

# RINA

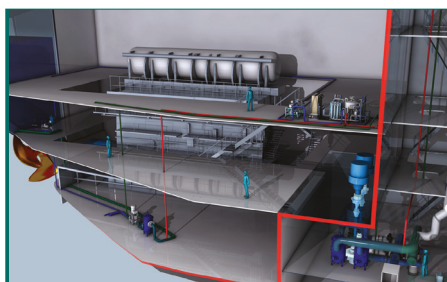
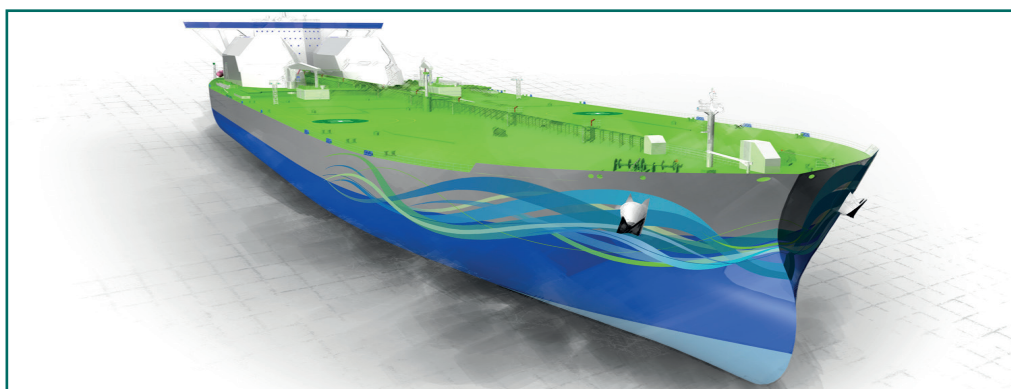
The Royal Institution of Naval Architects



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International Conference

## THE ENVIRONMENTALLY FRIENDLY SHIP

28-29 FEBRUARY 2012  
RINA HQ, LONDON

## day 1

09.00 - 09.30 COFFEE AND REGISTRATION

09.30 - 10.05 DCNS' ECO-DESIGN PROCESS; AN INNOVATIVE AND MULTI-SYSTEM APPROACH

*C Bonnard, DCNS, France*

DCNS, leader naval defence group in Europe is working to reduce and optimize the environmental impacts of its activities and products. In this context, the Warship Engineering deploys a strategy centred on the environment through an eco-design approach of ships and an ISO 14001 management system of design activities. The objective? Offer high value-added products, by leaning on the numerous possible improvement levers: energy savings, decrease of the emissions and the waste, use of renewable sources of energy and innovative materials, maximal traceability of dangerous substances... All these actions come along with precise impact analysis of products and equipments, especially through Life Cycle Analysis (LCA), to detect the possible transfers of pollutions and make sure that the earnings for the environment are real. DCNS applies concretely the teachings gathered in this day for its programs and future projects; and so demonstrates that eco-design in the naval domain is an innovative approach and a real asset for the future.

10.05 - 10.40 NATURAL GAS AS FUEL FOR SHIPS: PROPERTIES, RISKS AND REGULATIONS

*B San, Lloyd's Register, UK*

As of today, fuel oil for ships is prevailed by petroleum residue and distillate. But with the worldwide desire to shift to a sustainable future, looking for alternative fuel for marine industry has become an impending task with the gradually stringent exhaust emission regulations. Depends on the availability, quality, yield and pollution, available choices for marine alternative fuels will be narrowed down to a few popular options e.g bio-fuel, methane, methanol/ethanol, propane, butane and hydrogen. Of which, LNG is a very attractive and feasible option thanks to the large reserve of natural gas and competitive bunkering price. This paper will start with a short introduction on property of natural gas and design principle for using natural gas as fuel. The main body of the paper will emphasize on the risk and safety aspects of using natural gas as fuel and explain how Class Rules is developed to address the issue.

10.40 - 11.10 COFFEE

11.10 - 11.45 BIO-LUBES

*P Vickers, Vickers Oils Ltd, UK*

"Bio-lubes" provide an effective way to mitigate the effects of accidental and operational leakage from equipment such as CPPs, deck equipment, sterntubes and thrusters. Such products are becoming more widely used and are being promoted by various regional initiatives and regulatory pressures. This paper will provide a definition for marine "bio-lubes" and will consider the claims that can be made for such products. Drawing on Vickers Oils' experience of supplying "bio-lubes" to more than 1,000 vessels, it will compare myths and realities; and will set out clear guidance to help both users and equipment manufacturers to select appropriate products.

11.45 - 12.20 PRACTICAL TECHNIQUES FOR REDUCING THE UNDERWATER NOISE POLLUTION GENERATED BY COMMERCIAL SHIPS

*M R Renilson, Renilson Marine Consulting Pty Ltd, Australia  
R Leaper, International Fund for Animal Welfare*

Underwater noise pollution from shipping has raised ambient noise levels in the 10-300Hz frequency range throughout the world's oceans. Impacts on marine life include disturbance, stress and the masking of biological sounds used to communicate and find food. Impacts on marine mammals have been of particular concern but many species of fish may also be affected. We examine ways in which noise may be reduced while still optimising efficiency and conclude that it may be possible to quieten the noisiest vessels through measures that also improve efficiency. We recommend a programme of measurements designed to contribute to a better understanding of how different factors contribute to noise output and how improved propeller design and wake flow related to energy saving measures may also reduce noise.

12.20 - 13.20 LUNCH

13.20 - 13.55 DEVELOPMENT OF THE SEAGATE COLLAPSIBLE SAIL SYSTEM FOR COMMERCIAL AND LEISURE USE

*A R Cloughton, Wolfson Unit, UK*

In 1985 the Wolfson Unit conducted a comprehensive series of Wind Tunnel tests to explore the aerodynamic and structural

characteristics of the mast and sails used by artisanal beach based fisherman. The results of these experiments showed the Crab Claw rig to have much better aerodynamic behaviour than the conventional Bermudan rigs, and also it was ideally suited to construction from simple bamboo spars and flax sail cloth because of the low structural burden the sails placed on the rig. In short it was aerodynamically and structurally very efficient. The paper will describe the aerodynamic development of the Seagate rig for leisure and commercial applications, and will describe the extensive study of fuel saving carried out for Wallenius & Wilhelmsen under the auspices of their "Orcelle" Grant scheme. This simulated the performance of a bank of Seagate modules operating over a 3 year period using the weather data logged from operational vessels.

13.55 - 14.30

A METHODOLOGY FOR A 'DESIGN FOR SHIP RECYCLING'

*S A McKenna, R E Kurt, & O Turan, University of Strathclyde, UK*

The concept of the Environmentally Friendly Ship is seen by some as a standard to aim for in the medium to long term future. However, when a ship comes to the end of life and recycling phase an important point to note is that approximately 96% plus of an average ship is currently reused. Therefore the main concern with an end of life ship is not how much on board the ship can be recycled, but rather in which manner these ship recycling activities are carried out and what effect on the workers' health and safety and the impact on the surrounding environment do they have? In this paper, through research of the ship recycling industry and referring to previous ship recycling process analysis carried out by the authors, the various hazardous materials and processes involved in ship recycling will be documented, a link established to the marine design cycle and a methodology for a 'design for ship recycling' introduced.

14.30 - 15.00

COFFEE

15.00 - 15.35

THE EFFICACY AND ACCEPTANCE ON ENVIRONMENTAL IMPACT AND LIFE CYCLE MODELS WITHIN THE DESIGN SECTOR OF THE MARINE INDUSTRY

*K W Hutchinson, Babcock International Group, UK*

Over the last decade there has been a plethora of environmental impact and life cycle models developed for use within the marine industry. The focus and level of sophistication of these various models has been extremely varied. Some models have been industry specific while others have been for general use. Some models are based around software specially written for the purpose, others are based on putting data into a proprietary spreadsheet, while other models are purely paper based. This paper investigates the development of environmental impact and life cycle models and there link to through life cost scenarios within the maritime industry.

15.35 - 16.10

ASSESSMENT OF CONTAINERSHIP UTILISATION RATES VS. THE ENVIRONMENTAL IMPACT OF DIFFERENT CARGO HANDLING SYSTEMS

*A Viitanen, Cargotec Finland*

The cargo handling system plays a vital role in both the environmental impact of the ship and its cargo. The more efficient the cargo handling system, the greater the number of TEUs a ship can carry, which in turn reduces the emissions per carried TEU, and subsequently per transported commodity. Practical experience from existing ships already supports this assumption, but it is Cargotec's wish to establish evidence that proves that an efficient cargo system really counts when addressing environmental issues. To Cargotec's knowledge, no similar research has been previously undertaken. As a result, Cargotec has initiated a study that is looking at ways to best determine improvements in container ship utilisation, and proposes to compare potential installations of its cargo handling systems onboard containerhips versus other alternative arrangements.

16.10 - 16.55

ENVIRONMENTAL CONCEPT

*P E Vedlog, Rolls-Royce, Ship Technology-Merchant, Norway*

Ship Technology - Merchant in Rolls-Royce has developed a new bow form which gives a significantly better performance in a seaway, less speed reduction, reduced accelerations and less risk of hull plate deformation in the forebody. This bow design is the subject of a pending patent. It combines a vertical leading edge with a bulbous lower section and strait lined sections with no flare in the upper section. To reap the greatest environmental and operational benefits the new bow can be combined with Rolls Royce design and integration skills and hull, engine and propulsion elements. The company's "Enviroship Concept" combines these elements to give a reduction in CO2 emissions of more than 40%.

EVENING DRINKS RECEPTION

## day 2

9.00 - 9.30 COFFEE AND REGISTRATION

9.30 - 10.05 ENVIRONMENTAL SHIP INDEXING OF SHIPS

*P Misra, Mercantile Marine Department, India*

International shipping emits 870 million tonnes of CO<sub>2</sub> annually, or 2.7% of global CO<sub>2</sub> emissions (an increase of 85% since 1990). This share is projected to rise to 1250 million tonnes or 6% of global emissions by 2020. The conclusions of the Second IMO GHG Study 2009 provide a clear basis for IMO action: Developing an emission inventory (Sox, Nox, Co<sub>2</sub>) of ship both by Theoretical and experimental means. The theoretical means of estimation uses the techniques like Environmental Ship Indexing (ESI), EEDI (Energy efficiency design Index), EEOI (Energy Efficiency Operational Indicator). The experimental means of developing an inventory involves one year deployment of ultra high precise instruments on board ship for a year, to estimate the most accurate emissions from the ship engine stacks.

10.05 - 10.40 SHIP'S ENVIRONMENTAL FOOTPRINT

*S Hänninen, VTT Technical Research Centre of Finland*

This paper describes an environmental footprint calculation system developed in a national research project promoted by Fimecc (Finnish Metals and Engineering Competence Cluster) and funded by Tekes. The objectives include evaluation of ecological footprint from shipbuilding and ship operation. Existing Life Cycle Assessment (LCA) methods have been applied in the study. LCA is a standardized technique to assess environmental aspects and potential impacts associated with a product, process, or service. For the operational period, a computer tool has been created to help the designer to test different choices. The idea was to test the LCA procedure in shipyard and ship operation contexts. Results from the life cycle inventory show the main resources used and the emissions produced during ship's construction and operational phases. In the life cycle impact assessment, the emissions are distributed into categories according to where they affect on (global warming, acidification, etc.).

10.40 - 11.10 COFFEE

11.10 - 11.45 EXHAUST GAS EMISSIONS FROM REGIONAL SHIPPING: MITIGATING TECHNOLOGIES AND EMISSION INDICES

*A J Murphy, Newcastle University, UK*

The effects of exhaust gas emissions from all modes of shipping are a subject of concern for two main reasons. Namely, CO<sub>2</sub> contributes to anthropogenic global climate change and, additionally, many exhaust gas species, e.g. PM, NO<sub>x</sub>, SO<sub>x</sub> and emissions due to incomplete combustion, are detrimental to both environmental and human health. This paper provides an analysis of these technologies in terms of their effectiveness, technology readiness and suitability for application against the full spectrum of exhaust gas species of interest. Furthermore, another approach to reduce harmful emissions is to modify the way in which ships are operated, e.g. modified voyage speeds; modified machinery management during manoeuvring and other part- or transient- load conditions.

11.45 - 12.20 SHIP DESIGN AND EVALUATION FOR A GHG CONSTRAINED FUTURE

*J N Calleya, University College London, UK*

The future is uncertain, but it is not unreasonable to imagine that it may herald higher energy prices and greater regulation of shipping's GHG emissions. With the adoption of the Energy Efficiency Design Index (EEDI) and Ship Energy Efficiency Management Plan (SEEMP) into MARPOL Annex VI there is already some movement towards such a future. It is suggested in this paper that understanding the many components of the "shipping system" can ensure the most robust analysis of economic viability and competitiveness of ship designs both relative to an existing fleet of ships and under possible future regulatory and cost environments. This paper describes the development of some of the methods in the RCUK project "Low Carbon Shipping - A Systems Approach" that can be used to explore 'what if' questions around the future of ship design - taking the perspective that a key challenge for design will be around increased energy efficiency and lower GHG emissions.

12.20 - 13.20 LUNCH

13.20 - 13.55 ELECTRIC DRIVES CONSUME UP TO 30% LESS ENERGY AND ARE ENVIRONMENTALLY FRIENDLY

*M Sjöberg, Cargotec, Sweden*

The most obvious benefit of replacing hydraulically-powered deck machinery with electric versions is to eliminate the risk of hydraulic oil leaks causing pollution or cargo damage. However, there are good commercial reasons for shipowners to switch and they also provide further environmental benefits. Energy is saved because electric drives run only when manoeuvring equipment; power can

also be fed back into the system when larger winches, such as those found on RoRo ramps, are lowered. Energy losses are much lower, because electrically-driven systems are not affected by pressure drops. Electric drives are easy to monitor and service, enabling peak efficiency. Time, money and energy are saved while shipbuilding; it is easier to install electrical cable than piping and no pump units are needed. Lower power consumption enables a ship to be designed with reduced power generation needs.

13.55 - 14.30 INSTALLATION OF CLEANBALLAST BWTS AT DIFFERENT SHIPYARDS

*C Lork, Marine Water Technology, Bremen, Germany*

Over the past years RWO GmbH has developed CleanBallast, an effective, scalable ballast water treatment system based on two treatment steps, Disc Filtration followed by an advanced Electrochemical Disinfection (EctoSys®). The CleanBallast system features technical advantages concerning the sediment removal and the performance in low salinity water due to the used treatment components. CleanBallast was tested in river water with TSS counts of 580% (on average during the test) of the IMO test water requirements. CleanBallast is one of the few systems that can demonstrate a longer operational duration in commercial application. The topic of this paper is to give a feedback from the commissioning experiences at two different yards in China, the sea-trials in of the harshest environments in the world, as well on the operational experiences.

14.30 - 15.00 COFFEE

15.00 - 15.35 DEVELOPMENT AND TEST OF A FULL SCALE INTEGRATED ABATEMENT SYSTEM FOR THE TREATMENT OF SHIP

*E Firenze, D Cazzola and L Grossi, CETENA, Italy*

This paper deals with an integrated system for the treatment of air emissions from ships. The pollutants which are the main object of international rules have been addressed. In the ambit of a collaborative project named ECOMOS co-founded by MIUR (National Ministry of Education, University and Research), a Consortium led by Fincantieri and RAM (Mediterranean Highway Network) has implemented a full-scale prototype which combines catalytic reduction and seawater scrubbing techniques for NO<sub>x</sub>, SO<sub>x</sub> and particulate abatement. A land installation has been realized and an extensive experimental campaign carried out in order to determine system performances and actual abatement efficiency. Results from the experiments are presented in the paper, and indicate an high abatement rate for SO<sub>x</sub> and PM, as well as a significant, even if lower, removal of NO<sub>x</sub>.

15.35 - 16.10 FUEL CONSUMPTION AND AIR EMISSIONS' PREDICTION BY ENERGY FLOW MODELING ONBOARD SHIPS: APPLICATION ON A MODERN BULK CARRIER SHIP

*K Chatzitolios, Bureau Veritas, France*

Energy efficiency and air pollution prevention are the two main driving forces for future ship designs. A number of solutions for reducing fuel oil consumption and air emissions are presented in the paper together with their advantages and disadvantages. The challenge that is faced by designers today is to optimally combine some of these measures in order to obtain a fuel efficient and environmentally friendly ship. Bureau Veritas has developed a ship modeling platform to effectively simulate the different energy systems and the energy transformations shared between them. The methodology of component-oriented modeling is described in this paper and the energy model of a bulk carrier is presented. The results of comparative simulations for the given model are analyzed and the potential uses of energy flow simulation in the optimization of ship design are also discussed.

16.10 - 16.45 FUTURE CONCEPT BREATHE'S INTELLIGENT PROPULSION SYSTEM

*J Lavertu, De Voogt Naval Architects B.V., The Netherlands*

The naval architects from De Voogt came up with the revolutionary Breathe concept, which reduces fuel consumption by 20 to 40% at cruising speed. To achieve this exceptional reduction in fuel consumption the hull has a remarkable wedge-like shape with the centre of buoyancy far aft. The Wave Damping Aft body creates negligible stern waves, is better for the environment, and generates less resistance. The propulsion system has only one large main propeller, making the most of the very latest innovations. The combined effect of the hull shape, the reduced appendage area, the large diameter propeller and the use of a medium-speed engine gives a total efficiency gain of approximately 40% at cruising speed.

16.45 - GENERAL DISCUSSIONS



