THE AUSTRALIAN NAVAL ARCHITECT

JUNE 1997
ISSUE 2

NEWSLETTER OF THE AUSTRALIAN DIVISION OF

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

Courtesy of Wavemaster International

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS (AUSTRALIAN DIVISION)
Box No. 4762,
GPO, SYDNEY,
NSW 2001

Please send all correspondence and advertising queries for the next edition (deadline 29 August) to: The Editor
Australian Naval Architect
c/- RINA
Box No. 4762, GPO,
SYDNEY, NSW 2001

CONTENTS:

A note from the President .....Page. 2
Editorial .....Page. 4
News from the Sections .....Page. 5
Industry News .....Page. 6
Trade News .....Page. 8
Education News .....Page. 9
Letters to the Editor .....Page. 15
Our Profession .....Page. 16
Just Launched .....Page. 20
The Australian Division of RINA .....Page. 21
Technical Paper:
Small, low drag, solar powered monohulls and multihulls .....Page. 23
Positions Wanted .....Page. 27

Cover photo:- High Speed Catamaran ferry "Sun Royal" designed and built for the Japanese Government's Ministry of Transport and Ezaki Kisen Co. by Wavemaster International. "Sun Royal" will operate between Minamata and Ushibuka in south west Kyushu reducing travel time by 30% from the older monohull ferries currently in use.

LOA:	24.2m
Beam:	7.8 m
Passenger seats:	96
Minimum service speed:	28.5 knots
Main engines:	MTU 12V 183 TE92, 2 x 660 kW
Propulsion:	KaMeWa waterjets

Computer controlled active stabilisation system
Hydraulic powered transom flaps
Classification: Japanese Government

A NOTE FROM THE DIVISION PRESIDENT

First of all my congratulations to the team that was responsible for the production of our first edition of the Australian Naval Architect. The

content and presentation was very professional and the efforts of those who solicited advertising ensured that the project is self funding. It would boost our local income if we could inveigle other advertisers to support the journal and I hope that our members will assist in seeking this additional revenue. I was pleased to table a copy at the meeting of the London Council on 23 April last.

At that meeting I also tabled a request for additional funds over the next two years to assist in our revamping of the Division. I also tabled documentation on the professional liability capping scheme that has been implemented in NSW and is now being introduced in Western Australia. The professional bodies in UK do not have a similar scheme and the Council in London asked us to provide them with the information with a view to something similar being implemented there. I plan to go back to London later in the year to argue our case for additional financial support while we revamp the administrative procedures of the Division.

Being a progressive old grey beard I have just jumped feet first into surfing the internet and at great expense, as I have to use an STD line and have a teenage daughter, I have learned the advantages that are available in using this medium of communication. I believe that the Division should get into the act and provide a home site for a bulletin board where members can inform others of information and events that are of general interest. As an example of its use I am of the opinion that it could be an effective vehicle for advertising positions vacant and positions wanted for the mutual benefit for both employers and employees. Do we have a volunteer to get this project up and running?

If we are to function as a strong professional body I am of the view that we have to speak out on matters in which we are expert and to address those issues that are of public interest. From my observations over the years I have concluded that the outside world sees ours as being a glamorous profession and it has, in my time, attracted a number of practitioners who have short circuited the system and have hung out their shingles without first obtaining the eduction and/or training which, in my opinion, is necessary for someone to competently advise the public on matters naval architectural. As a consequence of this situation at the present time John Citizen is uncertain whether the naval architect he retains has the qualifications and experience to do the job required or not. With these thoughts in mind I expressed the view at the AGM that the Division should establish a register of properly qualified members who are providing consulting services. As you will be aware documentation on this matter has already been circulated and I strongly urge those who are concerned to signify their interest by advising the executive officer before the end of July so that the register can be prepared for promulgation by September.

Another area that we need to address is that of providing the names of properly skilled members to act as expert witnesses and arbitrators. As President of the Division I was recently approached by a firm of solicitors to provide the name of an arbitrator to act in a dispute between an owner and a builder. I contacted four members to inquire if they were willing to perform the task. For one reason or another they all gracefully declined. So as not to upset the system I reluctantly put my name forward. While I enjoy jousting with the barristers I was diffident to act in this instance because, to some less charitable than myself, it may have appeared that I was taking the cream by virtue of my position as President.

At present there is reason to believe that the education of masters of both small commercial vessels and pleasure craft is lacking in providing them with the necessary skills to assess the stability of their vessels. Over the years I have frequently encountered a situation where a master has a pristine copy of the stability data for his vessel but did not understand what it all meant. With these thoughts in mind I have asked Bob Herd to fom a sub committee to

look at ways to address this problem. If you wish to make a contribution to this project then I suggest that you send it to the secretariat who will forward it to Bob.

Finally some thoughts on the Maritime Engineering Society (MARENSA) that has been formed by the Institution of Engineers. I personally support the formation of this society and the Division has indicated its support also. In talking with some members they have indicated their opposition to this society because they see it as a threat to the Division. I do not hold this view. For a number of years I have been a member of IE Australia's Maritime Panel which has performed a similar role to MARENSA within the Sydney Division. The Panel's experience has been that in order to attract people to its meetings the topics have to be of a general nature because if addresses of a specialised nature are given then only a small number of people, whose interests are related to the topic, will attend.

I was more than a little surprised at the way in which the society was formed. Ostensibly it was intended that this new society would embrace coastal engineers, marine engineers, and naval architects. Oddly enough the targeted bodies, including the Sydney Maritime Panel, were not approached on the formation. The coastal engineers already have a national body with which they are quite happy. I understand that the marine engineers were not particularly keen on an association with IE Aust, thus the main source of interest appears to be the naval architects. When the proposal was initially floated the Division Council wrote to IE Aust to clarify some points that were unclear. Several follow up letters were sent until finally a letter to the President of IE Aust was needed to get a reply. However, MARENSA is now a fact of life and I think that it deserves our support.

I leave you with these thoughts and look forward to getting some air time in the next edition.

Noel Riley

EDITORIAL

A very sincere thanks to all those who contributed to and assisted with the production of the first two issues of "The Australian Naval Architect". One of the major problems that the Australian Division has faced in the past is the great distance between members. This newsletter bridges those distances. It is dedicated to promoting Australian naval architects and has the following primary focus;

- Establish a forum where all members can express their views.
- Present technical articles of Australian origin.
- Report news directly relevant to Australian naval architects.
- Foster a sense of belonging to a cohesive organisation.
- Create a flagship that promotes our members and their qualifications to public and private organisations in Australia and abroad.
- Provide a modest source of revenue to help support the Australian Divisions activities.

To be viable and present a competent image of our profession "The Australian Naval Architect" needs the support of both members and advertisers. Our advertisers need to be able to justify their expenditure and require a measure of the effectiveness of their advertising. If you are interested in a product advertised in these pages I urge you to contact the company and let them know that you heard of them and what they are doing through "The Australian Naval Architect".

Image is vitally important to our profession. Whilst there are many naval architects working in the most visible arena of high speed catamaran design and production other areas of commercial design are being forgotten. In WA (and I believe in other states) many workboats and fishing vessels, often as large as 30m, are designed by unqualified personnel or simply assembled by the boatbuilder with few drawings. The common excuse given is that the cost of employing a

professional cannot be justified. I believe that this is not common in the UK, Europe or USA. As a professional body we have not promoted ourselves well. The builders of these vessels do not recognise that the work of a professional naval architect not only results in an improved design but can save his fee several times over in reduced materials and production times.

A new segment, "Our Profession", appearing in this issue features articles of professional, rather than technical, interest. Planned future articles include professional indemnity insurance and guideline scale of fees. Other topic suggestions are welcomed and should be referred to myself.

David Lugg

NEWS FROM THE SECTIONS

CANBERRA

There have been no Canberra section activities reported in the last three months.

Peter Hayes

NEW SOUTH WALES

Ken Warby addressed an enthusiastic audience at the Australian National Maritime Museum. A video was made of the presentation and is available for loan to members by contacting Phil Helmore on 02 9385 4092.

Trevor Rabey

VICTORIA

A recent combined meeting of the RINA and IMARE heard a presentation by Alan Taylor, MRINA, FIMarE, of BHP Transport, on the design considerations for ballast water control and treatment.

Ballast water is a contentious topic at present, with the increasing fears of invasions by exotic creatures and organisms.

Alan Taylor's paper discussed the design considerations for ships for the control and treatment of ballast water to minimise the risk of introduction of unwanted aquatic organisms and pathogens into port and territorial waters by ships' ballast water and sediment discharges. The design aspects discussed were those relating to the ship structure and installation of equipment to ensure that any management, control or treatment option is safe for the ship and crew, environmentally acceptable to the marine environment, technically achievable, practicable for the ship and crew and cost effective in obtaining the appropriate level of protection to minimise the risk of introduction of unwanted aquatic organisms and pathogens into the receiving environment.

The full text of Alan Taylor's paper is available in the proceedings of IMAS 1996, "Shipping and the environment, is compromise inevitable?", published by the Institute of Marine Engineers.

Bryan Chapman

TASMANIA

A joint meeting with the Nautical Institute and the Institute of Marine Engineers was held on 9 April at the Australian Maritime College. The presentation was given by Mr Geoff Hunter, of Esso, Australia, on the West Tuna/Bream B Project. As usual there was a good turnout with about 40 people attending. The next joint meeting will be held in July and is being organised by the Institute of Marine Engineers.

This year's naval architecture students at the Australian Maritime College are currently planning an entry into next year's solar boat challenge. It is understood they have a very promising design and are looking for sponsorship to develop it further and enter the race.

Professor Don Bass has just returned to Canada after a very fruitful sabbatical. He developed a method for predicting the performance of passive roll tanks, and conducted experiments in the towing tank at the Australian Maritime College to validate the theory. Plans are now underway

to fit a full scale tank to the College's 35m fisheries training and research vessel, "Bluefin". This will be followed by full scale trials to verify the effectiveness of the tank.

Initial commissioning trials for the Australian Maritime Engineering CRC's high speed testing facility have now been completed. This will allow testing at speeds of up to 35 knots and is ideal for towed array work and for investigations into the performance of very high speed crafts such as ekranoplans.

Martin Renilson

WESTERN AUSTRALIA

Our own Kim Klaka gave an excellent presentation on Yacht Performance in February. His talk described towing tank work completed on an IMS style racing yacht. Wave patterns were measured to gain insight in to interaction between hull and appendages. The results were input to a velocity prediction program.

The March meeting "Fatigue Strength of Alloy Structures" was presented by Steve Maddox of the Welding Institute, UK. Steve's appearance resulted as a joint effort between RINA WA, AMECRC and the CRC for Materials Welding and Joining. The presentation was very well attended. Steve gave a general introduction to the fatigue of welded joints, aspects specific to aluminium alloys and recent developments in Europe on fatigue design standards.

Our most popular meeting for the quarter was Laurie Prandolini's "WISE up to ekranoplane GEMs". Nearly 50 people attended in mid April to hear about these promising new craft and view a most interesting video.

Owen Sweetman and John Millet of International Paints introduced us to Intersleek at our May meeting. The Intersleek system results in a very smooth surface to which marine growth and slime cannot get a good bond. The product has no toxins. Issues of speed, fuel savings, improved operational efficiency and environment were discussed. Details of the paint system and a promotional video are available in The RINA WA library.

Jim Black

INDUSTRY NEWS

AUSTRALIAN MARITIME ENGINEERING MARKET STUDY

The Australian Maritime Engineering Cooperative Research Centre (AME) recently commissioned an extensive market study to establish priorities for R&D in the maritime engineering industry in Australia.

The survey originated from a concern by the AME that market data is fundamental to understanding the "demand pull" for maritime engineering research and is crucial to the development of a sustainable maritime industry in Australia.

Melbourne based shipping consultants Thompson Clarke Shipping won the competitive consultancy and undertook the work with an extensive team made up of marine engineers, naval architects, oil and gas engineers and marketing consultants.

The broad aim of the survey was to canvas the maritime industry and other sectors reliant, or potentially reliant, on maritime engineering and technology to determine their existing needs, capabilities and competitiveness, and likely future needs based on market predictions and export potential.

Almost 100 organisations from the industry were interviewed by the survey team. The final report was delivered to AME in late March and addressed a range of issues including:

- National maritime capability
- Trends in maritime engineering and related R&D
- Opportunities for future technological developments in the priority sectors

The report also estimated Australia's maritime industry generates about A$14.5 billion each year in direct sales or production which compares with a figure of A$45 billion for the same sector

in the UK, which is some three times in size, (ie about pro rata to the population). The offshore oil and gas sector is by far the largest in dollar terms followed by shipping, ship/boatbuilding and repair.

Interestingly R&D was reported as generally lagging behind other OECD economies both in terms of human resources and expenditure. R&D spending in the Australian maritime sector was estimated to be only one sixth of equivalent UK spending in the same sector.

The outcomes of this confidential survey are now being assessed by the AME, particularly in relation to determining its business strategies and research priorities for the future.

The AME wishes to acknowledge the role of Thompson Clarke Shipping and their team and the many business organisations who contributed in a very positive way to the survey.

Brian Chapman

Victoria

High speed vessels for Victoria

A proposal is being developed to build high speed surface effect vessels in Victoria. A company called Fast Ships International Pty Ltd has been formed to develop the designs, build prototypes, and bring the vessels to market. The development involves engineers associated with the University of Melbourne, Victorian based Naval Architects, and former senior naval and civilian maritime personnel.

Prototypes are expected to be built in currently available facilities in the inner metropolitan area, where they will be convenient to existing manufacturing facilities and to those involved in development of the designs. It is planned that in the longer term production facilities will be constructed elsewhere in Victoria, and available land is already being assessed for suitability.

The project has attracted interest from the Victorian and Federal governments, navy and army, and local and overseas financiers. We'll keep you posted on further developments.

Whale of a tale

Naval architects will be interested in something currently happening at the old Point Cook air station - a remake of the 1950's film "Moby Dick".

Based on Melville's tale, the movie's production involves the construction of a movie set replica' of a 32 metre Nantucket whaling vessel, which will float in a specifically constructed tank being built at the air station.

The replica is being constructed on a special sub-structure which will enable it to be readily rolled and pitched in a controlled fashion to simulate the behaviour of an old-time whaler at sea.

Naval architects in Victoria and Tasmania have been working with the film's producers to ensure that the vessel will behave in a predictable manner, and that its operation will be safe.

It is understood that shooting of the movie will start shortly, and that it will go to air on the Nine network next year.

Brian Chapman

Western Australia

A list of the major recent launchings and newbuildingss tells the story of the frantic pace being set here in the West.

Shipyard	
Austal	*Recent launchings*
March 1997	82m HS catamaran for Poland
April 1997	60m HS catamaran for Turkey
April 1997	30m HS catamaran for Japan
	Newbuildings
	60m HS catamar an for Turkey
	40m HS catamaran for China
	40m HS catamaran for China
	82m HS catamaran for TBA
	47.6m HS catamaran for TBA
	42m HS catamaran for China

Oceanfast	*Recent Launchings*
April 1997	35m Pearling vessel for Australia
	Newbuildings
	46m Motor Yacht for USA
	80m Car/Passenger ferry for Polynesia
	59m Yacht conversion for USA
	50m Motor Yacht for Europe
Sabre Cats.	*Recent launchings*
Jan 1997	22m HS catamaran for Phillipines
March 1997	22m HS catamaran for Phillipines
	Newbuildings
	22m HS catamaran for Phillipines
	22m HS catamaran for Phillipines
Transfield	*Recent launchings*
Feb 1997	31.5m Patrol Boat for Federal States Micronesia
Feb 1997	36.5m Patrol Boat for Brunei
Feb 1997	36.5m Patrol Boat for Brunei
	Newbuildings
	21.6m Prawn Trawler for Australia
	21.6m Prawn Trawler for Australia
Wavemaster	*Recent launchings*
March 1997	24.5m HS catamaran for Japan
April 1997	28.5m HS mono for Singapore
April 1997	28.5m HS mono for Singapore
	Newbuildings
	30.3m HS mono for Singapore
	30.3m HS mono for Singapore
	37.5m HS mono for Singapore
	30.3m HS mono for Singapore
	30.3m HS mono for Singapore

Kalevi Savolainen

TASMANIA

Incat Australia is intent on providing a service between the large island and the smaller island south of that, (Tas & Vic). The 86m vessel, Yard No. 045 is set to take on the load carrying work whilst the Spirit of Tasmania enters dry dock for a fortnight or so.

Other news to spring from the Incat work place is that of the latest 86 m vessel - Incat 044 which was launched mid May and completed sea trials early June is yet another large wave piecing catamaran set for overseas sale, delivery commencing 7 June.

On the sailing front, yachts are still being constructed as Hobart readies itself for the oncoming winter months. The two Fred Barrett penned Mungral 25's are steadily reaching the final stages of construction and should (?) see them both hit the tide in mid September in preparation for the oncoming season. Another yacht to hit the drink will be the Lyons 47' R/C design fashioned in alloy, built by John Smith (another consultant to Incat). Information regarding the three remaining yachts under construction has been hard to source, no doubt fires will be raging to battle off the heavy Hobart frosts, which will see these yachts also fall into the drink by the end of the year.

L.S.A. Life Raft Systems Australia are expanding business, with the planned construction of a larger loft to accommodate the increase in work orders.

Hobart TAFE is undertaking training in the field of naval architecture in the form of three modules associated with the Associate Diploma of Mechanical Engineering. This should benefit those Incat employees undertaking studies at TAFE in gaining a better understanding of general naval architecture. Guy Doyle, the Incat drawing office manager will be teaching the modules.

Fred Barrett (Sec/Treas. Hobart section R.I.N.A.)

TRADE NEWS

Marine Transmissions

Already well known in the marine industry for their range of marine transmissions Twin Disc have some exciting new additions to their product line.

Arneson Surface Drives - these surface piercing propellers provide increased speed, acceleration, manoeuvrability, as well as increased fuel efficiency. A main advantage over many other surface drives

is the steerable and trimable propeller shaft. The Ameson drive allows the naval architect to design a boat with considerably less draft than conventionally powered hulls allowing greater access to shallow water areas.

Doen water jets - 12 axial flow models from 30hp to 2000hp, catering for high speed craft operating at speeds greater than 45 knots. All jets are manufactured with corrosion resistant aluminium castings, stainless steel fittings and sacrificial anodes for cathodic protection.

Marine Transmissions - fitted with helical gears for quieter operation and are able to take full power in forward and reverse. Most models are offered with optional trolling valves, which lower the propeller speeds below what would be possible at idle.

Composites Consultancy

SP Technologies is an independent structural engineering consultancy providing composite engineering services for most of the worlds leading marine designers.

Projects undertaken by SP Technologies in recent years also include the design development of composite structures and components for civil, automotive, power generation and defence applications. In addition, SP Technologies has been involved in a wide variety of marine related projects including Americas Cup racing yachts, high performance superyachts, oil rig lightweight fire and blast protection systems, surface effect ferries, patrol boats and lifeboats.

SP Technologies has pioneered most of the current innovative structural design associated with sail and power boats, which has led to involvement with a large number of highly successful yachts. The reasons for this success stem from a unique integrated approach where all aspects of the design, materials used and construction process are analysed and incorporated in the final design solution to optimise the performance benefits available through composites.

A wide range of services can be provided at various levels on either an individual basis or as part of a complete integrated package , including conceptual design studies, laminate analysis, detailed construction drawings, finite element modelling, testing and on site support.

EDUCATION NEWS

UNIVERSITY OF NSW

Navy Engineering Field Day

On Saturday 10 May the Royal Australian Navy held its inaugural Navy Engineering Field Day for engineering students from six universities from Newcastle, Sydney and Wollongong. The day was aimed at giving engineering students a day in industry, a look at some hi-tech navy equipment, and alerting them to possible careers in the RAN. But it was much more than just a careers day with the whole emphasis being on involvement of the students. About twenty students from UNSW attended, of whom eight were naval architects. The day was based at HMAS Waterhen, but included a boat trip to ADI Garden Island to visit HMAS Anzac or HMAS Newcastle, and the FFG machinery control room simulator. Other items on the program included ultrasonic non-destructive testing methods, and a very entertaining presentation on the extensive shafting and propeller problems resulting from last year's grounding of HMAS Torrens, and their solution, was given by the naval architect on the repairs Mr Hugh Hyland and the engineer on watch at the time of the grounding LCDR Bill Barrett.

Launching of Fourth Anzac-class Frigate

On Saturday 10 May the fourth Anzac-class frigate, HMNZS Te Mana, was launched by the Maori queen, Te Arikinui Dame Te Atairangikaahu, at Transfield Defence Systems' Williamstown yard for the Royal New Zealand Navy. A group of our fourth-year naval architecture students attended the launching and, on the day prior to launching, were shown over the launching

arrangements and the construction facility by naval architect Mr Peter Goodin and LEUT Darryl O'Rourke of Principal Naval Representative (Victoria)'s staff. A big thank you to Transfield and PNR(Vic).

FAST '97

The fourth international conference on fast sea transportation is being held in the southern hemisphere for the first time this year, at the University of NSW from Monday 21 to Wednesday 23 July. There will be four parallel sessions, and the conference details show a packed program of interesting papers on all aspects of fast craft. This year, also for the first time, there will be a prize for the best paper presented by a young (less than thirty years) person. The cost of registration is $1300 (the date for early-bird registration has now passed) or $300 for students. If you haven't already registered, then contact Ms Michelle Cubberley at the Conference Secretariat, Baird Publications, PO Box 460, South Yarra, Vic. 3141,
Phone: (03) 9826 8741, Fax: (03) 9827 0704,
E-mail: marinfo@baird.com.au

Workshop on Composite Structures

A workshop on the Structural Analysis and Design of Composite Boat Hulls is being organised by the Australian Maritime Engineering CRC and will be held at the University of NSW from Wednesday 16 to Friday 18 July (you can put this together with FAST'97 and have the intervening weekend sight-seeing in Sydney!). The three-day program includes the important aspects of composite design and construction, together with hands-on use of finite-element analysis software. Presenters include Mr Craig Hughes from Det Norske Veritas, Mr Stuart Dutton from the Advanced Composite Structures CRC, Jeffrey Lingard from the Ships Structures and Materials Division of DSTO, Prof. Madhujit Mukhopadhyay from the Indian Institute of Technology, A/Prof. Don Kelly from our Dept. of Aerospace Engineering, and Mr Mac Chowdhury from our Dept. of Naval Architecture. The cost of registration is $900 ($450 for CRC participants) or $150 for students. If you have not already registered, then contact Mrs Pym Bains at the Workshop Secretariat, AME CRC Sydney Research Core, School of Mechanical and Manufacturing Engineering, The University of New South Wales, Sydney 2052,
Phone: (02) 9385 4120, Fax: (02) 9313 6449,
E-mail: p.bains@unsw.edu.au

SHIPSAFE '97

A workshop on Ship Safety is being organised under the sponsorship of a group including AMC, AMECRC, AMSA, the Australian Shipowners' Association, the Company of Master Mariners of Australia, IMarE, UNSW and others, and will be held at the University of NSW on Monday, 10 November. The one-day program will include topics such as common structural defects, fatigue and corrosion, electrical/electronic failures, maintaining economic life with safety, navigation hazards and collision avoidance, safe carriage of cargoes, routing, training, management, OHS at sea, and the ISM Code. Presenters include international experts in these fields of ship safety. Reserve this date in your diary now, and watch this space for further details.

Undergraduate Research

The undergraduate thesis projects in progress include:

Tristan Harris	*Optimal Structural Design of Pontoons*
Brad Hillman	*Container Lashings and Stability of Ro/ro Vessels*
Chris Hughes	*Viscous Roll Damping of High-speed Vessels*
Anthony Krokowski	*Improving the Hydrodynamic Efficiency of Paravane Stabilisers*
Scott McErlane	*Rubber to Metal Bonding of Resilient Superstructure Mounts*
Sean Phelps	*The Influence of Transom Stems on Wave Resistance*
Tauhid Rahman	*Aluminium Welding in High speed Craft and its Fatigue Life Assessment Under the Effects of Sea-water*

Post-graduate and Other Research
Research in progress includes:

Greg Seil (PhD): Research into the flow into waterjets, with particular attention to the uniformity (or otherwise) of the flow in way of the impeller and the pressure distribution on the surface of the duct because of concerns with cavitation. Optimisation of the waterjet is an additional aspect being implemented.

Tony Armstrong (PhD): Investigation into the form factor for slender hulls with application to the prediction of resistance of catamarans, in which it is thought that values currently being assumed for the form factor are too low. Experimental work has been carried out in UNSW's large wind tunnel, and CFD modelling is now being done with the commercially-available package Fluent and by panel programs.

Lawry Doctors (AMECRC): Study of the flow around the transom stern of high-speed vessel forms. A procedure has been developed which models the complex flow in a realistic way, so that the sectional shape of the transom, the run angle, and the speed of the vessel are all considered, and the shape of the resulting hollow in the water is reliably predicted. The resulting calculations for the resistance agree well with experimental measurements.

Sandy Day, Lawry Doctors, and Tony Armstrong (AMECRC): Concept evaluation for high-speed vessels. Optimisations have been effected for a variety of high-speed concept craft, including monohulls, catamarans, SWATHs, hovercraft, and surface-effect ships.

Dugald Peacock (PhD): Decision-Based Hydrodynamic Design of Displacement Monohulls. Aims to demonstrate the benefits of a holistic mathematical model for the preliminary hydrodynamic design of displacement monohulls. A model is to be developed and be applicable over a wide speed range that couples the prediction of ship motions using strip theory, resistance estimation using statistically based regression equations, free trimming hydrostatics for stability calculations with hull form design and superstructure definition. It should be developed to incorporate as many hydrodynamic design constraints as possible (92 constraints and 68 goals) to allow the generation of candidate superior hull forms for further refinement in a subsequent detailed design process.

Dugald Peacock (Research assistant for AMECRC): Very High Speed Ships. Aims to develop methods for the analysis and design of high speed vessels. The VHSS is very wide scoped incorporating hydrodynamics , structural analysis, propulsion and economic considerations of high speed vessels. Dugald will be researching and developing methods for the prediction of resistance and seakeeping performance of high speed craft using numerical techniques. For further information on this topic contact Mr. Tony Armstrong AMECRC Sydney Research Core.

Some of these will be reported at FAST '97.

Phil Helmore

Papers published since last RINA publication.
Peacock, D., Smith, W.F. and Pal, P.K. (1997) *"Correction to the published resistance methods of Fung and Leibman"*, AMECRC. Commercial in confidence internal report. Launceston,AMECRC IR 2/97, 25pp.

Peacock, D., Smith, W.F. and Pal, P.K. (1997) *"Hull-form generation using multi objective optimisation techniques"*, proceedings of International Marine Design Conference IMDC '97, University of Newcastle-upon Tyne, England, 12pp.

Peacock, D., Smith, W.F. and Pal, P.K. (1997) *"Minimal ship motion hull-form using design multi criterion optimisation techniques"*, Proceedings of FAST '97, University of NSW, Sydney, 12pp.

Peacock, D., Smith, W.F. and Pal, P.K. (1997) *"Decision based hydrodynamic design of dis-*

placement monohulls", Proceedings of AME '97 Postgraduate conference, Melbourne, 89pp.

CURTIN UNIVERSITY

Postgraduate Research

The educational focus for naval architecture in WA is in postgraduate studies at Curtin University. There are 6 Postgraduate research students currently enrolled. Two of these are conducting research which involves the use of the 8 metre experimental catamaran Educat. Stephen Cook recently graduated in naval architecture from AMC with first class honours and has been awarded an AME PhD scholarship to investigate the wave induced loads on high speed catamarans. Jan Krasnodebski completed his first degree in mechanical engineering at the University of Waterloo, Canada and a masters degree in fluid dynamics at Massachusetts Institute of Technology (MIT), USA. He was awarded an AME PhD scholarship to investigate ways of improving high speed ship motion predictions, by comparing calculated and measured pressure distributions on Educat. The vessel has been constructed as a joint venture between South Metro TAFE's Fremantle Maritime Centre and AME. It is used by TAFE for boathandling proficiency training and related activities, whilst AME will use it for research and technology exchange. The vessel was designed by AME participant Incat Designs and is operated jointly by AME and TAFE.

The principal research use for the vessel is to help predict the loads and stresses on the hulls and bridging structures of large catamarans. The wave induced loads on such vessels have always been difficult to estimate. Most vessels are built to guidelines developed from experience with similar vessels, with error margins built in. This can lead to inefficient design and operation.

A scientific approach to estimating loads helps overcome these problems. There are three approaches which may be taken - theoretical computer predictions, scale model tests or full scale measurements. Some combination of all three is generally considered most effective. However, each has its drawbacks. Theoretical predictions require some form of independently

derived data to compare with the computer output. Model tests in towing tanks are difficult to conduct in waves at high speed, and there are scaling problems if very small models are used. Measurements of stresses and loads on full scale ships are difficult to obtain because the structure of the ship is necessarily complex and difficult to analyse, and the operational practicalities make it very expensive to conduct dedicated research trials on these vessels.

The use of the 8m scale catamaran will overcome several of these obstacles. It is large enough to minimise the scaling problems of conventional model tests, it can be run in real ocean waves at high speeds and on various headings (conditions not readily available at model test research facilities), it is designed so that the parts of the vessel of particular interest are of simple geometry hence easy to analyse, and the cost of running the vessel for dedicated research trials is comparatively modest.

Measurements will be taken of the forces and bending moments exerted by the ocean waves on the hulls and the cross-structure joining the hulls. These data will be analysed, scaled up and then used in the structural design of full scale vessels. It is envisaged that computer prediction programs written by AME staff will be checked and fine-tuned using the data from the 8m catamaran trials.

The research will be available firstly to the participants of AME. Secondly, the work will be used to support the consultancy work of AME for clients across a spectrum of the Australian shipbuilding industry. Thirdly, the techniques and research findings will be disseminated internationally through conference papers and technical publications, demonstrating to the world that Australia has strong research capability supporting its maritime industry.

All this activity will be of direct benefit to Australian designers and builders of high speed catamarans, through more accurate loading estimates leading to lighter, more efficient vessels without compromising safety. This will help maintain Australia's leading edge in the industry, by combining safety, high technology and low cost.

For further enquires contact Kim Klaka.
Telephone: (08) 9266 7380

Offshore Workshop

Curtin University was the venue for a 2-day AME workshop held at the end of April, on the Dynamics of Floating Production Systems. The drive towards deep water sites makes this topic one of immediate relevance to the Australian offshore industry. The workshop presented an in-depth view and discussion of dynamic aspects of FPS and other components that are so important to naval architects and offshore engineers who are taking this technology to its limits. The workshop attracted 30 participants from around Australia and featured an impressive range of eminent presenters from USA, Norway and Australia.

Short Courses

AME at Curtin will again be offering short courses in Advanced Naval Architecture, Design for Small Craft, and Marine Structures and Materials. The courses run in the evenings for 2 hours per week over 13 weeks, starting 28 July. This is the eleventh year these courses have been offered, with several hundred successful attendees.

Telephone: (08) 9266 7380 for details.

Fremantle TAFE

The last issue of the Australian Naval Architect advised that Fremantle TAFE were offering a new course in Ship Knowledge for Shipbuilders. I am pleased to report that all places in the course were taken up, which bodes well for the future.

Telephone: (08) 9239 8000 for details.

Kim Klaka

LETTERS TO THE EDITOR

Dear Editor,
Congratulations on an excellent first issue of The Australian Naval Architect. You and all the team which put it together can be proud of your achievement.

I was pleased to see Frank Jarosek's technical paper on his assessment of Australian Standard 4132.1 Design Loadings and his overall conclusion that it is a good design tool, but may perhaps benefit from some fine tuning. It is clear that he has spent much time in comparing the results of the Australian Standard with other applicable results, and his thoughtful appreciation of the causes and effects are appreciated. His action in making the comparisons available to industry is of benefit to us all and is to be applauded.

Phil Helmore

Dear Editor,
Frank Jarosek's excellent article in the March 97 newsletter was long overdue. It provides a comprehensive technical explanation of many important parts of the standard. It may be of interest to readers to know who wrote the standard and how it evolved to its current version.

It may come as a surprise to some that the working group that wrote the standard was made up of four commercial naval architects, four government naval architects plus one academic (me) in the Chair. All these people were volunteers and the standard was written in their spare time. The group first met in April 1989, the first draft of the Standard being completed in July, after just three months. However, it took a further four years to obtain feedback from industry, amend, dot the "i's" and cross the "t's" to develop the final document.

Two underlying principles that we kept to were:
the water doesn't know what the ship is made of and the loads are the worst likely to be experienced by the vessel.

These two simple principles had significant implications.

The first principle was important from the viewpoint of safety factors. One of the main sources of confusion with other codes is duplication and, far more seriously, the omission of safety factors (factors of ignorance really) as a consequence of splitting the code into design loadings and scantling calculations. We needed to make sure that the people writing the materials sections incorporated safety factors which allowed for materials defects, computational approximations etc but not load uncertainties. Consequently their input (our output) was the load that the structure must withstand. This was fine in principle, but loads are not well behaved. The pressure used to calculate the required strength of a frame is different from that used in the surrounding plating, because of the spatial and temporal distribution of loads. I believe that we almost got it right, except perhaps for loads on longitudinals as pointed out by Frank in his article.

I thought the most challenging part would be bottom plate pressures, as there is so little information (just Refs 1 and 2 of Frank's article really) and the loads themselves are very high. The decision to put an upper limit on Froude number dependence - a radical decision at the time - has since been vindicated by a number of operators and researchers, and the bottom plate loadings are generally sound as indicated in Frank's first table. However, a word of caution is worth issuing here. Comparison of AS loads with those of other codes can be very misleading, because safety factor coverage will be different from code to code, as mentioned earlier.

We expected to receive criticism - and we did! - for distinguishing between "ordinary" vessels and heavy-weather vessels. This distinction ties in with the Froude number limitation, in that the loads experienced are limited not by speed but

by the maximum vertical accelerations acceptable to those on board. Employees and passengers on normal vessels have a lower tolerance level than those operating heavy-weather craft and it is from this distinction that the definition of heavy-weather craft derives. A heavy-weather craft is one where the crew are prepared to suffer significant physical hardship in order to accomplish their mission.

As it turned out, two of the most difficult aspects of the code were the "simple" clauses on deck loadings and the like, and the type of service for which the vessel would be used.

The simple clauses had to cover a range of geometric and operational permutations that could have swamped the code with detail, so we accepted the shortcomings of simple formulae and definitions in the hope that common sense would prevail on interpretation.

The issue of service was also difficult. It was considered inappropriate to define sheltered waters etc. within the code, so all loads were for open waters. Separate regulations or guidelines would have to be applied if dispensations were to be sought for operating in sheltered areas. Such dispensation often requires local knowledge as well as a thorough understanding of the manner in which vessels respond to different wave spectra, matters way beyond the scope of a volunteer group.

To sum up, I agree with Frank's conclusion that the standard is a good first-cut, but needs some fine tuning. However, it will always be a cheap alternative to classification societies unless the industry is prepared to back the Australian Standard with the dollar support for technical development and re-drafting.

Kim Klaka

Dear Editor,
I have received my first copy of "The Australian Naval Architect", and want to say that I'm impressed with both its presentation and its content. I congratulate those involved with its preparation.

I have worked in the industry in Australia for more than 35 years, and have always found keeping up with activities and developments in other parts of the country to be difficult. This was a greater problem in the past than is now, but it still isn't exactly easy.

I believe that your publication will play a big part in developing a strong and united maritime industry community in Australia. I wish it, and those involved with it, every success in the future.

Bryan Chapman

Thanks for the thanks, however, its not "our " publication. It belongs to all members and associates of the Australian Division of the RINA, Ed.

OUR PROFESSION

NAVAL ARCHITECTURE IN AUSTRALIA - A Professional Future?

Jim Black MRINA

The purpose of this article, the first of many I hope, is to stimulate discussion on the professional development of naval architects and on the stature of naval architecture within Australia. These are my own personal views expressed below and should be read as such.

First, let me introduce myself: I am a corporate member of both the Royal Institution of Naval Architects (RINA) and the Institution of Engineers Australia (IEAust) and have chartered engineer status in Australia (CPEng) and the UK (CEng). I have been practicing naval architecture in the private sector since my graduation in 1972, the last 19 years of it in Australia and am currently quality manager at Austal Ships. I am proud of our profession and of its achievements over the years in this country.

Recent years have brought about some of the most dramatic changes in the face of shipbuilding and naval architecture that this country has ever seen. We have seen the virtual demise of traditional steel commercial shipbuilding and severe cutbacks in government employed professional and technical staff and in sponsored cadetships. Meanwhile we are seeing substantial specialised naval shipbuilding programmes and the meteoric rise of the high-speed aluminium shipbuilding industry.

A high proportion of our recent graduates are now employed in the private sector, either in the new shipyards or in consultants' offices. Most are graduates with BEng, or BTech degrees and some are graduate members of RINA or IEAust. Very few, if any, are involved in formal career development programmes. Should they be? And, if so, what and how?

The main career path "milestones" with both RINA and IEAust are corporate membership and chartered engineer status, with the IEAust administering the additional step of registration on section three of the National Professional Engineers Register (NPER-3).

What does all this mean to the naval architect and his/her employer?

A university degree obtained from a recognised course indicates that the graduate naval architect has been suitably educated and is now ready to gain experience and competency in his/her chosen profession. Achieving chartered engineer status indicates that the necessary experience has been gained in a suitably wide range of competencies, that the naval architect is continuing his/her professional development and has agreed to abide by a professional code of ethics. In particular, the professional has agreed not to practice outside his/her areas of competence. In very simple terms this means that the employer or client has some guarantee of standards and the professional, as a "known quantity" should have enhanced employment prospects.

How does the graduate set about becoming a chartered engineer? And should he/she follow the RINA or IEAust path?

Both RINA and IEAust have published chartered engineer requirements and guidelines as to how to progress towards that goal. Inevitably, there are differences between the two, so which to aim for? I think the answer has to be: both. Corporate membership of RINA indicates a world wide accepted standard as a naval architect (our chosen profession) whereas corporate membership of IEAust indicates an Australia wide acceptance as a professional engineer which opens a number of useful doors in this country.

However, I consider it to be unnecessarily onerous for the graduate, while probably holding down a very challenging job, to have to follow two sets of guidelines, keep two sets of log books and maybe even work with two mentors. I would like to suggest that one set of guidelines be developed that would satisfy both Institutions and to further suggest that the most suitable body to carry out this development is the Australian Division of the RINA.

Why should we bother?

I hear many complaints, some of them genuine, about lack of competence and professionalism amongst those practicing marine design in Australia today. The most positive contribution that we can make towards improving this situation is to ensure that as many naval architects as possible reach a nationally and internationally accepted standard and then work on publicising the worth of our professionals (the recent CPA advertising being an excellent example).

Now a brief word about IEAust's NPER-3: While I am personally not yet fully convinced about taking this extra step (although I agree with its requirement for auditable continued professional development) there would seem to be one particular advantage on the near horizon a cap on professional liability. For those who are

familiar with the problems of obtaining suitable professional indemnity insurance at an affordable cost, this is a most welcome development and one to be closely watched.

I should like to explore these thoughts further with anyone who is interested, particularly the setting up of a relevant graduate career path for Australian naval architects.

I can be contacted at 116 Beatrice Street, Innaloo WA 6018, Fax: (08) 9445 1106 or Email: jdblack@ois.net.au .

AUSTRADE

- Global Marine Marketing Team

The Australian Trade Commission (Austrade) is a Federal Government agency which assists Australian companies to successfully sell their products and services overseas. With a network of 97 offices in 67 countries, they are committed to helping Australian exporters take their products and services to the world.

In recognition of the Australian Marine Industry's high export capability, Austrade has established a Global Marine Marketing Team with a network of dedicated marketing officers operating in key marine markets around the world. Headquartered in Perth this specialist unit is dedicated to assisting the Australian marine industry maximise its international business activities through project identification and investment attraction services.

Austrade's services to overseas buyers include:

- Providing details of capable Australian companies to potential buyers.
- Disseminating details of opportunities to capable Australian exporters.
- Arranging overseas buyer visit programs to Australian exporters.
- Buyer introduction to structured finance alternatives.

Austrade's services to Australian exporters include:

- Identifying and facilitating market opportunities on behalf of Australian exporters
- Identifying suitable agents and partners in export markets
- Trade display support and exhibition management services
- Market research / analysis services.

To assist Australian businesses to enter and develop overseas markets, Austrade administers the Australian Governments Export Market Development Grant (EMDG) Scheme which provides financial support especially to small and medium sized companies. Under the scheme, businesses are reimbursed for part of the export marketing costs they incur.

By providing an incentive for Australian businesses to gain experience in international markets, the EMDG Scheme promotes an export culture, encourages more businesses into export markets and results in higher export revenue. The scheme is open to all businesses which meet criteria under the EMDG Act (1974) as amended.

To qualify for a grant, the claimant must incur a minimum eligible expenditure of $30,000. First time claimants can accumulate this amount over two years. As the scheme is targeted at the small to medium exporter, claimants must have export revenue of less than $25 million. The maximum grant is $200,000. The majority of claimants that benefit from the EMDG scheme are small and medium enterprises. More than 60% of the grant claimants have turnover of less than $5 million and almost 60% of claimants have fewer than 20 employees. Around one third of claimants have fewer than six staff.

The National Export Awards are organised by Austrade to give important recognition to our exporters. Each year National Export Award winners are selected in a number of categories from the best of the winners of the State and Territory export awards.

Austrade Export hotline from anywhere in Australia on 13 2878 or
internet site http:/ www.austrade.gov.au

JUST LAUNCHED

Just launched is to be a regular column featuring Australian designed vessels. If your design has just hit the water, tell us about it. The more technical, the better.

AUSTAL SHIPS "BOOMERANG" TRIAL RESULTS

"Boomerang" heads for Poland

On 1 May 1997 "Boomerang", the 82 metre Auto Express catamaran built for the Polish Baltic Shipping Company (Polferries), departed Fremantle (Western Australia) on its 11,000 nautical mile delivery voyage to Poland. The vessel was built by Western Australian aluminium shipbuilder Austal Ships, and contracted through their marketing joint venture, Ferries Australia.

"Boomerang" will enter service in June on the 131 nautical mile route between the Polish port of Swinoujscie and Malmo, Sweden and will cut the current crossing time by almost two thirds, from nine hours to three and a half hours.

"Boomerang" will be the fourth Auto Express to enter service in Europe since April 1996, with deliveries to Denmark for DSB Rederi, Germany for TT-Line and Sweden for the SweFerry/DSO partnership, with all vessels supported by Austal's European Service Office based in Malmo, Sweden. The next two 82 metre designs will be ready for delivery in November 1997 and April 1998.

The efficient and practical garage design of the Auto Express makes for easy vehicle access and orderly traffic flow. In "Boomerang's" case, vehicle access is via stern ramp with drive-around provision forward. With eight main deck and six mezzanine deck lanes, "Boomerang" can carry 175 cars or an alternate load of up to ten buses and 70 cars. The two centre lanes have a 4.4m clear height and 12 tonne maximum axle load.

The quality of workmanship and attention to detail, combined with a comfortable and functional interior design has become the signature of the Auto Express ships. "Boomerang's" interior fitout again satisfies the need for passenger comfort and commercial revenue generating possibilities for the operator.

While the passenger spaces provide the perceptible comforts, the Ocean Leveller ride control system and the semi-swath hull shape of the catamaran provide excellent seakeeping qualities for optimal passenger comfort in the typical 2 metre significant wave heights of the Baltic crossing.

The interior features colourful chair fabrics, use of uplights and patterned and woodgrain Amtico floor covering defined with carpeted zones, to create an almost art deco feel. A large central atrium and skylight enhances the spaciousness of both passenger decks, which devote a total of 1700 square metres to the vessel's passengers.

Main deck facilities include seating for 600, an expansive duty free shop, forward restaurant, aft lounge bar and buffet, mother's room and children's play area. The bridge deck has 100 seats dedicated for business class travellers arranged in grouped table settings. Seating extends around the outer surrounds of the atrium balustrade and a large curved lounge faces aft to provide panoramic views. A bar is located immediately behind the wheelhouse.

A new feature seen in "Boomerang's" wheelhouse is the forward raked windows at the central command station, with the slight 15 degree forward angle providing improved visibility. The windows on the lower level of the split level wheelhouse remain aft raked. Kamewa waterjet controls are mounted on the captain and first officer's chairs and can be controlled centrally or from the enclosed wing stations, which provide excellent visibility along the entire length of the vessel for docking or tight manoeuvring.

Some of "Boomerang's" electronic equipment includes fully integrated Kelvin Hughes navigational equipment, twin ARPA radars and Multi Feature Display (MFD) electronic chart navigation. Once again, like the previous deliveries of "Delpin" and "Felix", the MTU MCS-5 monitoring and control system and CCTV allow extensive monitoring of all machinery spaces and systems throughout the ship from the engineer's console, which is positioned immediately aft of the command position. The communication station is positioned behind the engineer's console on the aft bulkhead.

Four Marine Evacuation Systems (MES) stations each with integral 100 man liferafts and 17 metre escape slides, were again supplied by Liferaft Systems Australia and are located amidships and aft to port and starboard. Additional 4 x 100 man liferafts, one for each MES, are located above each station.

Principal Dimensions

Length overall	82.3 metres
Length (waterline)	70.7 metres
Beam (moulded)	23.0 metres
Depth (moulded)	6.7 metres
Hull draft (approx.)	2.5 metres

Payload and Capacities

Passengers:	- 700
Vehicles:	- 175 cars or 70 cars & 10 coaches
Maximum deadweight:	348 tonnes
Maximum axle loads:	
- centre lanes	- (dual wheels) 12.0 tonnes
	- (single wheels) 9.0 tonnes
	- side lane 1.0 tonnes
	- mezzanine lanes 0.8 tonnes
Crew:	- 24
Fuel:	- 80,000 litres

Propulsion

Main engines :	- 4 x MTU 20V 1163 TB73
	- 6000 kW @ 1250 rpm
Gearboxes:	- 4 x Reintjes VLJ 4431
Waterjet:	- 4 x KaMeWa 112 SII

Performance

Service Speed

340 t DWT, 100% MCR	- 40 knots
340 t DWT, 90% MCR	- 38 knots
Fuel consumption	
(approx.) at 90% MCR	- 4.55 tonnes/hr

Survey

Det Norske Veritas +1A1 HSLC Passenger Car Ferry A R1 EO.

THE AUSTRALIAN DIVISION OF RINA

THE WALTER ATKINSON AWARD

History

Walter Atkinson was a foundation member of the Australian Division of the Royal Institution of Naval Architects and a Council Member of long standing. He was Senior Naval Architect at Garden Island Dockyard when he died in the early seventies.

To perpetuate his memory, the Division Council resolved in 1971 to present an annual "Walter Atkinson Award", at the Council's discretion, to the author of what they consider to be the best selected paper or meeting of the Institution in Australia that year. The award was originally to be valued at approximately $25.00 and to be presented at the AGM the following year.

The inaugural presentation was made at the 1972 AGM by Walter Atkinson's son Philip to Mr Guy Griffiths, Assistant General Manager of the Australian National Line, for his paper "Sea Transport in the Seventies". His prize was an impressive painting of the clipper ships "Ariel" and "Taeping" racing under full sail.

At the time it was stated that "The object of the award is to stimulate increased interest in the preparation and to increase the standard of technical papers for presentation in the Institution." This object still stands good today.

Today

The Walter Atkinson Award has been awarded in most years to date. The Award is currently assessed, on behalf of the Division Council by a sub-committee consisting of Bryan Chapman (Victoria.), Prabhat Pal (New South Wales) and Jim Black (Western Australia) and is now usually valued at around $250.00.

The current guidelines are:

1. All members of the RINA Australian Division are eligible, with the exception of members of the Division Council.

2. The paper must be presented at a RINA meeting or maritime conference within Australia during the current year.

3. The paper must be a technical paper, not simply a lecture and it must be more than just a promotional presentation.

4. The sub-committee will consider such selection criteria as:

- Is there a stated or implied purpose?
- How important is that purpose in the context of the Australian industry?
- Does the paper have any new ideas to impart?
- How easy is the paper to understand?
- How "rigorous" is the paper?

I hope that the above summary has stimulated your interest and I look forward to receiving a flood of top class papers this year. My thanks to Alan Mitchell and Bryan Chapman for providing the information contained here.

Jim Black

AUSTRALIAN MARITIME COLLEGE

WANT TO DESIGN THE SHIP OF THE FUTURE?

APPLY NOW FOR THE UNDERGRADUATE RESEARCH PROJECT

(NAVAL ARCHITECTURE)

The Australian Maritime College (AMC) is Australia's National Centre for Maritime Education, Training and Research. It runs Australia's largest undergraduate course in Naval Architecture and hosts the headquarters of the Australian Maritime Engineering CRC Ltd. AMC has access to $100 million worth of unique maritime-related infrastructure, including a Ship Hydrodynamics Centre, Cavitation Tunnel and Planar Motion Mechanism.

Situated in Northern Tasmania, at Launceston, the campus overlooks the Tamar river, Launceston, the main centre in the north of the state, is a city with a population of about 80,000 (Tasmania's unique geography offers world class recreational opportunities.)

Applications are now invited for the AMC Council Tom Fink Scholarship. This is awarded annually to allow an outstanding undergraduate to conduct his/her research project in Australia at the Australian Maritime College.
The scholarship will include;

(i) return economy airfare from the institution where the student is enrolled to Launceston;
(ii) accommodation at the residences on AMC's campus;
(iii) office space, library access and use of experimental facilities where appropriate;
(iv) supervision from an AMC academic staff member;
(v) a book allowance of $500; and
(vi) a stipend of $3,000.

The scholarship holder will spend 12 months in Australia, at least 11 of which will be on AMC's campus. The student will be expected to complete a final research project under joint supervision from an academic at the home institution, and an academic at AMC.

The scholarship is open to any student who will have completed his/her penultimate year in naval architecture or related discipline. It is for a period of 12 months, commencing at any time during the 12 month period from the end of September 1997. The intended starting date must be nominated in the application.

Applications must be received by 28 July 1997 and should be addressed to:
The Secretary,
AMC Council Tom Fink Scholarship Selection Committee,
Australian Maritime College,
PO Box 986,
Launceston, Tasmania, Australia 7250
Fax: +61-3-63266493

Applicants are encouraged to obtain further information, including selection criteria, from the Secretary, AMC Council Tom Fink Scholarship Committee, at the above address.

TECHNICAL PAPER

SMALL, LOW DRAG, SOLAR-POWERED MONOHULLS AND MULTIHULLS

L. Lazauskas and E. O. Tuck
Department of Applied Mathematics
The University of Adelaide, South Australia 5005
email: llazausk@maths.adelaide.edu.au
WWW: http://www.maths.adelaide.edu.au/Applied/llazausk/leo.htm

Introduction

The second Advanced Technology Boat Race was held on Canberra's Lake Burley Griffin in April 1997. The aim of the Australian Science Festival, organisers of the event, is to encourage the development of innovative non-polluting technologies in a way that incorporates the fun, excitement and frustrations of scientific development. There are a number of categories, each with a set of technical rules and limitations. In this short note, we restrict our attention to monohull and multihull designs for the Competition Class, where vessels are limited to an overall length of 6m and an overall width of 2.5m.

The inaugural race was won by a catamaran design, Incat Australia 039, which covered 66 km in the five hours allowed for the race, reaching speeds of up to 11.5 knots. The winner of this year's race was a trimaran design entered by a team from the Australian Maritime Safety Authority. Their entry completed 49.2 km at an average speed of about 5.4 knots. In the present study, genetic algorithm techniques are used to find dimensions for small (300 kg displacement) monohulls, catamarans and trimarans which minimise the total (wave + viscous) resistance at design speeds of 7.5 knots, 10 knots, 12.5 knots and 15 knots.

Geometry

The trimarans of interest here consist of a main hull together with two side hulls placed parallel to each other, with their centres at a distance W aft of the centre of the main hull and at distances LBC abeam of it. The side hulls can have different displacements, lengths, drafts and shapes from the main hull but are identical to each other.

All hullforms in this study come from the same three-parameter mathematical family. One parameter controls the waterline shape, another parameter controls cross-section shape, the third parameter determines the keel-line. These shapes include as special cases rectangular, elliptical and parabolic curves, and provide a smooth interpolation between these cases.

Estimation of Resistance

We use Michell's integral (Michell 1898; see also Tuck 1987) to estimate the wave resistance, Rw, of the vessels. The numerical method used is described fully in Tuck (1987). Although there is no actual Michell integral for multihulls, we assume that each separate hull can be represented by the same singularity distribution (namely sources distributed over its own centreplane) as if that hull were alone. This neglects one type of interaction between the hulls, namely the influence of one hull on another in creating a cross-flow which modifies this singularity distribution, in particular inducing vortices as well as sources. On the other hand, it does not prevent interference between the wave systems generated by the centreplane sources. Little is known of the relative importance of these two types of interactions, but the present assumption seems to yield quite good results for the wave resistance (Tuck 1987).

The viscous resistance Rv can be written as $Rv=\frac{1}{2}\rho U^2 S C_v$ where ρ is the water density and S the wetted surface area of the hull. When skin friction dominates, the drag coefficient C_v approximately equals C_f, where C_f is a skin friction coefficient which can be estimated using the ITTC 1957 ship correlation line.

Including a form factor specific to the hullform under consideration can often give better estimates of the viscous drag. In their examination of eight-oared rowing shells, Scragg and Nelson (1993) found a simple empirical formula for the form factor of these small fine hulls. The viscous resistance coefficient is written as $C_v = (1+k)\,C_f$, where $k = 0.0097(q_{entry} + q_{exit})$. Here, q_{entry} and q_{exit} are the half-angles (in degrees) of the bow and stem, respectively, at the waterplane.

Method

The computer program GODZILLA (Lazauskas 1997) was used to find the optimum dimensions of the vessels. The program contains a variety of hill-climbing routines to assist in the search process, however for the highly multimodal objective function we are considering in the present study, the program's nonlinear components are essential. These include genetic algorithm techniques based on Eshelman's (1991) CHC algorithm, and a number of other heuristics that can broadly be described as Artificial Life methods.

At each design speed we searched for the optimum monohull, for the optimum symmetric catamaran, and for two optimum symmetric trimarans, one where the central hull weighs 270 kgs and the outriggers each weigh 15 kgs (s=0.1 in our notation), and another trimaran where the central hull weighs 120 kgs, and the outriggers each weigh 90 kgs (s=0.6). Here s is the proportion of total displacement that is attributable to the sum of both outriggers.

For monohulls we have a five parameter optimisation problem, one length, one draft and three shape parameters. For catamarans, the problem has six parameters, the same five as for monohulls, plus the lateral separation distance, W, between the centreplanes of the demihulls. For each trimaran, s=0.1 and s=0.6, we have a twelve parameter problem; two lengths, two drafts, three shape factors for the central hull, three shape factors for the outriggers, one lateral hull separation distance, and one longitudinal hull separation distance. Each of these four candidate vessels, monohull, catamaran, s=0.1 trimaran, and s=0.6 trimaran, were optimised at the four design speeds, making 16 design problems in all.

Results

The length of the optimum monohulls at all design speeds is 6m. In our examination of low drag rowing shells, Tuck and Lazauskas [1996], we also looked at monohulls of 300 kg displacement over a range of design speeds similar to the present study. We used "PEP" hulls (Parabolic waterlines, Elliptical cross-sections and Parabolic keel-line), and found that the optimum boat at a design speed of 10 knots had a length of approximately 12m. Thus, under the rules of the present boat race, we are restricted to about half the optimum unconstrained length.

We have also examined 150 kg monohulls equivalent to the present catamaran demihulls. The optimum length for the PEP hull at a design speed of 10 knots is approximately 9.8m. Thus, although the catamaran demihulls will be shorter than the optimum unconstrained length, the constraint is not as severe as for the monohull.

At a design speed of 7.5 knots the optimum demihull spacing is such that the overall width of the catamaran is the maximum allowable by the rules. At 12.5 knots and 15 knots the optimum separation distances are small; the demihulls are almost touching. However at a design speed of 10 knots, there is a genuine optimum demihull separation distance, W=1.69m, such that the overall width of the catamaran is 2m, less than the maximum allowable by the rules.

The optimum s=0.1 trimaran has outriggers which are 2.44m long and the lateral spacing of the outriggers is 0.64m. Since the outriggers are quite small, they are not affected by the 6m length constraint. At the

two highest design speeds (12.5 knots and 15 knots), the optimum s=0.1 trimaran has short outriggers, (Lw=1.1m), and they are tucked in close together near the rear of the central hull. In effect, this trimaran reduces its total resistance by trying to behave like a monohull!

The optimal s=0.6 trimaran for a design speed of 10 knots (and also 12.5 knots) has three hulls which are almost identical to each other in a parallel formation with no longitudinal spacing. The length of all three hulls is the maximum 6m. On the other hand, at the lowest and highest design speeds, 7.5 knots and 15 knots, the optimum s=0.6 trimarans have hulls which are equal in length but much shorter than the limit of 6m, with a longitudinal spacing such that the overall length of the trimaran is 6m.

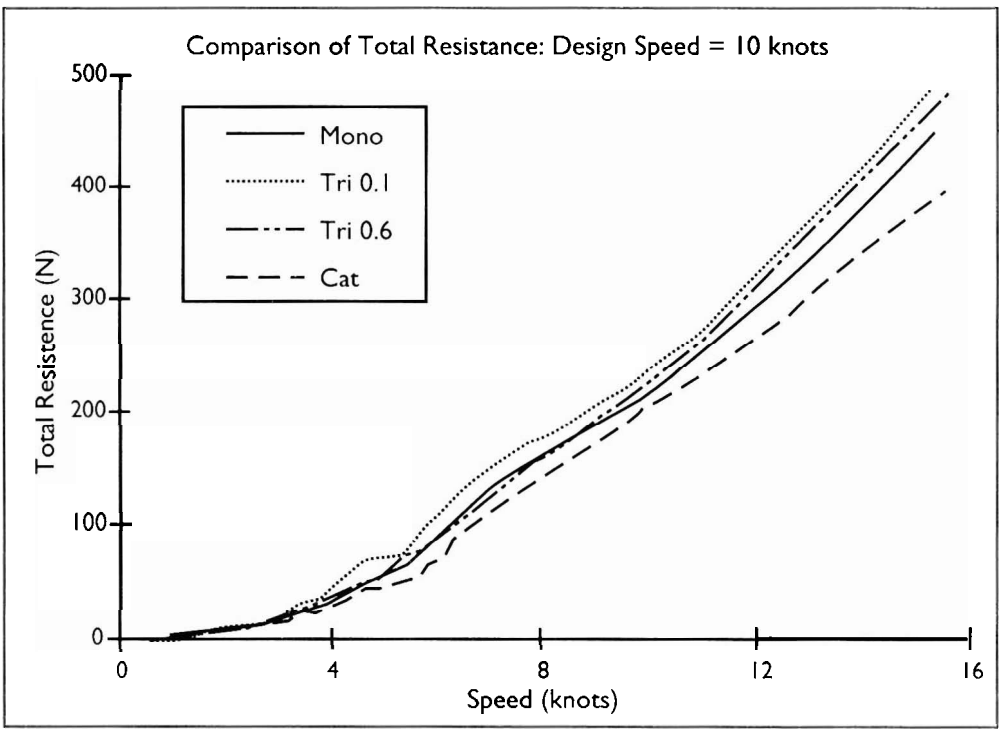


Figure 1: Total resistance of 10-knot designs at off-design speeds.

Figure 1 shows the total resistance as a function of boatspeed of these four candidate designs, optimised for minimum total resistance at a design speed of 10 knots. The monohull is clearly best, next best is the catamaran; the two trimarans are not competitive.

A Variable Width Catamaran

Although catamarans are marginally inferior to monohulls at fixed speeds, there is a possibility that they can be superior over a range of speeds, providing the optimum configuration can be maintained as the speed is varied. One way to do that would be to vary the lateral spacing during the race.

For this purpose, we will use the catamaran optimised at a design speed of 10 knots as a baseline. This

vessel has a lateral spacing of 1.69m, the demihull beams are each 0.31m, giving an overall width of 2m in its optimal form for operation at design speed. However, other lateral spacings may be better at off-design speeds or if greater static stability is required.

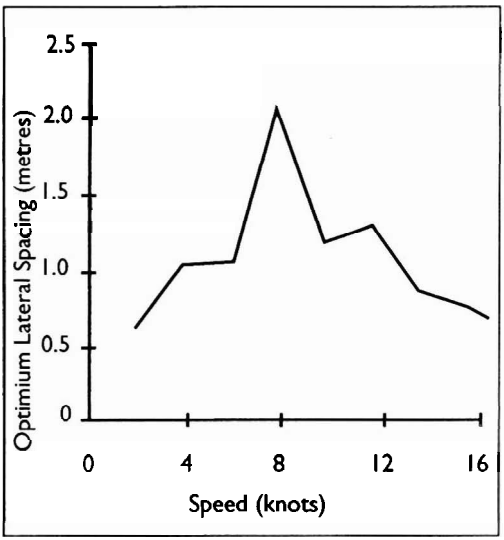


Figure 2: Total resistance of 10-knot designs at off-design speeds.

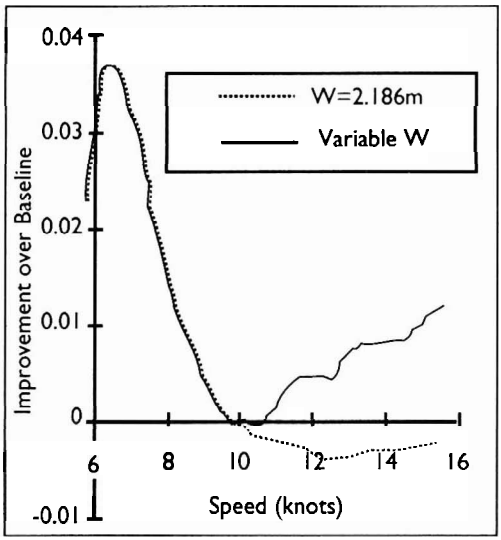


Figure 3: Relative improvement in total resistence.

Figure 2 shows the optimum demihull spacing found by our program for the baseline catamaran over a range of speeds. (At each speed we have a one parameter problem, since all parameters except W are fixed). The optimum spacing increases from small values at low speeds to a maximum at about 8 knots then decreases again as the speed increases further.

Figure 3 shows the expected relative improvement (i.e. reduction in drag) in employing a catamaran whose demihulls are spaced according to the optimum values shown in Figure 2. Also shown is the expected relative improvement achieved by using a catamaran with W fixed at 2.2m, which gives the maximum allowable overall width of 2.5m. The improvements shown are relative to the total resistance of the catamaran with W fixed at the optimum of 1.69m. Thus our baseline catamaran is the positive x-axis in this plot.

Using maximally spaced catamaran demihulls at speeds below 9.5 knots will lead to an improvement over the baseline catamaran. However, at speeds above 9.5 knots, performance will be worse than the baseline catamaran, but only by about one third of one percent. On the other hand, using the optimal lateral hull spacing regime, which involves reducing the spacing below the baseline value of 1.69m, can improve performance for speeds greater than 10 knots. Of course, when the demihulls are close together they will interfere with each other to a greater degree. We could end up doing worse this way than by using fixed widely-spaced hulls.

A "swing-wing" trimaran which can take advantage of both lateral and longitudinal spacing is currently being investigated by the authors.

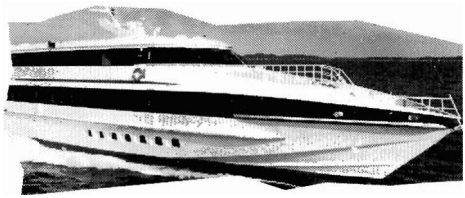
References
Australian Science Festival, 1997, Advanced Technology Boat Race, Rules and Regulations.
Eshelman, Larry J., "The CHC Adaptive Search Algorithm", Foundations of Genetic Algorithms, Rawlins, G. J. E. (ed), Morgan Kaufmann, pp 265-283, (1991).
Lazauskas L. "User's Guide for GODZILLA", The University of Adelaide, Applied Mathematics Report L9701, 1997, in preparation.
Michell, J. H., The Wave Resistance of a Ship", Phil. Mag. (5), Vol. 45, pp. 106-123, 1898.
Scragg, Carl A. and Nelson, Bruce D. "The Design of an Eight-Oared Rowing Shell", Marine Technology, Vol. 30, No. 2, April 1993, pp. 84-99.
Tuck, E. O. and Lazauskas, L. "Low Drag Rowing Shells", Proc. 3rd Conf. on Mathematics and Computers in Sport, Bond Uni., Queensland, Australia, 30 Sept. - 2nd Oct. 1996, pp. 17-34.
Tuck, E. O. "Wave Resistance of Thin Ships and Catamarans", The University of Adelaide, Applied Mathematics Report T8701, (Jan. 1987).

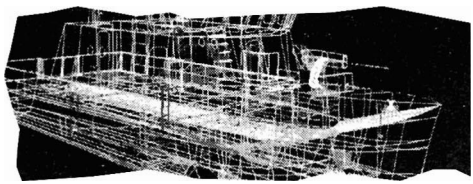
POSITIONS WANTED

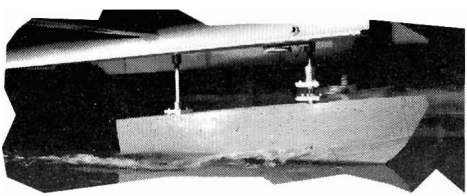
Warwick Benn, B.E. (Nav. Arch.) Australian Maritime College 1996 Ph: 03 9735 1280 Fax 03 9735 0420
Dion Alston, B.E. (Nav. Arch.) Australian Maritime College 1996 Ph: 071 224 597

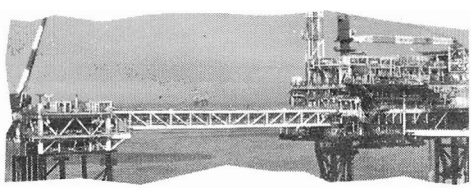
Australian Maritime Engineering

Our outstanding engineering capabilities, world class facilities and links to the international research communitv make AME your premier R&D partner.









AUSTRALIA WIDE – WORLD CLASS

- Marine hydrodynamics
- Maritime structures
- Pipelines and subsea systems
- Systems and operation
- Innovative materials
- Full-scale trials
- Model development and testing
- Consultancy services
- Education and training

AUSTRALIAN MARITIME ENGINEERING

Australian Maritime Engineering CRC Ltd
Head Office
PO Box 2147 Launceston Tasmania 7250
Tel: (03) 6335 4875 Fax: (03) 6326 6261

Established and supported under the Australian Government's Cooperative Research Centres Program.

CRC

Research cores located at Launceston, Melbourne, Perth and Sydney for all of your research and consultancy needs.

BUILDING PARTNERSHIPS WITH AUSTRALIA'S MARITIME INDUSTRY