The Royal Institution of Naval Architects

Full Scale Ship Performance

International Conference

Full Scale Ship Performance

24 - 25 October 2018,

RINA HQ, London, UK

www.rina.org.uk/Full_Scale_Performance

Call Catherine on +44 (0) 20 7235 4622 or email conference@rina.org.uk

DAY 1 PAPERS:

08.55-09.30 **COFFEE & REGISTRATION**

09.30-10.05 **SHIP PERFORMANCE - USING THE REAL WORLD AS A LABORATORY,** *Serena Lim, Serkan Turkmen, Federico Prini, Ali Rostami, Vita Kurniawati, Alessandro Carchen, Martin Gibson, Simon Benson, Kayvan Pazouki, Alan J Murphy, Richard Birmingham, Newcastle University, UK.* The near future will see further enhancements of performance monitoring with the widespread advancement of sensor technology, data capture techniques, data filtering and cloud-based storage capacity. This must be coupled to further innovations in big data analysis to interpret and effectively exploit these real-world laboratory experiments. A body of diverse research activities at Newcastle University challenges this conventional approach by linking real world data directly to laboratory-based experiments and simulations. This showcases a multi-dimensional ship performance envelope which includes environmental influences, operation location and condition, structural response, machinery performance, environmental impact, hull and propeller surface, course keeping efficiency, energy flow distribution, social and economic aspects of the ship or fleet. This paper details a series of case study projects which contribute to the Newcastle approach for ship performance monitoring.

10.05-10.40 **MODELLING THE PERFORMANCE OF ENERGY SAVING TECHNOLOGIES ON SHIPS,** *David Pearson, BMT, UK***.** The introduction of the EEDI, MRV and other ship performance regulations have driven an increased uptake in the use of Fleet Performance Monitoring (FPM) technologies, and are now at the point where accurate and comprehensive measurements of propulsion performance can be undertaken. In conjunction with this change, the 2020 IMO sulphur emissions limit and 2050 IMO CO2 reduction target have driven increased interest in the retrofitting of low sulphur fuel capability and/or Energy Saving Technologies (EST) in order to comply with these targets. The benefits of most EST are subject to weather conditions and their specific use case, most notably wind-based devices such as Flettner Rotors. Using the FPM data from real ships on real voyages, the performance of a ship before and after the installation of ESTs is modelled and estimated, and compared to the known baseline. This FPM ship data is paired with adapted ship models, created using a variety of methods in order to achieve a valid ship definition. A range of resistance and power calculation methods are employed to provide a distribution for statistical confidence analysis.

10.40-11.15 **HYDRODYNAMIC DIGITAL TWIN: MACHINE LEARNING AND TRADITIONAL MODELLING,** *Ivana Melillo, D'Amico Shipping Group, UK, Alessandro Pescetto, RINA Services SpA, Italy***.** Collecting large amounts of reliable data on board ships is no longer restricted to rich pioneers and technology enthusiasts. With numerous permanent monitoring systems now on the market, it's easy and affordable for all of us. The era of big data has reached the maritime sector. Big data can help shipping in the same way that it helps other fields. In this paper, we present full scale performance data collected on board and analyzed together between d'Amico Fleet Performance and RINA Services Marine Innovation team. Real comparison between data collected through noon reports and an automatic data acquisition system are presented and in particular it is demonstrated how some kind of analysis are almost impossible using noon reports data. Furthermore, it is also presented and benchmarked different methods for building hydrodynamic digital twin of a ship, capable to forecast propulsive power in the different loading and environmental conditions: one more physical, based on ISO 15016, and the other one using a black box approach through machine learning techniques.

11.15-11.40 **COFFEE**

11.40-12.15 **THE IMPORTANCE OF DATA QUALITY IN VOYAGE MODELLING,** *Carlos Losada, BMT, UK.* Traditionally analytical models have been used to estimate ship performance, based on a set of equations, which use a number of coefficients to generalise for various conditions. The coefficients are derived from either the design parameters of the ship or from full scale ship measurements. The draw back to analytical models are the changing ship parameters through the vessels life and the complexity of the models resulting from capturing the interactions between the vessel subsystems. Data driven models are used in many industries as a solution to understanding complex multi-dimensional systems. The complexity from the interaction between the subsystems is removed since the model learns these relationships from the patterns in the data. However, the quality of the data driven models is directly proportionate to the reliability and quality of the data being used to generate or train the model. This paper will aim to show the importance of data quality when looking to develop data driven ship performance models with the aim of voyage optimisation and planning. Furthermore to present how to identify bad datasets and what to do in these instances when the data is not suitable for building these models.

12.15-12.50 **DEVELOPMENT OF A NUMERICAL MODEL ON DISPLACEMENT CORRECTION FOR SHIP PERFORMANCE IN CALM SEAS BASED ON FULL-SCALE MEASUREMENT,** *Naoto Sogihara, Akiko Sakurada, Mariko Kuroda, Masaru, Tsujimoto, Yoshihiko Sugimoto, Ken Hasegawa, National Maritime Research Institute Japan, Japan***.** Ships in service is operated with various displacement depending on the amount of cargo. Normally, performance data (e.g. ship speed or braking power) measured at specific displacement is corrected to the designated displacement for the performance evaluation in service. In case the amount of displacement correction is small, the Admiralty coefficient can be used for the correction. Otherwise a relationship between displacement and speed or power obtained by means of model tests is used for the correction. However, such relationship is rarely provided to ship operator and it is not appropiate to apply the Almiralty coefficient to container ships or vehicle carriers since the displacement is widely varied. Authors propose a numerical model of ship performance in calm seas based on full-scale measaurement to provide practical correction on displacement. Data which are regarded as in calm seas are sceened out and fitted to the numerical model, which enables accurate prediction of ship peformance in calm seas for any displacement. The validation for the proposed model is carried out by comparing full-scale measurement for containership and vehicle carrier and vessel performance simulation in which the model is applied.

12.50-13.45 **LUNCH**

13.45-14.20 **JORES JIP - A UNIQUE JOINT INDUSTRY PROJECT TO CLOSE THE KNOWLEDGE GAP,** *Dmitriy Ponkratov, UK, Gijs Struijk, MARIN, The Netherlands.* With the implementation of new environmental regulations the shipping industry is challenged and hence highly motivated to explore new energy efficiency solutions. A well-designed ship hull, appendages, propeller or ESDs (Energy Saving Devices) is of paramount importance to this. Ship designers make use of Computational Fluid Dynamic (CFD) for their design work. While being a flexible and relatively low-cost tool, its results are subject to validation. For this a model test is often used, as it offers a well-controlled, physical measured value. However, the uncertainty in both scaling effects and the modeling of full-scale flow in CFD is not addressed. It is due to a lack of good flow data on full-scale that the industry has not been able to close the loop between model tests, CFD and the full-scale reality. With this understanding, a group of key companies and research bodies have now stepped up to close this knowledge gap and propose the JoRes JIP (Joint Industry Project).JoRes JIP aims to increase the understanding of the ship hydrodynamics in full-scale by using a state-of-the-art measurement techniques (PIV/LDV for propeller flow, thrust measurements by optical sensors, Speed Through Water assessment by wave radar etc). By doing this, a comprehensive set of data becomes available to the participants to base upon their further developments in designs and design tools.

14.20-14.55 **ON THE ANALYSIS OF RANS - BASED FULL- SCALE POWER PREDICTIONS,** *Bram Starke, MARIN, The Netherlands***.** When performing full-scale power predictions at the trial conditions, a balance has to be found between resistance and thrust and torque and RPM. For various reasons this balance will not –exactly- be found from a CFD computation, not even when one is able to show that the common numerical errors (the discretization error and the iterative error) are sufficiently small so that they can be ignored. Most notable errors in the resistance, due to physical features that have not been taken into account in the simulations: most notably the superstructure, surface roughness and in the case of [2] also the bilge keels and the anodic protection of the hull. But the frictional resistance and the propeller wake field are also affected by the choice of turbulence model, and the propulsive parameters may be affected by the choice of propeller modeling: RANS-BEM or RANS-sliding interface. Therefore, corrections have to be added to the CFD results to obtain the most accurate prediction of the ship self-propulsion point. Various methods may be defined to do so and that will be discussed in the present paper. The test case of the 2016 LR Workshop on Ship Scale Hydrodynamic Computer Simulation will be used as an example.

14.55-15.20 **COFFEE**

15.20-15.55 **SEA TRIAL CORRELATION,** *Mark Pieter de Jonge, Nils Hagemeister, Van Oossanen, The Netherlands.* A reliable method for predicting the full scale power curve of a vessel is an essential base for a sound design. Although modern day naval architects have excellent tools for predicting the required power of a vessel, a discrepancy is often found between the prediction and the sea trial results. At Van Oossanen, Computational Fluid Dynamics (CFD) is used to provide input for an in-house developed empirical propulsion calculation. This calculation provides, among other things, estimations for the resistance and power curves, and the theoretical top speed. To validate this calculation, the results are often compared with model tests, and sea trials. For the latest vessel of the Rotterdam Port Authority (RPA-8), a range of CFD computations and tank tests experiments have been performed in order to estimate the vessel's behavior and performance at full scale. Recently, sea trials have been conducted as well. Having such a broad range of data allows for a proper comparison between the found results, and an in-depth analysis of the probable causes of the found differences. Furthermore, this paper will show where errors are introduced and where margins should be taken into account. At the end a discussion is provided of possible improvements for the propulsion and resistance calculation, as for the sea trial procedure. This could lead to a more trustworthy prediction of the top speed and will help naval architects in the prediction of a vessel's full scale performance.

15.55-16.30 **VALIDATION OF A NOVEL APPROACH TO FULL SCALE - PROPULSION NUMERICAL SIMULATIONS,** *Marco Bovio, Leading Edge Marine Engineering, the Netherlands***.** The paper is intended to prove how, in comparison with usual model scale experiments, modern CFD RANSE techniques provide with a viable and reliable solution for the accurate power and speed prediction of full-scale vessels even at early design stages. In particular, the paper will focus on the Validation of a simplified approach, based on the use of an advanced actuator disk method to reproduce the propulsion, against the full-scale data set collected during 2016 Lloyd's Register measurements campaign on the 138m General Cargo "Royal", which is the most recent and publicly available benchmark useful for the scope. All the steps involved in the numerical process will be accurately described and external references to support the initial assumptions will be also provided. Particular attention will be dedicated to the sensitivity of those parameters which are playing a major role in the results achieved through the numerical approach employed for the study.

16.30- **GENERAL DISCUSSION & DRINKS RECEPTION**

DAY 2 PAPERS:

08.55-09.25 **COFFEE & REGISTRATION**

09.25-10.00 **SHIP PROPULSION PERFORMANCE MONITORING AND ENERGY MANAGEMENT: EXPERIENCES AND LESSONS LEARNED,** *Erik van Ballegooije, VAF Instruments, the Netherlands.* The paper will focus on the additional benefits offered via the full scale measurement of propeller thrust (and torque), in relation to fuel saving potentials and emissions reduction. By adding thrust measurements to the ship propulsion performance measurements, a whole new level of performance insights is opened due to the possible separation of the measured propeller performance from the hull performance. New insights are provided in the following areas as full scale propeller efficiency, efficiency loss when operating a controllable pitch propeller at constant RPM versus variable RPM, propeller cleaning and polishing, hull cleaning and coatings, propeller retrofits, hull modifications and hull trim. This new level of insights, provides unique opportunities to further improve the vessels propulsion performance during operation. Case studies of acual experiences and lessons learned will be shown and discussed, with respect to fuel saving potentials and operational insights, provided by the above mentioned thrust measurement and big data handling solutions, which are applied on various ships in service.

10.00-10.35 **THE EFFECT OF OPERATIONAL FACTORS ON CONTAINER SHIP FUEL PERFORMANCE,** *Lina Christensen, Technical University of Denmark, Denmark, Giles Thomas, John Calleya, UCL, UK, Ulrik Nielsen, Centre for Autonomous Marine Operations, Norway.* This study uses operational noon-report (NR) data from six identical container ships to evaluate the effect of different operational factors on fuel consumption. The ships have been built to the same design with the same machinery; thus, the ships present a unique opportunity to investigate the impact of operational factors. The purpose of this study is twofold; firstly, to investigate if operational factors influence fuel consumption, and secondly, to compare how different types of data collection systems capture such influences. Focus has been given to the effect of trim, a change in captain, and the effect of choosing different sister ships. The data analysis approach used minimum modelling, as it might have added uncertainty to the results and instead relies on filtering. Statistical tests are used to determine the importance of different factors. An ANOVA (Analysis of Variance) test is used to investigate if a change in a particular factor leads to a significant change in average fuel performance. A t-test, which tests for the difference in groups of data, is used to investigate how big an impact a factor has on fuel consumption. Crew was found to be the most important factor using NR data, while some factors had negligible impact on fuel performance. The NR was also compared to continuous monitoring data to assess the benefit of more frequent and potentially more accurate data. Using this data trim was found to be the most important factor, the large amount of data reduced the uncertainty in the results.

10.35-11.10 **IMPROVING THE ENERGY EFFICIENCY OF FERRIES BY OPTIMIZING THE OPERATIONAL PRACTICES,** *Marie Lützen, University of Southern Denmark, Denmark, Stig Eriksen, Jens Brauchli Jensen, Svendborg Maritime Academy, Denmark***.** Over recent decades, there has been an increasing focus on sustainable maritime transport. Stakeholders in the maritime industry have identified several methods of improving energy efficiency, and a large number of studies have been conducted. It is found that improving the energy efficiency is not only a technical issue and efficient operation is not achieved by only installing new equipment on board. Increasing the awareness of the daily operation is also important as significant reduction in fuel can be achieved through changes in operational practices. The aim of the study is to describe a system for energy optimization of ferries sailing on a fixed route. A system that can help the officers on board or shore staff to identify the most environmentally friendly way of operating the ship. The system is not a real-time decision support system, but a system for evaluation and reflection on voyages for determining best practice. For ferries sailing on fixed routes, different voyages can be compared to each other directly. If voyages of similar external conditions result in different energy consumptions, there is reason for analysing the voyages in detail and thereby identify where the extra consumption comes from. The study has been conducted and the system developed for a ferry sailing in Danish national waters. However, it is assumed that the results can easily be used as guidance for development of systems for other ferries and vessels with shorter sea passages, where the focus is on the work they perform as e.g. supply vessels.

11.10-11.35 **COFFEE**

11.35-12.10 **NORMALISATION OF SHAFT POWER FROM FULL SCALE MEASUREMENTS TO DERIVE THE CALM WATER PERFORMANCE OF A SHIP,** *Arun Puram Lakshmynarayanana, Dominic A. Hudson, University of Southampton, UK, M. Limelette, University of Western Britanny, France.* The need to monitor performance of ships at full scale has increased in recent years due to the influence of various factors like new regulations coming into force, environmental concerns and the need to improve fuel efficiency. Traditionally, noon-reports were used to carry out in-service monitoring of a vessel and to inform ship operators of the total fuel consumption per day. Automatic high-frequency data acquisition has, however, given the opportunity of continuous monitoring of a vessel during the course of her operations and offers the possibility to take preventative actions at shorter time intervals. However, most analyses to monitor the performance of a vessel through speed-power curves, or using Key Performance Indicators over time focus on filtering and 'binning' methods to derive the calm water condition. This paper presents a method to normalise the shaft power data recorded at high-frequency to derive the baseline (calm water power) curves by applying a shaft power correction. This is carried out using the added power correction due to wind and waves developed for sea-trial measurements - namely, STAWAVE-1 and STAWAVE-2. The calm water power is then obtained as a difference between the measured power and the added power. The results obtained using this normalisation method are compared to filtering techniques. The purpose of this study is to investigate the possibility of retaining more data without sacrificing accuracy, rather than to applying strict filtering constraints that can reduce datasets by up to 90%.

12.10-12.45 **SKIN - FRICTION DRAG MEASUREMENT OVER A RECENTLY CLEANED AND PAINTED SHIP HULL UNDER STEADY CRUISING VIA IN - SITU LASER-BASED MEASUREMENT,** *K A P Utama, I K Suastika, M L Hakin, M N Nurrohman, Teknologi Sepuluh Nopember, Indonesia, B Nugroho, R Baidya, J P Monty, N Hutchins, University of Melbourne, Australia, A K Yusim, University of Diponegoro, Indonesia, F A Prasetyo, Indonesian Bureau of Classification, Indonesia, M Yusuf, PT Dharma Lautan Utama, Indonesia, B Ganapathisubramani, University of Southampton, UK.* **A recent study on assessing the drag penalty due to hull roughness from a recently cleaned and painted ship hull is reported. The experiment is conducted on an operating ship (Roll-on/roll-off ferry) under steady cruising by measuring the velocity profile directly over the hull using a Laser Doppler Anemometer (LDA). The use of LDA allows a non-intrusive measurement without perturbing the flow over the ship hull. Here a window was installed on the underside of the hull, located approximately 25.5 m downstream of the bow of the ship during its annual dry-docking and hull cleaning (Rex around 80 millions). The window is enclosed within a water-tight enclosure that is constructed between the double bottom hulls which also houses the LDA and computer controlled traversing rail. The set-up allows the outward-looking LDA to measures the velocity gradient in the turbulent boundary layer formed over the hull (during steady sailing) across some traversable distance from close to the hull surface, to at least the end of the logarithmic region. Initial results show that there is a substantial increase in skin-friction drag for a recently cleaned ship-hull compared to the hydrodynamically smooth surface.**

12.45-13.40 **LUNCH**

13.40-14.15 **ASSESMENT OF BULBOUS BOW PERFORMANCE OVER OPERATIONAL PROFILES USING FULL SCALE DATA,** *Henry Way, University of Southampton, UK.* Bulbous bows are primarily designed to reduce wave-making resistance for the design speed and draught of a vessel. However, in real operations many ships are operated over a range of speeds and draughts due to loading condition, fuel price, and route. In these cases, the bulbous bow may actually be detrimental to vessel performance. In this study, the performance of bulbous bows for 7 sister LNG carriers is assessed using full scale data, recorded over a year at 2 samples/second. This study has developed a method of isolating the effect a bulbous bow has on fuel consumption, over an operational profile, from full scale data. Performance parameters of bulbous bows, as may be used in design, are defined to quantify how the bulbous bow is affecting the measured shaft power, and hence the fuel consumption over the actual operational profile. These performance parameters are calculated using regression techniques and with neural networks, and compared to each other. The 'performance' of a bulbous bow is defined as a change in shaft power for a given speed in Laden and Ballast conditions. A parameter representing bulb immersion is shown to be the main factor causing a change in shaft power. Use of this single parameter enables vessel operators to gain additional fuel savings through draught and trim optimisation with vessels in service. Additionally, it is shown that the performance of the bulbous bow in realistic operations should be considered at the ship design stage through a multi-criteria optimisation.

14.15-14.50 **CONSIDERATION OF ENVIRONMENTAL CONDITIONS FOR DETERMINATION OF MANOEUVRING CHARACTERISTICS BY SEA TRIALS,** *Carl-Uwe Böttner, Hanne Jansch, Federal Waterways Engineering and Research Institute Hamburg, Germany***.** There is a lack of recent sea trial data to validate manoeuvring performance prediction ap-proaches. This is especially the case for shallow water conditions. As a contribution to fill this gap a comprehensive measurement campaign was set up to precisely determine the manoeu-vring performance and characteristics of a mid-size multipurpose vessel. The campaign aims to provide a manoeuvring test case for numerical and physical models of manoeuvring characteris-tics and performance prediction. The sea trials were performed utilizing the MV MELLUM, a pollution control vessel patrolling along the German coast, owned and operated by the Federal Waterways and Shipping Admin-istration Germany. Her particulars are considered reasonable for physical and numerical model tests by a length of 80 m, a breadth of 15 m and draught of 5 m. She is a twin-screw with control-lable pitch propellers in ducts and conventional rudders. The sea trials were conducted in the German Bight, where the vessel is in daily operation. Even though this arrangement allowed a spontaneous start of the sea trials whenever calm weather conditions could be expected, the environmental conditions and particularly the tidal current showed a distinct impact on the ma-noeuvre determination. After introducing the full set-up of the sea trial measurement campaign, the presentation will provide a detailed discussion of the detection of the dominating environmental conditions and their consideration when processing the measured data to obtain accurate manoeuvring charac-teristics.

14.50-15.25 **FULL SCALE PERFORMANCE MEASUREMENT AND ANALYSIS OF THE SILVERSTREAM AIR LUBRICATION SYSTEM ,** *Luke De Freitas, Noah Silberschmidt, Takis Pappas, Johannes Johanneson, Silverstream Technologies, Denmark.* In this paper, Silverstream Technologies will discuss Full Scale Performance Measurement and Analysis of the Silverstream® System; an Air Lubrication Energy Efficiency Technology. This unique energy saving solution has the capability of being switched ON and OFF once installed giving owners the added benefit of measuring vessel performance in each condition after filtering of environmental and other factors. With successful completion of three installations; 2 x 115,000+ GT cruise ships and 1 x 40,000 DWT tanker, Silverstream Technologies have been involved in extensive data collection and analysis of ship performance. Through research and development together with access to in-service performance data from full scale installations, Silverstream have developed a practical and effective testing regime for assessing efficiency gains achieved from their Air Lubrication Technology. This methodology includes specific requirements for data collection, measurement and accuracy incorporating industry best practices and utilizing applicable methods outlined in ISO 19030, the results of which have been verified by ship owners and 3rd party organizations. This paper will detail the challenges encountered with on-board data collection encompassing the accuracy of measurements received from instruments, the methodology used for determining in-service performance results, applicability of ISO 19030 and the uncertainties that changing environmental factors introduce in achieving accurate results. Additionally, recommendations for improved data collection methods and analysis techniques to improve confidence in results obtained from Energy Efficiency Technologies will also be discussed.

15.25- **GENERAL DISCUSSION & EVENING DRINKS RECEPTION**

International Conference

FULL SCALE SHIP PERFORMANCE

24 - 25 October 2018, London, UK

To register, simply complete all sections of this form and return it with your payment to:
The Conference Department, RINA , 8-9 Northumberland Street London, WC2N 5DA
TEL: +44 (0)20 7235 4622
FAX: +44 (0)20 7259 5912
E-MAIL: conference@rina.org.uk

TITLE (Dr, Mr, Eur Ing):

NAME (as it should appear on name badge):

POSITION:

COMPANY (as it should appear on name badge):

INVOICE ADDRESS:

POSTCODE:
COUNTRY:
TELEPHONE:
FAX:
E-MAIL:

CONTACT MAILING ADDRESS (if different):

POSTCODE:
COUNTRY:
TELEPHONE:
FAX:
E-MAIL:

PLEASE INDICATE REGISTRATION FEE & METHOD OF PAYMENT:

☐ MEMBER, ☐ NON MEMBER, ☐ CONCESSION, ☐ AUTHOR

I enclose a cheque for: £
(made payable to RINA)

Please send me an invoice for : £

Purchase Order Number:

Bank Transfer details enclosed for: £

Please debit my credit card by: £

Card Number: (Visa/Amex/Mastercard)

Expiry Date: **Signature:**

How did you hear about this conference?

REGISTRATION FEE	By 24/09/18	After 24/09/18
RINA MEMBERS:	£650+VAT=£780	£750+VAT=£900
NON-MEMBERS:	£750+VAT=£900	£850+VAT=£1020

CONCESSIONS: *(Retired/Students etc.)*	£335+VAT=£402
PRINCIPAL AUTHOR	£140+VAT=£168
ADDITIONAL AUTHOR	£650+VAT=£780

The registration fee includes printed conference papers, lunch, refreshments, a CD of the papers and presentations after the conference, and VAT

CONFERENCE PAPERS
Delegates will receive a copy of the conference CD-ROM which will include the presentations, this will be posted out around 10-12 weeks after the conference.

Aditional copies of the conference papers will also be for sale after the event in both print and CD ROM versions. If you would like to order copies, please fill in the relevant sections.

I am unable to attend the conference, please reserve me _______ set(s) of Conference proceedings

Papers **£120** (members) ☐ **£140** (non-members) ☐

CD ROM **£120** (members) ☐ **£140** (non-members) ☐

For a full list of the Institution's Conference papers, CD-ROM's and other technical publications please contact our Bookshop Assistant on +44 (0)20 7235 4622 or via e-mail at: publications@rina.org.uk

PAYMENTS
Payment must be made in pounds sterling by Eurocheque, cheque drawn on a bank with a UK branch address, credit card (VISA/Amex/Mastercard) or bank transfer. Please note RINA requires payment before the conference date.
Account Name: The Royal Institution of Naval Architects;
Account Number: 10042127; **Account Code:** 160016
Bank Address: Royal Bank of Scotland PLC, Belgravia Branch, 24 Grosvenor Place, London, SW1X 7HP, UK.
IBAN No: GB14RBOS16001610042127
SWIFT No: RBOSGB2L

*VAT: Under UK Customs and Excise regulations delegates from all countries are required to pay VAT on any course taking place in the UK. Delegates from outside the UK may be entitled to reclaim this cost.

VENUE
The Venue for the conference is: RINA HQ, 8-9 Northumberland Street, London, WC2N 5DA, UK

ACCOMMODATION
Upon registration you will be provided with details of a hotel booking service offering reduced rate accommodation for conference participants.

CONTINUING PROFESSIONAL DEVELOPMENT
RINA Certificates of Attendance will be issued at the event, which contributes towards the Institution's Continuing Professional Development Scheme. For further details regarding the scheme please contact Giuseppe Gigantesco, Director, Professional Affairs on Tel: +44 (0)20 7235 4622 or e-mail: membership@rina.org.uk

STUDENT SPONSORSHIP
A number of sponsored places at this conference are available for Student Members of RINA. For more information, please contact Nick Cox, Professional Affairs, RINA on Tel: +44 (0)20 7235 4622 or e-mail:ncox@rina.org.uk.

PROMOTIONAL OPPORTUNITIES
Why not use this conference to promote your company's products and services? It provides an excellent opportunity to increase your profile and to network with a highly focused audience. We offer a number of cost effective options, including various conference sponsorship packages, exhibition space and literature distribution. If you are interested in any of these promotional opportunities please contact John Payten at JP Media Services, jpayten@jpmediaservices.com to discuss your individual requirements.

CANCELLATION CHARGES
Cancellations received in writing two weeks before the event takes place will be subject to administration charge of £200+VAT. Cancellations received after this time cannot be accepted and are subject to the full event fee. Delegates may be substituted; however, this must be sent in writing and confirmed with the conference Co-ordinator. It may be necessary for reasons beyond our control to alter the content and timing of the programme. In the unlikely event that RINA cancels the event for any reason, our liability is limited to the return of the registration fee.

PRIVACY
Personal data held by RINA will only be used in connection with RINA activities, and will not be passed to third parties for other use. Full details of RINA's Privacy Policy are available online.

☐ I wish to receive information on technical developments in or related to the maritime industry and on future RINA events. I understand that I may stop receiving such information at any time.

If you have any questions regarding this or any other RINA event please contact, our Conference Organiser on:

Tel: +44 (0)20 7235 4622 Fax: +44 (0)20 7259 5912
E-Mail: conference@rina.org.uk www.rina.org.uk/events