

# RINA

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## DESIGN AND OPERATION OF TANKERS

8 - 9 JUNE 2011

EUGENIDES FOUNDATION, ATHENS, GREECE

## day 1

08.30 - 09.00 Coffee and Registration.

09.00 - 09.35 **Keynote Address: The Evolution of The Environmental Friendly Tanker**  
*K. Tikka, Vice President Global Technology & Business Development, ABS*

09.35 - 10.10 **Exploring Options to Reduce Fuel Consumption**  
*J. Knott and J. Buckingham, BMT, UK*

This paper presents a range of energy saving technologies in the context of the BMT's own Product Tanker design. The hull form and propulsion machinery have been carefully matched and tested over a series of model tests that have resulted in predicted fuel consumptions of approximately 25% less than today's accepted norm. The study seeks to show, from an independent viewpoint, how they might be applied to achieve the real financial and environmental benefits. The general impact of such technologies on the ship design as identified along with the consequences for machinery performance. The estimated acquisition and implementation costs are compared with the benefits to the ship's resultant in-service costs. To show how the choice of an energy saving solution needs to be considered in conjunction with the ship's overall design, its machinery and its operating role

10.10 - 10.45 **Ship Design for Minimal Fuel Consumption in Everyday Use**  
*K. W. G. Hagesteijn and P. Hooijmans, MARIN, The Netherlands*

The ship design efforts are dominated by the focus to attain this contract speed. This hull lines design philosophy will most likely not result into the most fuel efficient design in the daily service conditions. In daily operation, a ship will be sailing at different draughts and it will meet off-design conditions such as weather conditions other than the ideal trial conditions. Its operational draughts and added resistance due to waves should be the key drivers for a successful modern ship design. This paper demonstrates the capacities of the available tools for designing a ship for service conditions and the impact on performance and design procedure. Tools such as viscous flow calculations in an explorer mode, calculating numerous hull form variations overnight in order to maximize the performance of the vessel, and voyage simulations to determine true service margins are essential when designing a ship.

10.45 - 11.15 Coffee

11.15 - 11.50 **"To measure is to know"- Quantifying Energy Performance to Improve Propulsion Efficiency in Tanker Operations**  
*V. Roine, Eniram Oy, Finland*

Technological developments in propulsion efficiency have meant that tanker operators can now measure and quantify the factors affecting energy usage on board a vessel. For example, by using data collected on a vessel, operators can accurately monitor the propulsion power decomposition (performance affecting factors such as trim, fouling, etc) at sea and the effects of cargo loading and unloading in harbour. This paper will cover how analysis of data affecting energy usage on board a vessel can be used to enable ship owners and operators to improve the energy efficiency and therefore the environmental performance across the fleet. Particular emphasis will be made on the commercial and environmental impact of dynamic trim including the results of a trial done on board a VLCC tanker.

11.50 - 12.25 **Hull and Propeller Performance Monitoring of Tankers at Sea**  
*Daniel Kane, Propulsion Dynamics Inc, USA*

The paper provides information regarding the relevance of Hull and Propeller Performance Monitoring in immediate fuel conservation and emission reduction of tankers. Hull Performance Monitoring is a topic on the IMO Ship Energy Efficiency Management Plan. In addition, the recent Tanker Energy Management Plan (Intertanko) includes the topic of "Propulsion Resistance Management Program", describing the need for hull and propeller performance monitoring as a key element in vessel optimization. This paper will describe hull and propeller performance monitoring, provide case studies of Aframax, Suezmax and VLCC's. The presentation will include an anonymous benchmarking sample of the hull and propeller condition of a sample of the world tanker fleet and conclude with estimations of fuel savings and emission reduction of tankers by type.

12.25 - 13.35 Lunch

13.35 - 14.10 **Voyage Decision Support: A System for Optimizing the Planning and Real-Time Conduct of Tanker Voyages**  
*H. R. Hansen, Low Carbon Shipping AS, Norway*

Optimizing a voyage at the planning stage as well as regularly during the voyage itself, requires the correct evaluation of the ships performance as controlled by a number of parameters whose relationship is far too complex to be 'solvable' by the human mind. The Voyage Decision Support system or VDS optimizes the voyage at the planning stage as well as daily, providing the master with advice on which route or course and speed will result in the lowest possible sum of fuel expense and time cost. It has been develop by ECDIS provider MARIS of Tonsberg, Norway, in close cooperation with Teekay Shipping Ltd, and functions as an extra overlay on the MARIS ECDIS system. This has given a system that during more than 1.5 years of testing on a Suezmax tanker has been shown to provide on the average about 5% savings on fuel/time costs.

14.10 - 14.45 **Coatings and Permanent Means of Access - the Anti-Corrosion Challenges**  
*J. P. Lomas, Amtec Consultants Ltd, UK and P. D. Contraro, PDC Maritime SA, Greece*

The design, construction and maintenance of PMA's (Permanent Means of Access) in modern vessels has become of major importance recently. These structures have increased in both number and complexity to comply with new regulations. This has placed challenges on the design of ship's hulls as well as to the application and maintenance of coatings on these complex shapes. This paper outlines several of the factors related to the design issues around PMA's and describes typical problems experienced with construction of new vessels together with ongoing washing, cleaning and maintenance problems between cargoes. The necessity of preparing PMA.s for painting plus achieving a good standard for the application and curing of coatings is increasingly important for these vessels.

14.45 - 15.15 Coffee

15.15 - 15.50 **Tanker Hull Structure Cracks: Costs, Benefits of Prevention, Framework for Management and Remed**  
*T. Ward, Fairlead Maritime, UK  
 H. Polezhayeva, Lloyds Register, UK  
 M. Norwood, MARTEC, Canada.*

The cost benefits of understanding cracking problem in hull structure of tankers at the design stage and in service is discussed. The probability of unplanned repairs in service due to fatigue cracking of hull structure and the 15 year average cost of unplanned repairs is compared against the costs of enhanced detailed design and verification at the build stage. Cost of hydrocarbon leakage is discussed including loss of contracts, downtime due PSC detention and downtime due to repairs. A framework for addressing some of these problems is presented. The framework shows how to draw up and plan effective long term repairs. An analysis of the cost benefits of the repair due to minimising loss of earnings and reducing the risk of crack recurrence is presented. Management of cracks by operational constraints is discussed. The importance of understanding of the hull crack risks and managements as well as communicating to PSC and charterers is emphasized.

15.50 - 16.25 **Managing Corrosion of Stainless Steel Pipes and Heating Coils**  
*M. Shahid, Binary Systems and Engineering*

Corrosion of stainless steel components such as heating coils and valve remote control (VRC) lines in oil, product and chemical tankers has been a problem for many years, with failures leading to expensive repairs. Heating coils can perforate causing cargo contamination, failed VRC lines can disrupt vessel operation and cause additional work for crews, whilst corrosion of stainless steel access ladders in chemical tankers can result in a major expense. Some of these issues can be addressed at the new building planning stage by selection of suitable materials and this paper discusses several of these choices. Good design of the layout and handling of stainless steel components can also mitigate potential problems, as can careful and thorough supervision during installation, commissioning and maintenance during service can also prolong the life of stainless steels.

16.25 - 16.45 General Discussion

16.45 - Drinks Reception

## day 2

08.30 - 09.00 Coffee and Registration.

09.00 - 09.35 **BEST - Better Economics with Safer Tankers**

*P. C. Sames and K. P. Coyne, Germanischer Lloyd SE, Germany  
A. Papanikolaou, National Technical University of Athens, Greece  
S. Harries, FriendShip Systems GmbH, Germany*

Motivated by significant findings of a formal safety assessment on large oil tankers recently submitted to IMO, and the need to develop more efficient ship designs from a CO<sub>2</sub>-emissions and the likely oil pollution point of view, GL completed a novel Aframax tanker design concept which offers high cargo capacity, low oil outflow index, low EEDI and best in class cost of transport. This novel design, which is herein targeting Caribbean crude trades, is the focus of the paper. A large number of design variants were tested before a competitive design solution emerged which offered the desired properties.

09.35 - 10.10 **Triality, a VLCC for the Future**

*S. Schwalenstöcker and A. Ellefsen, Det Norske Veritas, Norway*

The concept vessel Triality was developed by DNV to demonstrate how the maritime industry may go forward in solving some of the environmental challenges lying ahead. In order to be a success the vessel needed to fulfill three main goals; it needed to be technically feasible, have significantly less emissions to air and sea and be as financially competitive as a conventional VLCC. This paper discusses and shows how the key features of the vessel fulfill these three main goals. The Triality's three main features are; LNG as fuel, no use of ballast water and capture and use of VOCs. By utilizing high pressure LNG dual fuel main engines, the vessel maintains the high efficiency of conventional two stroke engines, while at the same time reducing its emissions of CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>x</sub>. By modifying the hull shape and creating a new cargo tank arrangement, the Triality is able to complete its return leg without the use of ballast to submerge its propellers and bow. Finally, the Triality utilizes the cooling energy that comes with the use of LNG as a mean for further increasing the main engines' efficiency and for re-condensation of the cargo vapors.

10.10 - 10.45 Coffee

10.45 - 11.20 **An Overview of Shuttle Tanker Requirements for Operation Offshore Brazil**

*L. Motta, Europe Division, ABS, Greece*

At the end of 2010, Petrobras proven oil reserves in Brazil stood at more than 15 billion barrels and they expects to boost recoverable reserves up to 35 billion barrels by 2014. The majority of Brazil's oil reserves are in the offshore Campos and Santos Basins, located off of the country's southeast coast. As Brazil continues to increase its offshore production bringing new fields on stream, the logistics of transporting the oil to shore will require the use of an increasing number of shuttle tankers. This presentation will provide an overview of the offshore field development in the Campos and Santos Basins, the current oil production and future growth estimates. It will also address the projected requirements for shuttle tankers to support the production and transportation infrastructure. In order to support the fields offshore Brazil the shuttle tanker fleet will have specific environmental and operational requirements. Particular emphasis will be given to these requirements and their impact on the specification for the vessels which will be employed for operation offshore Brazil

11.20 - 11.55 **Corrugated Bulkheads Designs of Tankers**

*T. Hayashi, ClassNK, Japan*

Corrugated bulkheads are often used in chemical tankers and product tankers to carry out cargo tank washing efficiently. Sufficient service records have proved the advantage and contribute to the advanced designs corresponding to larger cargo tank capacity due to the increased demand for the transport of product oils and chemical products. It is obviously important in ship design to follow satisfactory experiences and to reflect feedback from past damage records together with the verification based on the latest design technologies. This paper summarizes some of the recent developments together with the trend in the design of corrugated bulkheads considering the specific limitation of the designs of product/chemical tankers and also shows the impact of scantling and related key design issues.

11.55 - 13.00 Lunch

13.00 - 13.35 **Mapping of Toxic Vapours Onboard of Tankers**

*W. Jacobs, Antwerp Maritime Academy, Belgium*

The handling of cargo vapours and their possible emission into the atmosphere has become an important item for several reasons - greenhouse gases, environmental health, safety and health of the crew and a more stringent MARPOL regulation. This research takes a closer look to the onboard situation regarding the safety and health of the crew. The focus is not on the deck area, but on the accommodation, the bridge and the engine room. The concentrations measured clearly show that there is a relationship between the cargoes transported and the concentration of the cargo vapours in the atmosphere in and around the vessel. These results were confirmed by wind tunnel studies. Oil tankers must have a VOC management plan according to MARPOL Annex VI and technical solutions like vapour collecting systems are tested. For gas tankers, where a reliquefaction plant is installed, simply introducing more stringent procedures is a possible solution. For chemical tankers, finding a good solution might be much more difficult. The frequency of gas-freeing operations on board modern parcel tankers is much higher and deals with a large scale of different products.

13.35 - 14.10 **Simulation of External Application of SuSy devices on a Aframax Tanker that has be Structurally Compromised**

*Chatzidouros Elias, National Technical University of Athens, Greece*

"Surfacing System for Ship Recovery" (SuSy), gas inflated balloons are envisaged to be used for providing reserve buoyancy to damaged ships for the purpose of preventing ship capsizing and/or sinking, along with lifting wreckages from the seabed. The external application of a SuSy device on an Aframax Tanker that has been structurally compromised is studied, using the finite element method and following the IACS CSR rules for Tankers. The damage condition is simulated using a three compartment finite element model along with a simulated damage on the middle compartment. The global ship strength is evaluated considering the most suitable areas for attaching the balloons for lowering the stress peaks that appear on the damaged compartment of the vessel. The local ship strength is evaluated considering the stress concentrations produced on the balloon attachment areas.

14.10 - 14.40 Coffee

14.40 - 15.15 **Tanker Damage Stability: What are the Issues and Solutions**

*K. W. Hutchinson, Babcock International Group  
A. L. Scott MCA, UK*

The fundamental issue with tanker damage stability lays with the complexity of dealing with fluid loss from a damaged tank which may be filled to any level and carrying liquids a wide potential range of specific gravity. When this is allied to an extensive variety of loading patterns with empty, part filled and multi-compartment side or bottom/raking damages, demonstration of compliance can be problematic. The industry in general, in conjunction with national regulators and international organisations now widely acknowledge that there is an urgent need to develop guidelines for the verification of damage stability requirements for tankers that regularly sail in condition of loading significantly different from those in the approved Stability Information Booklet. Such guidelines are currently under development at IMO. This paper discusses these issues from the aspect of the practicing ship designer, regulators and operators, and proposes practical and effective solutions.

15.15 - 15.50 **Loading Software for Tankers**

*L. Letizia, Herbert Engineering Ltd, UK*

It is generally understood that since nearly all tank vessels use computer programs to evaluate intact stability and longitudinal strength for any loading condition, there is no longer a practical incentive to remain constrained to the standard loading conditions to comply with damage stability regulations. This is particularly true for tankers that change their loading patterns often, such as product, chemical and parcel tankers. For these reasons the use of approved loading computers which perform direct damage stability calculations is a practical solution to demonstrate compliance with the damage stability regulations for non-standard loading conditions.

15.50 - 16.15 General Discussion

