

The Royal Institution of Naval Architects

Design & Operation of Passenger Ships



International Conference

Design & Operation of Passenger Ships

1st May 2019

RINA, HQ, London, UK

www.rina.org.uk/Passenger_Ships_2019

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08:55 - 09:30 Coffee and Registration.

09:30 - 10:05 KEYNOTE: Stephen Payne, Chief Designer of Queen Mary II

10:05 - 10:40 Ship Evacuation and Emergency Response Trends
Fotios Stefanidis, University of Strathclyde, UK

The last decade, a rapid growth in demand of cruises has lead to an increase of the average cruise ship size by 30%. This was driven mainly by the effort to exploit the profit opportunities that come with economies of scale while trying to meet the market demand which continuously exceeded supply. This increase in passenger and crew capacity brings safety related issues to the spotlight of technical challenges that have to be addressed. Based on its criticality and timebound nature, ship evacuation and its corresponding procedures, modelling techniques and regulations should be reviewed and updated.

Ship evacuation analysis can no longer be a static plan, independent of the state of emergency (fire, flooding or security concerns). The authors argue that in an era of 'smart' devices, IoT, augmented reality and Large Data, the evacuation analysis should be transformed into a 'live' tool, able to address the dynamic, constantly changing situation aboard, integrated in an overarching risk based decision support system. The paper aims to address on the pros and cons of the past and current trends in evacuation modelling, procedures and emergency response, identifying the gaps and the areas for improvement of the existing risk models and explore the potential use of new 'smart' technologies. Thus, it will set the foundation for a disruptive change in the evacuation analysis based on the type of emergency state and calculation of the associated risk, taking into account not only the mustering and embarkation phase, but also the search and rescue possibilities and risks.

10:40 - 11:15 Assessment of the Minimum Speed Requirement in Safe Return to Port
Rob Grin, Rien de Meij, Stephane Rapuc, MARIN, the Netherlands

Cruise ship and RoPax ferry, which are typically twin-screw ships, have to comply with the requirement for Safe Return to Port as detailed in SOLAS Ch. II-2/21.4.1 - Propulsion. Part of this requirement is the necessity to be able to maintain a minimum sustained speed of 6 knots in Bft 8 weather conditions for the worst single compartment damage case. This worst damage case is typically failure of one shaft line or engine room.

Over the years, at MARIN we have gathered experience on how to address this problem by means of calculation work, model tests and a combination of both. The present paper discusses these methodologies, some of the pitfall to avoid and present the study case of a 120m expedition type cruise vessel.

Based on this study case, the paper also presents the sensitivity of this requirement to exact environmental conditions, to the choice of blocked- or water milling propeller and to the ship design speed in calm water. In particular, it is seen that for relatively small and slow passenger ships, the SOLAS requirement may necessitate to increase the intended onboard power. Finally, a case of bow quartering seas is presented and the difficulty to keep course with one propulsor is discussed and compared to the head sea case.

11:15 - 11:45 Coffee

11:45 - 12:20 Concept of Design and Implementation of Pilgrim Ships in India
Yashwant R. Kamath, Dr K Sivaprasad, Cochin University of Science and Technology, India

Being the land of Spirituality and Mythology, India has thousands of pilgrimage centres across its breadth and length. River Ganges, which originated from Great Himalaya and flows through number of states and finally merges at Kolkata with Bay of Bengal, is worshipped as goddess of prosperity by the masses in India. The goddess river Ganga has many pilgrimage centres spread along her shores right from the origin to the river mouth. The concept of Pilgrim Ships started in the year 1602, between Falmouth, England and Plymouth. From there has been more than 250 pilgrim ships plying mainly in Europe and America in the mid-17th Century. India, Specifically, the City of Bombay and parts of Gujrat became a part of global pilgrim ship route in the early 19th Century. There are also records of Pilgrim Ships built in India, during the reign of Mughal Emperor Akbar. All these has set forth a set of rules in the Indian Merchant Shipping act which gives specific rules for design of type vessel for pilgrimage. The proposed paper brings out design of a Pilgrimage Cum Cruise Vessel for Ganges, National Waterway No.1, with reference to the unique and specific design guidelines provided in the Indian Merchant Shipping Rules. The paper will discuss specific design issues related to requirements of pilgrims and general solutions to the requirements with a naval architectural touch. Potential for developing similar designs for other inland water-based routes in India will also be discussed as part of exploring a business proposal in this sector.

12:20 - 12:55 Design Features of River-Sea Cruise Passenger Vessels for Russian Inland Water-Ways and Adjacent Seas
Alexander Egorov, Marine Engineering Bureau, Ukraine

The principal characteristics and concepts of river-sea cruise passenger vessels for the Caspian, Azov and Black seas areas, consistent with the main operator requirements, are developed. The new concepts are not only new vessels, but also describe a new tourist product. There are almost no offers covering the sea-river cruise market for ports on the Black, Baltic, and Caspian seas so to provide a solution for that gap modern cruise vessels of PV09 and PV300VD projects are offered. Research has shown that for typical local conditions traditional single hull type vessels are preferred. CFD-modelling tests were executed to optimize hull form. Modular principles were widely adopted for creating inner living space. The use of standardised modular cabins enables the provision of a range of passenger capacities by using modules of varying size to achieve the desired level of comfort. All the main design features of the PV300VD concept were established from the PV09 concept including: architecture (especially a side elevation typical of modern yachts and cruise vessels); compartments and cabins with maximum glazing; a "floating hotel" concept with featuring balconies, fore view saloon, two-level sun deck with bar (in bad weather part of sun deck is closed by movable canopy), pool; diesel-electric propulsion with full rotating rudder propellers. The new concept passenger vessels meet all SOLAS, MARPOL, COLREGS and all national requirements.

12:55 - 13:55 Lunch

13:55 - 14:30 Introduction of New Shaped "Y-Hull", Generating Reduced Resultant Wave from Hull and Experiencing Comparatively less Resistance by the Bow
Amitavo Chowdhury Wye, ShipDYN Ltd, Bangladesh

This invention introduces Y-HULL which relates to the generation of reduced wave by the hull of the ship and results in low resistance while moving forward, compared to Mono-hull & Catamaran ships. Mono-hull & Catamaran hulls generate significant waves on the river ways which create heavy pitching & rolling motion for small country boats which are used in crossing rivers by rural people. The current invention of Y-HULL reduces waves significantly because of its unique shape of combining Mono-hull and Catamaran. This hull experiences less resistance which increases efficiency and reduces fuel cost. This combined hull shape is called Y-HULL as the hull buttock-line has a shape of Engle letter Y at the centre keel position. This Y-Hull ship significantly reduces accidents of small country boats caused by heavy waves induced by ship's hull and also reduces river bank erosion.

14:30 - 15:05 Passenger Vessel Operation in Bangladesh: A Study on Accidents
Imran Uddin, Zobair Ibn Awal, Bangladesh University of Engineering & Technology (BUET), Bangladesh

Bangladesh is bestowed with numerous rivers criss-crossing the whole country. So the inland water transport is popular among the people of Bangladesh for a long time. It carries almost one-fourth of total passenger traffic in Bangladesh. But the safety of passenger vessel operation is still in a vulnerable condition. In the last few decades, the country has experienced several dreadful accidents involving the passenger vessels. The inland passenger vessel accidents during the period 2005 to 2017 are analyzed in this study. The accident data has been collected from the Bangladesh Inland Water Transport Authority (BIWTA) and Department of Shipping (DOS). The most vulnerable zones for the occurrence of passenger vessel accidents are analyzed by the Geographical Information System (GIS). It is found that the leading causes of passenger vessel accident are collision, stormy weather and overloading. It is revealed that more than 49% accidents involve any passenger carrying watercrafts that shares 97% of total fatalities in the inland waterways of Bangladesh. In more than 42 % cases complete loss of the watercrafts occur which is the main reason behind such a high rate of fatality. Therefore, the problem of passenger vessel accidents is the burning question in Bangladesh considering the safety issue at present. At the end of the study, a number of recommendations are put forward to improve the safety of passenger vessel operation in Bangladesh.

15:05 - 15:40 **An Experimental Investigation Into Reduction of Sloshing Effects in Swimming Pools Onboard Cruise Vessels**
Diogo Nunes, Dominic Hudson, University of Southampton, UK

On cruise ships, sloshing may be observed in swimming pools, where its consequences can detrimentally affect passenger comfort and the useful availability of the pool. Sloshing is defined as any free surface motion inside a container. On different ship types this can have significant impact on the ship's structure, stability and comfort. The natural frequency of the water in the pool can be correlated to the response of the vessel in waves and is mainly excited by the combination of pitch and surge motions. This study aims to analyse swimming pool sloshing for cruise vessels and suggest ways to mitigate its impacts without disrupting passenger usage. A custom-built large model-scale modular tank fitted to a 6-axis motion table was designed to conduct model scale experiments. The motions experienced by the vessel in typical moderate and harsh seaways were calculated using strip theory approach and used as input to the 6-axis motion table. Tests were conducted to determine the pool's natural frequencies and wave amplitude for a typical large modern cruise vessel both with and without baffles fitted. Baffle designs considered include current designs applied to LNG vessels and road tankers. However, these must be adapted to satisfy drowning and entrapment regulations for swimming pools and the different form factor of such. As a result, large surface area baffles cannot practically be used. Instead, smaller baffles are deployed in a larger array. Future studies using the same experimental design could investigate active ways of reducing sloshing on swimming pools.

15:40 - 16:10 **Coffee**

16:10 - 16:45 **SPEED: a New Software for Speed & Power Sea Trial Analysis**
Paolo Becchi, CETENA, Italy

The latest international procedures and legislation prescribe how the speed & power sea trials should be carried out and analysed to evaluate the effective ship performances at the contractual load condition taking into account the environmental effects of wave, wind, current and water temperature. For this reason, CETENA recently developed the new software "SPEED" aimed to perform the analysis of the data measured during official S&P sea trials and to provide the final results onboard just as the sea trials have been finalized. In order to guarantee both the software development and the accuracy of computation that can be carried out, in summer 2018 the software certification was completed in accordance with ABS and RINA rules. The possibility to directly choose one of the correction procedures implemented (ISO15016, ITTC2017, ITTC2014) and to select each single correction to be applied makes it possible to investigate the effect of procedure adopted and the effect of each correction formulation on the final results. Where no onboard ship systems for measuring wind, wave and/or current are available, the SPEED software can be connected with the remote CETENA own weather forecasting system that gives the possibility to identify the environmental conditions under which the sea trials are being performed. The ship speed and power performance analysed by "SPEED" and thus referred to ideal conditions can be used for verifying the Energy Efficiency Design Index (EEDI) of the ship.

16:45 - 17:20 **Control of welding deformation in thin plate**
Muhammad Taha Ali, DAMEN, Romania

Welding is the production process to join metals. Shipbuilding industry trying to improve the welding process from last seven decades but welding in thin plate brings more nonlinear problems. Welding deformation in the thin plate is one of the critical issues in the shipbuilding especially in ferry boats and passenger ships for good outlook. Welding deformation decreases the productivity and increases the production cost for treating the welding distortion. That is why shipyards more concern in this issue because they want to deliver the ship to the client on time with minimum cost. For this reason, this thesis is focused on the different welding techniques, clamping and additional heating to control welding distortion. In shipbuilding two types of analysis are commonly used, experimental and computational analysis. Both the methods of analysis for 5mm to 8mm plates of steel and aluminium materials are used. For experimental analysis, MAG and MIG welding process is used while compiling with IACS rules and welding standards. For computational analysis, 3D model in FEM is developed to validate the analysis by temperature and residual stress measurements. Computational results and experimental measurements are validated. These measurements and modification are used to optimize the methodology to curtail the welding deformation.

17:20 - **General Discussion and Drinks Reception**

Conference Overview

The rapid growth of passenger ships over the last twenty years in the travel and tourism industry prompted cruise lines and ferries operators to build ever more innovative ships to cater for the diverse needs of a growing number of passengers. This has including ever increasing size of vessels to benefit from the economy of scale, small vessels specialising in more niche markets, vessels catering specifically for the growing Asia cruise market and vessels capable of itineraries to a greater range of destinations including environmentally sensitive areas.

The need to balance economic and environmental efficiency with increased passengers expectations of comfort and on-board amenities, along with improved passenger and crew safety, brings new challenges for those involved in the design, construction and operation of today's passenger vessel.

Topics include:

- All aspects of design - hydrodynamics, structures, layout
- Interior design, leisure, entertainment and hotel features
- Smart ship technology to enhance the passenger experience
- Operation (on-board noise and vibration to be kept to a minimum...)
- Current & future regulation & classification
- Managing environmental impact
- Innovative powering & propulsion solutions
- Emergency response, LSA and MES

