Marine Design 2020

15-16 January 2020, Cadiz, Spain

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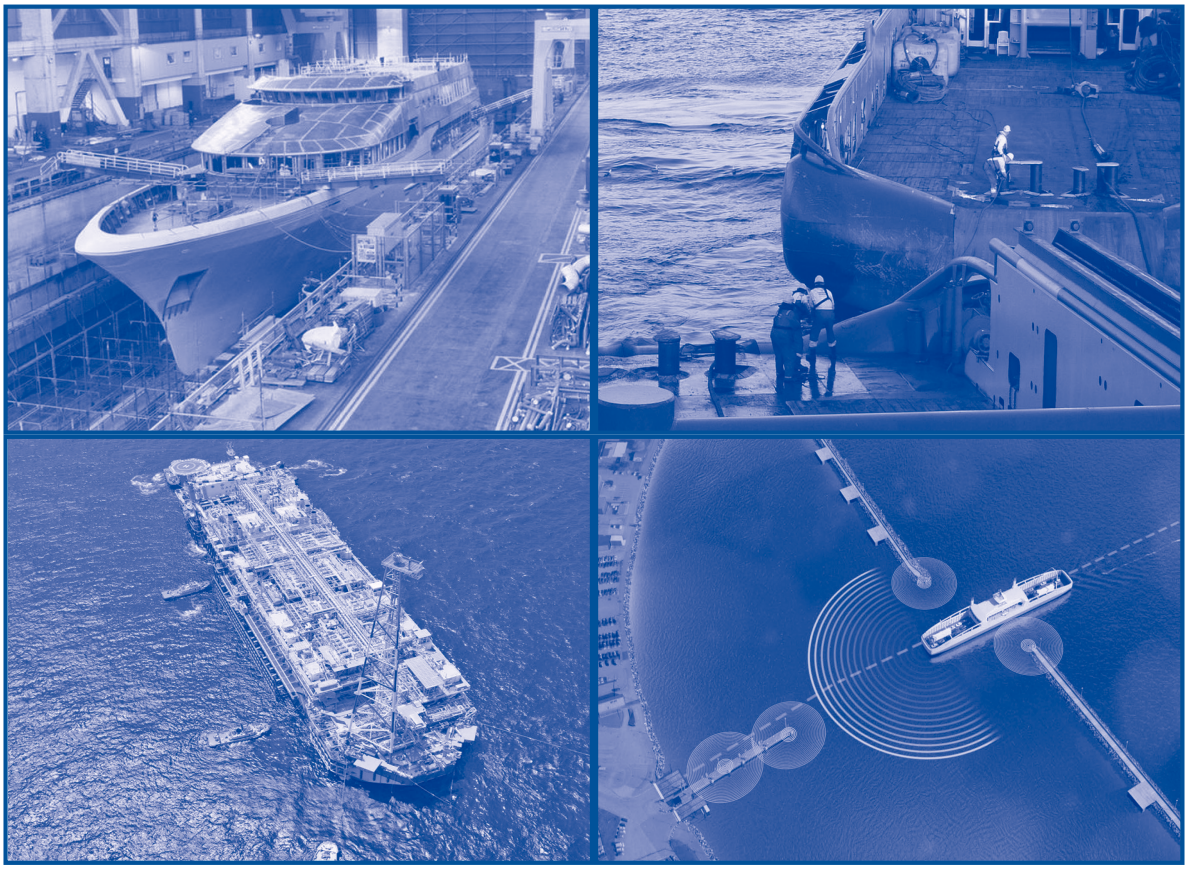

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Designing Water Taxis
A.Nazarov, Albatross Marine Design, Thailand

Water transport in Bangkok, Sydney and Dubai play an important role in mass passenger transit within these cities, whilst also providing a sightseeing attraction as an integral part of city landscape. This paper presents new designs of catamaran water taxis, as next generation small passenger watercraft designed for modern urban environments. These boats are highly efficient, light but safe and comfortable. Innovation in hull design and technology, such as electrical propulsion and solar panels, achieve low wave making and low noise. Ergonomics of water taxis are reviewed in terms of design compromise in comparison to the requirements for larger vessels. Comfort and safety are analyzed by reviewing typical interior layouts, in terms of seating arrangements, boarding options and luggage storage areas. Where special attention is given to accessibility for passengers with disabilities or mobility restrictions. For the new designs presented safety assessment related to exterior styling and layout is reviewed, and recommendations to applicable rules and standards are delineated.

Design of a Novel Hull to Induce a Natural Air Layering System to Reduce Viscous Drag
A.Spiteri, University of Malta, Malta
M. Armin, LJMU, UK

A fundamental modification has been applied to the Kriso container ship (KCS) which demonstrates a reduction in viscous drag. This modification is aimed at lowering shipping emissions through the reduction of fuel consumption, thus helping ships meet the new IMO requirements for the EEDI rules and overall decarbonization targets. The hull was modified to induce a natural air layer. This air layer helps to reduce the drag force by reducing the wetted area, turbulence and wall shear stresses. Two different models were tested over a range of Froude Numbers which translated to air flow rate. Tested speed included 16, 20, 24 and 26 knots. This paper reports on a parametric study, carried out on the air entrance width to investigate its impact on the air flow rate. Additionally, the impact of the position to release the intake air on the hull bottom was considered. The models were designed with minimal change (≤1%) to internal volume. A numerical simulation approach was utilised using Averaged Navier Stokes Equation and □−□ models to capture a turbulent flow. Parametric testing on the number of prism layers and a Richardson extrapolation was done to ensure accurate and factual results. The original ship was compared to an ITTC standards to validate the modelling technique which showed 99.05% accuracy. The air volume fraction achieved was 0.3 across all models. This led to a decrease in drag ranging from 22% to 5%. The sinkage and trim were calculated which showed negligible effect, thus giving further confidence in the ship design.

Fire simulations of a fishing research vessel with FRP structures
A. Tissari, T. Korhonen, T.Kling, A. Korkealaakso, T. Hakkarainen, VTT Technical Research Centre of Finland Ltd, Finland

This paper reports on fire simulations of a fishing research vessel with fibre-reinforced polymer (FRP) structures. The objective of the simulations was to study the fire safety effect of using FRP as the primary construction material of the vessel, compared to conventional steel structures. This research was carried out as part of the European FIBRESHIP project. Several fire scenarios with various design fires, bulkhead structures and ventilation conditions were simulated using the Fire Dynamics Simulator software. The effect of FRP structures on fire development was assessed by comparing the gas temperatures and the potential heat releases obtained from simulations with FRP and steel structures. As FRP materials are combustible, FRP structures begin to contribute to fire under heat exposure, unlike steel structures. The degree of contribution depends on the fire scenario and protective measures. The structural integrity of FRP structures was assessed using simulated structure temperatures as indicators of integrity. After reaching its glass transition temperature, FRP material will lose a significant portion of its load carrying capacity. To quantify the effect of protective layers, mineral wool and an intumescent coating were used in the simulations. The results showed that despite the protection, the structural integrity of FRP bulkheads could be compromised in fire conditions. Mineral wool was found to be better protection than the intumescent coating, it can either prevent or postpone the pyrolysis of the FRP bulkhead, depending on the fire exposure. It is noted, however, that the protection shall be designed taking into account the designated used and the fire load in the space.

Laser Hybrid Welding in Shipbuilding
C. Churiaque, M. Chludzinski, R.E.dos Santo, J.M.Sánchez-Amaya, UCA, Spain
M.Porrua-Lara2, F.Abad-Fraga, Navantia S.A., Spain

The progress of the shipbuilding industry 4.0 involves addressing a number of challenges in the shipyards for the development and improvement of more efficient and productive processes. The joining of flat plates is one of the first stages in the manufacturing process of large vessels which is pivotal to the production of the whole the ship. High Power Laser Arc Welding (HLAW) is a deep penetration and highly efficient welding process that produces welds with a high depth to width ratio, providing high quality joints. This paper reviews the most influential process variables in thick plate naval steel butt welds and gives a brief summary of techniques applied to improve the quality of the joints and key characteristics of the equipment used. Recent published studies show good results in butt welds of high thickness (28 mm) in single pass using a magnetic backing. The use of HLAW achieves a significant reduction of seam irregularities, which can act as potential starting points of failure during service. This reduction in distortion, coupled with reduced bead size and increased quality and speed, make hybrid laser welding a realistic alternative of the conventional submerged arc welding. From this study, it seems that a single pass procedure to ensure high quality of thick welds is one of the key aspects required by industry, to be covered by the near future research.

On Board Additive Manufacturing of Spare Parts for the Naval Sector
D. Moreno-Sanchez, J.D. Rodriguez, A. Domínguez-Calvo, S.I. Molina, IMEYMAT,UCA, Spain
E. Corrales-Estárico, F. Abad, V. Casal, Navantia S.A., Cadiz, Spain

The failure of a component element of a ship, sometimes requires a fast replacement to avoid delays in its operations. One of the most promising innovation to reduce the time required to replace a failed part and improve logistics, is the use of 3D printers to produce spare parts onboard a vessel. Additive manufacturing technologies allow parts to be created anywhere, with almost any shape using a wide range of materials, directly from a digital 3D model. In order to create the digital model, either reverse engineering technologies can be implemented, or a database of optimized 3D components needs to be developed. Navantia in collaboration with the INNANOMAT research group, have studied in detail the change of mechanical properties of parts produced using 3D printers. This study was carried out using platforms that simulate vibrations produced in a ship, and with 3D printers installed onboard a ship. In this paper we present the process of manufacturing spare parts using 3D printers that work on a ship, evaluate the influence of sailing conditions on the quality of the manufactured parts, and review examples of spare parts produced with 3D printers onboard.

Paperless Design in the Shipbuilding Environment
R. Perez, SENER, Ingeniería y Sistemas, Spain

New and innovative AI technologies are developing, which will eventually become integrated within digital design systems in order to facilitate the design process itself. The technologies of big data analysis, and fast searches, will facilitate the design of a part or any vessel concept through the application of design rules. The integration of the design validation process of the 3D models by the Classification Societies, shall be done by using cloud computing or with direct connection with cloud applications. This will result in a faster and more reliable ship design. Ship design also requires the validation of the 3D model from the point of view of the Classification Societies. For this purpose, models have to be exported into a specific format for calculations. There is an additional step that adds complexity to this process, the Classification Societies normally want to review the models by their own means. This paper reviews the latest advances, and CAD Industry efforts, regarding the classification approval process for ship design, through the use of 3D models. This paper discusses the various classification approval process scenarios and describes the adopted solution to be integrated into a CAD System. The digital age has come, as an age of collaboration, where the new technologies will be imposed and where the enterprises of the shipbuilding industry and the Classification Societies shall adapt both their internal processes and their methodology in parallel with the general progress of the industry.

Developing Costal Patrol Interception and Mega-City Littoral Support for West Africa using the Marine Design Process
S. McCartan, EBDIG, FAH, Coventry University, UK
T. Dobbins, ST Research, UK
I. Chapsos, EBDIG, CTPSR, Coventry University, UK

The Gulf of Guinea is a vast expanse of water, stretching almost 6,000km from Senegal to Angola, with weak surveillance and uncoordinated security patrols. The historical focus of local states security policy on land security in the region has left the maritime domain unpatrolled. There has been increased incidence of armed robbery at sea and piracy; theft of hydrocarbon resources on the high seas/illegal bunkering; pipeline vandalism; illegal trafficking in arms, drugs and people; and illegal, unreported and unregulated fishing in the waters of the region. One specific political challenge of the host communities of the rich natural resources of the region is poverty, which is fuelling the illegal activities. There are unclear definitions of piracy and armed robbery at sea, as well as an inadequate legal framework for prosecuting criminals when intercepted. Environmental pollution from exploitation and exploratory activities, and accidents from oil spills are also a significant issue for the region. This paper presents a vessel concept based on the current Icarus Marine 14m patrol boat with inboard diesel propulsion. Developed using the Marine Design process informed by UX context for a patrol boat operating in West Africa. Using automotive design language to develop exterior styling and interior design principles to refine the layout and UX of the interior. A critical aspect of interior design was to promote gender equality, through facilitating the needs of mixed gender crews.

Large format additive manufacturing in the leisure and sportive boat construction industry
D. Moreno Nieto, S. de la Rosa Silva, S. I. Molina, IMEYMAT, UCA, Spain

Additive manufacturing is becoming an established technology that is finding real applications in industry. The increase in innovation performance of this technology has enabled it to be scaled up to achieve Large Format Additive Manufacturing (LFAM). Several technology platforms are increasing their size, with material extrusion being one of the most developed. This technology combines a vertical extruder with either a gantry-based system or a robotic arm, both of which have already been tested with excellent results in industrial applications. One of the more innovative applications of LFAM is the manufacture of moulds and tools for large components. This paper reviews the main applications of LFAM technology and presents case studies of LFAM implementation in the leisure boat sector, involving moulds and direct printing of scale model boats. These case studies show the significant potential of this technology to innovate next generation vessel design and manufacture of 3D printed sport and leisure vessels.

Silent vessels technology and the reduction of underwater radiated noise as a significant issue for the future of maritime engineering
P. Beltrán, Técnicas y Servicios de Ingeniería SL, Spain

The underwater radiated noise (URN) due to shipping activity has received recently considerable attention among the scientific community due to its negative environmental impact on marine fauna. High levels of URN emitted by vessels block the ability of animals to communicate, reproduce, navigate or hunt, which is vital for the sustainability of the oceans. As a result, new regulatory frameworks to control the acoustic signature of vessels are being developed and promoted by IMO to mitigate the negative effects of URN in the oceans, which can also be used to reduce the noise onboard vessels, improving the comfort of the crew. This study describes a validated methodology applied to FRVs to minimize their underwater acoustic signature, which is mainly originated by propellers and main machinery. To achieve this goal, an extensive analysis using advanced simulation software is performed to predict the vibration and noise emissions of the main noise sources in the ship. Based on the results of this analysis, control preventive actions are applied to the noise sources. Historical results show that this procedure can be successfully used to predict and reduce the URN generated by any type of ship. This cutting-edge solution based on vibration and noise comprehensive management analysis, should be integrated into the ship design process and building phases. In order to detect acoustic problems in the early stages of the project and control them through the construction process, to minimize costs and reduce URN negative impacts in the oceans.

Design-Driven Innovation: La Trasatlántica – 280m Sustainable Luxury Transatlantic Pentamaran Superliner
S.McCartan, EBDIG, FAH, Coventry University, UK
D. Moreno Nieto, EBDIG, Department of Mechanical Engineering and Industrial Design, UCA, ES
M. Mooney, EBDIG, MVizUK, UK

Historically, the Normandie, is considered the greatest of the superliners, due to the innovative technical design and luxurious interiors. This paper reports on a DDI design proposal inspired by the design meaning of the Normandie for the region of Andalucía, as a homage to the cultural heritage of Compañía Transatlántica Española (CTE) or "La Trasatlántica". This vessel is an expression of the finest attributes of Andalusian design, culture and cuisine. The interior and furniture design processes were stimulated by the innovative manufacturing capabilities of the 3D printing technology. Where several pieces where developed with specific design workflows to examine the relationship with integrated lighting and how the CAD design process can be optimised to understand the opportunity of integrated lighting technology in 3D printed furniture. The interior design process is informed by the risk of crash at high speed and the implications on passenger evacuation. This vessel proposal will act as a trade and cultural connection between Andalucia, Cuba and South America. This project engages in Design-Driven Innovation to develop a new market sector for high speed multifunctional vessel to compete with both air freight and business class air travel in addition to the role of a superliner cruise ship. The concept will engage in sustainable luxury by combining logistics capability with a luxury superliner, powered by green hydrogen. The vessel will operate at speed of 40knots enabling it to travel from Cadiz to various ports in South America and Cuba in 5 days.

Design-Driven Innovation: Sustainable Luxury River Cruise Network for Colombia to Support the Economic Development of Rural Communities
S. McCartan, EBDIG, FAH, Coventry University, UK
A.Nazarov, Albatross Marine Design, Thailand

This paper presents a Design-Driven Innovation proposal of a sustainable luxury river cruiser network for ecotourism. This proposal provides river logistics and infrastructure to support the economic development and security of rural communities along the Magdalena river in Colombia, funded by the income from ultra-luxury cruising ecotourism. The key aim of the engagement in sustainable luxury is to support rural environmental sustainability in today's post-conflict Colombia. The Magdalena river flows northward for 1,528km through the western half of the country. It has a drainage basin which covers 24% of the country's total area, where 66% of its population lives. The needs of small farmers and rural communities around the Magdalena river are reviewed. 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.

ESPOmar Project: New passenger maritime transport system for the Gulf of Cadiz
A. Querol, P. Sánchez, J.C. Rasero, A. Vargas, S. Sotomayor, C. Perez, D. Sales, A. Güelfo , UCA, Spain
A. Vargas, Universidad de Huelva, Spain
F. Perna, Universidade do Algarve, Portugal

The ESPOmar project is a cooperation research network with the aim of designing and evaluating a new sustainable cross-border maritime transport system for the Gulf of Cadiz. The key objectives of the ESPOmar project are: to analyse the real demand of such a transport system; study the nautical condition for navigation of the area; define the capacity and specification of each proposed maritime route and optimize the design of specific ferries to compete with the established land transport system in terms of speed, safety and comfort, reducing emissions and economic viability. Economic viability and local economic impact were key tenets of the evaluation process. This paper presents the results and conclusions of the evaluation process for the proposed maritime routes examined.

Analysis of the transport operation of the floating wind turbine tanks. Simulation of a multi-tow operation
J. Fernández Prisuelos, CEDEX, Spain

This paper describes the works carried out for evaluating the viability of the transport operation of the main components for a floating wind turbine in the framework of the project supported by the European Program H2020 "Telwind". The transport operation studied was designed as a direct towing process of two cylindrical tanks, connected to each other, both afloat and separated by a security distance, with a single tug pulling from the broader tank side. The feasibility of the operation was deduced from the results obtained after simulating the towing operation in real time, with a "full mission" type ship maneuvering simulation system, towing in open sea including the expected weather conditions in the simulation scenarios - essentially wind and waves-. Prior to simulate the transport operation towing tank experiments were conducted with physical scaled models of both tanks in order to check their main physical properties, their towing resistance in calm water and waves influence in order to develop the mathematical models introduced in the simulations.

Application of 3D technologies in ships operation and training of their crews
M. Benito Berlinches, J. L. Muñoz Pérez , Navantia Sistemas, Spain

In modern digital ships, crew members work as a team, following ship specific procedures and interacting with the machinery mainly through computer tools, with the goal of fulfilling a particular mission. Information Technology allows ship manufacturers to design digital ship management tools connecting data from different sources through homogeneous well-arranged interfaces, providing the user with a unified perception of the situation, enabling the decision-making process and acting as the executive overview of the consequent actions. These tailored tools aim to represent the relationships between the data, enabling understanding and awareness of the situation and allowing the operator to anticipate the consequences of the available commands. Likewise, crew members training following established procedures greatly improves ship operation and equipment maintenance skills. This paper presents the use of 3D technologies to communicate data within a three-dimensional environment, it is considered a key technique to improve and accelerate both, the transformation of simple data into information, and knowledge transmission among the human teams.

Educating Future Superyacht Designers at Solent University – MSc Superyacht Design
G. S. Barkley, Southampton Solent University, Southampton, UK

Building on from Solent University's very successful undergraduate B.Eng Yacht & Powercraft Design degree, the team has recently launched a new master's degree titled the 'MSc Superyacht Design'. The program aims to provide graduates from a wide range of Engineering and Technical Architectural design disciplines, with both the technical skills and an appreciation of the architectural design skills typically required by the superyacht industry. The first 2 semesters concentrate on delivering appropriate knowledge in the areas of Naval Architecture, Structural Design, Design Development, Manufacturing, On-board Systems and other new technologies associated with the design of superyachts typically between 24-85m in length. Through experiential learning students will gain knowledge and design practice for both generic and specific design problems, ranging from space planning in conjunction with MLO requirements, through to FEA and CFD analysis of specific structural and fluid flow issues. Students will also work in multidisciplinary groups simulating industry practice, generating solutions to various projects. The third semester involves students having a work placement with either a Superyacht Design house or with a Superyacht Design facility. Whilst there, the student may be involved in a research-based project, aimed towards improving or developing new Superyacht platforms. Equally, they could be on site investigating and improving production processes. This paper gives an overview of the program and outlines some examples of the experiential learning the first cohort gained last year whilst at Solent University. The paper concludes with views on the course from the students, teaching staff and industry perspective.

Notes on Maritime Cybersecurity in Ship Design
C. Mascareñas, A.I. y Vázquez, UCA, Spain

European merchant traffic through the internal and external maritime lines, are a critical infrastructure within the European Union, likely to be attacked. In this paper, an analysis of the main control systems of a ship and the possibilities of being attacked cybernetically are delineated. Conservative hierarchy in the design of the control systems is proposed and the general conclusions of the analysis are presented. The current trend towards automation implies that many ships rely on data networks and information systems for the following functions: Navigation: ECDIS, AIS, Radar; Command and Control Networks; Engine: propulsion, fire protection, lighting, bilge pumps, alarms; Cargo: cargo location control, ballast tanks, ship stability; Internal and External communications: general orders, manoeuvre net, satellite, VHF / OC / OM radio, NAVTEX; Management systems: ERP, crew, fuels, accounting; Maintenance and inventory systems; Social and entertainment. Two very important data networks are the navigation network and the propulsion control network, which can also be interconnected with each other and, in turn, to other networks. The control systems in turn depend on SCADA equipment that has already been shown to be vulnerable to attacks to alter its operation. Ship design strategies that can resist or mitigate the effects of a cyberattack with reduced crews are discussed.

The Development of a Personal Protective Equipment (PPE) Exoskeleton for Reducing Repeated Shock, Whole Body Vibration and Fatigue on High Speed Craft
T Dobbins, 20KTS+, UK

High Speed Craft (HSC) are characterised by their planing motion, resulting in the crafts occupants being exposed to high levels of Repeated Shock (RS) and Whole Body Vibration (WBV). Such exposure has been shown to cause high levels of post-transit fatigue, acute injuries, and is linked to chronic musculoskeletal injuries. Shock mitigation seating has been shown to be effective in reducing fatigue and the risk of injury by reducing the magnitude of RS and WBV exposure. Unfortunately shock mitigation seating is not appropriate for all craft and on-boat tasks, therefore alternative shock mitigation systems are required to protect the crew, for example where the craft is unable to have suspension seats fitted and where the individual undertakes tasks at the bow where RS and WBV exposure is greatest. A shock mitigating passive leg exoskeleton has been developed to act as Personal Protective Equipment (PPE) for the craft occupants. The system has been tested both in the laboratory and on-water, and shown to reduce fatigue and shock exposure by operationally meaningful levels. As the exoskeleton is lightweight and delivers effective shock mitigation it acts as effective PPE as part of an organisation's ALARP risk mitigation process. Further developments are continuing to further integrate the exoskeleton into the operators clothing and equipment.

Analysis of the fluvial traffic of cruise ships from AIS and GIS data: most crowded river basins and wastes productions
I. Vicente-Cera, A. Acevedo-Merino, J. A. López-Ramírez, E. Nebot, INMAR, UCA, Cadiz, ES

In recent years cruise tourism has experienced a significant growth, both in the size of its ships and in the number of transported passengers. Although it is a well-known market in terms of its social impact, it is still largely unknown scientifically in terms of its environmental impact. There are some studies that address the challenges of maritime traffic of these vessels but very few in terms of their navigation in rivers. From statistical analysis and big-data methodologies developed for the marine environment, new methodologies have been adapted and developed from the combination of AIS (Automatic Identification System) and GIS (Geographic Information Systems) for the study of the fluvial environment. This paper reports on the state of the traffic of this industry at a global level, as well as its economic, social and environmental impacts. It has been found that the ten basins most navigated accumulate 95% of the navigation hours of the entire fleet, all of them are in Europe. Adding to these 10 basins other basins of interest such as Mississippi, Columbia and Guadalquivir rivers, it has been found that the 296 river vessels studied produce 302kt per year of CO2, 3hm3 per year of wastewater and 113kt per year of waste. The river cruise sector, which transports barely 10% of cruise users with respect to the ocean sector, accumulates around 20% of its global economic impact, €8,955 million per year.

NAVANTIA's Vision for Smart
J. Antonio Pagán, NAVANTIA, Spain

This paper describes the works carried out for evaluating the viability of the transport operation of the main components for a floating wind turbine in the framework of the project supported by the European Program H2020 "Telwind". The transport operation studied was designed as a direct towing process of two cylindrical tanks, connected to each other, both afloat and separated by a security distance, with a single tug pulling from the broader tank side. The feasibility of the operation was deduced from the results obtained after simulating the towing operation in real time, with a "full mission" type ship maneuvering simulation system, towing in open sea including the expected weather conditions in the simulation scenarios - essentially wind and waves-. Prior to simulate the transport operation towing tank experiments were conducted with physical scaled models of both tanks in order to check their main physical properties, their towing resistance in calm water and waves influence in order to develop the mathematical models introduced in the simulations.

ESPOmar Project: Ship design optimization for new passenger maritime transport system for Gulf of Cadiz
A. de Querol, M.J. Legaz, B. Flethes, M. Ávalos, UCA, Spain
S. McCartan, EBDIG, FAH, Coventry University, UK

The ESPOmar project is a European Interreg POCTEP Project, in which several Spanish and Portuguese Universities, research groups and public organizations, collaborated to examine the potential of establishing a competitive regular passenger maritime transport system in the Gulf of Cadiz. This paper reports on the engagement of the project in the multidisciplinary approach of Marine Design for each of the different maritime routeways evaluated. This multidisciplinary approach examined: ships optimization; design requirements; process methodology; interior and exterior layout together with structural and propulsion specification. Two distinctive new concepts vessels are presented in this paper. This first is a passenger ferry for coastal routes, which has been designed with the aim reducing CO2 emissions in comparison to the equivalent land based public transport system. This innovative design proposal has a sustainable propulsion system, lightweight structure and hydrodynamically optimized hulls. The second vessel is a medium size ferry specifically designed for nautical tourism, with the design meaning of both a meeting point and an entertainment centre.

Mechanical characterization of polymer composite materials for long length ships
A. Kumar Haldar, G.Kannan, A.Portela, C.Athavale, A.J.Comer , IComp, University of Limerick, IRL

In the marine industry, FRPs are currently dominating the manufacture of vessels up to 50m in length, with liquid resin infusion (LRI) being the most frequently used manufacturing technique, of which vacuum-assisted liquid resin infusion is the most widely adopted LRI variant. However, current regulations restrict the use of composite materials in vessels over 50m in length. FIBRESHIP is a Horizon 2020 funded EU project, that aims to further the use of FRPs in vessels over 50m in length by addressing the regulatory restrictions and the numerous other challenges associated with manufacturing long-length FRP composite ships. The mechanical performance of new commercially available composite material constituents as potential candidates for selection in composite ship construction is central to this work. This paper provides an overview of the work performed as part of the FIBRESHIP project in terms of evaluating various mechanical properties of selected laminates under dry and wet conditions. The laminates were immersed in seawater at 35°C for durations of one to three months. Initial attention focuses on alteration in mechanical performance of these laminates due to immersion in seawater. Three-point bend and dynamic mechanical analysis (DMA) tests were undertaken in order to investigate the change in the mechanical properties of composite laminates subject to immersion. Finally, specimens were observed using micro-computed tomography (μCT) and a scanning electron microscope to evaluate the failure morphology.

ASV for Water based Sustainable Urban Mobility in Venice and Groningen in 2050
S. McCartan, EBDIG, FAH, Coventry University, UK
M. Mai, Aquacon, AT
M. Mooney, EBDIG, MVizUK, UK

Engaging in the principles of Design-Driven Innovation this paper reports on the development of a new exterior and a range of interiors for the Aquacon ASV, with a design meaning and UX inspired by first-class aircraft and first-class train interiors. This 54ft ASV platform will operate as high-speed sustainable transport in 2050 by having a hydrogen fuel cell and using green hydrogen. The vessel will have 70% less weight that a conventional aluminium vessel. A family of vessels proposals have been developed with different seating arrangements to facilitate an operating speed of 40knots on the following regions of operation: Venice water taxi services, from waterbus to water based limo; Groningen regional routes: Eems canal connecting Groningen to Delfzij; Delfzijl to urban developments along the Emse river; Delfzijl to urban developments of the north coast of the Netherlands and the islands of Borkum, Rottumerplaat, Schiermonnikoog, Ameland, Terschelling, Vlieland, and Texel. For each area of operation, the following interior layout types were developed: luxury motoryacht; Executive luxury transport – design meaning of 1st class train; Economy waterbus – design meaning of 2nd class train; Waterbus – combination of 1st class and 2nd class train.

Maritime augmented reality, as a tool for immersive experiences for ferry and cruise operators between the UK and Ireland, creating new commercial opportunities for the marketing, advertising and tourism sectors

P. Woodbridge, EBDIG, LJMU,UK
A. Eilbeck, EBDIG, LMU, UK
S. McCartan, EBDIG, FAH, Coventry University, UK

There are a variety of service owners within both the Ferry and Cruise market between the UK and Ireland. Their service offer, ranges from functional price driven travel to luxury high end experiences on cruises. Although their investment in immersive experiences and the opportunities vary as much as the markets they operate within, it is clear that these are both growing sectors with a need for entertainment, storytelling and engagement. The number of short sea international ferry journeys in the UK alone is 20.5 million and the global cruise industry generated an estimated revenue of 39.6 billion U.S. dollars in 2015, The passenger numbers of the global cruise market reached 27.4 million in 2016 and capacity is expected to continue to grow1. It's a huge market, and a huge opportunity for new kinds of onboard entertainment. This represents a significant global market for the development of a scalable world class entertainment experience, which would lead to the creation of new opportunities for ferry and cruise operators, content makers as well as new commercial possibilities for the marketing, advertising and tourism sectors. The research presented in this paper informs the design specification and design thinking for a new AR Platform specifically developed for the maritime sector, aimed at Ferry and Cruise passengers. Working with users, ferry and cruise operators, and other stakeholders to analysis, design and determine the focus for a new immersive product for the maritime transportation sector with a focus on onboard entertainment experiences for ferry and cruise passengers. Hyper-localised content delivery requires deep customer insight in context of their current behaviours. This paper reports insights and mapping of current and future desires/needs/behaviours of end-users and other stakeholders so that the proposed digital platform can offer context relevant, connected and tailored AR content delivery that supports user, as well as business, needs.

Design Analysis of High Speed Vessel
L. Krishna, IIT Madras, India

Composite hulls typically in fibre-glass are commonly used for high speed light crafts. Proper design of the hull requires knowledge of the actual structural stresses in the material of the hull. It is important to have reliable knowledge of the upper limits of stresses experienced by the hull in order to avoid conservative over-design as a matter of safety. This paper addresses a methodology to determine dynamic loads for such crafts. High speed crafts experience high dynamic loads in the form of dynamic pressure peaks and slamming due to encountering waves. This paper presents computational fluid dynamics based analysis for a candidate high speed planing vessel. The method specifically adopts the use of overset mesh to effectively handle the visualization and dynamic effects due to the occurrence of spray and waves. Once the dynamic load distribution is known, then an uncoupled fluid structure interaction approach can help to determine the structural stresses and design for safe loads. The paper demonstrates the use of the modern computational tool and brings out results highlighting the use of the overset mesh approach. Effective wavelength and vessel speed influence the dynamic loads experienced by the hull. The study brings out the effect of effective wavelength and vessel speed which influence the dynamic loads on the hull and which are of vital importance to the designer in evolving safe structural hull form design.

Towards EEDI and EEOI variables discussion
J. Moreno-Gutiérrez, F. Calderay-Cayetano, Y. Amado Sánchez, E. Pájaro Velazquez, R. Rodriguez Moreno, V. Durán Grados, UCA, Spain

The Third GHG Study of the International Maritime Organization (IMO) estimated that greenhouse gas (GHG) emissions from international shipping in 2012 accounted for some 2.2% of anthropogenic CO2 emissions and that such emissions could grow by between 50% and 250% by 2050. Although shipping is still widely considered as the most energy-efficient transport mode, projections such as this exert a lot of pressure on the industry to reduce its carbon emissions.
From the side of the IMO, the measures until 2015 on the climate change front included, as progressively stricter energy efficiency standards for new ships, according to which, the so- called Energy Efficiency Design Index (EEDI) of all newly built vessels from 2013
The so-called Energy Efficiency Operational Indicator (EEOI) was suggested as a tool for Ship Energy Efficiency Management Plan (SEEMP) implementation but only on a voluntary basis and solely for monitoring the performance of individual ships. Earlier discussions on the possibility of adopting a market-based-measure had been suspended in May 2013 following a highly political clash between developed and developing countries. Given that the 2011 IMO initiatives of EEDI and SEEMP were considered inadequate, the 59 Commission proposed in 2013 a document that two years later was adopted as the EU MRV 60 Regulation. It obliges companies to monitor, report and verify the fuel consumption, CO2 emissions and energy efficiency of their ships on voyages to, from and within EU ports, and calculate annually indicators, including EEOI. In this paper we discuss the variables that affect the EEDI and EEOI indicators values.

Conference Overview

Conference Venue

The Marine Design 2020 conference will be held at UCA (Cadiz University):

Centro Andaluz Superior de Estudios Marinos (CASEM)
Puerto Real Campus
Cadiz, Spain

REGISTRATION FEES

REGULAR FEES:	350€ + IVA= 423.50€
CONCESSIONS:	94€ +I VA= 113.74€
PRINCIPAL AUTHOR:	125€+IVA= 151.25€
ADDITIONAL AUTHOR:	200€+IVA=242.00€

*These fees will increase 10% for registration after the 31st December

REGISTRATION

For registration and payment please follow:
http://fundacionceimar.com/es/congreso-marine-design-2020