RINA

The Royal Institution of Naval Architects

International Conference

HIGH SPEED CRAFT

17 - 18 NOVEMBER 2004,
RINA HQ, LONDON, UK

HIGH SPEE

17 - 18 NOVEMBER

Prospects within the high speed craft sector are once again beginning to improve. Craft are being designed and built for an ever wider range of roles and more demanding applications. The industry is seeking to extend the economic operating envelope of these craft, reducing downtime, increasing reliability and safety.

The conference will consider a wide range of vessel types including small high speed craft, military vessels, passenger ferries, freight carriers, etc. Continuing the Institution's successful series of conferences on high speed craft, this two day event will give the industry the opportunity to debate these problems and look at possible solutions.

day 1

09.30 - 10.00 **Registration and coffee**

Session 1 - New Technology

10.00 - 10.35 **The Influence of New Technology on the Design and Manufacture of High Speed Craft with Special Reference to Recent Monohulls, Multihulls, Air Cushion Vehicles and Surface Effect Ships**
J.L.Allison, B.G.Forstell, D.R.Lavis, J.Purnell, CDI Marine, USA
This paper addresses all the aspects of High Speed Craft with reference to actual vessels that have been recently designed, developed and successfully built and tested, together with some that are currently in process of final design and completion, and some advanced concepts under research. The Paper addresses the need to ensure that new High Speed Craft have viable economic bases and / or military missions. The use of new materials for hull construction is discussed with several examples. A current design example is a version of the US Navy's Landing Craft, Air Cushion, LCAC that employs new deep skirt technology and low-profile bow thrusters. The development of advanced axial flow waterjets is also discussed.

10.35 - 11.10 **High Speed Multihull Craft for Medium Distance Marine Transportation**
E Begovic, C Bertorello, S Caldarella, P. Cassella, University of Naples, Italy
The increasing demand of fast marine transportation also for routes of medium range has led to a significant interest in multi-hull ships. Therefore, new unconventional multihull craft, suitable for medium size fast ferries have been proposed. The trimaran and the pentamaran seem to be interesting possibilities for such routes, because of the benefits given by their main hull slender form stabilized by very slender outriggers. Experimental research has been carried out at Naples University towing tank comparing the resistance of trimaran and a pentamaran hull forms suitable for a medium distance ship with equivalent service capability as existing monohulls. The powering performances and stability characteristics, determined for different freeboard/beam ratios of the two considered vessels have been assessed and compared.

11.10 - 11.40 **Coffee**

11.40 - 12.15 **Defect and Damage Assessment for Ships Built in FRP Sandwich**
Brian Hayman, Det Norske Veritas, Norway
Sandwich construction, with fibre-reinforced polymer (FRP) skins separated by a lightweight core, has been used extensively in the hulls and superstructures of high speed and naval craft. When such a structure experiences damage, the current practice is normally to repair it as soon as possible. The paper describes a damage tolerance based approach that will enable more rational decisions to be made as to whether, when and how a repair should be performed. With reference to some specific defect and damage cases, a scheme is described by means of which the local and global performance of the damaged ship structure can be assessed, and acceptance criteria can be established for defects and damage with regard to their size and location. The paper includes a brief discussion of the challenges being faced with regard to the detection of such defects and damage and the determination of their location and extent.

12.15 - 12.50 **An Inverse Design Procedure for Hydrodynamic Optimisation of High Speed Hull Form Using Commercial Software**
Nigel Koh, University of Newcastle
The objective of this paper is to present a novel approach to multi-objective hydrodynamic optimisation of hull forms in preliminary design stage using commercial naval architect software by Tribon Solutions and Artificial Neural Networks (ANN). The objective functions are good resistance, seakeeping and manoeuvring qualities at design speed. A high speed RoPax is taken as the parent hull form in the studies. The hull form geometry is systematically varied by changing the independent primary and secondary form parameters at similar displacement to investigate the design space. Semi-empirical design tools are used to estimate the powering and manoeuvring performance and the seakeeping performance is computed using linear strip theory. The cause and effects of variation of primary and secondary parameters of hull form geometry are studied. All the results are established as a database, in the form of regression equation using ANN technique. The optimal hull form is selected using ANN based optimisation techniques.

12.50 - 13.25 **Aluminum Construction for High Speed Craft: A Case Study**
Jennifer Grimsley, Carderock Division Combatant Craft Department,USA
The U.S. Navy has accepted delivery of a technology demonstration craft designed by NAVSEA NSWC Carderock Division Combatant Craft Department (CCD) and built by Oregon Iron Works (OIW), a metal manufacturing company headquartered in Clackamas, OR. The craft, named SEALION, is currently undergoing testing and evaluation. This paper will discuss the design approach, technology insertion and lessons learned through experimentation by the US Navy. It will also describe advances in aluminum construction that proved successful on the SEALION technology demonstrator. This paper will go on to describe approaches taken for design and construction to meet the rigors of high-speed operation in heavy seas and still maintain tolerance requirements. Investigations into design and construction techniques for modular payloads will be discussed.

13.25 - 14.25 **Lunch**

14.25 - 15.00 **The Development and Validation of a Hydrodynamic and Structural Design Methodology for High Speed Rescue Craft**
Holly Phillips and Bob Cripps, Royal National Lifeboat Institution
Simon Rees andRoger Dennis, Frazer-Nash Consultancy Limited
The RNLI, with their key partner Frazer-Nash Consultancy, have been working for some time on a design methodology for high speed craft that operate beyond normal design rule conditions. From a hull-shape concept, the hydrodynamic and then dynamic behaviour of the hull in smooth and rough water can be predicted numerically. The effect of wave slam events and effective load curves can then be examined, and the structural layout of the craft modified accordingly. Each stage has now been validated. Smooth and rough water hydrodynamic performance has been compared with tank and full-sized craft measurements, and the structural response predictions checked against strain-gauge data. The methodology can now be used as a tool for both design, and potentially for the development of future design codes.

15.00 - 15.35 **The Influence of the Central Bow Bulbs on the Resistance of Catamarans**
Carlo Bertorello & Pasquale Cassella, University of Naples, Italy
Dario Bruzzone, University of Genoa, Italy, Igor Zotti, University of Trieste, Italy
It has been demonstrated that the use of central bow bulbs on a catamaran hull can improve its seakeeping and resistance characteristics. These hull configurations, defined by a central bow bulb, placed between the demi-hulls, were called Bulb-Cat configurations. The resistance data presented previously was obtained from a series of tests made on a small scale model (1:20) tested at the towing tank of the Trieste University. To verify the reliability of the results, it was decided to extend the resistance tests to a larger scale model. The results obtained from the experiments have been compared with similar results obtained from a numerical investigation on the wave pattern resistance to investigate the scale effects. A detailed description of the tests and the most significant results obtained both from the experiments and the numerical investigations will be given.

Session 2 - Design

15.35 - 16.05 **Coffee**

16.05 - 16.40 **No Stone Unturned: A Comprehensive Approach to the Development of a New Class of High Speed Ferry for Alaska.**
J Bonafoux and J Lawless, BMT Nigel Gee and Associates, G Smith, Alaska Marine Highway Systems, G Higgins, Derecktor Shipyards
In 1998 Alaska Marine Highways System (AMHS) started a procurement programme for high speed passenger and vehicle ferries to provide improved transport links for communities on the West coast of Alaska. This paper will provide a summary of the work completed by AMHS to identify the owner's requirements with regards to design function, arrangement, weight restrictions, noise, vibration, fatigue and wash. The paper will go on to look at the design challenges presented by these requirements, and those imposed upon the project through US federal regulatory requirements, during the development of the first of these vessels MV Fairweather. Comparisons between the predicted performance and trials results will also be presented. The paper will also look at production methods used during construction and difficulties encountered in building the first IMO HSC approved passenger/vehicle ferry in the USA.

16.40 - 17.15 **Seakeeping Predictions for a 100 knot Yacht**
Jeffrey B. Bowles and Dean M. Schleicher, Donald L. Blount and Associates, Inc., USA
DLBA has previously explored the technical feasibility of a 100 knot yacht using data available within the public domain, examining the state-of-the-art relationship between weight, power and speed for hard chine hull forms. This paper explores the seakeeping characteristics of high speed craft in a macroscopic sense using data and information available in the public domain, supplemented by an extensive proprietary database of high speed, rough water model tests of hard chine hull forms. A method will be presented to apply analytical design tools to evaluate the seakeeping performance of a vessel in the concept design phase. Recommendations for maximum speeds in various sea states will be provided for the 100 knot yacht.

This represents a preliminary program

day 2

09.00 - 09.30 **Coffee**

09.30 - 10.05 **The Evolution of the 112m Wave Piercing Catamaran Design**
Gary Davidson and Tim Roberts, Revolution Design, Australia.
After successfully introducing the Incat 96 and 98 meter passenger car and cargo ferries, Incat believed it was time to offer a viable alternative to freight companies worldwide for fast freight transport by sea. The vessel, a 112 meter concept craft from Revolution Design, will be a large wavepiercing catamaran, specifically orientated to carrying large payloads at speeds in excess of 40 knots. This paper will explore the design process that enables this vessel to obtain improvements in ride, capacity, reliability and speed. The level of design to achieve this has been significant compared to earlier vessels and is well justified by the increased capability of the vessel.

10.05 - 10.40 **Design of High Speed Low Wake Hydrofoil Passenger Ferry**
Endicott M. Fay, Teignbridge Propellers Ltd., UK
In many areas around the world it has been imperative that fast passenger ferries provide fast reliable surface across protected harbours, bays and rivers. While travelling at high speed, the existing ferry configurations create relatively low, high-energy waves that can erode shorelines and upset small vessels. The paper introduces a trimaran-configured hydrofoil to reduce the wake to an acceptable level while maintaining the speed necessary to provide a competitive service. The design will provide a passenger carrying capacity of 350 and a cruise speed of 35 knots. The hydrofoil will be a canard style arrangement using a diesel electric drive system with a pair of pod drives. The paper focuses on the preliminary design of the vessel with emphasis on the hull design, hydrofoil arrangement and propulsion system.

10.40 - 11.10 **Coffee**

11.10 - 11.45 **The X-Craft**
Nigel Gee and Mike Machell, BMT Nigel Gee and Associates Ltd
The United States Navy Office of Naval Research have commissioned BMT Nigel Gee and Associates through Titan Inc. of California to design and build an experimental vessel that will be used to demonstrate mission modularity and evaluate hydrodynamic performance, structural behaviour, and propulsion system efficiency of high speed vessel technology suitable for use in the littoral. The vessel, now known as X-Craft, is a 1000 tonne catamaran, required to carry up to 700 tonnes of deadweight and be capable of operating at a maximum speed of 50 knots and at 45 knots in sea state 4. The vessel is now under construction at Nichols Bros in Washing State, USA for launch and sea trials at the end of 2004. The paper describes the development of the X-Craft and shows how its capability will meet most of the requirements of the United States Navy proposed littoral combat ship.

11.45 - 12.20 **The Design of a Low Wash Fast Ferry for Inland Waters use: the TRIDELTA**
J.A.Keuning , H. Boonstra and M. van den Hoven, DELFT University of Technology
Triggered by the continuing problems caused by the types of Fast Ferries currently used on the Dutch Inland waterways a novel alternative for these "Low Wash Catamarans" has been developed. The concept is based on the use of three very short and beamy planing hulls, with low deadrise, sailing at high Froude numbers. The resulting wash is therefore low and with a short length. In addition to this the overall resulting wave system may be minimized by using interaction effects between the three respective wave systems. In this paper an explanation of the philosophy behind this concept will be discussed in conjunction to some measurement results obtained from towing tank experiments. The concept has been further elaborated into an actual design using an existing fast ferry as a benchmark. The resistance and propulsion will be discussed and compared with the benchmark boat.

12.20 - 12.55 **Design Development of 24m Air-Supported Vessel (ASV) Catamaran Demonstrators, Suitable for Fast Passenger Ferries and Various Naval /Paramilitary Applications**
Ulf Tudem, SES Europe AS, Norway
Due to the very low hull resistance at high speed, the Air Supported Vessel (ASV) concepts are highly competitive candidates for fast ferries and various naval applications. The focus of this paper will be the R&D of several tank-testing models, leading to the design development of a 24m ASV catamaran demonstrator vessel. The vessel, under construction at Swede Ship - Djupviks Varv, is the first ever, full scale ASV. To assess scaling laws of the ASV concept, several of the SSPA tank testing evaluations have been repeated in a different scale at the Technical University of Athens (NTUA). A selection of the preliminary NTUA results will be presented.

12.55 - 13.55 **Lunch**

Session 2 - Regulatory Research

13.55 - 14.30 **An Overview of Current UK Research Projects into the Stability of High-Speed Craft**
Andrew G. Blyth, Blyth Bridges Marine Consultants Ltd, UK
Ronald Allen, Maritime and Coastguard Agency, UK
A revision of the IMO Code of Safety for High-Speed Craft (2000) has recently commenced. The paper will give an overview of five research projects commissioned by the UK Maritime and Coastguard Agency. The paper will not be a detailed exposition of all five projects, which will be given in individual technical conferences as opportunity permits. However, to inform the high-speed craft community whilst the IMO revision is ongoing, the paper will present the objectives of each project, together with an interim report on the main findings to date. The five projects that will be described are: Extent of bottom raking damage, Behaviour of monohulls and catamarans in following and quartering seas, Wind heeling moments of wide craft such as multihulls, Adequacy of the intact and damaged stability criteria for monohulls and multihulls and Analysis of stability and buoyancy incidents to high-speed craft in relation to the 2000 HSC Code.

14.30 - 15.05 **HSC Incident Statistics**
Stephen Phillips and Dan Hook, Seaspeed Technology Limited.
In support of the UK Maritime and Coastguard Agency's (MCA) recent research programme concerning the stability of high-speed craft, their database of HSC incidents was analysed to provide statistical data relating to stability and buoyancy incidents. By reviewing all 680 incident descriptions within the database it was found that 62 were stability and buoyancy related, mainly resulting from hull damage (ranging from small holes to total vessel destruction). It was further determined that these 62 incidents accounted for nearly 50% of all recorded fatalities, with the majority occurring in poor visibility or heavy seas and often very close to an otherwise safe track. Of the 62 incidents studied, 22 were found to be particularly significant. As a result of this study, a number of recommendations were made for further consideration.

15.05 - 15.35 **Coffee**

15.35 - 16.10 **High Speed Safety: The Impact of Human and Organisational Factors**
Torkel Soma, Det Norske Veritas, Norway
This paper assesses the use of Bayesian Networks (BN) and Influence Diagrams (ID) to analyse the risks that govern high speed navigation. First the characteristics of a typical navigational accident are outlined. Secondly the results of the EU-project SPIN -HSV are presented. In this project the BN are used to model the accidents risk and ID is used to evaluate the costs-effectiveness of a range of risk control options. Finally, it is discussed how BN and ID can be applied in regulatory context. The discussion includes experience from the referred project and with reference to the High Speed Craft Code but most importantly the integration into Formal Safety Assessment with emphasis on integrating Human Reliability Analysis (ref. IMO FSA Guideline, Appendix1 MSC\Circ. 1023, MEPC\Circ. 392)

16.10 - 16.45 **Raking Damage to High Speed Craft: A Proposal for the High Speed Code**
Bo Cerup Simonsen, Det Norske Veritas, Norway
This paper describes the technical background for a proposal for new bottom raking damage requirements in the IMO High Speed Code. The proposal takes into account the vessel building material, the structural scantlings, the vessel speed, and the displacement. Based on a comprehensive series of full-scale testing and non-linear finite element analyses, a new simplified theory was developed for prediction of the extent of damage in a grounding accident. By comparison to two real-life accidents and one large-scale experiment, excellent prediction capability was found. A realistic simulation was then set up and calibrated to agree with existing results. By use of the safety levels for passenger vessel proposed in the HARDER EU-project, the rule proposal for raking damage to HSC was then finally derived. The application of the proposed formula to a range of HSC is shown.

International Conference

HIGH SPEED CRAFT

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RINA HQ, LONDON, UK

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VENUE
The Venue for "High Speed Craft"
is RINA, HQ, London, UK

EVENING RECEPTION
17th November 2004
Following the end of day one, delegates are invited to attend an evening reception at the conference venue.

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Upon registration you will be provided with details of a hotel booking service offering reduced rate accommodation for conference participants.

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The RINA regrets that the following charges will be made in the event of cancellation: £100 if received by 3rd November 2004 and £200 thereafter. Cancellations received within 24 hours of the event, or in the case of non-attendance will not be refunded. Delegates may be substituted; this must be sent in writing and confirmed with the Conference Organiser.

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