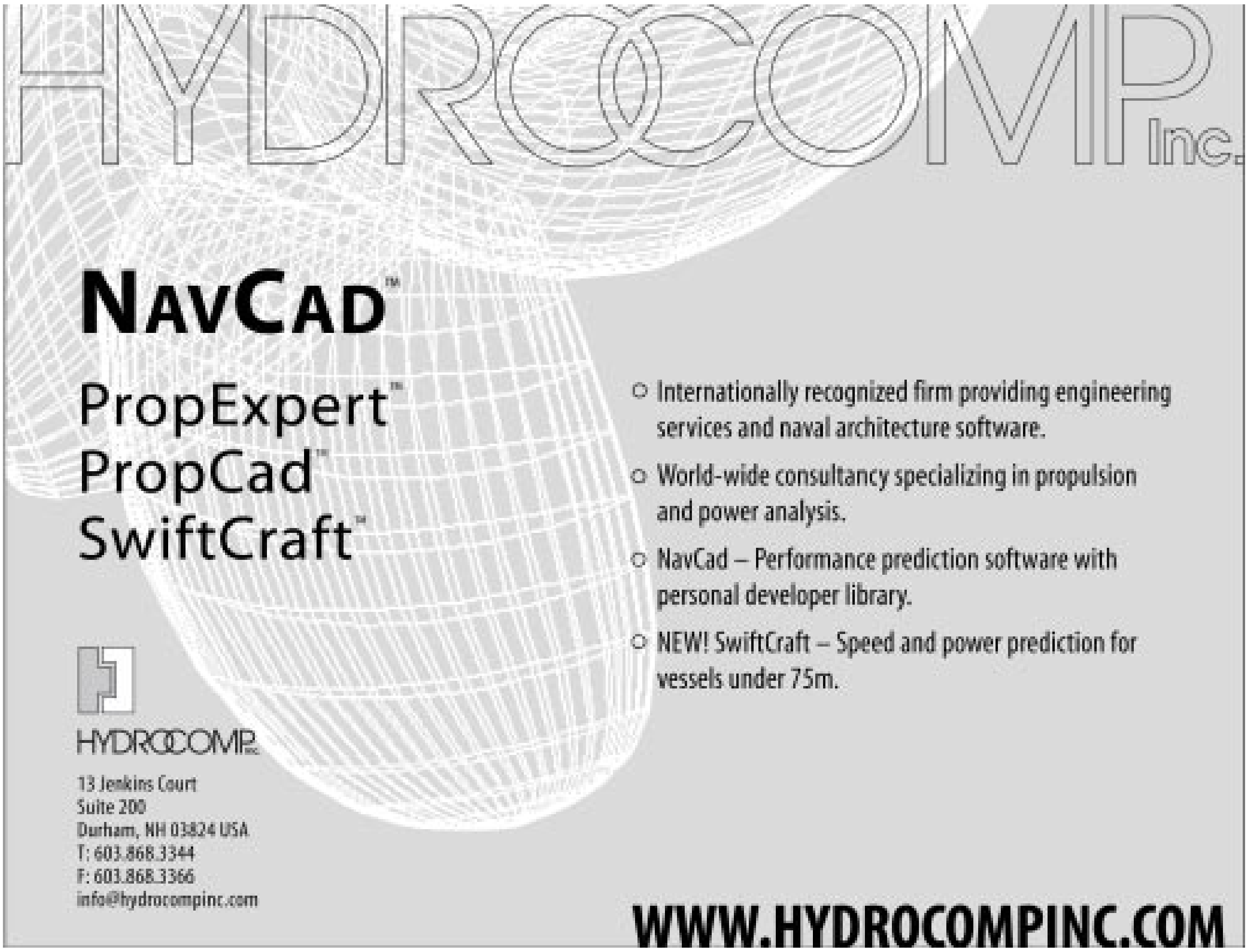
Austal subsidiary Image Marine will build the two new catamarans. The high-speed ferries will be almost identical to the trio Austal Ships delivered to First Ferry (Macau) in October last year and will join those vessels on the Hong Kong-to-Macau route.

Due for delivery in September 2004, the two new vessels will carry 430 passengers, a slight increase compared to the previous three deliveries. They will powered by four MTU 16V 4000 diesels driving KaMeWa waterjets to give a service speed of 42 kn, allowing the crossing from Hong Kong to Macau to be completed in approximately 55 minutes. First Ferry (Macau)'s operational experience has proved the excellent seakeeping performance of the Austal hull design and led to its decision not to fit the retractable ride-control fins that feature on the earlier vessels.

The First Ferry (Macau) contract takes the total number of vessels currently contracted to the Austal Group to 24, including five vehicle-passenger ferries. Having recently delivered an Auto Express 66 catamaran to Fred. Olsen SA, Austal Ships in Western Australia is now building a 126 m trimaran for the same company, an 86 m catamaran for Canadian American Transportation Systems, a 56 m catamaran for Aremiti Cruise, and a 50 m catamaran for Kangaroo Island SeaLink. In Mobile, Alabama, Austal USA is building a 58 m *Auto Express* catamaran for Lake Express, which will operate it across Lake Michigan.

In the paramilitary market, Austal Ships is currently building ten 37 m patrol boats for a Middle Eastern nation and, together with partner Defence Maritime Services, has recently been awarded preferred tenderer status for the design and construction of twelve 56 m Armidale-class patrol boats for the Royal Australian Navy. Image Marine will soon launch three 22 m Coast Guard vessels for the Kuwaiti Government.

Principal Particulars	
Length Overall	47.5 m
Length Waterline	44.0 m
Beam Moulded	11.8 m
Hull Depth Moulded	3.8 m
Maximum Draft	1.4 m
Passengers	430
Crew	8
Propulsion	
Engines	Four MTU 16V 4000 M70
Gearboxes	Four Reintjes VLJ 930 HL
Waterjets	Four Kamewa 63 SII
Speed	42 kn
Survey	
Classification	Det Norske Veritas ✠ 1A1 HSLC Passenger R2 EO



Warramunga Firsts

In early September the Royal Australian Navy successfully test fired the new Evolved Seasparrow missile from HMAS *Warramunga* at the Pacific Missile Range in Hawaii.

Defence Minister Robert Hill said the test firing was a milestone for the Seasparrow project, which involves fitting Australia's Anzac-class ships with the new self-defence weapon for use against anti-ship missiles.

"HMAS *Warramunga* is the first Anzac frigate to be fitted with the missile and leads the way for it to be brought into service in the remaining Anzac ships," Senator Hill said.

"The Evolved Seasparrow missile is expected to now be fitted in Anzac ships along with significant combat system software upgrades and illumination radar.

"The test firing from HMAS *Warramunga* is part of the operational evaluation stage of the project which is being managed by the Defence Materiel Organisation.

Senator Hill said the missile has been developed, tested and manufactured under a cooperative program by ten nations including Australia, Canada, Denmark, Germany, Greece, the Netherlands, Norway, Spain, Turkey and the United States.

Australian industry will undertake work in excess of $500 million for development and production activities over the life of the project. The Defence Science and Technology Organisation also participated in the development and test programs for the missile.

In another first for HMAS *Warramunga*, a Super Seasprite helicopter landed onboard the ship alongside at Fleet Base East in Woolloomooloo on 5 November. The helicopter has been embarked to commence first-of-class trials in the frigate. The trials will be used to evaluate procedures for the new Super Seasprite, including landing, lash-down and stowage aboard the Anzac-class warships.

The first of the eleven Super Seasprite helicopters was provisionally accepted by Defence at a ceremony in Nowra on 18 October for testing, evaluation and training. Once accepted into service and fully equipped, the Super Seasprite will provide the primary anti-surface weapon system for the Anzac-class frigates, with up to six aircraft deployed at sea at any one time.

The first Evolved Seasparrow missile emerging from its silo in HMAS *Warramunga*
(RAN photograph)

New South Wales Industry News

New Design

Grahame Parker Design is designing the ninth CityCat for the Brisbane City Council. However, this new vessel differs significantly from the previous eight identical sisters, being wider, having more seating and engines with more power, and is visually very different (except for the colour scheme). The new vessel will have aluminium alloy hulls and composite superstructure.

Principal particulars of the vessel are:

Length OA	25 m
Beam OA	7.3 m
Draft (hull)	0.8 m
Passengers	165
Engines	Two Scania DI12 305 kW @ 1800 rpm
Gearboxes	Two Twin Disc 2:1 RR
Speed (loaded)	25 kn

Construction has just commenced at Norman Wright and Son in Brisbane, and launching is due in June 2004.

New Construction

Bill Bollard has completed his own personal fishing vessel, with launching taking place on 26 March this year. Bill says that the boat initially floated at level trim and about 40 mm high, with displacement just under 3 tonnes. Performance is as predicted, achieving 16 knots at 2000 rpm, although slightly over propped. He won't change it at this stage, as he rarely runs over the continuous rating of 1800 rpm and still achieves 13.6 knots. Fuel consumption from one tank-full averaged 6.80 litres per hour. The boat handles well at sea, and steering is precise. Now, where are the fish biting?

Bill Bollard's new boat prior to launch
(Photo courtesy Bill Bollard)

Construction has started at Boatspeed in Gosford of a new boat for Ellen Macarthur. The 23 m trimaran is being designed by France-based British naval architect Nigel Irens in conjunction with the Offshore Challenges technical team. The giant three-hulled "flying machine" will be sailed single-handed by Ellen, and will be designed with a single focus — solo records. Without the constraints of class rules or grand prix racing, the boat has been conceived with trans-ocean passages in mind, and fully optimised, much like the monohull *Kingfisher* was, for solo sailing. The concept is built around trying to achieve high daily average speeds in a variety of conditions, coupled with safety and reliability, in equal measure.

Constructing the new solo trimaran in the southern hemisphere will allow Ellen to use the return voyage to Europe as part of a vigorous training campaign and potentially set a solo record at some point on the return. A detailed programme for the new boat will be announced later this year, but it is likely to include a number of big trans-ocean records as well as some shorter passages, including the solo 24-hour distance record.

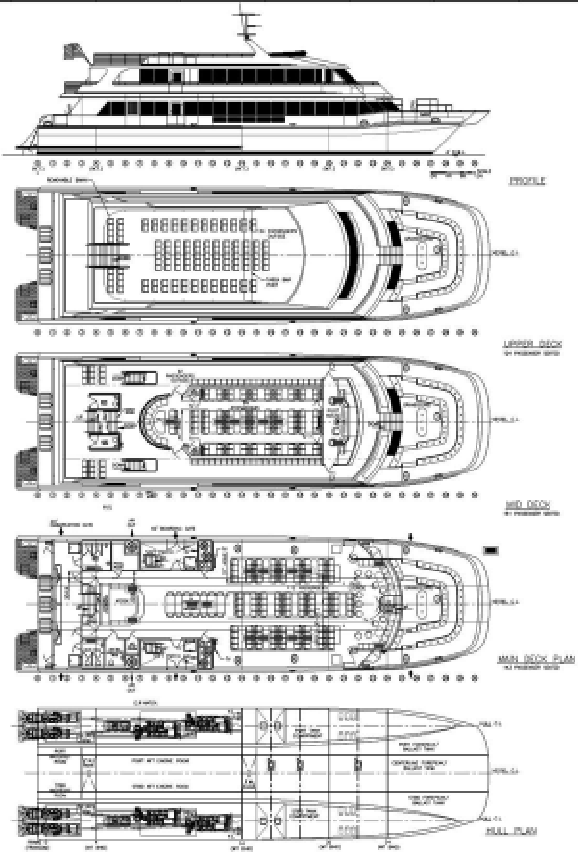
For more information and photos of construction in progress, including a webcam, visit www.boatspeed.com.au.

A 40 m whale-watching catamaran, *AtlantiCat*, to a design by Crowther Design has recently been completed by Blount Boats of Warren, Rhode Island, USA. The vessel will be operated by Acadian Whale Adventures, and will run out of Bar Harbor, Maine, two to three times daily depending on the season. Spear-Green Design was contracted by Crowther Design to provide assistance with interior design as part of their total design package.

Principal particulars of the vessel are:

Length OA		39.80 m
Length WL		32.60 m
Beam OA		10.97 m
Draft (hull)		1.20 m
Passengers		
	Upper Deck	70
	Mid Deck Internal	99
	Mid Deck External	62
	Main Deck	157
	Foredeck	54
	Total	442
Crew		10
Fuel		Two 11 360 L
Fresh water		Two 6434 L
Deadweight		57.5 t
Engines		Four Cummins KTA-50 M2 1342 kW @ 1900 rpm
Jets		Four Hamilton HJ561
Speed		36 kn
Survey		US Coast Guard Subchapter K
Construction		Aluminium

Crowther Design's *AtlantiCat*
(Photo courtesy Crowther Design)



General Arrangement of Crowther Design's *AtlantiCat*
(Drawing courtesy Crowther Design)

A 25 m sailing catamaran, *Passions of Paradise*, to a design by Grahame Parker Design has recently been completed by Kanga Birtles at Jarkan Yachts in Huskisson. The vessel is owned by Yardarm, and will be operated by Passions of Paradise Charters out of Cairns, Qld, to the outer reef. The vessel is equipped with a galley, bar and change rooms. Construction is all composite, with corecell used for the hull, balsa core for the decks, E-glass and vinylester resin.

Principal particulars of the vessel are:

Length OA	25 m
Beam OA	10.2 m
Draft (hull)	0.9 m
Pax	100 (including 30 divers)
Engines	Two Cummins 6BT
	134 kW @ 2500 rpm
Gearboxes	Two ZF 2:1 RR
Speed (loaded)	15 kn

For sailing the vessel is sloop rigged and, in some heavy weather on trials, was clocked at 14 knots! The vessel has just been delivered to Cairns and has commenced operations.

Around and About

Pacific Sky commenced the summer cruising season with three visits to Sydney in October, and four in November. She was joined by *Pacific Princess* and *Star Princess* in November, with these three vessels the regular visitors to Sydney until mid-January when other vessels make their appearance.

Phil Helmore

Grahame Parker Design's *Passions of Paradise*
(Photo courtesy Grahame Parker Design)

Strategic Marine Activity

Strategic Marine is currently building four 14.85 m aluminium work platforms for use in wharf maintenance by the mining industry.

Sycara III launched by Oceanfast

Marking Oceanfast's second launch and third delivery for 2003, *Sycara III* was removed from her building hall and launched on Saturday 4 October. The launch comes just two months after the handover of *Perfect Prescription*.

Oceanfast General Manager, Mr Brad Draper, said the launch represented another huge achievement for the yard and a strong sense of accomplishment, given that the yacht's concept was originally penned by the late Jon Bannenberg yet completed in detail by the Oceanfast design team.

Continuing the theme of repeat deliveries, *Sycara III* is the third Oceanfast yacht for the same owner.

The interior of the 56.5 m yacht features the stunning use of oak-burl and marble throughout and provides luxurious accommodation for 10 guests and 12 crew.

Principal Particulars

Length	56.5 m
Beam	10.5 m
Draft, max.	3 m
Materials	Steel hull/Composite superstructures
Accommodation	10 Guests/14 Crew
Main Engines	Two Caterpillar 1305 kW
Speed	15 kn
Classification	Lloyds Register
	Code of Practice Compliant

Sycara III
(Photo courtesy Oceanfast)

Queen Mary 2 Passes Sea Trials in Style

Cunard Line's flagship *Queen Mary 2* returned from the sea for the first time on 29 September, having completed her sea trials with flying colours. The largest, longest, tallest, widest, and at — $780-million — the most expensive passenger liner ever built underwent four days of rigorous testing of her power, manoeuvrability and vibration levels off the Brittany coast. The successful trials put *QM2* right on schedule for her 12 January maiden voyage from Southampton, England, to Fort Lauderdale, Florida.

According to Captain Ronald Warwick, master-designate, "The sea trials for *Queen Mary 2* have been a tremendous success. It was great to finally take her out to the open ocean, where she belongs."

Another observer on board during sea trials, the ship's naval architect, Stephen Payne, was also jubilant: "For a first builder's sea trial, the performance of *Queen Mary 2*, being a prototype ship, exceeded expectations in all respects."

Destined to become the defining luxury ocean liner for the 21st century, *QM2* will offer 15 transatlantic crossings in her inaugural year as she takes over the role currently operated by her sister ship, *Queen Elizabeth 2*, as Cunard's transatlantic liner. Prices for six-day crossings begin at $1 499 per person, double occupancy. The vessel also introduces a series of Caribbean cruises from New York and Fort Lauderdale; a voyage to Rio de Janeiro and back, timed for Carnival; five European itineraries and two autumn foliage cruises to ports in Canada and New England.

Cunard's *Queen Mary 2* features sweeping staircases, expansive promenades and luxurious accommodations for 2 620 passengers; nearly three-quarters of which have private balconies. World-famous chef Daniel Boulud is the ship's culinary consultant. Facilities include 10 dining venues, including the only shipboard restaurant by celebrity chef Todd English, the only Canyon Ranch SpaClub at sea, the world's first planetarium at sea, the largest ballroom at sea, the largest library at sea, and the largest wine collection at sea.

The ship also features a Veuve Clicquot Champagne bar, several other elegant bars and showrooms, a two-story theatre, a casino, five indoor and outdoor swimming pools, hot tubs, boutiques, a pet kennel, and a children's facility, complete with British nannies.

A special highlight of the *QM2's* inaugural schedule will be its maiden eastbound crossing from New York on 25 April as both *Queen Mary 2* and *Queen Elizabeth 2* will sail in tandem. This day will be the first time two Cunard Queens have been berthed in the port together since March 1940.

Meanwhile Carnival, owners of Cunard, which announced in June that it is studying the feasibility of building a mega-cruise ship that would be the world's largest, is now considering building two such vessels, Vice-chairman and Chief Operating Officer Howard Frank said on 30 September.

P&O Princess had been considering construction of a 170 000 – 180 000 gt cruise ship capable of accommodating 3 600 – 4 000 passengers prior to its acquisition by Carnival in April. Carnival opted to continue work on the project, which it dubbed the Ultimate Carnival Princess.

Queen Mary 2
(Photo PR Newswire)

Application of Hydrofoils to Improve the Performance of High-Speed Catamarans

Michael Andrewartha, Lawrence Doctors, Kishore Kantimahanthi and Paul Brandner

1 Introduction

1.1 History

Investigations into hydrofoil support for ships have been ongoing for over 140 years with the first recorded experiments occurring in the 1860s and the first patent being issued in 1890. Alexander Graham Bell, inventor of the telephone, worked on a prototype design for over a decade, succeeding in building a craft that was for many years the fastest boat in the world. Other notable scientists who investigated hydrofoil support include the Wright brothers who conducted some experiments on a catamaran with hydrofoil support.

The recent increase in production of high-speed catamarans and the desire for reduced fuel consumption have created an environment suitable for investigations into foil-assisted catamarans (FACs). Several researchers have shown that large reductions in resistance are possible. The potential benefits of foil assistance also include improved seakeeping characteristics; this is certainly a desirable outcome for many fast-ferry operators that merits further investigation.

The greatest proponent of foil-assisted catamarans to date has been Professor Karl-Gunter Hoppe, formerly of the University of Stellenbosch in South Africa. Hoppe has conducted a lot of research into the Hydrofoil-Supported Catamaran (HYSUCAT) design through extensive model testing and he described a theoretical model (Hoppe, 1995). The HYSUCAT employs a single main foil near the LCG with a hard-chine hull form that is able to produce planing lift. The resistance-prediction technique developed by Hoppe calculates the foil forces using a combination of aerofoil theory and empirical corrections, whilst the hull forces are calculated using the semi-empirical planing formulations of Savitsky (1964). Hoppe also stated that the developed computer program corrected for interference of the foils on the demihulls, but did not elaborate on how this was done. The work focussed on the resistance of such craft and substantiated claims have been made to the effect of resistance reductions of 40%.

Miyata (1989) published the results of a series of model tests conducted on foil-assisted catamarans. Twin V-shaped hulls were tested with two foils in varying configurations. Reproducible data is published in this paper for the resistance, dynamic trim and sinkage of the models. Miyata clearly showed that the vessels tested benefit from foil assistance in the form of reduced resistance and improved seakeeping characteristics.

In response to the increasing numbers of catamarans with round-bilge hulls that operate in the semi-displacement speed regime, Hoppe began work on the HYSUWAC (Hydrofoil Supported Watercraft which has two foils in lieu of the HYSCAT's one) concept in the late 1990's. The problem with the HYSUCAT system was that the resistance near hump speeds, where semi-displacement craft operate, was increased for vessels with foil assistance when compared with vessels without. Thus, Hoppe investigated the type of foil system that would give improvements in this area, again focussing on model testing as an avenue to solve the problem.

The HYSUWAC system was also attractive in a commercial sense, as Hoppe could see the great opportunity of being able to retrofit existing craft with his patented HYSUWAC system. The HYSUWAC system consists of twin foils fore and aft that span the tunnel. The forward foil protrudes below the baseline, whilst the aft foil is located either above or below it.

1.2 Efficiency of Foil-Assisted Catamarans

With several groups around the world trying their hand at foilcat design, it is pertinent to examine the efficiency of this type of craft when compared with others. An often-used and good method for doing so is to examine the specific power defined by Gabrielli and von Karman (1950). This is defined as the ratio of the supplied power to the product of the weight and speed of transportation. By using brake power in the definition, the propulsive efficiency is included as a variable as this is considered to be somewhat inherent to a specific vessel types.

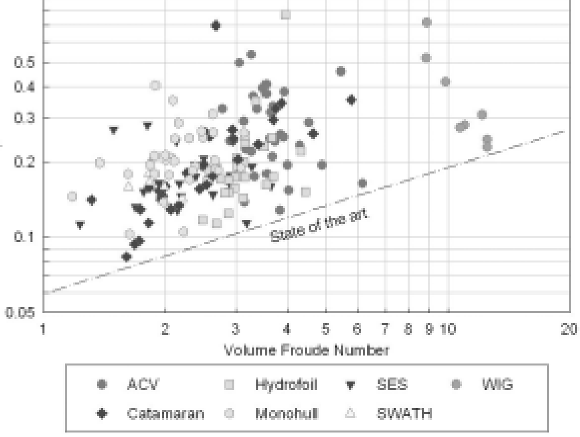


Figure 1 – Specific power versus volume-Froude number for different types of vessels

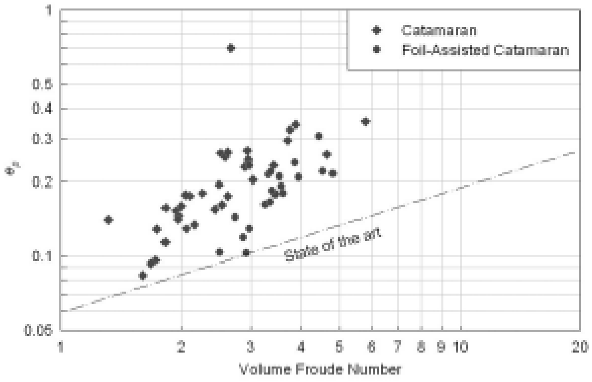


Figure 2 – Specific power of foil-assisted catamarans compared with catamarans

Figure 1 shows the specific power of several types of vessels. It only includes vessels that have been built and trialled, and does not include design vessels. There are many more high-speed marine vehicles in operation than this, however the majority of manufacturers prefer to not publish displacement data. A state-of-the-art line has been placed on the graph to indicate the current boundary of the best-performing vessels.

Figure 2 contains a simplified version of the previous figure with an addition. The efficiency of FACs is compared with that of standard catamarans and the state-of-the-art line. One is able to observe that foil cats are generally more efficient than standard catamarans at volume-Froude numbers near 3.0 and 4.0. Several current designs also lie quite close to the state-of-the-art, line indicating the relative efficiency of the craft.

2 Theoretical Work

The task of designing an efficient FAC is not a simple one. Most vessels that have been built to date have been backed up with a programme of experimental testing and varying degrees of theoretical work. Despite the lure of large reductions in resistance, the possibility of increased resistance also looms in front of a designer. It thus becomes important to be able to predict and optimise the resistance of a design prior to, or without, model testing.

An understanding of the components of resistance of a FAC is essential. We aim to present a method which allows the designer to evaluate the trends that are apparent in the variation of the various design parameters, i.e. number of foils and their size, longitudinal and vertical position of foils and loading condition.

2.1 Previous Work

Migeotte *et al*. (2001) discussed further improvement of their computer model where they modelled the foils using a non-linear vortex-lattice method. The hulls were modelled using a planing surface. It is claimed that this method also shows consistent results in the transition to the planing phase, but does not indicate the success when a semi-displacement (round bilge) hull is used.

Shimizu *et al.* (1993) conducted a series of experiments to evaluate the resistance components of a catamaran with two foils. Lift, drag and pitching moment were measured on the hull and each foil independently for fixed values of dynamic sinkage and trim. A computer program was created to calculate the resistance tendencies of the vessel using the experimental data. The experimental data showed that the lift of the aft foil had a greater effect on the hull resistance than that of the forward foil. The reasons for this occurring were not discussed.

Tsai *et al.* (2001) tested two foil-assisted models with two different foil configurations, a tandem and a single foil configuration. Two components of force, namely lift and drag, were measured from each foil; however the authors did not elaborate on the method and instrumentation used in obtaining this data.

2.2 Current Aims

To date, no research has been devoted to the numerical investigation of the resistance of a foil-assisted catamaran with semi-displacement hulls. This is most likely due to the lack of numerical methods that are able to quickly and accurately evaluate both the resistance of catamarans and the sinkage forces and trimming moments on a round-bilge hull. The aim of the current research has been to create a calculation method able to evaluate the resistance and running condition of a foil-assisted catamaran with semi-displacement demihulls.

For design purposes, it is important to be able to get quick feedback on the effect of changing foil configuration. Foil section type and location is likely to be changed more often in the quest for better performance or avoidance of cavitation.

Hull shape is a more complex parameter and more likely to stay the same through the design spiral. This is especially relevant to retrofit cases. Thus, the method for calculating hull resistance is permitted to be time consuming, as it only needs to be performed once. This also presents the opportunity to derive hull forces from suitable experimental data, i.e. tests where sinkage forces and trimming moments are measured in addition to resistance for a range of values of dynamic trim and draft.

For the purposes of the numerical method and future analysis, the forces acting on a hydrofoil-assisted catamaran are considered to come from two separate entities: the foils and the hulls. Two computer programs that calculate the forces from these two entities have been integrated together to form a program that calculates the resistance, sinkage and trim of a foil-assisted vessel at any speed.

2.3 Hydrofoil Forces

The first step in the project was to investigate the foil geometry. It was necessary to calculate the lift, drag and cavitation aspects of the foils in order to evaluate their performance. The foils of a typical FAC operate in close proximity to the free surface of the water and, hence, there is a significant amount of wave making involved. This creates an additional component of drag to that of the frictional component. The free-surface will also affect the lift and pressure distribution of the foil.

A computer program has been written in FORTRAN to calculate the two-dimensional viscous flow over a series of foils near the free surface. It is envisaged that the two-dimensional results will be sufficient for the prediction of the flow characteristics due to the fact that the tips of the foils are butted to the sides of each demihull. It is anticipated that this will minimise the amount of transverse flow over the foils.

A panel method described by Giesing and Smith (1967) has been adopted because it takes into account the free surface effect, lifting flow and is able to be used for multiple foils. However, the method described by Giesing and Smith does not include viscosity effects, so the current method was further adapted to include them via a viscous-inviscid interaction method.

This method was chosen because it is efficient for FAC resistance-prediction purposes; the solution only takes about a minute for a twin-foil system with adequate number of panels for sufficient accuracy. Panel methods are computationally more efficient that a typical CFD RANS solver such as CFX or Fluent. A RANS solver requires a very large grid, whilst panel methods only require the boundary of the foils to be panelled, resulting in matrices which are much smaller to solve. Additionally, RANS methods require known boundary conditions, something which is not known prior to solution for a hydrofoil problem due to the wave pattern downstream of the foil.

Calculation of the potential flow is employed by panelling each hydrofoil and applying a constant strength source over each panel. This method is able to satisfy the foil-boundary condition exactly and the free-surface condition is applied by a second-order linearisation. Lifting flow is created by distributing vortex panels along the mean line, and the strengths of these are determined by applying the Kutta condition at the trailing edge. The linearised free-surface condition can be shown to be accurate at high speeds or chord-Froude numbers, which makes it suitable for use in the foil-assisted catamaran context.

The calculation of the boundary layers is performed for the upper and lower surfaces of each hydrofoil using the pressure distribution calculated by the potential-flow solution. The program first finds the stagnation point and then develops the laminar boundary layer from there using an integral method. The program checks for both laminar separation and transition to turbulence using empirical methods.

Transition from laminar flow to turbulent flow is assumed to occur at one panel, and in this way transitional flows and laminar-separation bubbles are not accounted for. This assumption can be shown to be valid at full-scale Reynolds numbers; however, at model-scale significant areas of laminar separation can be present. The method for overcoming this is discussed later.

Calculation of the viscous boundary layer gives the frictional drag, whilst the potential flow solution calculates lift and wave drag. However, viscosity also affects the lift produced by the hydrofoil, in that the pressure distribution is distorted and made to follow the contour of the displacement thickness. This effect is accounted for in the numerical method by applying a viscous-inviscid interaction. A wall transpiration velocity is calculated from the displacement thickness at each panel, and is applied to the inviscid flow solution in this way. Thus, several iterations of the program are required to find a converged solution; typically 10 iterations are sufficient.

To calculate the forces on a three-dimensional hydrofoil, several corrections are made to the forces calculated for the two-dimensional foil section. Lifting-line theory provides the basis for a correction to allow for finite aspect ratio (Abbot and von Doenhoff, 1959). Glauert (1944, p. 150) gives a correction to the lift to convert the assumed elliptic load distribution to the actual rectangular one. Induced drag is added to the section drag, whilst a correction for the drag of bare tips can be made if they exist. However, the foils on a foil-assisted catamaran are usually bounded by struts or the sides of the demihulls.

2.4 Hull Forces

After developing the foil program, the next stage was to look at how to predict the resistance for a foil assisted vessel. Figure 3 shows a summary of the forces acting on a vessel with foil assistance. The foil lift and drag are able to be calculated from the foil program, and the thrust and weight are easily calculated based on the vessel's attitude. The lift and drag of the hull is a different matter, as it is necessary to solve for equilibrium in the vertical direction and the trim angle for a range of speeds for an arbitrary hull form.

The Michell (1898) integral was used to calculate the wave resistance of the catamarans as it is efficient and accounts for the wave interference between the two demihulls in a consistent manner. However, for the foilcat resistance program, more than just wave resistance was needed. Calculation of the near-field was achieved by calculating the pressure distribution over each demihull in order to find the sinkage forces and trimming moments due to pressure.

For the FAC prediction program, it is necessary to perform calculations for resistance, sinkage force and pressure moment only once. The output is stored in a file which is input as a matrix to the FAC prediction program. Bilinear interpolation is used to find values for arbitrary dynamic trim and draft, within the specified limits.

2.5 Foil-assisted Catamaran Forces

The output from the foil and hull methods are combined in a program that iteratively solves for the equilibrium values of sinkage and trim at any vessel speed. The hull forces are calculated as described in Section 2.4, whilst the foil forces are calculated during each iteration within the FAC prediction program. In order to find the equilibrium position, the computer program uses a two-dimensional Newton-Raphson method to adjust the trim and draft. Three function evaluations for every iteration are required in order to calculate the partial derivatives. This iteration process converges very rapidly due to the linear relationship between both trim and foil lift, and buoyancy and draft.

The process is generally run for a range of speeds, starting at the lowest speed. Trim and sinkage are smallest at the lowest speed and hence the initial estimates are those from the static case. To aid convergence, each subsequent speed uses the values of trim and draft from the previous speed as the starting point for the iteration process.

Convergence occurs when the non-dimensionalised net vertical force and moment are less than some arbitrary tolerance, or when the calculated changes in trim and non-dimensional draft are less than a specified amount. The method generally converges to a relative tolerance of 10^{-6} within four iterations.

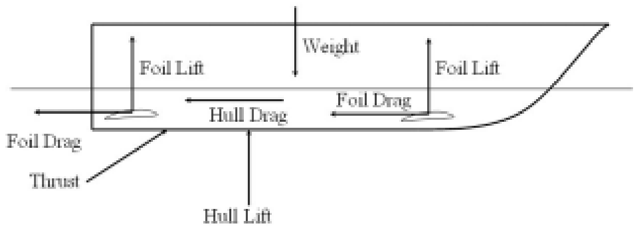


Figure 3 – Forces acting on a foil-assisted vessel.

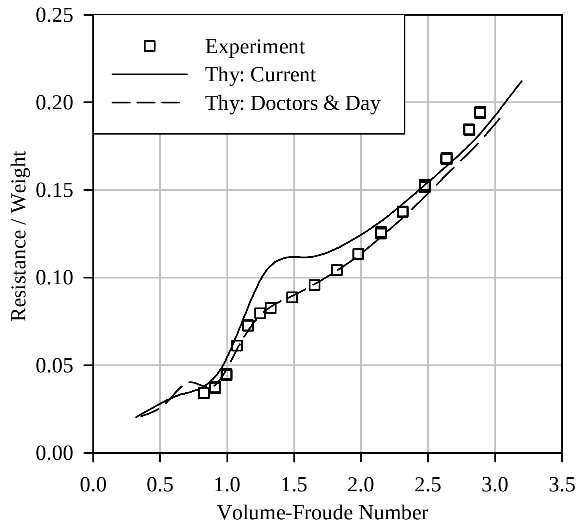


Figure 4 – Resistance data for theory and experiment at 100% of full-load displacement

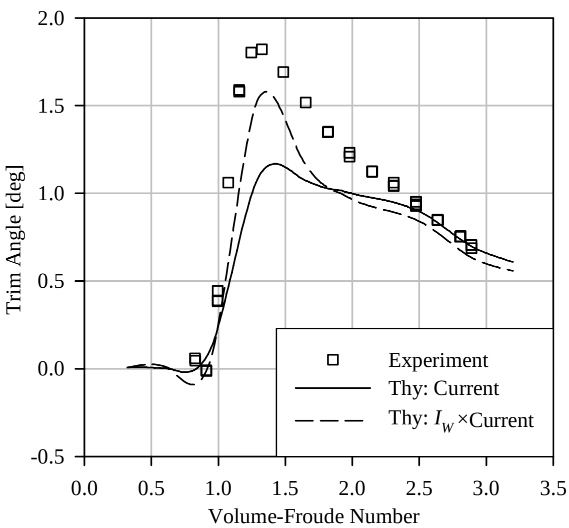


Figure 5 – Trim data for theory and experiment at 100% of full-load displacement.

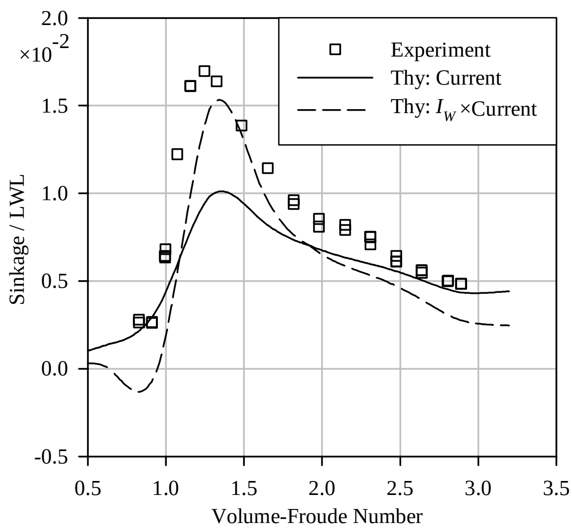


Figure 6 – Sinkage data from theory and experiment at 100% of full-load displacement.

2.6 Interactions Between the Demihulls and Foils

By considering the forces on the hulls and foils separately, we are effectively ignoring the interactions between the two entities. The interactions are assumed to be of two types: viscous and wave effects.

Whilst the wave systems from the hulls and foils have been considered to calculate the wave resistance of each, the interaction of the two wave systems is more difficult to evaluate and has not been considered in the current method. It is encouraging to note that at high speeds, the wave resistance of a foil-assisted catamaran is steadily decreasing due to the increased Froude number and reduction in immersed hull volume.

However, it is possible to calculate one interaction between the foils and demihulls. The hydrofoil creates a surface wave between the demihulls and this increases the wetted-surface area of the demihulls and hence the frictional drag. As a result, the method has been adapted to include this effect.

Another considerable interaction is due to the rolling up of the vortex sheet aft of each hydrofoil; this changes the flow over the demihulls, and Hoppe has reported that he believes that this causes a suction force on the demihulls at hump speeds. This can be used to explain the increase in resistance of HYSUCAT craft at hump speeds, and thus it is desirable to minimise this effect.

Viscous interactions are of a smaller scale and will include the change in boundary layers near the foil-hull junctions and the wake of the hydrofoil on the hull surface. Due to the complex nature of these interactions they have been ignored in the current method.

3 Comparison With Experimental Data

3.1 Bare-Hull Tests

A series of standard resistance tests was conducted on a bare hull for comparison with foil-assisted tests. This allowed evaluation of the resistance change when using foil assistance, and also validation of the theory for a bare hull. A semi-displacement hull at scale 1:20 was tested at various displacements and static trims. Five displacements were tested, varying from 70% to 100% of full-load displacement. Static trim was varied from -1.0° to 1.0° in 0.5° increments.

Figures 4, 5 and 6 show a comparison of the experimental data with results from the FAC prediction program for a case with no foils. The theory shows reasonable agreement with the experimental data, except near the hump region. The theory over predicts the resistance and under predicts the sinkage and trim at hump speed. This can be attributed to two different factors.

The implication of using the FAC prediction program is that we are including the effects of sinkage and trim into the calculation, while Doctors and Day (2002) showed that the method is more accurate when sinkage and trim are not included. Theoretical data from this linear method is also included in Figure 4.

Using non-zero values of sinkage and trim is a departure from the consistent linear theory of Michell. Whilst one would expect that this should improve the relation between theory and experiment, we are neglecting the other major non-linear effect, namely the free-surface distortion. For this reason, it is anticipated that this approximation to a non-linear method is the reason for the discrepancy in the resistance values at hump speed.

The discrepancy between the sinkage and trim values is due to the interference of the demihull wave systems at hump speed. The resistance values are calculated using the far-field theory which accounts for the wave interference in a consistent manner. However, it is necessary to use near-field theory to calculate the pressure distribution (and hence sinkage force and trimming moment) over the demihulls, and these calculations do not account for the wave interference.

The effect of the wave interference on sinkage and trim can be accounted for to some extent by examining the difference between the resistance of a demihull in isolation and of the catamaran. By this we define a wave-interference factor, I_W: where $R_{W,\mathrm{cat}}$ is the wave resistance of a catamaran and $R_{W,\mathrm{demi}}$ is the wave resistance of a demihull in isolation.

$$I_W = \frac{R_{W,\mathrm{cat}}}{2R_{W,\mathrm{demi}}}$$

The wave interference is a function of Froude number, and can be derived from the theory described in Section 2.4. If we multiply the sinkage and trim values by I_W, the fit is much closer as shown in Figure 5 and Figure 6. While this is not the recommended method for calculating sinkage and trim, the close match in the slopes at hump speed demonstrates that wave interaction should be accounted for in the calculation of pressure distribution in some manner.

3.2 Bare-Foil Tests

Tests on a single hydrofoil using a six-component force balance were conducted to measure forces from a bare foil. The test matrix involved varying the speed, depth and angle of attack of the foil. The foil spanned two faired struts that were attached to the tips of the foil and the outside of the force balance. The type of foil section to be used was based upon a NACA 4412 section. The NACA 4412 section was chosen as it showed consistent performance at low Reynolds number through analysis with the XFOIL program (Drela 1989) . The foil chord was 60 mm, span was 325 mm and a range of speeds between 0.5 and 4 m/s were tested. The angle of attack was varied from -4° to 4° in 1° increments and the depth varied from 30 mm (half the chord) to 180 mm (three chords) in half-chord increments.

Tests on the bare struts were also conducted to calculate tare values. Speed and depth of strut were varied over the same range as the foil tests. These tests enabled the calculation of the drag for the hydrofoil section as well as the drag for the struts as a function of strut depth.

Two samples of the results from the bare-foil experiments are plotted in Figures 7 and 8. Plotted against this for comparison are results from the numerical foil program. The numerical data have been corrected in the manner discussed in Section 2.3, and the effective aspect-ratio is increased due to the end-plate effect of the struts. The effective aspect ratio has been calculated using the data presented by Wadlin (1951, Figure 27).

The drag values have also been corrected to allow for the model-scale Reynolds numbers. The values of viscous drag calculated by the current foil method are not applicable at these very low Reynolds numbers (around 10^5). Instead, the viscous drag has been calculated by the XFOIL program. The method used by XFOIL is able to handle small regions of laminar separation which may be present at model-scale Reynolds numbers. By making the above corrections, the theoretical predictions show good agreement with the experimental data in Figures 7 and 8.

3.3 Foil-Assisted Catamaran Tests

Experimental tests were conducted on a foil-assisted catamaran with one foil located 10 mm below the keel at the LCG. The model was tested at the same displacements as for the bare-hull tests. The angle of attack of the foil was also varied between 3° and 4°. A force balance sat atop the demihulls and the struts extended down through rectangular slots cut into the keel of each demihull, Figure 9. In this way the force from the foil was transmitted entirely through the force balance to the hulls.

Figure 10 plots the experimental drag values against speed for the 100% displacement load case. The foil drag was measured using a six-component balance and the hull drag calculated as the difference between total drag and foil drag.

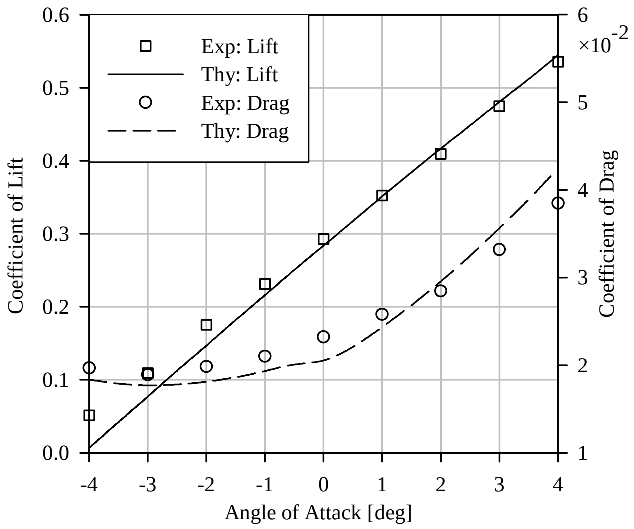


Figure 7– Comparison of lift and drag coefficients from theory and experiment

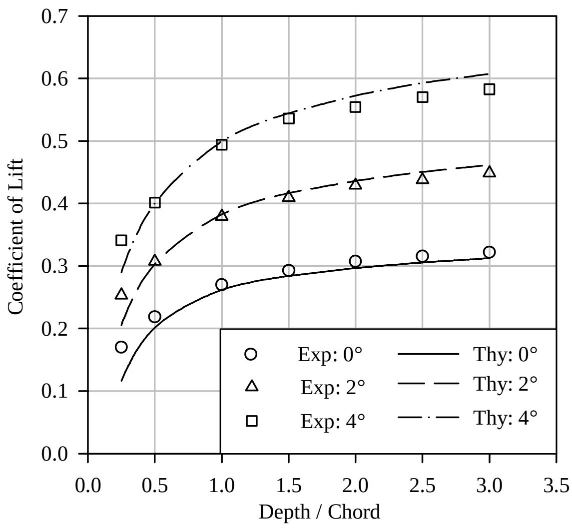


Figure 8 – Comparison of lift versus depth of submergence for theory and experiment at various angles of attack

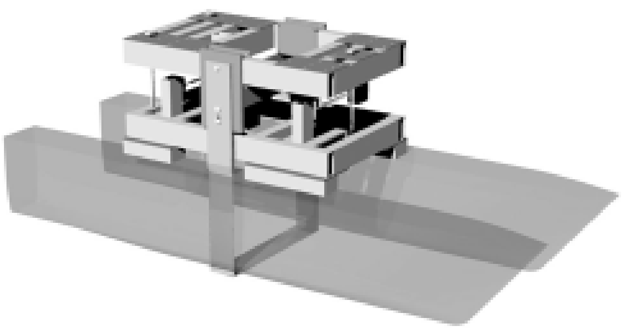


Figure 9 – Setup of the foil-assisted catamaran for experiments with six-component force balance attached

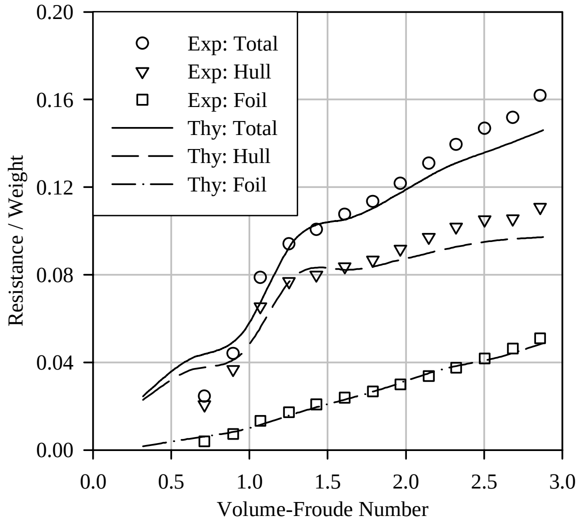


Figure 10 – Comparison of components of experimental drag and theoretical drag prediction for a FAC

Also plotted in Figure 10 are predictions from the theoretical program discussed in Section 2.5. The predictions have been made at model scale and the viscous foil drags corrected using values predicted by the XFOIL program.

The theoretical predictions are quite reasonable; the foil drag is predicted with good accuracy and the hull drag is quite close to the drag measured in the experiments near the hump speeds. At higher speeds, the theoretical hull drag is less than that measured experimentally, presumably because of spray drag. Spray was observed during the experiments. This is also seen in the bare-hull data (see Figure 4).

The predicted values of sinkage and trim are plotted in Figure 11. The theoretical sinkage matches the experimental data, while the trim at hump speed is not predicted well due to the reasons discussed in Section 3.1. The lift force from the foil is plotted for theory and experiment in Figure 12. The agreement is excellent, similar to the agreement of the drag predictions. Even at the hump speed, the absolute accuracy is quite good, despite the fact that the theoretical trim is different. This indicates that the major factors affecting foil lift are speed and submergence.

4 Conclusions

4.1 Current Work

The drag and lift of the foil is predicted with good accuracy by the theory, both with and without the influence of the demihulls. To a certain extent, this indicates that two of the assumptions made in the theory are validated, as described next.

The results show that the hull has a minimal effect on the foil flow. This goes some way to validating the lack of interaction effects accounted for by the theoretical method. Additionally, the assumption of two-dimensional flow is shown to be useful in calculating the macroscopic properties of the flow, i.e. lift and drag coefficients.

The theory used to predict the hull forces has also been validated. However it would be desirable to have a method that was able to account for the dynamic sinkage and trim in a more consistent manner. It would also be desirable to be able to calculate the drag due to spray.

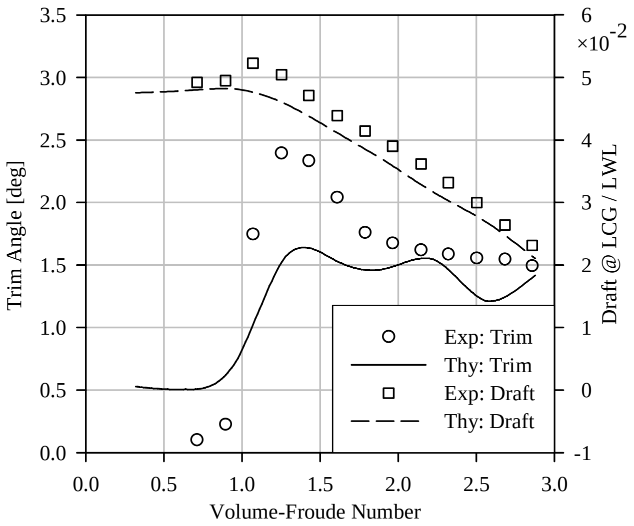


Figure 11 – Comparison of experimental trim and draft with theoretical predictions for a FAC

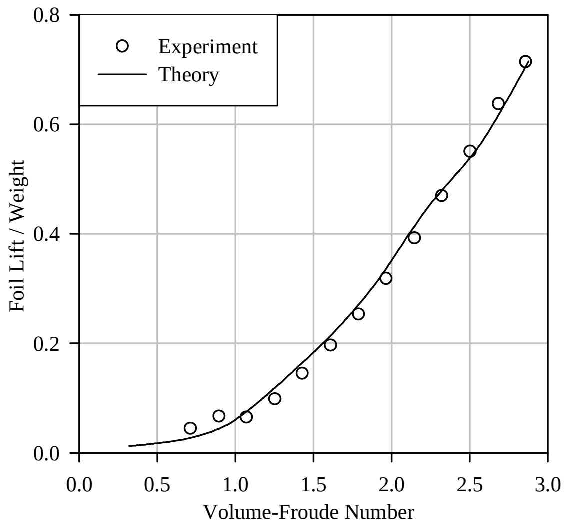


Figure 12 – Comparison of the theory and experiment for foil lift of a foil-assisted catamaran

A numerical resistance-prediction program has been developed and shown that it is capable of predicting the resistance of a FAC within reasonable accuracy. It has been shown that a significant interaction occurs between the foil and hull; the frictional resistance of the demihulls is increased due to the surface wave produced by the foil.

4.2 Further Work

Future work in the field should include the interactions between the wave systems of the hulls and foils in more detail. These effects have been mostly ignored by the current method, but should be considered for more accurate analyses in the future.

It would be extremely beneficial to investigate the flow near the foil-hull junctions using a Navier-Stokes solver with experimental work to back it up. It may not be necessary to have a free surface to look at the viscous effects experimentally; the work could be carried out at a larger scale (more realistic Reynolds number) in a facility such as a cavitation tunnel.

5 Acknowledgements

This work has been supported by The University of New South Wales, the Australian Maritime College and the Australian Research Council in the form of Grant C00001861 under the Strategic Partnerships with Industry — Research and Training (SPIRT) Scheme.

The authors would also like to acknowledge the support of Crowther Design, Sydney for their assistance and sponsorship of the project. Their in-kind assistance and technical knowledge have been invaluable.

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Australian Maritime College

15th International Ship and Offshore Structures Congress

Dr Jinzhu Xia attended the 15th International Ship and Offshore Structures Congress (ISSC) in San Diego, on 9 to 16 August. The congress was very successful with about 200 members and observers from universities, research organisations, classification societies and shipping and offshore engineering industries. Jinzhu was re-elected to the Technical Committee for Loads until the 16th congress to be held in Southampton in 2006. While in San Diego, Jinzhu discussed international opportunities particularly with classification societies such as Bureau Veritas and the American Bureau of Shipping. An agreement was made with BV on joint industry-university research collaboration and scholarship opportunities. Thanks to the Ian Potter Foundation for a travel award that provided partial financial support for this trip.

Australasian Coasts and Ports Conference

Jon Duffy presented a paper at the Australasian Coasts and Ports conference in Auckland in September. The paper was titled *Berthed Ship – Passing Ship Interaction: A Case Study for the Port of Newcastle* and was co-written by Jon and Gary Webb, CEO of Newcastle Port Corporation (NPC). This study involved a comprehensive series of model experiments conducted in the AMC Model Test Basin and subsequent mathematical analysis on a commercial basis for NPC last year. The presentation generated a good deal of interest and positive feedback.

Less Stress for AMC Students?

Three undergraduate students who are currently completing their 3rd year of the naval architecture degree at AMC have undertaken an impressive extracurricular task — to design, build and race their own International Moth-class sailing dinghy. Nick Billet, Alan Goddard and Mark Hughes first came up with the idea back in February 2002 after a "rather mediocre day sailing corsairs". They debated a few concepts between different skiffs and catamarans but then looked at Alan's existing Moth. After some reading about the class they decided that its development style was ideal for their naval architecture aspirations. Their ultimate goal is to build three identical Moths for exciting match racing and effective training.

One of their first tasks was to secure sponsorship for the materials to construct their first boat, which soon came from the AMC. The engineering of the design, including finite element analysis, was performed using software packages available to AMC students and in consultation with AMC staff. Sixteen months later they had completed their first boat and following the last few months of trials they sincerely believe it is comparable in performance to the world's leading Moths. The photographs included here show the finished product during early trials. A full account of their adventure (described in typical university style) can be found at their website academic.amc.edu.au/~moth-crew.

Early sailing trials (above and below)
(photos courtesy AMC)

The Moth class is at the extreme end of dinghy racing. Being a development class with restrictions on maximum length, beam, mast length and sail area only, there are quite a few areas that can be developed. Originally the dominant hull form was similar to a windsurfer with a very flat and wide hull called a scow. Then came the skiff hulls that were developed in little incremental steps from being slower than scows to not even being threatened by them. These early skiffs were wide, typically >500 mm waterline beam, and very similar to the 18ft skiffs but, since then, they have developed into extremely thin, typically 240 mm waterline beam, hulls weighing between 12 – 20 kg rigged. Within the last 2–3 years a new development has been coming along slowly with the incorporation of hydrofoils to lift the hull clear of the water. Due to longitudinal stability issues with the narrow hulls, horizontal foils have been in common use for many years, but now there are a few promising technologies in full hydrofoil boats. Both surface-piercing and fully-submerged foils have been proven to work in the right conditions, usually when it's blowing, and are being improved to provide spectacular speeds in all conditions. GPS speeds of 20 kn have been recorded on the national champion's new hydrofoil boat in 12 kn of breeze, nearly twice as fast as a "conventional" narrow skiff moth. These developments have also coincided with jumps in rig development, particularly lightweight aluminium masts and carbon-fibre masts with the respective developments in sails that these masts can carry/control. These rigs are now very similar to formula windsurfer rigs with large square leeches/ roaches and pocket-luff sails.

Recently the Moth World Championships were held in France where Australian skippers took out 1st, 2nd and 3rd in their highly developed craft. This class, initiated in Australia, has always been dominated by Australians despite valiant international fleets. All three students plan to attend the Australian Moth Championships this summer on Lake Cootharaba, at Queensland's Sunshine Coast where they will be racing their creation, known as *AMC Stress Less* σ<. Since their first boat was launched they have received significant interest in purchasing the plans of their design from Australian and New Zealand sailors.

The AMC Dash 2003

Following the success of the inaugural running of the AMC Dash in August last year it was decided that this should become an annual event. The AMC Dash is a competition to determine which Tasmanian school can design and construct the fastest model sea-going vessel. It is open to teams of four students in years 10–12 from Physics-, Mathematics- and Technology- related classes. AMC developed this idea as an opportunity to enhance its involvement with secondary schools in the local community and to introduce the career of naval architecture to a large number of school students.

To facilitate awareness of the activity a comprehensive information campaign was carried out in the early months of the academic year. Schools were provided with a standard kit to assist development of their project. The kit included a motor, propeller, shaft and design guideline. In addition, AMC provided a student 'mentor' who was available to share knowledge, experience and skills. These mentors were typically naval architecture students in their final year of study at AMC.

On 20 August a total of 40 teams assembled at the AMC Model Test Basin to compete over a series of races to determine the fastest model vessel. One of the three teams from Rosny College, Hobart, successfully defended the title they won last year.

The event was an innovative, practical and 'fun' project. It enabled students from a wide range of backgrounds to participate to achieve a tangible outcome, while raising awareness of alternative tertiary education and career opportunities. It also highlighted the facilities and services unique to AMC and gave naval architecture students an opportunity to develop their supervision skills.

Final Year BEng Naval Architecture Research Thesis Presentations

The Naval Architecture Program held their annual undergraduate research thesis conference on Saturday 25 October. The conference was opened by AMC Principal/ CEO, Dr Neil Otway, and guests/invited moderators included Mr Steve Buckland of Tamar Designs (Launceston), Mr John Colquhoun of the Department of Defence (Canberra), Mr Keith Wood of Sinclair Knight Merz (Melbourne) and Mr Rob Gehling of the Australian Maritime Safety Authority (Canberra).

Competing models in the AMC model test basin
(Photo courtesy AMC)

The student research topics presented included:

Robert Ochtman-Corfe — *Reliability Centred Maintenance (RCM) of Naval Hull Structure*

Alistair Allen — *Ship Design, Moving Backwards*

Martin Mok — *Power Prediction of Sailing Yachts*

John Ballantyne — *Design and Modelling of a Compliant Tower*

Stuart McDonnell — *An Investigation into Ship-Bank Interaction and Vessel Squat for Full Form Vessels*

Blair Lewis — *Experimental Investigation into Drag Reduction by Thin Air Film*

Lee Fennel — *The Quantification of Waves Generated by Vessels Travelling at Super-critical Speeds*

Andrew Graham — *Monitoring NOx and Particulate Emissions in Marine Engines*

Luke Dodds — *Experimental Investigation into FPSO Offloading Operability*

Aaron Morris — *Modernising Single-cylinder Test Bed*

Tobias Clarke — *Resistance of Novell Hull Forms*

Sevanaia Sawalu — *On the Progressive Failure and Stiffening Effect of Laminated Composite Panels*

Tze Phung Yap — *Expert System for Power Plant Selection*

Mark Wilson — *Extreme Weather and the Prediction of Extreme Values*

Zadok van Winden— *Artificial Intelligence in Prediction of Engine Emissions*

UNSW Research Project

A PhD candidate from the University of NSW, Simon Robards, completed a series of model tests in the Towing Tank. Simon and his supervisor, Prof. Lawry Doctors, are investigating the effect that the hollow behind the transom of a ship travelling at high speed has on the resistance and trim of the vessel.

Ship Interaction Study Conducted at AMC for Rio Tinto Major Projects

Rio Tinto is currently investigating the extension of the existing iron ore loading wharves at Parker Point and Cape Lambert in North Western Australia.

The AMC Ship Hydrodynamics Centre, through AMC Search, has recently conducted a research program to investigate the effect of a passing ship on the forces and motions on ships berthed at the proposed extended wharf sections. The primary objective of the study was to determine if the proposed separation of 50 m between the passing and berthed ships is adequate with respect to the motions of two berthed ships for the range of likely manoeuvring speeds.

Physical model tests were conducted in the AMC Model Test Basin. The scale ship models of Cape and Panamax size vessels were represented by 4.2 m and 3.0 m long models respectively, with total model displacements in the range 160 kg to 590 kg. The stationary models representing the berthed vessels were constrained in surge, sway and yaw enabling the forces and moments in these dimensions to be measured. These models were free to heave, pitch and roll. Figure 1 shows the ship models set up for the Parker Point configuration. The berth pockets and channel/basin were modelled to a geometry that represented the specific development under consideration at the time of the study.

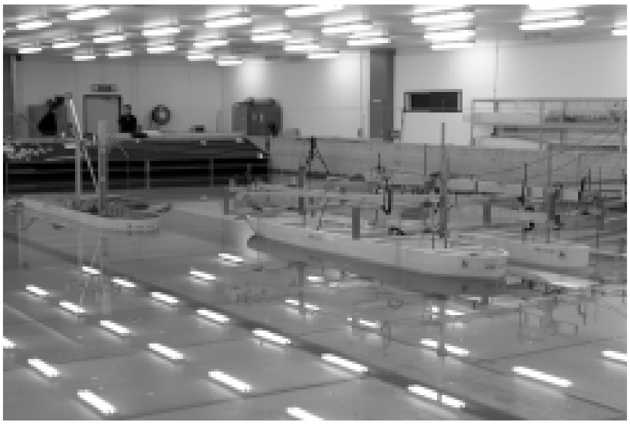


Figure 1 — Ship models set up for the Parker Point configuration (Photo courtesy AMC)

Figure 2 shows the model port geometry for the Parker Point facility. Obtaining the interactive forces and moments on berthed ships using model experiments is a proven method that allows many site-specific variables to be considered in detail.

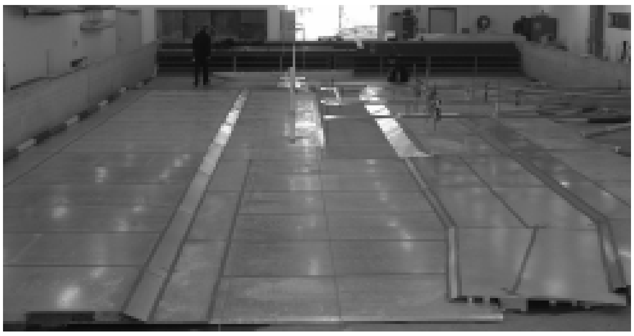


Figure 2 — Model port geometry for the Parker Point facility (Photo courtesy AMC)

Secondly, the forces and moments measured during the physical model tests were used as input to a mathematical model. This model takes into account the dynamics of the vessel and the mooring line and fender forces, and was used to predict the surge, sway and yaw motions in the time domain as a Cape-size vessel passed the berthed vessels. These motions were evaluated against PIANC guidelines in order to determine whether the proposed separation of 50 metres between the passing and berthed ships is acceptable.

The vessel interaction investigations were part of an ongoing study being conducted by Rio Tinto to assess the feasibility of the proposed port designs. The proposed Parker Point and Cape Lambert layouts have been modelled on the Ship Handling Simulator at the AMC, which is currently being used to assist in the evaluation of dredging requirements, channel/basin design and to establish safe environmental operating conditions. The marine pilots from these ports have contributed to this study and are also using it as a useful training exercise.

AMC is grateful to Rio Tinto Major Projects for their permission to publish the above details.

Gregor Macfarlane

Curtin University

Curtin University postgraduate student Colin Ayres has won the IMTA Ferry conference student prize for presenting the most innovative idea for improving comfort on ferries. Colin's work is on motion stabilisation, conducted under the supervision of Kim Klaka. Colin won an all-expenses paid trip to the 2003 conference at Amsterdam in September, where he competed against students from around the globe to win a further trip to the 2004 conference in the Bahamas. The Centre for Marine Science and Technology (CMST) at Curtin is assisting with the commercialisation of the research.

Kim Klaka presented a paper *Roll Motion of Yachts at Anchor* at the RINA Modern Yacht Conference at Southampton in September. Among the many interesting papers covering the design of yachts ranging in length from 1 m to 90 m was a market survey that estimated the international market for super-yachts as being greater value per year than the output of the entire Australian commercial shipbuilding industry. Food for thought!

Dr Tim Gourlay of CMST presented a paper on fluid dynamics software applications at a workshop on Computer-aided Engineering at the Australian Maritime College in October.

Kim Klaka

The University of New South Wales

Undergraduate News

Once again this year, the Third-Year students in Naval Hydrodynamics were guests at the Australian Maritime College, on August 4 and 5, 2003. As was the custom in previous years, the visit lasted two days and was most ably organised by Mr Gregor Macfarlane. UNSW is very grateful to him for his hospitality. In addition, Mr Richard Young, Dr Paul Brandner, Mr John Wakeford, Mr Peter Guy, and Mr Graham O'Connor assisted with the tour itself.

The experience the students 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 channel, the ship-model basin, and the vessels at Beauty Point) was most valuable and was a great addition to their theoretical studies at UNSW.

In return, Professor Lawrence Doctors gave an evening presentation on the subject *The Influence of Viscosity on the Wavemaking of a Model Catamaran* on August 4. This was an official activity of the Tasmanian Section of the RINA. In his talk, he emphasised the importance of viscosity on the waves generated by small ship models, particularly at low speeds.

At the School's annual undergraduate thesis conference on 9 and 10 October the following presentations on naval architecture projects were made:

Graeme Collins	*Trim Tabs versus Interceptors for Ride Control*
Gerard Engel	*CFD Analysis of Catamaran Resistance*
Peter Holmes	*Air and Wind Resistance of Ships*
Olav Opheim	*Investigation of Catamaran Waves*
Tony Sammel	*Optimisation of Passive Stabiliser Fins for Fishing Vessels*
Cengizhan Uluduz	*Aerodynamic and Structural Analysis of Free-fall Lifeboats*
Carl Vlazny	*Comparison of Analysis of Marine Ducted Propellers*
Marco Diaz	*Fatigue and Fracture Analysis of High-speed Light Craft*

RINA and Austal Ships jointly offered an award of $500 and a certificate for the best presentation at the conference by a student member on a naval architectural project. Assessment was made on the basis of marks awarded by School staff, with marks being standardised to remove the effects of marker variability. The award went to Tony Sammel for his presentation on *Optimisation of Passive Stabiliser Fins for Fishing Vessels*, and was announced at the thesis conference dinner at the Dolphin on Crown Hotel on the evening of 10 October. The certificate and cheque have subsequently arrived from London, and were presented to Tony at the technical presentation by Roger Kinns at UNSW on 29 October. Congratulations, Tony!

Also at the thesis conference dinner, the School's 166 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 Dr Hugh Starke, who coordinates the solid mechanics strand.

For the first time in many years, there were no naval architects at the graduation ceremony on 14 October.

Post-graduate and Other News

The Seventh International Conference on Fast Sea Transportation (FAST'03) was held on 7 to 10 October. As at previous FAST conferences, the size of the Australian contingent at FAST'03 was most respectable with respect to our population. A total of 194 participants attended, while the Australians numbered nine. The location of the conference was the idyllic island of Ischia, Italy, which can be reached via a forty-minute fast ferry from Naples. Readers of *The ANA* will be pleased to learn that there is a large variety of high-speed vessels operating in the seaway near Naples. These include monohulls, catamarans, surface-piercing hydrofoil boats and surface-proximity hydrofoil boats.

Presentation of the RINA/Austal Ships Award for 2003 to Tony Sammel by Phil Helmore (Photo courtesy Lawry Doctors)

A total of 126 papers was presented, of which ten were from Australia; a most commendable result. These papers were:

A New Generation of Large Fast Ferry — from Concept to Contract Reality, by Tony Armstrong and Kjell Holden (invited paper)

The Effect of Demihull Separation on the Frictional Resistance of Catamarans, by Tony Armstrong

The Optimisation of Trimaran Sidehull Position for Minimum Resistance, by Lawrence Doctors and Robert Scrace (invited paper)

Transom Hollow Prediction for High-Speed Displacement Vessels, by Simon Robards and Lawrence Doctors

Effect of Sea, Ride Controls, Hull Form and Spacing on Motion and Sickness, by Michael Davis and Damien Holloway

A Numerical Method for Performance Prediction of Hydrofoil-Assisted Catamarans, by Michael Andrewartha, Lawrence Doctors, Kishore Kantimahanthi, and Paul Brandner

A Study on Wave Resistance of High-speed Displacement Hull Forms in Restricted Depth, by Prasanta Sahoo and Lawrence Doctors

Wetdeck Slamming of High-speed Catamarans with Centre Bows, by James Whelan, Damien Holloway, Tim Roberts, and Michael Davis

Rigid-body Dynamic Hull Bending Moments, Shear Forces and PCM in Fast Catamarans, by Damien Holloway, Michael Davis, and Giles Thomas.

Transient Dynamic Slam Response of Large High-speed Catamarans, by Giles Thomas, Michael Davis, Damien Holloway, and Tim Roberts.

All aspects of high-speed marine vessels were covered, principally resistance, motions, wave loads, propulsion, environmental wave generation, structures and materials, operations, economics, safety and training. Types of vessels were monohulls, catamarans, trimarans, pentamarans, planing craft, hydrofoils, hovercraft, surface-effect ships and wing-in-ground-effect craft.

FAST'05 is scheduled for Saint Petersburg, Russia, in June 2005. The dates have not been finalised as we go to press. Further information as the planning progresses can be obtained from Prof. Lawry Doctors by phone on (02) 9385 5215 or email l.doctors@unsw.edu.au.

The 2003 Air-Cushion Technology Conference and Exhibition (ACTC'03) was timed to follow the FAST'03 conference and took place in Lee-on-the-Solent, UK, on 14–15 October 2003. Sixteen papers were delivered on all aspects of hovercraft and related vehicles, including surface-effect ships and wing-in-ground-effect craft.

Of particular interest to Australian naval architects who are concerned with reducing the wave generation of river vessels were two papers on essentially the same topic. This was the optimisation of an air-cushion-assisted catamaran (surface-effect ship) by selecting the optimal distribution of the weight between the demihull buoyancy and the air cushion.

Lawrence Doctors presented a theoretical paper on this topic while John Lewthwaite discussed the practical aspects of such a design, which he calls the partial-air-cushion-supported catamaran (PACSCAT). It was noteworthy that both authors had shown, by different methods, that an optimal vessel, with considerably enhanced performance, was one in which around 50% of the weight is carried by the air cushion.

Phil Helmore
Lawry Doctors

THE INTERNET

OzBoyz Challenge for the America's Cup

It's twenty years since Australia's historical America's Cup victory in Newport USA. On 6 October 2003, OzBoyz Challenge was announced to contend for the 2007 America's Cup with a new generation of Australian yachting talent, technology and business partners.

The OzBoyz Challenge for the XXXII America's Cup has been created with the founding rule of the campaign that 60% of the team must have been born in or after 1983. The significant date in the America's Cup archives of 6 October 1983 was when Australia II defeated Liberty 4-3. Etched in the public's memory are images of the then Prime Minister Bob Hawke demonstrating Australia's jubilation at being the first country in 132 years to defeat the Americans.

While most potential syndicates for the next America's Cup are focusing on big budget campaigns, OzBoyz Challenge has a modest budget of AUD58 million. The campaign is based primarily on the youth of Australia. Male and female team members will be selected for their practical and academic talent in yachting, finance, marketing, administration, engineering and business. They will work with experienced mentors in each of these fields as well as legal experts, television, media and PR professionals who all have previous experience in the America's Cup event.

Founding partners Saatchi & Saatchi, Seek Communications and Sumo have established the OzBoyz Challenge identity, recruitment process and website to complete phase one of the project. The second phase of the OzBoyz Challenge project commenced with the official launch of the website www.ozboyzchallenge.com on 5 November 2003, followed by the online recruitment program commencing in December 2003. This coincides with the selection process of the OzBoyz Challenge Yacht Club. The current rules of the America's Cup state that any syndicate wishing to participate shall be represented by a Yacht Club

For further information contact Sebastien Destremau on (0412) 144 564 or sdestremau@ozboyzchallenge.com, or visit the website www.ozboyzchallenge.com.

Ghost Ships Without Refuge

The UK high court on 5 November blocked any work being carried out on dismantling the so-called "ghost ships" heading for Britain until crucial legal challenges have been heard.

Four former US Navy vessels contaminated with toxic chemicals were heading to Britain to be dismantled at a breakers yard in Hartlepool. Three of the town's residents succeeded in obtaining an injunction to postpone the dismantling work. Neil Gregan, Stephen Hall, and Ben Marley, who all live near the breaker's site, believe the ships are in a poor condition and could pose considerable environmental risks to ecologically-important sites nearby.

Mr Justice Maurice Kay ordered urgent hearings of various legal challenges arising out of the controversy to take place in December. He said that, until a key hearing due to take place in the week beginning 8 December, the ships could dock, but no work should take place "except for measures to make and keep them safe".

Mr Gregan said after the hearing: "We are very pleased to have got the injunction, but the fight must still go on to send these ships back to America, their country of origin. They should not be dismantled here."

This court case is the latest chapter in a series of legal wrangles as environmental groups battle to stop the vessels coming to the UK. Before setting sail last month a last-minute injunction in a US court prevented nine of the thirteen ships from sailing pending a further hearing.

For further information visit the website www.guardian.co.uk/waste/story/0,12188,1078370,00.html

Phil Helmore

Maxsurf links with ShipConstructor

Formation Design Systems and Albacore Research Ltd. (ARL) have announced that Formation's Maxsurf suite of naval architecture and ship construction software now links with Albacore's ShipConstructor software suite to provide shipyards with a complete end-to-end solution for ship design, detailing and production.

The link has been developed by Formation Design Systems as part of their ongoing program of adding further capabilities to the Workshop module within the Maxsurf suite of software. The new functions allow naval architects and structural designers to take preliminary structural definitions from Workshop and export them in a format compatible with ShipConstructor. This format allows transverse frames, longitudinal stringers, hull plates and decks to be transferred.

Formation Design Systems broadens scope of software suite from design to shipyard production environment

Philip Christensen, Managing Director of Formation Design Systems, says "This link has been developed as a result of demands from our shipbuilding customers for a smooth link from initial design and structural definition through to detailed design and production. We decided to link with the ShipConstructor system because of its support for the industry standard AutoCAD platform as well as its comprehensive range of detailing tools and expanding production capabilities."

"This solution satisfies the practical needs of builders during the detailing and construction phases. Intelligent data transfer of this type reduces errors, maintains part accuracy and saves valuable time in the detailing process" added Christensen.

A range of part types to be exported

The new Maxsurf/ShipConstructor interface allows a range of parts to be exported. These include export of hull plates complete with both 2D and 3D plate information and marking lines; export of stringer information including the full 3D stringer shape; export of transverse frames including cutouts for stringers and openings in the frame; export of decks including any deck openings.

All parts can be rendered in 3D before export and verified in a similar way after import into ShipConstructor. The Maxsurf to ShipConstructor functions are available immediately in the version 9.6 release of the Maxsurf suite of software.

ARL's President, Rolf Oetter, says "Providing a direct link from Maxsurf to ShipConstructor aids Maxsurf users in making a smooth transition into production detailing, providing significant cost savings in production. In the next step, the ShipConstructor database can be integrated with other shipyard functions, such as production planning, scheduling, purchasing, and accounting. ShipConstructor users have reported a reduction in man-hours of up to fifty percent per vessel."

Formation Design Systems develops integrated, computer-aided design and engineering software incorporating the latest advances in 3D modelling technology. Specialist areas of application include shipbuilding, structural engineering and industrial design. All products are characterized by three main design criteria — a consistent and intuitive graphical user interface for all modules, an integrated database which provides a parametric design capability and strict compliance with industry standards for software and data exchange. Formation's products are used worldwide by leading shipbuilding and construction companies from concept to construction.

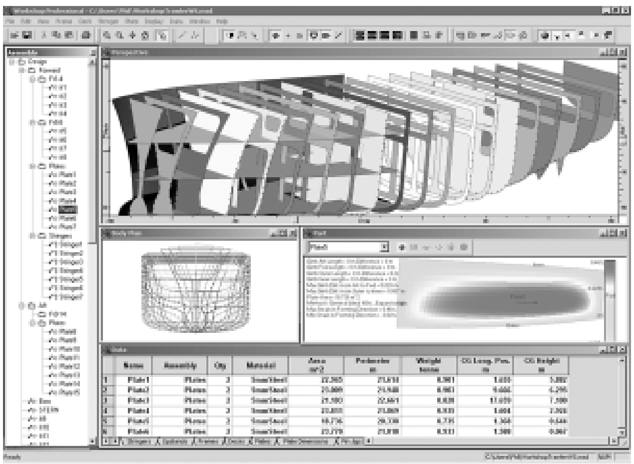
For further information contact Philip Christensen, Formation Design Systems Pty. Ltd., PO Box 1293, Fremantle 6959, phone 9335 1522, fax 9335 1526, email info@formsys.com, or web www.formsys.com.

Albacore Research develops the software suite ShipConstructor, an easy-to-use, 3D product-modeling tool for ships and offshore structures of all sizes. ShipConstructor provides functions for Curved Plate Production, Internal Structure, Piping, HVAC, Nesting and NC Processing.

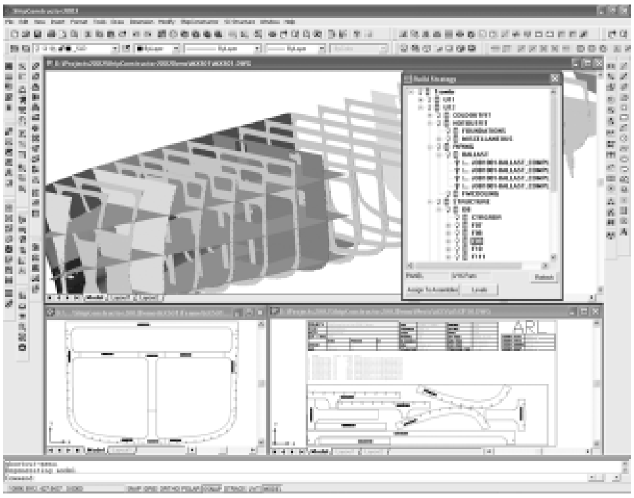
ShipConstructor runs inside AutoCAD connecting all data to Microsoft SQL Server, thus presenting a familiar environment and resulting in minimal training requirements. The modular software design and flexible licensing allow ShipConstructor to be fully scalable to the client's specific business needs from the largest shipyard down to the smallest boat builder. ShipConstructor is used worldwide by hundreds of shipyards and naval architects on a wide range of vessels and offshore structures.

For further information contact Rolf Oetter, Albacore Research Ltd., #304 - 3960 Quadra St, Victoria BC, V8X 4A3, Canada, phone +1-250-479-3638, fax: +1-250-479-0868, email info@ShipConstructor.com, or web www.shipconstructor.com.

The views below show the Workshop and ShipConstructor interfaces for the same trawler hull.



Formation Design Systems' Workshop Interface
(Image courtesy Formation Design Systems)



Albacore Research's ShipConstructor Interface
(Image courtesy Formation Design Systems)

Market success for Sulzer common-rail engines

In October Wärtsilä Corporation reported a market success for the Sulzer RT-flex common-rail marine engines. Confirmed orders for RT-flex engines now amount to 45 engines having a combined power of 1.86 million kW.

The major contribution to this success comes from the containership sector. Of the total number of RT-flex engines ordered, 29 are of the Sulzer RT-flex96C type for large container liners. These comprise twelve 12-cylinder engines, three ten-cylinder engines, ten eight-cylinder engines and four seven-cylinder engines, and will be built under licence in Korea and Japan.

The release early this year of the RT-flex version of the Sulzer RTA96C engine, with power outputs up to 80 080 kW in the 14-cylinder model, came at an opportune time, just before the recent surge in containership newbuilding orders.

The other RT-flex engines, delivered and on order, comprise nine RT-flex60C engines and seven RT-flex58T-B engines.

The Sulzer RT-flex engines are the latest development of Sulzer RTA low-speed marine engines by Wärtsilä Corporation. They are the only large marine engines to incorporate common-rail fuel injection and valve operation with fully-integrated electronic control. This is a major step in the development of large marine diesel engines. It offers unrivalled flexibility of operation to deliver benefits such as smokeless operation at all operating speeds, lower fuel consumption, reduced maintenance costs and lower steady operating speeds for better manoeuvring.

Service experience with Sulzer RT-flex engines is building up. The first engine, a Sulzer 6RT-flex58T-B in the bulk carrier *Gypsum Centennial*, has successfully passed the landmark of 10 000 running hours. She entered service in September 2001.

The second, third and fourth ships powered by RT-flex engines were recently completed. The second is the Aframax tanker *Sea Lady* of Scinicariello Augustea Ship Management SpA, built at Sumitomo Heavy Industries Ltd in Japan. Also powered by a 6RT-flex58T-B, she entered service at the end of August 2003.

The third vessel is the Agrexco reefer *Carmel Ecofresh* built at Estaleiros Navais de Viana do Castelo in Portugal. She is equipped with a Sulzer 7RT-flex60C engine and completed her sea trials in mid September 2003.

Another 7RT-flex60C engine powers the multi-purpose carrier *Wladyslaw Orkan* of Chipolbrok which completed sea trials at the end of September. She was built by Shanghai Shipyard in China.

Wärtsilä and Volvo Penta to Cooperate

Wärtsilä will start servicing and selling large Volvo Penta engines for commercial shipping applications, initially in selected markets and later globally.

Volvo Penta has broadened its engine range to cover commercial vessels and the company now offers engines for increasingly large vessels for both main engine and auxiliary engine duties. The largest engines have outputs of 1470 kW. Wärtsilä marine engines are considerably larger than these, the largest having outputs of 80 080 kW. Wärtsilä is the world's leading supplier of ship power and propulsion systems. The respective product ranges of the two companies complement each other very well.

Volvo Penta's engine deliveries to Wärtsilä will comprise mainly the engines in the output range of 220 to 1470 kW.

The cooperation covers only Volvo Penta engines designed for the commercial marine market.

Wärtsilä Generating Sets for Royal Fleet Auxiliary Support Ship

In October the Wärtsilä Corporation was awarded a contract by the UK Ministry of Defence to supply four diesel generating sets for the Royal Fleet Auxiliary (RFA) vessel *Fort Austin*.

The four Wärtsilä generating sets will each be powered by a Wärtsilä 8L20 diesel engine to give an electrical output of 1290 kW at 900 rpm. These sets will replace the existing outfit of eight smaller, faster-running sets. The new sets will be delivered by Wärtsilä in January 2004, and installed during the ship's forthcoming refit.

Replacing the generating sets will give *Fort Austin* the benefits of modern machinery, designed and built for greater reliability and reduced maintenance, thereby lowering the overall costs.

The 23 400 t displacement *Fort Austin* was built in 1979 and is propelled by a Sulzer low-speed diesel engine. She carries ammunition and other stores for replenishing Royal Navy warships at sea. She is one of more than 20 ships in the civilian-manned RFA fleet supplying RN warships at sea with stores and fuel. They operate world-wide.

This is the latest in a series of contracts concerning RN and RFA ships awarded to Wärtsilä. The RFA vessel *Sir Bedivere* was re-engined in 1996. New ships with Wärtsilä engines include the RFA fleet oilers *Wave Knight* and *Wave Ruler*, the landing platform dock (LPD) vessels HMS *Albion* and HMS *Bulwark*, the Bay class of four LSD(A) (landing ships dock auxiliary) vessels and the Type 45 air-defence destroyers. HMS *Albion* and *Bulwark* are also equipped with Lips propellers and the Bay class with Lips azimuthing thrusters.

Maxsurf Users Conference

Formation Design Systems, authors of the widely-used Maxsurf and Multiframe software, held a well-attended Maxsurf and Multiframe users conference following Ausmarine East on Friday 31 October in Brisbane. The presenters were Mr Philip Christiansen and Dr Dougal Harris of FDS. The program was targeted at all users (from beginners to advanced) with presentations by FDS staff on capabilities and new features, and plenty of time for interaction, and questions and answers.

Sessions included:

- Maxsurf modelling and fitting (hull generation)
- Hydromax (stability) analysis and criteria
- Workshop (plates, frames and stringers)
- Multiframe (three-dimensional frame anlysis)
- Seakeeper (seakeeping)

Seakeeeper now has an animation feature, which shows the motion of the ship among waves (any spectrum you choose) very realistically.

Maxsurf started life as a hull-generation program, and has grown as capabilities in other areas are gradually added, and it is now one of the most-used naval architecture packages.

Familiar faces at the conference included Antony Krokowski and Violta Gabrovska (Marine Safety Queensland), Peter Goss (Force Five Design), John Lund (Lund Marine Designs), Adam Williams (Australian Defence Industries) and Chris Hutchings (Oceanic Yacht Design).

Phil Helmore

NMSC Strategic Plan

NMSC in conjunction with its Industry Advisory Committee undertook a review of NMSC's strategic direction late last year. The review focussed on establishing a vision for Australia's marine industry and looking at NMSC's ongoing role in achieving reform in the marine sector.

Following the Australian Transport Council's decision to extend NMSC's life until 2008, the planning day looked at a five-year strategy. This culminated in the development of a new five-year Strategic Plan for the NMSC. This plan was agreed to by ministers in May this year and will underpin NMSC's workplan for the next five years.

Copies of the Strategic Plan can be viewed at www.nmsc.gov.au under publications.

The NMSC's strategic priorities for the next five year period will be to:

- Accelerate the completion of standards for the safety of commercial vessels.
- Simplify the regulatory and administrative system for marine safety.
- Support alternative approaches to marine safety.
- Gain greater Government commitment to marine matters.
- Improve training to meet industry and regulatory needs.
- Complete the national safety system for recreational boating.

New Chair of NMSC Appointed

Des Powell, formerly of the Victorian Department of Infrastructure, has been appointed as Independent Chair of the National Marine Safety Committee for a six-month period. Mr Powell replaces Colin Finch who recently stepped down after three-years as Chair of the Committee. Colin Finch will stay on the NMSC as a committee member representing Marine and Safety Tasmania.

Release of Standards on the Web

NMSC has agreed to make available all of the completed standards to users at no cost. All the marine standards which have been released by NMSC over the last two years, along with the various guidelines it has published, are now available at www.nmsc.gov.au.

A recent survey of our users suggested that about half of the respondents wanted web access to standards. The other half were comfortable with CDs. NMSC will explore future development options for releasing the standards on CD.

Current users of the the National Standard for Commercial Vessels CD Edition 1, which was first released in August 2002, may have found that their automatic access to the disk expired on 1 August 2003. However the PDF files that make up the standard can still be accessed from the CD. If you have this problem contact NMSC on (02) 9555 2879 for full details on how to access these files.

Australian Builder's Plate

The Australian Transport Council approved the new National Standard for the Australian Builder's Plate for Recreational Boats at their May 2003 meeting, paving the way for the national introduction of the standard.

The Australian Builder's Plate (ABP) is being introduced nationally to enhance the safety of most new recreational boats. The ABP provides ready access to essential safety information about the use and limitations of certain recreational boats, including maximum number of persons, load, engine rating and weight and buoyancy performance.

The ATC has charged NMSC with achieving the uniform adoption and implementation of the standard in law from 1 July 2005. From this date, all manufacturers and importers will be required to affix the plate to the majority of new recreational boats built or imported for use in Australia.

There will be two types of builder's plate; one for boats under 6 metres in length and another for boats 6 metres or more in length. The key difference is that buoyancy information is required to be displayed on vessels under 6 metres in length. Inadequate flotation will not be permitted on boats built after 1 July 2006.

New recreational boats that will not need to affix the plate include aquatic toys, pedal powered boats, personal watercraft carrying 1 or 2 persons, racing boats, sailing and rowing boats, and canoes and kayaks.

To view the standard go to www.nmsc.gov.au → Documents.
Safety Lines, August 2003

MEMBERSHIP NOTES

AD Council Meeting

The Australian Division Council met on 24 September, with teleconference links to all members, and the President, Mr Rob Gehling, in the chair. The President welcomed Mr Giles Thomas who had been appointed by the Tasmanian Section to replace Mr Gregor Macfarlane who had resigned recently. Matters, other than routine, which were discussed included:

- The provision of public risk insurance covering the activities of Sections and the Council. Although insurance is currently held, Council is seeking detailed advice on the extent and meaning of the cover.
- IEAust/RINA Joint Board: Mr Bryan Chapman, Chairman of the Joint Board, advised Council of ongoing matters of interest to both parties. Of particular interest was the work of the Competency Panel. It is hoped that a draft of the naval architectural competencies will be available prior to the next meeting of Council for consideration and, hopefully, endorsement.
- Council gave its approval in principle to support the proposed lecture tour by Professor Peter Jackson of the University of Auckland. He is regarded as an expert in the field of high performance yacht engineering. Council has recommended that, should the tour proceed, visits should include centres where there is great interest in high performance yachts by naval architects and, if a charge is to be made for attendance, RINA members attendance should be at no, or minimal, cost.
- Pacific 2004 — International Maritime Conference: It was reported that arrangements were well in hand for this event to be held in Sydney from 3–5 February 2004. An attractive program of first-class papers for presentation from overseas and local speakers has been prepared.

The next AD Council meeting is scheduled for Thursday 4 December.

Keith Adams
Secretary

45 Years Membership

Noel Riley, a former President of the Australian Division and currently a member of the London Council of RINA, recently travelled to London for a meeting of Council and the Annual Dinner. While there, he and Ray Adams, a former Treasurer of RINA, were presented with certificates attesting to forty-five years of membership of the Institution. Congratulations, Noel!

Rob Heather (Chair of Council), Ray Adams, Noel Riley and Trevor Blakeley (Chief Executive) at 45 Year Certificate Presentation
(Photo courtesy RINA London)

MISSING IN ACTION

The following members are Missing in Action:

Mr P. McGovern, former address c/o BHP Melbourne, and Mr I. Waqa, former address Mowbray, Tasmania.

If anyone knows their present location, please let Keith Adams know on (02) 9876 4140, fax (02) 9876 5421 or email kadams@zeta.org.au.

ARE YOU MOVING?

Moving house can be…well, not one of life's greatest pleasures. It is easy to overlook telling those who would like to know where you are. If you are about to change your address, please add an item to your check list to tell Keith Adams, so he can ensure that *The ANA* and other important communications from RINA continue to arrive.

VALE JOHN TUFT

Robert John Tuft was born in 1917 in Crows Nest, Sydney. He did well at school (North Sydney Boys' High) but, before completing his Leaving Certificate, he left to take up a fitting and turning apprenticeship at Garden Island. Hundreds had applied for a handful of apprenticeship positions and an offer couldn't be refused at the height of the Great Depression.

On completing his apprenticeship, he immediately commenced a diploma course in mechanical engineering at Sydney Technical College, studying part time while still working in the Garden Island workshops, and then later transferring to the design office. That diploma was in turn immediately followed by enrolment in the diploma course in naval architecture at the request of the Navy, who felt that they needed more naval architects for the war effort. His request for leave to enlist in 1942 was refused by the Navy for the same reason. John graduated with honours and received the Sydney Technical College Medal for naval architecture.

By this time it was 1945, he was twenty-eight, and had spent twelve years at Garden Island gaining a great breadth of practical experience. His activities there included extensive design work (largely related to conversion of ships requisitioned for the war), supervision of testing, and overseeing construction and fitting out of naval ships at Cockatoo Island. However, he wasn't fond of sea trials — vulnerability to seasickness is a disadvantage for a naval architect.

Almost as soon as he had completed the naval architecture diploma, he was asked to help teach the same course, and was also teaching part time at a private marine engineering school. Within a year, in about 1946, he was asked to teach full time at Sydney Technical College. He then made the decision to resign all his other positions and was a full time educator for the remaining thirty years of his career.

The NSW Institute of Technology grew out of, and separated from, Sydney Technical College 1947, and John became a Senior Lecturer with the NSWIT. The name was changed to the University of NSW in 1958, and teaching gradually migrated to the Kensington campus as buildings were constructed. John eventually moved from Broadway to the new Mechanical Engineering building in January 1963, where he remained until retiring in 1977. He spent a year on sabbatical in 1970–71 at the University of Newcastle-on-Tyne, UK, gaining exposure to both European shipbuilding and UK educational practices.

He was the first Head of the Naval Architecture Department at the new university, and was responsible for the solid grounding in the principles of naval architecture imparted to many of the current captains of the naval architecture profession in Australia.

He was highly regarded by his students, not least because of his practical background and experience over a range of engineering roles. Not many academics have started as a tradesman and brought such first-hand experience of practical issues to the teaching of engineering design. It is a tribute to his abilities that he was such an effective teacher at university level, despite having neither Leaving Certificate nor degree of his own.

He was active in the affairs of the then Australian Branch of RINA, and held the reins as President from 1968 to 1971.

John is survived by his wife Maisie, two sons, two daughters and five grandchildren.

Peter Tuft

The ANA *records with sadness the passing of John Tuft on 11 October 2003, and extends the sympathy of all naval architects to Maisie and the family* — Ed.

NAVAL ARCHITECTS ON THE MOVE

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

Michael Andrewartha has submitted his PhD thesis on *The Performance of Foil-assisted Catamarans* to The University of New South Wales and has taken up a position as a naval architect with North West Bay Ships in Sydney. Nigel Lynch, a recent graduate of UNSW, is also at NWBS, making this the highest-ever concentration of University Medallists under the one consulting roof!

Andrew Cooper has moved on within Australian Marine Technologies and is currently on secondment to Blohm + Voss in Hamburg for six-to-eight months.

Chris da Roza has moved on from Incat Designs after fourteen years, and has taken up a position with Austal Ships in Fremantle. He says that he has been working on various projects, but primarily on the project team for the new Fred. Olsen 126 m high-speed passenger/car ferry.

Tim Dillinbeck has moved on from Det Norske Veritas and has headed for the Gold Coast. The position of Regional Manager Australia/New Zealand has been taken over by Michael Fletcher, moving in from Pusan, South Korea.

Mark Gairey retired from the Department of Defence in November after nearly thirty-seven years. Mark was one of the early students to study naval architecture at UNSW on a cadetship with the then Department of Navy. He now intends to do an advanced diploma in building design, and then to start up his own house-plan business in a couple of years' time.

Peter Goss has moved on from Incat Designs and is now consulting as Force Five Design in Sydney. He took time out to attend the recent Maxsurf users conference in Brisbane.

Chris Hughes is still with BMT Seatech in Southampton, UK, where he is mainly involved in the development of the manoeuvring simulator and stress-monitoring systems which the company produces. He still reads *The ANA*, and says that things are fine in Southampton apart from the early onset of winter, and the fact that the English are favourites for the rugby world cup!

Sean Johnston has moved on from Tenix Defence and is now consulting as Sou'Westerly Yachts in Melbourne. Sean says that his first major project, currently under way, is the complete refit and conversion of a vessel to a restaurant for approximately 150 passengers to run up and down the Yarra River from Southgate.

Scott McErlane is now in Europe, working as the Second Engineer on a 520 t sailing yacht. However, he says that he will be back for a couple months over Christmas, and expects to catch up with naval architect cronies at SMIX Bash.

Roger Ramsey has moved on from Scientific Management Associates after sixteen years, doing NA work for the Department of Defence, the RNZN and shipbuilding and repair companies, mostly in Australia and New Zealand, mingled with some aeroplane construction. He has taken up a position with Tenix Marine Division (with shipyards at Williamstown and Henderson) as Principal Naval Architect. He will be based in the Canberra office of Tenix (which has a mixture of Tenix staff from various divisions) but will, no doubt, have a bit of travel to work at the two yards.

Dudley Simpson moved to Pusan, South Korea, in August with new wife Sonja's company Bosch Rexroth (drive and control — hydraulics, pneumatics etc.) Dudley is also working for Rexroth at the moment, checking out the local market in marine equipment and the shipbuilding industry which has, not surprisingly, been very interesting: culinarily, culturally and naval architecture-wise. They expect to return to Germany in November, where Dudley says that he will most likely go back to German school and work on his master's degree while he looks for some marine-related systems work.

David Sherwood has moved on from Shipworks Superyachts in Brisbane and has taken up a position as a project naval architect with Image Marine in Fremantle.

Michael Tiller has moved on from North West Bay Ships in Sydney and has taken up a position with Diab Australia in Sydney.

This column is intended to keep everyone (and, in particular, the friends you only see occasionally) updated on where you have moved to. It consequently relies on input from everyone. Please advise the editors when you up-anchor and move on to bigger, better or brighter things, or if you know of a move anyone else has made in the last three months. It would also help if you would advise Keith Adams when your mailing address changes to reduce the number of copies of *The Australian Naval Architect* emulating boomerangs (see *Missing in Action*).

Phil Helmore

AMC Graduate Survey

Since 1990 a total of 182 students have graduated with a Bachelor of Engineering degree from the Australian Maritime College. A recent update of the employment status and geographical spread of these graduates provides some interesting reading.

Number of Graduates by Strand

Maritime Engineering	48
Naval Architecture	123
Ocean Engineering	11

(*includes 2 with OE/NA double degree)

Response to Survey

Percentage of graduates on AMC BEng email list	77.5%
Percentage of graduates with employer status recently confirmed	76.9%
Percentage of graduates with employer status known (not all confirmed)	94.5%

Employment Sector

Naval architecture/engineering consultancies	24.4%
Ship builders/designers	23.3%
Military (Department of Defence, RAN, etc)	15.7%
Government departments/classification societies	9.9%
Research/academic/higher degrees	7.6%
Offshore engineering consultancies	7.0%
Other maritime-related positions/other engineering	6.4%
Other employment	3.5%

Location

Western Australia	32.0 %
Overseas*	15.7 %
Queensland	12.2 %
Tasmania	11.6 %
New South Wales	9.9 %
Australian Capital Territory	6.4 %
Victoria	5.2 %
South Australia	1.7 %
Northern Territory	1.7 %

* "Overseas" includes New Zealand, England, India, Scotland, Thailand, Malaysia, Fiji, USA, Taiwan, Vietnam, Germany, Dubai, Ireland, Singapore and Japan.

Interesting Facts

Austal Ships is the single largest employer of AMC Bachelor of Engineering graduates with a total of nineteen at last count. The percentage of graduates employed overseas has increased from 9.9% in 1999 to 15.7% in October 2003.

The complete list of AMC Bachelor of Engineering graduates and last known place of employment can now be viewed at www.amc.edu.au/alumni/alumni.html.

Gregor Macfarlane

Austal Trimaran Propulsion system

On 13 November Austal Ships announced details of the propulsion system selected for the *Auto Express* 126.7 m cargo-vehicle-passenger trimaran currently under construction for Spanish ferry operator Fred. Olsen SA.

Providing capacity for 1350 passengers, over 340 cars and more than 400 freight lane-metres, the aluminium ferry will feature a quadruple diesel-engine main machinery package coupled to a trio of waterjets. This will enable it achieve in excess of 40 kn loaded when it is delivered to the Canary Islands in the second half of 2004.

MTU Friedrichshafen will supply four 20V 8000 diesels, each rated at 8 200kW but with the agreement to increase their output to 9 100kW during the first quarter of 2006. The same model engines are also being used to power the Auto Express 86 catamaran that Austal is presently building for operation between the United States and Canada across Lake Ontario.

The engines are arranged in two separate engine rooms in the trimaran's central hull. Those in the aft engine room will each drive a KaMeWa 125 SII steerable waterjet from Rolls-Royce while the two forward engines deliver their combined power to a KaMeWa 180 BII booster waterjet. Each of the three drivelines features Renk transmissions, with lightweight composite shafts fitted between the waterjets and gearboxes and on the output shaft of the forwardmost engine.

Harbour manoeuvring is an important consideration, and one of Fred. Olsen SA's requirements was that the trimaran's performance in this regard be at least as good as that of the catamarans in its current Canary Islands fleet.

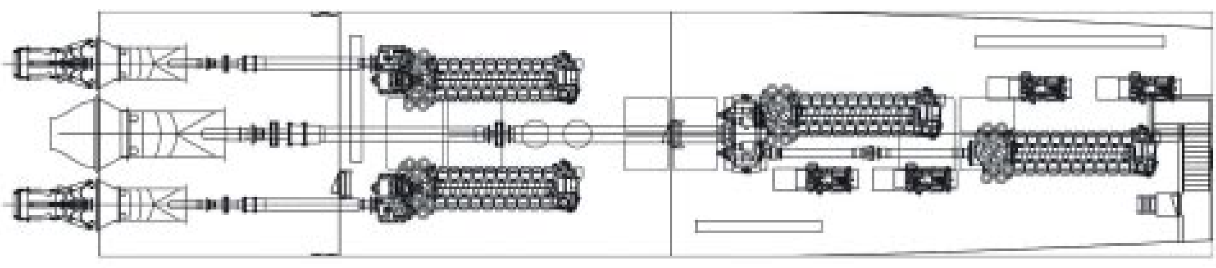
"Even though the Austal ferry is very much larger in terms of both length and capacity, our analysis shows that the trimaran's manoeuvring characteristics will be better than those of the existing vessels," said James Bennett, Austal's Technical Manager.

This has been achieved by fitting two Ulstein Aquamaster UL601 azimuthing bow thrusters from Rolls-Royce. The ability to synchronise the thruster and waterjet control systems will give the captain maximum control to ensure fast, efficient and safe operation in port. Once in open water the electrically-driven thrusters are retracted into the hull to reduce drag and thus maximise speed and efficiency.

The ship's electrical load will be met by three MTU 12V 2000 diesel generator sets.

Main Machinery Details

Main engines	Four MTU 20V 8000 8 200kW at1150rpm each
Gearboxes	Four Renk ASL65; one Renk ASL 2X80
Waterjets	Four Kamewa 125 SII; one Kamewa 180 BII
Azimuthing bow thrusters:	Four Ulstein Aquamaster UL601
Generator sets	Three MTU 12V 2000 M40



The layout of the machinery spaces in the Austal 126 m trimaran
(Image courtesy Austal Ships)

Western Australian's are used to seeing large vessels travelling by road. These photographs show *Pride of Milford*, built by WaveMaster International on the way to launching at the Tenix shiplift on Cockburn Sound on 9 August 2003
(Photographs courtesy Martin Grimm)

HMS *Gannet* Afloat Again

After 14 months of careful restoration and hard work, HMS *Gannet* (1878) — Britain's last sloop of Queen Victoria's Royal Navy — was re-floated in September at Chatham Historic Dockyard.

During the delicate operation, No. 4 dry dock was "flooded up" over a two-day period to enable the depth of water to reach 6 m. There is now approximately 20 000 tonnes of water in the dock where HMS *Gannet* proudly floats.

HMS *Gannet* is listed among the nation's core collection of historic ships and £3 million was secured from the Heritage Lottery Fund, with contributions from Medway Council for this final stage of her restoration; which is now complete. Visitors can view her from the dockside and she will be open as an attraction next year to join the other two historic warships, HMS *Cavalier* and the Submarine *Ocelot*.

Chatham Historic Dockyard Trust has recently received £212,500 from the European Regional Development Fund for further improvements to HMS *Gannet*. This money will be spent on replica main armament, a replica ship's boat and other on board fit-out and interpretation areas, including some multi-lingual interpretation. The Chatham Historic Dockyard forms part of the Maritime Heritage Trail, a partnership between Medway and other destinations in Kent and the Nord pas de Calais to promote heritage/maritime tourist attractions.

The Historic Dockyard at Chatham chartered *Gannet* from The Maritime Trust in 1987 and started a restoration programme. She was last used as a school accommodation ship, Training School *Mercury* on the River Hamble. The objective of the restoration programme was to return *Gannet* to her 1886 appearance — when she saw action for the only time in her naval career at the defence of the port of Suakin. In 1994 ownership of the vessel was passed to the Chatham Historic Dockyard Trust. The drill-deck cover was removed, leaving her hull which was conserved. Work then ceased while the Trust raised funds for her current restoration programme. This final stage in her restoration was started in July 2002.

HMS *Gannet* afloat once more
(Photograph courtesy Chatham Historic Dockyard)

A NOTE TO CONTRIBUTORS

Whilst all contributions to *The Australian Naval Architect* are very welcome, the Editors' hearts warm to those contributors who provide material in a format that requires little work to prepare for layout. *The ANA* is built (once a shipbuilder, always a shipbuilder) in Pagemaker v.6.5 running under Windows. Articles should be sent as Word documents or text files with a minimum of formatting. Illustrations should never be sent in Word files, but as separate attachments in JPG, TIF, EPS or WMF format. A resolution of 200-300 dpi is preferred. If in any doubt, an email to the Editor will sort out potential problems.

FROM THE ARCHIVES

Collision Damage Repairs to HMAS *Melbourne*

John Jeremy

It is almost forty years since the Royal Australian Navy's flagship HMAS Melbourne *collided with and sank the destroyer HMAS* Voyager *off Jervis Bay, with the loss of 82 lives. Whilst the circumstances of the collision and the aftermath have continued to be debated in the decades since, little has been published about the repairs to HMAS* Melbourne.

On the night of 10 February 1964, the aircraft carrier HMAS *Melbourne* collided with the Daring-class destroyer *Voyager* while engaged in night-flying exercises off the south coast of New South Wales. *Voyager*, of 3 615 t full-load displacement, completed by Cockatoo Docks & Engineering Co. Pty Ltd in 1957, was struck by *Melbourne* at the aft end of her bridge. The destroyer was heeled to starboard to an angle of about 50° and was pushed bodily through the water for several seconds before breaking in half. The forward section passed down *Melbourne's* port side and the after section down the starboard side. At the time of the collision both ships were travelling at a speed close to 22 kn. The bow section of *Voyager* sank almost immediately, and the stern section sank a little over three hours later.

Melbourne remained at the scene of the collision until the morning of 11 February, when she left for Sydney at a speed of about 8 kn, arriving at the Garden Island Naval Dockyard early on the morning of 12 February.

As soon as the extent of the damage was known more accurately, immediate arrangements were made for the ship to be docked and repaired by Cockatoo Docks & Engineering Co. Pty. Ltd., at Cockatoo Island, Sydney, that yard being more suited to carrying out major structural repairs than the Garden Island Naval Dockyard.

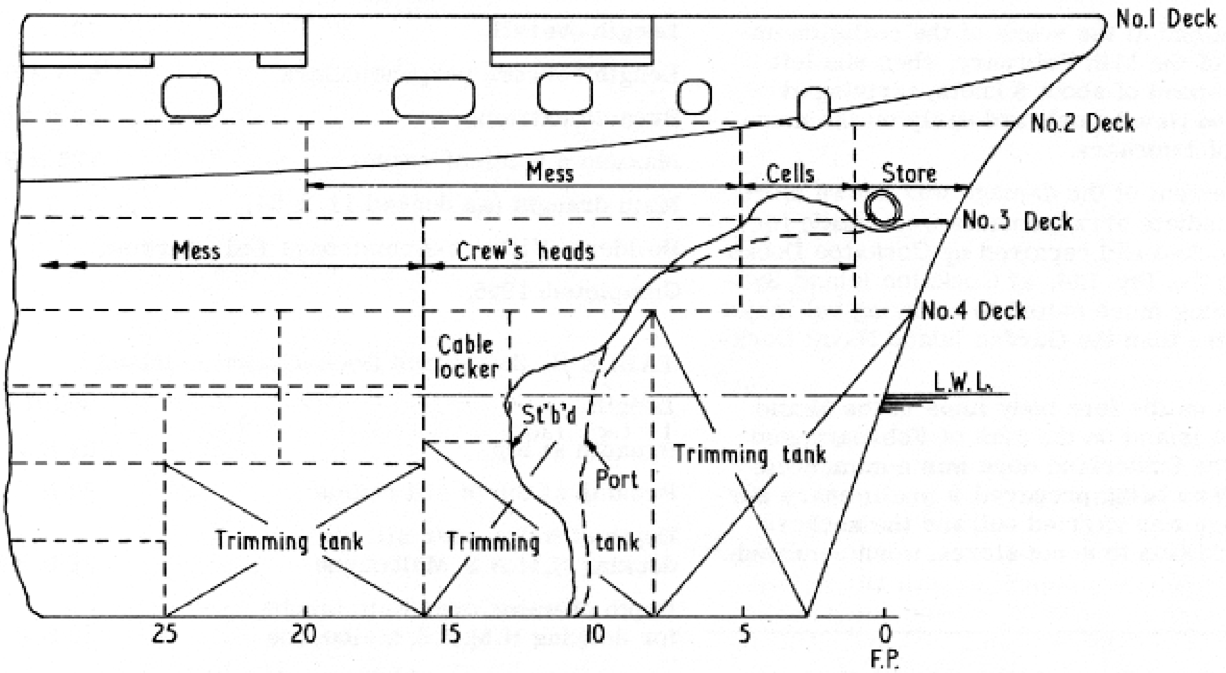
Work was begun on the fore-body lines in the mould loft at Cockatoo Island on 12 February, and preparation of the Sutherland dock was commenced. While the dock was being prepared a preliminary survey of the damage was carried out and the anchors and cables, in addition to some stores, were removed from the ship.

Preparations for Docking

Although HMAS *Melbourne* was not an unusually large ship, there were a number of problems associated with docking the vessel in the Sutherland Dock. The dimensions of the ship and the dock are given in Tables I and II. It will be seen that clearances between the ship and the dock were not large and it was considered necessary to take some special precautions to ensure a safe docking. To prevent any possibility of the bilge keels striking the dock sill, additional 1.2 m wide fenders were placed within the dock. These fenders reduced the clearance on each side of the ship at the waterline to 250 mm, but prevented any possibility of damage to the bilge keels should the ship come hard up against the fendering. Additional rubber fenders were also arranged at the dock entrance.

Fifteen metres of slide blocks with shaped oregon capping were erected each side, and in addition to the usual precau-

HMAS *Melbourne* stemming the Sutherland Dock on the morning of 14 February 1964
(Cockatoo Dockyard photograph, J. C. Jeremy collection)



The extent of major crushing

tion of removing keel blocks in way of the sonar and other underwater fittings, the keel blocks in the fore end of the dock in way of the damage were removed. To provide the maximum possible space around the bows, it was decided to dock the ship as far aft as practicable. To do this it was necessary to remove a portion of the guardrails from the dock caisson. On docking, the clearance between the ship's stern and the caisson was approximately 450 mm.

On the ship, the outboard light booms of the mirror landing-aid were dismantled on both sides to allow passage of the dockside cranes on the starboard side and clearance from a cliff on the port side. The clearance between the mirror landing-aid sponson and the cliff was approximately 1 m.

After a diver had inspected the damage below the waterline, *Melbourne* was successfully docked on the morning of 14 February 1964.

Extent of Damage

Late on 14 February it was possible to determine more completely the extent of the damage to the ship. The ship's bows had been completely crushed for a distance of about 10 m from the stem at the keel and about 12.7 m above the keel. Below the upper edge of B strake, the structure was bent to starboard about 170°. Between No. 4 deck and the upper edge of B strake, the structure was completely crushed.

On the port side No. 4 deck was pushed hard up to No. 3 deck forward of frame 9. On the starboard side the damage was much more severe, the heads being completely crushed forward of frame 9. No. 3 deck was punctured by No. 4 deck forward of frame 5 on the starboard side. The cell bulkheads on the starboard side were badly buckled and some fittings damaged. A minor bulkhead about 0.6 m off the centre line to port was buckled between frames 5 and 9.

The shell plating above No. 3 deck was extensively dented and punctured forward of frame 3. In addition, the shell was punctured in several places on both sides by the two halves of *Voyager* as they passed down *Melbourne*'s sides.


The port side of the crew's heads after the collision. Fortunately the compartment was unoccupied at the time.
(RAN photograph)

Method of Repair

There were several factors which had a bearing on the method of repair adopted. First, and foremost, the ship had to be returned to service as quickly as possible. Secondly, the normal demand on the Sutherland Dock (the only large commercial dry dock then available in Sydney) for routine ship dockings governed the length of time the ship could economically be allowed to remain in dock. The overhang of the flight deck would not permit the dockside cranes to plumb the edge of the dock, a mobile crane being the only means of lowering material directly to the bottom of the dock. With these factors in mind, it was decided from the outset to prefabricate as much as possible of the structure in the shipyard. To enable the dock to be used by other ships, and to allow the fitting out of the rebuilt compartments to progress, it was decided to undock the ship as soon as sufficient structure above No. 4 deck had been completed to permit fitting-out trades to work in the ship while afloat. The structure below No. 4 deck would be prefabricated and fitted to the ship in dock, at which time the remainder of the structural work above No. 4 deck would be completed.

Work Carried Out During First Docking

Work was commenced on Saturday 15 February 1964. The drawing office staff could now prepare working drawings of the prefabricated bow section as it was now possible to determine how much structure required replacing. Shipwrights from the mould loft commenced checking the existing structure at the ship, in order that the new bow would fit with the minimum of fairing. Keel sets were made at frames 14, 14½, 16, 18 and 20, and half breadths were lifted where possible at frames 13, 14 and 15. This information enabled the lines to be faired correctly in the loft, which had already completed most of the templates for the structure above No. 4 deck.

Work was also commenced on cutting away the damaged structure, concentrating on the structure above No. 4 deck.

The shipyard began receiving material from the platers' shop on 14 February. By Sunday 16 February, No. 4 deck forward of frame 10½, No. 3 deck forward of frame 5 (starboard side only) and the top sections of bulkheads 8 and 13 were fabricated and ready for erection at the ship. These units had to be slid across on logs from the dockside and erected in the ship with chain blocks. By the time the ship was undocked on 3 March, No. 3 deck, No. 4 deck, the heads flat 0.6 m above No. 4 deck and the bulkheads were erected in addition to all frames, floors and breasthooks from No. 3 deck to just below No. 4 deck. A section of the new stem and most new shell plating aft of frame B were fitted during this docking, and nine new screen bulkheads were erected in the heads.

As much damaged structure as possible was cut away during this docking, although some of the damage below the waterline was not touched to allow the ship to be undocked. All piping on the port side of No. 4 deck forward of Bulkhead 16 was stripped during this docking, and the stripping of the starboard side was commenced. All ventilation and cable trays on No. 4 deck, and most of the fittings in the cells and stores on No. 3 deck forward of frame 5 were also stripped.

Work Carried Out Afloat

After undocking on 3 March, *Melbourne* was moved to Garden Island as there was no berth available at Cockatoo Island. *Melbourne* remained at Garden Island until 25 March, and work was progressed on the removal of damaged structure forward of frame B, and continued on the new structure begun during the first docking. The repair of the damaged bulkheads on No. 3 deck was commenced.

The stripping of fittings, piping and ventilation in damaged compartments was completed, and some progress had been made on the refitting of these compartments by the time the ship returned to Cockatoo Island, where the manufacture of new fittings was well advanced.

Construction and Preparation of Bow Unit

The fabrication of the bow unit constituted a major part of the repairs. In order that the floating crane which would move the unit to the dock could reach it, a building platform was specially constructed on the nib of No. 1 slipway. The platform consisted of a 10 m square framework of 150 x 75 RSJs welded together, and was to remain with the unit until after it was fitted to the ship.

By Friday 21 February, all floors, breasthooks, stem plate and keel had been delivered to the building skid for fabrication. The keel, which was laid on the skid on 22 February, consisted of two 19 mm plates butt-welded end-to-end. The two halves were each made up from two plates welded edge to edge after bending. The narrow shape of the keel made welding difficult — hand welding was used inside, with machine welding outside. All the lower sections of the floors and bulkheads 8 and 13 were positioned and tack welded to the keel. Following the positioning of the two lower rows of breasthooks, the form of the unit was thoroughly checked, and the floors welded to the keel.

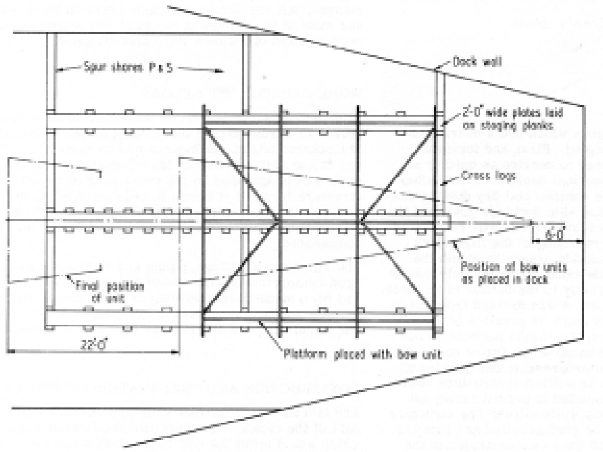
The stem, which was erected at this stage, consisted of four 16 mm thick steel plates butt-welded end-to-end. Temporary stiffeners were fitted inside the stem to retain its shape until incorporated in the unit. As the upper sections of the floors and breasthooks were fitted and tack welded; the lower ones were fully welded with care being taken to avoid distortion. As welding progressed up the unit the erection of the shell plating was progressed. The starboard plate in each strake was erected before the port plate, the sequence being maintained throughout. To avoid distortion of the structure as much as possible, port and starboard seams were simultaneously welded inside and out before any inside fillet welds were deposited. This sequence was only changed where limited accessibility required outside butt welds on a previously-fitted backing bar. Backing bars were also used to connect A and B strakes to the floors with slot welds where no access could be gained for normal welding.

As the original cast forefoot had been badly damaged in the collision, and as time did not permit the manufacture of a new casting, a fabricated forefoot plate was fitted. This plate had an open bevelled U-shape at one end to mate up with the stem plate, and a wide U-shape with sharper bent corners at the other to match the keel plate. The welding of this plate, although awkward, presented no great difficulties.

At intervals during the construction of the unit, its shape was checked to ensure that it would fair into the existing structure at the ship.

On completion, the unit was stayed to its building platform with steel tubes welded to both the unit and the platform. The unit was complete and painted ready for transport to the dock by 18 March 1964.

While the bow unit was being fabricated, the Sutherland Dock was being prepared to receive it. As much damaged structure remained to be cut away, the unit had to be placed out of



The arrangement of the skid for the bow unit in dock

Placing the new bow unit in dock during the 1969 repair
(Cockatoo Dockyard photograph, J. C. Jeremy collection)

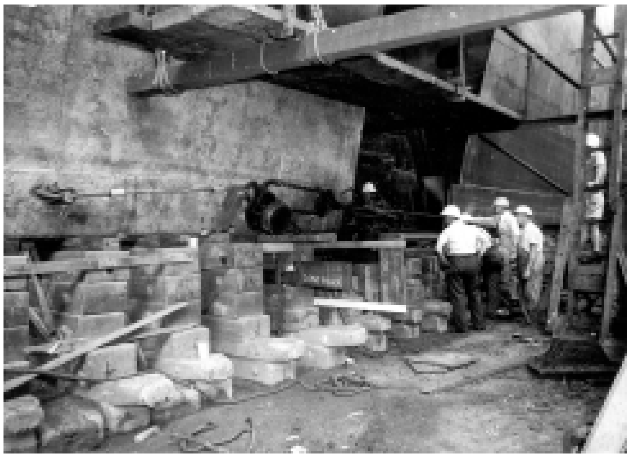
position on a specially-constructed skid laid in the dock. Skid blocks were erected in the fore end of the dock on the centre line and 3.86 m off centre line to port and starboard. Steel plates 12 mm thick were laid on the blocks and securely bolted to them. The plates were greased, and to take any thrust should the unit have to be moved sideways more than a small amount, a number of cross logs and side shores were fitted. During the first docking, the height of the keel blocks had been determined, and the skid blocks set up accordingly. To allow adjustment of the block height should the crushing of the keel blocks be different during the second docking, launching wedges were incorporated in the skid blocks in such a way that their height could be altered.

Sight marks were erected on the dockside for positioning the unit, and white lines painted on the skid plates to allow the unit's position to be checked by a diver. On 22 March, the unit (which weighed 38.7 t) was carried to the dock and lowered into position by the floating crane *Falcon*. The unit was sunk onto the skid.

The Second Docking

Similar precautions to those taken for the first docking were taken for the second docking on 25 March. An immediate start was made on cutting away the remaining damaged structure and preparations were made for moving the unit.

When the ship was ready, two 5 t chain blocks were set up on each side of the ship for moving the unit aft. Although it was found necessary to use a hand jack to overcome initial friction, no trouble was encountered during the operation, which involved moving the unit 6.7 m. Only very small sideways movement of the bow unit was necessary. A number of pairs of steel lugs were welded to the centre skid plate at an acute angle to the centre member of the building platform. Wedges placed between the lugs and the RSJ permitted very fine adjustments to sideways position to be made during the fitting of the unit. The allowance made in the height of the skid blocks for the crushing of the keel blocks under the ship proved insufficient. To lower the skid blocks, the weight of the unit was taken from the skid with the aid of hand jacks, and the skid lowered with the aid of the launching wedges incorporated for that purpose. By this means the unit was lowered 19 mm.



The bow unit being hauled into position
(Cockatoo Dockyard photograph, J. C. Jeremy collection)

After positioning, the unit was set, spiled and welded to the existing structure. Careful construction resulted in the unit being a near-perfect fit. To ensure maintenance of correct form, the unit was checked regularly for position and height while the welding was carried out. It was necessary to fair some frames and one bulkhead to the existing structure where it was found that the frame spacing varied in places. The fitting of the closing sections of frames, breasthooks and bulkheads between the unit and No. 4 deck was progressed allowing the side plating to be completed.

While the bow unit was being fitted, the repairs to the shell plating and framing forward of frame B were completed. The repair and partial replacement of the minor bulkheads on the cell flat was completed, and the remaining steelwork on No. 4 deck finished. Exterior fittings replaced included draught marks, jackrails, eyeplates and a new cable lookout platform. When the welding of the bow unit was completed the building platform was cut away one section at a time and keel blocks were set up under the new bow.

Fitting Out of Compartments

The replacement of damaged piping was a major item of fitting out. All the piping to Nos. 1 and 2 trimming tanks was completely renewed. All damaged piping in the crew's heads was renewed, and the remaining piping which had been removed for cleaning was replaced. In addition to the replacement of smashed WCs and urinals, some new wash basins were fitted. In order to save time, it was decided not to refit the portion of the heads forward of frame 5, the compartment being left empty. Four storm valves which had been damaged beyond repair in the collision were renewed and a number were refitted.

Two centrifugal fans below No. 3 deck forward of frame 5 were found to be repairable. These fans were replaced and all ventilation trunking which had been damaged in the collision was repaired or renewed. On No. 3 deck, the cells were refitted, as were the lamp room and the bosun's lower store. Various damaged lockers and fittings were repaired and replaced where necessary. In addition to the rewiring of the damaged compartments, shipside insulation was patched where necessary, deck coverings laid and the compartments painted.

Alignment of Steam Catapult

There was some concern that the collision may have distorted the flight deck and upset the alignment of the steam catapult. Breakage sights taken during the repairs revealed rather large deflections which, on analysis, were found largely due to thermal effects. Shortly before the ship was undocked for the last time, the dock was flooded and the alignment of the catapult checked afloat under various thermal conditions. These investigations revealed no misalignment.

Staging

Staging for the repairs presented a major problem. Steel stanchions for use in the fore end of the dock were placed in the dock prior to the first docking, as the dockside cranes would have been unable to place them in the dock with *Melbourne* in position. These stanchions, which supported staging up to No. 4 deck level were secured by bolts grouted into the dock bottom. The staging for the work above No. 4 deck was largely suspended from the ship. Although some support was gained from the stanchions and from the dockside, most of the weight (a load of up to 10 t at one stage, without men and gear) was taken by attachments to the ship. The procedure adopted for the repairs required that the staging be removed and erected a number of times.

Completion

The repairs completed, HMAS *Melbourne* was undocked on 27 April 1964, within the time originally estimated soon after the collision. In addition to the collision damage repairs, numerous planned maintenance items were also undertaken by the dockyard during the repair period.

HMAS *Melbourne* completed and ready for undocking
(Cockatoo Dockyard photograph, J. C. Jeremy collection)

The Second Collision

On 3 June 1969 HMAS *Melbourne* collided with the destroyer USS *Frank E Evans* during exercises in the South China Sea. The forward section of the destroyer sank, and *Melbourne* suffered similar damage to that of 1964. After temporary repairs in Singapore *Melbourne* returned to Sydney where almost identical repairs to those of 1964 were completed at Cockatoo Dockyard between 16 July and 11 October 1969.

This article is based on a paper presented to the Second Commonwealth Welding Conference organised by The Institute of Welding and the British Welding Research Association in London in 1965. It is reproduced by permission of TWI Limited.

Back to service — HMAS *Melbourne* passing under the Sydney Harbour Bridge on completion of the 1964 repair
(Cockatoo Dockyard photograph, J. C. Jeremy collection)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