The Royal Institution of Naval Architects

Marine Design 2015

International Conference on
Marine Design 2015

2-3 September 2015, London, UK

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08.30-09.00 **COFFEE & REGISTRATION**

09.05-09.30 **DESIGN-DRIVEN INNOVATION: NEXT GENERATION WIND FARM MOTHERSHIP FOR THE NORTH SEA**

D. Boote, F. Galleggioni and T Colaianni DITEN, Genoa University, Genoa, Italy, S. McCartan and T. Thompson EBDIG-IRC, Department of Industrial Design, Coventry University, UK, Flliopulos, Knud E. Hansen A/S, I McFarlane, Romica Engineering Ltd, UK, B. Verheijden, Academy Minerva, Groningen, NL, C Anderberg and H Phalm, Division of Maritime Human Factors and Navigation, Chalmers University, SE

An analysis of the offshore wind market identified the challenges of vessel financing compared to the oil & gas sector, as a unique opportunity for a common platform technology vessel. The concept presented has an innovative WFSV launch/recovery system enabling a conventional OSV platform to be adapted into a mothership role, resulting in a more cost effective O&M solution.

09.30-09.55 **A SWATH MOTHERSHIP CONCEPT FOR THE FAR SHORE WIND FARMS USING THE ENVIRONMENTAL PSYCHOLOGY NETWORK MODEL**

S McCartan, L Moody and T Thompson, EBDIG-IRC, Coventry University, UK, B Verheijden, Academy Minerva, Groningen, NL, D Boote and T Colaianni DITEN, Genoa University, Genoa, Italy, I McFarlane, Romica Engineering Ltd, UK, C Anderberg and H Phalm, Division of Maritime Human Factors and Navigation, Chalmers University, SE

09.55-10.20 **LANDLUBBER TO SEAMAN – AN INDUSTRIAL DESIGN IN THE PROCESS OF GETTING HIGHLY SPECIALISED ONSHORE PERSONNEL TO WORK OFFSHORE**

M.M.de Monchy and B.D.Smit, DAMEN Shipyards, NL

This paper describes the user centred design process of creating an offshore work and leisure solution. By means of qualitative research methods, such as interviewing, creative sessions and story boarding, design insights were established. In turn, these insights were used to create a design solution concept for an offshore vessel. The design concept is based on user experiences and tailored towards the user to provide with the needs for land-based specialists in an offshore environment.

10.20-10.45 **COFFEE**

10.45-11.10 **EMOTIONAL DESIGN AND THE EXTERIOR STYLING DEVELOPMENT OF A WFSV**

N Crea, E Stubbs, A Barrett, S McCartan and T Thompson, EBDIG-IRC, Coventry University, UK, B Mainprize, Mainprize Offshore Ltd, UK

This paper reviews current examples of exterior styling in the commercial vessel industry and the associated benefits to both brand and user (crew). Several exterior styling proposals for a WFSV are presented and reviewed in the context of manufacturing process and associated costs.

11.10-11.35 **CATAMARAN YACHTS: STYLING TRENDS AND DESIGN PRACTICES**

A.Nazarov, A.Jabtanom, A.Leeprasert, T.Phormtan, and P.Suebyiw, Albatross Marine Design, THAILAND

This paper presents a summary of styling trends, architectural types, layout solutions and design innovations, for catamarans below 24m in length, based on the extensive experience of Albatross Marine Design. Special attention is given to superstructure configurations, where differences in aerodynamics have been studied. Common design problems are reviewed and the advantageous design parameter ranges, where catamarans show their benefits, are identified. Catamaran design guidelines are delineated with associated rationales for their shapes, layouts and engineering feasibility.

11.35-12.00 **DESIGN-DRIVEN INNOVATION: A PROPOSAL FOR IMPROVING THE SUSTAINABILITY OF FREIGHT TRANSPORT IN IRELAND THROUGH A MODAL SHIFT TO COASTAL VESSELS**

S McCartan and T Thompson, EBDIG-IRC, Coventry University, UK, G Lynch, EBDIG, NMCI, IRL

This paper presents a Design-Driven Innovation scenario for the use of the coastal waterways of Ireland for both freight and passengers, based on the EU MoS (Motorways of the Sea) proposal. There are two key objectives of the EU MoS proposal, to reduce road transport congestion by direct replacement with water based transport routes and to reduce transport CO2. The congestion aspect relates to the cost of motorway infrastructure and the delays in journey time. A preliminary business model was developed to determine the feasibility of the proposal for a range of vessels. This was based on estimations of vessel cost, infrastructure costs, as well as their associated operating costs and CO2 emissions. These being offset by the average indicative motorway infrastructure costs and reduction in annual road freight transport volumes enabled the potential CO2 and operational cost reductions to be identified, with a sensitivity analysis of changes in operations costs and fuel taxation. Statistical analysis of national annual road freight transport was carried out using the EU Eurostat database to determine potential freight volumes that this integrated transport proposal could support. Several vessel platforms and concepts were evaluated, including high-speed catamaran ro-ro ferries and a new vessel sector the Cruise-Logistics-Ferry (CLF).

12.00-13.00 **LUNCH**

13.00-13.25 **SUSTAINABLE LUXURY CATAMARAN SUPERYACHT (SLCS)**

S McCartan, A Barrett, L Swinfield and T Thompson, EBDIG-IRC, Coventry University, UK, B Verheijden, Academy Minerva, Groningen, NL, R Shouten and J Schaffers, Feadship, NL

This paper reports on a collaborative professional practice project engaging in Design-Driven Innovation. The aim of which was to examine a new market sector of a sustainable luxury superyacht based on a catamaran platform for the South East Asian market, informed by the innovative 'Future Concept Feadships' as well as the DDI insights of EBDIG-IRC. The catamaran platform has recently arrived in the superyacht sector at 40m Loa, by comparison the World's largest superyacht has an 180m Loa (Azzam, 2013). Whereas, in the commercial vessel sector Incat have recently completed a 99m Loa LNG fuelled gas turbine powered catamaran ferry capable of 58knots, which was designed to compete with short air travel routes. Informed by this innovative platform, the SLCS proposal was developed to address the significant market opportunity of the sector between superyachts and cruise ships. The technology innovations of the LNG fuelled gas turbine catamaran platform and the implementation of Passive Design act to reduce CO2 and other emissions, compared to other vessel platforms of comparable size and speed.

13.25-13.50 **DESIGN-DRIVEN INNOVATION: A NEW DESIGN MEANING FOR SUPERYACHTS AS A LESS EGOCENTRIC USER EXPERIENCE**

S McCartan and T Thompson, EBDIG-IRC, Coventry University, UK, L Mori and A Brossa, De Jorio Design International, Genoa, IT, B Verheijden, Academy Minerva, Groningen, NL

This paper examines the relationship and commonality between contemporary cruise ship technologically innovative interior concepts and the possible future evolution of the megayacht. This paper presents a Transfer of Innovation (TOI) of a conceptual design approach to support the evolution of the megayacht towards a less egocentric product, informed by the design practices of the cruise ship industry. Addressing the market sector between superyachts and ultra-luxury cruise ships, through a new design meaning informed by technological innovation through the process of Design-Driven Innovation.

13.50-14.15 **DESIGN-DRIVEN INNOVATION: SUPERYACHT VERTICAL TENDER**

S McCartan and M Bryden, EBDIG-IRC, Coventry University, UK

This project engages in Design-Driven Innovation to change the design meaning of the relationship between tender and mothership by developing an Aston Martin helicopter as a Superyacht Vertical Tender, where the mothership superyacht has the VVIP helicopter as a focal point of the user design experience. The project's core aim was to create a design that embodied the exclusivity and convenience of helicopter travel with the emotional appeal of the Aston Martin brand. With the future of high-end transportation becoming more individual, the design was tailored for a specific client user application. The final design proposal was a low carbon helicopter designed specifically for the VVIP market.

14.15-14.40 **BOUTIQUE EUROPEAN RIVER CRUISE VESSEL**

S McCartan, E Stubbs, N Crea and A Whitaker , EBDIG-IRC, Coventry University, UK, B Verheijden, Academy Minerva, Groningen, NL

This design proposal engages in Design -Driven Innovation to create a new market sector through the use of within the river cruise industry in Europe. The current average age and target market in the river cruise industry is 55+, however this target age group has less than 10% of the luxury tourism market. By designing a new era of River cruise vessel that appeals to 25-50 year olds it would attract more than 80% of the luxury tourism market each year. The design of the current vessels does not appeal to this new design conscious. This concept is more minimalistic and has a quirky aesthetic allowing it to the classed as boutique (trendy and design oriented). It is more exclusive and design experience focussed allowing for a memorable and comfortable experience. The exterior is inspired by superyacht styling and architecture.

14.40-15.05 **COFFEE**

15.05-15.30 **DESIGN-DRIVEN INNOVATION: SUSTAINABLE LUXURY HIGH SPEED RIGID WING HYDROFOIL**

S McCartan, E Stubbs, N Crea and M Hopper, EBDIG-IRC, Department of Industrial Design, Coventry University, UK

This paper reports on a new sector for leisure superyachts, building upon the high profile implementation of rigid wing and hydrofoil technology in the recent America Cup boats. The design meaning is that of a motoryacht with effectively a zero carbon footprint, achieved hrough the use of an automated control system for the rigid wings as the main form of propulsion.

15.30-15.55 **TRANSATLANTIC WIG: ULTRA ECO-LUXURY TRAVEL**

S McCartan, E Stubbs, N Crea and S Quilter, EBDIG-IRC, Coventry University, UK

This project proposes a transatlantic WIG vessel to address the market opportunity between air freight and sea freight, as well as providing a positive user experience for luxury travel to compete with conventional aircraft first class travel. This design proposal offers the business traveller a personalised pod space with global connectivity to make the journey a seamless extension of the working environment. It is specifically targeted at CEOs and ultra-luxury travellers seeking new and exciting travelling experiences.

15.55-16.20 **DESIGN-DRIVEN INNOVATION: ULTRA-LUXURY RIVER CRUISE NETWORK FOR COLOMBIA INFORMED BY SUSTAINABLE LUXURY**

S McCartan, A Atkinson and A Phillimore, EBDIG-IRC, Coventry University, UK, A Nazarov, Albatross Marine Design, Chonburi, Thailand

This paper presents a Design-Driven Innovation proposal of an ultra-luxury river cruiser network for ecotourism, based on the principles of sustainable luxury. This proposal provides river logistics and infrastructure to support the development and security of rural communities along the rivers of Colombia, funded by the income from ultra-luxury cruising ecotourism. Research established the needs of small farmers and rural communities around the river networks. In response to which an ultra-luxury river cruiser with TEU logistics capability and a smaller higher speed vessel for local public transport and logistics were designed, along with infrastructure to support ecotourism and local social needs. The estimated cost of the proposed system compared favourably against the infrastructure cost of road and rail transport.

16.20-16.45 **MEDICAL SUPPORT VESSEL FOR 2025**

S McCartan, E Stubbs, N Crea and A Kennard, EBDIG-IRC, Coventry University, S Blaikie, Bibby Marine Survey Services Ltd, UK

Currently there are significant challenges for humanitarian aid provision in developing countries regarding disaster and disease, such as: cholera; ebola; floods; drought. This project proposes a pontoon based medical support vessel concept for 2025, informed by the design of the Bibby Challenge offshore accommodation pontoon. The vessel is towed along the coast of a developing country by tug to the location of major disasters to provide support, otherwise it is used as a portable medical centre provision with a defined annual route. It would be operated by NGOs for humanitarian aid as a cost effective alternative to a hospital vessel.

16.45-17.10 **BEACH CLUBS VS. WAVES; A QUANTITATIVE STUDY ON IMPEDIMENTS IN USE**

P.T. van Loon MSc., Feadship, NL

This paper presents a study, the aim of which was to gain insight into the impediments hindering the use of the beach club. Embarking a tender, the occurrence of slamming events and the probability of incoming water are all dependent on the relative waves. A quantitative study has been carried out on the relative waves around beach clubs. These were evaluated through the performance of both mathematical modelling and model tests. During the model tests slamming events were examined through video recordings and vibration measurements on the modelled platforms. Incoming water was also observed during model tests and was subsequently modelled *using CFD analysis.*

DAY 2 PAPERS:

08.30-09.00 **COFFEE & REGISTRATION**

09.05-09.30 **SETTING THE STAGE FOR FUTURE SHIP DESIGNERS' UNDERSTANDING OF CONTEXT OF USE**

Apsara Abeysiriwardhane, Margareta Lützhöft, Hossein Enshaei and Erik Styhr Petersen, Australian Maritime College, an Institute of the University of Tasmania, Australia

Adopting a Human Centred Design (HCD) process during ship design offers the potential to address usability concerns to reduce the cost associated with re-design, work-arounds or later, accidents. HCD is a process of systematically applying Human Factors and Ergonomics (HF&E) knowledge and techniques during design stage which can improve the overall safety, efficiency and wellbeing of the seafarer. One foundation of this process is an understanding of the situation in which the product will be used; the context of use (COU). Thus ship designers' COU knowledge plays a paramount role within the ship design process.

09.30-09.55 **A GUIDE FOR DESIGN-DRIVEN FIELD RESEARCH AT SEA**

Sigrun Lurås, DNV GL/The Oslo School of Architecture and Design, NO

Designing ships and marine equipment to be used onboard are challenging tasks, mainly because the situation to design for is unfamiliar to most designers. For this reason field research is essential in marine design. The paper will present a guide for design-driven field research at sea. The guide is based on the experiences with field research derived from the Ulstein Bridge Concept design research project, as well as other field studies performed at the Ocean Industries Concept Lab at the Oslo School of Architecture and Design. The basis for the guide is the model for design-driven field research. This model is specifically aimed at the needs of a design project and emphasises three focus areas in field research for design: 1) data mapping, 2) experiencing life at sea, and 3) on-site design reflection. The practical aspects of how to plan and carry out field research at sea are stressed in the guide, which can be applied directly in design projects. In the paper the guide will be presented in detail and its value for design will be discussed.

09.55-10.20 **CONNECTING THE SHIP SYSTEM DATA TO MARITIME OPERATIONS AS MEANS FOR DESIGN**

Snorre Hjelseth, Kjetil Nordby; The Oslo School for Architecture and Design, NO

During field studies it is a challenge to see and connect the ship data displayed in ship bridges with the operation being performed. This is a problem since data from systems such has conning systems, dynamic positioning (DP) and integrated automation system (IAS) are a crucial part of getting a full understanding of the performed operation. To meet this challenge we have developed a technique to visualise ship system data captured from real operations as an overlay on video captured simultaneously. The technique has been used to understand the engine and proportion effects, and fuel consumption in relation to the ship contextual factors such as wind, current and motion in different operational settings. We have found that the technique enables ship designers to explore their designs and it has led to insights that can have impact for decision-making during ship design. In this article we describe the technique in detail combined with a case study were it is used as part of field studies supporting ship design. Finally, we suggest possible improvements to the procedure and the implications of using such field data for ship design.

10.20-10.45 **COFFEE**

10.45-11.10 **DESIGNING FOR PROJECT COLLABORATION IN THE MARITIME INDUSTRY**

Etienne Gernez, Snorre Hjelseth and Kjetil Nordby; The Oslo School for Architecture and Design, NO

This article examines the notion of project as a place for collaboration in the maritime industry, and as vehicle for knowledge creation and innovation transfer. To investigate this we apply concepts from service design and computer supported collaborative work. We are particularly attentive to the meeting points between potential project collaborators along the ship design process (called "touch-points"). We are looking into how the fundamental interactions taking place between collaborators at these touch-points are mediated. We adopt the perspective of designers whose mission is to assist potential project collaborators in understanding each other´s way of thinking and working, looking at how they exchange data to build on each other's work. We argue that a human-centered design perspective on collaboration processes and collaborative tools can contribute to better shape the way ship design related projects are initiated and carried out.

11.10-11.35 **MULTIMODAL INTERACTION FOR MARINE WORKPLACES USED AS STRATEGY TO LIMIT EFFECT OF SITUATIONAL IMPAIRMENT IN DEMANDING MARITIME OPERATIONS.**

Kjetil Nordby, Oslo School of Architecture and design, NO

Constant changing conditions such as weather, operation type, time of day and fatigue are part of everyday life at the sea and lead to considerable challenges for the design of ship bridge interfaces and workplaces. Such conditions lead to users experiencing situational impairments where users cannot operate equipment optimally due to temporary, operation caused, limited mental or physical ability. To limit the impact of situational impairment in ship bridges the article report on a design project, Ulstein Bridge Vision, exploring alternate ways doing interaction for ship bridges. The project demonstrate how multimodal interfaces might show a way forward towards better interfaces more in line with the changing needs of marine operations. I show examples of multimodal design for ship bridges and discuss the possible implications of such design in the future. Finally, we suggest that it is important to better understand multimodal interfaces in context of the changing conditions at sea to be able to design next generation interfaces for demanding marine operations.

11.35-12.00 **MARS TANKER 'DESIGN FOR ENVIRONMENT'**

Dan Boyd, Consultant, BMT Isis, UK

The Military Afloat Reach and Sustainability (MARS) Tanker (Tide Class) was commissioned to replace current Royal Fleet Auxiliary (RFA) vessels which are non-compliant with the International Convention for the Prevention of Pollution from Ships (MARPOL) requirement for double hulling. This is the first high profile Ministry of Defence (MOD) procurement project driven in part by an environmental requirement. Initial environmental assessments had been carried out at the Concept phase. By working with the MOD and designers Daewoo Shipbuilding & Marine Engineering Co., Ltd (DSME), the opportunity was exploited to create a platform that is "designed for the environment", not only in the finished product but also through more sustainable manufacturing practices. This allowed for environmental considerations to influence design, over and above simply meeting current environmental requirements, and to enhance the ability of the platform to meet future environmental requirements.

12.00-13.00 **LUNCH**

13.00-13.25 **THE ROUTE TO VIRTUAL HYDRODYNAMIC MODEL TESTING**

Sam Hill, Programme Manager IMCS, QinetiQ, UK

Hydrodynamic model testing remains the route to demonstrate at the earliest stage that designs are suitable for their intended role and demonstrate first stage compliance with standards such as EEDI. The industry has long talked of being able to simulate these tests computationally but physical test facilities remain well utilised. Computational Fluids Dynamics methods have matured significantly in recent years, to the point that it is believed that now a feasible roadmap can be developed. This paper will describe the potential roadmap, and the technologies and alliances which are necessary to achieve it.

13.25-13.50 **LIGHWEIGHTING OPTIMISATION OF A TRIMARAN HIGH SPEED CRUISE LOGISTICS FERRY (CLF)**

C Bastien, L Malin, E Adams, P Eyres and J Venables, EBDIG-IRC, Coventry University, UK

The proposed study is researching the opportunities for lightweighting of a high speed multi-purpose trimaran ferry, which is complying already with the Lloyds Registrar regulations. The purpose of the study is to generate a lighter structure in order to improve fuel economy and reduce costs of running such vessels, as well as clarifying whether Lloyds Registrar rules over-engineer such ship design architectures. The study has generated a computer algorithm of a wave which has been applied on the vessel, in sagging and hogging, on a full 3 dimensional finite element model of the ferry. Using these wave loadings, the study compares the level of over-engineering of the vessel and proposes a lightweighting method which will fulfil vessel fatigue loads which will be present during its service.

13.50-14.15 **INJURY PREDICTION MODELLING IN THE GA DESIGN OF A TRIMARAN HIGH SPEED CRUISE LOGISTICS FERRY (CLF)**

M. Orlowski, C. Bastien and S. McCartan EBDIG-IRC, Coventry University, UK

Crash in high speed vessels has more in common with automotive accidents that those of slower larger vessels. Using the crash pulse established in previous work of the authors a computer simulation model was developed to predict the risk of injuries to ship crew and passengers for a range of locations in the GA, in the event of a 40knot crash of the CLF with a harbour structure. The work involved reviewing and implementing established crash modelling and occupant simulation methodologies from the automotive sector. In terms of an injury prediction model, a number of key areas of the GA were modelled as discrete spaces, to which the crash pulse was applied, this facilitated a computationally efficient analysis. A number of the discrete spaces were validated against a full vessel model crash simulation. For each of the key GA areas, both standing and seated occupant models were used to simulate injuries and trauma, for a range of positions in each area. The results were used to inform the GA development process in order to improve evacuation and propose innovative active safety technology, to mitigate the risk of fatalities in these next generation high speed vessels.

14.15-14.40 **COFFEE**

14.40-15.05 **MODELLING PASSENGER SHIP EVACUATION FROM A PASSENGER PERSPECTIVE**

Nevalainen, Jonna. Aalto University Department of Applied Mechanics
Ahola, Markus. Aalto University Department of Applied Mechanics, FI

This study uses passenger ship accident investigation reports to map environmental factors impacting on human behavior under emergency. Comparing and contrasting the subjective perception of passenger with the physical environment helps us understand the safety environment more comprehensively during an accident. Our research revealed that in emergency people trust more in their own perceptions and intuition than given instructions by the crew. Human behavior is guided by instinctual urge to get away from the danger, while rational thinking needed in way finding is secondary. Furthermore, if there's a lack in safety instructions people tend to follow each others, which often results in crowding in places that should be untrammeled in order to ensure efficient evacuation. Current evacuation modeling doesn't consider human-environment interaction in acceptable level and given insight to human cognition affects on the evacuation process can be used to develop evacuation analysis towards reality.

15.05-15.30 **FAST CRAFT CRASH AND REPEATED SHOCK SAFETY ENHANCEMENT THROUGH THE IMPLEMENTATION OF HSI**

T Dobbins, STR, UK, S McCartan and T Thompson, EBDIG-IRC, Coventry University, UK

By using the crash analysis matrix (Pre : During : Post vs. Human : vehicle : Environment) the nine interaction areas were examined to identify issues. The results of which were used to develop design and operational solutions. Technology transfer from the automotive sector demonstrates the ability to utilise design features from road vehicles within boat design to enhance occupant safety. This paper describes how designers can utilise the crash analysis matrix to understand how safety can be designed into a craft through a systems design approach. Design features that help reduce the risk of injury of the user impacting the crafts structure are delineated.

15.30-15.55 **TURKISH MARITIME INDUSTRY, TODAY AND TOMORROW**

S Isık, and S Sernikli, Piri Reis University, Istanbul, Turkey

In parallel to the contraction in the global shipbuilding industry during the 2007-2008 economic crises, the Turkish shipbuilding industry was affected deeply and suffered considerable losses. The total number of shipyards in Turkey is 145 today with an installed shipbuilding capacity of 4.2 billion DWT . In accordance with the recent studies that carried out by Turkish Shipbuilders Association, only 93 of those shipyards are in operation currently and providing employment in the region of 20 000, which is well below the total capacity. The recovery is slow, and due to the fact that the existing capacity of global shipping industry in the supply end is likely to exceed the actual demand in the near future, the Turkish shipping industry needs to adapt its structure to sustain its existence. An initial step in this direction is the implementation of new and innovative methods in design, construction and management of the current shipbuilding practices. In this regard, the outcomes of the EBDIG-WFSV project can prove to be valuable to the Turkish Maritime Industry in designing and building of the new generation marine vessels. There are also domestic initiatives to expand the R&D and innovation capacity of the shipyards and design offices in the Ship Building Industry. A project called "Shipbuilding Industry R&D and Innovation Capacity Developing Centre and Certification Program" by Piri Reis University has been recently completed with a successful outcome. This paper gives an overview of the Turkish Maritime Industry today and its prospects for the near future.

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