THE AUSTRALIAN NAVAL ARCHITECT

Volume 14 Number 2
May 2010

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THE AUSTRALIAN NAVAL ARCHITECT

Journal of
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(Australian Division)

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Cover Photo:

HMAS *Sirius* at sea with HMAS *Arunta* in the background during the recent Fleet Concentration Period off the east coast of Australia (RAN photograph)

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The Editor
The Australian Naval Architect
c/o RINA
PO Box No. 462
Jamison Centre, ACT 2614
AUSTRALIA
email: jcjeremy@ozemail.com.au

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on the
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From the Division President

Firstly I would like to welcome back Wärtsilä as one of the major sponsors of this journal. Many of you will know that their organisation changed somewhat during the latter part of last year and there was some concern over their continued support. I am pleased to see that they have agreed to continue to support *The Australian Naval Architect* and are once again featured in this edition. The Air Warfare Destroyer (AWD) Alliance has also recognised the benefit of supporting this journal and they have agreed to come onboard as well. I would therefore like to express my gratitude to both organisations and I look forward to their support in the future.

Support for the Australian Division of the Royal Institution of Naval Architects comes from many places. It includes not only corporate support like that of our advertisers in *The ANA* but also individuals and the organisations which employ them in our industry. In some cases the individuals are self employed. One person who has supported the Australian Division for many years has been Allan Soars. Allan has held the position of Honorary Treasurer for the last decade. During this time he has produced the yearly budgets and provided us with the financial data to ensure that our accounts are audited correctly. He has also responded to the needs of the Sections when the demands for funds have been made. Allan has an extremely demanding work program and travels very frequently for business. During these times he has not let the Institution down despite the demands for his time. I was saddened to hear that Allan has chosen to retire from the Division Council as Honorary Treasurer shortly after the recent AGM. His support and enthusiasm will surely be missed by all those who worked with him in this role. I would personally like to acknowledge Allan's contribution over the years and wish him all the best for his future challenges. It is always pleasing when, as soon as a retirement is announced, somebody is willing to take on the role. In my last column I thanked those retiring members from council but I'm now really pleased to welcome Craig Boulton back to Council as the Honorary Treasurer. I sense that this may be one of the shortest retirements from Council on record. Craig has supported us for many years and I am sure that his good work will continue in his new role.

Whilst I'm on the theme of thanking members for the efforts they have put in, I would also like to thank the Western Australian Section members for their organisation and extremely impressive turnout for the Division's AGM. In particular, I would like to thank Jim Black who proposed holding the AGM in WA but was beaten by a bad cold on the day. Turning up for an AGM is sometimes an issue because people have in the back of their minds the question "Will I get nominated for something I don't want to do?" Fortunately, the positions on Council had been determined well before the meeting started. I must say, though, that I was pleasantly surprised at the numbers that turned out and stayed for the technical presentation which I gave afterwards. It was good to prompt a good discussion and showcase an activity in which some of the Division members were engaged. The work for the Commission of Inquiry into the loss of HMAS *Sydney* and the consequent raising of the profile of the RINA and the Division has been recognised by the Institution, and the Division has been awarded a Certificate of Commendation, details of which are included elsewhere in this edition of *The ANA*.

All of those members mentioned above have put many hours into the RINA for a number of reasons. In part I give time to the Institution because of its members who assisted me early on in my career, and I wanted to give something back in return. In my years I have been a member of the Victorian Section committee, including the chair and Division Council representative. Prior to being President I was Vice-President and a member of the executive committee. Other activities I have completed have included being a member of the Engineers Australia/RINA Joint Board, assisted in the development of the National Professional Engineering Register for naval architects, completing university engineering degree accreditation visits, chairing chartered engineer professional review interviews and attending London council meetings. It should not be a surprise that the more I put in the more I seem to get out. Participating in the RINA at different levels has enabled me to gain a very important network of professional naval architects to whom I can turn when I have an issue at work. This might include something of a technical nature or simply asking them to act as a referee when applying for a different position. Towards the end of this year we will again be asking for nominations to serve on the Division council and now is the time to consider whether this is something for which you wish to nominate. I would urge you all at least to take the time to consider it.

One of the key members of the Victorian Section who asked me to consider being on the Section committee and then on the Division Council was Past President Bryan Chapman. Bryan has put significant effort into the organisation over the years and is well known by many of us. In April Bryan suffered a severe stroke and was hospitalised. His wife Frances has been continually keeping me informed on his slow progress to recovery which is excellent news. I'm sure all members of the Division will join me in wishing Bryan all the best during his difficulties and we all look forward to his full recovery.

Stuart Cannon

Editorial

The explosion and fire on the mobile offshore drilling rig *Deepwater Horizon* on 20 April 2010 in the Gulf of Mexico focussed worldwide attention on the risks of exploring for oil at sea in deep water. When the accident occurred, *Deepwater Horizon* was operating 52 n miles from shore in 1513 m of water and eleven lives were lost. The continuing pollution from the faulty riser has prompted calls to limit offshore oil exploration — an understandable reaction in the circumstances. There can, however, be no doubt that the demand for oil in coming decades will ensure that the technological boundaries of oil exploration will be pushed even further, with the inevitable risk of more catastrophic failures like that which occurred on 20 April. The means of managing these risks will have to be developed to balance environmental concerns with an insatiable demand for energy. The costs will ultimately be borne by all of us.

Public attention is rapidly drawn to the risks of oil pollution

from ships, particularly when incidents occur in sensitive areas. The early work of the salvors of the bulk carrier which recently ran aground north of Gladstone was concentrated on removing or securing her oil fuel, in this case the quite small amount of about 900 t. To the public, ships seem to be a large pollution risk. Actually, based on 1990 figures, oil pollution from accidents at sea is relatively small. In that year, some 2.35 million tonnes of oil pollution found its way into the marine environment. Most (>50%) came from land based sources but 24% was attributed to operational discharges from tankers. Some 11% arose from natural seeps [1].

As awareness of oil pollution at sea grows, there will be more pressure for action to control losses from ships — either during operations or as a result of accidents. Of course, double-hull tankers and protected inboard fuel tanks are designed to address these problems, but oil in sunken ships remains a problem for future generations. In this edition of *The ANA* we report on the recent recovery of oil from the small tanker USS *Chelahis* which sank in 1949 in Pago Pago Harbour in Western Samoa. The quantity recovered was quite small but many thousands of tonnes of oil remain on the sea floor in World War II wrecks, many in the North Atlantic close to the shores of Europe. As these wrecks deteriorate and start to release their oil, pressures will mount for the recovery of the oil to prevent unacceptable pollution incidents. Whilst modern technology is making such recovery possible, the cost will be enormous.

Despite the approach of 'peak oil' and the need to find other sources of energy, we can expect the transport of enormous quantities of oil by sea to continue for many decades to come. As the community begins to measure the oil-spill risk in litres rather than tonnes there will be a need for cost-effective means for the rapid recovery of oil from ships after shipwreck or sinking. Perhaps it will not be long before ship designers are required to provide such facilities in ships from the outset as yet another safety feature for modern ships.

John Jeremy

1. www.offshore-environment.com/oilpollution.html accessed on 12 May 2010.

Deepwater Horizon on fire in the Gulf of Mexico
(US Coastguard photograph)

LETTER TO THE EDITOR

Dear Sir,

I was pleased, as always, to receive the February 2010 issue of *The Australian Naval Architect* and, in particular, was interested to read the comprehensive report prepared by Phil Helmore of the presentation given to Engineers Australia by Tony Armstrong on *Design of High-Speed Ships* in Sydney in February.

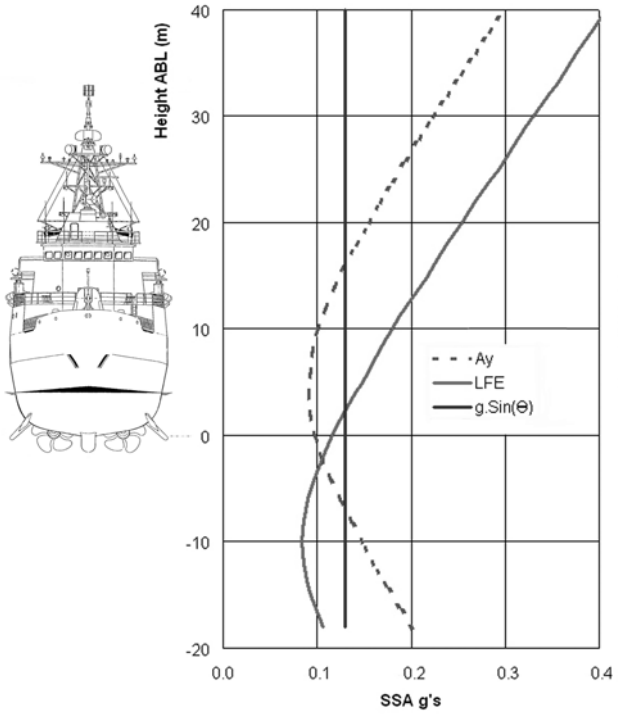
Tony remarked about one of the slides related to transverse accelerations that "interestingly, the graph for the monohull showed that for comfort, the passengers should be placed low in the vessel, and the vehicles high, which is contrary to what is currently done!". I imagine that the trend of increasing lateral acceleration with increasing height above the keel would not be unique to monohulls, but would also be apparent on trimarans and catamarans, accepting that the shape of these curves would vary somewhat between these ship types.

Tony's observation prompts me to provide a graph of the variation in lateral accelerations versus height for a representative frigate operating in beam seas to highlight some of the factors that come into play. The accelerations in this plot are for a location on the centerline at midships and spanning a height range from 18 m below the keel to 40 m above the keel. The accelerations are predicted by the DRDC SHIPMO7 code for a realistic load condition and wave height and period combination. A frontal profile of the frigate is included alongside the graph to the same scale as the ordinate axis.

If the lateral acceleration is measured relative to an earth-fixed coordinate system (Ay on graph), then there will be contributions to this acceleration from the sway, roll and yaw motions of the ship. For the example frigate, this acceleration reaches a minimum at around 4 m above the keel. Below and above this height, lateral accelerations increase due to the roll acceleration being the dominant contribution. However as far as crew, passengers or cargo loads are concerned, it is more relevant to measure lateral acceleration relative to the deck of the ship. This then includes a component of gravitational acceleration acting transverse to the deck of the rolling ship which corresponds to $g\sin\theta$, where θ represents the Single Significant Amplitude of roll. This ship-fixed acceleration is commonly referred to as the Lateral Force Estimator (LFE on graph). Factoring in the gravitational acceleration component, lateral accelerations (LFE) high in the ship are considerably increased compared to those based on an earth-fixed coordinate system (Ay). This is because the lateral acceleration induced by roll accelerations and the gravitational acceleration component are in phase with each other. On the other hand, near the keel, these two components are 180 degrees out of phase and so tend to cancel each other, leading to low lateral acceleration levels. On the attached graph, LFE is shown to reach a minimum at around 10 m below the keel (assuming an item could be rigidly connected to the ship at such a position) before increasing again for imaginary locations still further below the keel.

In summary, for practical purposes, LFE is seen to increase fairly linearly and significantly from the keel upwards beyond the top of the mast.

Martin Grimm
Navy Engineering Division
Department of Defence



Lateral accelerations for representative frigate vs height above baseline on centerline at midships calculated using SHIPMO7 (Image courtesy Martin Grimm)

NEWS FROM THE SECTIONS

Tasmania

Development and Engineering Aspects of the INCAT High-speed Ferries

The technical meetings for the Tasmanian section of RINA for 2010 began on 29 April with Professor Mike Davis' presentation titled *Development and Engineering Aspects of the INCAT High-speed Ferries*.

In recognition of RINA's long history, Professor Davis began his talk with a brief discussion of the work of John Scott Russell and Isambard Kingdom Brunel on *Great Eastern* and their efforts to help in the founding of the Institution of Naval Architects. Professor Davis used these great events to point out that the first advanced catamaran used for ferry services in Tasmania was actually PS *Kangaroo*, a model of which can be seen in the Tasmanian Museum and Art Gallery. *Kangaroo* featured a double-ended catamaran design with loading ramps at both ends for quick turn-arounds and an innovative central paddle wheel. *Kangaroo* entered service in 1855 and continued to ferry passengers, carts and finally cars across the Derwent River until 1926. The conclusion from this is that innovative catamaran ferry design within Tasmania has a history dated from three years before the launch of *Great Eastern* and five years years before the founding of the Institution.

Professor Davis then gave a short history of International Catamarans (INCAT) from Hull 001 in 1977 through to Hull 065 in 2008. Mike and his group at the University of Tasmania began collaborative research with INCAT in 1992 on the 74 m designs of the time. This research has continued right up to the present day with significant research being carried out on the 112 m designs. The research has been over three broad areas of propulsion, seakeeping and structural loading and response from slamming events.

From the early studies on inlet velocity profiles, the research soon began to encompass seakeeping at high Froude numbers. The high Froude numbers create considerable complications for traditional analysis methodologies. However, surprisingly, the advances required in prediction methods are not as detailed as might be expected, providing, that is, that some simple approximations are completed correctly. Structural analysis of slamming, combining full-scale, model-scale and computational work, begun a little over ten years ago for the researchers at the University of Tasmania and continue to the present day. Mike presented some very interesting results from those years of research and some very comforting correlation between all the methods or analysis presented.

Mike finished his talk by looking to future research in the high-speed ferry industry, pointing out that the advances in design from 1977 to 2010 have outstripped by many orders of magnitude those made between 1855 and 1977 in terms of speed, capacity and safety. A visual comparison between Hull 001 and *Kangaroo* shows a striking resemblance but the same can certainly not be said when comparing Hull 001 to Hull 065!

Jonathan Binns

Professor Mike Davis being introduced by Jonathon Binns
(Photo courtesy AMC)

Professor Mike Davis talking to a packed house
(Photo courtesy AMC)

New South Wales

Annual General Meeting

The NSW Section held its 12th AGM on the evening of 3 March, following the March technical presentation in the Harricks Auditorium at Engineers Australia, Chatswood, attended by 10 with Graham Taylor in the chair.

Graham, in his third Chair's Report, touched on some of the highlights of 2009, which included nine joint technical meetings with the IMarEST (Sydney Branch), with attendances varying between 36 (at the forum on *Design and Operation of Harbour Ferries*) and 20. The EA move from North Sydney to Chatswood is having a continuing effect on attendances: average attendance for the nine meetings was 27, compared to 37 prior to the move to Chatswood, and 34 as the long-term average. Two additional meetings were held in 2009: Nigel Gee's presentation on *Experiences of the First Innovator-in-residence at Curtin University of Technology* at Engineers Australia, and Lachlan Torrance's presentation on *Engineering of High-technology Composite Yachts* at the University of New South Wales.

SMIX Bash 2009 was successful and was attended by 215, including a number of national and international guests.

The Treasurer's Report was also presented by Graham Taylor. The EA venue at Chatswood had, as usual, been our major cost for the year. However, with a close watch on the outgoings, we had managed to operate within our budget and have a grand total of $236 in the Section account at 28 February 2009. SMIX Bash is funded separately through the Social account which currently has a healthy balance. SMIX Bash 2009 is expected to make a small loss, but projections are for a sufficient overall surplus to enable preliminary arrangements for SMIX Bash 2010 to proceed.

There is a minor change to the NSW Section Committee for 2010. Craig Boulton's term as the NSW Section Nominee to the Australian Division Council has expired, and has been taken over by Adrian Broadbent in addition to his post as Treasurer. Otherwise, all committee members have agreed to carry on in their respective positions for a further year, and there were no new nominations. The committee for 2010 is therefore as follows:

Chair and AD Council Member	Graham Taylor
Deputy Chair	Craig Hughes
Treasurer and AD Council Nominee	Adrian Broadbent
Secretary	Craig Boulton
Assistant Secretary	Rozetta Payne
Website and TM Program Coordinator	Phil Helmore
Auditor	Stuart Friezer
Member	Matthew Stevens

Committee Meetings

The NSW Section Committee met on 23 March and, other than routine matters, discussed:

- SMIX Bash 2009: Most expenses have been paid, with some accounts still due and some sponsorships still outstanding; letters of thanks and certificates of appreciation have been sent.
- National Approach to Maritime Safety Reform: There

has been little movement on this issue, with no guarantee of funding from the Federal Government for AMSA to undertake additional roles, and possible complications provided by two upcoming state elections.

- Weblink to AMC: There have been discussions with the Australian Maritime College regarding linking presentations from the NSW Section to AMC; discussions are positive, but are dependent on equipment being installed at the Engineers Australia venue.
- Nominee to ADC: Craig Boulton's term as NSW Section Nominee to the Australian Division Council of RINA has expired, and Adrian Broadbent has taken over from the conclusion of the AGM of the Australian Division today.

The NSW Section Committee also met on 27 April and, other than routine matters, discussed:

- SMIX Bash 2009: Most expenses have been paid, with some accounts still due and some sponsorships still outstanding.
- SMIX Bash 2010: A preliminary booking has been made for *James Craig* for Thursday 2 December.
- Weblink to AMC: Discussions between RINA and Engineers Australia continuing, but dependent on EA.
- PI Insurance: It is a requirement of RINA that members who undertake consulting work have PI cover. There is a limited number of insurers available in Australia, and further details are being sought.

The next meeting of the NSW Section Committee is scheduled for 15 June.

HMAS *Sydney* and HSK *Kormoran*

John Jeremy, past President of the Australian Division of RINA, gave a presentation on *A Forensic Analysis of the Wrecks of HMAS* Sydney *and HSK* Kormoran to a joint meeting with the IMarEST attended by forty-two on 3 March in the Harricks Auditorium at Engineers Australia, Chatswood. This was the highest attendance at a technical meeting since the move of EA from North Sydney to Chatswood in May 2006, being just headed by Steve Quigley and Rob Tulk's presentation on *Design and Construction of Cutting-edge Vessels* in August 2007 with an attendance of 46.

Introduction

John began his presentation with a slide of HMAS *Sydney* in Sydney Harbour on 10 February 1941 in her wartime camouflage paint. On 19 November 1941, the Royal Australian Navy Modified Leander Class light cruiser, HMAS *Sydney*, en route to Fremantle from the Sunda Strait, Indonesia, intercepted the disguised German raider, HSK *Kormoran* about 100 n miles west of Steep Point off the coast of Western Australia. In the ensuing battle, *Sydney* was sunk with the loss of the entire crew of 645. *Kormoran* was subsequently scuttled with the loss of 81 men. Following the discovery of the wrecks of *Sydney* and *Kormoran* in March 2008, the Chief of the Defence Force, Air Vice-Marshall A.G. Houston AC AFC, established a Commission of Inquiry, charged with the following terms of reference "To inquire into and report upon the circumstances associated with the loss of Sydney in November 1941 and consequent loss of life and related events thereto".

After discussions with both organisations, the Commission subsequently appointed the Defence Science and Technology Organisation (DSTO) and RINA "to report on the Technical Aspects of the Sinking of HMAS *Sydney* and HSK *Kormoran*."

This was followed by a slide showing the names of those involved in the investigation:

Michael Buckland (DSTO)
Stuart Cannon (DSTO/RINA)
Leo de Yong (DSTO)
Grant Gamble (DSTO)
John Jeremy (RINA)
Tim Lyon (RINA)
Patrick McCarthy (DSTO)
Brett Morris (DSTO/RINA)
Roger Neill (DSTO)
Michael Skeen (DSTO)
Brigitta Suendermann (DSTO)
Terry Turner (DSTO/RINA)

They set to work in May 2008, and submitted their final report to the Commission in January 2009. The wreck sites of *Kormoran* and *Sydney* were extensively surveyed by SV *Geosounder*. The footage was extensively analysed by DSTO and RINA to assess the extent and type of damage to both *Kormoran* and *Sydney*.

Battle Assumptions

The analysis of the action between *Sydney* and *Kormoran* was bound by a number of assumptions concerning the battle sequence, the environmental factors and other operational aspects which were provided by the Commission of Inquiry. John Jeremy and Tim Lyon decided to test the battle assumptions to see if they hung together regarding the guns and torpedo hit.

Here John showed a slide illustrating one of the tests showing the relative positions of *Sydney* and *Kormoran,* almost abeam on parallel courses of 250° and at the extremely close range of about 900 m with *Sydney* to starboard of *Kormoran.* They concluded that yes, the battle assumptions hung together practically.

Information Sources

In order to be able to describe the vessels properly, the team needed to access as much primary source documentation on their design and construction as possible. Sources included the National Archives of Australia (in both Canberra and Melbourne), the Australian War Memorial, the Sea Power Centre – Australia, the RAN Historical Collection (Spectacle Island, Sydney), the Australian National Maritime Museum, the National Maritime Museum (Greenwich, UK), and private collections.

The original packing list of material supposedly deposited with the National Archives, included general arrangements, as-fitted drawings, and working drawings. However, the National Archives could only find the as-fitted drawings, and insisted that packing lists were notorious for being incorrect, and suggested that they look overseas. However, the missing drawings eventually turned up in Canberra, and included over 1000 drawings of HMAS *Sydney.*

Here John showed some of the drawings, including the

plate-line body plan of HMAS *Phaeton* (which became HMAS *Sydney*), a profile general arrangement and a WT and OT compartment drawing. John said that full credit must be given to the National Archives Canberra, who carefully conserved the drawings before photographing them and supplying them to the Commission and the technical team, initially as TIFF files. Some were as big as 2.5 GB which made them a challenge to handle and later drawings were supplied as much smaller PDF files instead. The National Archives in Melbourne was also extremely helpful.

Other information which turned up included the Ship's Cover (folder) from the National Maritime Museum in the UK which gave some basic design information, including a mass distribution curve in the hogging condition, a stability book, and original sea trial information. Further information was obtained from the Ship's Book held by the National Archives in Canberra.

However, they could not locate any machinery or electrical drawings, which they found hard to believe. Then, two weeks before the final report was due for submission, one of the Commission's team re-visited the RAN Historical Collection on Spectacle Island, and found the original Machinery Information Book. The discovery did not change any of their conclusions, because any vessel built to Admiralty standards was built the same way, and the assumptions which had been made turned out to be close to the documentation.

Scientific Approach

In the provision of expert advice and opinion, DSTO and RINA used a number of scientific analysis tools. Aside from the physical examination of the video imagery and a large quantity of historical documents, photographs and other publications, the analysis used modern computer codes.

A numerical model of the ship and her compartments was generated in PARAMARINE. To ensure accuracy, the calculated mean draft was compared to that obtained from HMAS *Amphion*'s (sister vessel) hydrostatic curves, and other details compared to *Amphion*'s metacentric diagram.

For an analysis of flooding, the numerical model was imported into FREDYN, which predicts ship motions and simulates flooding and stability due to hull and compartment damage. Using this package and stepping through time, estimates were made of the time to sink, and these are borne out by the witness of the German survivors.

XVAM was used for the vulnerability analysis, and calculates the probability of failure of systems, personnel and structure from detonation of conventional gunnery and torpedo warheads.

To determine strength and structural loads, the body plan was first imported into the 3D CAD software package Rhinoceros. This was then used to create a three-dimensional set of coordinates of the hull surface which could be used by an automatic mesh generator to model the complete underwater hull.

This mesh was imported into PRECAL to determine the magnitude of the loads experienced by the hull due to the sea conditions. Comparison showed that PRECAL results were within 10% of the original graph of the bending moments in the hogging condition, which not only gave confidence in the PRECAL model, but also displays the proficiency of the naval architects who performed the original calculations over 70 years ago.

ULSTR was then used to calculate the ductile collapse, i.e. the ultimate strength of the hull sections. This program is based on a variety of empirically-based strength-of-materials solutions for the most-probable failure modes for stiffened and unstiffened plate structures.

Blender is an open-source 3D visualisation software package and was used to generate a model of the ship which could be used for forensic visualisation of parts of the ship and to simulate the engagement and its aftermath. Here John showed a 360° "fly around" of the vessel, showing the vessel as she would be seen from a helicopter flying at about 100 m distance and a height of 30 m. This "fly around" is included on the CD in the back of the hard-copy report.

The Leander Class

The Leander-class cruisers arose from the need of the Royal Navy for 70 cruisers to look after the UK's commitments. The design settled on was the Leander class, designed by Sir Charles Lillicrap, which had eight 6 in guns on a standard displacement of 7154 tons. There were six built to the original design, and these had considerable success in the Mediterranean Sea, but were criticised because of the elimination of the second Director Control Tower. This had been deleted along with other items including, for example, magazine cooling and a number of internal phones, due to money being tight at the time.

HMAS Sydney

The modified Leander-class vessels *Phaeton, Amphion* and *Apollo* were completed for the Australian government as HMA Ships *Sydney, Perth* and *Hobart. Sydney* was built by Swan Hunter and Wigham Richardson at Newcastle-upon-Tyne, UK, launched on 22 September 1934 and completed on 24 September 1935. The modified vessels had a unitised machinery layout, with A Boiler Room, A Engine Room, B Boiler Room, B Engine Room (from forward to aft) and generator compartments outboard of B Boiler Room. This layout subsequently became standard for RN cruisers.

Principal particulars of the modified Leander class were

Length OA	562 ft $3^{7}/_{8}$ in	(171.40 m)
Length OA	530 ft $0^{3}/_{8}$ in	(161.55 m)
Breadth moulded	56 ft 0 in	(17.07 m)
Depth to Upper Dk	32 ft 0 in	(9.75 m)
Draft at Standard Δ		
Forward	15 ft 3 in	(4.65 m)
Aft	17 ft 3 in	(5.26 m)
Standard Δ	7198 tons	(7314 t)
Fuel oil	1800 tons	(1829 t)
Range	7000 n miles @ 16 kn	
Armament	Eight 6 in (15 cm) guns in twin mountings Four 4 in (10 cm) guns in single mountings Three 0.5 in (12 mm) quadruple mountings Eight 21 in (533 mm) torpedo tubes on quadruple mountings P&S One depth-charge rack for four charges, with two additional	
Complement	645	

John then showed several slides of *Sydney*, illustrating the details of the vessel. She had eight 6 in guns in four twin mountings, two (A&B) forward and two (X&Y) aft. She had eight 21 in (533 mm) Mark IX torpedoes from two quadruple above-water tubes P&S on the Upper Deck. She had four boilers and four shafts, each capable of 18 000 hp

(13 423 kW) for a total of 72 000 hp (53 690 kW). Maximum designed speed was 32.5 kn, and she achieved 33.05 kn on trials at full power.

By way of lifesaving equipment, *Sydney* had two 32 ft (9.75 m) life cutters in davits which were swung outboard while at sea, a 30 ft (9.14 m) gig, a 36 ft (10.97 m) cutter, a 16 ft (4.88 m) dinghy, and two 27 ft (8.23 m) whalers, all stowed around midships. With the exception of the cutters, all required the aircraft crane for launching. There were also nine Carley floats in total. The small one (stowed on top of one of the larger ones on the aft deck) was probably the one which was one of the few items found in the initial search, and is now in the Australian War Memorial in Canberra.

Sydney had 23 watertight compartments, and here John showed slides of the vessel's profile indicating the extent of side-protective armour plating, and the location of the damage-control stations.

HSK Kormoran

Kormoran began life as a cargo liner for the Hamburg-Amerika line, and was launched under the name of *Steiermark* by Deutsche Werft in Kiel, Germany. She had completed trials, but the outbreak of WWII prevented her being taken into service. She was armed and the armament camouflaged, and then commenced operations as a *Handelstörkreuzer* (HSK) or 'commerce disruption cruiser' during the war as Raider No. 41. Principal particulars were

Length OA	167.5 m
Length WL	157.0 m
Beam	20.2 m
Draft	8.5 m
Displacement	20 220 t
Power	Four diesel engines each 3600 hp (2685 kW)
Propulsion	Twin screw, diesel-electric
Fuel	5283 t
Speed	17.5 kn maximum
Range	50 000 n miles @ 17 kn
Armament	Six 15 cm guns in single mounts Two 37 mm AA in single mounts Five 20 mm cannon Six 21 in (533 mm) torpedo tubes: Two twin-tubes P&S above water Two submerged tubes 360 mines
Complement	400

Here John showed a profile of *Kormoran* as built as *Steiermark*, a profile and plan view showing her armament and arcs of fire, and then underwater views of her Nos. 2 and 3 15-cm guns, the above-water torpedo tubes on the starboard side, and an underwater torpedo tube.

HMAS *Sydney* Wreck Site

The wreck site of *Sydney* covers an area of slightly more than 500 m × 500 m. John showed a side-scan sonar image of the site, showing the bow section about 470 m away from the main hull, and the debris field mainly in between.

The bow lies inverted on the ocean floor, and shows significant damage due to its tearing apart from the main hull and final impact on the ocean floor. Damage on the port side shows the typical concave indentation of an explosion on the surface, consistent with torpedo damage.

They had some 25 h of video to go through, and the video was sometimes more revealing than the still photos taken by the ROV. Some of the slides included views of the degaussing cables on deck which were installed in 1941, damage due to both 6 in (15 cm) armour-piercing shells and 6 in (15 cm) high-explosive shells, sidelights on the vessel (some blanked and some not), shell holes just above the boot topping, B turret trained to port and with the aft access door open and the left-hand top of the turret blown off [this was 1 in (25 mm) thick D-quality steel, but not armour against a 6 in (15 cm) shell!], A turret in a real mess, with its rear end missing and the roof missing.

Damage Assessment

As part of the damage assessment, they measured the sizes of all holes and their locations from photographs. On the bow section, the indentation and the plate lines show where the torpedo hit. There is much evidence showing that the structure was torn apart.

The general effect of the torpedo hit would be to put the vessel down by the bow (in Sea State 3) and this is borne out by the testimony of the German witnesses, who said that they could see the tips of the propeller blades. *Sydney* could have survived this amount of damage on it own. However, there was much other damage and, in combination, led to her loss.

B turret took two hits from 6 in (15 cm) shells, either of which would have disabled the turret. X turret, on the other hand, sprang into action, and was responsible for the fatal damage to *Kormoran.* A and B turrets are trained to port, and X and Y turrets are trained to port and forward, consistent with engaging *Kormoran* on the port side.

The 4 in (10 cm) guns were not involved, and one is lying in the debris field.

There is shell damage to the torpedo tubes on the starboard side, which would have put the tubes out of action, and *Sydney* did not fire any torpedos from that side. Two torpedos are missing from the port side, and a single totpedo is lying in the debris field.

The bridge has collapsed, and there is evidence of it having been hit during sinking, possibly by the bow section as it broke off. The Director Control tower is lying in the debris field with, coincidentally, the bridge roof lying against it. Its tower on the bridge was hit by a high-explosive shell, and this probably killed all on the bridge at the time.

There is damage to the ship's boats from both fire and shells, and from deterioration. The boat badges are in a very preserved state, possibly because they were cast in gunmetal.

There are armour-piercing shell hits in way of the Wireless Telegraphy Office and the Transmitting Station. One AP shell will ruin your day, but there are multiple hits, some in groups. The aircraft catapult took two 6 in (15 cm) shell hits. The trajectories of the shells can, in some cases, be traced, and show the trajectories to have been nearly horizontal, evidence of very close range.

A lot of the wreck has collapsed. The aft section would have been full of air when it left the surface, and so has imploded when the pressure became too great, and the hull hit the bottom at speed.

Fire Damage

There is evidence of extensive damage by fire, much of which occurred in the bridge area, but also midships and aft. There would therefore have been lots of smoke. A Boiler

Room and A Engine Room would have quickly become uninhabitable due to smoke drawn in from the Upper Deck by the forced-draught fans.

Not much of the ship is unaffected by shell damage. It is estimated that 70% of the ship's complement of 645 were incapacitated during the first few minutes of the battle. The total damage was overwhelming.

Here John showed slides of plots of the damage to the port and starboard sides of the vessel, followed by a video re-creation of the shell and torpedo hits to *Sydney* as would have been seen from *Kormoran* in real time, although the real sequence is not known.

Structural Integrity

Could the bow have fallen off? To answer this, they checked the strength of the hull in way of Frame 27. *Sydney* had much of her decks and bulkheads welded, but the shell was rivetted, and these were taken into account. At the start of the battle, the seas were at Sea State 3, increasing to 4 towards the end, so they would have been seeing waves of 2.5 m height at the end. They tried removing 70% of the vessel's structure, and found that there was sufficient structure remaining to hold the bow in place in that sea state; i.e. the bow could not have simply fallen off.

How long could the vessel have remained afloat? Analysing the progressive flooding of the vessel, they found that the vessel could have remained afloat for up to 12 h (depending on direction) in Sea State 3 and allowing flooding through hull penetrations and the torpedo damage alone. However, if increased to Sea State 4, and flooding was allowed through all predicted internal damage as well as flooding through hull penetrations and the torpedo damage, then the vessel could only survive between about 2 h and 4.5 h. This is consistent with the evidence of the German witnesses, who said that the final glow disappeared about 4 h after engagement.

How was *Sydney* Lost?

The process of the foundering of *Sydney* is difficult to determine exactly, but there is a scenario which is highly likely. Here John showed a flowchart of the possible causes of the loss. Some possible causes are not supported by the available evidence, and so are not considered likely. The likely scenario is for a trim by the bow following the torpedo damage forward, followed by uncontrollable progressive flooding with loss of buoyancy or the collapse of a bulkhead, either of which would have led to rapid sinking.

Conditions on board *Sydney* at the time would have included it being dark, the vessel had no power and, hence, no lights, there would have been at least 400 casualties and the survivors did not include the command team, and there would have been lots of smoke. Imagine it!

The vessel would have plunged rapidly, probably with the loss of the bow very close to the surface. Extensive damage was done to the ship during the sinking. The speed at which the ship would have hit the bottom is not known, but evidence suggests a very heavy landing.

Likelihood of Survivors

It is not possible to factually state that there were any survivors from *Sydney* who entered the water, although that is possible. However, the conditions at night (rough seas, suffering from smoke inhalation, stressed and shocked from the battle, and the presence of sharks—attested by the Germans) were not conducive to survival. The search was not commenced for four days, and there are questions about its thoroughness and its ability to find lone survivors in the water. Given the depth of the water, and the limited possibility that a drowned body would later float to the surface, the likelihood of finding any trace of bodies after the first few days would be very small.

Conclusion

An extensive analysis of the loss of HMAS *Sydney* was conducted by DSTO and RINA, and all of the available evidence points to a likely scenario for the engagement between HSK *Kormoran* and HMAS *Sydney,* and the subsequent loss of both vessels.

Questions

Question time was short, due to the impending AGM of the NSW Section, but elicited some further interesting points.

The use of *Kormoran's* starboard underwater torpedo tube was considered, but thought unlikely because it could not be used at speeds higher than about 4 kn, and the vessels were doing about 14 kn at the commencement of the engagement. However, even if the vessels were travelling slower, they would have needed a gyro offset angle and a firing solution (the underwater tubes could not be simply aimed like the above-water tubes), and this was also unlikely.

The time to decamouflage *Kormoran* was very short. The 20 mm and 37 mm guns could be decamouflaged in seconds. The 6 in (15 cm) guns would have taken longer, as the covers would have to be removed and the guns trained, which would take a total of, say, 18 s. The torpedo tubes would have to have the covers removed and be guns trained, which would take a total of, say, 30 s.

The vote of thanks was proposed, and the "thank you" bottle of wine presented, by Phil Helmore, who said that many Australians have been interested in the fate of HMAS *Sydney* for a long time, and such a definitive report was welcome. The vote was carried with acclamation.

The full DSTO/RINA report is available for download at www.dsto.defence.gov.au/publications/scientific_record.php?record=9862. The report is a very readable account if you are interested.

John Jeremy (presenter) and Graham Taylor (Chair)
(Photo Phil Helmore)

Developments in Marine Diesel Engines

Eric Clarke of MAN Diesel & Turbo Australia gave a presentation on *Developments in Marine Diesel Engines* to a joint meeting with the IMarEST attended by 31 on 4 April in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

Eric began his presentation by saying that the name of the company had recently been expanded to include "& Turbo" as in turbo-machinery, not turbo-chargers. MAN has headquarters in Augsberg, Germany, and has ten locations throughout Europe and 51 300 employees world-wide. Revenue in 2008 was of the order of €14.9 billion, with an operating profit of €1.7 billion. Their areas of activity cover two- and four-stroke diesel engines, exhaust-gas turbochargers and, recently, turbo-machinery. MAN was the birthplace of the diesel engine, and they still own the first three diesel engines ever built, and they all still work!

The 28/33D Engine

The new MAN 28/33D is now the world's most-powerful 1000 rpm engine. MAN knew that they were competing with MTU, and that they would have to compete on power/weight ratio. 28/33 indicates 28 cm bore and 33 cm stroke and D indicates diesel. Other letters, if appended, are V indicating vee configuration and STC indicating sequential turbo-charging. The engine produces 9.1 MW at 1000 rpm, or 10 MW at 1032 rpm maximum. Specific fuel consumption is 188 g/kW-h at 1000 rpm, and 191.5 g/kW-h at 1032 rpm.

The benefits of the engine are high power/weight ratio, low operating cost, minimum engine down-time, low maintenance cost, and the engine is environmentally compliant.

The engine has a 52° vee angle to get the power to the crankshaft and a reduced component count. It is easy to connect the cooling-water interface and the engine has attached lube-oil, fuel and water pumps, lube-oil cooler and filters. There are two-stage charge-air coolers. The engine has a high-efficiency turbo-charger with sequential turbo-charging.

The engine is designed to be user-friendly, with ease of construction, simple maintenance, excellent performance and load response, and low emissions being key design features.

The engines are IMO Tier II and EPA Tier 2 compliant.

Sequential Turbo-charging

The engine operates with a high-efficiency turbo-charger, and a second turbo-charger can be switched off. The engine is then always running at the optimum operating point, and the result is an extended torque operating envelope at low engine speeds. This gives reduced fuel consumption at part-load operation. There is power in reserve for ship acceleration, turning, sprints, or towing. The engine has low thermal signature, reduced smoke emission, and low vibration characteristics.

Gensets

There are genset versions of the 28/33D engine available which compete with the MTU 20V8000 and Pielstick 20PA6B STC gensets.

Applications

The main driver for the design of the 28/33D engine was to get to the fast-ferry market, as well as the offshore, naval and mega-yacht markets. Here Eric showed slides of some of the successful MAN applications.

Milenium Tres is a 98 m wave-piercing catamaran built buy Incat and has four 16V28/33D engines, each rated at 7200 kW @ 1000 rpm MCR producing a speed of 40 kn with 900 pax and 267 cars. *Gotlandia II* runs in Scandinavia and photos of the engine room and route were shown. *Natchan Rera* and *Natchan World*, also built by Incat, each have four 20V28/33D engines for a total of 36 MW. There were initial problems with the turbo-chargers, but these have been sorted out.

Austal Ships have under construction a trimaran which is 113 m long and 26 m wide and will carry1000 t deadweight including 1400 pax, 357 cars, with speeds up to 40 kn and operating at 37 kn, and is expected to be launched in November 2010.

Naval applications include the two offshore patrol vessels for New Zealand.

Engine Overview

Here Eric showed a slide of the engine, which has an underslung crank, and hydraulically-tensioned main bearing studs. There is a 52° vee angle.

The cylinder heads have an intensively-cooled flame face, twin inlet ports, and a common exhaust port. They are secured by four hydraulically-tensioned cylinder-head studs.

The electronically-controlled injector pump has a roller tappet design and operates at 1600 bar (160 MPa) and delivers fuel to mechanical injectors of proven design.

The piston has been optimised and is of two-piece bolted lightweight steel construction, and has three rings, two for compression and one scraper which prevents bore polishing. It is designed for 210 bar (21 MPa) maximum pressure, and plateau honing results in low lube oil consumption and long life.

The engine has MTU's new Safety and Control System (SaCoS) which has been approved by all classification societies.

Optimised components include the air manifold, connecting rods, oil sump, crankshaft, turbo-charger, combustion chambers, and the shut-down flaps. This results in better reliability, ease of maintenance, and reduction of specific fuel consumption.

The oil sump, pump, filters, etc. are all attached to the engine, and so there are no external connections necessary for the oil system.

There is no common-rail fuel supply.

The crankshaft has been designed in accordance with proven MAN standards for a medium-speed engine, and has been drop-forged from high-quality steel.

The air manifold is a symmetrical one-port design, with an integrated fluids gallery for high- and low-temperature water, lube oil, etc.

Here Eric showed a cross section of the engine and the vessel rolling, in which the oil sump has been designed

for rolling up to 22.5°, pitching up to 5°, and an additional dynamic of 7.5°.

The connecting rods have been straight cut, with four tie rods according to established MAN standards, and has led to an improved and safer design which is lighter and gives better engine balancing.

The engine is insulated to reduce engine noise and heat loss, and the engine shut-down flaps are of carbon fibre for light weight and high stiffness.

The turbo-charger has been specifically tuned for the 28/33D engine, and has high efficiency, high pressure ratio, extended lifetime and easy maintenance.

Emission-reduction methods were a primary driver in the design of the engine, which complies with IMO Tier II (a reduction of 20%) and EPA Tier 2. In order to meet these requirements, they optimised the injection nozzle and the combustion chamber for the new emission layout, implemented Miller cycling, and provide a high-efficiency charge-air cooler. They are now looking at IMO Tier III (a reduction of 80%), and they will be ready for the expected implementation in 2016.

Conclusion

MAN have come up with a new diesel engine which develops 455 kW per cylinder at 1000 rpm, or 500 kW per cylinder at 1032 rpm maximum for 1 h in 6. The engine is reliable, has easy maintenance, low specific fuel consumption, high power/weight ratio, compact design, and is environmentally friendly. The emissions comply with IMO Tier II and EPA Tier 2 requirements.

Questions

Question time elicited some further interesting points.

The engine can burn heavy fuel 380, although this is not recommended and cannot be done in Scandinavian countries. The engine cannot yet run on LPG or LNG.

The high pressures are handled safely by having double-wall piping. The operating temperature of the engine has decreased due to Miller cycling and more air.

The lube oil consumption is of the order of 0.4 g/kW-h (maximum); i.e. not much!

The dry mass of the engine is 66 t.

The anti-bore-polishing ring at the top seals the oil transfer from the crank-case and so carbon does not build up and does not wear the cylinder liner.

The crankshaft components are hydraulically fitted, and so there is no balancing of the crankshaft required.

The vee angle is reduced below that of some other engines, but the vibration dampers take care of possible resulting vibrations. Lots of vibration is eliminated through coupling design and harmonic balancing of the crankshaft, which is taken care of outside the engine.

The coolers used to be located off the engine, but are now on board, as are many other components. They are compact, but easy to get at. Much of this was driven by the fast-ferry industry, which tends to repair by replacement of the whole engine, which they can do pretty quickly if everything is on board the engine.

Low-speed running, idling, and starting and stopping are taken care of by the SaCoS. The majority of the running time of an engine is spent at 1000 rpm, with maybe a 2 h turn-around time in port during which the engine is shut down. There is no problem if the engine is idling, as there is no coking, etc.

Full power can be developed within 7 min from a cold start. However, many operators idle in port for half an hour before initial departure for the day.

MAN is developing more market share with this new engine, and the development work is paying off!

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

Ship Resistance Reduction Using Super-Hydrophobic Surfaces

Andrew Baglin, PhD student at the University of New South Wales, gave a presentation on *Ship Resistance Reduction Using Super-Hydrophobic Surfaces* to a joint meeting with the IMarEST attended by 18 on 5 May in the Harricks Auditorium at Engineers Australia, Chatswood.

Introduction

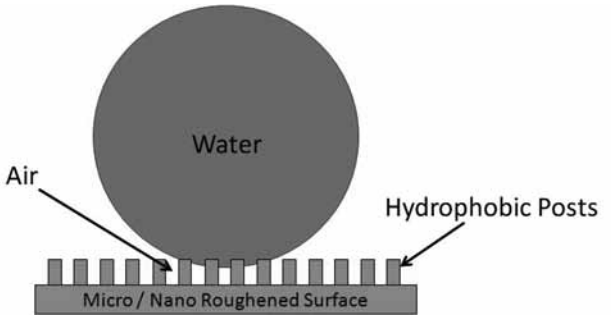
Andrew began his presentation by showing a slide of *Anna Maersk*, one of the large container ships in the world, and giving some of her principal particulars. She has a length of 352 m, beam 42 m, draft 12.8 m, displacement 109 000 t and carries 8272 TEU. She burns 175 t of fuel per day, which costs $493/t and so costs $2 650 368 for a 28-day voyage, or $32 million per year. Shipping creates 800 million tonnes of CO_2 annually, and this accounts for 5% of total carbon emissions per year. This is forecast to rise by 30% in the next ten years.

There is a number of solutions to reducing fuel consumptions and, hence, carbon emissions. These include:

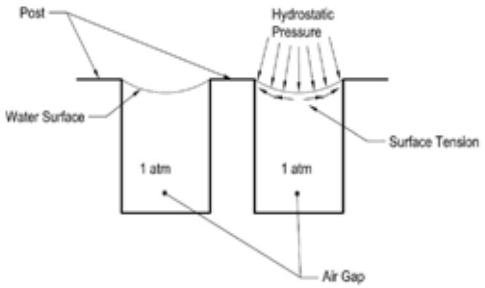
- Going slower: Some companies are trying "slow steaming", an some even "super-slow steaming", where the voyage speed is reduced from 25 kn to 14 kn; this can reduce the fuel used and CO_2 emitted by up to 43% per voyage, or 30% for the service. However, speed reductions of this magnitude double the time taken for delivery, and this is not a great option.
- Increasing engine efficiency: More efficiency gives more power for less fuel and less emissions. However, engine efficiency increases tend to be incremental rather than significant.
- Reducing resistance: Resistance may be reduced in a number of ways, including polymer injection (in which long-chain polymers are introduced into the water from the forward end of the vessel, and can account for reductions of 15–70%, depending on who you believe), riblets or compliant surfaces (including dimples and oscillating walls, and can account for up to 40% reductions), electro-hydrodynamics or magneto-hydrodynamics (up to 40%, but these both use power which negates their usefulness), and super-hydrophobic surfaces, which can reduce resistance by 20–60%.

Super-hydrophobic Surfaces

Surfaces are characterised by their affinity for (hydrophillic) or repellence of (hydrophobia) water. The contact angle for hydrophillic surfaces is less than 90° (e.g. glass), for hydrophobic surfaces it is greater than 90° (e.g. Teflon), and for super hydrophobic surfaces it is greater than 150° (micro- or nano-roughened surfaces). What happens is that air is trapped in the valleys between the surface roughness peaks, and surface tension keeps the water from entering.



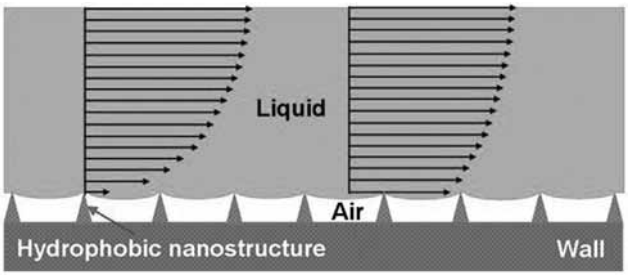
Super-hydrophobic surface and water droplet
(Diagram courtesy Andrew Baglin)



Action of a super-hydrophobic surface and a liquid
(Diagram courtesy Andrew Baglin)

Nature has, in fact produced some good super-hydrophobic surfaces. Here Andrew showed a movie of a small pool of water on a lotus leaf, and the water clearly moved as one unit as the leaf moved. A micrograph of the leaf structure showed peaks about 10 μm wide, and about 15 μm high. Another fine example from nature is water striders, insects which can walk on water, with nanometric hairs on the pads of their feet.

The application of this to drag reduction is centred on the existence of the "no-slip" boundary conditions. This was first discovered by Prandtl, who postulated the existence of the boundary layer, where there could be no slip between the water and the surface, as opposed to water and air, where there could be slip, as is the case with super-hydrophobic surfaces.



Application of super-hydrophobic surface to resistance reduction
(Diagram courtesy Andrew Baglin)

Recent Research

The first research on super-hydrophobic surfaces was carried out in 2004 by Watanabe, Yanuar and Udagawa at Tokyo Metropolitan University. They tested flow in two pipes coated with acrylic resin, and measured the pressure drop across the pipes for laminar flow. One pipe had a super-hydrophobic surface (comprising micro-cracks in the acrylic surface), and the other did not, and they found a pressure reduction of 14%.

Later in 2004, Ou, Perot and Rothstein at the University of Massachusetts made a super-hydrophobic surface comprising structured posts 30 μm wide and 30 μm high, at a range of spacings of 15, 30, 60 and 90 μm. They found generally that larger spacings gave higher drag reduction, but the best results were obtained with the 60 μm gap, giving 60% drag reduction for laminar flow.

Oner and McCarthy, also at the University of Massachusetts, experimented with different shapes of protrusions from the surface, trying various star and cross-shaped cross sections.

Henoch at the Naval Undersea Warfare Center, Newport, in 2006 made a super-hydrophobic surface comprising posts 0.4 μm wide by 7 μm high on 1.25 μm spacings on 20 mm square wafers, glued together on a backboard to give a 475 mm square panel of what he called "nanograss". This was tested against a PVC plate as a reference, and gave a 50% reduction in resistance in laminar flow, and around 20% reduction in transitional flow at Reynolds numbers up to 10^4.

McHale, Shirtcliffe, Evans and Newton at Nottingham Trent University in 2009 made spheres with super-hydrophobic surfaces, and here Andrew showed a movie of the spheres being dropped into water at the same time as plain spheres, and the spheres with SHS clearly fell faster. The time-to-fall showed a 15% reduction in resistance at Reynolds numbers up to 10^5.

Resistance Reduction for Ships

If we now look at ships, we find for a 10 m vessel travelling at 10 kn that the Reynolds number is of the order of 4.3×10^7, while for *Anna Maersk*, of length 352 m travelling at 20 kn the Reynolds number is 3.0×10^9. These numbers far exceed the tests carried out on SHSs thus far, and it is one of the main objectives of Andrew's research to determine whether the benefits demonstrated for laminar flows continue up into the transition and turbulent regions.

In addition, the pressure at the keel of *Anna Maersk* at a draft of 12.5 m is 227 kPa, or 2.27 atmospheres, or twice the pressure of any SHS tests thus far.

There is significant interest in SHSs in Australia, including the Maritime Platforms Division of the Defence Science and Technology Organisation for possible applications, and the Australian Maritime College. AMC has their new cavitation tunnel due to come on stream in June this year, and testing of Andrew's SHSs is scheduled to commence in July. The cavitation tunnel is capable of a speed of 12 m/s in the working section, and producing high Reynolds numbers. The boundary-layer thickness can be controlled and the pressure in the working section can be varied from 4 to 400 kPa.

Andrew proposes testing panels of two different sizes, covered in two different types of SHSs including carbon nanotubes about 5 μm long (these can be grown to any length, becoming somewhat like a carpet). As water flows over the surface, this may change the boundary layer, and a longer surface is needed to check this, hence the two different panel lengths.

If the testing of the panels shows good results, then Andrew hopes to be able to test a model vessel with SHS in the towing tank at AMC.

Computational Fluid Dynamics

Andrew is also investigating the phenomenon using computational fluid dynamics, and modelling the SHS as posts on a surface. However, as surface tension is the dominant force involved, and due to the fact that the commercial CFD codes don't seem to like it when surface tension dominates Andrew has had to write and implement his own code using a new method of CFD known as the Lattice-Boltzmann method. This has resulted in the right type of flow, with water flowing over the top of the air gap, a boundary layer on top of the posts, and air recirculating within the air gap.

Additional Benefits of SHSs

In addition to teh direct reduction of resistance, SHSs provide some additional benefits:

- Reduced added mass: The SHS reduces the thickness of the boundary layer, and so the mass of entrained water also reduces.
- Added buoyancy: The air in the gaps helps to lift the vessel. The water close to the SHS has reduced density, and so this reduces the resistance even further (albeit a small effect).
- Anti-biofouling: The SHS significantly reduces biofouling, as the organisms cannot properly attach to the surfaces.

Conclusion

Research has turned up interesting properties of super-hydrophobic surfaces, and they show great promise for reducing the resistance of ships. However, they are highly theoretical at this stage, and it may be some time before they become a practical reality.

Questions

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

One possible application—when they become practical—is to torpedoes. Some SHSs can be stamped on with little effect, while stamping would damage some others; some are very tough.

There are several methods of producing super-hydrophobic surfaces. They can be produced by photo-lithography, by growing carbon nanotubes, and can be made in sheets by spraying nanometric-sized silica balls onto a surface and then cooking with a chemical which grows off the balls to produce a carpet.

There are currently about four or five groups around the world working on super-hydrophobic surfaces.

Producing test panels is one thing, but producing ship-sized super-hydrophobic surfaces may be another matter entirely, and the means for so doing is outside the scope of Andrew's project. If you want one soon, talk to 3M!

Andrew was requested to make a progress report in a year's time, or to provide a full report on submission of his doctoral dissertation.

The vote of thanks was proposed, and the "thank you" bottle of wine presented, by Phil Helmore. The vote was carried with acclamation.

Phil Helmore

COMING EVENTS

New South Wales

Technical Meetings

Technical meetings are generally combined with the Sydney Branch of the IMarEST and held on the first Wednesday of each month in the Harricks Auditorium at Engineers Australia, 8 Thomas St, Chatswood, starting at 6:00 pm for 6:30 pm and finishing by 8:00 pm.

The program of meetings remaining for 2010 (with exceptions noted) is as follows:

2 Jun Michael Mechanicos, Germanischer Lloyd
Developments in Naval Regulations via the International Naval Safety Association (INSA) and Naval Ship Code

7 Jul Rob Gehling, Rob Gehling and Associates
IMO's New Goal-based Standards

4 Aug Yan Tso/Chris Norwood, Defence Science and Technology Organisation
Control of Shipboard Noise: A Stepwise Design Process

1 Sep Alan Goddard, Gurit Australia
Composite Structural Engineering of the Panamax Ketch and other Large Projects

6 Oct Andrew Scardino/Lyn Fletcher, Defence Science and Technology Organisation
Marine Biofouling: Current Challenges and Potential Solutions

2 Dec SMIX Bash

Tasmania

The next two technical meetings for the Tasmanian Section will discuss the present state of Antarctic expeditions. Dr Julia Jabour will begin on 26 May at the AMC discussing the lessons learnt from the sinking of the tourist vessel MV *Explorer* in November 2007 and the IMO plan to develop a mandatory polar shipping code. On 21 July Dr Carmen Primo will talk about her experiences on a Spanish Antarctic research vessel over the 2009–2010 summer. Three more technical meetings are planned during the year.

Ship Contract Management Course

Fisher Maritime's widely-respected three-day training program, *Contract Management for Ship Construction, Repair and Design*, will be available in Sydney on Wednesday 21 to Friday 23 July and in Melbourne on Monday 9 to Wednesday 11 August 2010. These are open-registration presentations of the program which have been previously conducted over 300 times world-wide, including five times in New Zealand and 34 times in Australia. Registrations will be limited to about 25 persons per presentation (not more than 12 persons per organisation unless some seats remain available) in order to ensure effective interaction, which is a vital part of the course.

This program assists you in defining, understanding and appreciating the most professional manner of managing, controlling, developing and/or using the language of the contract to maximize benefits during ship construction, repair and design. Your participation in this program will assist you by continuing to improve your professional project-management skills which are vital to the cost-effectiveness of your work and essential to the long-term success of your organisation.

The benefit of improved contract management is the identification of the pitfalls and traps experienced within the industry. Attendees will be more prepared to identify all the costs and schedule impacts of changes, and to properly assign responsibility for those changes and effects. This will save considerable sums in each major contract. The benefits are estimated at two to three percent of the total value of all contracts managed after the training program.

The open registration fee has been set lower than in the past in order to give small organizations the economic opportunity to send participants at about the same per-person cost that has been effectively paid by organisations for in-house presentations. However, due to time constraints, this precludes the opportunity for in-house presentations in those same cities for 2010.

A cost-effective in-house presentation for up to 25 persons in any of Queensland, Western Australia, Canberra, or South Australia can be arranged for Tuesday 27 to Thursday 29 July 2010. The fixed fee for an in-house presentation is equivalent to 15 full registration fees. Please email Ken Fisher directly if your organisation is interested in that opportunity at kwfisher@alumni.sydney.edu.au.

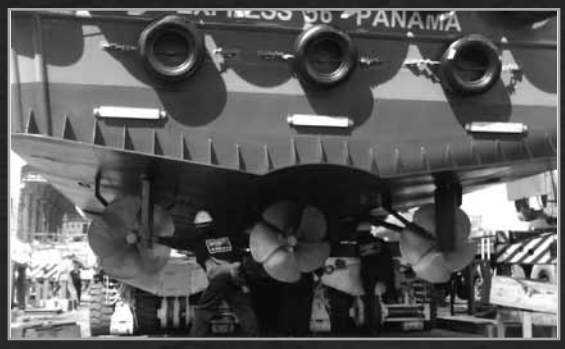
Further details of the program and a registration form for fax or mail may be found at www.fishermaritime.com/Publications/PDF/Contr-Mngmnt-AusNZ-2010.pdf.

Marine Safety Conference 2010

The Marine Safety Conference 2010 will be held at the Burswood Entertainment Centre in Perth, WA, from 22–24 August with the theme *Safe Passage to a Marine Nation*. The conference, the sixth in the series hosted by the National Marine Safety Committee, is the pre-eminent gathering on marine safety in the Southern Hemisphere. Perth's state of Western Australia boasts a long coastline with a wide variety of marine-related activities and supporting industries. The Burswood Entertainment Centre venue itself is on the water and the conference program will take advantage of the surrounds.

NMSC's CEO, Margie O'Tarpey, said that this year's program reflects an exciting response from speakers and sponsors to make the Perth conference a 'must' on this year's maritime calendar. "Over 35 speakers are now confirmed, with presentations on the latest in commercial and recreational boating safety from around Australia, the Pacific, and beyond," Ms O'Tarpey said. In addition to Irish Water Safety's CEO, John Leech, British Columbia's FishSafe Manager, Gina Johansen, and Michigan State University's marina research specialist, Dr Ed Mahoney, and the US Coast Guard's Boating Safety Division Head, Jeff Hoedt, will present on the second day".

The Federal Minister for Transport, Anthony Albanese, has been invited to address the conference and WA Transport Minister, Simon O'Brien, is expected to attend. The development of the Single National Jurisdiction will form the basis of a timely plenary panel on the first day, with input from AMSA and the Australian Maritime Group.



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Canadian FishSafe project manager, Gina Johansen, said that she is looking forward to sharing what she has learned in order to inspire others to work with the people they are trying to reach with a safety message. "Our model is being adopted Canada-wide, and we believe that this common-sense approach promotes ownership of safety as opposed to regulatory-driven models which promote compliance—it's simple and it works," she said. "I look forward to meeting safety professionals from all over the world and learning from their experiences".

John Leech from Irish Water Safety also hopes to meet many of the Australians working and involved in the marine environment. "Ireland and Australia have enjoyed strong connections between each other's nations for a very long time", he said, "and the exchange of ideas can act as a stimulus for change and improvement in all our organisations to further reduce the unnecessary drownings and aquatic accidents which occur each year".

Local WA industry presenters include MJ Kailis's Engineering Manager, Terry Hewitt, Senior Marine Surveyor, Denis Brookes, and Marine Safety Education Officer, Fiona Heart, while specialists such as the head of Marine Rescue NSW, Glenn Finniss, the Bureau of Meteorology's Peter Dexter, and NMSC's Principal Technical Adviser, Mori Flapan, are among many others bringing their expertise to Perth.

Both Fiona Heart and Denis Brookes from WA's Department of Transport will bring local perspectives to the broad topic of managing marine safety in more-remote areas or in less-accessible parts of the boating community. Mr Brookes' topic covers the problems encountered in surveying and complying with statutory survey requirements in remote areas of Western Australia.

His colleague, Ms Heart, will explore the challenges faced by Indigenous Australians and other members of the broader community who may have limited access to boating safety education. "I'll be sharing the methods we've devised to ensure that safe boating practices are achieved across the whole of Western Australia," she said.

Currently on secondment from the NSW Police Force, Glenn Finniss has taken on the role of acting Commissioner, Marine Rescue NSW. He views the conference as a way of bringing together people from all areas and different perspectives, yet with the same goal—marine safety. Mr Finniss explained that Marine Rescue NSW is the integration of the former Royal Volunteer Coastal Patrol, 14 individual marine units of the Volunteer Rescue Association of NSW, and the NSW Flotillas of the Australian Volunteer Coast Guard. "The integration has been an almost career-long ambition for me, as I just couldn't understand why we had three different volunteer marine rescue organisations, competing for money, support and the airwaves", he said, "but the most important and challenging aspect for me is to provide these volunteers with some creditable recognition and support, not only from the boating public but from government".

The program also includes innovators, such as ABC TV's New Inventors' 2009 winner, Queenslander Colin Chamberlain, with his Environmental Safety Propeller, and New Zealander Ray Chanmugam, with his fully-automated boat gangway.

For further information, contact the MSC 2010 Conference Secretariat, GPO Box 3270, Sydney NSW 2001, phone (02) 9254 5000, fax (02) 9251 3552, email msc2010@icmsaust.com.au, or visit the conference website www.nmsc.gov.au and click on the MSC 2010 icon. The preliminary program for the conference is now posted on the website. Registration is now open online on the website or via the Conference Secretariat. Early-bird registration ($795) closes 18 May 2010, followed by standard registration ($875) to 22 August.

Basic Dry Dock Training Course

Following on from the success of the courses held in Melbourne in 2008 and Brisbane in 2009, the Royal Institution of Naval Architects has announced its intention to hold the Basic Dry Dock training course again in Australia. However, no dates have yet been arranged.

This unique four day course covers the fundamentals and calculations of dry docking. The course begins with the basics and safety concerns, and progresses through all phases of dry docking: preparation, docking, lay period, undocking, and ends with a discussion of Accidents and Incidents.

Presented through classroom lectures, student participation in projects and practical application exercises, the course addresses the deck-plate level of practical operation needed by the dock operator and the universally-accepted mathematical calculations required to carry out operations in accordance with established sound engineering practices.

To view details of the last course held at Forgacs Cairncross dockyard, Brisbane, in 2009, visit www.rina.org.uk/basicdrydockaustralia2009.

To register your interest in this event or for more information, visit www.rina.org.uk/drydockaustralia.html or email awilliams@rina.org.uk.

AMC Maritime Engineering Conference and Reunion Dinner

Friday 5 November 2010
Launceston, Tasmania

The AMC National Centre for Maritime Engineering and Hydrodynamics will be hosting a conference and reunion dinner to celebrate AMC's 30th Anniversary and 20 years of producing Bachelor of Engineering graduates in the fields of:

- Maritime Engineering (1990 – 1999)
- Naval Architecture (1992 – present)
- Ocean Engineering (2000 – present)
- Marine & Offshore Systems (2003 – present)

This event follows on from the success of the inaugural conference and reunion held in October 2005 for AMC's 25th anniversary. Proceedings will commence with a free one-day conference. Details of the conference programme will be available soon.

Both the conference and reunion dinner will be open to all AMC Bachelor of Engineering graduates, past and present AMC maritime engineering staff, industry personnel with affiliation to AMC, conference delegates and family.

The conference will be followed by a Reunion Dinner. Held at Launceston's Hotel Grand Chancellor, the dinner promises some of the finest Tasmanian fare and the opportunity to network with graduates, industry representatives and past and present AMC engineering staff. Partners are welcome. Cost $50 (not including drinks).

Further details on the above events will be provided in the near future. Please

CLASSIFICATION SOCIETY NEWS

GL Approval Certification for Noise and Vibration Measurements

In early April, Germanischer Lloyd issued an approval certificate for noise and vibration measurements to Shanghai Jiangjia Shipping Technology Co. Ltd (JJS&T). The certificate recognises that the famous Chinese measurement firm has reached GL's requirements regarding sound pressure level measurement according to IMO A.468 (XII) and vibration measurement according to ISO 6954 Ed. 2000. The certificate is the first of its kind in China issued by a classification society to a measurement organisation. Both parties also signed an agreement for further cooperation.

The importance of noise and vibration measurements is mounting in sea-trial packages, as these two measurement items are expected to be held to stricter requirements in the forthcoming MLC 2006 and thereby lead to more concerns in a buyer's market. The high-quality measurement is crucial in meeting the upcoming standards and ensuring good working and living conditions for the crew.

GL Exchange Forum on Gas as Ship Fuel

Gas as Ship Fuel was the topic of a recent First Class Exchange Forum hosted by Germanischer Lloyd which highlighted GL's approach towards the environmental concerns of the maritime industry. The forum addressed all aspects related to LNG as an alternative ship fuel.

More than 140 experts from all over Europe gathered at GL's new head office in Hamburg to discuss the status and trends of using gas as ship fuel. The opportunity to analyse the implications of LNG as ship fuel correlates with discussions at IMO. Its sub-committee on bulk liquids and gases is working on new regulations to meet present demands for safety standards in the use of natural gas as a marine fuel. Interim guidelines by IMO will be available in June 2010 and the IGF Code is planned to enter into force with the SOLAS 2014 revision. GL published its own guidelines on using gas as a fuel in early April 2010 to complement IMO interim guidelines.

Invited speakers presented the LNG supply-chain development from a ship owner's and gas-terminal operator's view. Regulatory developments at IMO were explained by a representative of the Federal Ministry of Transport, Building and Urban Affairs, Germany. Details about a joint industry project on a gas-fuelled container feeder vessel were discussed by representatives of GL, MAN Diesel and TGE Marine Gas Engineering, a specialist in the design and construction of cargo-handling systems for ships and offshore units carrying liquefied cryogenic gases. Flensburger Schiffbaugesellschaft evaluated first results of the research project GasPax while the issue of gas bunkering was addressed by GL.

GL Introduces Extended Dry Docking Option

A new extended dry docking (EDD) option for container vessels, general cargo ships and multi-purpose dry cargo vessels has been introduced by Germanischer Lloyd to acknowledge longer-lasting coatings.

GL offers owners and operators the chance to extend the dry-docking period from five to seven-and-a-half-years. This option provides maximum scheduling flexibility while maintaining the highest standards of quality and safety. Owners who previously would have had to look for an available dry-docking facility each five years can now have their ship inspected at the dock-side.

While the extended dry docking option offers tremendous flexibility and savings in positioning and docking costs, it also reduces the off-hire times and allows owners to bring additional scheduling options to the table during charter-party negotiations.

Mike Mechanicos

LR Provides Guidance on EU Sulphur Directive

Lloyd's Register has provided guidance related to class matters, supplementing Guidance Notes for the Design Appraisal of Main and Auxiliary Boilers Operating on Low Sulphur Distillate Oil (November 2009) and frequently-asked questions on the 'at berth' requirements issued earlier in December by FOBAS.

EC Directive 2005/33/EC has been the cause of considerable interest, concern and uncertainty. The entry into force date — 1 January 2010 — of the Directive's 'at berth' requirement that ships burn 0.1% maximum sulphur fuel oil when in port, is certain. However, considerable uncertainties still exist as to compliance, associated technical issues and how the requirements are likely to be enforced.

Lloyd's Register's Technical Directorate has now released specialist class-related guidance to assist operators in understanding what is required from a classification perspective.

LR Explores Re-introducing Nuclear Power for Merchant Ships

NS *Savannah*, the first nuclear-powered cargo-passenger ship, was built in 1959 at a cost of $46.9 million and was funded by the United States government as a demonstration project for the potential usage of nuclear energy. *Savannah* remained in service until 1972 and is now a floating museum. She was one of only four nuclear-powered cargo ships ever built, the others being NS *Otto Hahn*, Germany, 1968–79 (re-engined with diesels in 1979), NS *Mutsu*, Japan, 1970–1992 (never carried a commercial cargo), and NS *Sevmorput*, Russia, 1988–present (still in operation).

Environmental concern in recent years has been focussed on the influence of greenhouse gases on the world's climate. Although the marine industry contributes a relatively small proportion of greenhouse gases in relation to the amount of goods and raw materials transported around the world, from a marine perspective the CO_2 contribution from exhaust emissions has been a particular concern in recent years. Indeed, a number of research and development initiatives have been introduced to mitigate this component of emissions from slow- and medium-speed diesel engines.

As part of these concerns, Lloyd's Register has been considering the problem of greenhouse gases arising from ship propulsion from a number of perspectives in order to assist the marine industry in reducing its carbon footprint for

the future. One such technology is that of nuclear propulsion which nullifies the CO_2 contribution.

Some two years ago, Lloyd's Register commenced an internal research programme directed towards the implications arising from the nuclear propulsion of merchant ships. This work built on the extensive and ongoing experience of Lloyd's Register in the land-based nuclear industries and previously in studies undertaken in the production of its Provisional Rules for the Nuclear Propulsion of Ships which were extant over a ten year period from 1966 through to 1976.

These Rules were developed in response to the interest shown in nuclear propulsion in the early 1960s, as typified by *Savannah* and *Otto Hahn*. Both of these ships were technically successful but, at the time, conditions were not conducive to their commercial success. They both nevertheless traded worldwide for some years.

The then-prevailing commercial situation has now arguably changed significantly, with the steady increase in conventional fuel prices and the probable advent of carbon taxes. Indeed, notwithstanding naval experience, since the 1960s there has been a steady but slow development of merchant-ship nuclear propulsion, principally with ice breakers but also extending to a lash barge carrier and a containership. Indeed, two nuclear ice breakers also undertake popular passenger cruising duties at certain times of the year.

Lloyd's Register's research programme revisited the technical aspects of the nuclear ship propulsion problem together with the associated refuelling and waste disposal issues.

This scope expanded to embrace public health, manning, training, operational, risk, and regulatory requirements. Within this study the application of nuclear propulsion to cruise ships, tankers, bulk carriers and container ships has been principally addressed although, clearly, a range of other ship types may also benefit from this type of propulsion system.

A major conclusion has been that the building and operation of a nuclear-propelled ship is technically possible, particularly with the range of small pressurised-water reactors (PWR) which are currently available, or other types which will be available in a relatively short time; these developments include a range of high-temperature reactors and embrace the pebble-bed concept as well as furthering the development of the PWR concept. Indeed, in the context of marine propulsion, most experience to date has been gained with the application of PWR technology to submarines and surface ships and, in these roles, they have demonstrated an enviable reliability and safety record when correctly applied and operated.

Other conclusions have been that enhanced safety and control features make their use increasingly attractive, particularly for merchant-marine operation, and the risks associated with well-manned and -operated ships will be minimal. Nuclear refuelling periods of four-to-five years are consistent with conventional survey periods. However, nuclear propulsion is not likely to be a realistic option for most operators in the near future.

Horizons, February 2010

The US Navy's latest aircraft carrier, USS *George H. W. Bush* (CVN 77), the tenth and last of the Nimitz class executing a high-speed turn during sea trials in February
(US Navy photograph)

GENERAL NEWS

Austal's New 102 m Trimaran

Austal's next-generation 102 m high-speed trimaran ferry has recently carried out trials and is nearing completion. Set to introduce unprecedented levels of passenger comfort compared to regular high-speed craft, particularly in adverse weather conditions. The vehicle-passenger ferry proves a fitting debut for Austal's second-generation trimaran hullform.

By incorporating lessons learnt from the success of Austal's inaugural 2005 trimaran, *Benchijigua Express*, and the Austal designed and built Littoral Combat Ship, USS *Independence*, recently delivered to the US Navy, the company's latest trimaran delivers innovation without risk.

Austal Technical Manager, James Bennett, said improving on a product as successful as *Benchijigua Express* was an exciting challenge.

"One of the most outstanding features of *Benchijigua Express* has been her ability to deliver passengers to their destination in comfort no matter the weather conditions."

"We wanted the second-generation trimaran to not only take passenger comfort to new levels, but also to optimise performance, sea keeping, fuel efficiency and payload."

Before proceeding with a successor to the company's inaugural trimaran, Austal conducted a complete review of *Benchijigua Express* to establish where improvements could be made. This was followed by a detailed market study on the commercial ferry industry looking at the size and capacity of existing fleets.

Based on the data collected from this study, it was determined that 102 m, 1165 passengers and 254 cars were the approximate specifications most applicable to the existing market.

Because the vessel was being built on speculation, the design of the vessel's interior and vehicle deck has been pitched at a level that permits the eventual owner to easily modify the vessel to suit their particular market.

The final design achieved a number of key improvements over its predecessor including;

- Refined waterlines to improve seakeeping and passenger comfort, and reduce resistance.
- A new and simplified ride-control arrangement and operating system to deliver improved control over the vessel's motions and handling characteristics.
- Simplified, three engine power train.
- New series water jets with improved cavitation margins.

The vessel's unique trimaran hullform combines the softer roll of monohulls with the low resistance, stability and carrying capacity of catamarans to deliver proven advantages over conventional designs.

These advantages include greater speed for the same installed power, an ability to operate in higher wave heights and maintain speed.

Most importantly, the trimaran's lower roll speed means lower accelerations experienced by passengers, significantly reducing passenger sea sickness.

Austal's new 102 m trimaran on trials
(Photo courtesy Austal)

Studies show that motion sickness on the trimaran will be approximately 56% lower than on a 100 m catamaran operating in head seas. Even larger benefits are realised in other headings.

For operators, this means higher passenger satisfaction, greater customer loyalty and positive word-of-mouth marketing.

It also means higher revenue from onboard sales resulting from the ease of movement onboard and reduced sickness. Improved revenue potential from the trimaran's ability to sail in a wider range of sea conditions (fewer cancellations) is another significant advantage.

Increased comfort also provides operators with a competitive marketing advantage compared with other high-speed craft. Greater customer satisfaction due to fewer cancellations means more repeat business and improved revenue potential from a more viable roster.

Effectively, the trimaran becomes the "preferred alternative" in a competitive market situation.

The most immediately noticeable change to its predecessor is the existence of a straight-stem bow — designed to maximise the vessel's waterline length and deliver greater speed and efficiency.

Another significant improvement is the adoption of a three-engine propulsion train which combines with the trimaran's unique hydrodynamic hull form to deliver fuel efficiency across a range of operating conditions.

The three-engine arrangement also means lower fuel consumption, lower emissions and reduced maintenance compared to fast ferries of a similar size which have four engines.

A speed of 39 kn (at 90% MCR) with 340 t deadweight was achieved during sea trials, as well as a maximum speed of 45 kn, and a 760 n mile range (at 90% MCR) with fuel consumption of only 4.90 t/h.

Powering the vessel are three class-leading MTU 20V 8000 Series diesel engines, which offer high power-to-weight ratio and are established as a low-risk propulsion engine option for many leading high-speed ferry operators.

Propulsion consists of three new-series Wärtsilä LJX 1300 water jets chosen for their improved cavitation margin (greater efficiency), each driven through a ZF 53800 reduction gearbox.

Austal's focus on maximising redundancy is evident throughout the vessel's machinery spaces, with two separate main fuel and day tanks and each of the vessel's three engines located in separate engine rooms. The vessel's four MTU S60 generators are split between the engine room and the starboard side of the main deck, again for redundancy.

The vessel's double retractable bow-thruster arrangement delivers improved manoeuvrability in harbour, along with redundancy in the event that one is damaged.

A new and simplified ride-control arrangement and operating system delivers improved control over the vessel's motions and handling characteristics in all sea conditions. Along with a central T-foil on the main hull forward, the new ride-control system includes T-foil roll-control fins on each of the vessel's amahs. All foils have been designed to permit removal and servicing without the need to dry-dock the vessel, reducing maintenance cost and down time.

Austal's new trimaran showing her clean wake at high speed
(Photo courtesy Austal)

The vessel has four decks — a main vehicle deck, mezzanine vehicle deck, upper passenger deck and bridge deck. A cavernous vehicle deck has space for 245 cars or 188 truck lane metres plus 145 cars.

With flexibility in mind, the mezzanine deck is a mixture of fixed and hoistable decks which allow the carriage of up to 132 cars with a clear deck height of 2 m.

When hoisted, there is a height on the main deck below of

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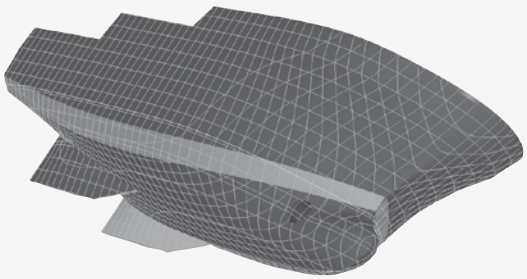
Maxsurf is an integrated suite of design, analysis and construction software suitable for all types of vessels. All modules feature a consistent, graphical Windows interface, work from a common database, and provide data exchange with AutoCAD, ShipConstructor and Microsoft Office.



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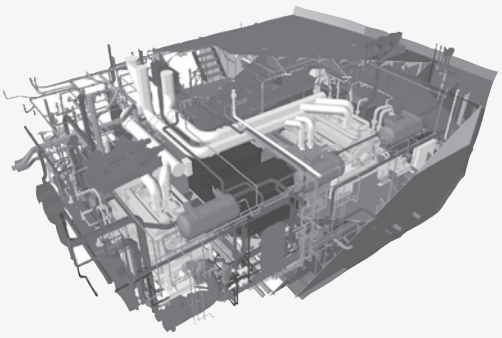

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4.3 m, and 2.3 m when lowered, and may be hoisted in two different sections at the same time.

As one of many measures aimed at reducing maintenance costs or the need to dry dock the vessel, a bow-thruster hatch on the forward mezzanine deck allows the equipment to be serviced while the vessel is afloat.

A similar approach is evident at the aft end of the main deck, where a large hydraulically-operated hatch opens when the vessel is not operating, permitting access to the vessel's waterjet compartment and machinery spaces. This access is complemented by bolted hatches over the main engine rooms for machinery component removal.

These design features mean that the vessel spends more time in service and reduces maintenance costs for the operator.

The aft end of the vessel is strengthened to accept a conventional ramp, an optional bi-folding ramp or a shore-based link-span ramp. Spray curtains are installed on the main vehicle deck aft to protect vehicles from exposure to light sea spray.

Vehicle turnaround occurs at the front of both the main vehicle deck and mezzanine levels, ensuring fast loading and unloading. The vehicle deck is designed to carry dangerous goods.

To maximise accessibility, passenger access is achieved via staircases located both port and starboard of the vehicle deck, with a disabled persons lift on the port side.

In order to isolate noise and vibration to the main deck, the vessel's entire superstructure has been resiliently mounted below the passenger deck.

This important design feature provides a quieter, more-comfortable passenger environment, reducing exposure to vibrations and stresses and allows for the large panoramic windows evident throughout the upper deck.

All passenger seating is located on the upper deck, which is separated into three lounges and can be customised to seat between 950 and 1165 passengers. Onboard amenities are designed to maximise accessibility and include wheelchair-accessible toilets, lift and four independent passenger-entry points.

A business-class lounge located on the forward upper deck is equipped with Beurteaux Ocean Club seats and dedicated bar, and offers panoramic views over the bow.

The extensive range of high-quality facilities on the passenger deck include two bar areas, a food-preparation room and service counter, baby-change room and disabled-person toilets. The upgradeable bar design features hot/cold servery and attractive black granite bench tops, a design feature repeated throughout the vessel. High-quality wool carpet, and wood laminates offer both style and durability.

A separate crew mess with lounge, table and well-equipped kitchen is located amidship alongside the stair access to the vessel's upper bridge deck.

In a first for large high-speed craft, the upper deck is installed with high-efficiency LED lighting, which requires significantly less electrical power and produces far less heat that traditional lighting, along with bulb life of up to 30 000 hours. This reduces both the vessel's overall running costs and emissions.

An IMCOSS^{tm} integrated PA and entertainment system with DVD, CD and MP3 player ensures that passengers and crew are informed and entertained, with a backup emergency unit situated within a separate protected compartment. Messages and entertainment are broadcast via the vessel's many ceiling-mounted high-definition Toshiba LCD screens.

Throughout the vessel, a passenger-friendly seating density ensures that rows are limited to no more than 2–3 seats, increasing comfort and accessibility, which is important during longer journeys. The amidship lounge features Beurteaux Tourist high-back seats, and room for an additional bar or shop. An open passenger sundeck with bench seating — a popular facility in warmer climates — is situated on aft upper deck.

The highest levels of passenger and crew safety are assured with the availability of four Liferaft Systems Australia MES systems using twin-track slides for faster and safer side-by-side passenger evacuation to canopied 100-person inflatable rafts.

A separate work desk and GMDSS Area A3-compliant radio console are also located on the bridge deck.

Principal Particulars

Length OA	102 m
Length WL	101.4 m
Beam (moulded)	27.4 m
Hull depth (mld)	7.6 m
Hull draft (max.)	4.5 m
Passengers	1165 in 3 lounges
Cars	254 (4.5 x 2.35 metres)
Truck lane metres	188 plus 145 cars
Trucks	12 t double wheel axle
	9 t single wheel axle
Maximum dwt	680 t

Machinery

Main engines	3 × MTU 20V 8000 M71L
	each 9100 kW
Gearboxes	3 × ZF 53800
Waterjets	3 × Wartsila LJX 1300
Generators	4 × MTU S60
Ride Control System	1 × 10m^2 T-Foil forward
	2 × 2.5 m^2 T-Foils on amahs
Bowthrusters	2 × 41 kN retractable
Rudder	1 × 'T' Max

Tankage

Diesel	144 000 L
Fresh water	7000 L
Black and grey water	7000 L
Lube oil	1000 L

Performance (with ride control fitted)

Speed	39.0 kn (90% MCR, 340 t dwt)
Fuel consumption	4.90 t/h
Range	760 n miles @ 90% MCR
	with 20% reserve

Survey

Germanischer Lloyd	HSC 2000 MSC.97(73) 100
	A5, HSC - B OC3 Hs=5m
	High Speed Passenger/Ro-Ro
	Type, MC, AUT
	Bahamian Flag Authority

Austal's new trimaran executing a tight turn to port
(Photo courtesy Austal)

AWD Module Fabrication Begins

On 15 April the Hon. Greg Combet, Minister for Defence Materiel and Science, visited the BAE Systems shipyard in Williamstown to celebrate the start of full production of the hull modules for Australia's new air-warfare destroyers. In his speech during this visit he said:

"Building the air-warfare destroyers will involve more than three thousand people across Australia.

"At this point in our Nation's history, the Air-warfare destroyers are the single biggest defence procurement ever attempted.

"When they are built and delivered, this new Hobart-class of air-warfare destroyers will provide the Royal Australian Navy with one of the world's most capable multi-mission warships. These ships will provide air defence for accompanying ships in addition to land forces and infrastructure in coastal areas, and for self-protection against missiles and aircraft. The Aegis combat system, in combination with the SM-2 missile, will provide an advanced air-defence system capable of engaging enemy aircraft and missiles at ranges in excess of one hundred and fifty kilometres.

"The Government's 2009 White Paper outlines the coming challenges in the next decades and emphasises the importance of a strong maritime force for Australia. The AWDs will be an important part of Force 2030.

"In terms of the complexity of the task, only the construction of the Collins-class submarines rivals the AWD project. To give this event some context, what does it actually take to build an air-warfare destroyer?

"The block you can see behind me reveals the challenge of constructing these machines. The material that goes into each ship is impressive and includes:

Fabrication of a hull block for the first AWD underway at the BAE Systems shipyard at Williamstown
(Department of Defence photo)

- four thousand, seven hundred and seventy tonnes of steel;
- one hundred and thirty seven thousand, eight hundred and thirty litres of paint;
- over fifty kilometres of steel piping;
- almost five hundred kilometres of electrical cable;
- nearly five thousand mechanical valves;
- about six kilometres of rope; and
- over one and a half million nuts, bolts and other fasteners.

"The people involved in the AWD project are engineers, boilermakers, electricians, pipe fitters, welders, storemen, project managers and safety officers, to name just a few. More than three thousand people in total across Australia. Each of you has an important part to play in the success of the project.

"Not only has the AWD project attracted skilled workers, it is attracting many young people. Young people who will begin their working careers as apprentices in shipyards building the AWDs, some of whom will go on to long careers in shipyards or in manufacturing, mining and other industries.

"BAE Systems currently employs 17 apprentices, with another 23 planned to be recruited over the next two years. ASC currently employs nine apprentices with another six joining in 2010 and more beyond that. Forgacs currently employs 23 apprentices, with another 17 to be recruited over the life of the project.

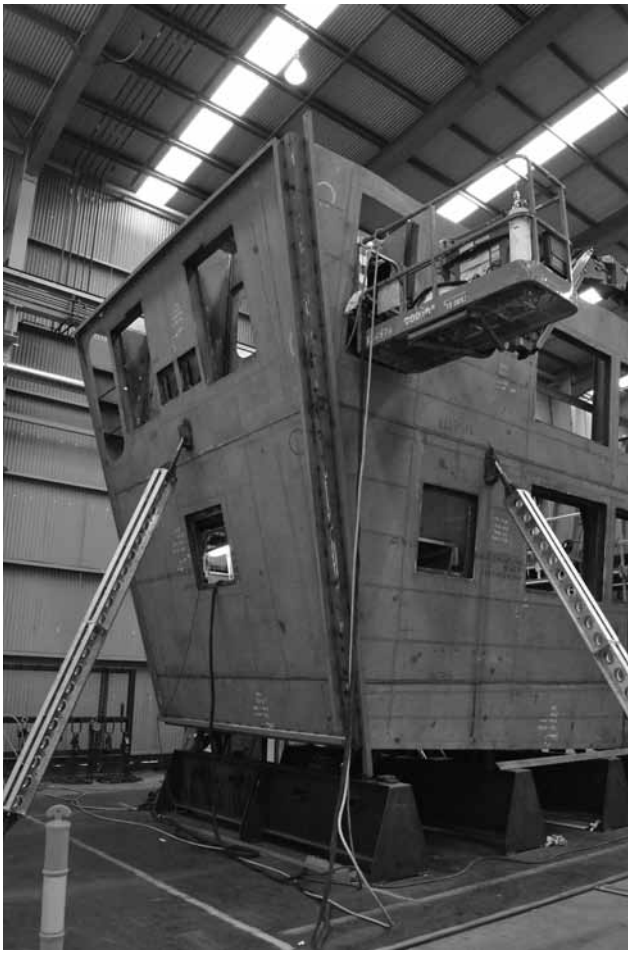
"All up, the AWD project will engage more than 200 apprentices, which is an important foundation for the Defence industry of the future. These really are exciting opportunities for young Australians.

"Today, there are three shipyards engaged in building hull blocks for the AWDs — BAE Systems here in Williamstown, ASC in Adelaide, and Forgacs in Newcastle.

Each AWD has 31 hull blocks, 93 blocks overall for the project. For each ship, BAE Systems will fabricate twelve blocks, ASC will fabricate nine blocks, and Forgacs will fabricate ten blocks.

"In this shipyard, four hundred production workers are involved in AWD block production; about five hundred production workers will be involved at ASC in Adelaide and around one hundred and forty at Forgacs in Newcastle.

AWD steel being prepared for fabrication at Forgacs
(Department of Defence photo)



Block assembly at ASC in Adelaide
(Department of Defence photo)

"These contracts are worth about $300 million to BAE Systems and $150 million for Forgacs. This is a considerable boost to the economies of Melbourne and Newcastle.

"BAE Systems is currently fabricating four keel blocks. When assembled, these blocks will form the foundation for the ship's gas turbine and diesel engine propulsion system, and will measure 69 m long and weigh over 450 t.

"At ASC, work is underway on two superstructure blocks, with a total length of 35 m and weighing more than 200 t. Forgacs is now working on three other superstructure blocks, with a total length of 36 m and weighing more than 200 t.

"In twelve months time, completed blocks will start to arrive in Adelaide for consolidation into the complete warship at the Government of South Australia's Common User Facility. The first block will come from this shipyard. Forgacs will deliver their first block in August 2011 and ASC will complete their first block in September 2011.

"The AWD project is currently on budget and on schedule, and I thank everyone involved with the AWD Alliance for their commitment and hard work. AWD construction work is also happening outside the three main shipyards. In Hobart, Taylor Brothers are manufacturing the accommodation modules for the ships. In Port Kembla, BlueScope Steel is producing steel for the ships. These contracts are each worth about $20 million to the economies of Tasmania and the Illawarra.

"In Adelaide, a range of companies including Ferrocut and United Fasteners have won contracts.

"I won't go into the details of all the activity surrounding the combat system, but organisation like Raytheon Australia, the US Navy, Lockheed Martin, Babcock Australia, Ultra Electronics, and many others are producing what will be a very sophisticated and powerful combat system for these warships.

"I also announced yesterday that the AWD Alliance had completed its Electronic Warfare source selection, and had chosen ITT-EDO Reconnaissance and Surveillance Systems as the preferred supplier.

"ITT will team with two Australian-based companies, Avalon Systems and Jenkins Engineering Defence Systems, to deliver this important capability for the AWD.

"This contract is worth around $30 million and over one-third of the work will be done locally. Importantly, this will help support the Priority Industry Capability which resides within certain parts of electronic warfare, specifically: EW counter-measures development and validation; EW re-programming, system integration and 'tuning' of overseas developed EW systems; the management of threat libraries; and selective strategic product development to maintain high-end EW knowledge and capability.

"This project is not just about building ships. The civil infrastructure development at BAE Systems, ASC and Forgacs, and the Common User Facility in Adelaide, represents an investment of $500 million. All those facilities will, of course, be used for other work, but this work is a major national project in itself.

" I would like to take this opportunity to thank John Gallacher for all his work in leading the AWD Alliance team over the past three years. Thank you John! We wish you well in your return to your family and new home in Perth. In closing, I would also like to commend Merv Davis and his shipbuilding team here in Melbourne, Steve Ludlam and his shipbuilding team in Adelaide, and Stephen Forgacs and his shipbuilding team in Newcastle, on the commencement of full-block production of the AWDs.

"The air-warfare destroyer project is an exciting endeavour for Australia. It brings together many thousands of skilled and talented people, committed to working together to make this project a success. There are sure to be challenges ahead. I know you have that skill and talent to bring the project to a successful conclusion. The ships which you will produce, the air-warfare destroyers, will strengthen the defence of Australia for the next generation and I thank you for your efforts."

Austal Rationalises Australian Operations

On 12 May 2010 Austal announced a rationalisation of its Australian operations and workforce as a result of the impact of changed market demand for smaller-sized vessels.

The rationalisation will unfortunately result in the closure of Austal's Tasmanian operations at Margate in September 2010.

Austal Director — Sales and Australian Operations, Andrew Bellamy, commented: "Based on Austal's current assessment of the global market, the forecast demand for smaller passenger ferries and small patrol boats can be fully serviced out of the Henderson facilities in Western Australia. "These changes are part of our ongoing effort to improve the level of efficiency and effectiveness of Austal's operations. We regret however that this will result in some reductions to our Australian workforce."

Austal's Tasmanian shipyard currently employs 121 people and will close upon completion of its current project.

Collins-class Battery Contract

On 4 May the Hon Greg Combet, Minister for Defence Materiel and Science, visited Pacific Marine Batteries Pty Ltd in Adelaide following its success in winning two multi-million dollar contracts from Defence.

Following a tour of the company's facilities, Mr Combet said that the Defence Materiel Organisation (DMO) had entered into two separate agreements with Pacific Marine Batteries for the provision of replacement batteries and technical support of batteries for the Collins-class submarines.

"The acquisition contract is valued at more than $81 million for the provision of five Collins-class submarine battery sets and will support 56 local jobs over the next six years," Mr Combet said.

"The standing offer, on the other hand, will provide the DMO with a flexible seven-year mechanism to engage Pacific Marine Batteries Pty Ltd at short notice for technical support of the Collins-class submarine battery sets.

"Pacific Marine Batteries will continue to provide an Environmental Protection Authority-approved storage facility for up to four battery sets (two in storage and two being ready for disposal).

"They will also provide equipment capable of conditioning the cells in anticipation of installation in a submarine, as well as providing decommissioning and disposal services at the end of the useful life of each battery set.

"Pacific Marine Batteries Pty Ltd is a small-to-medium enterprise which supplies components of a strategic capability to Defence.

"This contract reinforces the Government's commitment to building local industry capability for the defence of Australia, the protection of our sovereign interests and the security and stability of our region," Mr Combet said.

NSW Government appoints Defence Industry Advisory Council

On 28 April the NSW Minister for State and Regional Development, Ian Macdonald, announced the formation of an expert advisory council to help strategically grow the State's defence industry.

Mr Macdonald said the NSW Defence Industry Advisory Council will provide independent and high-level advice to the Government on targeting more defence contracts to support jobs and investment.

"This Council will play an important role in helping NSW achieve its target of securing at least 30% of Australia's in-country defence spending within a decade and creating an additional 1500 defence-related jobs," he said.

"I thank the newly-elected members of the NSW Defence Industry Advisory Council for their highly-valued contributions, and look forward to working with them for the benefit of NSW

"This expert Council comprises senior representatives

from the defence industry and private sector as well as former senior members of the Department of Defence and the Australian Defence Force.

"Our efforts to grow the NSW defence industry will support economic growth, jobs and investment in both metropolitan and regional communities, as well as build business competitiveness and workforce skills.

"The Federal Government's Defence White Paper foreshadows investment of over $100 billion in new defence assets over the next decade, and NSW is determined to secure a solid share."

Mr Macdonald said the formation of the Defence Industry Advisory Council was one of the recommendations of a NSW Defence Industry Scoping Study prepared last year. The scoping study identified future defence industry opportunities for the State and ways to maximise outcomes for the industry and economy.

"With the help of the NSW Defence Industry Advisory Council, NSW will be targeting major defence projects across the Army, Navy and Air Force to create jobs and investment," Mr Macdonald said.

"If NSW achieves its goals, then the combined direct and indirect economic impact could be in the order of $7 billion to $10 billion each year in defence industry work.

"We will be targeting key projects from the Defence White Paper and building better business relationships with defence Prime Contractors and defence SME networks.

"We will also be developing high-technology defence business hubs as a magnet for defence work. Already we've announced an Air Combat Capability Hub centred around RAAF Williamtown in the Hunter, and a Maritime Capability Hub to target Navy, related projects for Sydney, Newcastle and Nowra.

"Furthermore, we will explore opportunities to use the investment, skills and technology gained from our defence projects to benefit other sectors of our economy and to improve State infrastructure."

Members of the NSW Defence Industry Advisory Council

Chair – Peter Robson, Chairman, Consolidated Manufacturing Enterprises

Dr Richard Sheldrake, Director-General, I&I NSW

Air Vice Marshal John Blackburn AO RAAF (Ret'd), NSW Defence Industry Advisor

Rear Admiral Brian Adams AO RAN (Ret'd)

George Campbell OAM

Professor Ross Babbage, former advisor to the Minister for Defence during the preparation of the 2009 Defence White Paper

Air Marshal Errol McCormack RAAF (Ret'd)

Ken Moore, formerly Chief Finance Officer, Department of Defence

Chris Jenkins, Managing Director, Thales

John Allcock, Group General Manager, Raytheon

Alan Rankins, NSW President, Australian Industry Defence Network

Air Vice-Marshal Peter Nicholson AO RAAF (Ret'd), Govt. Relations, BAE Systems

Fuel Removed from Sunken WWII Era Ship

In April the US Naval Sea Systems Command's Supervisor of Salvage and Diving (SUPSALV), in a US Coast Guard directed initiative, provided a key operational and technical role in removing 229 000 L of petroleum products from the sunken ex-USS *Chehalis* (AOG-48).

USS *Chehalis* sank in Pago Pago Harbor, American Samoa, on 7 October 1949 as a result of a gasoline tank fire and multiple explosions on the ship. The fire caused the ship to sink and subsequently capsize in more than 48 m of water.

The Coast Guard requested SUPSALV expertise to support American Samoa's request for assistance by conducting a ship diving survey, detailed planning for, and the safe removal of the petroleum products from *Chehalis* which represented a potential threat to Pago Pago Harbor.

"What's unique about this Patapsco-class gasoline tanker which sank off the coast of American Samoa more than 60 years ago is that highly-volatile gasoline remained in several of the ship's cargo tanks," said Kemp Skudin, SUPSALV's ex-USS *Chehalis* project leader. "We do not normally encounter gasoline in sunken wrecks. Gasoline is not usually a maritime fuel and normally would have been consumed by fire or lost, since it has a much-lower flash point compared to marine diesel fuel or black oil."

Typically, and in this case for *Chehalis'* diesel bunkers, less-volatile fuels are removed using the "hot tap" method, requiring the tank to be cut into in order to install a valve and attach a pumping system. This method causes heat which can be explosive when combustible fluids like gasoline are involved. Also, gasoline in motion can explode due to electrostatic discharge caused by pumping turbulence in hoses, or when falling into a storage tank. Since safe diving operations are the highest priority for Navy divers, SUPSALV had to develop an alternate means of removing the gasoline.

"We used a buoyed suction head fed into the cargo tanks through their hatches by divers and controlled by an air hose on the surface. This meant that we did not have to hot tap into the gasoline tanks. To pump the gasoline we used an intrinsically-safe pneumatic pump on a small floating platform through internally- and externally-bounded suction and discharge hoses," said Skudin. "Our barge was rigged to load the tanks through the stripping lines. This limited the gasoline fall into the barge's tank to only a few inches, further reducing the potential for static electricity. As an added precaution, the Mobile Diving and Salvage Unit One Divers, working from USNS *Sioux* (T-ATF 171), were put in a separate moor from the pumping platform and ocean-going barge to which the gasoline was removed. "

USS *Chehalis*
(US Navy photo)

Malta's New Patrol Boat Fleet Commissioned

Austal has completed its first European defence contract following the commissioning of four 21.2 m inshore patrol craft for the Armed Forces of Malta (AFM).

The aluminium vessels have a maximum speed of more than 26 kn and will assist the AFM with surveillance and border protection throughout Malta's coastal waters.

Speaking at the commissioning ceremony held on 18 March 2010, Maltese Prime Minister Lawrence Gonzi, described the vessels as "the pride of the Maritime Squadron's fleet."

"The modern and cutting-edge technology coupled with the best accommodation facilities will also provide a better working environment for the crew," Prime Minister Gonzi said.

"The patrol boats were purposely built and customised in line with the Squadron's requirements."

Austal was awarded the contract in February 2009 following a competitive international tender process, which called for a proven design that addressed specific AFM requirements. The project was co-financed by the European Union's External Border's Fund.

AFM Lieutenant-Colonel Martin Sammut commended Austal for their willingness to ensure client satisfaction.

"Austal's professionalism has made it possible for all four vessels to be completed on time. Furthermore their continued assistance is testimony to their intent to seal this successful partnership," Lt Col Sammut said.

The four vessels were built at Austal's Western Australian facility and delivered to Malta via liftship.

Austal Director — Sales and Australian Operations, Andrew Bellamy, said that the successful delivery of Austal's first European defence contract was a proud achievement.

"We are pleased to deliver these state-of-the-art vessels and look forward to them serving the AFM for many years to come," Mr Bellamy said.

"This project illustrates Austal's ability to deliver quality customised solutions within timeframes that would be beyond most shipbuilders, including those offering standardised production designs."

Austal's 21.2 m inshore patrol boat is a fast and versatile vessel, designed for coastal surveillance and search and rescue. The all-aluminium monohull provides enhanced crew habitability, manoeuvrability and fuel efficiency across various operating conditions.

An elevated flybridge provides optimal visibility during near-range operations. The vessel is equipped with fire-fighting capability via a fire monitor on the aft flybridge deck, alongside two 7.62 mm light machine-gun mounts. Mounting for one 12.7 mm heavy machine gun is positioned near the vessel's bow.

Two separate amenities blocks are located either side of the main boarding entry. Their accessibility from the outside on the main aft deck enables non-crew use without entering the vessel's main internal areas.

Adding to the platform's versatility is a bilge manifold located above the main aft deck, which can perform salvage pumping for another vessel if needed. A stern launching ramp allows the safe deployment and retrieval of a rigid-hull inflatable boat and dive operations are supported via low-to-the-water platforms located aft.

A galley and crew mess are located on the lower deck, along

The Austal-built patrol boats for Malta
(Photo courtesy Austal)

with two 2-berth cabins each, with lockers and bench. A four-berth cabin is located in the vessel's bow, along with additional locker storage space.

Powering the vessel are two MAN D2842 LE410 diesel engines, each producing 809 kW at 2100 rpm and driving fixed-pitch propellers. Auxiliary engines consist of two Cummins MDKBUs.

The AFM vessels are classed by DNV with ✠1A1 LC R2 Patrol notation.

Principal particulars

Length OA	21.2 m
Length WL	17.8 m
Beam (moulded)	5.5 m
Depth (moulded)	2.8 m
Hull draft (max.)	1.83 m
Crew	8
Max. deadweight	6 t
Fuel (min.)	5000 L
Main engines	2 × MAN D2842 LE410 each 809 kW @ 2100rpm
Gearboxes	2 × ZF 3000 A
Propulsion	2 fixed pitch propellers
Speed	Over 26 kn
Classification	DNV ✠1A1 HSLC R2 Patrol

Austal Launches Ferry for Malta

On 28 April Austal launched a new 107 m high-speed vehicle-passenger catamaran *Jean de la Valette* for Maltese operator,Virtu Ferries, at its Western Australian facilities.

Intended to address increased heavy cargo traffic between Malta and Italy, the vessel has the capacity to carry 800 passengers and 156 cars at a speed of approximately 39 kn and is on schedule for delivery in August this year.

The ferry will be Austal's 24th commercial delivery to operators in the Mediterranean region, which includes 14 large vehicle-passenger ferries, and will join Virtu Ferries' existing 68 m Austal vehicle ferry *Maria Dolores*.

Virtu Fast Ferries Ltd Managing Director, Francis Portelli, said that the company was impressed with the speed of construction and quality of workmanship.

"The level of communication that we have experienced with Austal throughout the build process so far has also been outstanding," Mr Portelli said.

"As a repeat customer, the quality that we have come to expect from Austal is evident. We are confident that the versatility, speed and all-round efficiency of this vessel will deliver the best possible solution for the proposed route."

Designed to efficiently accommodate private passengers with cars and campers, commercial tourist operators and trucking companies, the vessel's vehicle deck has the capacity to carry up to 156 cars or 45 cars and 342 truck lane metres. Vehicle loading and unloading will be achieved via ramps installed on both the stern and port-side.

Seating for the ferry's 800 passengers will be spread over two decks, each offering a passenger-friendly seating density of 2–3 seats per row, as well as a dedicated upper-deck lounge area overlooking the vessel's bow. A central staircase will lead to a first-class seating area featuring natural overhead lighting, a separate kiosk and two VIP lounges. Outdoor seating will also be available for more than 110 passengers.

Powering the vessel will be four MTU 20V 8000 M71L diesel engines producing 9100 kW each and driving Rolls-Royce KaMeWa waterjets.

Austal was awarded the contract in April 2009 following a competitive international tender process which saw Austal utilise its in-house design team and experience to develop a highly-customised vessel design which met all Virtu's requirements for the route.

The vessel is being built in accordance with the requirements and under the survey of Det Norske Veritas, conforming to IMO HSC Codes and Malta Flag State and Italian Port State Regulations. Registration will be under the Malta Flag.

Jean de la Valette ready for launching
(Photo courtesy Austal)

The vessel is on track to commence sea trials in June.

Principal particulars

Length OA	106.5 m
Length WL	92.4 m
Beam moulded	23.8 m
Hull depth	9.4 m
Hull draft (max.)	4.90 m
Deadweight (max.)	850 t
Passengers	800
Crew	24
Vehicles	156 cars or 342 truck lane metres with 45 cars
Fuel (approx.)	335 000 L
Propulsion	
Main engines	4 × MTU 20V 8000 M71L each 9100 kW
Propulsion	4 × KaMeWa 125SIII waterjets
Service speed	approx 39 kn (85% MCR and active ride control)
Survey	
Classification	Det Norske Veritas

More News from the Western Australian Industry

Ningaloo Vision FPSO Delivers First Oil for Apache

Apache PVG Pty Ltd started oil production from the Van Gogh development in the Exmouth basin offshore Western Australia on 16 February 2010. The Van Gogh field is being produced using the Floating Production Storage and Offloading (FPSO) vessel, *Ningaloo Vision*.

Ningaloo Vision was converted from the doubled-sided Aframax tanker *Kudam* at the Keppel Tuas shipyard in Singapore. The FPSO has the capacity to process 150 000 barrels of liquids per day, including 63 000 barrels of oil per day, and store 540 000 barrels of oil. *Ningaloo Vision* will be operated by Prosafe Production.

The vessel is designed to remain on station in conditions up to and including the 100-year return non-cyclonic storm. She is equipped with a disconnectable turret mooring (DTM) system, which allows her to disconnect from the DTM buoy, risers and mooring system and sail away under her own power to avoid an oncoming cyclone. The DTM buoy, which is designed to withstand the 100-year return cyclone, will remain floating in the water column at a depth of approximately 50 m supporting the mooring and riser systems. The flexible riser system involves two 16 in (406 mm) production risers, one 16 in (406 mm) gas re-injection riser, one 16 in (406 mm) water re-injection riser and an electro-hydraulic umbilical for control of subsea manifolds and wells.

Bringing the Van Gogh project to the first oil is a significant milestone for Apache. Apart from Prosafe Production, an FPSO contractor and operator with headquarters in Singapore, a number of companies based in Western Australia contributed to the project at various stages, from the development of field layout, functional requirements, metocean and geotechnical data to the installation of the FPSO in the field. These include INTECSEA, Metocean Engineers, MCS, TS Marine, Arup, Acergy, GEMS, Mermaid Marine, Lloyd's Register and many others.

Martin Kuhn

MT *Kudam* undergoing conversion from tanker to FPSO at Keppel Tuas in Singapore
(Image courtesy Apache Energy Ltd)

Prosafe Production's DTM buoy being loaded onto heavy-lift vessel for transport to Van Gogh Field
(Image courtesy Apache Energy Ltd)

First of nine 12 t Vryhoff Stevshark anchors for the DTM mooring being deployed at the Van Gogh Field
(Image courtesy Apache Energy Ltd)

New South Wales Industry

McConaghy Boats Launches *Singularity*

McConaghy Boats in Mona Vale has delivered the Lutra 80 performance sailing yacht, *Singularity*, an 80 ft (24.38 m) cruiser/racer with state-of-the-art carbon sandwich construction, a canting keel and many go-fast features normally associated with pure racing yachts. The overseas owner commissioned the yacht as a day boat which had to be at the same time comfortable, fast and strong.

A top-class team, mainly Australian, started working on the project two years ago and the vessel is now on her way to the Mediterranean, ready to cruise and race during the European summer.

The design, which comes from the pen of the famous Dutch naval architect, Adrian Konynendyk, and Design Unlimited, a UK-based interior-design firm, was supported by an Australian team which included the Tasmanian-based naval architect, Fred Barrett, SP-High Modulus [the Marine Business of Gurit (Australasia)], and the in-house design staff of McConaghy Boats.

While detail design of components and rigging was performed by Barrett and McConaghy, the Sydney-based engineering team of SP-High Modulus was tasked to define all the composite structures, from the hull laminates to the deck-fitting foundations, through to the complex canting-keel structure. Central Coast Hydraulics, based in Gosford, designed and manufactured the hydraulic systems, including the impressive single ram used to cant the keel. McConaghy Boats, world-renowned high-tech racing-yacht builder, built the yacht and managed the team of specialists required for the project. The ultra-light interior was built off-site by Queensland-based Maxcraft, and installed when the composite structure and systems work were completed.

The yacht has fully-automatic hydraulic sail-trimming controls using a computer to allow the system to easily be tuned. This system allows a very small crew to sail the boat to her optimum potential.

When looking at the yacht closely, it is impressive realise how complex the systems are and how many of the components are custom made, from the clear carbon mainsheet island to the highly-stressed (and reinforced) structure supporting the composite fixed canard.

High optimisation of the structure was ensured, not only by the use of modern analysis tools such as composite finite-element analysis, but also by a strong interaction between the structural-engineering team, the system engineers, the yard, the client and the naval architect. Having most of the team in Australia helped to quickly sort out issues which often are only spotted during the construction phase. The structural engineering team being only couple of hundred metres away from the yard (the office of SP-High Modulus Australia is on the same street as the yard of McConaghy Boats) made it easy to frequently inspect the boat and go on site to quickly define the optimal solution.

Design loads on modern performance yachts can be very high, and *Singularity* is no exception. A working mast compression load of 51 t-f was validated during sea trials. The canard was engineered to support a side force equivalent to 4 London buses, including passengers!

Before being shipped to Europe, *Singularity* had to undergo a month of sea trials, tuning rig and sails, testing the canting keel and the complex control systems. Bowe Bekking, a veteran skipper from the Volvo around-the-world race, worked with his team and others preparing the yacht to ensure that she will perform well in this coming European summer season.

Principal particulars of *Singularity* are

Length OA	24.38 m	
Length WL	22.72 m	
Beam	5.33 m	
Draft	5.17 m	
Air draft	36.2 m	
Sailing Displacement	24 000	kg
Bulb and fin mass	10 994	kg
Keel cant angle	35°	
Upwind sail area	661 m²	
Downwind sail area	846 m²	
Max. design speed	30 kn	

Skip Miller and *Valerio Corniani*

Image of *Singularity*'s hull
(Image courtesy SP-High Modulus Australia)

Looking aft on *Singularity* during sea trials
(Photo courtesy SP-High Modulus Australia)

Boatspeed Launches *Majan*

Recently constructed at Boatspeed Australia is the state-of-the-art racing trimaran *Majan*, designed by Nigel Irens/ Benoit Cabaret (Nigel Irens Design, UK) for Oman Sail as the Arabian 100. This racing machine is one of the ten biggest and fastest ocean-racing yachts sailing around the world today. The main hull and floats are made from carbon fibre sandwich which makes *Majan* incredibly strong but also incredibly light. The mast is also of carbon construction.

The vessel has been designed for a crew of six; there are only three berths (pipe cots) on board, with no toilet or shower, and there is only one simple gas stove where crew can re-hydrate food by adding boiling water. *Majan* has three primary sails, totalling 710 m^2 in area, i.e. large enough to cover two tennis courts! The sails are made of "Cuben", a woven material which is both more durable and lighter than laminated material.

Principal particulars are

Length	32.00 m
Beam	16.50 m
Mast height	35 m

Majan set sail on 6 February on the first leg of the Indian Ocean Five Capes Race. *Majan* is trailblazing the course in this inaugural race in order to set a time and route for other racing yachts to follow in years to come. With a total distance of 16 300 n miles, this new course will take vessels via the Indian Ocean's five great capes. *Majan* will sail from Muscat through the tropical waters of Oman past Ras al Hadd (literally 'Cape' in Arabic) with her bows pointing towards the equator. After a stop in the Maldives, Majan will then head down to the tip of South Africa, crossing Cape Agulhas and Cape Town. The Omani team will then turn east to race across the frozen and treacherous Southern Ocean, one of the most exhilarating legs of the course, before reaching the warmth of Cape Leeuwin and Australia's west coast. From here she sails north to Cape Piai in the Malacca Straits, close to Singapore, and up to Cape Comorin at the southern tip of India before returning to the welcoming shores of Oman and the starting point of the journey in Muscat.

"Today the Atlantic is the playing field for the sailing world's greatest oceanic races and all the round-the-world races start and finish in Europe. The new Indian Ocean Five Capes Race course is 100% Indian Ocean, utilizing the boundaries of the Middle East, Africa, Australia and Central Asia," said Mark Turner, CEO of OC Group, the race organizers.

Sodeb'O, a sister Arabian 100 vessel to *Majan* and also built by Boatspeed for Thomas Coville (launched on 27 September 2009), now holds the record for the greatest distance covered single-handed in 24 hours of 628.5 n miles.

David Hayes

Majan at speed on trials
(Image courtesy Boatspeed Australia)

Majan at speed on trials
(Image courtesy Boatspeed Australia)

World Water Ski Record

The Horsehead Water Ski Club recently set a new world water-ski record on 28 March 2010 using an Incat Crowther-designed vessel. The club had already set the mark of pulling 120 skiers from a deep start in January this year (the most ever pulled behind one boat) but, with "only" 99 making it through the required nautical mile, it was two skiers short of setting a new record. For the successful attempt in March, the club managed to get 116 skiers started and still had 114 up at the conclusion of the nautical mile, smashing the 100 skier mark set in 1986.

The record was set behind *Eagle*, an Incat Crowther-designed 36 m catamaran tour vessel which operates from Strahan, Tasmania. The powerful yet efficient vessel was fitted with a custom-fabricated boom across its stern to spread the large number of skiers. Incat Crowther provided structural design support for the boom and provided detail drawings for the manufacturing of all components and attachment points.

Incat Crowther naval architect, Kristian Fet, spearheaded the support effort of the Sydney-based design office. "The club came to us with technical questions, and we welcomed the opportunity to get involved in a world record," he says. "As well as designing a boom which would be strong enough, we had to come up with a way of attaching the boom which minimised the need for any modifications to the vessel". The club had previously attempted to set the record using *Eagle* but was restricted to using boom designs not rigidly attached to the then-brand-new boat. This raised a number of issues and all the three previous attempts on breaking the record were halted by boom or rope failures. Following these first unsuccessful attempts, the committee finally obtained permission from the operators of *Eagle* to attach a more substantial boom to the vessel.

The organisers then turned to Incat Crowther for design help. Fet was handed a conceptual design and, through extensive finite-element analysis, was able to simplify the original concept into a boom which was both easy to construct and that could be assembled in a short time. A non-linear static solver in combination with cable elements for the support

ropes enabled an accurate prediction of the boom's behavior as it is gradually loaded up with the drag from 120+ skiers. "The use of stepped load increments allowed us to view the transition between only gravity acting on the boom setup and the full design loads applied. Having satisfied ourselves that all forces and stresses observed had comfortable safety factors on failure, attention was then turned to the finer details of attaching the boom system to the boat." The attachment is so simple that the ski team was able to do the record run at 7.30 am and remove the boom setup in time for the ferry's regular tourist run at 9 am! Disassembled, the complete boom and mast fits comfortably on the back of a small truck.

The Horsehead club's achievement continues a long association between Incat Crowther and the world record. The record of 100 skiers, which stood for nearly 24 years, was set by the Cairns and District Powerboat and Ski Club, using an Incat Crowther designed vessel. Prior to the 100-skier record being set, an attempt was made in San Francisco Bay using an Incat Crowther vessel. In 2000, Incat Crowther-affiliated yard, Nichols Brothers, made an attempt using the 40 m *Klondike Express*. And now the new record has been set using another Incat Crowther vessel.

"We don't actively put ourselves out there as being ski-boat designers", says Incat Crowther Managing Director, Brett Crowther, "but it is an extreme example of the versatility of our craft."

And the members of the Horsehead Club certainly agree. Plans are being made to attempt to stretch the record even further, with some members of the committee believing they can achieve as many as 150 skiers. Incat Crowther certainly believes that *Eagle* is capable of the job and stands ready to assist future attempts and help the club extend the record.

Incat Crowther-designed *Eagle* setting new world water-ski record
(Image courtesy Mark Seaton Photographics)

36 m Monohull Crewboat from Incat Crowther

Incat Crowther has designed a 36 m monohull crewboat for the Brazilian oil giant, Petrobras. This vessel is one of the first projects to take advantage of Incat Crowther's new USA office. The vessel, under construction by ETP Engenharia Ltda in Rio de Janeiro, Brazil, is a 36 m monohull crew boat complying with the Petrobras specifications for the P2 type crew boat.

The main cabin contains seating for 60 passengers in large reclining seats, some at tables. There are also generous luggage storage racks, a beverage counter and two toilets.

Aft of the passenger accommodation is the main cargo deck, which is divided to perform two main functions. The aft area of the deck is devoted to crew transfer, allowing for safe and trouble-free transfers to offshore platforms. The forward portion of the main cargo deck is configured to carry cargo, with a capacity of over 50 t.

Ship's crew accommodation has been arranged below decks. This accommodation consists of sleeping quarters for ten (including two with ensuites), a galley and mess as well as a crew wet room with multiple toilets and showers and laundry facilities.

In addition to the crew accommodation, below deck also houses the vessel's tanks. Aside from the ship's own fuel and water, the vessel is also equipped with cargo fresh water and fuel tanks. Each of these tanks is capable of holding in excess of 30 000 L.

The wheelhouse is located on the upper deck and includes forward- and aft-facing control stations, with all-round visibility. The upper deck also features a rescue boat with slewing davit, fire-fighting monitor (10 000 L/min) for combatting off-ship fires, and direct access to both forward and aft decks. A purpose-designed transfer platform has been arranged on the foredeck to further suit the Petrobras P2 vessel requirements.

The vessel will be powered by three Caterpillar C32 main engines, each driving a Hamilton HM721 waterjet. The centre drive line will be arranged to provide booster power, whilst the outboard jets will add steering functionality. A ZF3050 gearbox will provide gear reduction and clutching. A single 100 hp bow thruster will be mounted forward for station-keeping purposes. The three Caterpillar main engines produce a total of 3132 kW, giving the vessel a service speed of 25 knots. Primary electrical power is derived from a pair of Caterpillar C4.4 gensets, each producing 99 kW.

Principal particulars of the new vessel are:

Length OA	36.00 m
Length WL	32.95 m
Beam	7.50m
Draft hull	1.20 m
Passengers	60
Crew	10
Fuel	15 100 L
Fresh water	5800 L
Cargo fuel	30 200 L
Cargo water	30 200 L
Deck cargo	50 t
Deadweight	85 t
Main engines	3×Caterpillar C32 ACERT each 1044 kW
Propulsion	3×Hamilton HM721 waterjets
Gensets	2×Caterpillar C4.4 each 99 kW
Service speed	25 kn
Construction	Marine-grade aluminium
Survey	Bureau Veritas

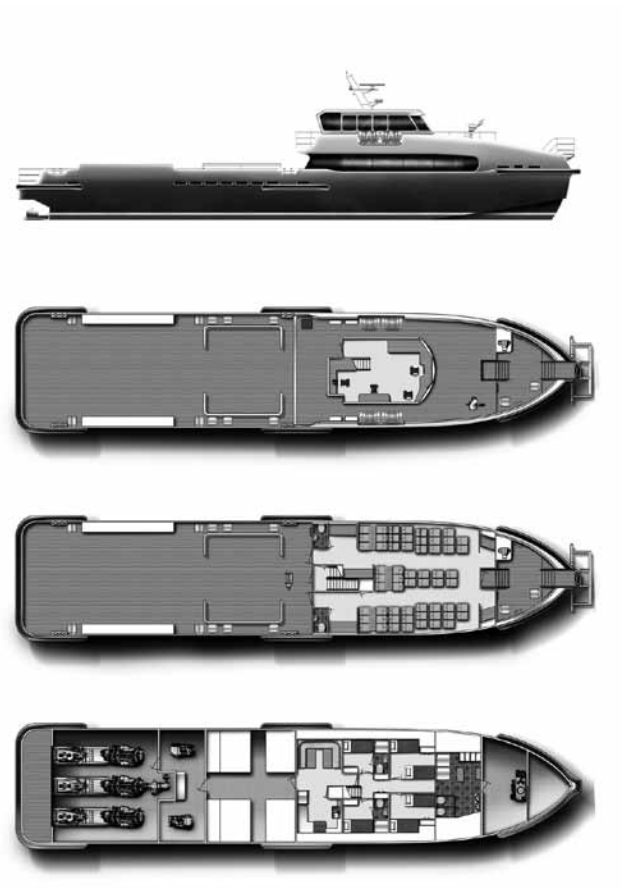
Image of 36 m crewboat for Petrobras
(Image courtesy Incat Crowther)

29 m Utility Catamaran from Incat Crowther

Incat Crowther has designed the 29 m utility catamaran, *Limitless,* which has been launched recently. The vessel follows up on the highly-successful *Unlimited*, a 24 m utility catamaran designed by Incat Crowther for the same operator.

Limitless is the 50th vessel built by Richardson Devine Marine and debuts the latest evolution of Incat Crowther's hullform. This hullform has already proven itself during sea trials, recording a top speed of 30.5 kn. The new and improved hull means that the larger more-capable vessel is able to travel 3 kn faster with a power increase of only 75 kW.

Limitless is capable of carrying 60 t of deadweight. The aft deck, with a cargo capacity of 24 t, is configurable for multiple uses. It has a large moon pool for exploration



General arrangement of 36 m crewboat for Petrobras
(Drawing courtesy Incat Crowther)

services, securing points for two 20 ft (6 m) containers, a Heila deck crane (capable of lifting 6.5 t) and a removable hydraulic 5 t SWL A-Frame (including a reel winch). The vessel features a towing hook with a bollard pull of 15 t.

In the main deck cabin and hull spaces, *Limitless* features accommodation for 12, including galley, lounge, laundry and pantry facilities. The upper-deck wheelhouse features crew and passenger seating and work stations, whilst the central helm seat affords good all-round visibility. Two wing control stations are fitted forward on either side with a tender/rescue boat situated aft within easy reach of the deck crane.

As well as bringing increased speed, the efficient new hullform also brings the advantage of increased range and better damping in a head sea, allowing the operator to reposition the vessel more effectively.

Limitless has taken its place alongside *Unlimited* in the Offshore Unlimited fleet, and will initially be deployed in Bass Strait. Offshore Unlimited is a Tasmanian company providing vessels to Australian waters with operations out of Dampier, WA, and Mackay, Qld. Offshore Unlimited provides a comprehensive range of offshore services including offshore installation re-supply, seismic ship resupply, dive and ROV support, crew transfer and chase-boat services.

Principal particulars of *Limitless* are

Length OA	28.70 m
Length WL	26.40 m
Beam OA	8.50 m
Draft (typ. load)	1.20 m
Depth	3.45 m
Passengers	32
Crew	18
Max. deadweight	60 t
Fuel Oil	30 000 L
Fresh Water	1500 L
Sullage	2000 L
Main engines	2×CAT C32 ACERT each 1080 kW @2300 rpm
Propulsors	Propellers
Generators	2×CAT C6.6 125 kW
Thrusters	2×Side Power SP550/Pro 60
Speed max.	30.5 kn
Cruising	25 kn
Cargo deck	
Length	12.00 m
Width	7.00 m
Area	84.00 m^2
Capacity	24 t
Construction	Marine-grade aluminium
Survey	NSCV 2A/1B
Flag	Australia

29 m Passenger Ferry from Incat Crowther

Incat Crowther has designed a 29 m catamaran ferry, *Freedom Monarch*, which was launched recently. Built by Aluminium Marine/Reefmaster Boats, *Freedom Monarch* will be operated out of Rosslyn Bay, Qld, by Freedom Fast Cats, servicing the Keppel Islands. The vessel has delivered to her owners low fuel consumption, a reliable and robust craft, high passenger comfort and innovative features, such as her beach-landing capability.

29 m Utility boat *Limitless* on trials
(Image courtesy Incat Crowther)

When using shore-side facilities, the operator can load passengers through side boarding gates at both ends of the main deck as well as the aft end of the mid deck. When servicing the islands, the operator can call upon the foredeck-mounted ramp. This ramp is rotated manually and deploys with hydraulic assistance. The ramp allows the operator to transfer passengers direct to locations without shore-side infrastructure.

Once on board the vessel, passengers have the choice of two interior decks and a sun deck. The main-deck passenger cabin is a large, light and airy space featuring seating for 182 passengers in a mix of forward-facing and booth configurations. At the aft end of the cabin is a kiosk and a walkaround servery. At the forward end of the passenger space is a vast luggage area, allowing passengers to stow and pick up their bags in close proximity to the forward doors that lead to the bow ramp. The main deck features a total of four toilets, one of which is wheelchair accessible.

On the mid deck, there are 30 external seats and 75 internal seats. Located forward of this is the wheelhouse, featuring excellent visibility over the bow, which aids beach landings and makes for safe loading over the bow. It also features external bridge wing stations for extra operational safety and flexibility during close-quarter berthing.

The sun deck is fitted with low benches which allow passenger access to the rails to take in the views.

29 m passenger catamaran *Freedom Monarch* on trials
(Image courtesy Incat Crowther)

Freedom Monarch is powered by two Yanmar 6AYM–GTE main engines and is propelled by fixed-pitch five-bladed propellers. The vessel has ample space around the main engine for maintenance and ventilation in a hot climate, and

Freedom Monarch beach landing
(Image courtesy Incat Crowther)

utilizing Incat Crowther's latest-generation hullform, is an extremely efficient vessel.

Principal particulars of the new vessel are

Length OA		29.00 m
Length WL		26.80 m
Beam (excl. sponsons)		8.50 m
Depth		3.60 m
Draft (max.)		1.65 m
Crew		8
Passengers	Internal	257
	External	45
Max. deadweight		37 t
Fuel oil (main tanks)		6800 L
Fresh water		1000 L
Sullage		2000 L
Main engines		2×Yanmar 6AYM–GTE each 670 kW
Propulsors		Propellers
Gensets		1× Cummins 4BT 40 kVA 1×Cummins 6BT 80 kVA
Speed		25 kn
Construction		Marine-grade aluminium
Survey		NSCV Class 1D/1C
Flag		Australia

Porsche Motor Yacht First Stage Complete

Incat Crowther has announced the completion of the first stage of the Royal Falcon Fleet 135, a 135 ft (41 m) motor yacht, designed in association with Porsche Design Studio. Stage 1 construction took place at 189 Shipyard in Vietnam, and included all aluminium structure work.

This milestone is a great achievement for Incat Crowther and the Royal Falcon Fleet team. The RFF135 breaks the mould in many ways and is unlike any other craft built before. Many challenges were faced in using aluminium to create such complex and flowing shapes without compromising any of Porsche Design Studio's vision or the vessel's structural integrity.

The vessel has now been shipped to Sweden where she will have her machinery fitted, after which she will undergo exterior finishing and interior fitout.

There has been much speculation about high-profile purchasers of the first RFF135 from many media outlets. Whilst nothing has been confirmed yet, an announcement is expected in the near future.

Stage 1 completion of the RFF135 motor yacht
(Photo courtesy Incat Crowther)

Principal particulars of the RFF135 are

Length OA	135 ft	41.20 m
Length WL	117 ft	35.70 m
Beam OA	41 ft	12.50 m
Depth	12 ft 6 in	3.80m
Crew	10	
Passengers	10	
Deadweight (max)	59 tons 60 t	
Fuel oil main tank	8454 gal	32 000 L
long range tank	5283 gal	20 000 L
Fresh water	1321 gal	5000 L
Sullage	2113 gal	8000 L
Main engines	2×MTU 16V4000M93L each 3440 kW @ 2450 rpm	
Gearboxes	2×ZF 9050	
Propulsors	2×KaMeWa 80S3 waterjets	
Generators	2×CAT C9 200 kW 50 Hz	
Speed max	38 kn	
cruising	30 kn	
Range	2000 n miles @ 30 kn	
Construction	Marine-grade aluminium	
Class/survey	Lloyd's Register ✠100 A1 SSC, Yacht Catamaran, HSC, G3, LMC, CCS(Bridge)	
Flag	Cayman Islands	

Stewart Marler

Rendering of competed RFF135
(Image courtesy Porsche Design Studio)

Cruising

The summer cruise season wound down through March and April, with visits by *Aurora, Sun Princess, Balmoral, Saga Ruby, Dawn Princess, Pacific Sun, Albatros, Amadea, Pacific Princess, Queen Mary 2, Volendam, Crystal Symphony, Pacific Dawn* and *Rhapsody of the Seas. Dawn Princess* and *Pacific Dawn* are the only vessels scheduled for cruises during May–October, when the cruise vessels for the next summer season start arriving, with *Millenium* and *Rhapsody of the Seas* due in mid-October.

Phil Helmore

Queen Mary 2 arriving in Sydney on 7 March 2010
(Photo John Jeremy)

FROM THE CROW'S NEST

Planet Solar

On 31 March 2010, the roof at the HDW Shipyard in Kiel, Germany slid open to reveal what is claimed to be the world's largest solar powered vessel, a wave-piercing catamaran named *Planet Solar*. Appearing small against the backdrop of the giant crane hoisting her to the water and the enormous ship building halls she was assembled in, the 101.7 ft (31.00 m) long, 52.5 ft (15.96 m) wide carbon-fibre craft was launched a few hours later into the Kiel fjord, floating to her lines and looking more like a misplaced space ship than an ocean-going yacht.

Designed by New Zealand's LOMOcean Design (formerly Craig Loomes Design Group) and constructed by Knierim Yachtbau of Kiel, this unique craft is intended not only to serve as the ultimate 'green' motoryacht, but also—under the auspices of the eponymously named Planet Solar organization—to be the first vehicle of any kind to circumnavigate the globe under solar power alone.

Over the course of its eighteen-month gestation period, the project has served to highlight not only the capabilities of current photovoltaic solar cell technology, but also the state of the art in wave-piercing catamaran hull design, of carbon-fibre propellers, and efficient electric motors, plus the best of advanced-composite shipbuilding and the latest in lithium-ion battery technology. The combination of these technologies allows the 85 t craft to run at a passage-making speed of approximately 7 kn from just 20 kW of installed power. To put this into perspective, imagine a 30 m yacht of any kind being propelled at 7 kn by just a 20 kW outboard motor.

Of significant importance to her owner was that this boat should be supportive of passengers and crew in relative comfort—*Planet Solar* is not a stripped-out race boat optimised solely for the circumnavigation; rather she is a spacious motor yacht, with an interior arrangement offering six double cabins each with ensuite bathroom, a large saloon and dining area, plus a spacious aft deck and separate crew quarters. Sunbathing space is, however, at a premium, with over 500 m^2 of the deck surface covered in solar cells, with just a blister-style wheelhouse breaking the expanse of blue-black panelling.

Fitting of the side and transom solar panels and dockside commissioning will occur in coming weeks. The circumnavigation is scheduled for mid 2011 and more details relating to the challenge are available on the Planet Solar website at www.planetsolar.org.

For a photo of the vessel, see http://marinelink.com/News/Article/333888.aspx.

Marinelink.com, Thursday 8 April 2010

Freewheeling vs Locked Propellers

Further to the debate on freewheeling vs locked propellers on sailing vessels (see the article by Kim Klaka in *The ANA*, August 2006; letters to the editor by Greg Cox and Martin Grimm in *The ANA*, November 2006; and Rebecca Dunn's thesis project at UNSW described in *The ANA,* February 2009), there is a recent paper addressing the issue: MacKenzie, P.A. and Forrester, M.A. (2008), Sailboat Propeller Drag, *Ocean Engineering*, v.35 n.1, pp.28–40.
One interesting conclusion was that the polynomials

associated with the MARIN B-Screw series can be used to predict the free-wheeling performance of sailing vessel propellers of conventional geometry provided that the blade sections are of the common mixed segmental/foil types, even where the geometry of interest does not mirror precisely the detailed MARIN standard.

Further, the experimental results found that a locked propeller produces greater drag than does a free-wheeling screw; up to 100% more drag was observed at the higher speeds. For the free-wheeling case, the magnitude of the hydrodynamic resistance was significantly affected by the amount of frictional torque on the shaft, low torque being accompanied by low drag.

This does not agree entirely with the conclusions of Cox (1985) and Dunn (2008), who both found that, for each forward speed of the vessel, there is a rotational RPM above which it is better to free wheel, and below which it is better to lock. However, Cox and Dunn agreed with MacKenzie and Forrester that much depends on the rotational resistance of the gearbox/shafting combination. Dunn also found that the maximum resistance is not achieved by a locked propeller, but by a propeller which is allowed to rotate slowly!

For further information, see the article by MacKenzie and Forrester.

Groupama 3 Takes the Jules Verne Trophy

The trimaran *Groupama 3* took the Jules Verne Trophy on 20 March for the fastest boat to circumnavigate the world. Franck Camas and his crew of nine completed the non-stop trip in 48 d 7 h 44 min, comfortably beating the previous record of 50 d 16 h 20 min held by Bruno Peyron on the catamaran *Orange 2* since 2005.

The Jules Verne Trophy is based on Jules Verne's Book, *Around the World in Eighty Days*, and was first awarded to Bruno Peyron who completed the circumnavigation in 79 d 6 h 16 min in *Explorer* in 1994. Since then the record has been broken seven times (including the current one), and has been almost halved!

Principal particulars of *Groupama* 3 are

Length	31.5 m
Beam	22.5 m
Draft	5.7 m
Mast height	41 m
Mainsail	356 m²
Gennaker	472 m²
Solent	201 m²

For photographs and further details, see http://yachtpals.com/fastest-boat-9044.

Phil Helmore

EDUCATION NEWS

Australian Maritime College

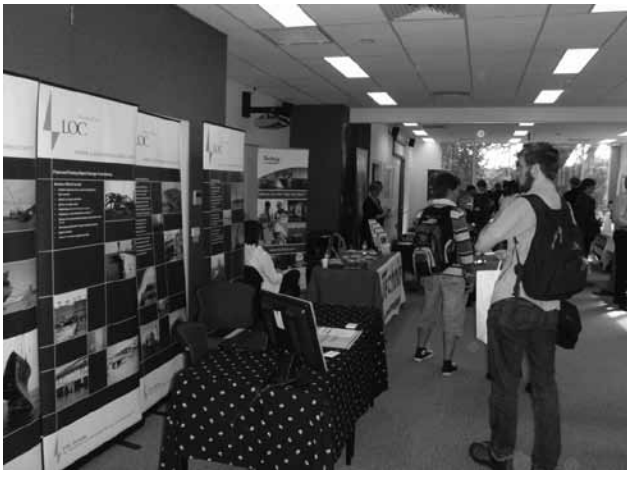
AMC Careers Day

The fourth AMC Maritime Engineering Industry Day and Careers Fair, held on Friday 30 April, was another great success. Over 30 representatives from industry-driven companies and organisations visited the AMC to present the opportunities which they can provide to engineering graduates and students alike. All maritime engineering students had a free day to attend the busy day of activities.

Proceedings began on Thursday night with an informal gathering at a local hotel for students, staff and industry representatives. On Friday the industry representatives set up trade stands in an Expo Show. A free barbeque lunch was held for all involved and visitors to AMC were given guided tours of AMC's large array of facilities, unique in Australia. The opportunity of having so many industry representatives at the AMC at one time was also used for several guest lecturers to be presented.

The efforts of industry in attending the Industry Day and Careers Fair were greatly appreciated. Anyone interested in attending in the future please contact Leslie Lundie (eng.careers.fair@amc.edu.au) to ensure that they are on the mailing list. The companies and organisations who attended this year included:

Austal Ships
Australian Marine Technologies Pty Ltd
Head Navy Engineering – Navy Engineering Division, Deptartment of Defence
Transport Safety, Deptartment of Lands and Planning, NT
London Offshore Consultants
BAE Systems Australia
BMT Design and Technology Pty Ltd
Defence Science and Technology Organisation
Technip Oceania
Clough Engineering
Defence Materiel Organisation
Acergy Australia Pty Ltd
South Australian Department of Transport — Marine Survey
Navy Headquarters Tasmania



One of the industry booths at the AMC Careers Fair
(Photo courtesy AMC)

Final Year Projects

This year's AMC final year projects are well underway. A listing at the end of February follows, although the titles may change as the projects develop. The number of projects and the breadth of research they cover is a sign of how much the undergraduate program is expanding.

Mustafa Al Maqbali — *Development of Control System using PLC and OPC*

Dylan Carpenter — *Ultimate Capacity of Hull Girder*

Nicholas Clark — *Boat to Boat Interaction.*

Ibrahima Diallo — *Ship Performance Modelling using Simulink*

Nathan Doyle — *Construction of a Circular Wave-pool Model*

Tim Field-Dodgson — *Offshore Pipeline Stability on a Mobile and Liquefied seabed*

James Erbacher — *Construction of a Circular Wave-pool Model*

Denis Garland — *The Effects of Software Optimisation on Ship Structures*

Marien Gheorghe — *Augmented Reality and the Sailing Simulator*

Nathan Grace — *Investigation into Effects on Permanently-moored FPSO*

David Harte — *Paddle Wheel Propulsion*

Tristan Jennings — *Cavitation induced by Underwater Impact*

Ashley Jones — *Dynamic Response of a SparACE*

Sheng Kok — *Investigation of a Met-ocean Survey Problem*

Paige Kranz — *Progressive Flooding of a Self-installing Platform*

Alex Laidlaw — *Pipeline Scour*

Alexander Law — *Computer-aided Propeller Design*

Bodie Mallett — *Shallow-water Pipelaying — Interaction between Soil and Tension Machine*

Tim Moore — *Hydro-elastic Analysis of Submarine Foils*

Ankit Munjal — *Development of Automatic Manoeuvring Systems for Surface Ships*

Amelia Nunn — *Calibration of Wave Tank*

Khan Peoples — *Shape Design for Maximum Wave-energy Extraction using Computer Modelling*

Matthew Riley — *Development of Data Communication and Software using Open-source Software*

Pragjandeed Sahoo — *Dynamic Response of the SparACE*

Sean van Steel — *Investigation into Near-surface Submarine Manoeuvring*

David Tynan — *Air-independent Propulsion for Submarines*

Paul Watson — *Alternative Fuels and Emissions Testing with a Cummins Diesel Engine*

Matthew White — *Impact of different Bow Shapes on Vessel Motions*

Aaron Young — *Optimisation of Composite Marine Structures*

Leong Zhi Quan — *Autonomous Underwater Vehicle Modelling and Testing*

Co-operative Education Program

Beginning in the second semester of 2010, the Australian Maritime College will introduce the co-operative engineering program to the current Bachelor of Engineering courses. The co-operative program integrates paid, supervised work terms with the undergraduate degree programs. Students gain valuable experience through full-time employment sequenced with their academic terms. The program has been formulated from the industry needs for knowledgeable and energetic engineering students. As the job market becomes increasingly competitive, employers must use a variety of methods to attract top talent. The co-operative program is a wonderful way for the employer to solve both long- and short-term employment needs — it also offers students the opportunity to complete formal education with extended paid-work experience. This makes for mature graduates who are more informed, having developed a high level of personal and professional skills early in their careers.
For further details please contact Mark Symes email mf-symes@amc.edu.au.

Steel-caps, Calculators and the Seaside

AMC first-year engineering students were thrown in at the deep end of the Tamar River in typical AMC fashion with activities at the Beauty Point campus. With the aim of illustrating principles and theories learnt in first semester and introducing to students concepts to follow in semesters to come, Engineering and Hydrodynamics staff and Ports and Shipping staff worked hard to give students real life engineering experiences.

Equilibrium and Inclinating Experiments aboard FTV *Reviresco*

Students observed the effects of changing the height of the centre of gravity of a vessel with the use of models before undertaking an inclining experiment aboard FTV *Reviresco*. While half the group conducted this experiment, half investigated various marine and shore based structures around the campus, drawing free-body diagrams and discussing engineering approaches to problems.

Speed Trials — FTV *Bluefin* and *Pinduro*

Students conducted a set of speed trials to determine the maximum speed that the AMC vessels *Bluefin* and *Pinduro* can attain over a measured distance. The key to success here was planning — students needed to consider what equipment was available on the bridge for recording position and speed, what ship details need to be noted and what environmental variables needed to be measured.

FTV *Bluefin* just prior to full-scale speed trials in the Tamar River (Photo courtesy AMC)

Practical Ship Design aboard *Stephen Brown*

Students were required to gather information onsite to perform design work as if they were field engineers. They gathered information and presented diagrams on the various components which make up the ship's structure in way of the hull cross section, and an overview of the powering and propulsion systems.

Marine Engine Systems in *Stephen Brown*

The route of the fuel oil system was identified and flow diagrams developed to indicate fuel flows and devices encountered along the way to the combustion chamber. Students also measured shaft defections of the engine crank.

Survival at Sea

Students completed occupational health and safety training in order to take part in the activities aboard AMC vessels, giving them a unique insight into non-technical aspects of the engineering industry.

Irene Penesis
Year One Course Coordinator

University of New South Wales

Student–Staff Get-together

The naval architecture students and staff held a get-together on Wednesday 17 March. This was to enable the students in early years to meet and get to know the final-year and post-graduate students and the staff on a social level, and to discuss the course and matters of mutual interest. Pizza, chicken, beer and soft-drink were provided and, after a slow start, conversation was flowing pretty freely an hour later! This year we have nine students in the third year and about twenty-five in fourth year (twelve expecting to complete in mid-year), most of whom attended. Some of the first- and second-year students, and the post-graduate student came along, as well as the full-time staff and the Head of School who is an honorary naval architect. A broad mix, and some wide-ranging discussions ensued.

Staff Changes

In NAVL4140 Design of Yachts and High Speed Craft, Rozetta Payne has taken over teaching of hydrodynamics of high-speed craft from Phil Helmore in Semester 1, while Craig Boulton continues teaching the HSC Code and structural aspects of high-speed craft, and David Lyons continues teaching the design of yachts.

Inclining Experiment

Sydney Heritage Fleet provided access to their yacht *Boomerang* for the third-year students to conduct an inclining experiment at Rozelle Bay on 5 May. The students conducted the experiment with the guidance of lecturer Mr Phil Helmore. There was a light shower on the way in, but it cleared away and the day turned out perfectly for an inclining; fine with almost no breeze the whole time. The sky then clouded over and, following the freeboard measurements and the water density readings, another shower came down. The experiment was completed in record time, and the students made a good fist of their first inclining. The theory of stability is fascinating, but seeing it in practice at an inclining makes it come *to life* for the students.

Graduation

At the graduation ceremony on 10 May, the following graduated with degrees in naval architecture:

Nichola Buchanan
Stewart Grant Honours Class 1
Anne Simpson Honours Class 1 and University Medal

Sydney Heritage Fleet's S.Y. *Boomerang*
(Photo Phil Helmore)

UNSW Year 3 inclining crew (L to R)
Malinda Wickremaarachchilage, Julia Müller,
Tucker Barth, Alex Conway, Ivy Zhang, Dane Fowler,
Zensho Heshiki, Nathan Gale and Geordie Grant
(Photo Phil Helmore)

Phil Helmore with naval architecture graduates
Nichola Buchanan, Anne Simpson and Stewart Grant
at UNSW Graduation Ceremony on 10 May
(Photo courtesy David Keppel)

Prize-giving Ceremony

At the prize-giving ceremony for the School of Mechanical and Manufacturing Engineering on the same day, the following prizes were awarded in naval architecture:

The Royal Institution of Naval Architects (Australian Division) Prize and Medal for the best ship design project by a student in the final year to Anne Simpson for her design of a 12 m composite cruising/racing yacht for a Broken Bay owner.

The David Carment Memorial Prize and Medal for the best overall performance by a student in the final year of the naval architecture degree program to Anne Simpson.

Congratulations, Anne!

Anne Simpson receiving the RINA (Australian Division) Prize from Phil Helmore on 10 May

(Photo courtesy Diane Augee)

Graduates Employed

Our 2009 graduates are now employed as follows:

Nichola Buchanan	Delta Electricity
Stewart Grant	Investigating opportunities
Anne Simpson	Lightning Naval Architecture, Sydney

Thesis Projects

Among the interesting undergraduate thesis projects under way are the following:

Renewable Energy Systems for Ships

With "peak oil" in sight, and the cost of fuel set to rise, renewable energy systems are becoming more attractive on a cost basis. Matthew Fox is conducting an investigation of the possible systems, including solar, wind (sails and kites), biomass and biofuels, etc. He has then focussed in on the Flettner rotor, testing a model in the wind tunnel and conducting a computational fluid dynamics investigation to compare the results.

Investigation of Post-tensioning for Ship Structures

Post-tensioning has been successfully applied to civil engineering structures, and there may be possibilities for its application to ships. Andrew Hoff is conducting an investigation to determine whether there are significant benefits. He is using the world's largest vessel, *Knock Nevis*, as a trial horse and using a computational fluid dynamics investigation to model the flow around a dimpled, post-tensioned hull.

Longitudinal Stability Criteria for Ships

Current stability criteria address transverse stability criteria only, and for most vessels most of the time, this is entirely appropriate. However for small vessels with a high proportion of their full load displacement as cargo (landing craft), there are limitations on how much you can reasonably sub-divide the ship, and this damage to one or two compartments could result in loss of the vessel through insufficient longitudinal stability. Bryan Kent has conducted a literature survey to find out what has been done on this up until now. He has then created some simple landing-craft models in Maxsurf, and investigated their longitudinal stability, gradually increasing the complexity of the models, with the aim of developing criteria in the longitudinal direction.

Analysis of Ship Emissions for Tugs and Ferries

Growing attention is being paid to the emissions from ships, i.e. the nitrous oxides (NOx), sulphurous oxides (SOx) and greenhouse gases (GHG). The recent publication of a method for calculating the emissions of vessels based on the fuel consumption, route, usage, etc. by the National Technical University of Athens has provided a basis for further study. The vessels analysed in the study were generally large, tankers, bulk carriers, container ships and the like, and these are also the basis for the IMO guidelines on the Energy Efficiency Design Index. Jonathan Ling is applying the methodology to two sets of smaller vessels, the tugs on the east coast of NSW, and the ferries on Sydney Harbour.

Post-graduate and Other News

Head of School

After acting in the position of head of School for eighteen months, A/Prof. Philip Mathew has been appointed as Head of the School of Mechanical and Manufacturing Engineering.

Presentation by Martin Grimm

Martin Grimm, Acting Principal Naval Architect and Hydrodynamics Technology Manager for the Directorate of Navy Platform Systems, Department of Defence, Canberra, gave a presentation on *Destroyer Hullform Resistance Optimisation Study* to a meeting of naval architecture students and staff attended by 25 on 7 May in Room 101 in the School of Mechanical and Manufacturing Engineering.

The study was undertaken for the Department of Defence by Leo Lazauskas (University of Adelaide) and he made use of the Michell-theory-based thin-ship resistance-prediction method coupled to a genetic algorithm to search for and determine the optimum hullform parameters. The hullforms considered were based on a fairly simple set of geometric parameters, and both constrained- and unconstrained-length monohulls and multihulls were examined. The only other consideration was that upright stability should at least be reasonable. The presentation described the assumptions made, and the results achieved.

The vote of thanks was proposed by Em/Prof. Lawrence Doctors, and carried with acclamation.

Engineering Alumni Dinner

The year of graduation is taken as the year in which your

testamur was awarded. For most graduates, this is usually in the year following that in which their last coursework requirements were completed. For example, if you completed your coursework requirements at the final exams in November 2008, then you would expect to graduate in April 2009, and 2009 would be the year of your graduation. The Engineering Alumni Anniversary Dinner for 2010 will be held on Friday 6 August 2010 at 1900 in Leighton Hall, Scientia Building, for the graduates of 1960, 1970 1980, 1990 and 2000. So, if you graduated with Simon Robards (2000), Peter Goodin (1990), Tim Lyon (1980), or Bryan Chapman (1970), then you should be dusting off the tux, polishing your shoes and asking your partner to keep the evening of Friday 6 August free.

The latter class is distinguished by being UNSW's fifth graduating class of naval architects, the first having been Brian Robson in 1963, followed by David Hill, John Jeremy and Conan Wu in 1967, Richard Caldwell and Phil Hercus in 1968, and Laurie Prandolini in 1969.

Watch this space for updates, or check the Engineering website www.eng.unsw.edu.au/news/index.htm.

Phil Helmore

Visit to University of New Orleans

During his recent overseas trip, Em/Prof. Lawrence Doctors was invited to make presentations to the students and academic staff in the School of Naval Architecture and Marine Engineering at the University of New Orleans, in New Orleans, Louisiana. On 23 February 2010 he presented his research on *Resistance Prediction of High-speed Vessels* to senior (Year 4) students. On 24 February he gave a more general presentation to junior (Year 3) students on *The Australian High-speed Ferry Design and Construction Industry*.

Lawrence Doctors

Future Vessel Requirements for Sydney Ferries

Dennis Mole
Chief Operating Officer
Sydney Ferries

Introduction

Ferries of various types have been operating on Sydney Harbour for 211 years. Many small ferry companies merged and in 1899 most of them were incorporated in Sydney Ferries Limited. The local industry was characterised by a high degree of innovation; for example, in the late nineteenth century the world's first double-ended propeller-driven ferry entered service on Sydney Harbour. Double-ended propeller-driven ferries have been operating on the harbour for about 120 years, and six are still going today.

By the early 1930s, Sydney Ferries Limited had grown to become the largest ferry operator in the world, carrying 30 million passengers per year. The opening of the Sydney Harbour Bridge in 1932 saw passenger numbers plummet and financial hardship for the private operators. The NSW Government took over Sydney Ferries Limited in 1951, although the Port Jackson and Manly Steamship Company continued as a private venture, operating large ferries to Manly until 1974, at which time it too became government-owned and merged with the remainder of Sydney Ferries.

Innovation in design has always been evident. Hydrofoil ferries operated from 1965 until the early 1990s. Catamaran-hulled ferries have been in service for the past 26 years. Specialised catamarans of light construction, low wash, high speed, low height and shallow draft were introduced in 1992 to operate all the way to Parramatta, the destination of the first ferry in 1789.

Today, Sydney Ferries is an agency of the NSW Government. It is a small part of the public transport system. Sydney Ferries operates a fleet of 30 ferries and carries more than 14 million passengers each year, or about 40 000 each day. We operate at 43 locations around Sydney Harbour, conducting more than 500 services each day. The organisation has about 600 employees, mostly maritime workers, masters, engineers and deckhands.

The past 15 years has been a somewhat tumultuous period for Sydney Ferries. In the 1990s Sydney Ferries was part of the State Transit Authority, the agency responsible for bus transport. Performance was poor. The frequency of vessel accidents was unacceptable. An inquiry was conducted in 2001 and, although many recommendations were implemented, there was little improvement. Another inquiry was conducted in 2003 and that led to separation of Sydney Ferries from the State Transit Authority in 2004 and its establishment as a State-owned corporation in July that year. Unfortunately Sydney Ferries was the poor cousin of the State Transit Authority. Sydney Ferries was not established adequately as a State-owned corporation, with the management team being too light and there being insufficient funding.

High-profile accidents continued through 2004 and 2005. Vessel availability was low. Vessel reliability was poor and service reliability was poor through 2005. This led to a significant change of senior management in 2006. The new management team quickly appreciated that one of the major problems with Sydney Ferries was the old and ageing fleet, and a Fleet Replacement Strategy was developed in 2006.

Change was rapid, but a terrible accident in March 2007, in which four people died, was the catalyst for a Special Commission of Inquiry (SCOI) into Sydney Ferries. While the SCOI was in progress, we turned the Fleet Replacement Strategy into a Fleet Replacement Plan. The SCOI endorsed our plan; however, the SCOI also recommended that Sydney Ferries be market tested as a possible candidate for privatisation.

There has been significant improvement in SF over the past few years.

- Vessel availability and reliability has improved

- Service reliability is 99.7%
- On-time running is 98.2%
- Labour force has reduced, and costs have been contained
- No industrial disruptions to services in the last four years
- Patronage increasing
- Complaints have reduced by 60%
- Vessel accidents have reduced by 80%
- Customer Satisfaction Index is very high for public transport

The market-testing process is complete. The government announced in December 2009 that Sydney Ferries will not be privatised. We have spent the past few months negotiating our new operating contract, to commence on 1 April 2010 and to last for seven years.

Unfortunately, the market-testing process caused the entire Fleet Replacement Plan to go into a holding pattern. On 21 February this year, the NSW Government released the Sydney Metropolitan Transport Plan. Included in that plan is provision to replace six vessels in the existing Sydney Ferries Fleet. I will now describe the current fleet, its positive and negative attributes. I will then describe in broad terms our future fleet requirements and try to put the government announcement of six new ferries into context.

The Existing Fleet

We are the Ansett Airlines of the ferry business. Our fleet is a hodge-podge mix of vessels. We own 28 of the 30 vessels and charter the other two. The 30 vessels consist of seven classes and at least eleven variants. This is a logistics nightmare, generating significant cost in regard to maintenance and training.

Some variation of vessel types is necessary due to the diverse operating environment. One extreme is our western extremity, Parramatta. The upper Parramatta River is very shallow, narrow and has low bridges. Having been slowly silting up since it was last dredged in the early 1990s, it is now too shallow for even our smallest vessels at some low tides. It is too narrow for Rivercats to pass each other along much of the upper river.

The other extreme is the Manly service. Manly constitutes nearly 50% of our business. Ferries are the primary means of public transport between the Manly region and the CBD. Ferries must operate across the open Sydney Heads. Seas up to 8 metres high are not that uncommon.

Our youngest vessels are 10 years old and our oldest, *Lady Northcott*, is 36 years old. The average age of the fleet is 18 years, 18 very hard years which I will come back to.

Now for a quick run through the fleet from smallest to largest. I'll leave out the two charter vessels.

Harbourcat-class Vessels

The two Harbourcat-class vessels are the smallest in fleet.

Principal particulars are

Length	27.1 m
Beam	6.95 m
Draft	1.35 m
Displacement	34 t
Speed	24 kn
Passengers	150
Crew	2
Built	Brisbane 1998

They were designed as water buses, the concept being for low labour cost and for highly flexible operation, and there was to be a large number of them. However, in practice they were too small, and the low labour cost was offset by high fuel and maintenance costs, a poor wheelhouse arrangement, and poor emergency stopping performance. They are used mostly as back-up vessels on inner-harbour routes as required.

Rivercat-class Vessels

The seven Rivercat-class vessels were purpose-designed for the Parramatta River, and each is named after a famous Australian sportswoman.

Principal particulars are

Length OA	36.80 m
Beam OA	10.50 m
Draft	1.35 m
Displacement	58 t loaded
Speed	22 kn
Passengers	230
Crew	3
Built	1992 six in Qld
	1995 one in WA
	There are three variants

These vessels are good for the job. They have shallow draft and low profile to get under the bridges, and were designed to have low wash. They are highly manoeuvrable, but complex. There has been some river damage due to their operation. The cost of maintenance and repair is high. They have poor embarkation points. The timetable requires six of the seven vessels to be in service each day.

Supercat-class Vessels

The four Supercat-class vessels primarily service the eastern suburbs.

Principal particulars are

Length	34 m
Draft	1.5 m
Displacement	60 t
Speed	25 kn
Passengers	275
Crew	3
Built	2000–02 by ADI in Sydney

These vessels were designed to be multi-purpose, go-anywhere boats. Wrong. There was to be a large number of them. Wrong. They are of very light construction, have poor emergency stopping, steering response is not as good as required, and they have poor low-speed performance. The open area forward limits their use in high seas and wet weather, and one had an accident going across the heads to Manly. These vessels cannot now go to Parramatta (due to silting), and can't even go to Rydalmere on some low tides. The vessels have good reliability, but are already showing age-related problems.

First Fleet-class Vessels

The nine First Fleet-class vessels are named after nine of the eleven vessels in the First Fleet, and operate primarily on inner-harbour routes.

Principal particulars are

Length OA	25.38 m
Beam OA	10.04 m
Draft	1.95 m
Displacement	83 t loaded
Speed	12 kn
Passengers	400
Crew	3
Built	1984–86 by Carrington Slipways

These are excellent, simple boats, designed by the late Alan Payne. They are robust and reliable, even after 26 years of hard service. They are good people movers, albeit a bit too slow and producing a bit too much wash [*due to a length limit to reduce crewing being introduced late in the design stage* — Ed.] There is a good mix of internal and external seating, with good passenger embarkation points, and a very good wheelhouse. The timetable requires that eight of the nine vessels be in service each day.

Lady-class Vessels

The two Lady-class vessels run services to Taronga Park Zoo and Mosman, and are also used for special-event services.

Principal particulars are

	Lady Northcott	*Lady Herron*
Length OA	43.79 m	38.71 m
Beam	10.85 m	9.38 m
Draft	2.29 m	2.06 m
Displacement	383 t	287 t
Speed	12 kn	11 kn
Passengers	811	551
Crew	4	4
Built	1974	

These two vessels are the last of what was a larger group (including, for example, *Lady Wakehurst)*, and are quite different from each other. They are good crowd movers, and have the advantage of double-ended construction for manoeuvring in the crowded confines of Circular Quay. They are robust and reliable, but the risk is increasing with their age.

Freshwater-class Vessels

The four Freshwater-class vessels are the largest in the fleet and operate the Manly service.

Principal particulars are

Length OA	70.03 m
Beam	13.06 m
Draft	3.35 m
Displacement	1140 t loaded
Speed	14 kn one engine 18 kn both engines
Passengers	1100
Crew	6
Built	1982–84 three by State Dockyard 1988 one (different) by Carrington Slipways

These vessels move nearly 50% of our passengers on the Manly service. They are robust and reliable, even after 28 years. They are simple boats, and very cost effective at busy times, but costly at off peak times. They are of good double-ended design, have good embarkation points and good poor-weather performance.

That's our fleet.

Maintenance and Repair

Maintenance and repair of that fleet is quite challenging. Most of our maintenance and repair is conducted 'in house' at our own shipyard at Balmain. Our shipyard employs about 70 permanent staff and a few contractors as required. It has wharf space to berth half the fleet and is also the venue for fuelling and pumping bilges.

Our shipyard has a dry dock capable of docking all ferries except the four large Freshwater-class vessels. We outsource excess work to local ship repairers. We outsource refits of Freshwater-class vessels to appropriate companies, such as Thales Australia in Sydney, and Forgacs in Newcastle. Occasionally we go further afield. Refit of *Freshwater* is currently out to tender. The last refit of that vessel was five years ago and was in Brisbane.

Future Fleet Requirements

I will now talk about our future fleet. I must stress that no decisions have been made about new ferries for our fleet, other than that we will replace six of the vessels in the next few years. I will talk about what we believe we need in terms of performance characteristics.

I am very cognisant that most previous plans have not eventuated, but they also do not appear to have taken a holistic view, looking at not just the capital cost, but rather

the total cost of ownership.

The NSW State Plan requires an increase in the proportion of commuters using public transport. The roads are too congested, and are getting worse. This will mean that rail, bus and ferry usage will have to increase. The Fleet Replacement Plan needs to have a 30-year view, and our plan does that.

Sydney Ferries currently has a total passenger capacity of 12 811. The Sydney Ferries plan, at the high end, calls for an increase to 16 000. That is, an increase of about one third in total capacity.

I mentioned earlier that we are the 'Ansett Airlines' of the ferry business. We have too many classes and too many variants within classes. The integrated logistics costs are too high, particularly in regard to maintenance and training. Our plan calls for a reduction from seven classes of vessel to two classes. There is some internal scepticism that it can be achieved with less than three classes but, for the moment, we are working on two classes.

We have looked very carefully at what we like, and what we don't like, about our current fleet. In doing so, we have consulted our people in great detail. The following general characteristics apply:

- We want simple and robust vessels for hard working conditions, and this applies to the hull, propulsion and all systems
- Vessels must be capable of conducting 100 berthings each day, involving very high use of control systems, engine, and steering changes, and the vessels must have good fendering.
- Good manoeuvrability is a must, as vessels have to approach at right-angles to some wharves because the NSW Maritime Authority allows permanent moorings in the usual approaches to some wharves!
- Multiple layers of redundancy in control systems
- Good passenger embarkation points leading to quick turn-around time. This is a most-neglected area. There are only five wharves at Circular Quay, of which Sydney ferries uses four (the other is used by private operators), and sometimes ferries are stacked up, waiting for berths.
- Passenger comfort is important (we have low levels of vandalism, compared to trains, for example)
- Good all-round visibility from the wheelhouse is needed, i.e. the ability to see 360° (some vessels can't).
- Good wheelhouse layout—new navigational aids and FOCIS

What is not needed:

- Style rather than substance; i.e. the design must be practical.
- High speed; high-speed operations at night are not sustainable.
- Complexity; simplicity is needed.

What fuel should be used? Diesel? Bio-fuels? Gas? The problem is that, apart from diesel, we don't know what supplies will be available, and the supply needs to be continuous.

For planning purposes, we refer to our two future classes as the Harbour Class and the Manly Class.

Harbour Class

- We are unlikely to specify a requirement for a particular design or type
- 300 pax capacity
- 70/30% internal/external arrangement
- About 18 kn top speed
- Capable of maintaining a 15 kn timetable with a full passenger load. The JetCats were 33 kn vessels; the Supercats and Harbourcats 25 kn. We are going for a slower service on some routes due to changes in the Sydney Harbour environment.
- Good manoeuvrability
- Good wheelhouse visibility
- Fast passenger loading and off loading
- Draft less than 2 m
- Will usually operate in survey Class 1E conditions, but should be capable of operating in Class 1D if required.

Manly Class

- 800 seated pax capacity
- 18–20 kn?
- Good manoeuvrability
- Good wheelhouse visibility
- Must operate in survey Class 1D and should be capable of operating in Class 1C if required.
- If monohull, must be double ended.

They have considered community attitude, as ferries have iconic value (especially on TV). The Manly community is very vocal on the subject; they want big double-ended ferries!

Funding/Procurement

There are several options for funding and procurement:

- Conventional government capital procurement, i.e. design and build
- Alternative: design, build and maintain
- Alternative: some form of private financing.

Current Plan

This plan has not yet been approved

- Seek government approval — April 2010
- Call for expressions of interest to design, build and lease two Harbour-class vessels for six years — May 2010
- Select short list for Request-for-Tender (RFT) — May 2010
- Issue RFT to short list — June 2010
- Tender close — end August 2010
- Tender response assessment — September 2010
- Contract negotiations — October 2010
- Award design, build, lease contract (with option to buy) — late October/early November 2010
- Final design approval — end January 2011
- Construction of two vessels –– January to September 2011(?)
- Delivery of two vessels — September 2011; withdraw Lady-class vessels
- Design review/changes — October 2011
- Contract negotiations for construction of six vessels — November 2011
- Award contract for six vessels — December 2011

- Delivery of six vessels — July 2012 to December 2013; withdraw Supercats and Harbourcats.
- Develop case for second batch of 8 (?)
- Deliver second batch
- End lease of first two. Option to buy — March 2017
- Batch of three (?) vessels to replace First Fleet-class vessels — 2017 to 2019 (?)
- Manly Class ???

At this stage the NSW Government has approved, in principle, the purchase of six new vessels only, to replace the two Lady-Class and four Supercat-class vessels.

Conclusion

There have been a few turbulent years behind us and, while our ageing fleet is delivering the required service, newer vessels must be acquired soon. The NSW Government has agreed to initial purchase of six new replacement vessels.

A plan is the basis for change.

This presentation was made by Dennis Mole to the marine industry at the NSW Department of Industry and Investment in the MLC Centre in Sydney on 25 March 2010. The presentation had also previously been made to the Australian Ship Repairers Group on 28 January and the Australian Shipbuilders Association on 29 January.

On the Performance of a Wavy Keel

Kim Klaka, Curtin University

Have you ever wondered how accurate the section of a keel or rudder has to be? I have, so I did some background reading to find out. It all started a couple of years ago when my 10 m sailing yacht showed a tendency to turn to port and had an appalling tacking angle of nearly 100 degrees. That's the subject of a long and slightly different story — suffice to say that I had narrowed it down to a hydrodynamic cause. So I set to making templates for the fin keel and spade rudder to rectify the problem. Before doing this I had to satisfy myself that I could fair the keel to the required accuracy, which begs the question: what is the required accuracy? I am not talking about surface roughness (that is a well-understood effect), but larger-scale undulations — waviness, lumps and hollows.

As is so often the case with foils, the best experimental work is usually to be found in the archives for the period 1930–60. This instantly leads to three reference points — Abbott and von Doenhoff (originally 1949), Hoerner (originally 1951) and the suite of NACA technical bulletins from that era. Sure enough, they did not disappoint.

Abbott and von Doenhoff comment mostly on surface roughness and transition but, in Part 7c of their 1959 edition, they do provide the following delightfully-simple and practical advice about waviness:

"For the types of waves usually found on practical-construction wings, the test of rocking a straightedge over the surface in a chordwise direction is a fairly satisfactory criterion. The straightedge test should rock smoothly without jarring or clicking".

Similar advice is often given by good shipwrights. However, I wanted to quantify the effect of not meeting the above criterion, so my next step was to look in Hoerner's two books. They provided experimental data showing that drag increased with the square of the waviness aspect ratio, i.e. with the square of the wave amplitude over a given length. Unfortunately there was no applicable information about the effect on lift. To find out what happens to both lift and drag, I had to refer to NACA technical notes.

Powell (1954) tested helicopter rotor blades with and without fairing filler. The maximum variation in thickness was 0.13%, which resulted in 6% more power required to rotate the blades. However, the test conditions were rather different from the flow round a yacht keel.

Ward (1931) compared foils which were not exactly wavy, but they differed slightly in local thickness. For example, he tested a NACA 0021 section against a subtle variant, the NACA 100. The greatest thickness difference between the two sections at any point along the chord was 0.35% chord, i.e. for a typical keel of chord 650 mm, this is a section thickness variation of 2.3 mm. The wind-tunnel tests showed that, with all the usual caveats about two-dimensionality, Reynolds number and pressure gradients, this modest difference caused a 9.4% drop in maximum lift and 2.3% drop in maximum lift/drag ratio. So we now have a rule of thumb for a typical yacht keel: every 1mm of waviness decreases lift-drag by 1%.

Is it correct? I didn't have a wind tunnel handy, so I reverted to very-coarse full-scale measurements. Firstly I measured the profiles of my keel and rudder, and found out two things:

- Firstly, the maximum thickness port and starboard differed on average by about 5 mm over a chord length of 1400 mm, i.e. 0.35% of chord.
- Secondly, the thickness deviations from a NACA 630-series section were about 2 mm, i.e. 0.07% chord.

Then after two weeks of sanding and fairing, I had reduced the asymmetry and unfairness to about 1 mm worst-case (0.007%). The boat now tracks in a straight line and tacking angles are back below 90 degrees, saving about 5 minutes in a two-hour race. So I conclude that waviness of more than 1 mm makes a significant difference in performance.

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Wärtsilä Engines for South African Polar Supply and Research Vessel

In March Wärtsilä signed a contract with the STX Finland Oy shipyard in Rauma, Finland, to deliver four Wärtsilä 32 engines for a Polar Supply and Research Vessel. The owner of the vessel will be the Republic of South Africa's Department of Environmental Affairs, and it will be operated by SMIT Amandla Marine, of South Africa. The vessel's crew will be trained at the Wärtsilä Land and Sea Academy in Turku, Finland.

"This vessel order is one of the biggest single trade agreements ever between Finnish industry and South Africa, and we hope it will lead to additional business. We believe that by providing reliable technology and the highest levels of quality and service, we will benefit also in the future," said Mr Timo Suistio, Director, Rauma shipyard of STX Finland Oy.

The ice-strengthened vessel will be powered by four 6-cylinder in-line Wärtsilä 32 engines. It will be approximately 134 m long and will have accommodation for 45 crew and about 100 researchers and passengers. Construction of the vessel began in January 2010 and she will be launched in March 2012. Wärtsilä's engine deliveries are scheduled to take place in February 2011.

The vessel is being built for research activities and expeditions, but since she will be used to carry equipment and scientists working on the South African National Antarctic Programme, she will also have ice-breaking capabilities. Expeditions will take place during the Antarctic summer, starting at the end of December and continuing until the beginning of March. During the remainder of the year, she will serve as a supply vessel for three research centres located on Antarctic islands.

As a mobile research facility, the new vessel will be equipped with a laboratory so that scientists can conduct marine research while on board. Weather data for meteorological institutes around the world will also be collected. Classified as a passenger ship, the new vessel will feature some of the facilities found on cruise ships, including comfortable passenger accommodation, a gym, a library and a small hospital. She will also have a shelter and landing area for two Puma-class helicopters.

The new Polar Supply and Research Vessel
to be built by STX Finland
(Image courtesy Wärtsilä)

"As she will be operating in extreme conditions, the new vessel will need to be very reliable. She will also have to act as a tanker, because she will need to carry fuel oil for use at the Antarctic base. Every drop of fuel oil in the consumption chain will count. Wärtsilä 32 engines offer both low rates of fuel consumption and low levels of emissions, an important consideration when operating in the Antarctic's vulnerable natural environment," said Jukka Paananen, Business Manager, Wärtsilä Ship Power.

Wärtsilä has worked closely with STX Finland Oy for many years, and has a good relationship with the South African Department of Environmental Affairs. The new vessel will replace *Agulhas*, the department's previous expedition vessel, built in 1982 and equipped with Wärtsilä controllable-pitch propellers. The Department also owns a patrol vessel equipped with Wärtsilä main engines and propellers.

Wärtsilä and Samsung Heavy Industries to Develop Environmentally-sound Gas-fuelled Ships

Wärtsilä and Samsung Heavy Industries (SHI) signed a co-operation agreement in March to develop gas-fuelled merchant vessels. The intention is to jointly develop next-generation ships with efficient and competitive propulsion machinery concepts which meet or exceed the demands of future environmental regulations. The focus of the Wärtsilä/SHI joint study will be on utilising liquefied natural gas (LNG) as fuel for operating vessels. This is especially relevant in Emission Control Areas (ECAs). Wärtsilä's input will be related to the propulsion machinery, with particular reference to large-bore, dual-fuel engines combined with mechanical propulsion solutions. SHI will concentrate on the design of highly-efficient vessels incorporating fuel storage facilities and gas-powered propulsion machinery. Merchant vessels to be evaluated include crude oil tankers, for which both optimum propulsion concepts and the performance benefits achieved using LNG as fuel will be assessed.

"Compared to conventional engines running on heavy fuel oil (HFO), Wärtsilä's dual-fuel engine technology offers 20–25% lower CO_2 emissions, 90% lower NOx emissions and almost negligible SOx and particulate emissions," said Mr Jaakko Eskola, Group Vice President, Wärtsilä Ship Power. "We are the market leader in dual-fuel engine technology and deliveries, and our engine portfolio covers the majority of merchant vessel propulsion needs. In gas mode, our dual-fuel engines already comply with the IMO's Tier III regulations which come into force in 2016."

For many decades, engines running on HFO have been, and still are, the market standard for propulsion and electric power generation in merchant vessels. While HFO represents the cheapest available source of primary energy, future environmental regulations will require technologies with lower levels of emissions. ECAs, wherein emissions of NOx, SOx and particulates by marine engines will be regulated, have been announced under IMO Tier III, and the number of ECAs in different regions of the world is expected to rise.

Increasingly-tough environmental regulations will open up opportunities for new solutions incorporating cost-efficient technology, and this could trigger a substantial shift towards gas-powered dual-fuel vessels. The need to invest in emissions-abatement technology will make the use of liquid fuels increasingly expensive in the future. From a

price perspective, LNG is already competitive with liquid fuels, but further investment in the supply chain is necessary to encourage widespread use in the shipping industry.

SHI will be developing a highly-efficient and environmentally-friendly gas-fuelled ship with a new hullform and propulsion systems. It will include a fuel-gas storage and supply system, known as Samsung FuGaS. As well as identifying the major vessel parameters, SHI will provide input for the specifications regarding the propulsion system and fuel storage and handling systems, in addition to assisting with economic evaluations.

"We have delivered hundreds of vessels from virtually every ship category to customers worldwide, and we lead the industry in both the number of ships built and dock turnover time, a key measure of efficiency," says K.S. Lee (Vice-President, Project Planning Team at SHI). "We are also the leader in constructing next-generation LNG vessels using dual-fuel engines, a very fuel-efficient and environmentally-sound solution which requires significant technological expertise. As an advanced shipbuilder for environmentally-friendly vessels, we look forward to transferring our competence in LNG technology from LNG carriers to LNG-powered merchant vessels."

W TUG — Full Speed Ahead!

Tugs operate in a sector of the shipping industry which has not suffered dramatic consequences as a result of the economic crisis. When things start moving upwards again, it is also quite likely to be the first marine sector to recover. For Wärtsilä, now is the right time to enter this market.

A tug's most important properties are reliability, manoeuvrability and being able to generate a high bollard pull. All the tasks they carry out — escorting ships in and out of harbour through narrow canals and archipelagos, assisting vessels in crowded harbours and executing coastal towing and push-and-pull operations — require these in full measure.

"For operators, tugs are a tool," said Bram Kruyt, Business Development Director at Wärtsilä in the Netherlands. "To make money with this type of vessel, it must be efficient — it should run at low cost, be easy to service, and meet or exceed environmental demands made by the authorities. Harbours want to be green: new requirements for reduced emissions will be forced on operators within a couple of years. For Wärtsilä, the human factor is equally important. Our tug proposals are safe and user friendly.

Drawing on Knowledge and Experience

Wärtsilä certainly has the in-depth know-how required for tug design. Over the last few years, the company's ship-design capacity has been boosted through the acquisition of ship design and consultancy companies. Wärtsilä has designed more than 900 tugs already; this knowledge, combined with Wärtsilä's existing know-how in areas like engine and propulsion technologies — 200 tugs are equipped with Wärtsilä engines and/or thrusters — and lifecycle support, results in a significant competitive advantage.

"We're not aiming at shipbuilding — that's what shipyards do — but at being their solution provider of choice," said Kruyt. "Our scope of supply extends from a vessel's initial design to the supply of complete design documents for fabrication and to supplying the equipment required."

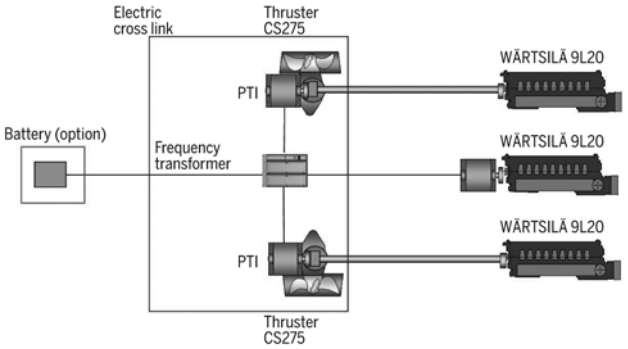
A ship's basic design includes the general arrangement drawing, the vessel specification, computational fluid dynamics (CFD) calculations and model testing, basic design calculations, and equipment selection and optimisation. The detailed design scope comprises building cost estimates, customisation, class approval drawings, production drawings and on-site support for both the shipyard and ship owner.

Supplying both Design and Equipment

"We supply both the tug design and the equipment for a vessel," said Kruyt. "Combining these two is still quite unusual. Our equipment scope consists of the main-propulsion package including the engines, thrusters and controls, engine and thruster auxiliary systems, winches, alarm and monitoring systems and electric cross-link drive as an option. We also provide installation, start-up support and on-site construction supervision."

"The fact that Wärtsilä supplies total solutions minimises risk for our customers. We deliver the best-possible level of systems integration. Our proven pre-design concept offers

Reliability, manoeuverability and high bollard pull are a tug's main requirements
(Image courtesy Wärtsilä)



W TUG 80 hybrid version propulsion configuration
(Image courtesy Wärtsilä)

guaranteed performance and we take full responsibility for all the equipment. We're a one-stop-shop with a single point of contact you can call in any situation during the design, building and even operational phases of a project."

Reaching out to a Worldwide Market

The W TUG is currently proposed in two versions, the W TUG 60 and the W TUG 80. Both were designed in house by Wärtsilä. Presentation of the two vessels was a key element in Wärtsilä's participation in the Middle East Workboat Show in Dubai in October 2009, and in the New Orleans Workboat Show in December 2009. In Dubai, show visitors responded enthusiastically to W TUG expressing great interest in the products.

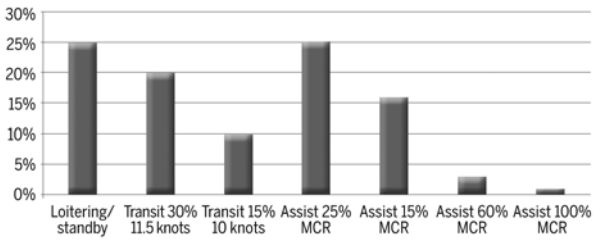
W TUG 60 is a standard solution at a competitive price, a harbour tug designed for operations close to the shore and a solution which should raise interest in Asia-Pacific markets. W TUG 80 has been designed to carry out ship assistance duties at offshore terminals, for high-speed escorting tasks, push-and-pull operations and coastal towing.

"W TUG 80 is a compact high-performance tug, 35 m long and featuring two propulsion configurations," said Kruyt. "It has a bollard pull of 80 tons and can run at a speed of 14 knots. Its two steerable thrusters make it highly manoeuvrable. The bow shape at deck/bulwark is designed with emphasis on pushing operations. The hull shape is optimized for optimal speed performance (reduced resistance and bow wave) and for optimal seakeeping characteristics. The combination of the forward hull shape and the large skeg results in an estimated steering force of 160 t at 10 kn during escorting."

The base version of the W TUG 80 is equipped with two 8-cylinder in-line Wärtsilä 26 engines, each rated at 2600 kW at 1000 rpm driving two thrusters. The hybrid version is fitted with two 9-cylinder inline Wärtsilä 20 engines directly driving the thrusters and a third one driving a generating set, the power of which can be transmitted to the two thrusters through PTI on the upper gearbox. Depending on the operation mode, either one, two or three engines can be running. For towing and escorting duties, the vessel is equipped with a 112 t-f towing/anchor winch forward and a 91 t-f towing winch aft of the superstructure. "A dual-fuel version will be applied later in the W TUG programme," said Kruyt.

Providing a Total Solution for Maximum Benefits

W TUG blends top-level ship design and Wärtsilä's extensive experience and track record in the fields of propulsion, engine and automation systems. By designing



A tug spends only 2% of its time at full engine load
(Chart courtesy Wärtsilä)

a complete solution, performance levels are raised, which means improved engine loadings, higher efficiency, lower fuel consumption and reduced emissions of particulates, CO_2, NOx and SOx.

Using the typical operating profile of a tug, the analysis of the complete system (hull, engine, propulsion and electrical installations) shows that the improvement in efficiency achieved in the W TUG 80 amounts to 6-7%.

"Further development of the hybrid solution will mean that a reduction of 14-15% in overall fuel consumption is not unrealistic," says Kruyt. "Once the first W TUG product is operational and the concept establishes its position on the market, we believe the demand for these products will steadily increase."

Marjatta Pietilä
From *Twentyfour7*, Issue 04.2009

Wärtsilä Power for New Cruise Vessel for Carnival Corporation

Wärtsilä received an order in March to power a new cruise vessel for Carnival Corporation, USA, carrying the preliminary name *Carnival Dream 3*. The vessel will be built by the Fincantieri Monfalcone shipyard in Italy and is scheduled to be launched in August 2011. *Carnival Dream 3* will enter service in the spring of 2012. Wärtsilä's scope of supply includes six Wärtsilä 46 engines.

"Wärtsilä and Carnival Corporation have been cooperating for many years and a number of Carnival Cruise vessels carry our propulsion solutions. Reliability is of prime importance in the cruise industry and Wärtsilä's leading position in the marine industry was a key factor in winning this order. In addition to supplying equipment, the contract includes commissioning of the engines. Members of the vessel's crew will also receive annual training on our premises," said Mr Carl-Henrik Björk, Vice-President, Cruise and Ferry, Wärtsilä Ship Power.

The 12-cylinder Wärtsilä 46 engines in a diesel-electric configuration have a rated output of 12600 kW at 514 rpm each. The electrical power generated will be used for propulsion, for bow and stern thrusters, air conditioning, lighting and auxiliary services.

Carnival Dream 3 will sail world-wide, although mainly in the Caribbean and the Gulf of Alaska. To protect the environment by reducing emissions in vulnerable sea areas, the vessel has been designed to also operate on light fuel oil.

Able to carry up to 3690 passengers, the new 130 000 t cruise vessel will have an overall length of about 306 m, a breadth

The new cruise vessel for Carnival Corporation
(Image courtesy Wärtsilä)

of 37 m and a maximum draught of 8.5 m. The deadweight at a draught of 8.2 m will be some 10 500 t.

Carnival Dream 3 is a further development of *Carnival Dream* and *Carnival Magic*. She will have 18 decks, a WaterWorks aqua park with a 91 m-long corkscrew water slide, a stunning indoor/outdoor café, a live entertainment venue called Ocean Plaza, a wide range of luxurious staterooms, extensive facilities for children and teenagers, a 2179 m^2 Cloud 9 Spa and the Lanai, an outdoor promenade featuring cantilevered whirlpools which extend over the ship's sides.

Owner of the new vessel will be Carnival Corporation plc, the largest cruise vacation company in the world. In addition to Carnival Cruise Lines, Carnival Corporation's portfolio of leading cruise brands includes Holland America Line, Princess Cruises and Seabourn Cruise Line in North America; P&O Cruises, Cunard Line and Ocean Village in the UK; AIDA in Germany; Costa Cruises in southern Europe; Iberocruceros in Spain, and P&O Cruises in Australia.

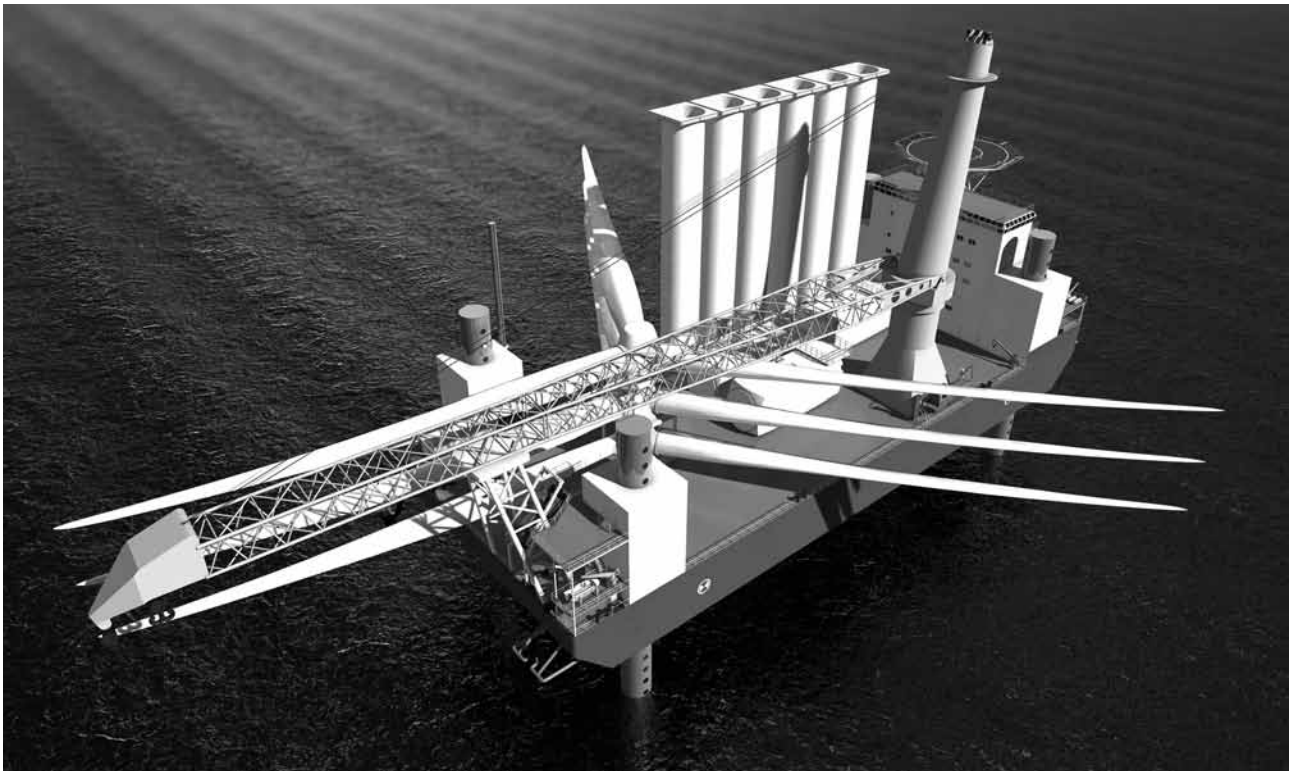
Order Placed for Jack-up Crane Vessels based on Wärtsilä-IMS design

Wärtsilä, in consortium with IMS Ingenieurgesellschaft mbH, was engaged in March by RWE Innogy, the renewable energy arm of the German utility company RWE, as its designer to provide the basic design and consultancy services for a jack-up crane vessel. Two such vessels with GL class approval have been ordered by RWE Innogy to be used for constructing offshore wind farms. The shipbuilding contracts have been awarded to Daewoo Shipbuilding and Marine Engineering Co. Ltd. (DSME), and delivery of the vessels is scheduled for late 2011.

Tailored specifically for year-round construction of offshore wind farms, the Wärtsilä-IMS advanced jack-up crane vessel is designed to remain operational under harsh Northern European sea and wind conditions. It also sets new standards for reliability and environmentally-sound operation.

The basic design by Wärtsilä-IMS takes into account the specialised needs involved in the construction of offshore wind farms. The vessels are 100 metres long and 40 metres wide, and feature an 800-ton crane for transporting and handling the foundations for the latest generation of up to 5 MW and 6 MW offshore wind turbines, as well as the turbine towers, nacelles, rotors and blades. The vessels have sufficient deck area and deadweight capacity to carry the components for up to four complete wind turbine units or several foundations. For operation in shallow water, a four-point mooring system is used, while in deeper waters a DP2 dynamic positioning system controlling steerable thrusters is employed.

The vessels are designated to undertake foundation and turbine installation at RWE Innogy's currently-planned wind farms — North Sea East, Innogy North Sea 1 and Gwynt y Môr.



The Wärtsilä/IMS advanced jack-up crane vessel for constructing offshore wind farms
(Image courtesy Wärtsilä)

Carrying Capacity of Lifeboats and Rescue Boats—Revision of LSA Code Chapters IV and V

The International Maritime Organization (IMO) adopted Resolution MSC.272(85) at the 85th session of the Maritime Safety Committee. This amended Chapters IV and V of the International Life-Saving Appliance (LSA) Code, introducing increased assumed mass of occupants for the approval of lifeboats and rescue boats, and enhanced seating arrangements for the occupants of free-fall lifeboats, for ships constructed (having their keel laid) on or after 1 July 2010.

The requirements apply as follows:

- Cargo ship lifeboats (both davit launched and free-fall) should be approved assuming an average mass of occupants of 82.5kg (increased from 75kg).
- Cargo and passenger ship rescue boats should be approved assuming an average mass of occupants of 82.5kg (increased from 75kg).
- Cargo ship free-fall lifeboat seating arrangements should comply with amended LSA Code Chapter IV, paragraph 4.7.2.

When installing new equipment on board vessels with a keel laying date before 1 July 2010, clear guidance on the application of Resolution MSC.272(85) should be provided by the Flag Administration.

Resolution MSC.81(70) — Revised Recommendation on Testing of Life-Saving Appliances (adopted on 11 December 1998) has been amended by Resolution MSC.274(85) to reflect these requirements. It should, however, be noted that MSC./Circ.980 — Standardised Life-Saving Appliance Evaluation and Test Report Forms — has not been similarly amended and, when required, these amendments will be applied and information included in the relevant test report forms.

Lloyd's Register's *Classification News*, No. 11/2010

Entry into force of the Revised MARPOL Annex VI

Some aspects of the revised MARPOL Annex VI will have immediate effect when they come into force on 1 July 2010. In particular:

- the maximum permitted sulphur content of fuels used in the two emission Control Areas for sulphur (the Baltic and North Sea area) will reduce from 1.50% to 1.00%
- all ships will be required to maintain a list of equipment containing ozone-depleting substances (ODS) and an ODS record book
- tankers carrying crude oil and certain gas carriers are required to have on board an approved VOC Management Plan (see Classification News 41/2009 and 03/2010).

In addition to the above, the Revised Annex VI includes amendments to the International Air Pollution Prevention Certificate and its supplement; as a result, all certificates and supplements will be required to be reissued. This will be carried out as follows.

For ships which currently hold an International Air Pollution Prevention Certificate or a Certificate of Compliance, the certificate and its supplement will be reissued at the next renewal survey after 1 July 2010, or on any other occasion (such as change of flag or name) which would necessitate the reissue of the certificate and its supplement, whichever comes first. Where applicable it will be confirmed that an approved VOC Management Plan is on board.

Ships flying the flags of countries which are not signatories to the Convention should be issued with a Certificate of Compliance with Annex VI. This will help avoid problems when trading to countries which are signatories.

Lloyd's Register's *Classification News*, No. 15/2010

New PFD Standard for Australian Boaters

Australia's marine safety authorities have agreed to accept personal flotation devices (PFDs) made to the new Australian Standard 4758 by 1 July 2010. The National Marine Safety Committee confirmed that this change will have a minimum impact on boaters, as PFDs made to the old Australian standards can continue to be sold after 1 July 2010.

NMSC's CEO, Margie O'Tarpey, explained that some jurisdictions already recognise PFDs made to AS4758 and, by 1 July 2010, this should be the situation nationally. "AS4758 is being introduced to more-closely align with international standards, and takes into account advances in PFD design and manufacture," she said.

Ms O'Tarpey confirmed that the NMSC is aware that new PFDs manufactured to AS4758 will soon start to appear on retailer's shelves, but cautioned that full market availability of the new product may not be reached until 2011. PFDs made to AS4758 are marked as

- Level 150 — which is similar to inflatable PFD Type 1 and suitable for offshore use
- Level 100 — which is similar to PFD Type 1 and the minimum requirement for offshore use
- Level 50 — which is similar to PFD Type 2
- Level 50 Special Purpose (50S) — to replace PFD Type 3

"Most PFDs made to the old standards will be recognised for many years to come and, in the majority of cases, people won't need to replace their existing PFDs as long as they are serviceable," explained Ms O'Tarpey. However, she said that it is important to note that some jurisdictions have applied limits to accepting older existing PFDs based on when they were manufactured. NMSC recommends that if boaters have an existing PFD made to the old standards, they should check with their local marine safety authority to find out whether it is still accepted.

PFDs are recognised as a key safety feature in recreational boating. An NMSC study found that people who survived a boating incident were more than two times more likely to have been wearing a PFD compared to those who died, and concluded that if PFD usage increased to 50%, then 2–3 lives could be saved nationally each year."

For details on PFD laws in your state, please contact your local marine safety authority.

Ursula Bishop

Marine Safety Conference 2010

The Marine Safety Conference 2010, themed *Safe Passage to a Marine Nation*, is the sixth to be hosted by the National Marine Safety Committee (NMSC).

NMSC's CEO, Margie O'Tarpey, said that the varied program makes the Perth conference on 22–24 August at the Burswood Entertainment Centre a 'must' on this year's maritime calendar. "Over 35 speakers are now confirmed with presentations on the latest in commercial and recreational boating safety from around Australia, the Pacific—and beyond," Ms O'Tarpey said.

Major sponsors Club Marine and the Department of Transport Western Australia have joined general sponsors the Australian maritime Safety Authority, the NSW Maritime Authority and the Department of Transport South Australia in supporting the key maritime event.

Program speaker highlights include:

- John Leech, CEO Irish Water Safety
- Gina Johansen, FishSafe Project Manager, British Columbia, Canada
- Jeff Hoedt, Boating Safety Division Head, US Coast Guard
- A plenary panel including the Australian Maritime Safety Authority and the Australian Maritime Group on the Single National Jurisdiction for maritime reform
- Glenn Finniss, Head Marine Rescue NSW
- Dianne Bates, CEO Marine Safety Victoria
- Launch of the first-ever national recreational boating usage study report
- Dr Ed Mahoney, Marina research specialist, Michigan State University
- Terry Hewitt, Engineering Manager, MG Kailis
- Alistair Murray, President AIMEX
- Catherine Taylor, CEO Maritime New Zealand
- Fiona Heart, Marine Safety Education Officer ,WA Transport
- Colin Chamberlain, New Inventor of the Year 2009 on ABC TV
- Mori Flapan, Principal Technical Adviser, NMSC
- Peter Dexter, Bureau of Meteorology

John Leech hopes to meet many of the Australians working and involved in the marine environment. In addition to his role as CEO of Irish Water Safety, John is Chairman of the Irish Branch of the International Institute for Marine Surveying and a Member of the Nautical Institute.

Australia's own marine surveyors have taken advantage of the Perth gathering by holding their bi-annual meeting in Fremantle on 25 August—the day after the conference.

Gina Johansen will share a panel session on the environmental and safety challenges facing the fishing industry as well as presenting a plenary session on her experience with the Canadian FishSafe project.

Commercial vessel construction standards will be visited by MG Kailis's Terry Hewitt, NMSC's Mori Flapan and Transport South Australia's Nik Parker. Mori's session asks: 'What should be done with Grandad? Discussing the application of new standards to the existing fleet'.

Glenn Finniss, head of Marine Rescue NSW, summed up the expectations of many for this year's conference: "The conference brings together people from all areas and different perspectives towards a common goal—marine safety".

For further information, contact the MSC 2010 Conference Secretariat, GPO Box 3270, Sydney NSW 2001, phone (02) 9254 5000, fax (02) 9251 3552, email msc2010@icmsaust.com.au, or visit the conference website www.nmsc.gov.au and click on the MSC 2010 icon. The preliminary program for the conference is now posted on the website. Registration is now open online on the website or via the Conference Secretariat. Early-bird registration ($795) closes 18 May 2010, followed by standard registration ($875) to 22 August.

Gina Johansen
FishSafe Project Manager, British Columbia, Canada
(Photo courtesy NMSC)

Glenn Finniss, Head Marine Rescue NSW
(Photo courtesy NMSC)

ATC Approves Buoyancy and Stability Standard

The National Standard for Commercial Vessels (NSCV) Section C6B — Buoyancy and Stability after Flooding

passed through the Australian Transport Council (ATC) in late April, bringing the trio of stability standards into application. NSCV C6A — Intact Stability Requirements, and C6C — Stability Tests and Stability Information were approved in 2008.

The new standard replaces and consolidates the relevant parts of USL Code Sections 5, 7, 8, 10 and 18, responding to newer technologies and removing the piecemeal nature of the current requirements.

NMSC's Principal Technical Adviser, Mori Flapan, said that the standard is a culmination of several years' research and consultation with members of a joint industry and government reference group. The deemed-to-satisfy solutions which it offers will benefit designers and operators alike. "The standard had to find the right balance between a vessel's capacity to withstand flooding and its commercial viability," Mr Flapan said, "so it takes into account factors like the number of passengers on the vessel and its area of operation".

The standard's requirements are focused on minimising the likelihood that flooding will cause sudden or progressive capsize or foundering, and preventing excessive angles of heel or trim. It provides a more performance-based approach which sets a consistent benchmark for determining initial and ongoing compliance.

For a copy of the published standard go to www.nmsc.gov.au and click on Standards and Publications>National Standards>NSCV or phone the NMSC Secretariat on (02) 9247 2124 for a hard copy.

Consultation Continues on Watertight and Weathertight Integrity

The draft standard for Watertight and Weathertight Integrity (NSCV Section C2) will be ready for public comment towards the end of June. A reference group has worked through a considerable amount of industry feedback on the issues paper in order to prepare this first draft.

The document explores options for protecting vessels from the ingress of water in heavy weather by their watertight arrangements, for example watertight doors, coamings, portholes, deadlights, freeing ports and minimum freeboard.

The design of commercial vessels has been undergoing some radical transformations since the mid-1990s when the Code of Safety for Dynamically Supported Craft was developed, so the industry deemed it time to filter some of those changes down to smaller commercial vessels in a formal way. For instance, it is not reasonable to expect small vessels, which are never loaded as heavily as are big ships on international voyages, to meet the same requirements to protect against heavy weather.

The new standard will be closely tied with the newly-approved NSCV Section C6B — Buoyancy and Stability after Flooding.

For further details, keep an eye on *Have Your Say* in June on the NMSC website, www.nmsc.gov.au.

Marine Survey Skills Project Prepares for Single National Jurisdiction

Twenty-six key stakeholders gathered at the Vibe Hotel in Sydney on 18 March to workshop the issues and options which will impact on marine surveyors surveying smaller commercial vessels for the Australian Maritime Safety Authority (AMSA) under the new Single National Jurisdiction (SNJ).

Conducted by AMSA with assistance from the NMSC, the project aims to develop a set of marine surveyor competencies, review appropriate training for marine surveyors, and look into options for a possible future national system of surveyor accreditation.

UK-based CEO of the International Institute of Marine Surveyors, John Lawrence, attended the workshop and presented a European perspective on 'best practice' in marine surveying skills.

Other participants included key stakeholders from marine surveyor professional associations including the Marine Surveyors Association and the Australian Institute of Marine Surveyors, those in charge of surveys in the jurisdictions, classification societies and educational institutions developing or offering marine qualifications.

NMSC's Director of Programs, Anne Rauch, said that the workshop recommended that a reference group be established to develop the core competencies for a marine surveyor under the SNJ.

She listed the key issues raised as:

- an appropriate and streamlined system for recognition of prior learning for existing experienced surveyors;
- a system of mentorship for novice surveyors lasting from 2–3 years;
- the importance of continuing professional development;
- gaps in the existing marine surveying training particularly the NSCV; and
- a common reporting system across the jurisdictions once the SNJ is in place.

For further details, contact Anne Rauch at NMSC on (02) 9247 2124, or Paul MacGillavary at AMSA on (02) 6279 5631.

Tauhid Rahman, DNV (centre right) discussing details with other stakeholders at the Marine Survey Skills workshop in Sydney
(Photo courtesy NMSC)

Scantlings Workshops

Lecturer in marine craft structure at the Solent University in Southampton, UK, Robin Loscombe, conducted a series of technical workshops in April around Australia on behalf of the National Marine Safety Committee. Eighty marine engineers and naval architects attended the workshops

nationally. The one-day workshops introduced Australia's National Standard for Commercial Vessels (NSCV) Part C Section 3 — Construction with hands-on tuition in the application of ISO 12215.

Mr Loscombe said that each workshop was intended to 'quick start' inspectors, surveyors or designers who are thinking about using ISO 12215 as a deemed-to-satisfy solution for determination of commercial vessel scantlings for light operations under NSCV Part C3. "The training has been shown to be of great interest to busy engineers and naval architects who are seeking an alternative to using Lloyd's SSC Rules but don't have time to plough through all the standards," he said.

NMSC issued certificates to those who successfully completed the workshops.

Protocol for Transition

The National Marine Safety Committee has published the *Administrative Protocol for Assessing the Application of the NSCV to Existing Vessels* as Manual 9 of the National Marine Guidance Manual.

The Protocol provides the principles which will be used to assess individual parts and sections of the National Standard for Commercial Vessels (NSCV) for application to existing vessels in order to develop policy for applicable legislation.

Participants in the Scantlings Workshop in Sydney in April
(Photo courtesy NMSC)

Existing vessels are those which fall outside the scope of the NSCV as defined in NSCV Part B — General Requirements and this is clarified within this administrative Protocol.

For a copy, go to www.nmsc.gov.au and click on Standards and Publications>Guidance Materials or phone the NMSC Secretariat on (02) 9247 2124 for a hard copy.

Rosemary Pryor

The Japan Maritime Self-Defence Force helicopter destroyer JS *Hyuga* (DDH 181) underway with the aircraft carrier USS *George Washington* (CVN 73) during an exercise in the Pacific late last year. The 'destroyer' has a displacement of some 20 000 t, a top speed of around 30 kn and can carry up to 18 helicopters.
The political classification of this modest aircraft carrier as a destroyer is reminiscent of the early classification of the Royal Navy's Invincible-class aircraft carriers *Invincible*, *Illustrious* and *Ark Royal*, as 'through deck cruisers'
(US Navy photograph)

MEMBERSHIP

Australian Division Council

The Council of the Australian Division met on Wednesday 17 March under the chairmanship of the President, Dr Stuart Cannon. Some of the matters raised or discussed during the meeting were:

The Australian Naval Architect

Council welcomed the offers of advertising and support provided to this publication by the AWD Alliance and Wärtsilä Australia subsequent to its previous meeting. Members were urged to continue efforts to secure additional advertisers.

Pacific 2010 and 2012 IMCs

The chairman of the Organising Committee, John Jeremy, reported on the successful outcome of the 2010 International Maritime Conference which was largely a result of the varied programme and high-quality papers selected by the Program Committee.

Mr Jeremy also reported on initial preparations for Pacific 2012 IMC. Keith Adams and Adrian Broadbent were confirmed as the Division's representatives on the Organising Committee for that conference.

Single National Jurisdiction for Maritime Safety

Council noted that since its December meeting there had been few significant developments in progressing towards the single jurisdiction. An update on this subject would be sought for the next Council meeting.

Retiring Council Members

Noting that this meeting would be the last attended before the retirement of a number of Council members nominated by Sections, the President thanked Roger Best, Craig Boulton, Craig Hutchings, Samantha Tait and Giles Thomas for their contribution to Council and expressed the hope that they might re-join Council in future. Council endorsed this expression of appreciation.

Next Meeting

The next meeting of the Council of the Australian Division is scheduled for Wednesday 16 June by teleconference originating from Canberra.

Annual General Meeting

The Australian Division's Annual General Meeting was held in Fremantle on 23rd March. The meeting was attended by the President, Secretary and a capacity turn-out from the WA Section and others interested in Dr Cannon's presentation on the work carried out by the Division and DSTO for the Inquiry into the loss of *HMAS Sydney II*.

Changes of Address

To ensure that they do not miss any copies of this journal and any other correspondence from the Division, members are requested to advise the Secretary by email (rina.austdiv@optusnet.com.au) of any change in their address. This should be in addition to advising Headquarters of the change as these changes are only advised to the Division annually. Alternatively, members may request me as Division Secretary to advise Headquarters of the change on their behalf.

Rob Gehling
Secretary

Commendation for the Australian Division


The Royal Institution of Naval Architects

Certificate of Commendation

awarded to

The Australian Division

The Council of the Institution commends the Australian Division for its contribution to the Commission of Inquiry into the loss of HMAS SYDNEY II,

Council recognises that the skills and professionalism displayed by the Division, collectively and by its members, were not only in keeping with the high standards expected of the Royal Institution of Naval Architects, but also served to raise the profile and standing of the Institution, both in Australia and internationally.

Signed on behalf of the Council

President 15 February 2010

The Council of the Royal Institution of Naval Architects has recognised the contribution of the Australian Division to the Commission of Inquiry into the loss of HMAS *Sydney II* with the award of a Certificate of Commendation

NAVAL ARCHITECTS ON THE MOVE

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

Yew Jinn Chieng, a student at the University of New South Wales, has taken up a part-time position at ASO Marine Consulting in Sydney while he completes the requirements for his degree.

Ed Dawson has moved on from BMT Design Technology and has taken up a position with the Maritime Platforms Division of the Defence Science and Technology Organisation in Melbourne.

Paul Duncan moved on from AMOG Consulting almost two years ago, and has taken up a position with INTECSEA, a brand of WorleyParsons. He is now based in Jakarta,

Indonesia, for 6–12 months as the Project Engineer for a new LNG floating terminal project for Pertamina and PGN (government oil/gas companies).

Richard Dunworth has moved on in the Department of Defence and has taken up the position of Stability Technology Manager in the Directorate of Navy Platform Systems in the Navy Engineering Division in Canberra.

Tim Gates has moved on in the Department of Defence and has taken up the position of Class Society Manager/Senior Naval Architect for the LHD Project Team in Ferrol, Spain.

Peter Hayes has retired from the position of Stability Technology Manager in the Directorate of Navy Platform Systems in the Navy Engineering Division of the Department of Defence, Canberra. However, the retirement didn't last long; he has now taken up a part-time position contracting to the Stability Technology Branch of the Directorate of Navy Platform Systems in Canberra.

Peter Henry has moved on from the Directorate of Navy Platform Systems in the Department of Defence and has taken up a position as a naval architect with Kellogg Brown and Root in Leatherhead, UK. He is currently working on the 'special structures' for a 260 m FPSO to operate in the harsh environment west of the Shetland Islands where it is cold and the seas are seldom less than heavy.

Hason Ho moved on from Qantas some time ago and has taken up a position as a biomedical engineer with Cochlear in Sydney.

Sajeer Kandathil has taken up a position as a naval architect with the Commercial Marine Services Branch of the Department for Transport, Energy and Infrastructure in Adelaide.

David King moved on about five years ago, and has taken up a position with Orica, buying, and more recently marketing, explosives products. Orica is one of the few truly-global Australian-based companies, with operations in around 50 countries and customers in twice that many.

Doug Matchett has taken up a position at Oceanic Yacht Design in Coomera, Qld.

Steve McCoombe has moved on from Marine Safety Victoria and has taken up a position as a naval architect with the Commercial Operations Branch of the NSW Maritime Authority in Sydney.

Joanna Mycroft completed her trip to Egypt by returning to the UK through Jordan, Syria and Turkey. She has now taken up a position as a naval architect with Tony Castro Naval Architects and Yacht Designers in Southampton, UK, working on motor boats and sailing yachts. Friends can check out the company's range of designs at www.tonycastro.co.uk. Jo is sailing again in the J/109 class on the weekends, and looking for berths in some of the big races—round the Isle of Wight, Cowes Week and Cork Week, etc.

Simon Orr moved on from VT Shipbuilding (now BAE Systems) in Portsmouth, UK, in February last year and sailed the yacht he was living on through the French canals, via Corsica and Italy to Africa. In November he came back to Sydney and worked at Burness Corlett Three Quays Australia for three months before returning to the UK. He has now taken up a position as a naval architect with Babcock Integrated Technology (Marine) at Newcastle-upon-Tyne, UK, working on the Queen Elizabeth aircraft carrier project.

Howard Peachey has taken up a position as senior naval architect with the Commercial Marine Services Branch of the Department for Transport, Energy and Infrastructure in Adelaide.

Peter Rout has moved on and has taken up the position of Assistant Director, Corporate and Operations at the Australian National Maritime Museum in Sydney. This includes responsibility for the ANMM's fleet of heritage vessels, e.g. the operational *Endeavour* replica and the major static-display vessels, *Vampire* and *Onslow*.

Frank Ryan has moved on from Austal Ships and has taken up the position of Structures Technology Manager with the Directorate of Navy Platform Systems in the Navy Engineering Division of the Department of Defence in Canberra.

Anne Simpson, a graduate of the University of New South Wales, has taken up a position as a naval architect with Lightning Naval Architecture in Sydney.

Leandre Sitja has taken up a position as a naval architect with the Commercial Operations Branch of the NSW Maritime Authority in Sydney, having previously been with the Canadian, Australian and Spanish Olympic sailing teams.

Mike Tweedie taken up a position as a naval architect with the Commercial Marine Services Branch of the Department for Transport, Energy and Infrastructure in Adelaide.

Bruce Watkins has moved on and has taken up a position working with Deakin University in Melbourne, doing a scoping study for the Department of Health and Ageing around the healthy food/preventative health space.

Jonathan Windsor, a graduand of the Australian Maritime College, has taken up a position as a naval architect with the Directorate of Navy Platform Systems in the Navy Engineering Division of the Department of Defence in Canberra, initially working with the stability group.

Daniel Wong returned to the University of New South Wales and, at the graduation ceremony on 10 May, graduated with a Master of Engineering Science degree in Manufacturing Engineering and Management.

Konrad Zurcher, a student at the University of New South Wales, took up a part-time position some time ago at Digital Wranglers, an IT company in Sydney, while he completes the requirements for his degree.

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

Phil Helmore

FROM THE ARCHIVES

A SURVEY SHIP FOR AUSTRALIA

John Jeremy

Fifty years ago Navy Office completed the design of the first purpose-designed survey ship for the Royal Australian Navy. Commissioned in 1964 as HMAS *Moresby*, the ship was to serve the Royal Australian Navy for 33 years and steamed well over one million miles during her long career.

HMAS *Moresby* had a full load displacement of 2393 t, an overall length of 95.7 m, beam of 12.8 m and a mean draught of 3.81 m. Built of steel, she was fitted with English Electric diesel-electric propulsion delivering 3729 kW to two fixed-pitch propellers for a maximum speed of 18 knots. She had a useful range of 10 000 n miles. Her complement was 146 and she carried a small helicopter and three survey motor launches.

Moresby was originally designed to full naval standards, but the construction cost was far too high. The Australian Shipbuilding Board was given the job of rewriting the specification to commercial standards, although the structure remained unaltered. The ASB invited Australian shipbuilders to tender for the revised design and an order was placed with the State Dockyard in Newcastle. The ship was laid down on 1 June 1962, launched on 7 September 1963 and accepted for service in February 1964 at a cost of £2 million ($4 million). The yacht-like ship, with teak-sheathed upper decks and painted gleaming white with a buff funnel, was commissioned in Sydney on 6 March 1964.

Moresby was soon busy with her job of surveying Australian waters, particularly in the north. In 1974 her home port became Fremantle in Western Australia. She moved to HMAS *Stirling* in 1978 when the new base was commissioned.

HMAS *Moresby* was paid off in Western Australia on 13 November 1997. She was sold to Mr Eric Hotung, founder and chairman of the Hotung Institute of International Studies, in September 1999 and renamed *Patricia Anne Hotung* and was refitted in Fremantle as a refugee relief ship. She was soon busy in her new role and between January 2000 and July 2001 carried some 10 000 refugees from camps in West Timor to East Timor on behalf of the International Organisation for Migration.

HMAS *Moresby* lying alongside HMAS *Barcoo* at Garden Island in February 1964. *Barcoo's* crew transferred to *Moresby* when she was commissioned on 6 March
(Photo John Jeremy)

The launching of HMAS *Moresby* at the State Dockyard, Newcastle, on 7 September 1963
(Photo John Jeremy)

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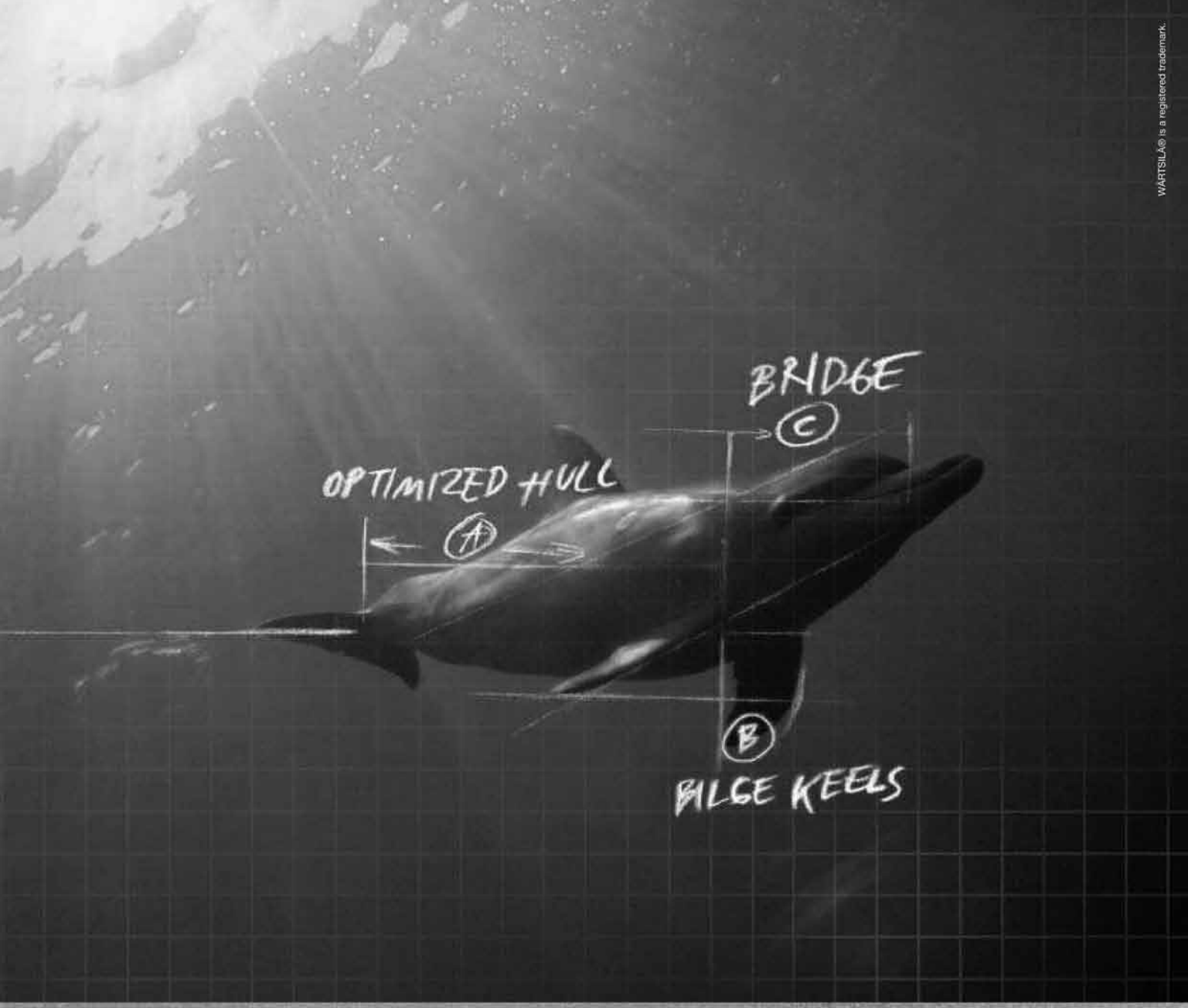
Sydney, 48 Huntingwood Drive, Huntingwood, NSW, 2148. Tel: +61 2 9672 8200
Perth, 19 Alacrity Place, Henderson, WA, 6166. Tel: +61 9 9410 1300



NOTICE HOW ALL THE PARTS FIT TOGETHER.

Wärtsilä now offers the marine industry total solutions that cover everything from design to lifecycle service. This makes our solutions uniquely efficient and environmentally sound. Read more about what we can do for you, wherever you are: wartsila.com.

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Wärtsilä in Australia:
Adelaide, 283–287 Sir Donald Bradman Drive, Brooklyn Park, SA, 5032. Tel: +61 8 8238 3473
Sydney, 48 Huntingwood Drive, Huntingwood, NSW, 2148. Tel: +61 2 9672 8200
Perth, 19 Alacrity Place, Henderson, WA, 6166. Tel: +61 9 9410 1300
Main Contact: Chris Field, Senior Sales Manager — Ship Power and Navy, email: chris.field@wartsila.com