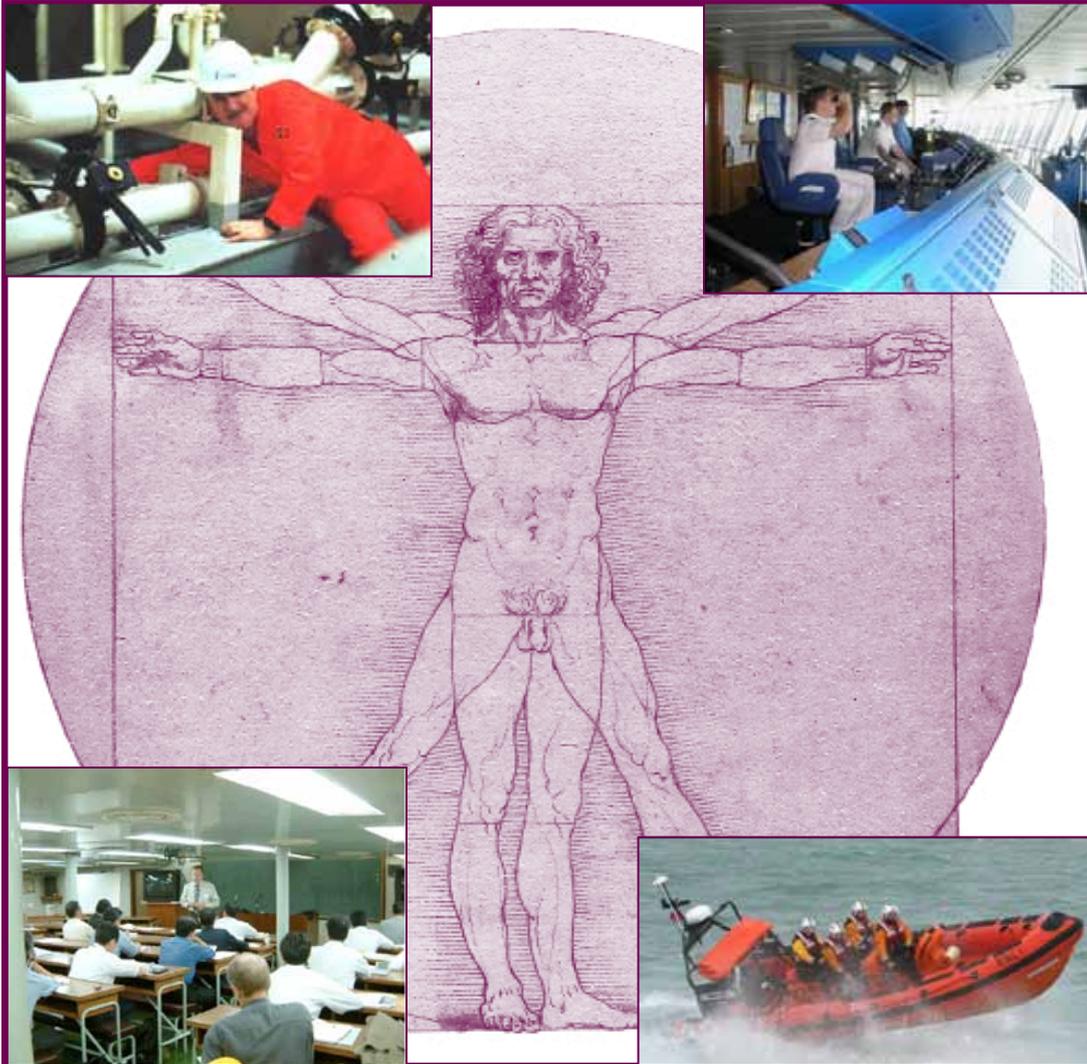


RINA

The Royal Institution of Naval Architects



International Conference

HUMAN FACTORS IN SHIP DESIGN AND OPERATION

16 - 17 NOVEMBER 2011
RINA HQ, LONDON

day 1

- 08.30 - 09.00 **COFFEE AND REGISTRATION**
- 09.00 - 09.30 **KEYNOTE SPEECH**
G Rudgley, Sea Systems Group, UK
- 09.30 - 10.05 **THE HUMAN ELEMENT COMPETENCY REQUIRED FOR DESIGN APPRAISAL**
O. Walker, Lloyd's Register, UK
Inclusion of ergonomic requirements in Class Rules can be achieved by two means; by introducing specific human element requirements into the Rules and by making current requirements with human element implications more explicit. Any attempt to address the human element in Rules requires that the competence of surveyors is increased just as the Rules are revised. Raising awareness of the subject is an essential first step if the benefits of improved design are to be realised. This paper outlines how Lloyd's Register is striving to address the Human Element in the Rules whilst at the same time putting in place mechanisms to ensure surveyor competency is met. The paper discusses the development of internal Human Element awareness training, the first step towards achieving a competent workforce in this area.
- 10.05 - 10.40 **THE HUMAN FACTOR IN THE INVESTIGATION OF MARINE CASUALTIES, AMENDMENTS TO MANILA STCW78 2010**
J Alvite Castro, A Coruña University, Spain
Due to the rebound experienced maritime accidents in 2010, the investigation of marine casualties in requires information on the human factor, particularly in the organizational factors and ergonomics. This study was carried out to develop a systematic series of actions to implement the method ILO / IMO, based on amendments to STCW78 Manila 2010. The result serves to facilitate the identification and sequencing of the acts or dangerous decisions that have been involved in the development of maritime casualty as well as the underlying factors behind them. The aim is to finally determine the existing security problems and to develop appropriate corrective measures and their inclusion in the "European Maritime Casualty Information Platform" (EMCIP)
- 10.40 - 11.10 **COFFEE**
- 11.10 - 11.45 **EFFECT OF ENVIRONMENTAL FACTORS ON HUMAN PERFORMANCE ON BOARD SHIPS - DOES INCREASING NOISE LEVELS BRING CREW PERFORMANCE DOWN?**
R. Emek Kurt and O. Turan, University of Strathclyde, UK
Most shipping accidents can be attributed to human factors and a main influence on this are the environmental conditions which the human inhabits. These conditions have a high degree of interdependence between the different factors on board ships, which has prevented researchers from modelling all of them together to effectively estimate human performance and comfort on board. However, investigating each factor independently is the first step towards modelling the effect of all the environmental factors. This paper analyses the effects the different factors have on human performance. It also studies in-depth one of the main environmental factors: noise from the engines and machinery. The case study will focus on the effects that noise exposure has on human performance and reliability deduced from the results of experiments carried out by the authors of this paper on crew members in ship simulators.
- 11.45 - 12.20 **HUMAN FACTOR DESIGN IN UK DEFENCE**
A Springall, Defence Engineering and Support, Sea Systems Group.
Human Factors in defence is all about delivering effective and available military capability. The defence engineering enterprise needs to be able to identify and capture human factors issues to enable resources to be assigned for their management, solution development and implementation through Human Factors Integration. The paper will discuss several areas where the author has developed Human Factors policies and guidance for Ship Accommodation Design, High Speed Craft Design and Ship Husbandry.
- 12.20 - 13.30 **LUNCH**
- 13.30 - 14.05 **MANNING CENTRED DESIGN IN THE NETHERLANDS**
W.M. Post, TNO Human Factors, The Netherlands
All navies have difficulties with determining in an early design phase the number of people that are needed to sail the planned ship. Later on, new questions will arise: How do you reach a cost-effective solution? How do you identify uncertainties? How do you coordinate all the stakeholders and experts involved in this process? And when a design program has started, other typical question will arise: how can you get a quick insight in the consequences of design choices? How do you account for your design decisions? TNO have reflected on a dozen of human centered design projects. They unified knowledge, methodologies and tools in one Manning Centered Design framework, aimed at reducing the complexity of such design problems, managing the risks involved, and capturing the applied knowledge and experiences for later use. In this paper, the framework will be explained and illustrated by two DMO projects in which it is recently applied.
- 14.05 - 14.40 **ENHANCING SAFETY PERFORMANCE WITH A LEADING INDICATORS PROGRAM**
C. Tomlinson, ABS, B. Craig, Lamar University, M. Meehan, AP Moller-Maersk
Encouraging safe working practices to improve safety performance requires an understanding of the social and organizational factors that foster professionalism in the seafarer. Safety culture mapping and safety performance monitoring through leading indicators are two key initiatives that may be able to improve safety performance. This paper presents the results of research undertaken by ABS and Lamar University, USA with AP Moller-Maersk. It details a method whereby marine organizations can self-assess their safety culture and/or develop their own leading indicators of safety programs. The paper will discuss the utility of different types of metrics for a leading indicators program, the safety culture questionnaires, safety performance datasheets, data analysis and how to incorporate the results into an organization's continuous improvement program.
- 14.40 - 15.10 **COFFEE**
- 15.10 - 15.45 **ASSESSING NAVIGATION PERFORMANCE OF DECK OFFICERS DURING EXTENDED NAVIGATION SIMULATIONS**
A. Kircher, M. Lützhöft, Chalmers University of Technology, Sweden
"Good seamanship" is used to describe behaviour of deck officers who navigate according to a commonly accepted set of norms. These offer a certain flexibility, but most of them are covered by laws and regulations. The navigation performance is also of interest, and there is a connection between the terms. The scope of the paper is to analyse whether subjective and objective measures can be used to describe good seamanship and performance, and the relationship between these in different collision situations. During an extended simulator study, 50 deck officers' navigation performance was assessed. Of main interest was if these different navigation performance scores are comparable. Data show that the selected objective and subjective measures alone may not be enough for a comprehensive picture, but are suitable for limited scenarios for training.
- 15.45 - 16.20 **FATIGUE AND PERFORMANCE IN BRIDGE AND ENGINE CONTROL ROOM WATCH KEEPING ON A 6 ON/6 OFF WATCH REGIME**
P.Maurier and P.Corrigan, Bureau Veritas, M.Barnett, D.Gatfield, C.Pekcan and G.Clarke, Warsash Maritime Academy and T.Åkerstedt, SRI
Reduced onboard stress levels and increased workloads potentially lead to a higher risk of accidents through human error. Project HORIZON is a European funded research project that seeks to investigate the problem of seafarer reliability, and to deliver measures that will help alleviate the safety hazards caused by fatigue. For this purpose, a realistic scenario was developed, in which watch keeper cognitive performance and fatigue levels were measured, using the simulator facilities at Warsash, to provide a 7 day continuous voyage. Analysis of the results shows a significant impact of the 6 on / 6 off watch pattern on the fatigue and performance of seafarers. It is hoped these results will lead to better fatigue management systems being developed, in order to improve the safety and reliability of ship operations and the welfare of seafarers
- 16.20 - **EVENING RECEPTION**

08.30 - 09.00 COFFEE AND REGISTRATION

09.00-09.30 THE EFFECTS OF HUMAN FACTORS ON SHIP COLLISION FREQUENCY

M. Hänninen, Aalto University School of Engineering, Finland
This study presents a tool for modeling the effects of various human factors on ship collision risk. It is possible to examine how various human and organizational factors affect each other and how they influence the collision frequency. In the future, the tool will also model the effects and costs of various decision alternatives. Then it can be utilized as an aid in choosing the optimal risk control options for maritime traffic. The presented Bayesian network model considers the probability of two ships not making evasive maneuvers while the ships are on a collision course. The model includes various variables describing human and organizational factors. Examples of the effects when applying the model to the maritime traffic in Gulf of Finland are presented and discussed.

09.30 - 10.05 PERCEPTION OF RISK - SOME CONSIDERATION OF THE IMPACT ON THE INCLUSION OF HUMAN FACTORS IN RISK ASSESSMENTS

V. Pomeroy, University of Southampton, UK
Human performance is more influenced by the individual's perception of the risks involved than by the actual risk. The work carried out by Bailey and Ellis in Cardiff has provided useful data on how individuals in the marine industry perceive the risks that they might face, and their assessment forms the basis of an exploration in this paper of the possible interpretation against evidence from incidents. The human element is seen as important in improving marine safety and any meaningful risk assessment must accommodate the contribution from people - designers, constructors, managers and operators. The paper will consider the evidence from Bailey and Ellis, place this in context and draw some inferences for the risk analyst.

10.05 - 10.40 SAFETY CONSEQUENCES ONBOARD SHORTSEA SHIPS DUE TO CREW INNOVATION

W. Post, TNO, The Netherlands
The paper investigates an alternative assignment of manning on board Dutch coasters to show that the current level of safety is maintained when monodisciplinary Chief Engineers are replaced by Maritime Officers (Marofs), combined with 24 hours shore support. A Marof has received education in navigational as well as engineering skills. The concept was compared to the traditional assignment in a study which involved 21 modern shortsea ships in over 16,000 shifts. Measurements were provided by Masters, Chief Mates and Chief Engineers c.q. Marofs. During their work, they answered questions about the specific conditions, the navigational and engineering process, and the safety outcome. The results indicate that sailing with a Marof combined with shore support is at least as safe as sailing with a Chief Engineer.

10.40 - 11.10 COFFEE

11.10 - 11.45 MAPPING OF WORK AREAS IN A PLATFORM SUPPLY VESSEL (PSVS): A CASE STUDY

K. Nordby, S. Komandur, C. Lange and A. Kittlsen, Aalesund University College, Norway
When designing ship-bridges there is a need to map and mediate the structure of existing ones from a user's perspective to all participants in the process. This work reports on one such approach in the context of the initial phases of a project for creating a cutting edge ship bridge design. The data was gathered in a field study on board a ship, and an image database was created for equipment and work zones in passive and active conditions. The mapping resulted in identification and mapping of five different interest areas that were critical for co-designing. Emphasis was placed on capturing all the main features of the bridge and their use. The data served as preliminary input in the early stages of design and for wholesome review of the workspace on a ship bridge of operation vessels for next generation bridges.

11.45 - 12.20 MARITIME PLATFORM HABITABILITY ASSESSMENT

A. Woolley, M. Riding, V. Pit and R. Mead, DSTO, Australia
The Defence Science and Technology Organisation has embarked on a research program to deliver to the Royal Australian Navy a capability to assess the conformance of maritime platform designs against habitability requirements. Habitability has been defined to encompass volumetric compartment space requirements, victualling and platform environment. The primary deliverable will be a platform habitability assessment software tool, which will output a measure of habitability conformance, known as the Platform Habitability Index. It will allow for identification of habitability deficiencies and therefore enable risk identification and the development of risk mitigation strategies. This paper presents an overview of the research program and how it may be utilised to provide holistic platform assessment during mission scenario simulation.

12.20 - 13.30 LUNCH

13.30 - 14.05 ANALYSIS AND EVALUATION OF STATIC WORKING POSTURES ON CREW, TO DETERMINE ERGONOMIC RISK ON BOARD VESSELS

A. Lossa, D Avilla, Cotecmar, Colombia
COTECMAR generated a research program to integrate Human Factors into the ship design process in order to obtain a vessel with improved conditions of operability, maintainability and habitability. This program was designed to assess Ergonomic Risk on board vessels in three phases: (1) Physical environment, (2) Static working postures and (3) Mental workload. In order to achieve this aim, protocols based on current norms and evaluation methodologies were developed to record the information. Working closely with the crew relevant information, including the feedback from the end users, was captured this way. The latter was employed to improve the usability of the furniture, devices, and spaces previously designed, as a response to the vessel's performance requirements in terms of ergonomics. The paper presents the results of this effort.

14.05 - 14.40 ENHANCING MARINE ERGONOMIC DESIGN VIA DIGITAL HUMAN MODELING

T. Dobbins, STResearch, J. Hill, Trident Marine, S. McCartan, Coventry University, UK
Small fast craft that suffer high level of repeat shock and whole body vibration, so there is still a need to support the marine sector to facilitate better ergonomic design. More effectively assessed ergonomic interaction within the 3D CAD environment would mean that physical mock-ups would be more effective. The potential to achieve this exists via the use of Digital Human Models (DHMs). DHMs are used within the design industry but have not been found to be effective for marine applications. To address this issue, motion capture analysis was undertaken to quantify the space envelopes and ranges of motion in marine environment. Subsequently DHMs have been used to develop console, cockpit and cabin spaces with the required ergonomic features to support C2. This paper describes the development process of marine-specific DHMs and their use in the optimization of ergonomic aspects of marine craft design.

14.40 - 15.10 COFFEE

15.10 - 15.45 DEVELOPING A STANDARD METHODOLOGY FOR DYNAMIC NAVIGATION IN THE LITTORAL ENVIRONMENT

F. Forsman, J. Dahlman, Chalmers University, Sweden and T. Dobbins, STResearch Ltd, UK
The safe operation of fast craft within the littoral environment places a high workload on the vessels crew and specifically the navigator, who has to avoid natural features as well as other vessel traffic. This task is subsequently made more difficult by poor weather and sea conditions. Due to the high operational tempo and the dynamic nature of transiting the littoral environment, a simple methodology was developed that would be robust in high workload conditions. The model is based on three components; i) the conduct of changes in direction/course, ii) the information required by the coxswain to perform the course change effectively and safely, and iii) the information required by the navigator to plan and direct the course change. This paper will describe the methodology, the concepts behind its development, and how standardised procedures enhance safety, operational effectiveness and interoperability.

15.45 - 16.20 SHOCK MITIGATION SEAT TEST AND EVALUATION PROGRAMME

J. Colwell, DRDC, Canada
Military personnel on small high speed craft experience sustained extreme motions and repeated high-g slam impacts. Shock mitigation seats reduce the negative effects of this severe environment on health and safety. Most shock mitigation seat technologies provide protection from vertical high-g shocks, but it is also important to provide protection from lateral high-g shocks. DRDC Atlantic is pursuing an R&D initiative to reduce the risk of acute and chronic injury to personnel serving in small high speed craft. This programme seeks to improve the state of the art for modeling, simulation, test, and evaluation of shock mitigation seat technologies.

16.20 - GENERAL DISCUSSION

