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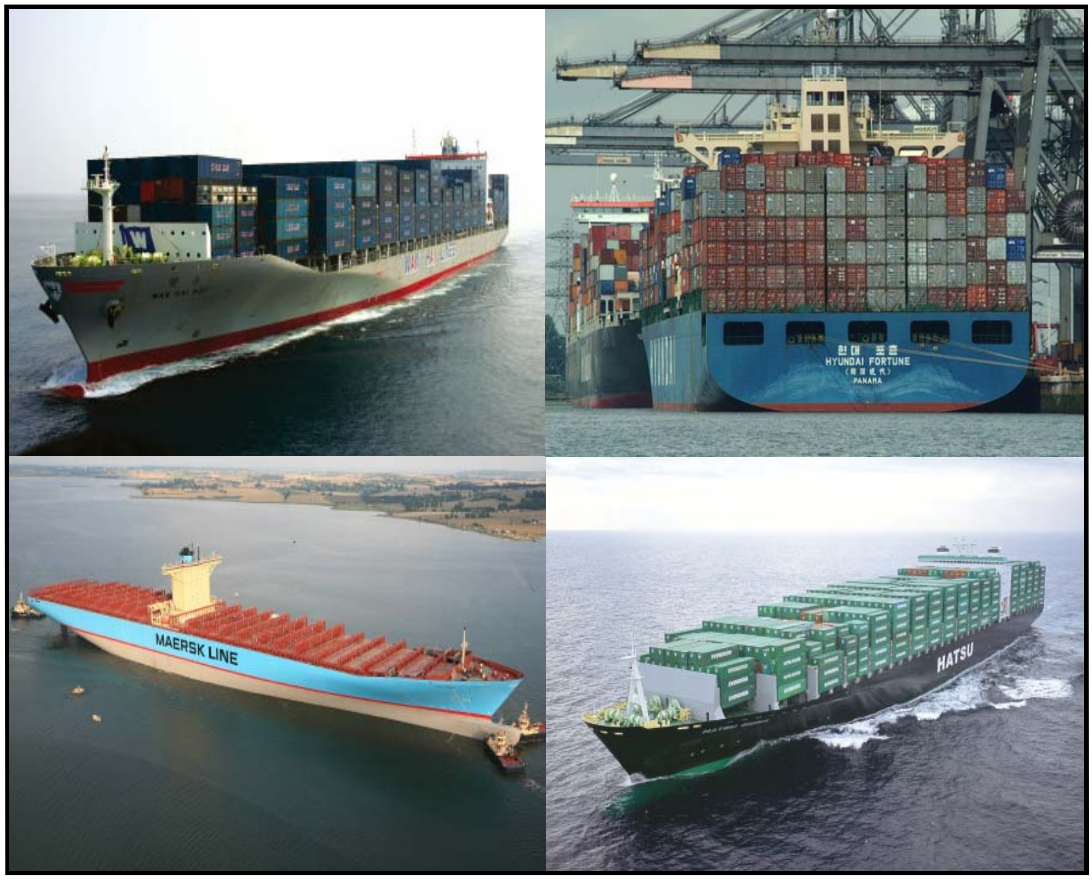

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Lloyd's Register

International Conference

DESIGN & OPERATION OF CONTAINER SHIPS

3 - 4 JULY 2008

RINA HQ, LONDON

Day 1

09.00 - 09.30 **Coffee & Registration**

09.30 - 10.05 **Keynote Presentation - Container Shipping Industry Update**
D. Tozer, Lloyd's Register, UK.

10.05 - 10.40 **Assessment of Whipping Effects on Global Loads of Ultra Large Containerships**
O. el Moctar and J. Oberhagemann, Germanischer Lloyd AG, Germany.
H -H Lee, T-H Park and H-R Ryu, Hyundai Heavy Industries Co, Ltd, Korea.

The paper will present a computational procedure that considers large-scale hydroelastic effects to assess slamming-induced hull whipping on sectional loads of a large containership in waves. The purpose was to compare computed results model test measurements. In the computations, rigid body motions are superimposed on elastic deformations, whereby the former can be of large amplitude while the latter have to be of small amplitude relative to rigid body motions. The slamming impact causes the ship structure to vibrate with a wide range of frequencies. Assuming that low eigenmodes in bending contribute most to total vibration energy, we apply a finite element Timoshenko beam, oriented in the longitudinal direction of the ship, to account for bending and shear deformation. The structural model is coupled to a RANS solver. This code solves the Reynolds-averaged Navier-Stokes equations in their integral form for a finite number of control volumes constituting the solution domain.

10.40 – 11.15 **3DFEM - 3DBEM MODEL FOR SPRINGING & WHIPPING OF CONTAINER SHIPS**
Š. Malenica, Bureau Veritas Research Department, France.
J. Tuitman, Delft University of Technology, Netherlands.

The paper deals with the modelling of the wave induced ship vibrations. Both the linear frequency domain (springing) and the non-linear time domain (whipping) models are considered. The method based on the full coupling of 3DFEM structural model and 3DBEM hydrodynamic model is presented. The choice of the full coupling with the 3DFEM structural model was necessary due to the particular structural characteristics of the container ships, in particular their open midship section, which leads to the increased sensitivity to the torsional type of loading and responses. The simplified non-uniform beam model, which is usually employed for these types of simulations, might become rather inaccurate or very complicated. Another advantage of the 3DFEM structural model is the possibility to have direct access to the structural response (stresses and strains) at any required location, so that no complicated post-processing is required.

11.15 - 11.45 **Coffee**

11.45 – 12.20 **Assessment of a Post Panamax Container Vessel by Direct Strength Analysis**
G. Storhaug and E. Moe, Det Norske Veritas, Norway.
H.L Lee, Det Norske Veritas, Korea.

Strength analysis has been carried out on 4600TEU post Panamax vessel that will be able to pass through the New Panama channel that opens in August 2014, but the stability which may be a concern for existing Panamax vessels is no longer an issue. Manoeuvring capabilities are also good. For Panamax vessels global FE models with direct load application may be regarded as unnecessary for well proven designs. Although this vessel is shorter than many Panamax vessels, it is wider, and certain details need special attention. A CSA-2 analysis is carried out for this vessel, including fatigue screening of critical areas, bow and stern slamming calculations and ultimate strength analysis, also utilising nonlinear wave load calculations.

12.20 – 12.55 **Integrated Structural Assessment of Ultra Large Container Ships.**
G. de-Jong, Bureau Veritas, France.

This paper will present the recently developed methodology for an integrated, consistent and practical assessment of hydrodynamic loads and structural response of container ships. The hydrodynamic software HydroSTAR has been developed to perform non-linear simulations in the time domain and integrated with a full ship finite element model to include hydro-elastic effects. A regulatory framework to assess the results in terms of acceptability of stress levels and fatigue lifetime has been set up. Dedicated model testing has been carried out to verify the theoretical models behind the methodology. In addition, validation studies are carried out by full-scale measurements on board a large container carrier. By means of example studies on new (over 10,000 TEU) and existing designs, the practical applicability of the method is demonstrated, bringing container ship classification to a new level.

12.55 - 13.55 **Lunch**

13.55 - 14.30 **Hydroelasticity of Very Large Container Ships**
I. Senjanović, S. Tomašević, S. Rudan and M. Tomić and N. Vladimir, University of Zagreb, Croatia.
Š. Malenica, Bureau Veritas, France.

Sea transport is rapidly increasing and Very Large Container Ships (VLCS) are built. They are more flexible and their structural natural frequencies can fall into the range of the encounter frequencies in an ordinary sea spectrum. Such conditions are not covered by the present Classification Rules for ship design and construction. So, structure design of VLCS is at the margin of the rules. Therefore, the wave induced hydroelastic response of VLCS becomes an imperative issue for improving the classification rules and ensuring ship safety.

14.30 - 15.05 **Full Scale Measurements of Stresses and Deflections of Post-Panamax Container Ships.**
M. Toyoda, IHI Marine United Inc, Japan

Large container ships require designers to take account constraints such as hull girder strength due to torsional, vertical and horizontal bending moment, fatigue strength of hatch corners and hatch opening deflection. On the other hand, rapid enlargement of rows and tiers on container ships raises large hatch opening deflection, and accurate estimation of deflection is now more important. Interferences between fittings such as hatch covers, lashing bridges and other container securing equipment need to be addressed when this new size of ship is explored. This paper shows results of full scale measurements of ships in service, and examples of design application are introduced.

15.05 - 15.40 **Measurements of Wave Induced Vibrations and Fatigue Loading Onboard Two Container Vessels Operating in Harsh Wave Environment.**
G. Storhaug and S. Erling Heggelund, Det Norske Veritas, Norway.

Ships vibrate locally and globally from verious sources of excitation. All sailors know this by experience. While most literature focuses on propeller and engine excited vibrations, which can be handled by proper design, wave induced vibration can not easily be avoided by moderate changes of the hull lines. The waves may cause the whole hull girder to vibrate due to springing 9resonance) and whipping (transient response), which increase the fatigue and extreme loading. DNV has done extensive research on the topic in the last decade and recently it has also become an industry concern. Commercial modern hull monitoring systems in combination with sophisticated model tests are the best tools to answer the key questions: How important is the wave induced vibrations and does it have to be included in the design rules?

15.40 - 16.10 **Coffee**

16.10 - 16.45 **New Rules for Breakwaters on Container Ships**
A. Kahl and H. Rathje, Germanischer Lloyd, Germany.

Recent reports on breakwater damages initiated activities at GL to assess the current practice and update the Rules to arrange and dimension breakwaters. In summary the process comprised five steps: 1. First, extreme load scenarios were modelled applying the equivalent design wave procedure. 2. The identified design waves were used to calculate time dependent pressure distributions and bending moments on the breakwater with the RANS code Comet. 3. Design pressures were determined such that the condition 'maximum bending moment' was fulfilled. 4. In the next validation step, the design pressures were compared to those re-calculated from selected damage cases. 5. Comparison of as-built scantlings with those obtained with old and with newly developed design pressures within a ramification study. To evaluate the effect of scale on the breakwater loads, a feeder, two panmax and a postpanmax container ship were investigated.

16.45 - 17.20 **Recent Experience with the Rudders of Container Ships – Some Problems and Their Solutions**
J. Carlton, D. Radosavljevic and S. Whitworth, Lloyd's Register, UK.

The paper describes recent cavitation, strength and performance experiences of modern container ship rudders. The paper presents the results of sea trials, CFD computations and gives recommendations for the alleviation of such problems in the future.

17.20 - **General Discussion & Evening Drinks Reception.**

Day 2

09.00 - 09.30 **Coffee and Registration**

09.30 - 10.05 **Seakeeping Issues in the Design of Containerships.**
R.P. Dallinga, F.V. Walree, R. Grin; MARIN, The Netherlands.

While the advanced art of minimising the installed power for a given speed has a clear role in the design of container ships, the place of seakeeping is less well established. The incidental character of seakeeping problems in combination with the fact that building for good seakeeping may decrease the container capacity and increase the building costs seems a major reason for this in addition to the sheer complexity of the issues. The paper will provide a complete review of the major seakeeping issues in containership design. Based on recent experience from model tests the work explores the physical nature of the involuntary speed loss in waves and reasons for a voluntary speed reduction (green water loads, whipping accelerations due to bow and stern slamming, engine racing) or change in course (exposure of containers to wave crests, rolling).

10.05 - 10.40 **Guidelines for Application of YP47 Steel Plates to Strength Deck Construction of Ultra Large Container Ships**
Y. Yamaguchi, Nippon Kaiji Kyokai (ClassNK), Japan.

With the continual increase in volume of marine transportation on a global scale, container ships are becoming larger in size, which cause the use of extremely thick steel plates for hull structure members to satisfy the strength requirements. In using such thick steel plates, ensuring safety against brittle fracture becomes one of the most important issues to be resolved. In this regard, application of steel plates with higher strength and sufficient fracture toughness is being evolved as a viable option for ship structures from the view point of ensuring the ships safety. Class NK have been developing guidelines specifying the structural and material requirements for the application of the YP47 steel plates to ultra large container ships, based on the outcome of a comprehensive research project and experience gained from the application to ships.

10.40 - 11.15 **Selection of a Design Concept for the CREATE3S Project**
M. Landamore, D. Broderick and P. Wright, Newcastle University, UK.

The CREATE3S project aims to reduce the door-to-door lead time of short sea shipping operations through improved logistics, in particular cargo handling. It will also increase vessel utilisation and inland waterway penetration. Several novel ship concepts were developed and assessed, including: Trailer - Truck Concept, Modular Ship Concept, Flo-Bo Concept and Mega Pallet Concept.

11.15 - 11.45 **Coffee**

11.45 - 12.20 **Analysis of High-Speed Trans-Pacific Nuclear Containership Service**
G. A. Sawyer, J. W. Shirley, J A. Stroud, E. Bartlett, General Management Partners LLC, USA.
C. B. McKesson, CCDoTT, USA.

The vast increase in the long distance U.S.-Far East Container Trade, the ever-increasing cargo values involved in this trade, and the increased size and speed of the vessels that service this trade are well-established phenomena. In recent years these trends have been accompanied by the higher energy costs associated with conventionally fueled ships along with ever more stringent governmental regulations imposed on the operators plying this trade. These issues combined have given rise to the question of whether a small fleet of large, very high-speed state-of-the-art nuclear powered ships could be both technically feasible and economically competitive in such service.

12.20 - 12.55 **Hydrodynamic Aspects of Containership Propulsion Challenges and Solutions**
A. Boorsma, S. Whitworth, P. Fitzsimmons, D. Radosavljevic, Lloyd's Register, UK

Recently Lloyd's Register Technical Investigations Department has been involved in a number of habitability problems on feeder container ships of 2000 – 3000 TEU capacity having all aft deckhouses. This location is close to the source of propeller excitation while the slender dimensions of the deckhouse reduce its resistance to vibration excitation. A major part of the problem was the propeller excitation, originating from the propeller inflow and the resulting cavitation dynamics. Lloyd's Register has been working actively on improving and validating prediction methodologies for propeller inflows, cavitation characteristics and radiated hull pressures. The paper will present and discuss; ship scale cavitation observation, the calculated ship wake and the calculated propeller cavitation characteristics.

12.55 - 13.55 **Lunch**

13.55 - 14.30 **Effective Use of Fuels for Container Ship Power Efficiency and Control of Harmful Emissions**
N. Rattenbury, Lloyd's Register, UK.

Emission control from oil engines is required by MARPOL Annex VI and this has come at a cost to engine efficiency – increased fuel consumption. Commonly a figure of about 1-2% loss in engine efficiency is quoted but unless the engine parameters are continually monitored fuel consumption increases of up to 6% have been recorded. The paper looks at the effects on fuel consumption when operating with emission controls and investigates means of monitoring power plant efficiency – condition monitoring of propulsion machinery and equipment including mechanical prime movers, electrical generators and power converters for accurate fuel consumption and power output.

14.30 - 15.05 **Efficient Propulsion for Large Container Vessels.**
H. Schmid, Wartsila Switzerland Ltd, Switzerland.

This paper will illustrate some approaches to reducing both the fuel consumption exhaust emissions (CO2, Nox, Sox, particulate matter, etc.) for large container vessels. Today these are cruitial requirements for all ships, but especially for the increasing numbers of large container ships of say 4000 TEU up to more than 13,000 TEU which have high installed powers and thus high fuel consumptions. A great economic impetus is given by the high proportion of operating costs going to bunkers with heavy fuel oil often costing more than US$400 per tonne.

15.05 - 15.35 **Coffee**

15.35 - 16.10 **Mooring Line Solutions for State-Of-The-Art Container Vessels with Dyneema®**
M. Eijssen, E. Grootendorst, DSM Dyneema B.V, The Netherlands.
S. Wardenier, Lankhorst Ropes, The Netherlands.

The shipping industry is rapidly growing worldwide; new-build activity is high and the trend is towards larger vessels. At the same time, operational costs need to be trimmed. Harbour turnaround needs to be faster. On top of that, labour regulations are becoming tighter and safety awareness is growing. To face these challenges, an increasing number of ship operators have chosen mooring lines with Dyneema®, a High Modulus PolyEthylene (HMPE) fibre. Mooring lines with Dyneema®, like the 12-strand braided Euroneema® rope manufactured by Lankhorst Ropes, have a proven track record, providing secure and safe mooring for LNG, VLCC and container carriers. This paper we will demonstrate the benefits of these next generation mooring lines to ship designers and end users, illustrated by case studies.

16.10 - 16.45 **Experience of Replacing Standard Mechanical Seal Pumps with Hermetically Sealed Magnetic Coupled Booster Pumps on Container Vessels**
T. Flauger, KRAL AG, Austria.

Residual heavy fuel oils are the common fuel on board of Container vessels. These residuals are a product of the refining process of crude oil, which extracts the components of higher volatility in a fractioned distillation process. Thus, the composition of the residual oils clearly depends on the grade and quality of the crude oil. The paper will describe the experience of KRAL AG with booster pumps over a period of more than ten years. A survey of the problems that were experienced - mainly on Container vessels - which revealed a large number of failures attributed to properties of the fuel. Most of the failures lead to a heavy HFO leakage, which has the risk of engine room fire and in case of a dirty engine room, Port State detentions.

16.45 - **General Discussion.**

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