International Conference
THE DAMAGED SHIP II
The Royal Institution of Naval Architects

Conference Programme

The 2nd International Conference on Damaged Ships
WEDNESDAY 30th & THURSDAY 31st JANUARY 2013
AT THE RINA HEADQUARTERS, LONDON, UK

For further information visit:
www.rina.org.uk/DamagedShip2013

Call Laura on +44 (0) 20 7235 4622
or email conference@rina.org.uk
ONBOARD STABILITY COMPUTERS AND DECISION SUPPORT SYSTEMS - REGULATION ON DAMAGE STABILITY

J. Guilakse, JG Consultant Engineers, UK

The paper introduces a “regulatory requirement” for either onboard stability computers or shore-based support to ensure that certain systems on passenger ships of 120 m length or more, or having 3 or more main vertical fire zones, remain operable after a fire or flooding. These guidelines are in result “Guidelines on operational information for Masters of passenger ships for safe return to port by own power or under tow” MSC.1/Circ.1400.

Thus, builders, designers, owners and managers will need to remember that provision of a computer able to carry out damage stability calculations for any damage scenario will be required. Further, Flag Administrations introducing these regulations will need to ensure that the necessary stability information is available onboard the affected ships. The goal of an onboard stability computer, used as a survivability assessment system, is to provide useful recommender to ship operator so as to ensure the safety of life and ship. Decision support system infers calculated results from the damage stability and structural safety. The system shall provide proper methods based on inferred results, and give timely and appropriate instructions such as necessary ballasting plan considering stability and structural safety.

The purpose of this paper is to investigate information requirements to be provided and criteria of regulations and techniques that will be used in safety levels between existing ships and newbuildings, making continuous modifications of safety onboard, hence preparedness and emergency response services, even more imperative. In this regard, it is of characteristic that damage stability and safety are also giving way to some important truths: ships are vulnerable platforms, a fact that is further emphasized by traditional operational practice. The realization of raising awareness and training to maritime industry safety culture, striving to raise and uphold high safety standards in ship design and operation through a regime that aims for and supports continuous safety improvement. The author, having played a protagonist role in many major contemporary rule development on damage stability and having been involved at the core in implementing these developments to the design of modern safety-critical ships, will demonstrate the aforementioned notions and truths as well as the implications of contemporary developments on the design and operation of passenger ships with suitable examples from existing ships and newbuildings.

THE DEVELOPMENT AND IMPACT OF CURRENT AND POSSIBLE FUTURE NATIONAL AND INTERNATIONAL DAMAGE STABILITY REGULATIONS.

K. Widmark, Maritime and Coastguard Agency, UK

Building on papers presented by the authors at the previous ‘Damaged Ship 2011’ conferences, this paper will confine and critically discuss the recent and potential future development of national, regional and international damage stability regulations etc. in light of recent incidents and events. The impact of such legislation etc. will be considered with respect to the work of designers, regulators and educators. The paper will also consider the availability of suitable analytical techniques for safe ship design, development and operation, hence investigating how such regulations and techniques can be utilised in the development of compliant and near-optimal design solutions with respect to safety / survivability and other performance criteria. The survivability performance of a damaged ship will be discussed from a range of perspectives such as flooding, stability, strength, seakeeping, evacuation etc. The paper will look at the development of various regulations over the years and will attempt to highlight and discuss potential future developments. Recent and impending developments will be scrutinised that address with respect to new and existing regulations and also potential future developments. The concepts and principals adopted in new regulations will be discussed with respect to their impact on the development of designs, their suitability for applicability to certain specific ship types and environments and their impact on design development and ship operation. Hence, the question as to how these new design and operational regulations, some potentially conflicting and diverse in nature, can be applied as a coherent whole for practical application within the design process will be addressed. As part of this, current issues surrounding regulations will be discussed along with a critique of recent research and the needs of the shipping industry. The impact of these will be investigated by considering the practicing ship designer, regulators assessing and ensuring the inherent and operational safety of new designs and major conversions and also those involved in the education of naval architects and seafarers.

SMALL PATROL BOATS: DESIGN FOR SELF RIGHTING

A Nazarov, Albatross Marine Design, Thailand

Self-righting concept is widely applied on patrol and rescue boats enabling safe operation in extreme weather conditions; this feature is often specified by operators for such designs. The questions that often stay unanswered are probable conditions of capsize and cost of self-righting solutions. Present paper examines self-righting phenomena from point of view of practicing designer. Self-righting and flooding process is studied for intact and damaged craft conditions, with affect of flooding rates for superstructures and inflatable volumes. Accelerations during capsize and their impact on crew/personnel, damages and flooding process are touched upon. Results of scale model testing on surf are presented showing capsize conditions and measured capsize parameters. Recommendations and system design are touch upon. Sample design briefs are presented for different types of self-righting craft.

THE DAMAGED SHIP - NOTIONS AND TRUTHS

D Vassalos, University of Strathclyde, Scotland, UK

Damage stability is not any longer limited to considering the properties of the residual G1 curve or damage freeboard alone. For passenger ships, in particular, such flooding, stability, strength, seakeeping, evacuation etc. The paper will build on papers presented by the authors at the previous ‘Damaged Ship 2011’ (also see The Naval Architect April 2011) and ‘Design and Operation of Passenger Ships with Special Reference to Damage Stability’.

Recommendations are provided for self-righting measures, sample design briefs are presented showing capsize conditions and measured capsize parameters. The concepts of damage survivability and safety tolerance are illustrated and raising awareness to stimulate and nurture a maritime industry safety culture, striving to raise and uphold high safety standards in ship design and operation through a regime that aims for and supports continuous safety improvement. The author, having played a protagonist role in many major contemporary rule development on damage stability and having been involved at the core in implementing these developments to the design of modern safety-critical ships, will demonstrate the aforementioned notions and truths as well as the implications of contemporary developments on the design and operation of passenger ships with suitable examples from existing ships and newbuildings.

THE DEVELOPMENT AND IMPACT OF CURRENT AND POSSIBLE FUTURE NATIONAL AND INTERNATIONAL DAMAGE STABILITY REGULATIONS.

K. Widmark, Maritime and Coastguard Agency, UK

Building on papers presented by the authors at the previous ‘Damaged Ship 2011’ also (see The Naval Architect April 2011) and ‘Design and Operation of Tankers 2011’ conferences, this paper will confine and critically discuss the recent and potential future development of national, regional and international damage stability regulations etc. in light of recent incidents and events. The impact of such legislation etc. will be considered with respect to the work of designers, regulators and educators. The paper will also consider the availability of suitable analytical techniques for safe ship design, development and operation, hence investigating how such regulations and techniques can be utilised in the development of compliant and near-optimal design solutions with respect to safety / survivability and other performance criteria. The survivability performance of a damaged ship will be discussed from a range of perspectives such as flooding, stability, strength, seakeeping, evacuation etc. The paper will look at the development of various regulations over the years and will attempt to highlight and discuss potential future developments. Recent and impending developments will be scrutinised that address with respect to new and existing regulations and also potential future developments. The concepts and principals adopted in new regulations will be discussed with respect to their impact on the development of designs, their suitability for applicability to certain specific ship types and environments and their impact on design development and ship operation. Hence, the question as to how these new design and operational regulations, some potentially conflicting and diverse in nature, can be applied as a coherent whole for practical application within the design process will be addressed. As part of this, current issues surrounding regulations will be discussed along with a critique of recent research and the needs of the shipping industry. The impact of these will be investigated by considering the practicing ship designer, regulators assessing and ensuring the inherent and operational safety of new designs and major conversions and also those involved in the education of naval architects and seafarers.

This represents a preliminary program, which may be subject to change.
J ASSESSMENT OF THE RESIDUAL HULL GIRDER ULTIMATE STRENGTH OF A DAMAGED VESSEL SUBJECTED TO VERTICAL AND HORIZONTAL BENDING MOMENTS
E Vanderhorn, M Lee, G Wang, ABS, USA
Current methodology for the rapid evaluation of the residual hull girder ultimate strength (HGUS) of damaged vessels primarily relies on proven analysis techniques from existing design guidelines, such as the IACS Common Structural Rules (CSR). As these guidelines were developed for symmetrical intact vessels, their application in calculating the residual HGUS must be re-evaluated to identify where improvements can be made to provide a more realistic estimate of the damaged condition.

This paper compares the current CSR methodology against an improved HGUS analysis procedure which considers damage-induced geometric asymmetry subjected to vertical and horizontal bending moments. Using a simplified method based on the incremental-iterative procedure, two convergence criteria are used to determine the rotation and translation of the neutral axis due to asymmetries in the geometry and loading. A case study of two incident responses is presented to demonstrate the effect of combined bending moments on the residual HGUS of asymmetrically damaged vessels.

APPLICATION OF AN IMMERSED BOUNDARY METHOD TO SIMULATING FLOW AROUND MARINE VESSELS FOR FLOW-INDUCED STABILITY ANALYSIS
K Yang, Inha University, Korea
Flow-induced stability analysis on marine vessels including damaged ships is quite challenging because simulation of flow around them is very difficult due to the complexity of vessel and the surface of the free surface. The conventional approach using body-fitted or unstructured grids demands much time in dynamic grid generation, and yields slow convergence of solution. Since a flow-induced stability analysis must be based on accurate simulation results, a more efficient way of simulating flow around marine vessels, without sacrificing accuracy, is desirable. In this paper we present the effect of an immersed boundary method to simulate vessel flowing. An immersed boundary method facilitates implementation of a complicated vessel shape on a Cartesian grid system. The 2nd-order accuracy of our simulation is maintained with the aid of an adaptive mesh refinement technique. A volume of fluid (VOF) method and an LES model are also incorporated to resolve the motion of the free surface and the turbulent eddies, respectively. In this presentation we will demonstrate the effectiveness of the immersed boundary method we adopted, by presenting the simulation results of the flow around a floating ship of complex geometry in the presence of tidal waves.

DIRECT BREP SOLID INTEGRATION: A STEP TOWARDS VIRTUAL SHIP’S ‘HIGH RESOLUTION’ STABILITY
M Pommelet, Stanlow Marine
As long as ship’s master model was a traditional lines drawing, the hydrostatic and stability calculations were based on 2D line integration. The initial hydrostatic solvers have then simply transcribed this manual process by digitizing the physical lines drawing, allowing to speed-up the calculations and to process more and more complex ship models.

But finally, following to computer’s growing power and affordability, the traditional lines drawings have been gradually replaced by 3D surface models, so that most of today’s hulls are now designed and fairness as 3D surface models (we announced this trend in our 1984 RINA paper: ‘Three-Dimensional Representation of Ship Geometries’). Although the common sense shows that compartments and tanks are solids by nature, this deep mutation of the hull design process hasn’t yet brought many changes in the field of hydrostatic and stability calculations, which still remains most often a line process, in which the surface- lines conversion introduces significant time, interactivity and accuracy wastes. The goal of this paper is therefore to discuss the benefits of this new approach as well as its computational cost, thanks to our experience in developing MAAT Hydro, our new BREP Solid based hydrostatic solver.

GLOBAL STRENGTH ASSESSMENT OF DAMAGED STEEL SHIPS DURING EMERGENCY RESPONSE
J M Underwood, A J Stepey, J I R Blake, R A Shennan University of Southampton, UK
During a damage incident where the vessel remains afloat and in need of assistance, assessment of the residual strength of the hull structure is critical in attempts to prevent loss of life and to avoid potential environmental disaster and ensure the most economic recovery mechanism for the vessel.

This paper proposes and demonstrates the application of a novel method to assess the residual strength of a damaged vessel. This approach allows greater definition of the damage event than is currently available to emergency response services, whilst operating within the timescales for crew safety. The method draws on the strengths of finite element analysis to assess the damaged strength of large generic ship type structures, storing this data within a response surface. The ultimate collapse strength of the damaged ship can then be rapidly assessed by implementing the procedure of progressive collapse analysis through the response surface. This allows the effects of the damage event on the larger structural arrangement to be assessed, accounting for both interframe and overall collapse modes that may develop in the structure across multiple frame bays. The paper outlines the method, the results of this method in comparison to current best practice and provides guidance for the behaviour of damaged steel structures.

RESIDUAL CAPABILITY OF DAMAGED COMPOSITE SHIP STRUCTURE
J Davies, University of Southampton, UK
Composites are used in the marine industry due to the ability to tailor their properties to specific designs as well as favourable strength to weight ratio, corrosion resistance and low thermal expansion. Conversely low stiffness properties require top-hat stiffened shell laminates in primary structures for the marine industry including deck, hull and super-structures. Catastrophic failure is often avoided in damage events occurring in composite marine structures but can lead to cracks, delaminations and debonds. The effect of such in-service damage on the residual capability of the vessel must be fully understood in order to develop both efficient designs and deal with post damage events. It is important to determine if the damaged structure can be rapidly assessed and precautions taken to ensure safety of the crew and vessel, but this must be done cost efficiently. To reduce expensive maintenance costs it is imperative to know if damage must be fixed immediately or if it poses no threat in the near future or that it is safe to proceed.

This paper investigates the effects of damage parameters on the residual capability of multi-stiffened top-hat marine structures. Non-linear finite element models accurately assess the crack propagation, progressive damage and ultimate collapse of the structure and provide guidance for post-damage maintenance.

CONTAINER SHIP WRECK REMOVAL
K Letchi, London Offshore Consultants Ltd., UK
In recent years container ship wreck removals have presented a huge challenge for salvors. The author will review recent high profile container ship wreck removals and give an insight into the particular issues container ship wreck, focusing on the structural integrity, removal of containerised cargo and associated stability issues.

Removal of containerised cargo in remote locations with limited resources complications adds to the challenge. The paper presents a number of techniques to engineer the removal of the cargo and subsequently the vessel.

RESIDUAL STRENGTH ASSESSMENT OF AN ALUMINIUM PATROL BOAT
T Mogno, T Aka
Defence Science and Technology Organisation, Australia
Marine-grade aluminium alloys are being increasingly used as the hull material of naval vessels, particularly in the case of high speed patrol vessels for which the requirement for reduced structural weight is critical. The demand for operation of naval vessels in harsh seaway environments, and the risk of collision, grounding and combat damage, has led to increased interest in the marine industries of damage tolerance and damage control procedures to evaluate the residual strength of the hull-girder. The Defence Science and Technology Organisation, Australia, is undertaking a range of research programs in the area of structural integrity of naval vessels including improvements for the assessment of reduction in ultimate strength of welded aluminium ship structures due to various damage scenarios.

This paper presents the effects of damage severity and location on the residual strength of a generic aluminium hull structure with scantlings typical of a patrol vessel. The state-of-the-art rapid assessment procedure ISFEM (Intelligent Superstructure Finite Element Method) is used for the investigation. Damage scenarios defined in Det Norske Veritas (DNV) High Speed Light Craft (HSLC) rules and Lloyd’s Register Rules and Regulations for the Classification of Naval Ships are considered.
Registration fee includes printed conference papers, lunch, refreshments, reception, a CD of the papers and presentations after the conference, and VAT.

**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 the RINA, Headquarter, London, UK.

**Evening Drinks Reception**
Following the end of day one (30 January 2013), delegates are invited to attend an evening drinks reception at the conference venue.

**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 Yuen Yee Pang, Professional Affairs, RINA on Tel: +44 (0)20 7235 4622 or e-mail: ypang@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 the Conference Organiser 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.

**Data Protection**
Personal data is gathered in accordance with the Data Protection Act 1998. Your details may be passed to other companies who wish to communicate with you offers related to your business activities. Please tick the box below where appropriate: Please do not pass my information to any third party.

I wish to receive email notification of future RINA events or publications if you have any questions regarding this or any other RINA event please contact, Laura Whelan, Conference Organiser, on:
Tel: +44 (0)20 7201 2401 Fax: +44 (0)20 7259 5912 E-Mail: lwhelan@rina.org.uk www.rina.org.uk/events