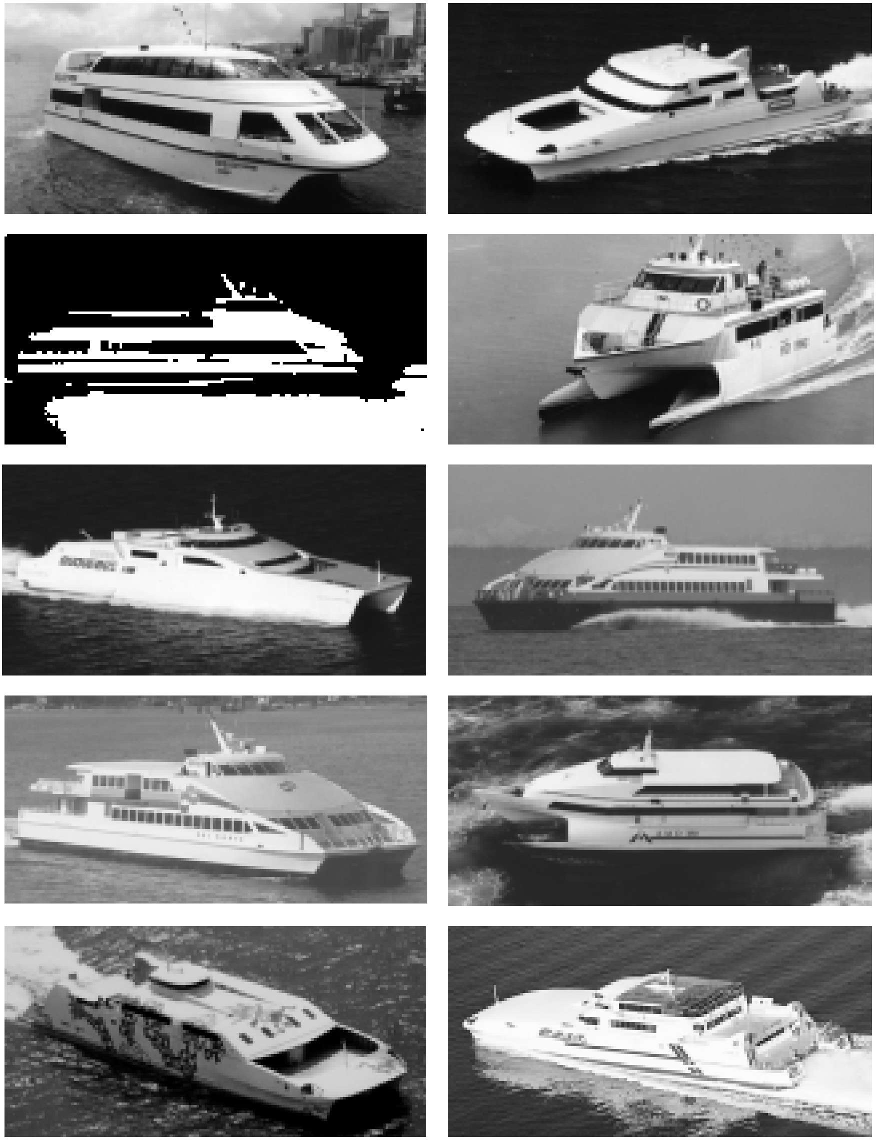
THE AUSTRALIAN NAVAL ARCHITECT

Volume 3 Number 2
May 1999



THE AUSTRALIAN NAVAL ARCHITECT

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Cover Photo:
The new patrol boat *Roebuck Bay* built by Austal Ships for the Australian Customs Service (photo courtesy Austal Ships).

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at
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A NOTE FROM THE DIVISION PRESIDENT

In the last issue of this journal I mentioned the Agreement between RINA and IEAust on mutual recognition, dual membership and closer cooperation. The full text of the Agreement is available at the RINA web-site and arrangements for members without Internet access are advised elsewhere in this issue.

The benefits which you, as a RINA member, will obtain from this Agreement will depend to a significant extent on what you want from it. As a personal view I see at least the following:

- It recognizes RINA, at least in the eyes of IEAust, as the paramount international learned society in the field of naval architecture. This enhances the status of RINA in Australia, and therefore its ability to represent its members to Government, industry and the community.
- It paves the way for the establishment of specific categories within the National Professional Engineers Register to enable registration of naval architects as a specific group. This in turn will enable registered naval architects to demonstrate readily their qualifications, competence and commitment to continuing professional development. These are issues of considerable importance in today's world.
- It provides opportunities for RINA to improve its services to its members in Australia, either through the provision of access to IEAust services and facilities, or by implementing new services and activities modeled on services already provided by IEAust.
- It provides an avenue for RINA to make its voice heard more clearly in Government, professional and community circles. In particular it provides us with an opportunity to raise the profile of naval architecture generally in Australia.

The agreement includes provision for a Joint Board of Naval Architecture to oversee its implementation, and this board's first meeting is expected early in June. A sub-committee of the Division Council has been established to consider RINA's approach to the various issues to be considered, and to ensure that RINA's representatives on the Joint Board are appropriately prepared. The sub-committee's considerations will include comments arising from a recent meeting of IEAust and RINA members in Canberra, and any comments which are provided to it by Division members generally.

I look forward to the full implementation of this Agreement between RINA and IEAust, and intend to do all that I can to implement it as quickly as possible. Certainly its implementation is in line with the long-term ideals I set out in the October 1998 issue of this journal, and I believe the Agreement has great potential for the profession and for RINA members in Australia.

Bryan Chapman

FROM THE CHIEF EXECUTIVE

Elsewhere in this issue of the ANA is reported the award of the Institution's 45 Years Service Certificate and message of congratulations from the Council. I am not aware of any published account of the Division's activities over the past 45 years, and so I looked through the Transactions to see what I could find. The following is an extract from the 1954 Annual Report of the Council:

"In 1954, the Council welcomed the proposal received from certain members of the Institution of NavalArchitects resident in Australia that it would be advantageous to have an officially constituted branch of the parent Institution in that country. Rules for the conduct of this branch which is open to all members of the parent Institution resident in Australia, have accordingly been drawn up and the Institution of Naval Architects (Australian Branch) is now formally established. The Council takes this opportunity of wishing the Australian Branch - the first branch of the parent Institution to be formed - every success in its activities."

The first President of the Australian Branch was Mr C E Boden, BSc and the first Hon. Secretary was Mr F G W Westhorp. The affairs of the Branch were managed by the Branch Council which consisted of the President, three Vice-Presidents and nine Members, plus the Hon. Secretary and Hon.Treasurer. The first Section to be formed was the Canberra Section, in 1972. The Annual Report of 1975 also records the formation of the Whyalla Section, which unfortunately did not survive the closure of the Whyalla Shipbuilding and Engineering Works later that decade.

In recognition of the achievements of the Australian Branch and as an expression of confidence in its future, in 1979, the year of its Silver Jubilee, the status of the Branch was raised to that of Division. The first President of the Australian Division was Mr J C Jeremy, BE.

Please add my congratulations to those of the Council.

Trevor Blakeley

EDITORIAL

For the Royal Australian Navy, 1999 looks like being a very busy year. The Australian Naval Architect frequently includes news of the launching or completion of a new ship for the navy. This year, notable milestones for the RAN include the commissioning of the submarine *Waller*, the hydrographic ships *Leeuwin* and *Melville*, and the minehunter *Huon*; the launching of the submarine *Sheean*, the frigate *Stuart* and the minehunter *Norman*; the laying down of the frigate *Parramatta* and the rededication of HMAS *Manoora*.

All the new ships are Australian built, but they are based on overseas designs, albeit with considerable Australian modification and development. It is unfortunately rare that we see the RAN acquiring a wholly Australian-designed ship. Perhaps the need was prompted by delays with the conversion of the LPA's *Manoora* and *Kanimbla*, but the recent decision to charter *Incat 045* from Incat Tasmania provides the RAN with a valuable opportunity to assess the capability of these unique wave-piercing catamarans.

It is easy for proponents of new designs and technologies to promote them as a solution to defence needs, but nothing beats trying the product in operation and the lease should not only be useful for the RAN but helpful to Incat in its marketing efforts to the military overseas.

John Jeremy

LETTERS TO THE EDITOR

Dear Sir,

The photo of a riveted stern unit being erected on the slipway (From the Archives, ANA February 1999) is that of the *Cape York* at Cockatoo Dockyard in 1925, as described in John Jeremy's excellent publication 'Cockatoo Island: Sydney's Historic Dockyard'.

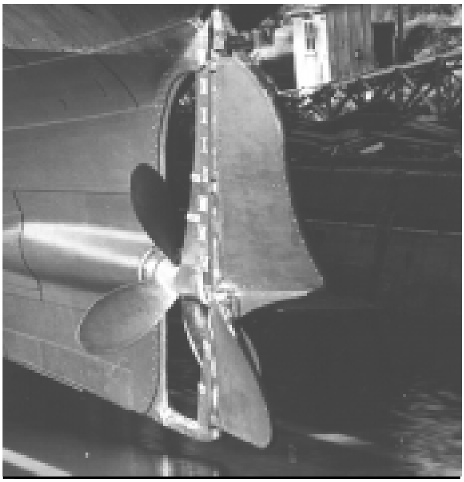
In 1931 there was a third lighthouse vessel built at Cockatoo - slightly smaller than the other two - named *Cape Otway*. During construction, the builders were concerned that the designed SHP would not be sufficient for her to reach the contract-specified maximum speed. As an experiment, my father David Mitchell, who was employed at the dockyard, fitted a reaction rudder to his 26'-0" launch, which resulted in an increased speed from 5.5 knots to 6 knots. As an 8 year old, I well remember the 'before-and-after' fitting, the new rudder, numerous runs on the Iron Cove Bridge – Rodd Island half-mile and learning the meaning of the term 'mean of means'.

These trials convinced the builders to fit a reaction rudder to *Cape Otway*. The ship achieved the specified maximum speed requirements, although I did find out that in a moderate-to-rough sea this type of rudder was very noisy and was not popular in the after crew's sleeping quarters. The rudder was changed to a conventional one in later years as a result. The enclosed photo was taken some years after the initial fitting of the reaction rudder to the launch. It was most successful for the rest of the vessel's life.

Alan Mitchell

David Mitchell with the prototype rudder.

The rudder as fitted to *Cape Otway*.



NEWS FROM THE SECTIONS

Canberra

The first technical meeting of the Canberra Section for the year was held on 31 March at which Dr Martin Renilson gave a presentation on *Wave wake: a Rational Method for Assessment* from ships as had been presented in Sydney several days previously by co-author Gregor Macfarlane. The meeting was arranged at relatively short notice to take advantage of a visit by Martin Renilson to Canberra for other discussions. Although attendance may have suffered as a result, those who were present appreciated Martin taking the time to give this topical and practically-oriented presentation.

Several other technical meetings are in the pipeline and it is intended that a schedule of meetings will be circulated to local members in coming weeks.

Following the finalisation of the IEAust / RINA joint agreement in recent months, a meeting between members of both RINA and IEAust, including MARENSA members, is planned for Thursday 29 April at IEAust headquarters. The subject of the discussion is *Working Together - Maximising Benefits from the RINA/ IEAust Agreement*.

It is intended that this forum will allow discussions on enhancing cooperation between the organisations, professional development activities, developing technical policies and standards, etc. It is proposed also to discuss approaches that might be taken to promote dual membership, and to expand the range of professional development and support services available to members.

All members of RINA, IEAust/MARENSA and IMarE and others who are interested in maritime engineering matters are invited to attend. The purpose of the meetings is to exchange views and pass suggestions to the RINA Australian Division and to IEAust. The discussions resulting from this meeting will be summarised in a forthcoming issue of ANA.

The Annual General Meeting of the Canberra Section is scheduled for late May. This meeting is a good opportunity for local members to provide feedback on what sort of activities should be organised by the section. If you are an enthusiastic Canberra Section member and would like to see more local section activities planned, why not consider nominating for a position on our local committee prior to the AGM?

Martin Grimm

Victoria

On 16 February 1999, at a joint meeting with the Institute of Marine Engineers, Mr Mahamedi Jadliwala presented an illustrated paper titled *Development of a new anti-fouling paint based on a novel zinc acrylate copolymer*. Anti-fouling paints based on tributyl tin, while having excellent technical performance when applied to ocean-going-vessels have caused significant pollution of the marine environment. The likelihood is that they will be totally phased out by 2006. Kansai paint have been developing a zinc acrylate copolymer for use in anti-fouling as the most suitable replacement for tributyl tin copolymer. Mr Jadliwala reported on the tests carried out and the successful performance so demonstrated.

On March 16 1999 Dr Rohan Smith, Business Development Manager for the Australian Maritime Engineering CRC, presented a paper on *The Prediction of Motion Sickness on Marine Vessels*. Motion sickness or kinetosis can occur in a wide range of environments, but Dr Smith's presentation was concerned mainly with marine operations. Individual susceptibility is quite varied and is believed to be subject to sensory conflict between motion and orientation senses. Various predictive methods were reviewed while the influences of kinetosis acceleration were explored. Some field studies were reviewed and a prototype Passenger Comfort Meter was outlined.

On April 20, 1999 Dr Stewart Cannon who is primarily responsible for the ship structures integrity task at DSTO, discussed some loss scenarios proposed for the loss of MV *Derbyshire*, the largest British ship to be lost at sea. Before the wreck was located in the north Pacific, some thirteen loss scenarios were proposed and investigated. Dr Cannon reviewed the history of MV *Derbyshire* and her sister ships, outlined the thirteen loss scenarios and discussed two of these scenarios, the investigation of which he was associated with at Brunel University, London. These two scenarios were brittle fracture at frame 65, or torsional weakness of the main hull girder. After an extensive survey of the wreck and intense investigation, these two scenarios were rejected as the principal cause of the sinking. Dr Cannon concluded by discussing briefly the general inference from the damage survey that the loss of the vessel was initiated by flooding forward with consequent loss of freeboard at the fore end of the vessel.

Bob Herd

New South Wales

Meetings

Warwick Malinowski gave a presentation on *Aluminium Construction: Dos and Don'ts* to a joint meeting with the IMarE on 24 February at the Portside Centre. Warwick recounted some of his experiences over many years of aluminium construction, concentrating on the commonly-used methods of arc welding in the shipbuilding industry: tungsten inert gas and metal inert gas (including its offsprings, notably pulsed arc). He illustrated his talk with many slides and overheads to illustrate the technical details of what to do and, more importantly, what *not* to do. His photographs of problem areas were gathered from shipyards in Australia, Europe, South-east Asia and the USA, and included examples of good and bad practices and details of problem connections. The author was at pains to point out that all defects shown were subsequently repaired to the required standard.

Gregor Macfarlane of the Australian Maritime College presented *Wave Wake: a Rational Method for Assessment* (which he co-authored with Martin Renilson) to a joint meeting with the IMarE on 24 March at the Portside Centre. Gregor gave an account of the interest being shown in the generation of waves due to the increasing use of high-speed vessels on sheltered and narrow waterways. Methods of obtaining and reporting wave heights vary, and this is complicated by the variation of wave height with distance from the sailing line due to the interaction between the divergent and transverse systems. This makes it essential to develop a method by which the major wave characteristics can be measured and compared for different craft. This they have done, and can now predict wave heights from measurements made at a distance from the sailing line.

Craig Boulton and Ian Sargeant of Advanced Multihull Designs gave a presentation on *Designing B-60: a 60-knot Gas Turbine Catamaran Ferry* on 14 April at the Lane Cove Club. Their 77-metre catamaran design, *Luciano Frederico L,* was built by Spanish shipbuilder Bazan and delivered to the owners, Buquebus, in October 1977. The ferry effectively competes with air travel on the 110 nautical mile route across the Rio de la Plata from downtown Buenos Aires in Brazil to downtown Montevideo in Uruguay. She carries 446 passengers and 52 cars, and is powered by two ABB GT35 gas turbines, together developing a shaft power of 31 600 kW. The turbines are able to operate on IF30 intermediate-type fuel oil to achieve low operating costs. Each gas turbine is coupled to a KaMeWa 112SII waterjet through a Renk AUS135 gearbox. The vessel is fitted with an active trim tab designed by Maritime Dynamics. The authors gave many insights into the design of this, the world's fastest ferry at a full load speed of 57 knots, and into the problems which an innovative design of this type provides and how they were solved.

Attendances

The inaugural NSW Committee, in considering meeting attendances for the past year, has come up with some interesting figures. Attendance from July to September 1998 (3 meetings) averaged 39 per meeting. Attendance from October 1998 to April 1999 (5 meetings since the NSW Section started) averaged 56 with a noticeable increase in youth and no discernible decrease in seniority. The record attendance for some years has been for Rob Tulk's paper *The BC Ferries Catamarans* in October 1998 which attracted 67. One of the all-time best attendances must be the 100 or more who packed the Portside Centre to standing-room-only for Ken Ross and Trevor Cosh's paper *The Kirki Salvage* in 1992.

Phil Helmore

Queensland

Flood Tide! On Tuesday evening 16 March twenty members, representative of long-timers, the bright breezy under 30's, and all activities of the Institution in the Sunshine State met and voted to establish the Queensland Section. The enthusiastic meeting received messages of support from a number of sources including the President, Bryan Chapman, and Keith Adams, Secretary of the Australian Division, and from Cairns member Don Fry.

The members from the Gold Coast, Brisbane, and the Sunshine Coast who met at the Yeronga Institute of TAFE were joined by two members from Cairns who participated by teleconference. Members agreed that the new Section was long overdue from a strategic perspective as it would facilitate formal representation into policy formulation. As well the bringing together of members will increase their opportunity for professional, educational, and social activities.

Members elected a Section Committee that was as inclusive as possible of the broad range of interests of members in the State. Those elected were:

Chair: Brian Robson (Noosa)
Deputy Chair: Geoff Glanville (Cairns)
Hon. Secretary/Treasurer (and member of the Council of Aust. Div.): BrianHutchison (Shorncliffe)
C'ttee Members: Chris Ramsay (Redcliffe)
Jacqui Rovere (Cairns)
StephenPlummer (Cashmere)

At the inaugural meeting of the Queensland Section Werner Bundshuh presented his paper *USL Code Review* which held the interests of members who asked many questions and sought input into the process and information on when the review would be implemented. Werner, who is working on the national review and would be pleased to receive suggestions and provide information, may be contacted on telephone (07) 3224 8715 or fax 3224 8718.

The process leading to the formation of the Queensland Section has generated a lot of interest and it has been necessary to ask Keith Adams for membership application forms for three new prospective members.

The Queensland Section will hold its next meeting on 8 June; in the meantime its Committee will be assembling its machinery of operation. The Queensland Section contact details are:

Post: PO Box 86,
Sandgate QLD 4017
Telephone/Fax: (07) 3269 4913

Brian Hutchison

The Queensland Section Chairman

Many members of the southern states have already had some form of association with Brian Robson, the newly elected chairman of the Queensland Section, through his various positions with the Department of Defence in Canberra or when he was the RINA Division President. However there may be Queensland members who are not so familiar with Brian's background and professional achievements.

Brian started life as an apprentice Boatbuilder and Shipwright in 1953 in Sydney. After completion of his apprenticeship he was appointed to a position of assistant draughtsman at Garden Island Naval Dockyard. In 1959 he received a navy Traineeship that allowed him to study naval architecture full time at the University of New South Wales. He was the University's first naval architecture graduate, graduating with a BE (NA) Hons in 1963.

Soon after graduation Brian served on the overseeing staff at Cockatoo Dockyard when the navy destroyer escort *Stuart* was under construction and Cockatoo was refitting the first of the British T Class Submarines. After a short term at Cockatoo Brian moved onto Navy Office in Canberra as a naval architect and was associated with the design of he navy support ship *Stalwart* and many of navy's new fleet of small craft.

Brian then moved on to the UK for three years where he was the Australian naval architect liaison officer with the British Ministry of Defence (Navy) and also served a short term at what was then called the Admiralty Experiment Works playing around with ship and propeller models.

Brian returned to Navy Office Canberra in 1971 and served there for three years where he became the first secretary of the newly-formed Canberra Section of RINA. Still not settled, Brian went overseas again for three years, this time to the USA as the RAN technical director of the RAN new frigate (FFG) project with the US Naval Sea Systems Command in Virginia.

Returning to Australia once more in 1974, Brian joined the Forward Design (Ship Projects) Section, primarily working on the design of the new FRP catamaran minehunters for the RAN. During this period Brian was elected Chairman of the Canberra Section of RINA.

While in Canberra from 1977 until 1996 Brian progressed through the ranks to occupy the positions of Director Naval Ship Design, Director Forward Design (Ship Projects), Director Naval Ship Production, Assistant Director General Naval Engineering Services and acted as the Director General for a time before retiring in 1996. During this period Brian was elected to the Australian Division Council of RINA and ultimately served as the Australian Division President on two separate occasions for a total period of seven years. Brian had two papers published in the RINA *Transactions* and presented many other papers, both locally and overseas. He retired from Defence in 1996 and is currently enjoying life at Noosa Heads on the Sunshine Coast.

Western Australia

The Western Australian Section of RINA started its year with an annual general meeting and video night on 27 January. The main purpose of the meeting was to elect/volunteer the committee for the year, but assignment of tasks was delayed until the following meeting. The videos presented included *Around Cape Horn*, a video of 1929 film footage taken by Captain Irving Johnson aboard the barque *Peking* as it sailed around Cape Horn in a wild storm; a video of a mooring buoy loading onto a floodable barge in Malaysia; and a video of the 1998 Whitbread around-the-world race highlights.

Following the committee meeting held on 3 March, Tony Armstrong has taken over the reins as chairman of the Western Australian section from David Lugg with Giles Thomas being voted in as vice chairman. Shaun Ritson has continued as secretary but has, with a sigh of relief, handed over the position of treasurer to John McKillop. John Wood has kindly volunteered his services as librarian, and Geoff Leggatt is continuing as Division representative. Steve Harler and Hugh Hyland complete our committee, and we welcome their services to the Division.

To date we have held two technical meetings. The first by Tony Armstrong was titled *Changes to the Safety Regulations - How your designs will be affected*. In his presentation Tony briefly outlined the regulations affecting pleasure craft with the main body of his talk concentrating on commercial vessels. EEC and Australian requirements for pleasure craft were discussed, followed by a brief outline of the role that the USL Code and AMSA play in the survey of commercial vessels operating in Australia. Tony outlined the origins of the IMO and the SOLAS regulations and then went on to discuss in more detail the USL Code review, the HSC Code review, the FTP code relating to fire tests, stability issues, and collision acceleration levels.

Our most recent technical meeting was presented by Dr Rohan Smith and was titled *A New Method for Predicting Motion Sickness on Marine Vessels*. Dr Smith described the limitations of currently-available techniques such as the Motion Sickness Incidence Method and the Motion Sickness Dose Value. Several members of the audiences chucked around their experiences of feeding the fish at sea on vessels of various hull-forms. Dr Smith concluded by presenting an overview of a new method for continuously predicting motion sickness on a vessel, based on the continuous signal from an accelerometer measuring the vessel's heave acceleration. Using this method Dr Smith has developed a passenger comfort meter to provide an indication of the percentage of passengers likely to vomit under the current operating conditions.

Geoff Leggatt

Tasmania

Over the past six months there have been a number of changes in Tasmania with respect to RINA. The northern and southern groups have been amalgamated into one Tasmanian Section. The intention is to make everything we do more attractive to both existing members and new members.

I noted in a recent list of members that there are far more in Tasmania than I had realized. My intention is to contact as many as possible to arrange our first combined Annual General Meeting. Those in Tasmania who are interested in attending the AGM can contact me by fax on (03) 6243 5365 or email gdoyle@tassie.net.au.

Many may be unaware that the Hobart Institute of TAFE is running a number of marine-related subjects as part of the Mechanical Engineering Diploma. They are Introduction to Ship Drawing, Ship Drawing 1 and Naval Architecture 1. They run over the whole year combined or one per term. This is the third year that they have been offered and students are either marine industry employees or interested amateurs.

Guy Doyle

COMING EVENTS

Victoria

Victorian members are reminded of the joint IMarE/RINA Technical Meetings that are held on the third Tuesday of each month at the IEAust Building, Bedford Street, North Melbourne. Meetings commence at 5.30 pm for 6.00 pm, and are normally completed by 8.00 pm. Light refreshments are generally provided.

The programme for the remainder of 1999 is as follows:

18 May	Stephen Kennett, DSTO; *Fire Modeling for Naval Vessels*
15 June	Presenter to be advised; *Launching the ANZAC Frigates*
20 July	Janice Cocking, DSTO; *Unmanned Underwater vehicles*
17 August	Doug Bews, Tenix (ex ASC); *The Collins Class Submarines*
21 Sept.	To be advised. Hopefully a BHP officer to discuss the current 180,000 dwt new-buildings
19 Oct.	*An Evening of Miscellany*; Short presentations based on the experiences of various individuals.
16 Nov.	Martin Robson, SPI International; *Ring Propellers and Controllable Pitch Propellers for Small Craft*

The 2000 Programme is presently under consideration. If you have particular topics in which you are interested, or a presentation which you think would interest other members, please contact Bob Herd on (03) 9722-1534 or Howard Mumford (IMarE) on (03) 9211-9311.

New South Wales

Workshop on High-speed Ferries

The University of New South Wales is organising a workshop on High-speed Ferries to be held at the University from Monday 27 September to Wednesday 29 September (note the *second* change of dates!) This workshop will have experts from industry, the regulatory authorities and academia giving presentations on feasibility analysis, general arrangement, resistance, powering, motion analysis and control, structural analysis, mathematical modelling and optimisation, safety regulations, classification society rules, design principles, and contracts and specifications for high-speed ferries. Further information may be obtained from Dr Prabhat Pal, phone (02) 9385 4092, fax 9663 1222 or e-mail `p.pal@unsw.edu.au`.

NSW Section Meetings

Meetings are generally combined with the Sydney Branch of the IMarE and held on the fourth Wednesday of each month at the Portside Centre, 207 Kent St, Sydney (unless notified otherwise). They start at 5:30 for 6:00 p.m. and generally finish by about 8:00 p.m.

The revised programme of meetings for the remainder of 1999 is as follows:

26 May	J. van Dam and D. Crane, P&O Polar, Aurora Australis: *Technical Challenges of Operation in Ice Conditions.*
23 Jun	K. Porter, Lloyd's Register of Shipping, *Problems with Carbon Fibre.*
14 July	J. Bethwaite, Star Constructions, *Design and Construction of the Olympic Skiff Class 49er,* at Lane Cove Club, 1 Birdwood Ave, Lane Cove.
28 Jul	G. Taylor and E. Ironside, Holyman Ltd, *The Design and Construction of the Bulk Refined-sugar Carrier MRS* Pioneer.
TBA	Visit to MRS *Pioneer.*
25 Aug	K. Gaylor, DSTO, *The Design of Smart Ships for the RAN.*
22 Sep	A. Rogers, *Description of a Three-man Submarine and a Voyage to* RMS *Titanic.*
27 Oct	I. Murray and A. Dovell, Murray Burns and Dovell, *Technology Trickle-through: The America's Cup.*
Late Nov	Combined RINA (NSW Section) and IMarE (Sydney Branch) Annual Dinner (watch this space!)

Sea Australia 2000

This conference will be held in Sydney from Tuesday 1 to Thursday 3 February 2000, in conjunction with the Pacific 2000 Exhibition. Organised by RINA, IMarE, IEAust and the AMECRC, the Sea Australia 2000 Conference will cover a wide range of topics relevant to the new millennium, including innovations in marine design, novel proposals for propulsion, trends in port handling facilities, developments in offshore industries, safety regulation and the marine environment. Further information can be obtained from the conference secretariat, Ms Anne Lewis at ICMS Ltd, phone (02) 9976 3245, fax 9976 3774 or e-mail seaaust@icms.com.au.

STAB2000

The Seventh International Conference on Stability of Ships and Ocean Vehicles will be held in Launceston from Monday 7 to Friday 11 February 2000. Organised by the AMECRC, AMC, UNSW, AMSA and RINA, this conference will promote a full exchange of ideas and methodologies on the stability of ships and ocean vehicles of all types. Topics include updates to IMO, USL Code and RAN stability criteria, damaged stability of ro-ro vessels, stability of high-speed craft, model testing and correlation, computer techniques, stability of offshore engineering structures, design aspects, and the human/vehicle interface. Further information can be obtained from the conference secretariat at the AMECRC Launceston, phone (03) 6335 4885, fax 6326 6261, e-mail stab2000@crc.amc.edu.au or web-site www.amc.edu.au.

IMarE Conference 2001

The Australia/New Zealand Division of IMarE will host an international maritime conference at the Wellington Convention Bureau, Wellington, New Zealand, from Monday 19 to Wednesday 21 November 2001. The theme of the conference will include latest developments, high-speed craft, fishing vessels, yachts and all aspects of the marine industry. Details are being developed; watch this space! Futher information may be obtained from Mr Barry Coupland, phone +64-4-382 9666, fax 382 6303 or email barry.coupland@marine.co.nz.

AWARDS FOR NAVAL ARCHITECTS

Robert Tulk presented his paper *The BC Ferries Catamarans* (see *ANA* February 1999) at a joint meeting with the Institute of Marine Engineers (Sydney Branch) on 28 October 1998. Robert received the IMarE (Sydney)'s Harry Lees Award for the best technical paper presented to them in 1998. The Institute of Marine Engineers (London) also conferred their Stanley Gray Award for an outstanding technical paper. This is only the second time in fifty years that this award has gone to Australia. The Stanley Gray award was presented to Robert by Mr Barry Coupland, the president of the Australia/New Zealand Division of the IMarE.

On the international stage, Martin Renilson presented his and Andrew Tuite's paper *The Effect of Principal Design Parameters on the Broaching-to of a Fishing Vessel* at the 1998 RINA Spring Meetings in London and, in recognition of the quality of the paper, the RINA have awarded them a Bronze Medal (*RINA Affairs*, April 1999). RINA also awarded Andrew Tuite the Calder Prize for the best paper on the subject of safety by an author under thirty.

Congratulations to all.

Phil Helmore

45 YEAR SERVICE CERTIFICATE FOR THE AUSTRALIAN DIVISION

In 1954, the Council of The Institution of Naval Architects approved the formation of the Australian Branch, later to become the Australian Division. In commemoration of this event, the Division has been uniquely awarded the Institution's 45 Year Service Certificate, and has received this message of congratulations from the Council:

To the Members of the Australian Division

Since its formation as the Australian Branch in 1954, the Australian Division has been vigorous in furthering the objectives of the institution in promoting the art and science of naval architecture, and in serving the interests of the members of the institution in Australia at national and local level.

The recent restructuring of the Australian Division ably demonstrates that the Division is responsive to the changing needs of its members. The Council is confident that the Division will continue to play a full part in ensuring that the institution remains a forward looking professional institution, deserving of the professional standing and influence which it enjoys in the international maritime industry.

The Council congratulates the Division on what it has achieved in the past 45 years, and wishes it every success as it moves into the 21st Century.

The Council of the Royal Institution of Naval Architects

London, 1999

INCAT DELIVERS BONANZA EXPRESS

Built for operation in the Canary Islands by leading Spanish ferry operator Lineas Fred. Olsen SA, *Bonanza Express* was launched on 31 January 1999 from Incat Tasmania's Coverdales shipbuilding facility at Prince of Wales Bay, near Hobart. The 96-metre wavepiercing passenger/vehicle catamaran is a near sister of Incat's first dedicated Ro-Pax vessel, *Devil Cat*, (see ANA Vol. 3 No. 1).

Bonanza Express entered service in April 1999 with Lineas Fred. Olsen on the 35 nautical mile route between the ports of Santa Cruz de Tenerife and Agaete on the nearby island of Gran Canaria, reducing travel time between the two islands from 2 hours 15 minutes to 60 minutes.

Bonanza Express incorporates several new features which allows it to carry significant numbers of heavy vehicles, making it a true Ro-Pax vessel. Perhaps the most remarkable fact about the ship is that it is almost capable of carrying its own weight. This equates to approximately 800 tonnes of deadweight which can largely be carried as a broad mix of light and heavy road freight.

This is achieved through a diligent approach to weight minimisation during construction, coupled with a subtle hull re-design from the 91-metre class to suit the larger vessel. The extensive and increasing use of aluminium extrusions at Incat has contributed to this dramatic weight saving. To achieve the required 9-tonne axle loading for the main vehicle deck an extruded hollow box planking was developed. Tunnel underside plating achieves maximum strength for minimum weight by the use of a corrugated aluminium extrusion.

Designed as a Car Ferry "B" Incat 051, *Bonanza Express* has an open fore deck and an open stern, allowing adequate natural ventilation to the vehicle decks. This led to a considerable saving of not only structural weight, but also permitted the omission of normally-mandatory items such as structural fire protection, ventilation fans, fire dampers, overhead fixed sprinkler systems and additional lighting. Further structural weight saving was achieved by reducing the physical size of the passenger cabin and wheelhouse.

Bonanza Express on trials (Photo by Richard Bennett, courtesy Incat Tasmania)

With a total capacity of 755 persons, most of the passenger accommodation is on a single tier with the wheelhouse positioned well aft, above the exclusive panoramic sky lounge.

The increased use of adhesives to bond non-structural superstructure side panels instead of welding allows the use of much thinner plating. Aluminium honeycomb panels are also used extensively, not only as non-structural interior partitioning but also in the newly-developed movable mezzanine vehicle decks. In conjunction with strict attention to weight minimisation during the design and construction stages has been a series of incremental parametric changes. A modified hull form has increased volume per lineal metre, thus providing more buoyancy, combined with a slight increase in maximum draft contributing to the 60% increase of allowable deadweight over the previous 91-metre model. The hull redesign had to consider any increase in wetted surface that may affect final performance. This balance has been successfully achieved as evidenced by the vessel's trial results.

The new ship is propelled by four Alstom/Ruston 20RK270 diesel engines of 7,080 kW each driving four Lips 150D waterjets through Reintjes VLJ6831 gearboxes. During trials *Bonanza Express* achieved 42.85 knots with 630 tonnes deadweight. She is designed to achieve 37.5 knots at 800 tonnes deadweight.

More photos of *Bonanza Express* by Richard Bennett (courtesy Incat Tasmania)

AUSTRALIAN MARITIME COLLEGE

Undergraduate Research Scholarship (Naval Architecture)

The Australian Maritime College (AMC) is Australia's national Centre for Maritime Education, Training and Research. It provides Australia's largest undergraduate course in Naval Architecture and Australia's only undergraduate course in Ocean Engineering.

AMC has access to AUS$110 million worth of unique maritime-related infrastructure. The campus is situated at Launceston (population 80,000), the main centre of Northern Tasmania.

Applications are now invited for the AMC Council Tom Fink Scholarship. This is awarded annually to allow an outstanding undergraduate to conduct his or her research project in Australia at the AMC, and provides:

- a return economy airfare from the institution where the student is enrolled, to Launceston;
- accommodation at the residences on AMC's campus;
- office space, access to library and research facilities;
- supervision by an AMC academic staff member;
- a stipend of $3,000 and a book allowance of $500.

The student will spend 12 months in Australia (at least 11 on AMC's campus) and will complete a final year research project, supervised jointly by academics from the home institution and AMC. The scholarship is open to any student who will have completed his/her penultimate year in naval architecture or a related discipline. It is for a period of 12 months, commencing at any time during the 12 month period from the end of September 1999. The intended starting date must be nominated in the application. Applicants should possess an adequate standard of English (IELTS: 6.0 or above). Applications must be received by 28 July 1999 and should be addressed to:

The Secretary,
AMC Council Tom Fink Scholarship Selection Committee,
Australian Maritime College,
PO Box 986, Launceston, Tasmania, 7250 Australia
Fax +61 3 6326 6493 Website www.amc.edu.au

Further information and selection criteria is available from the above address. Additional information on research targets can be discussed with Dr Martin Renilson, Head, Naval Architecture/Ocean Engineering and with appropriate staff of the department. Staff details can be found on the Website.

FIRST OF EIGHT PATROL BOATS FROM AUSTAL

Western Australian shipbuilder Austal Ships has delivered the first of eight 35 metre Bay Class Patrol Boats, *Roebuck Bay*, to the Australian Customs National Marine Fleet.

Austal was awarded the tender in May 1998 to supply the Commonwealth of Australia with the new class patrol vessels after an exhaustive selection process including, amongst other criteria, compulsory tank testing. The next two vessels are scheduled for handover in August 1999 followed by two in February 2000 and the remaining three by August 2000.

The 35 metre aluminium-hulled *Roebuck Bay* has a range of 1000 nautical miles and will be capable of operating around Australia's 37,000 kilometre coastline and out to the edge of the 200 nautical mile Exclusive Economic Zone. Powered by twin MTU 16V 2000 M70 engines, *Roebuck Bay* achieved a speed of 20.5 knots at 80% MCR in Sea State 3, 0.5 knots in excess of the contract requirement.

It also has the ability to maintain speeds of less than 5 knots for extended periods as required for surveillance operations. In combination with its fast tenders (RIBs), *Roebuck Bay* will be capable of sending boarding parties to other vessels ranging in size from a small dinghy to a large merchant vessel. The vessel and its 12 crew will be capable of enduring 28 consecutive days at sea. An additional 12 passengers/survivors can also be carried.

Following hand over of *Roebuck Bay*, an intense two-week Customs crew training and familiarisation program was undertaken at Austal's shipyard, including handling of the vessel and its tenders and engine training courses, to ensure the vessel is utilised to its full capabilities.

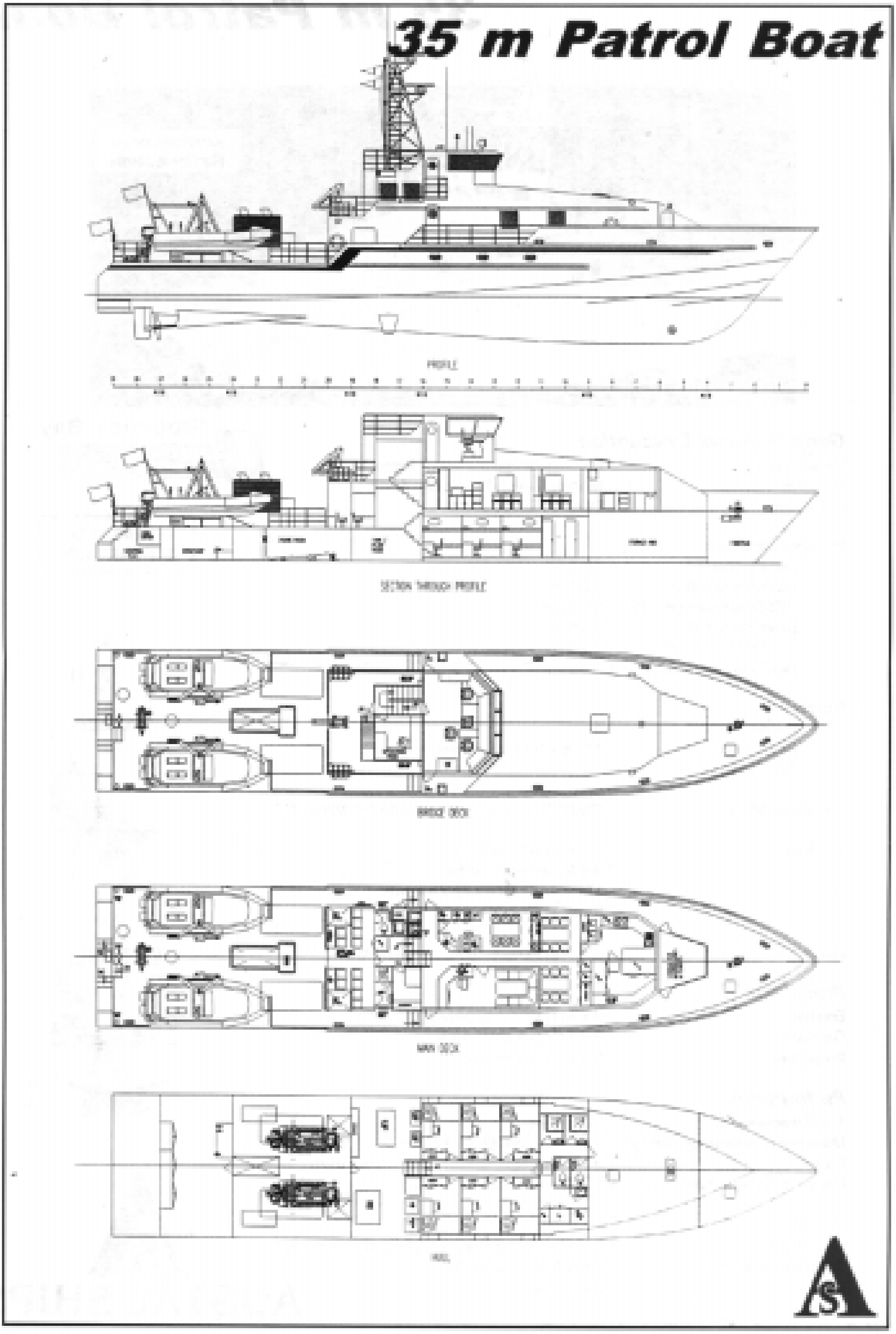
In co-operation with Stirling Marine Services (a division of Adsteam Marine Limited), Austal will provide a comprehensive maintenance program for the vessels for a period of 3 ½ years in which it is required to maintain the fleet at the various Australian ports and regions in which the vessels will operate. In the terms of the contract, the Commonwealth has the option to extend the maintenance service to a ten-year period.

Roebuck Bay features a semi-displacement hull form with a fine waterline entry designed for minimum resistance at 20 to 22 knots whilst providing maximum comfort in a seaway. As part of the tender process, the hull was tank tested to compare vertical accelerations with existing Customs vessels and other proposals. Streamline tests were also performed to align the bilge keels and ride control fins with the flow along the hull body. As the vessel is expected to spend time either stationary or at slow speeds in beam seas, passive roll stabilisation was enhanced with the addition of shaft support skegs and bilge keels. For roll and pitch control, an Austal active ride-control system consisting of rotating cantilevered fins amidships and flaps aft was fitted to optimise crew comfort and vessel performance at higher speeds. The system includes a facility to dynamically trim the vessel from the wheelhouse. The vessel is fitted with a bow thruster to assist with manoeuvering in difficult weather conditions and is capable of moving sideways at a minimum of 20 metres per minute and turning 360 degrees in its own length within 90 seconds. Large oversize rudders with quick response are fitted to provide steerage at low speeds.

The propulsion system consists of 2 x MTU 16V 2000 M70 main engines, rated at 1,050 kW each at 2,100 RPM, coupled to Reintjes gearboxes and 4-bladed 1.15 m diameter Veem propellers. The MTU 2000 M70 engines were chosen for their ability to operate at low RPM for extended periods without detriment, thereby achieving the required minimum operating speed of 5 knots.

The central elevated bridge provides 360 degree vision and is outfitted with an engineering station, a helm position, an officer-of-the-watch position and a master's station. Main propulsion and bow thruster controls are repeated at the wing stations, where a clear view of the tender launch and recovery areas can be obtained. All machinery and monitoring systems on board the vessel are controlled from the engineer's station.

Main bridge equipment features are 2 x Leica DGPS, Transas ECDIS display, Racal Decca 3 cm and 10 cm radar and ARPA, and a C Plath autopilot integrated with gyro. The operations room located aft of the bridge is an ergonomically designed communications station. Main equipment features are a GMDSS system for area A3, CYCOM field data terminal and printer compatible with Customs communications systems, separate UHF for communicating with both Customs and the Australian Defence communications system and an encrypted satellite facsimile.


35 m Patrol Boat

LAUNCH OF FRIGATE STUART

The sixth ANZAC class frigate built by Tenix Defence Systems at Williamstown in Victoria was launched on 17 April. *Stuart* was launched by Mrs Maxine Barrie, wife of Admiral Chris Barrie AO, Chief of the Defence Force. *Stuart* was named after two previous ships of the name that served the RAN with distinction. The first was the leader of the famous 'Scrap Iron Flotilla' of World War II and the second was a Type 12 Destroyer Escort built at Cockatoo Island in Sydney and completed in 1963. She was the first ship to be fitted with the Australian-developed IKARA anti-submarine guided weapon and was the trial ship for the system.

After fitting out the new *Stuart* will begin sea trials late next year and will be handed over to the RAN in 2001. Three ships of the class are already in service with the RAN and RNZN. The fourth *Te Mana* is nearing completion and *Warramunga* will begin sea trials early next year. The keel for the seventh ship, to be named *Parramatta* was laid on 24 April.

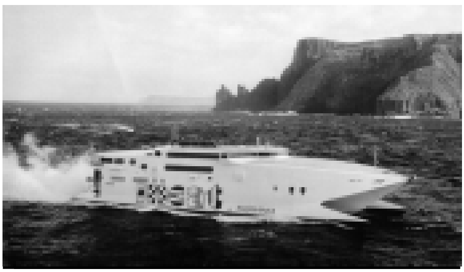
The ANZAC frigate *Stuart* on the way to the sea.
(Photo courtesy Tenix Defence Systems).

NAVY CHARTER OF INCAT 045

On 25 April 1999 the Minister for Defence, John Moore, announced that the Department of Defence was to charter a high-speed catamaran ferry from Incat Tasmania for two years to provide additional sea transport for the ADF in northern Australia.

The ship, *Incat 045,* will undergo some modification at the builder's yard – mainly to greatly increase range and to improve communications. It will be renamed and commissioned into the RAN with two crews of twenty RAN and Army personnel.

Training of the crews will be conducted at the Australian Maritime College at Launceston and the ship will be based in Darwin from the end of June 1999. It will participate in a range of ADF exercises including 'Crocodile 99' later this year.



MINEHUNTER PROGRESS

Progress with the RAN's minehunter project at ADI in Newcastle has been marked by the recent achievement of several important milestones. On 25 March the first of class, *Huon* was handed over to the RAN after nine months of intensive first-of-class trials in NSW and Queensland waters. HMAS *Huon* was commissioned in Sydney on 15 May.

In April, the second ship of the class *Hawkesbury* began sea trials. The 720 tonne ship has been carrying out engineering and sonar trials in coastal waters between Newcastle and Jervis Bay. This series of trials has included shock trials. Ordnance was detonated close to the hull to test the hull and machinery installation. ADI expect to hand over *Hawkesbury* to the RAN in late November 1999.

On 3 May, ADI's third birthday, the third of the class *Norman* was launched in Newcastle. She was named by Ms Agatha Grey-Wilson MBE of Melbourne, the great grand-daughter of Captain William Norman. Captain Norman was the first commanding officer of the Victorian Colonial Government's HMCS *Victoria*, launched in 1855, a ship in which he searched the coast for the missing Burke and Wills expedition.

Work is progressing on the fourth and fifth ships, *Gascoyne* and *Diamantina*, and the keel of the last ship, *Yarra*, will be laid next month. *Yarra* is expected to be completed in 2002.

THE 1999 OSAKA CUP

The Osaka Cup is a 5,500 nautical mile non-stop double-handed yacht race from Melbourne to Osaka. This is an open race, with no handicap system, but three length divisions – Class C for 10–12 m, Class B for 12–14 m and Class A for 14–16 m. For each length division the yachts are divided into racing and cruising divisions depending on the displacement and sail area.

Naval architects who go to sea regularly are, unfortunately, a rarity. But here in Australia we have a number who are keen sailors and two, in particular, who find it hard to stay ashore. Teresa Michell and David Pryce set sail on 17 April in their Adams 10 *Montane* (ex *Aurora*) with a fleet of twenty yachts in the 1999 Osaka Cup. This year nine of the yachts are competing in Class C, making it the most competitive class and, of those nine, seven are more than 11.8 m in length, dwarfing *Montane* at 10 m. Although *Montane* is the smallest yacht ever to have competed in the Osaka Cup, Teresa and David are confident of a good result as *Montane* performs well for her size.

The yachts took a pounding in high winds and huge seas from Gabo to Cape Byron, and *Montane* anchored for twenty-four hours at Trial Bay (South West Rocks), while several yachts retired and one sank. However, four days later *Montane* was relishing a broad-reach northwards in fifteen knots of breeze on a flat calm sea, passing Mackay, and lying in a meritorious seventh place overall, and third in class.

At the present rate of progress, the leading yacht *Sayenara* should reach Osaka about 17 May, and *Montane* about 27 May.

Teresa and David have their own web-site `members.tripod.com/Montane` (note that the M is case-sensitive) for the race, providing information about themselves, *Montane*, and race updates, with links to the Osaka Cup site at `www.osakacup.com` and race position and performance tables.

Phil Helmore

NORTHERN TERRITORY NEWS

The old adage "feast or famine" comes to mind as I report on activity from the tropical north. The relative intensity of the past eight months which, while not in itself a feast, has subsided to somewhere just above the famine level. The shiplift and berths at Darwin Ship Repair and Engineering remain active with an RAN Patrol Boat and Landing Craft and two army LCM8s generating enough work to maintain the long-term workforce.

Amongst the grey and khaki green vessels is a Marinetek/FBM catamaran which succumbed to the local sea conditions whilst making a passage from Penang to Noumea. Substantial structural damage to her fore-sections is being attended to by local aluminum specialists at ASM. Beyond this present period, bookings for the third quarter indicate an increase in activity.

The local offshore oil and gas sector is what can best be described as "on hold" with two Diamond Offshore semis stacked in Darwin Harbour and the only active rig rumoured to be likely to join them. With the Territory Government expecting 150 more wells in the next five-year period and a recent positive outcome of differences between Phillips and BHP the long-term outlook still looks positive.

The local Paspaley Pearling fleet has been bolstered by the addition of the 35 metre *Roslynne*. In keeping with the tradition of high quality outfitting and equipment levels for which the owners are renowned, the Phil Curran designed vessel was completed by Darwin Ship Repair and Engineering and is presently deployed off the Kimberley coast. Up-market accommodation for 40 people with extensive recreation areas are a prime feature of this vessel which is powered by a Cat 3508 and with Cat 3304s the mainstay of the generating package.

The arrival of the black striped mussel (*Congeria Sallei*) put a damper on Easter activities in the local Darwin marinas. This particularly prolific little breeder has felt the full chemical wrath of the Territory Government who hopefully have left no stone unturned in their efforts to eradicate a pest that has the potential to decimate the local prawn and pearling industries. Local yachties and small vessel owners have been inconvenienced and some charter operators are feeling the pinch, but most agree that the problem needs to be faced now to ensure that it does not take control of Territory waters or spread beyond.

It's not all doom and gloom, however, as every Territorian and his dog head for the wetlands with their ugly sticks and tinnys to welcome in the dry season with a 20 kilo barramundi.

Ian Stevens

NEW SOUTH WALES NEWS

New Construction

Applications for initial survey by the Waterways Authority are up on those received for the same period last year. Indications are that last year's all-time record number of applications for initial survey will be exceeded this year.

WaveMaster International is currently completing trials on a 26 m sailing catamaran undergoing initial survey with the Waterways Authority for operation on Sydney harbour by Vagabond Cruises. The vessel is intended to carry over 200 passengers within partially-smooth water limits.

Also undergoing initial survey is a 20 m monohull vessel driven by twin surface-piercing drives. The vessel is the Palm Beach 75, designed by Peter Lowe in association with Dave Warren and Sam Sorgiovanni for Addenbrooke Marine to carry up to 49 passengers within smooth water limits.

The Waterways Authority is assisting a feasibility project for a solar/wind powered catamaran currently being undertaken by Solar Sailor Pty Ltd in conjunction with Grahame Parker Design. The vessel is intended to carry 100 passengers, with computer control optimising the method of power generation for the prevailing conditions.

Advanced Multihull Designs have one of their AMD188 designs currently under construction at the Afai southern shipyard in China for the Hong Kong Yaumati Ferry Co. This vessel is a catamaran ferry of 25 m length, 8.9 m beam and 1.8 m maximum draft to carry 200 passengers. Power is by two GM 12V92TA diesels of 520 kW @ 2,100 RPM each, driving through ZF BW198 reduction gearboxes and fixed-pitch propellers giving a full-load speed of 23 knots.

New Designs

Incat Designs are completing the design of a 19 m low-draft catamaran cruise vessel for Amaroo Cruises for operation on Wallis Lake, Foster. The vessel is expected to carry 90 passengers at a maximum speed of 14 knots with twin John Deere engines of about 200 kW each.

Advanced Multihull Designs are working on the design of the AMD2900, a catamaran ferry of length 120 m, beam 32 m and maximum draft 3.5 m to carry 1,100 passengers and 420 cars or 250 cars plus 27 trucks and 43 coaches. The vessel is for a European shipyard and will be powered by four ABB gas turbines of 17 MW each, driving through reduction gearboxes and waterjets and giving a full-load speed of 55 knots.

AMD are also working on the design of the AMD2400, a monohull ferry of 142 m length, 22 m beam and 3 m maximum draft to carry 1400 passengers and 387 cars or 131 cars plus 131 trucks. The vessel is for a European shipyard, and maximum deadweight is 1,365 tonnes. Power is by three GE LM2500 gas turbines of 21.8 MW each, driving through reduction gearboxes and KaMeWa 180 S11 waterjets and giving a full load speed of 40 knots.

Around and About

The president of Bureau Veritas, M. Renard, together with his wife and the chief executive for South-East Asia, M. d'Arifat, visited BV's offices in Perth and Sydney during April. Among other engagements, they visited several shipyards in Fremantle, and attended the launching of HMAS *Norman* at the ADI Minehunter facility in Newcastle.

The Sydney Heritage Fleet is progressing with the restoration of *James Craig,* with most above-water riveting completed, all spars and standing rigging in place, and the decks re-laid and caulked. The sails and running rigging are under way, the engines are in place and the vessel will be docked in October, when the stern tubes will be installed. Restoration is on track for sailing in mid-2000.

The Cruising Yacht Club of Australia has announced a number of significant changes in safety procedures for yachts competing in this year's Sydney–Southport race which starts on July 31. Each yacht will be required to carry public liability insurance, and will be subject to random safety checks by YA of NSW inspectors. Each yacht, in addition to its radio compliance certificate, must make a pre-race check with Penta Comstat to verify the strength and clarity of their signal. Each yacht must submit a comprehensive crew list, and demonstrate to race officials their proficiency in hoisting storm tri-sail and storm jib. One member of the crew must be proficient in first aid. The weather briefing is compulsory for the skipper and navigator, and there will be briefings on search and rescue operations for all crew.

The Welcome Wall at the Australian National Maritime Museum is a national tribute to all people who have migrated to live in Australia. The Wall was opened on Sunday 24 January by the Governor-General, Sir William Deane. The Wall has the names of people cast in bronze, together with details which are accessible via the Internet. Anyone is welcome to submit names of relatives who have migrated to Australia, and new bronze names will be added each Australia Day while web details become available when entered. Further information may be obtained from the Welcome Wall Manager on (02) 9552 7567, fax 9211 6283 or from the web-site www.anmm.gov.au/ww.

Phil Helmore

No, not another Incat product, but the US Navy ship *Sea Shadow* underway in San Francisco Bay at dusk on 18 March 1999. This unusual vessel, a stealth test platform, was reactivated this year to support evaluation of future navy ship designs and technologies, including automation for reduced manning, propulsion concepts and characteristics of surface ship stealth. (US Navy photograph)

1999 SOLAR AND ADVANCED TECHNOLOGY BOAT RACE

The fourth Solar and Advanced-technology Boat Race, held on Saturday, 1 May 1999 in Canberra, attracted a record forty-two entries from all over Australia together with several international entries. The race marked the beginning of the Australian Science Festival from May 1–9, and was started by Dick Smith, with boats racing around a four-kilometre course on the East and Central Basins of Lake Burley Griffin between 10:00 a.m. and 3:00 p.m. Boats raced in five classes and, with the exception of the competition class, the winner also put in the fastest lap:

Competition: Boats limited to 6 m length, 2.5 m height and 2.5 m beam; solar panels (if used) must be commercially available; batteries must be commercially-available lead-acid not exceeding 125 kg. This class was won by *GreenChoice – Spirit of Canberra,* a foam/FRP trimaran with solar electric propulsion from Lake Tuggeranong College, ACT (last year's AMSA entry with significant modifications), with the fastest lap put in by *Y10K* from Bruce McLauglan.

International: Boats limited to 6 m length, 1.5 m height and 3 m beam, and must comply with international race rules. This class was won by *Shadow*, the Kevlar/carbon fibre sandwich solar-powered hydrofoil from Marquette University, Milwaukee, USA.

Open A: Boats limited to 4 m length, 2 m height and 2 m beam, and may use any approved non-polluting energy source *except* human power. This class was won by *Sci-Flyer,* a coxless four rowing shell with outriggers, batteries and an outboard motor leg from DSTO.

Open B: Boats limited to 4 m length, 2 m height and 2 m beam, and may use any approved non-polluting energy source *except* human power. This class was won by *Soloray Long,* an FRP/aluminium hull with small solar panel and electric outboard motor from Haber Pilot Pty Ltd.

Commercial: Boats limited to 4 m length, 2 m height and 2 m beam, and all equipment, including vessel, solar panels, batteries, motor unit and propulsion unit, must be commercially available. This class was won by *Invader,* a 5 m canoe with batteries powering an electric outboard motor from Calwell High School, ACT.

Hybrid: Boats limited to 4 m length, 2 m height and 2 m beam, and must use direct, solar, electrical or other approved non-polluting energy source in combination *with* human power; battery mass restrictions apply. This class was also won by *Soloray Long,* winner of the Open B class.

There was an amazing variety of concepts and adaptations of commercially-available craft, including rowing shells (with and without outriggers), kayaks, canoes, a Hobie 18, together with purpose-built monohulls, catamarans and trimarans. Canberra-based naval architect Martin Grimm was part of the *Sci-Flyer* winning team, and part of the *Ampcat 4* team from the Alternative Technology Association.

Further information about the race (no entries or results) may be found on the Science Festival web-site at `www.sciencefestival.com.au`.

Phil Helmore

WORKSHOP ON SAFETY OF OCEAN RACING YACHTS

The University of New South Wales was the venue for the much-publicised workshop on the safety of ocean racing yachts. While the impetus for the workshop was provided by the tragic events of the December 1998 Sydney–Hobart yacht race, the underlying purpose was to discuss matters of safety relating to ocean racing in general. Furthermore, an effort was made to cover *all* topics bearing on safety, and not just pure naval architectural aspects.

The workshop was organised by members of the naval architecture course at UNSW in association with RINA (Australian Division) and supported by the Institute of Marine Engineers (Sydney Branch) and Baird Publications Pty Ltd.

The Dean of Engineering and Pro-Vice-Chancellor (Research) at UNSW, Professor Mark Wainwright, welcomed the 85 delegates to the workshop. This was followed by the official opening by Sir James Hardy, AO, who (among other achievements) had participated in many Sydney–Hobart races. He delivered a vivid description of the dilemmas he faced and the hardships he endured as skipper of an Admiral's Cup yacht during the Fastnet race in August 1979. A total of 15 sailors perished on that occasion. It has been noted by many observers that there are many parallels between that Fastnet race and the recent Sydney–Hobart race.

The twelve lectures delivered at the workshop were:

Organisation of Ocean Yacht Races by Mr Mark Pryke, Cruising Yacht Club of Australia, Rushcutters Bay
Can We Predict the Weather? by Mr Patrick Sullivan, Bureau of Meteorology, Darlinghurst
What is Wrong with Modern Ocean-Racing Yachts? by Mr Warwick Hood, Naval Architect, Blackheath
Safety or Performance? by Mr Andrew Dovell, Murray Burns and Dovell Pty Ltd, Newport
Yacht Stability and Seaworthiness by Mr Christopher Murman, Floating Point Designz, Mosman
Aspects of Classification of Yachts by Mr John Donovan, Det Norske Veritas, North Sydney
Value and Quality of Experience of the Skipper and Crew by Mr Alastair Mitchell, Maritime Consultant to the Australian Yachting Federation, Sydney
Operational Decisions which the Skipper Must Make by Mr Michael Cranich, Barrister and Yachtsman, Sydney
The Lucky Yachtsman by Mr John Quinn, Yachtsman and Owner, Wahroonga
Dynamics of Vessel Capsizing in Critical Wave Conditions by Dr Jan de Kat, Maritime Research Institute Netherlands, Wageningen
Safety of Offshore Racing — The Critical Factors by Dr Martin Renilson, Australian Maritime College, Launceston
Where do We Go from Here? by Mr Bryan Chapman, President RINA (Australian Division), Melbourne).

On the design side, Mr Warwick Hood proposed a new rating rule for "serious offshore racers" which gives credit for seaworthy design features, while Mr Andy Dovell eloquently put the case for modern lightweight flyers designed to the IMS.

The discussion of all papers was lively, making it difficult to keep the running of the seminar to schedule and demonstrating the considerable interest shown in the subject. One worthy outcome of the day's activities was that personal contact was made between senior members of the naval architecture community and VIPs in the yachting world. Perhaps more significantly, the opportunity for first contact was made between professional naval architects and people responsible for the upcoming coroner's inquest and the investigation being carried out by the Cruising Yacht Club of Australia. This contact was made on a friendly and cooperative basis and it is anticipated that much will be gained from this cooperation.

In addition to prepared papers by the authors, delegates were requested to prepare written discussion in order to complete the documentation of the day's deliberations. As we go to press, the book of proceedings is being printed and will be mailed to participants and those who have ordered separate copies.

If you did not attend the workshop, proceedings are available for $20 collected from UNSW, $25 posted within Australia, or $30 posted overseas (cheques should be made payable to "UNSW Naval Architecture"; credit card facilities are unfortunately not available).

Further information about the workshop and copies of the proceedings can be obtained from: A/Prof. Lawrence Doctors or Mr Phillip Helmore, School of Mechanical and Manufacturing Engineering, The University of New South Wales, Sydney NSW 2052 Australia, Telephone: +61-2-9385 4098/5215, Facsimile: +61-2-9663 1222, Email: `L.Doctors@unsw.edu.au` or `P.Helmore@unsw.edu.au`

Lawry Doctors
Phil Helmore

Sir James Hardy opening the workshop watched by Lawry Doctors and Professor Mark Wainwright (above).

Many familiar faces in the attentive audience (below).

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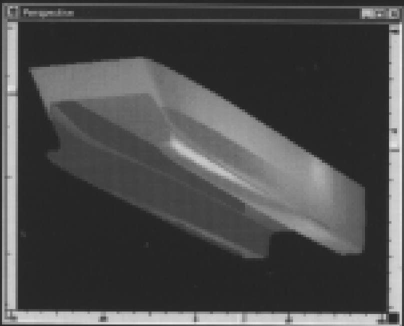

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© Austal Ships: Auto Express 86 -'Adnan-Menderes', 86 metre vehicle-passenger catamaran built for Turkish fast ferry operator, Istanbul Deniz Otobusleri, designed using Maxsurf.

Australian Maritime College

The first semester at AMC, which commenced on 22 February, started with a bang with the Industrial Liaison Committee meeting to review the Bachelor of Engineering (Ocean Engineering) course. Industry representatives from the oil and gas and offshore industries spent the whole day working with lecturing staff to review the course and make recommendations for improvement. An interview with a group of existing students was also arranged. Feedback from the Committee suggests that only minor modifications to the existing Ocean Engineering program are required.

Alan Hill, Supervising Naval Architect of Kvaerner Oil and Gas Ltd gave an interesting talk on Transportation and Offshore Installation of an integrated deck on the northwest shelf of Australia, which was well attended by students and staff of AMC. Mr. Jan Soholt has joined AMC as the new lecturer and Course Coordinator of Ocean Engineering in the faculty of Naval Architecture and Ocean Engineering.

The following students are pursuing their higher degree by research at AMC:

Teresa Hatch: *An Investigation into Squat of Ships Using Full Scale Validation*

Gaspar Guzvanj: *Mathematical Model of a Ship Pilot for Fast Track Simulation*

Alex Robbins: *Wave Wake of High Speed Catamarans*

Lieven Theys: *Improvement of a Theoretical Method for Manoeuvring Coefficients*

Gregor Macfarlane: *The Measurement and Prediction of Vessel Wave Wake*

Martin Hannon: *Deck Diving of High-Speed Passenger Catamarans in Following Seas*

Tim Mak: *Prediction of Manoeuvring Coefficients from Captive Model Tests*

Trevor Manwarring: *Broaching and Capsizing of Small Vessels in Following Seas*

Johnathan Duffy *Squat and Bank Effect of Large Ships in Shallow Water*

Mr. Johnathan Duffy is also the recipient of the STN ATLAS scholarship to pursue further studies on Mathematical Modelling of Ship-Bank Interaction. The annual Graduation and Prize giving ceremony of AMC was held on Friday, 9 April 1999. Mr. Predrag Bojovic, presently working with ABS Houston, is the first recipient of MPhil degree awarded by AMC. The prize for best Ocean Vehicle Design Project went to David Neumann and Andrew Cooper bagged the RINA prize for best research project. Dr Seref Aksu received the AMC Council Award For Academic Excellence (Teaching). Martin Hannon was awarded the RINA prize for the best final year project from all the British Universities. He won this for the project he completed at the University of Glasgow prior to coming to Australia to work towards his PhD at AMC. Matthew Hogan was awarded the Connell Medal for overall academic achievement by an undergraduate.

The following academic staff members are the recipients of AMC Research Grants:

Dr. Seref Aksu for *Loads and Responses on A Structural Scale Model of A Wave-piercing Catamaran.*

Dr. Prasanta Sahoo for *Theoretical and Experimental Investigation of Resistance of High-Speed Round-Bilge Hull Forms.* A paper based on this research has already been accepted for presentation at the FAST'99 conference.

Prasanta Sahoo

University of New South Wales

Undergraduate News

The Principal Representative Maritime and Ground Systems (Victoria) was once more a generous host to our final-year students and group leader, senior lecturer Mr Phillip Helmore, for them to see the launching of the sixth Anzac class frigate, HMAS *Stuart,* at Tenix Defence Systems' construction facility at Williamstown.

On Friday 16 April, the day before the launching, Mr John Garbutt welcomed the students to the yard and talked to them about the benefits of experience, and possible career paths. The Project Manager for the Anzac vessels, Cdre Trevor Ruting was fortuitously at the yard, and gave the students a short talk on the technical and strategic importance of the vessels. Mr Peter Goodin then gave a presentation on the launching drawings, arrangements and calculations, followed by a guided tour of the ways where preparations for launching were in progress. After lunch Mr Peter Cook led a tour of the Tenix construction facility with vessels in various stages of completion, from cutting plate for Anzac 08 to HMAS *Warramunga* (Anzac 05) fitting out in the wet dock. The launching of HMAS *Stuart,* on Saturday 17 April, was textbook-smooth and a credit to all concerned.

The group is grateful to Mr John Garbutt, Mr Peter Goodin and Mr Peter Cook of PRMGS(V), and Cdre Trevor Ruting of the RAN, for their time and effort in making the visit interesting and enjoyable. The theory is interesting, but seeing a launching brings all the theory *alive!* The group is also grateful to Tenix Defence Systems for permission to inspect the launching arrangements and facilities.

At the graduation ceremony on 11 May 1999, the following people graduated with degrees in naval architecture:

Joseph Chieng	
Matthew Cleary	H1
Scott Davenport	H1
James Fenning	H2/1
David Gosling	H2/2
Brendan Gray	
Stephen Harler	H2/1
Christopher Hutchings	H1
Mark Korsten	H2/2
Angus MacDonald	H2/1
James Smithers	H1
Dominic Worthington	H1

This is our largest ever graduation, and a few more are expected in October when industrial training requirements are completed.

At the prize-giving ceremony on the same day, the following prizes were awarded in naval architecture:

The Baird Publications Prize 1 for the best performance in Ship Hydrostatics to Michael Andrewartha.

The Baird Publications Prize 2 for the best performance in Ship Structures 1 to Michael Andrewartha.

The Royal Institution of Naval Architects (Australian Division) Prize for the best ship design project by a student in the final year to Christopher Hutchings.

The David Carment Memorial Prize and Medal for the best overall performance by a student in the final year to Scott Davenport.

Congratulations to all on their fine performances.

Post-graduate and Other News

Dr Prabhat Pal, Mr Dugald Peacock, and Mr Donald Gillies have had their paper *Hatchcoverless Container Ships for the 21st Century* published in the proceedings of the International Conference on Design and Operation of Container Ships which was organised by The Royal Institution of Naval Architects and held on 24–25 March 1999 in the Weir Lecture Hall, London. Sixteen papers were accepted for presentation.

Preliminary Design of High-speed River Catamaran Ferries by Dr Prabhat Pal, Mr Dugald Peacock, and A/Prof. Lawrence Doctors was presented by Prabhat at the 1st International Congress on Maritime Technological Innovations and Research which was organised by the Department of Nautical Science and Engineering, Universitat Politecnica Catalunya and held on 21–23 April 1999 in Barcelona, Spain. Seventy-two papers were published in the proceedings, covering all aspects of naval architecture, shipping and maritime activities, and more than 100 people registered for the congress. UNSW was the forum for a most interesting presentation by Mr Karl-Morten Wiklund on 18 February. Mr Wiklund has been associated with the high-speed light-craft industry since 1970. During that time, he has headed Det Norske Veritas' activities in that area on a world-wide basis, particularly regarding the legislative aspects of these craft during 1988 to 1996.

DNV currently has 80% of the market share of classification of high-speed car ferries (by numbers) and 60% of high-speed passenger ferries (by numbers), on a global basis. An excellent measure of the interest in this subject was the fact that 28 persons attended the presentation, despite its awkward timing with regard to the University recess.

Some of the main points covered by Mr Wiklund included the training of the masters of these vessels and he cited incidents in which lack of training with regard to manoeuvering tactics led to collisions. One dramatic slide showed a perfect T-bone collision between two Australian-designed and built catamarans in Hong Kong harbour. The collision was caused by operator error and it was impressive to observe that both vessels easily survived the accident and suffered very little list or trim, with no fatalities and few injuries to personnel.

As an example of potential difficulties in the industry, Mr Wiklund cited current proposed IMO legislation which would require a catamaran to survive an idealised accident in which all compartments in one demihull are considered to be penetrated. Clearly, politics and international economics play an important part in this exercise.

The University of New South Wales would like to express its appreciation to the Sydney Office of DNV for initiating this lecture.

Phil Helmore

UNSW Naval Architects' Reunion 1999

A reunion dinner was held at UNSW on the evening of Saturday 27 March for graduates, staff and current students of the naval architecture degree course at UNSW. The black-tie dinner was organised by senior lecturer Mr Phillip Helmore and graduate Mr David King in celebration of fifty years of the University of New South Wales, and forty years of naval architecture there. The precise fiftieth birthday for pedants among our readers was 22 March 1999.

Much effort went into arranging this function; in particular into tracking down the 237 students who have completed our bachelor's degree courses and who have spread to all corners of Australia and the globe. Use was made of the annual graduation ceremony programmes as well as personal lists of addresses maintained by staff and any other persons who could be cajoled into this service. The remainder of the information was obtained through the personal network of graduates, while the Internet proved to be most useful in accelerating the process.

The new Head of the School of Mechanical and Manufacturing Engineering, Professor Kerry Byrne and his wife, Geraldine, were the guests of honour at the dinner. Professor Byrne made the speech of welcome, after being introduced by current Course Coordinator, Associate-Professor Lawrence Doctors.

The class of 1967. Senior Lecturer John Tuft with Conan Wu, David Hill and John Jeremy during a final year naval architecture lecture at Kensington.

Following the entree, Mr Helmore presented awards for several achievements: Graduates who had Travelled the Furthest: Mr Jan de Kat from The Netherlands, and Mr Barry Spradbrow from Norway; a dual award for Best Attendance by a Graduating Class, and Male Attendees from the Earliest Graduating Class (67% of the Class of 1967): Mr Conan Wu and Mr John Jeremy; and Female Attendee from the Earliest Graduating Class: the trail-blazing Ms Gayle Shapcott (Class of 1979). As a matter of interest, the next female graduate was Ms Jennifer Knox in 1991, with about one every two years since then.

An entertaining after-dinner speech was made by Mr John Jeremy with his reminiscences of the early days of naval architecture at UNSW. He brought along a museum piece: a tubular slide-rule (Fuller calculator) from Cockatoo Dockyard with an effective length of six metres (twenty feet), giving five significant figures! He had those present smiling and wondering where the time went.

The final speech was made by Mr Noel Riley, who claimed that Mr Jeremy was a hard act to follow. That notwithstanding, Noel put on his own special show and paid tribute to Mr John Tuft, the first person in charge of the naval architecture course, and to whom many in the room owed much for their solid grounding in naval architecture. He concluded by paying tribute to the present staff of the naval architecture course.

Graduates of UNSW have achieved considerable distinction in many areas of endeavour, including the high-speed-ferry design and construction industry, more traditional naval architecture, state authorities, national authorities such as AMSA, classification societies such as Det Norske Veritas, Bureau Veritas, American Bureau of Shipping and Lloyd's Register of Shipping, as well as a large range of consultancies. There is no doubt that our graduates have influenced the maritime community significantly.

Lawry Doctors
Phil Helmore

Thirty three years later, Conan Wu and John Jeremy with Senior Lecturer Phil Helmore at the reunion dinner.

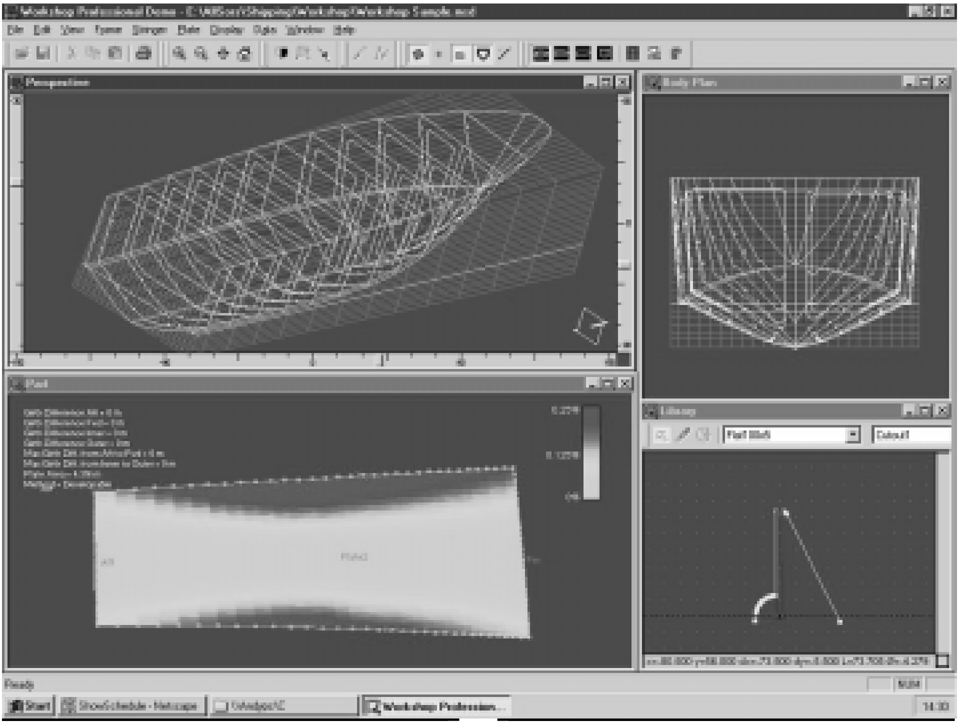
INDUSTRY NEWS

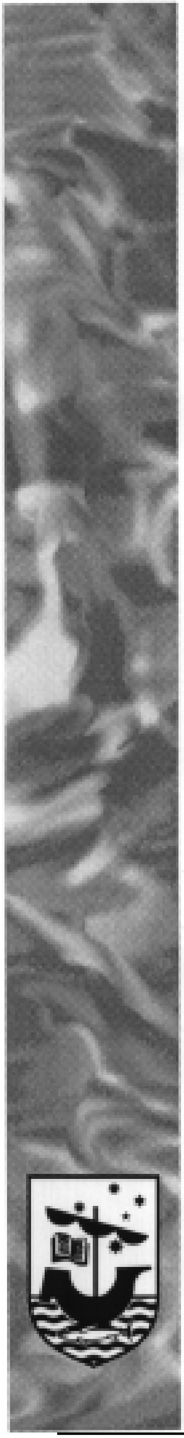
Formation Design Systems Releases "Workshop" Ship Construction Software

In January Formation Design Systems announced the release of Workshop for Windows, a ship and boat construction detailing software system. This new release of Workshop now runs on the Windows 95/98/NT platform and marks the final stage in Formation Design Systems' conversion of all of its marine software products to the Windows platform. Workshop offers a range of structural detailing capabilities including automated generation of longitudinals and stringers, definition of transverse frames with automatic cutouts, and definition and development of developable and compound hull plates. All of Workshop's capabilities are available via a point-and-click interface for defining parts directly on the hull surface as well as tabular and parametric definition of parts.

The Windows release of Workshop includes a range of new Windows-specific capabilities including tree controls to more easily manage shape and material databases, floating and dockable toolbars for frequently-used commands, and a new searchable on-line help system for both novice and experienced users. Workshop continues to offer the same suite of capabilities as its Macintosh version, including direct definition of parts from the NURBS surface model, automatic recalculation of parts in response to hull changes, and an integrated database of parts which can be exported to other Windows programs. Workshop for Windows is available immediately and is available in two versions: a professional version and a limited Workshop/P version which contains only plate development capabilities.

Workshop forms a part of the Maxsurf suite of naval architecture and ship construction software. Maxsurf is used by over 600 naval architects and shipbuilders worldwide to design and build vessels from 3-300 metres in length. Formation Design Systems develops computer aided design software systems for naval architects, shipbuilders, engineers and designers. Its products are available on Windows 95/98/NT and Macintosh platforms and are used by industry, educational institutions and government defence organisations.





LECTURER

SHIP AND OCEAN STRUCTURES

The Australian Maritime College is Australia's national centre for maritime education, training and research. AMC conducts the largest Bachelor of Engineering (Naval Architecture) course in Australia. In 1997 AMC commenced Australia's only Bachelor of Engineering (Ocean Engineering) course.

AMC is seeking to appoint a lecturer specialising in ship and ocean structures to join the Naval Architecture & Ocean Engineering department. Applicants should ideally possess a relevant higher degree, (preferably a PhD) together with appropriate industry and/or academic experience.

Salary is negotiable within the range $33,538 to $56,895 per annum commensurate with qualifications and experience. AMC offers a generous employer superannuation scheme. Relocation expenses are available.

Further information about this position is available from Dr Martin Renilson, Head, Naval Architecture & Ocean Engineering, tel: +61 3 6335 4770, fax: +61 3 6335 4720, email: M.Renilson@mte.amc.edu.au.

A position description, selection criteria and information regarding conditions of employment are available from Chris McGee +61 3 6335 4718. Email: C.McGee@corp.amc.edu.au

Applications including Curriculum Vitae and a statement addressing the selection criteria plus the names and addresses of at least two referees should be forwarded to:

The Manager - Human Resources (Applications)
Australian Maritime College
PO Box 986
LAUNCESTON TASMANIA AUSTRALIA 7250

APPLICATIONS CLOSE ON THE 27th of AUGUST 1999

Late applications may be considered in exceptional circumstances.

AUSTRALIAN MARITIME COLLEGE

Australia's National Centre for Maritime Education, Training & Research

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THE PREDICTION OF MOTION SICKNESS ON MARINE VESSELS

by
Dr Rohan Smith
Business Development Manager
Australian Maritime Engineering CRC Ltd

1. INTRODUCTION

The syndrome known as motion sickness or kinetosis occurs in a wide range of environments such as boats, cars, aeroplanes, spacecraft, trains, cinemas, fairground rides and virtual-reality devices. It is a normal reaction in healthy people and is generally characterised by pallor, nausea, cold sweating and vomiting. Other recognised signs and symptoms include yawning, increased salivation, burping, flatulence, changes in pulse rate, epigastric discomfort, headache and dizziness.

2. SUSCEPTIBILITY

Whilst susceptibility varies widely from individual to individual, certain trends have been identified based on factors including age, gender, exposure history, vehicle control, drugs, fear and anxiety, alcohol and odours.

3. SENSORY CONFLICT THEORY

The sensory conflict theory claims that motion sickness can be stimulated in environments in which the motion and orientation senses (i.e. vestibular system, visual senses and somatosensory system) send conflicting information to the central nervous system. For sea sickness, the primary stimulus is generally considered to be low-frequency vertical motion in the axis of a standing person together with the lack of correlation between the motion sensed by the vestibular system and the visual senses.

4. PREDICTIVE METHODS

ISO 2631/3

This standard provides "severe discomfort" boundaries for exposure to narrow-band whole-body vertical acceleration in the frequency range 0.1 to 0.63 Hz.

Motion Sickness Incidence

O'Hanlon and McCauley [1] presented a method of calculating the percentage of subjects who will vomit, the *Motion Sickness Incidence* (MSI), when exposed for two hours to a constant-magnitude sinusoidal vertical acceleration using the cumulative normal distribution function, whilst McCauley and Royal [2] presented an extension of this method to include exposure time as a variable.

Motion Sickness Dose Value : BS6841

The British Standard BS6841 [3] *Measurement and evaluation of human exposure to the whole-body mechanical vibration and repeated shock*, defines the Motion Sickness Dose Value ($MSDV_Z$) as:

$$MSDV_z = \sqrt{\int_0^T a^2(t)\,dt} \quad [\mathrm{m/s^{1.5}}]$$

where *a(t)* is the time-domain frequency-weighted vertical acceleration [m/s^2] and *T* is the total period [s] during which motion could occur.

5. KINETOSIS ACCELERATION

Whilst the incidence of vomiting for a given population is necessarily cumulative (i.e. cannot decrease) over a period of study, the instantaneous severity within a population may increase or decrease over time. Furthermore, when the stimulus is completely removed, the well-being of the exposed population can be expected to return to normal.

Smith [6] described a new measure, termed the *kinetosis acceleration*, that is representative of the instantaneous motion sickness severity within a population. Prior to the development of kinetosis acceleration there were no methods available to continuously predict motion sickness. The scope of the kinetosis acceleration formulation is limited to:

- environments in which the stimulus to motion sickness is low frequency (i.e. 0.1 to 0.5 Hz) vertical acceleration;
- subjects who are standing or seated with the z-body-axis (buttock to head) aligned in the vertical gravity axis; and
- subjects who are not habituated to the motion environment.

The kinetosis acceleration is particularly suited to environments in which the magnitude of the stimulus is intermittent or changing with time. In sea-going vessels, such environments can occur when vessels are operating in partially sheltered seas or making several course changes.

Cumulative Vomiting Incidence

Smith [6] presented an explicit relationship to calculate the cumulative *Vomiting Incidence* (*VI*) as a function of the peak kinetosis acceleration as:

$$VI = 100e^{(-1/a_k)} \quad [\%]$$

The relationship between cumulative incidence of vomiting and the cumulative peak of kinetosis acceleration is presented in Figure 1.

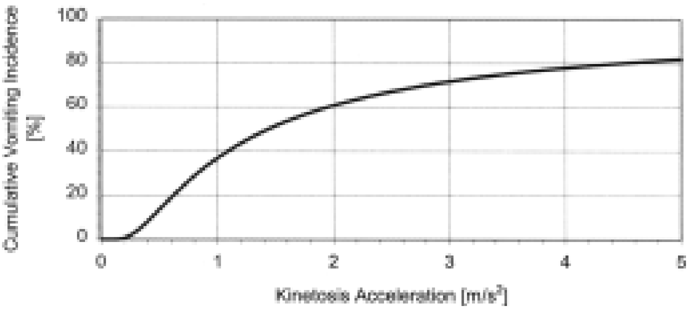

Figure 1. Cumulative incidence of vomiting as a function of the peak of kinetosis acceleration

Smith [6] calculated a correlation coefficient of 0.94 between the predicted cumulative vomiting incidence using Equation 2 and the corresponding observed vomiting incidence by McCauley and Royal [2].

Illness Rating

The subjective "Illness Response" is obtained by averaging the response by passengers to the question "How are you feeling" with choices 0 = "all right" through to 3 = "absolutely dreadful". Smith [6] developed empirical relationships that estimate the illness response for groups such as males and females.

6. FIELD STUDIES

During the course of the research, field studies have been carried out on two maritime training vessels, two passenger ferries [4], two wavepiercing catamarans [5] and a naval destroyer. In these studies, the motion of the vessels was recorded and the response of passengers (or crew) obtained.

Furthermore, Smith [6] presents an analysis of the combined data from the two passenger ferry studies using both the instantaneous severity measure, kinetosis acceleration, and the cumulative incidence measure, motion sickness dose value. This analysis included the surveyed response from 692 passengers, recorded over 43 separate trips ranging in duration from 25 minutes to 210 minutes.

A sample r.m.s. vertical acceleration (Figure 2) recorded on a wavepiercing catamaran, together with the corresponding motion sickness dose value (Figure 2) and the kinetosis acceleration (Figure 3) are presented below. The zero acceleration during the course of Figure 2 corresponds to the vessel being docked.

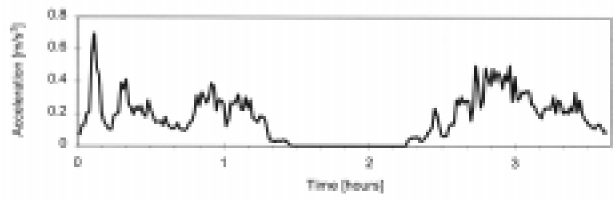

Figure 2. R.M.S. Vertical Acceleration on a wavepiercing catamaran.

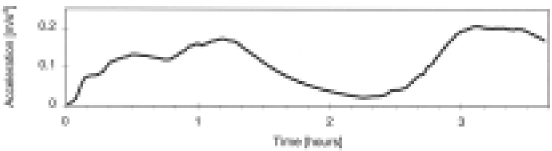

Figure 3. Corresponding kinetosis acceleration calculated from motion recorded on a wavepiercing catamaran.

7. PASSENGER COMFORT METER

A prototype has been constructed. It takes an accelerometer signal and continuously calculates parameters such as "percentage vomiting " and subjective "illness rating". Furthermore, it has digital output which can be potentially interfaced with other control devices (such as alarms, ride control or route optimisation) to input human comfort parameters.

By utilising three accelerometers a version could be constructed that calculates the parameters at any location on a deck of a vessel, thus potentially providing response in different areas on a vessel.

8. CONCLUSION

The research has developed a predictive measure that can be used to provide an instantaneous measure of the severity or incidence of motion sickness experienced by a population. Further empirical relationships can be used to estimate parameters such as percentage vomiting and illness rating from the predictive measure. A portable device has been produced to continually calculate and display these parameters based on the input signal from an appropriate accelerometer.

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FORENSIC NAVAL ARCHITECTURE

Bob Herd's series of articles on Forensic Naval Architecture will continue in the next edition of The Australian Naval Architect. *In his first article (see ANA Vol. 2 No 3) he discussed the loss of the Daring class destroyer HMAS* Voyager *in February 1964 after collision with the aircraft carrier HMAS* Melbourne *and the loss of the bucket dredge* W. D. Atlas *by capsize in 1965. It prompted Bob Halliday to write the following letter:*

After the tenth of February 1964 the reports in the media highlighted those aspects of the tragedy which were sensational but I did not find any reliable indication of the tracks of HMAS *Melbourne* and HMAS *Voyager*. In fact, the information given in your paper in The Australian Naval Architect enabled me for time first time to make a rough plot.   Now, in 1998 I realise that the model tests done by Vickers at St Albans in England around1928 might be relevant. These tests explored the possible role of ship interaction in the loss of the Sydney Ferry *Greycliffe* after a collision with the liner *Tahiti* in November 1927.

In your paper you note that: "A suggestion was made to Counsel assisting by a member of the public that interaction between the two ships had been significant." The writer of the letter referred to tests conducted at Sydney University following the collision between the ferry *Greycliffe* and the passenger ship *Tahiti*. Up to that time no tests had been carried out at Sydney University. I would surely have known about any tests in the Ship Model Test Tank in the Hydrodynamics Laboratory, and before that tank was commissioned the only facility in the Engineering School was an 18 inch wide flume. The letter referred to tests carried out in the ship model tank at St Albans. A movie film record of those tests was regularly shown to 3rd year engineering students at Sydney University by Mr Keith Hart to illustrate his lectures on dynamic similarity (theory of models). A model of the liner *Tahiti* was towed by a winch attached to the towing carriage while a model of the ferry *Greycliffe* was clamped to the carriage so that the models were running on parallel tracks with the larger model overtaking the smaller. As the bow of the larger model approached the stern of the smaller model, the latter was unclamped and allowed to run free. In the majority of the test runs recorded on the movie film the ferry model abruptly changed course and cut across the bows of the liner model. In many cases a collision occurred with the ferry model broadside across the bows of the liner model. The action was quite startling, but even if a high-speed camera had been used and the film screened at normal speed to properly adjust the time scale the action would have still seemed abrupt, even violent.

The notion of the ferry model being "clamped to the carriage'' calls for some explanation about the role of this clamp. A ship model is very heavy compared with the drag to be measured by the drag force balance. During almost all model tests the clamp is used to steady the model as the carriage is accelerated and decelerated. This saves the drag force balance from gross overload. Once constant speed has been achieved, the clamp is eased and then released as the towing force balance takes the towing load. Before the tests the model would be floated into position and the clamp engaged. Usually the clamp was designed to allow the tank operator to ease the model onto the drag force balance so that the initial disturbance to the balance was minimal. It is highly likely that this clamp was used to hold the ferry model. The drag force balance would have been raised up out of the way. Certainly the need to release the ferry model without introducing any bias would have been recognised as a critical factor when conducting the tests.

While the liner model was guided and towed by a winch, a towline attached to the ferry model would have introduced a very serious bias and utterly inva1idated the tests. It was essential that the ferry model be free-running. Since the ferry model was not self-propelled it would be 1osing speed and so the point of release from the clamp was a compromise between having an ideal free-running model and a model which had not lost too much momentum. The effect of varying the point of release was explored, but this was nevertheless a somewhat unsatisfactory feature of the test procedure.

There is no doubt that the use of radio-controlled free-running self-propelled models would have been a far better technique, but these tests were run around 1928 when suitable equipment was not available. For self-propulsion tests the bare hull model was run on the drag balance and the model propeller was run on a propeller dynamometer separately attached to the towing carriage. The propeller was mounted ahead of a streamlined pod containing a Z-drive, while the torque balance, the thrust balance, the tachometer, the driving motor and the speed control gear were all placed at a convenient level on the towing carriage. The propeller was then moved into the correct position re1ative to the hull but was not otherwise connected to the hull model. The propeller dynamometer was a heavy piece of machinery and the electric motor alone would have sunk most models.

Consulting naval architect Ceci1 Boden also investigated the loss of the *Greycliffe*. He carried out similar model tests in a channel used by the Sydney Water Board at Prospect. A substantia1 carriage spanned the channel and traveled on rails along its length, being normally used for cleaning and servicing the screening and sedimentation equipment. Mr Boden adapted the carriage to act as a towing carriage for the model tests. Both series of model tests showed that hydrodynamic interaction was a possible cause of the *Greycliffe* disaster. However both series of model tests showed that a collision would only occur in one particular combination of the relevant parameters. These were the speed of the liner model, the speed of the ferry model, the course separation and the moment of release of the ferry model. Mr Boden concluded that it was highly improbable that such a combination of circumstances would have occurred at the time of the collision.

The case went to the Privy Council. According to Keith Hart the evidence of a tug-master seemed to have been significant. At any rate the Law Lords rejected the hydrodynamic interaction theory. For my part I believe the evidence of the tug-master was no more relevant than the flowers that bloom in the spring, and I will explain why it was so a little later in this discussion. However I am not saying the hydrodynamic interaction caused the disaster, but rather that the possibility was real and it was rejected for the wrong reasons.

The notion of hydrodynamic interaction between ships had been dismissed by men who navigated ships at sea as rubbish. Stuff and bloody nonsense! There were several reasons for this, the most important being that the men who could have passed on the lessons of their experience did not survive the collisions. When the Royal Navy was embarrassed by a large number of unintended collisions during the "Cod War" with Iceland, the reality of interaction was at last being recognised. While these were of the "side-swiping" kind rather than being fatal, there were far too many incidents to be explained away as momentary errors of judgement. Another reason why little credence was afforded to the interaction theory was the experience of nava1 commanders keeping two ships side by side during replenishment operations at sea. The ships tended to repel one another. A ship passing through a canal tends to sheer away from the bank. Against this, among the casual proponents of the various interaction theories, there was the usual talk of suction. The work of Daniel Bernoulli was blatantly misrepresented. Certain1y some regions of reduced pressure have been measured during laboratory tests, but the forces have been less by an order of magnitude than the forces predicted by misapplying Bernoulli's theorem.

In the nineteen seventies I had set up a slotted working section in the 3 foot by 4 foot flume in the Hydrodynamics Laboratory for work on the 12 metre class yachts. The *Greycliffe* disaster had come up in casua1 discussion and I tried some model experiments. Since I could not justify the allocation of significant resources to the job, I used two existing models which represented nothing in particular, and let the smaller model fall back from a position ahead and to starboard of the larger model. As the stern of the smaller model was coming abreast of the bow of the larger model, the former veered to port and ended up broadside against the stem of the larger model. Even allowing for the scaling of the time interval, the action could fairly be described as violent. My crude, (one could say "scatter-brained'') model tests duplicated what had been shown in the movie film record of the St Albans' tests where the *Tahiti* and *Greycliffe* models had been accurately formed to the same scale ratio including the righting arm and radii of gyration of the free-running ferry model. The St Albans' tests explored a range of speed and relative speed of the models, the separation of the parallel courses and the timing of the release of the ferry model. The range of experimental parameters was chosen to match the best evidence from the initial inquiries, and to allow for probable errors in the estimates made by witnesses. The ferry was travelling at normal cruising speed. The liner was ignoring harbour limits and overtaking the ferry. As stated previously the St Albans' tests did not show that hydrodynamic interaction was the cause of the tragedy, but they did show that interaction was a possible explanation.

Now let me attempt to analyse the observed hydrodynamic interaction between the models. Several things must be clearly understood. (a) The smaller model must be between one third and one half the length of the larger model. If much smaller, out-wash from the bows of the larger model would merely push the smaller model out of the way. If the smaller model were approaching the size of the larger model it would respond with a very much slower rate of yaw, which in the case of a real ship could probably be corrected by the helmsman without any drama. (b) The two models must be on more-or-less parallel courses and the spacing must be around the length of the smaller model or less. (c) The larger model must be overtaking the smaller model or the latter falling back relative to the former. (d) Suction is not involved. The phenomenon depends on the repulsion due to the sideways movement of water as the bow of the larger model pushes the water out of her way. Fairly full bow lines such as one would expect to find on a passenger liner or an aircraft carrier are needed on the larger model. An aircraft carrier with fine lines at the water surface and a bow bulb would act like a concentrated travelling source. The strongly concentrated out-wash would have a localised action on the stern of the small model and produce the startling rate of yaw. (e) The smaller model is not sucked towards the bows of the larger model. The smaller model's own momentum (and her propulsive machinery in the case of a ship) drive her across the bows of the larger model after the heading of the smaller has been changed by the repulsive force on her stern. (f) Ships are not directionally stable. For an aircraft to be considered directionally stable it must resume its original heading after a momentary disturbance in yaw. A ship is considered to be directionally stable if it settles to a new steady heading after a disturbance in yaw. For a ship to be stable in the aeronautical sense, it would need to be fitted with enormous skegs extending aft and down so that the extra viscous resistance and draught would be unacceptable. Since ships respond very slowly compared with aircraft the human navigator can cope quite well with this instability. (g) As outlined in the last clause, the ship has inherent directional instability and this reduces the size of the rudder needed for effective control in most circumstances. (h) However in the exceptional circumstances outlined in this paragraph, the smaller ship may not have sufficient control to escape disaster. Even if she has, the delay on the part of the navigator in detecting and diagnosing the problem, and the delay on the part of the ship's systems in responding to the initial command, may prevent control action being effective in the short time available. (i) The instability outlined in earlier clauses also means that the rate of yaw is enhanced and this may go a long way towards explaining the unexpectedly high rate of yaw in the St Albans' model tests.

Now I must add a personal note. I was not involved in any way with the inquiry into the *Voyager* disaster. I had no idea of the track of each ship and no reason to make any inquiries. Until I carefully read the report in The Australian Naval Architect (Vol. 2, No. 3, October 1998) I did not relate the cause of the collision to the St. Albans' model tests for the *Greycliffe* tragedy. Now I am starting to wonder. The *Melbourne* and the *Voyager* would have been making a good speed if flying operations were about to commence. They were on more or less parallel courses. The *Voyager* was ahead, and was falling back relative to the *Melbourne* while veering to starboard away from her. I would imagine the navigator intended to pass down along the starboard side of *Melbourne* and take up station 1,000 yards to the rear and match her speed. The *Voyager* was around half the length of the *Melbourne*. The bows of the *Melbourne* would be as full as the bows of the *Tahiti*. Taken all round the similarities are startling. It would be more plausible to suppose that the hydrodynamic interaction caused the fatal change in heading to port than to suppose it was a navigational error. The order ''full ahead both, hard-a-starboard" was given in vain. Indeed, "full ahead both" would have contributed to the disaster.

Returning now to the evidence of the tug-master before the Privy Council, it should be plain that a tug does not fit the picture. Even in 1927 a tug would have been too short, while having relatively high propulsive power and a large rudder designed to manage not only the tug herself but a larger vessel as well. She would not have been fussing around the bows of a ship travelling at cruising speed. For these reasons the tug-master's experience was not relevant.

When the *W. D. Atlas* was lost, I was asked about some points which had been made in the evidence given by survivors to the Court of Inquiry. In particular one statement seemed hard to believe. The dredge was said to have rolled on its side and balanced there for four minutes before capsizing. Another question related to the adequacy of the clearing ports. The well of the dredge was thought to make clearing ports unnecessary. Again the dredge was said to have been lying disabled at 45 degrees to the wave crests and windage on the top hamper was thought to be the cause. The dredge may have fared better if she had lain parallel to the wave crests.

In order to gain some insight into these matters I picked up a timber plank and roughly shaped it to represent the *Atlas*. I hacked a well out of the aft end and fashioned a head frame using dowel rod with lead weights at the top to roughly represent the known stability of the dredge. A strip of sheet aluminium served as bulwarks of the correct height and holes were drilled to represent the clearing ports.

The wave-maker in the Sydney University ship model tank was set up to produce waves representing (as close as I could guess) the conditions which sank the dredge. The model was placed in the tank, heading into the waves. It soon took up a heading at 45 degrees (more or less) to the wave crests. There was no wind in the model tank, so the differential drag of the well was probably the reason for this. The model would roll and pitch scooping up water on the weather bow and transferring it across the deck to the lee quarter. The clearing ports were quite inadequate and the well did not help to get water off the deck. In fact the well may have added to the water on the deck. Finally the weight of water on the lee quarter, aided by the momentum of the water washing across the deck, rolled the model onto her beam ends where she hovered for maybe ten seconds before capsizing. This experiment was repeated many times. However when the bulwarks were removed, the model would not capsize.

The hesitation of the model was timed and when scaled to the full size of the dredge was of the order of several minutes. This agreed with the verbal account of one witness who estimated four minutes. The importance of this exercise was that it gave credibility to the witness.

I had met Admiral Dieudonne who was in charge of the French maritime disaster investigation laboratory. Professor P T (Tom) Fink once recalled that the Admiral had insisted that ships did not just roll over and sink but rather that the losses were due to the action I have just described in relation to the dredge model. I thought this was rather significant.

The model was crude to the point of being ludicrous yet it yielded valuable insight. Naturally such a model or results obtained from it would not be a suitable basis for a report to a Court of Inquiry. Nor could I consider asking the University accountant to charge a fee for the demonstration. However one senior barrister and his retinue visited the laboratory and spent quite some time pacing up and down the beside the tank, saying nothing and watching this ugly chunk of wood capsize over and over again. For me, that was reward enough. That was the last I heard of the matter officially. There was no request to do a proper investigation. From unofficial sources I heard some rather strange and startling stories about the last hours of the *Atlas* and her crew. I have often wondered if those stories were true.

I look forward to the continuation of your report in The Australian Naval Architect and I trust I will find it as interesting as the first part.

Bob Halliday

Bob Herd relies:

Thank you for your careful consideration of and comments on my first article in The Australian Naval Architect, particularly your thoughts on the loss of *Voyager*.

My introduction to the phenomenon of interaction occurred just after I started studying at Glasgow University in 1948. Professor Robb, who had been a technical adviser to Cunard-White Star in their actions against the Admiralty in the aftermath of the *Queen Mary - Curacao* collision, gave a lecture on the subject; the House of Lords appeal having recently been completed.

Later, in the course of his lectures on the subject of ship resistance the topic was considered again [6]. In the interim, the Professor gave a paper *Interaction between ships* which reported on the tank tests conducted at NPL on behalf of Cunard-White Star [3]. Professor Telfer, who was a consultant to the Admiralty, had conducted similar tests earlier. So far as I am aware, details of these tests were not published, though Professor Telfer did refer to them in his discussion of Chislett's paper on *Replenishment at Sea* [4]. The significant feature of these tests were that they related to pressure effects in deep water with vessels abreast on parallel or near-parallel courses. By way of contrast there were two earlier incidents, one a collision, the other nearly so, where the influence of the pressure field surrounding a ship was involved, but this time in shallow water.

The first was the collision between the *Olympic* and HMS *Hawke*, a cruiser, in the Solent when the liner was commencing her fifth voyage [7, Page 95, 8, Page 13]. The second was the near-collision between the *Titanic* commencing her maiden voyage from Southampton and the American passenger liner *New York* whose mooring lines broke under the influence of the pressure field surrounding the departing *Titanic*. Both these incidents occurred in shallow water.

Dr Gawn in his discussion of Robb's paper [3] stated that model tests of the *Olympic - Hawke* collision were made and published some time later, though I have no reference to them. In 1913, however results of an extensive series of tests carried out for passing vessels in what was said to be effectively deep water were reported [1].

The tests carried out for *Greycliffe* and *Tahiti* would, I expect, be shallow water tests because of the location of the collision. Subsequently Ian Dand [5] has reported on the influence of a large vessel on its attendant tug at varying longitudinal positions and separation. All these tests have been carried out on vessels which were overtaking or steaming on parallel courses, mostly in shallow water conditions.

I feel now, as I did in 1964, that the circumstances of the *Voyager - Melbourne* collision are different. Firstly the depth of water was such that it could be regarded as deep (beyond the 100 fathom line I believe). Secondly is the question of how far ahead of a vessel its pressure influence may be felt. The only research done on this question that I am aware of is that by Gawn done during the war in the fight against pressure mines and reported in [2]. Again, this is research conducted into shallow water effects. The changes in pressure which precede the hull do not extend to significant distances ahead of the ship. For a ship of 428 feet LWL, 14,000 tons displacement, 28.5 feet draught proceeding at speeds of 6 to 12 knots in 68 feet of water, the pressure influence ahead did not extend more than 300 feet from the fore end of the waterplane. Abeam, even at distances of 153 feet off the keel the effects were still evident.

Reverting to the *Voyager - Melbourne* manoeuvres, the destroyer was instructed to take up Plane Guard Station No. l when the carrier was proceeding in a generally southerly direction. This station requires the destroyer to take station at a distance of 1000 to 1500 yards from the carrier on a bearing of 200° relative to the flight operations course, i.e. on the port quarter of the carrier. The destroyer must maintain this relative bearing and keep within the distances while flying is in operation. At 1000 yards distance the separation of courses would be 342 yards and at 1500 yards distance 513 yards. By way of comparison *Melbourne* had an overall length of 710 feet 6-1/2 inches (approximately 237 yards) and *Voyager* 390 feet (130 yards)

Because of inability to find enough wind to commence flying operations, *Melbourne* ordered *Voyager* to turn together to a course of 020° firstly and then to a course of 060° and subsequently advised that the flying course was 020°. Turning together meant that the ships turned together maintaining true bearing and distance. With the carrier steering 060°, the destroyer would then be in a position on the port bow. With the carrier steering 020° the destroyer would be on the starboard bow. If the destroyer was in station then I feel that she would not be within the sphere of the carrier's pressure field, based on the references I consulted.

The trouble began with the last signal that the flying course was 020°. The Navy experts could not agree on whether this meant that the destroyer should immediately move from the starboard bow into Plane Guard Station No. l position on the port quarter. Some felt that the order "Execute" should have followed before the destroyer moved.

The carrier's bridge staff when they saw the destroyer commence a starboard turn did not know if the destroyer proposed to come round in a wide turn and come into position astern or to "fishtail" by port and starboard helm movements which would slow the destroyer down till the carrier passed when she could cut across astern into position. In this manoeuvre, some interaction could be possible. In the event, the starboard turn became a wide turn to port bringing the destroyer almost square across the bows of the carrier. On this basis, it did not seem that interaction was a factor of significance.

The above explanation is, I know, lengthy but tries to follow the background to my decision to recommend to Counsel Assisting that the *Greycliffe - Tahiti* tests not be followed up (as best I can recall 35 years on).

Turning now to *W.D. Atlas* and your experiments on its mode of capsize, Admiral Dieudonne's observations on the mechanics of capsize do not always hold. Vessels such as the *Edith Terkol*, *Helland Hansen*, *Gabriella*, and *Kaptain Nielsen*, among others, have in fact gone straight over. On the other hand *Blythe Star*, *Straitsman*, and *Estonia,* for example, have in fact capsized in the manner he states and you have established by test. The stability of *W.D. Atlas* was better, at least initially, when the single-bottomed engine room was awash above floor level. The well for the dredging arm was at the fore end of the *Atlas,* though I doubt whether that would have made any significant difference to your experiments.

As I recall the evidence, the well found between the bulwarks and the deckhouse was filled with water continuously. The fact that the well for the dredging arm forward was open seemed to do nothing to relieve the vessel of water and, as you say, could have contributed to the water on deck when the vessel was wallowing. I knew the Master of the *W.D. Atlas* from my time with ANL as he was on leave from there, a fact which caused his widow considerable trouble in establishing her claim to his super.

During the course of the Preliminary Inquiry (I was an assessor to that as well as expert witness to the Court of Marine Inquiry) we listened to the Sydney Radio tape of the last hours of the vessel up to the time the Master said that they were abandoning the ship. The story as presented by the few survivors was a rather grim tale.

Bob Herd

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DESIGN AND CONSTRUCTION OF SHELL TANKER HELIX

A 40,000 DWT PRODUCT CARRIER FOR SHELL AUSTRALIA FROM CONCEPT TO DELIVERY

by
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This paper was first presented to a combined meeting of the Institute of Marine Engineers and RINA in Victoria on 21 October 1997. It presents an overview of the process involved from concept to delivery of the Shell tanker *Helix.* The financial, commercial and management issues are discussed as well as the design and construction of the ship. The elapsed period from the start to the end of the story is about five years.

1. THE CONCEPT

The initial concept to build a new products tanker dates back to 1991 and was linked to a decision by Shell Australia to fully utilise the production capacity of the new catalytic cracker unit at the Geelong refinery. The total output of the new cracker, coupled with other production facilities at Geelong, exceeded requirements of the Geelong Refinery supply area comprising inland Victoria and southern New South Wales, Tasmania, Queensland, Esperance and the Pacific Islands. It was therefore decided to export the excess production to Darwin and north-west Australia, an area traditionally supplied from Singapore.

To accomplish this task Shell required a coastal tanker of approximately 40,000 dwt suitable for the transport of multi-grade cargoes of up to eight different products. An initial search of the market for ready-built new ships proved fruitless, the majority of vessels not being suitable for one reason or another. Shell were looking for a vessel with a minimum of 14 cargo tanks to adequately cope with multi-grade cargoes, as well as the carriage of crude and condensate back-haul cargoes from Western Australia. The latter requirement also meant the ship would have to be fitted with a mooring system acceptable to the offshore terminals in the west and, of course, the ship had to comply with AMSA requirements and be acceptable to the Australian maritime unions.

Eventually, having determined that no ready-made, suitable ship was available it was decided to bare-boat charter a vessel as a stop-gap until such time as the company could design, tender for and build a new ship. Subsequently the *Osco Star* which was on time charter to Shell Australia was selected as the most suitable vessel available and the ship was chartered for an initial three year period commencing April 1992. As a matter of general interest, about A$400,000 was spent on the vessel to make it suitable in all respects for Australian flag, A$100,000 of that money being spent on a new galley and A$200,000 on modifications to the mooring equipment.

Thereafter the process of acquiring a new ship commenced with the preparation of an outline specification and, in parallel, the development of the financial justification to go before the tender board. An initial justification was required to enable the whole process to get underway and thereafter, of course, a tender board decision was required to make the final selection of ship builder.

However, I will not dwell on the new ship acquisition process that was initiated in1992 following the bare-boat charter of *Osco Star,* as the project eventually stalled when management failed to gain board approval for the capital expenditure required. The immediate outcome was a decision to extend the bare-boat charter of *Osco Star* for a further three years until April 1998, a decision which in hindsight was ill founded.

Early in 1994 a change in senior management within the Oil Products division of Shell Australia resulted in a re-assessment of the coastal freighting business and a new strategic plan emerged. The plan called for the construction of a new vessel but for different reasons to those outlined above. A number of business premises had developed in the interim:

- The development of refinery exchange business with other oil companies and
- The Geelong catalytic cracker not performing up to expectations, resulting in the emergence of a whole new strategy.

It was established that, by operating one ship instead of two, capable of delivering in excess of 1 million tonnes

The Shell tanker *Helix*
(photograph by Marine Photography)

of product per year and with an increase in refinery exchange deals, a 30% reduction in primary delivery costs could be achieved. Other quantifiable benefits were identified associated with the more efficient use of energy resulting from a lower fuel demand for tank cleaning, tank heating, inerting and cargo pumping operations. *Conus*, whilst still performing well at 13 years age, was becoming too small for the task and supplementary tonnage was being chartered in from time to time. Consequently a decision was taken in early 1994 to construct a new coastal products tanker to replace *Conus*. The basic reasoning was simple – cut costs by having a single-ship coastal operation, with NW Australia reverting to supply ex-Singapore.

Other reasons in support of the decision to replace *Conus* were:

- Quality standards were being tightened and a parcel-type tanker was considered more desirable for reasons of product segregation and cargo outturn
- Dredging of the Geelong channel was being planned and there was an opportunity to substantially increase the cargo lift from 30,000 tonnes to 40,000 tonnes. This in itself was a very important factor as it represented an overall saving in freight costs of approximately 30%.
- Environmental pressures were leading towards a preference for double-hull tankers. There are of course operational benefits in operating double-hull tankers. The main features are a tank structure generally clear of structural steel making cleaning much easier, and the opportunity to fit suction wells within the double-bottom structure which greatly enhance the tank draining characteristics.
- High shore-based maintenance costs escalating rapidly on older tonnage coupled with the increasing difficulty and high cost of sourcing Japanese-made spares as required for *Conus*.
- More efficient machinery coupled with Greenhouse compliance criteria. Shell Australia is a signatory to the Federal Government's Greenhouse Challenge and whilst ships' emissions represent a very small proportion of the total industry the new ship nevertheless contributes to the overall improvement target.

2. DESIGN

In considering the issues relating to design I will take them in order of priority and, as you will note, some of these are related to the reasons for justification stated above.

2.1 The Hull

The concept was to build a ship capable of lifting the maximum quantity of refined products at the new Geelong draft of 11.3 metres whilst meeting the constraints of all discharge ports in Australia and the Pacific Islands. This meant that we were limited to a length of 183 metres, a beam of 42 metres and a design draft of 11.3 metres. The average cargo specific gravity was determined at 0.75 which called for a high cubic capacity of 54,000 m^3 to meet our target design deadweight of 40,000 tonnes. One of the parameters controlling the length is the limitation for exempt Masters at the port of Geelong.

Service speed was specified as 14.5 knots laden and 15.2 in ballast to be achieved at a CSR of 85 % of MCR.

The cargo tank configuration was an important factor in the hull design as the vessel was being purpose-built for a highly specialised trade which demands flexibility to cope with a large number of grades whilst achieving high standards of segregation to preserve quality standards. Based on an estimated maximum of twelve grades per voyage in varying quantities plus the heating of some grades, the final design called for a total of 22 cargo tanks varying in size from 500 cubic metre slop tanks to a maximum size of 4, 500 cubic metres including four special products tanks of 1,000 cubic metres each.

To achieve the most suitable cargo tank configuration within the shipbuilder's design constraints, a centre line bulkhead was required with a port and starboard tank arrangement. The outline specification provided approximate cargo tank sizes only and it was left to the shipbuilder to determine the most suitable transverse bulkhead positions based on their standard designs. To accommodate heated cargoes it was decided to provide heating for those cargo tanks positioned from the cargo manifold to the aftermost tanks. Steam-heated deck heaters were specified except for the slop tanks which were fitted with conventional coils. The specification also sought a quotation on an alternative thermal oil heating system but this was later ruled out because of the high cost.

The cargo tank structure called for scantlings that would withstand sloshing forces with the tanks filled to any level and the deck structure was required to be inside the tanks rather than external as is common in modern construction techniques for product-type tankers. This requirement may not have been in the best interests of a clean internal structure but it was considered necessary to have a clear deck in view of the continuous access requirement in the very intensive coastal trade for which the ship is designed. The safety of personnel was also seen as an important consideration as well as the high maintenance load the external structure can generate. Sloping floors were specified for the cargo tanks but were later discounted for reasons of cost. Instead it was decided to arrange the suction wells on the port side of all tanks so that a slight list in one direction would enhance final draining.

The hull form was a matter for the shipyard designers but clearly called for the most efficient achievable with the limitation of the block coefficient determined by the large cubic capacity requirements of our design. Model tests of resistance, propulsion, cavitation, seakeeping and manoeuvring were specified to verify the design for both laden and ballast condition.

Additional special features included the fitting of a 20 tonne thrust bow-thruster driven from the cargo pump hydraulic system and a Schilling high-lift rudder. Deck machinery was specified as totally enclosed, and hydraulic equipment with remote control access from suitably-located positions at the ship's side. Initially the deck hydraulics were to be integral with the cargo system; however, later in the design phase it was decided that a separate low-pressure system would be more suitable, avoiding the need to operate the main system during cargo loading operations

One of the most important aspects of the hull specification, the painting schedule, was spelled out in some detail. In particular, the cargo tank system had to be compatible with cargo grades comprising black and white petroleum products plus hydrocarbon-based chemicals and a maximum cargo temperature of 85 degrees Celsius.

Within the hull specification was the material list for pipelines and valves which included a requirement for all ballast tank lines to be glass reinforced plastic.

The navigating bridge specification called for the latest technology in navigational equipment including electronic charts and suitability for one-man operation. Accommodation was designed in accordance with the usual high standards of Australian ships with cabin spaces separated from the working areas.

The fire control management required ship-wide coverage using an analogue addressable-type system including IS detector heads and manual call points. A gas detection system was specified for the double hull and cofferdam spaces and an oil mist sampling system covering all areas where fuel, lubricating oil and hydraulic oil under pressure was present.

2.2 Cargo System

The demands of ever-tightening quality standards left no doubt that the ship had to be of a parcel-tank type design to provide the most reliable segregation between cargo grades. However, there had to be a compromise between segregation and the number of loading/discharge manifolds to enable the ship to operate efficiently at several terminals, with anything from a single hose to a maximum of four lines for discharge. The compromise was four main manifolds and four smaller manifolds associated with the 1,000 cubic metre special products tanks plus a line crossover system adjacent to the manifolds.

The choice of a hydraulic motive power cargo pumping system as opposed to an electric powered system was based on a number of factors. First and foremost it was the reliability factor based on recent Shell International Marine experience. Then there was the prospect of integrating the cargo hydraulics with deck machinery and the bow thruster, although as already mentioned it was later decided to separate the cargo and deck hydraulics whist retaining the bow thruster within the cargo hydraulics system. The inclusion of the bow thruster called for a slightly larger hydraulic power pack which comprises three diesel-driven and two electrically-driven units.

Another consideration, although less important was the variable-speed control available with the hydraulic units which enables a high degree of control over discharge rate. They are self-stripping and provide for controlled circulation of product through the external cargo heaters. External heaters took preference over internal coils for reasons of cost, maintenance and a clean cargo-tank design. An essential feature for a ship engaged in coastal trading with frequent changes of cargo grade is an efficient tank-cleaning system enhanced by minimising tank pipework, structural steel and associated shadow areas.

For cargo measurement we specified a radar-type installation, again based on past experience in respect of accuracy and reliability. Other ancillary equipment such as the inerting system and valving was at the discretion of the shipyard but ultimately with owner's approval. Comprehensive monitoring of cargo tanks for level, high level, temperature and pressure also featured in the cargo system design package.

2.3 Main and Auxiliary Machinery

The main engine design parameters regarding MCR and CSR operational ratings and other basic factors such as two-stroke single-acting crosshead-type engine were included in the outline specification as well as a verbally-expressed preference for a Sulzer unit. The latter preference was based on the excellent operating experience that Shell Australia has had with Sulzer engines which has not really allowed the opposition 'to get a foot in the door'. However, recent operating experience on a bare-boat chartered ship with an engine from another builder did not exactly enhance their opportunity of selling one of their units.

The propeller was to be fixed pitch and the tailshaft bearing a non-metallic synthetic. Diesel generators were specified in very general terms, with two important parameters being continuous operation on heavy fuel and their ease of maintenance and serviceability in Australia. The power and number of machines would later be determined by the builder once the power requirements had been determined, but we did stipulate a minimum of three sets with any two carrying the full port load. Sulzer units were eventually accepted subject to strong pressure from the shipyard who have financial interests in Cegelski Sulzer.

The boiler plant required consist of a separate boiler and waste heat unit designed for automatic, simultaneous operation with a burner unit capable of burning sludge. Steam was required primarily for cargo heating, tank cleaning, bunker heating, fresh water generators and domestic water. Two sea water evaporating plants rated at 20 tonnes per day with at least one to have dual jacket water and steam heating arrangements were required.

With respect to other machinery there were no radical variations from conventional engine room equipment. To provide a few examples:

- a central fresh water cooling system was specified;
- rotary air compressors except for the main engine starting air units;
- a rotary vane steering gear to cope with the requirement to turn the Schilling rudder through angles of 65 degrees; and

- a fully integrated machinery and cargo control room control system from one supplier, with all monitoring control and alarm processing facilities from VDU work stations.

There was considerable debate about the control room locations with our previous product carrier having a combined engine/cargo control room at accommodation deck level. However, in the end it was decided to have separate engine room control station located within the engine room and the cargo control room in the administration area one deck above main deck level.

A further consideration in the design and selection of equipment was the criterion for the reduced manning of Australian ships.

2.4 Electrical

The specification for the electrical system covered the broad parameters such as quality of materials, certification of equipment for hazardous areas and the fact that all control circuits, including components such as timers, relays and electronic control units, had to be fail-safe.

The supply and distribution system was in accordance with SOLAS standards, with services generally distributed between main and emergency switchboards to ensure continued operation of the propulsion plant and cargo and ballast systems in the event of one switchboard losing power. Two 24 volt systems were incorporated, one for general and one for security services with the first backing up the latter, plus dedicated uninterruptable power supply systems for computer and microprocessor systems, gyro and communications and instrumentation for essential services.

The electrical generating system called for a power management system for automatic start up, synchronising and connection of stand-by units in the event of failure, low frequency or voltage, and overcurrent. This system also blocks the start-up of heavy consumers in the event of insufficient on-line capacity.

3. TENDERING

The tendering for *Helix* was split into two phases, the selection of the builder based on the best specification and most competitive bid, and the selection of a finance house to provide the most competitive package based on an operating lease. The financial deal was secured by Citibank who set up a shelf company called Phinda to provide the vehicle for the transaction. An operating lease for seven years plus an option on a second seven was the basis of the deal. A South African Company, Unicorn Lines, also became part of the arrangement by taking up the residual risk at the end of the first seven years of the lease.

The shipyards selected to tender were recommended to Shell Australia by Shell International Trading and Shipping who had been engaged as the project managers. A total of fourteen yards were chosen from Korea, Japan, Europe and the USA. Some additional yards became involved as a result of the finance tender in that some finance houses preferred to work on the basis of a total package in conjunction with selected shipyards. This led to the introduction of Sembawang Singapore and Uljanik Croatia.

As it turned out the inclusion of the latter mentioned yards was a benefit in that very few of the fourteen yards invited to tender actually returned an offer and some of those that did, quoted prices that would indicate a distinct lack of interest. Others could not meet our delivery date. Three yards were short listed - Szczecin Poland, Uljanik Croatia and Sembawang Singapore with Asterillos Spain, Halla Korea and Newport News USA on the reserve list. The shipyards on the reserve list could only provide modified standard hulls which were not strictly in line with our specification but, with the very limited short list it, was considered prudent to keep them interested.

The reason behind the seeming lack of interest by certain shipbuilders in response to our tender invitation was clear. These yards had strong order books and were not interested in becoming involved in a single ship order. More particularly, the required ship was to be a purpose-built unit which did not fit into the parameters of a typical, standard design. However, one of the yards was building a series of similar-sized vessels for Unicorn Lines, South Africa, and whilst our ship was different, there was enough in common to limit the additional design work. The yard was Szczecin, Poland, with whom Shell had had no previous experience.

Once the initial offers had been received the next step was to compare the specifications and prices of the three short-listed yards and compile cross-reference lists to ensure an accurate assessment and equalisation of prices. Once this process was complete the three yards were invited to London for discussions during which their specifications were analysed in some detail and modified where necessary to comply with Shell Australia requirements. At this stage there is always room for some compromise; however, certain aspects of the design remained critical and mandatory.

During the second round of discussions, the representatives from the Polish yard demonstrated a technical proficiency and a willingness to cooperate with the owner. The attitude towards the yard changed to a position of keen interest. By way of example, their willingness to meet the owner's position was clearly demonstrated when they agreed to change from a four-cylinder to a six-cylinder main engine. This was not a minor change but as a result, Unicorn Lines followed suit for the series of ships to be built.

At the end of the second round of discussions, the shipyards were each given three weeks to revise their specifications in accordance with the agreements reached and they were requested to re-submit their specifications with a revised price. The yards on the reserve list were also consulted in general terms to determine their willingness to modify their standard design and during this process two of them, Newport News USA and Asterillos Spain dropped out due to inability to meet the delivery date requirement. Shell Australia had a very critical delivery date in order to qualify for the Australian Government's Ship Capital Grant which was terminating on 30 June 1997.

Eventually the three short-listed yards were confirmed as the final selection to be presented to the tender board and a financial evaluation of their relative positions was prepared. Most shipyards base their finance terms on five equal payments of 20 % commencing at the signing of the contract. Szczecin however, offered far more attractive finance terms with small, up-front payments and the largest payment (67 %) on delivery. This weighed heavily in their favour in the final outcome. Those involved in the processes were becoming convinced that this was really the only yard on the short list that was a viable proposition.

The tender board presentation was duly made in favour of Szczecin, as expected, and the process of building the ship began in earnest.

4. BUILDING

The first plate was cut on the yard's new fully-programmable plasma cutting machine on 11 October 1996 and the ship was delivered on 27 June 1997. It was a very tight construction schedule which called for a highly-skilled and experienced project manager with the ability to control standards whilst keeping the project on schedule. Shell Australia were fortunate in having the right man as their site manager who took control from the first day and did not permit the shipyard to forget who was in charge whilst retaining the respect of those with whom he worked.

It was no mean feat and full credit is due to the site manager and his team for seeing the project through to a successful conclusion and for managing the personal safety of everybody involved in a very difficult working environment. The Shell new building contract contains an extensive addendum dealing specifically with the safety standards required of the shipbuilder and clearly this was new and somewhat onerous to Szczecin. Prior to the final selection of the yard Shell International conducted a safety audit in order to have some idea of what to expect.

The safety record of the shipyard was not seriously deficient, otherwise Shell would not have been building there, but their safety culture was years behind and did not create the minimum required environment expected. Consequently, the management of safety became almost as big a job as the construction of the vessel itself. In fact it became an integral part of the process. There is no doubt that the yard derived considerable benefit in this field in dealing with Shell.

Generally the building process and schedule went well during the early stages but, as the block sections started to take shape, the first major problem started to manifest itself. The painting of the block sections was slow and very soon started impacting upon the slipway construction schedule. It appeared to be a combination of factors relating to poor organisation and over-zealous application of quality standards. It is not often that one has to reduce quality standards but it became necessary in this instance without any detrimental effects being felt in respect of the overall quality of the hull painting.

As the hull started to take shape on the slipway, with the keel-laying on 5 February 1997 ready for an April launch, the progress with fitting-out started to show itself as being the new critical path and considerable pressure had to be applied to convince the shipyard to speed up the process. There was some slippage in the launching date but eventually, on 7 May 1997, the author had the pleasure of cutting the ceremonial ribbon to release the mechanism that let go of the triggers holding the ship in its position on the slipway.

The river at Szczecin is rather narrow and the launching of large ships is a rather exacting process. *Helix* was the largest launched to date. Anchors are dropped as soon as the bow is afloat and then a series of synthetic ropes attached to the ship's side start to take up tension to stop the vessel mid stream. At a calculated, predetermined tension the ship has reached a stop and the ropes are automatically released to prevent any recoil action that would bring the ship racing back towards the slipway. Everything worked like clockwork and the launch was quite spectacular and a complete success.

At the time of launching there was very little to be seen in the way of cargo pipe work and deck fittings. It was difficult to imagine how the complex array of piping could all be completed in time for sea trials and delivery at the end of June. Under deck there was also a considerable amount of painting to be completed. The final painting of the cargo tanks involved a full blast back to bare steel being done after the completion of construction. This was a major task that eventually would lead to delaying the sailing of the ship from the yard. Staging within cargo tanks was also an ongoing safety problem and was the subject of frequent dialogue between the Shell site manager and yard management right up to the end of the project.

During the hull construction phase it became clear that there was something of an overkill in structural steel design, the shipyard clearly preferring to err on the side of excess strength, beyond the requirements of class. The hull construction is impressive and those involved who had witnessed ships being built in Korea recently, were rightfully impressed by the determination of the Poles to build a ship that was clearly going to stand the test of time. The quality of finish was also of a much higher standard than expected and more in line with the Japanese yards' standards when Shell Australia built *Conus* and *Nivosa* back in the early eighties.

5. DELIVERY

The period between launching and delivery developed into a pretty frantic race against time, the more so because by now we had used up all the slack built into the programme and had to meet the definitive date of 27 June to meet the deadline of the Australian Government's Ship Capital Grant. A failure to achieve this goal would have cost Shell Australia in excess of $3.5 million and for the author, probably his job.

There was a side benefit to this brinkmanship in that, for every day of delay beyond 1 June, the shipyard was paying a penalty of US$20,000. Earlier in the contract we had negotiated a delay in the delivery date at the shipyard's request to enable them to fit one more container ship into their schedule before *Helix*. We agreed to the yard's proposal and accepted a six-week slippage to 15 May 1997 in return for US$300,000 compensation and, additionally, a shorter period of grace of 14 days from contract delivery date. In effect the compensation reduced the capital cost of the ship by about US$800,000.

And so at the beginning of June the schedule was looking like this: naming ceremony by Felicity Kennett on 14 June (this date was cast in stone), commencement of sea trials on 16 June, return to the shipyard six days later on 22 June, leaving a few days grace to tidy-up loose ends before the delivery on 27 June. Actually the ship did not leave for trials until 20 June and arrived back in the shipyard at 20:00 on 26 June, only just in time for delivery the next day.

For those who saw the ship at the time of naming on 14 June it was difficult to believe that the ship would be ready to leave the yard in three weeks, let alone one. The engine room was still a shambles with loose wiring hanging everywhere, a considerable amount of machinery not tested, the accommodation far from ready and the galley just a bare steel space with no equipment whatsoever. It was hard to believe that just one week later they were cooking for 130 people from the same space

Of the 130 people on board when the ship left for trials on 20 June, a large number were actually engaged in finishing-off work rather than the sea trial, it was a real case of finishing the job on the run. The sea trial schedule was developed in much the same way and it was not until we were one or two days into the trials that we had a very clear idea of the plan. It served to highlight another of the yard's shortcomings – their organisational strength, and during the trial it was clearly going to be one thing at a time with no substitutions or rearrangement of the plan if one sector of the programme did not go according to expectation.

It became a very frustrating process and we began to wonder if it would ever end. However, one has to admire the Poles for their determination and desire to get things right which, in the end for us, proved to be a very satisfying result. Having said that the start of the trial was amusing in that we were some two or three kilometres downstream from Szczecin under tug assistance before the main engine was started. Almost immediately the senior members of the owner's team were ushered into the senior yard staff cabin to what we thought was to be some serious discussion about the engine problem. Instead out came the vodka bottle to celebrate the first start of the engine under way. I am not sure to this day whether it was tradition or a sense of relief that compelled them to open the bottle. Apart from that opportunity the rest of the sea trial was a pretty dry affair, although I have to say the food was plentiful and in typical Polish style very nourishing.

At the end of the programme just about everything that was to be tested was proven to the owner's satisfaction, although a few important items of equipment, for example the engine room integrated control system, the inert gas generator, and the air conditioning were far from satisfactory. These problems stemmed largely from the last minute rush and lack of time to do a full pre-commissioning trial of all equipment.

The main engine performed very well and the manoeuvring trials with the Schilling rudder were very successful and well up to expectations. It was the first time the shipyard had fitted a special rudder and they were more than impressed with the performance. It is worth mentioning the value of the Digitec main engine monitoring equipment that was able to detect the smallest of deviation in individual cylinder performance and help pin-point the cause. One of the exhaust valve hydraulic lifters was identified as a problem and when opened up it contained debris from pipe plugs.

In this brief overview of the project I would like to acknowledge the professional skills of all involved. They include the people who worked through the initial financial justification, to those that put the specification together, the negotiating team that worked through the tenders, and the Shell site team who, in conjunction with the ship yard management and work force, saw the project through to a successful conclusion. Not forgetting of course the ship's staff from ASP Ship Management who worked extremely hard to successfully commission the *Helix* and take her to sea. *Helix* arrived for the first time in her home-port of Geelong on 28 October 1997.

6. OPERATIONAL EXPERIENCE

In common with the majority of new builds, *Helix* experienced some operational problems during the first year of her life that were directly attributable to the construction process, the first running of new equipment and experience of the operators. I have to say that it is a credit to all concerned in the design, construction and operation of the vessel that these problems were few and, when they did occur, were rectified without causing any significant delays to the vessel.

There were also those who seem determined to find fault with anything new with *Helix*, being a totally different design to the ship she replaced. The shore terminals were not comfortable at first because of more hose changes and slower discharge times, plus a number of more trivial issues. I am pleased to say that despite initial setbacks during the first 18 months, the ship has well and truly proven that operationally everything is in accordance with design and owner's expectations.

Notwithstanding the success of *Helix*, there have been a number of disappointments that we could have done without. Probably the most notable event was a fire in the engine room caused by escaping hydraulic fluid igniting on a diesel exhaust manifold. The incident was directly related to a manufacturer's equipment assembly error. More details of this incident will be available in the Department of Transport Marine Incident Investigation report to be published shortly.

Probably one of the most disconcerting deficiencies for the ship's staff and one that that is directly attributable to the builder was electrical faults mainly due to loose or incorrect wiring connections. Some of these faults cost the ship's engineers many hours of investigative work and it all became very frustrating.

On deck, the biggest headache has been valves, and I am sure this is related to the fact that the shipyard had to access a new supplier at the last moment due to the original supplier closing down their business without warning. Cargo line drain valves and inert gas system valves have been the biggest problem and we have probably not seen the last of it yet.

In summary there is no doubt that the many positive features about *Helix* have outweighed the negative and I will mention a few of these:

- The bridge layout and equipment has proved very successful.
- The Saab fully-integrated cargo system with light pen touch-screen operation has received a lot of praise from the operators.
- The single blade Schilling rudder in conjunction with a 1300 kW bow thruster has given the vessel excellent manoeuvring characteristics.
- The totally-integrated Norcontrol control and monitoring system has been excellent.
- The parcel tanker concept and Framo hydraulic pumping system has proved its value in respect of cargo integrity, outturn quantity and loading and discharge flexibility.

Submission of Drawings for Class

An itinerant naval architect passing through Sydney recently alerted me that some classification societies accept drawings for approval by email. On checking around, Bureau Veritas accept drawings by email with comments returned by email, but require two final hard copies for stamping. Det Norske Veritas have a complete electronic approval scheme in the pipeline, with all mark-ups done electronically and no hard copies required (due to start within months). Lloyd's Register in Australia (but not elsewhere) accept drawings by email with comments returned by email, but require two final hard copies for stamping; they are working towards complete electronic approval. ABS currently require hard copies.

Y2k Update

There are now less than 220 days to go to 31 December and possible computer headaches. Is your testing programme proceeding according to plan? The Institution of Engineers, Australia's web-site at `www.ieaust.org.au` has a good section devoted to the Y2k Problem. As a matter of interest, Australia is ranked as one of the world leaders in Y2k remediation.

Muir Engineering

Muir Engineering, a family company established by current managing director John Muir to service and repair commercial and recreational vessels, has become a world leader in deck machinery and anchoring systems. Visit their web-site at `www.muir.com.au` for details of a wide range of equipment, with advice on what to look for and sizes required.

Viruses

It's amazing how many people fall for virus hoaxes, most of which are simple variations on the same old theme. Stop by the Computer Virus Myths site for news of the latest hoaxes, and real viruses at `www.kumite.com/myths`. Melissa was certainly successful as a virus. This was due, in part, to its ability to send emails masquerading as a person known to the recipient, so as to fool even security-conscious users who are normally careful with email attachments. However, it was not as destructive as some viruses seen last year.

Passwords

Forgotten your password? There is a fix on your Windows CD: `pwledit.exe` is a utility which comes with Windows 95 and 98 and allows you to delete a corrupted or forgotten password. You can find this utility on the 95 CD at:
`d:\admin\apptools\pwledit.inf`,
or on the 98 CD at:
`d:\tools\reskit\netadmin\pwledit\pwledit.inf`.

Phil Helmore

FROM THE ARCHIVES

SOMETHING OLD IS NEW AGAIN

Many may have missed this small item (at right) in *The Naval Architect* of June 1998 (page31). The docking concept described in this patent is well-known in Australia, and in Sydney in particular. Back in the 1960s, when plans were being developed for the refit of the RAN's Oberon class submarines, the need for additional docking facilities at Cockatoo Dockyard became evident. Options like floating docks and ship lifts were considered before it was decided to adopt the slave dock as the chosen solution. The slave dock concept was not new. Slave docks were known to be used in Germany after World War II, and the Canadian Navy used a slave dock for the docking of their hydrofoil *Bras d'Or*. The Australian slave dock was designed specifically for the Oberon class submarine and was designed and built at Cockatoo Dockyard for use with the Sutherland Dock.

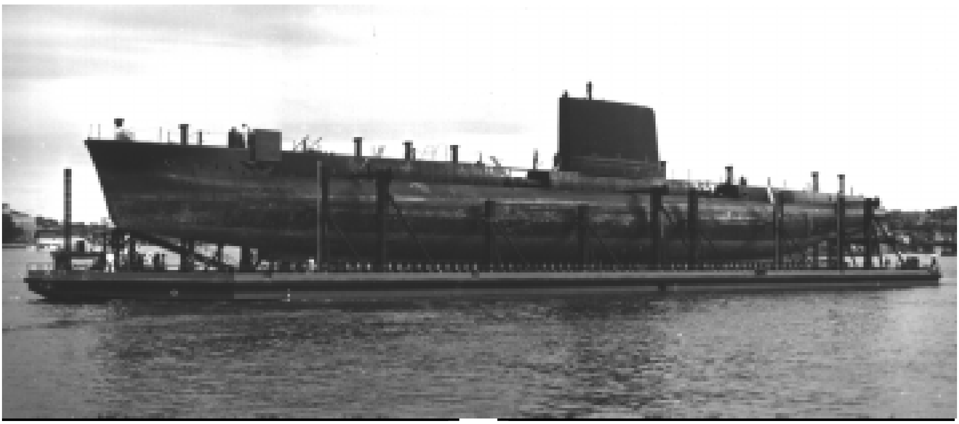
The dock, designated SD3201, was launched in March 1974. Trials were completed with the Royal Navy submarine HMS *Odin* later that year, and the first RAN submarine to use the dock was HMAS *Onslow* which was docked in May 1975 at the start of her 1975 to 1977 refit. The dock was used for all subsequent submarine refits at Cockatoo and at Garden Island. One of its last tasks was to serve as a platform for the demolition of the submarine *Otway* at Garden Island.

The Sydney Heritage Fleet also uses a slave dock for the refit of its vessels. It was used for the restoration of the *James Craig* and it is currently occupied by the pilot vessel *John Oxley*. One wonders about the value of GB Patent 2313345.

Drydocking pontoon for nuclear-powered submarines

In GB Patent 2313345, James Kenneth Dobson describes a method of drydocking a marine vessel, preferably a nuclear-powered submarine comprising the steps of docking down a pontoon onto the floor of a drydock, filling tanks in the pontoon, flooding the drydock, docking down the nuclear-powered submarine onto the pontoon and resting the submarine on supporting means, emptying the tanks and reflooding the drydock, allowing the pontoon to float in the drydock facility. The submarine is thus supported above the water in a 'dry' condition.

James Craig emerging from the Sutherland Dock on the Heritage Dock in 1985 (above), and HMAS *Onslow* on SD3201 for the first time in 1975 (below) (photos J C Jeremy collection)



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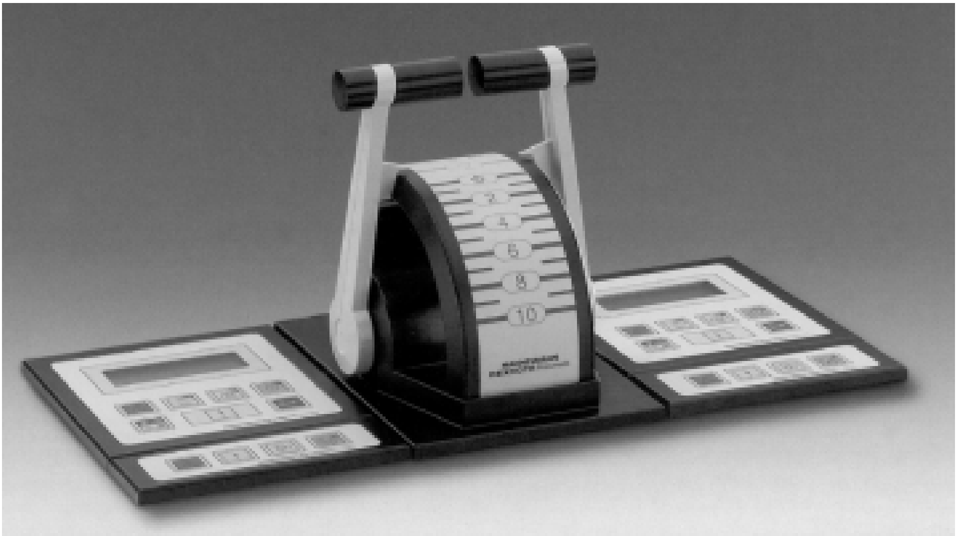

MAREX OS in any case....
the remote control with CAN bus

The concept
- Open, modular system configuration
- Can be used in any marine propulsion system
- Intelligent and compact basic components
- Control heads with lever follow up

The technology
- Microprocessor based control processing
- Data transfer via CAN bus
- Clear text information via display
- Serial interfaces to external systems

The advantages
- Safe and comfortable manoeuvring
- Minimises design and installation costs
- Simplified display adjustment for commissioning
- Reduced service costs using telediagnosis

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