

Design, Construction & Operation of Super and Mega Yachts



The Royal Institution of Naval Architects



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Conference Programme

Design, Construction & Operation
of Super and Mega Yachts

8-9 May 2013, Genoa, Italy

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Day 1 Papers:

08.30 - 09.00 COFFEE & REGISTRATION

REGULATION AND YACHTS - STRANGE BEDFELLOWS

David W Ralph, MCA, UK

This paper will address the curious, sometimes uneasy relationship between Regulation and yachts. Since the UK Maritime & Coastguard Agency first published the fore-runner of today's "Large Yacht Code", in 1997, launching it at San Remo, there has been much change. Many will be surprised to learn that far from finding regulation abhorrent the industry had requested the UK maritime administration to produce something that would help. Subsequently, the Code was described as "the white knight to the industry" and we have seen not only its willing acceptance by the wider industry, but significant development in an industry empowered by this new tool.

THE MARINE LABOUR CONVENTION 2006

Albert Levy, Ince & Co, UK

YACHT GREENHOUSE GAS EMISSIONS: EU POLICY DEVELOPMENTS

Mark Robinson, MYBA, UK

The European Commission supports international regulation of maritime greenhouse gas emissions through the International Maritime Organisation (IMO). Yet due to obstacles remaining in ongoing IMO proposals - and should nothing transpire in time - the EU is committed to drafting its own policy proposal. The scope of the EU policy is likely to include emissions relating to all voyages terminating in an EU port (ie intra-EU voyages, plus voyages into the EU). This paper will brief the Conference on the current state of policy development at the European Commission, and summarise the potential impact of the proposed regulatory options on large private and commercial yachts.

10.50-11.20 COFFEE

RINA SAILING RIG GUIDELINES AND CERTIFICATION

Paolo Moretti, RINA, ITALY

The new guidelines for sailing rigs have been developed using a bottom - up philosophy, studying rig failures and researching relevant solutions to achieve cost effective reliability improvement. Under RINA requirements for sailing rigs, critical rig items will be surveyed and tested under surveyor attendance. A planned maintenance scheme will be required and scheduled periodical surveys will be witnessed by class surveyors, supported by approved manufacturer as required. One of the central aspect of RINA certification will be the use of a dedicated computational tool that has been developed to support rig structural design. This software based on CFD and FEM analysis is the most advanced in this field and permits to calculate also inertial loads due to the hull motions in severe weather conditions.

DESIGN-DRIVEN INNOVATION OF A HIGH SPEED ART DECO SUPERYACHT COASTAL CRUISER FOR THE CHINESE MARKET

Sean McCartan, Bob Verheijden, Coventry University, UK

James Roy, BMT Nigel Gee Ltd, UK

Carlo Nuvolari, Nuvolari-Lenard, Italy

The Chinese cultural interpretation of a superyacht, in terms of luxury and functionality, is fluid. It will eventually become more defined, as leisure boating becomes more established as a high-status luxury activity. This paper reports on a multidisciplinary superyacht design project engaging in Design-Driven Innovation through the application of a technologically advanced high speed platform combined with the implementation of a culturally specific emotional design framework. Building on the emotional design aspects of high speed boating and contemporary Chinese luxury, including the heritage of Chinese Art Deco, this project proposes a change in the design meaning associated with superyachts by developing an Art Deco high speed superyacht coastal cruiser for the Chinese market, based on the 130m BMT Nigel Gee Pentamaran concept.

DESIGN-DRIVEN INNOVATION: A NEW LUXURY MARITIME LEISURE SECTOR BETWEEN CRUISING AND SUPERYACHT CHARTER

Sean McCartan, Jake Edens, Coventry University, UK

The cruise industry has become one of the fastest growing tourism sectors. Growth in popularity has changed the luxury design meaning of cruising from its elitist beginnings into something more accessible and less luxurious. This paper reports on a design proposal that challenges perceptions of exclusivity in the American cruise market by using Design-Driven Innovation to create a 'technological epiphany', a new market between luxury cruising and superyacht charter. The design proposal consists of a main entertainment vessel (cruise liner) acting as a mothership, which transports SWATH floating apartments to various destination around the Caribbean. Where they are launched and later recovered, operating on the same principle as Dockwise yacht transporters. The SWATH floating apartments offer clients the freedom, luxury and privacy normally associated with superyachts. When docked with the mothership the floating apartments are fully integrated into the interior design of the mothership. The interior design proposals for both the mothership and floating apartments have been informed by the cultural specificity of luxury in the American market.

13.05 - 14.05 LUNCH

A HUMAN FACTORS' APPROACH TO MEGA YACHT CONCEPT DESIGN

Tineke Bosma, University of Strathclyde, UK

The aim of this paper is to demonstrate that there is an absence of prioritising the importance of implementing the human comfort factors into the preliminary mega yacht design stage in its place of the final design stage. Prioritising human comfort factors contribute to a reduced risk of conflicts between the different domains; yacht owners, naval architects, interior and exterior designers, amongst others. The aim is to demonstrate and suggests a new approach to concept mega yacht design by presenting a framework of how these identified human comfort factors can be implemented as early as possible within existing classical process of mega yacht preliminary ship design.

PLATFORM ENGINEERING FOR PRODUCTION AND SEMI-CUSTOM YACHTS

Lee Archer, James Roy, BMT Nigel Gee Ltd, UK

With the growth in the Super yacht market over the last 2 decades many production boat builders, traditionally focused on yachts of less than 24m, have incrementally increased the size of their product in order to enter this market. This paper will investigate the application of Platform Engineering to the smaller yacht market (25-50m) and explore the possibilities that may result as well as highlighting some of the barriers that may exist in the existing business practices and infrastructure of a typical high volume production boat builder.

DEVELOPMENT OF AN ECO-CATAMARAN FOR THE CHARTER MARKET THROUGH THE IMPLEMENTATION OF 'PASSIVE DESIGN' TECHNOLOGY

Sean McCartan, Christopher Kvildums, Coventry University, UK

This paper reports on a catamaran design proposal that addresses the 'green luxury' gap in the market for luxury charter performance orientated vessels, which implement ecological technologies that enhance the user experience and also benefit the environment. It was designed using the principles of 'Universal Design' for short cruises in coastal areas around the Bahamas, Caribbean Sea, Dominican Republic, and Cuba. Ecological accounting was used as a design tool to indicate energy intensive applications such as the HVAC systems and lighting, and further used to indicate cooling loads and major sources of heat gain, which became the focal point for the design specification. Although propulsive power dominates the energy profile of most ships, yachts are in harbour 75% of the time with auxiliaries accounting for 22% of CO2 emissions. Therefore considerable gains could be made from the reduction of auxiliary electrical loads.

15.15-15.40 COFFEE

IMPROVING THE EFFICIENCY OF THE MEGA-YACHT WORLD THROUGH FLEET MANAGEMENT SOFTWARE

Lefteris Maistralis, Regional Director, EMEA, ABS Nautical Systems

As more mega-yachts are built and the yachting sector continues to grow, technology advancements have seen great application in this niche part of the maritime industry. Mega-yachts tend to be larger, more complicated to operate and do not always have the appropriate crew on board. In order to keep up with the increased demands of the yacht owners, the builders are developing designs and technologies that will increase the comfort and safety of the yachts. Lefteris Maistralis, Regional Director, EMEA for ABS Nautical Systems will introduce the N55 Enterprise software suite and discuss how these products will assist the yachting industry to achieve maximize operating efficiency, overall fuel consumption and target a performance level unreachable until now, due to the lack of appropriate tools.

WHEN ALL OTHER MEASURES FAIL, CHANGE MANAGEMENT IN MEGA YACHT CONSTRUCTION

Tomek Glowacki, Teg & Associates Ltd., NEW ZEALAND

Ten months have elapsed building a yacht. Launch date is in 12 months but everything indicates that there will be a sizable delay and the yard can't say how big a delay. To make matters worse, it looks like the cost will be exceeded and the quality of craftsmanship is already below the expected standard. Despite the client hiring a respected naval architect, well-known interior designers, and careful selection of yard, the project is not going satisfactorily. Some "unseen forces" are causing the project to move in the wrong direction. The situation becomes tense. To salvage the project, the owner hires independent specialists. First he hires another naval architect, then a project management specialist, then a contract manager and finally... the attorneys. In connection with these moves the situation becomes even more strained and the yard takes defensive positions. More and more documents are exchanged, simply adding to the already growing cost. This tense situation only worsens the construction performance. Morale is getting lower, inferior quality of execution, increasing delays, rising costs. Finally the client brings in a mediator. This is the usual chain of events in most cases when a yard fails to perform. I would like to offer a different approach to reversing this negative spiral: change management.

16.55 - GENERAL DISCUSSION & EVENING DRINKS RECEPTION

Day 2 Papers:

08.30 - 09.00 COFFEE & REGISTRATION

FAST NUMERICAL METHODS IN EARLY STAGE DESIGN OF MEGA YACHTS

Lennart Pundt, Hamburg University of Technology, GERMANY

The presented paper will show examples of fast and reliable design methods for the basic design of Mega Yachts in various fields. Starting with the design of the hull form it will be presented how an energy efficient but still very fast hull can be custom designed with potential flow CFD optimizers. A CFD Resistance prediction is followed by the design of the propeller and rudder. Modern high skew yacht propellers with very low pressure peaks is quite challenging for high efficient and low cavitating rudders. An advanced twisted flow rudder will be presented. Also the optimization of appendages by RANS solvers is described in the paper. Finally a sea keeping analysis with coupled motion of water in a very large pool is shown. All calculations were further investigated by model scale tests. The paper will describe the methods used for the calculation; present the results and the verification by model tests.

DESIGN OF PLANING HULLS WITH LONGITUDINAL STEPS: CFD IN SUPPORT OF TRADITIONAL SEMI-EMPIRICAL METHODS.

Stefano Brizzolara, Alessandro Federici, University of Genova, ITALY

Paper intends to present main results achieved from a CFD investigation about the resistance of a modern high planing hull speed with the effect of spray rails. The aim is the resistance reduction of an existing planing hull, suitable for fast yacht applications as well as fast patrol boats, having a top speed in excess of 50 knots. The focus of the paper is on the effect longitudinal and transversal steps on the resistance characteristics of the hull at high speed, including dynamic stability. All investigations are performed by means of a modern volume of fluid RANSE solver, as already successfully recently applied and validated by the authors on different types of planing hulls.

SEAKEEPING ANALYSIS AND RELATED SEASICKNESS: COMPUTATIONAL FLUID DYNAMICS APPROACH

G Redondo, Santiago de Compostela, SPAIN

S Bartesaghi, Mechanical Engineer & Yacht Designer, Milano, ITALY

Over the past decades, the evolution of computing systems and the growth of computational resources have led to a rapid diffusion of advanced tools to support the design in the marine industry. In particular, Computational Fluid Dynamics (CFD) is an advanced tool that allows engineers to evaluate the hydrodynamic performance of a boat without recourse to towing tank testing. In this work, the evaluation of the seakeeping performance and its related comfort on board is carried out using a CFD approach.

10.45-11.15 COFFEE

CFD MODELLING OF GREEN WATER FLOW ON MOTOR YACHT DECK IN ROUGH SEA CONDITIONS

G Redondo, Phycisist & Marine Engineer, Santiago de Compostela, SPAIN

S Bartesaghi, Mechanical Engineer & Yacht Designer, Milano, ITALY

In rough seas, a vessel is subject to numerous undesirable phenomena that are generally not found while cruising in calm sea conditions. During the impact of the waves with the bow of the hull, the boat can take on board a large volume of water. This phenomenon is usually called green water flow. At the design stage, it is necessary to estimate the quantity of the volume of green water on the deck flow and the ability to shipping the same without causing a continuous presence of that. In fact, the presence of water on deck may change the dynamic behaviour of the boat and in critical conditions of navigation can lead to ship safety. In addition to the green water flow phenomena, the wave impact on the superstructure and the windage can also cause structural damage. In this paper we describe how, using a RANS approach, it is possible to perform an accurate estimation of green water flow on deck and how it affects the dynamics and stability of a motor yacht.

NUMERICAL AND EXPERIMENTAL ANALYSIS OF THE DYNAMIC BEHAVIOUR OF LARGE YACHT SUPERSTRUCTURES.

Stefano Dellepiane, Cantieri Navali Benetti, ITALY, Dario Boote, Tatiana Pais, Università di Genova, ITALY

The dynamic behaviour of hull structures has a great impact on the comfort level on board modern superyachts and, from the structural point of view, this is one of the subjects shipyards are more interested in. In addition many important Classification Societies have issued new rules and regulations for the evaluation of vibration maximum levels. Such rules, usually named as "Comfort Class Rules", contain both the general criteria for noise and vibration measurement in various yacht areas, and maximum limit values which such measurements should fall into. In this work a complete review of the existing rules is presented. Then a case study is presented, consisting in a 60 meters superyacht, on which a detailed FEM investigation has been carried out in order to investigate the dynamic behaviour of hull and superstructures. The results of modal and transient analyses are compared with a first series of experimental data gathered during the vessel construction. At the moment sea trial are under course and the vibration measurements are going to be carried out in several part of the vessel.

EXPERIMENTAL ASSESSMENT OF MEGAYACHT AERODYNAMIC PERFORMANCES AND CHARACTERISTICS

F. Fossati, F. Robustelli, M. Belloli, Politecnico di Milano, ITALY, C. Bertorello, Università di Napoli Federico II, ITALY

S. Dellepiane, Azimut - Benetti Group, ITALY

Windage evaluation of very high superstructure, aerodynamic load assessment, and accurate air flow simulation are considered very important in the design procedure to get optimal layout and opening position. Moreover they are used to precisely evaluate thrusters and Dynamic Positioning Systems horsepower. The lack of data concerning the peculiar megayacht forms and the result requested accuracy lead to set up scale model wind tunnel tests. They are asked more and more frequently by designer and surveyors and considered a fundamental reference for any further CFD simulation. In this paper experimental methodologies developed at Politecnico di Milano Wind Tunnel in order to assess megayacht aerodynamics in terms of aerodynamic loads, comfort analysis, pollutants dispersion and re-ingestion analysis using wind tunnel tests are described.

13.00 - 14.00 LUNCH

EXPERIMENTAL INVESTIGATION ON HYDRODYNAMIC PERFORMANCES OF WARPED HARD CHINE DISPLACEMENT HULLFORM

Ermina Begovic, Carlo Bertorello, University of Naples Federico II, ITALY

Larger main dimensions, superior comfort and more recently, increased fuel cost lead to consider displacement hull forms as very interesting for "sustainable" design of large yacht while they remain the only possible choice for maxi and mega yachts. Displacement hullforms are generally round bilge. Hard chines hull forms have been considered recently for low relative speed high size motoryacht and trawlers. They provide higher roll and pitch damping and allow simplified construction and fairing processes. In this paper the results of experimental tests relative to resistance, seakeeping and roll decay of a warped hard chine hull form, suitable for large yacht design are reported.

THE APPLICATION OF FUEL CELL SYSTEM AS AUXILIARY POWER UNIT ONBOARD MEGA YACHT VESSELS: A FEASIBILITY STUDY

Thomas Lamberti, Loredana Magistri, Paola Gualeni, Alberto Da Chá, Alessandro Calcagno, University of Genoa, ITALY

The present paper proposes a study for the integration of Fuel Cells (FC) as Auxiliary Power Unit (A.P.U.) source for marine application, in particular for Mega Yacht. The assessment of the applicability of an onboard Fuel Cell system to reduce the environmental impact has been conducted in order to identify the achievable vessel solution in which the system could be installed and the appropriate operative conditions in which it could be used. The study includes the assessment of different Fuel Cell technologies as well as of different Hydrogen Storage systems in order to find the ones that better comply with the requirements. A technical sizing of the FC system to be installed onboard has been designed, supported by an analysis of its dynamic performance on the base of real PEM (Proton Exchange Membrane) fuel cell data. An identification of the spaces for the installation of the FC system and the Hydrogen Storage system has been made. Finally an assessment of the technical impact on the ship has been carried out and a selected solution among several identified arrangements has been specifically investigated. The feasibility of the proposed design has been tested through design changes of a Mega Yacht draft called XProject based on a LNG fuelled engine provided by Fincantieri.

15.10-15.40 COFFEE

MOTOR SAILING SUPER YACHTS

Stephen Wallis, Southampton Solent University, UK

This paper will look at the savings in powering and fuel consumption that can be made with a motor sailor as opposed to a pure motor yacht. The paper will discuss; sail forces, performance prediction, using a simplified VPP technique, power saving at given cruising speed in differing wind strength, best course, apparent wind effects, and trade wind sailing. Specific design issues relating to sailing a super yacht will be addressed; side force generation and draft, stability and acceptable heeling angles, indicative additional capital costs.

CATAMARANS AS SUPERYACHTS

A.Nazarov, Albatross Marine Design, THAILAND

The paper presents the review of design experience for catamarans 18...36m in length developed by Albatross Marine Design and features perspectives of application of this experience to superyacht range. Comparison of catamarans with traditional monohull motor yacht is presented in terms of usable space and layout concepts. Possible areas and ranges of application of catamaran platform are specified. General dimensioning of catamarans at early design stages based on parametric study is reviewed. Styling trends and new approaches for layout planning specific for catamarans are discussed. Presented are results of sea trails for number of catamarans and new design samples.

16.50 - GENERAL DISCUSSION

