The Royal Institution of Naval Architects

WARSHIP 2018:
Procurement of Future Surface Vessel

International Conference

Warship 2018:
Procurement of Future Surface Vessel
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08.55-09.30 COFFEE AND REGISTRATION

09.30-10.05 KEYNOTE

10.05-10.40 THE CONFLICT BETWEEN SHIP DESIGN AND PROCUREMENT POLICIES, *David Andrews, University College London, UK.* For the naval ship designer the aim is to produce the "best" design possible. This should mean the most effective vessel that is affordable, safe and able to be produced to programme and perform effectively through its designated life. The process to ensure this can be achieved ought to follow the outline of, specifically, the concept phase as detailed in a recent comprehensive paper on the sophistication of the earliest stages of ship design (Andrews, 2018). This will not ensure the rest of the design process is also coherent and efficient, however the converse is surely a recipe for failure. However the single most difficult issue designers of such complex vessels have to deal with is the conflict between identifying a coherent design aim and the pressures of externally imposed acquisition or procurement imperatives, not least affordability. The paper draws on the author's experience, particularly for four years at the end of the Cold War, when he was the Warship Project Manager for the full replacement programme for a substantial warfare area. This was an era before Integrated Project Teams and the UK's adoption of SMART Procurement, so subsequent procurement policies will also be addressed for their impact on design practice. Thus the effect of various procurement policies on the design of major naval vessels will be addressed through specific case studies. Most of these the author had some (often) significant involvement in a design focused career in the UK Navy Controllerate and the Defence Procurement Agency before a second career in teaching aspects of ship and submarine design and researching into the nature of complex ship design.

10.40-11.15 A METHOD FOR ASSESSING FLEXIBILITY AS A SHIP DESIGN REQUIREMENT, *Dylan M. Dwyer, Brett A. Morris, Defence Science and Technlogy Group, Austria.* Australia is embarking on a national endeavour to build and sustain a naval shipbuilding enterprise. Objectives of the 2017 Naval Shipbuilding Plan are balanced between delivering an economically viable continuous shipbuilding program, and delivering the required capability to meet Navy's strategic interests and objectives in an ever changing environment. Due to the nature of continuous shipbuilding, a class of ships could be delivered into service over the course of a number of decades. In this time, ship sub-systems that are susceptible to changing strategic circumstances or high technology refresh rates need to be upgraded in order to maintain a capability edge; these sub-systems are termed 'dynamic'. To support the objectives of the shipbuilding program the ship design must be flexible to allow efficient integration of dynamic sub-systems without ramifications on the ships performance. This paper proposes a method for assessing the flexibility of a ship's design in a quantitative manner. The method employs the use of an established Modelling and Simulation framework to characterise the space, weight and power requirements of a ship design. It is proposed that flexibility is related to the ships availability of reserve space, weight and power capacities. Where, a flexible ship is able to adapt to increasing space, weight and power demands from upgrading a dynamic sub-system while still meeting the necessary in-service performance requirements. The paper concludes with recommendations for future work.

10.15-11.40 COFFEE

11.40-12.15 HOW MUCH IS TOO MUCH? THE COST OF COMMONALITY, *Oliver Short, Naval Design Partnering Team, UK.* It's widely understood that combining requirements to create common adaptable vessels provides advantages in many key areas including spares, operability, availability and design. This is especially relevant where operational fleets have developed over a long period of time resulting in an assortment of designs with a variety manufactures and equipment. But to what extent can requirements be combined whilst still creating both operational and financial advantages? In this paper the cost of commonality is analysed based on a study conducted by the NDP (Naval Design Partnering) for a common launch along with the use of rapid design tools to understand the implications of disparate requirements. The study combines six operational profiles currently conducted by individual in service vessels and investigates to what extent requirements can be combined. The main through life cost drivers are considered, from requirements writing through to end of life, with key cost and benefit areas examined to identify pitfalls when combining requirements.

12.15-12.50 CONTRACTING IN A CHANGING THREAT ENVIROMENT, *Philipp Schön, ThyssenKrupp Marine Systems, Germany.* In the last decade, Naval contracting has entered a new era just to change course again recently. Due to the world financial crisis and the related austerity measures, military acquisition budgets globally have flattening out and were declining. Large scale multi-billion euro shipbuilding programs were scaled down and delayed. The nature of Contract Procurement also witnessed a slow change from traditional contracts to new concepts like Availability or Capability Contracting and Through Life Capability Management. Customers were also adopting new concepts like Smart Acquisition or Better Buying Power and reforming their acquisition processes making them more complex and demanding while trying to "Do More with Less" (standardization) and taking the contracting process and its execution out of the hands of the user and into the hands or procurement agencies. The increasing procurement pressure and (slowly) rising budgets are now confronted with rather bureaucratic procurement processes developed for peacetime procurements. Where does that leave naval planning?. The trick will be in balancing all of these and more. The paper will try to outline a holistic approach for such.

12.50-13.45 LUNCH

13.45-14.20 DESIGN SPACE EXPLORATION FOR MILITARY HIGH SPEED CRAFT PROCUREMENT, *Steven Lee, Naval Design Partnering Team, UK.* High speed craft have highly constrained design constraints with multiple, conflicting requirements placed on the designer. Numerous requirements are also difficult to quantify, assess and specify using the classic procurement models. The NDP explain how early stage design tools, operational role assessment and novel techniques can mitigate the risk and improve the understanding of the design space and key performance measures. Using these techniques to explore the design space allows procurement specialists to more accurately translate the users' requirements into the engineering space. Early stage design programs such as HiSCAT (High Speed Craft Assessment Tool) can be used to rapidly assess the impacts of requirements allowing a better understanding the design space. More complex requirements can't always be assed in this way and this paper looks at how bespoke software and upfront design can be used to support requirements development.

14.20-14.55 THE NATO DRIVE TO MISSION MODULARITY, *David Manley, Ministry of Defence, UK.* The drive to deliver flexible, adaptable ships had caused a number of NATO navies to consider modular systems as a means to deliver capability. At the same time there is an increasing desire to increase scope for interoperability. And the rapid advances in unmanned surface, air and subsurface systems requires a method of delivery of those systems into ships that allows new technology to be embarked quickly without costly modifications to the host platform being required. As a result of these imperatives NATO established the Specialist Team on Mission Modularity (ST/MM), working under the NATO Naval Armament Group to deliver standards and guidance in ship and module design, operability, logistics, maintenance and manning. This paper covers the work of ST/MM and its supporting teams within navies and Industry, progress towards the publication of standards and guidance, tests, trials and other activities that have been conducted to inform the programme. It considers the use of 20' ISO containers as a basis for a modular system, looking at a number of enhancements over existing standards to improve their ability to be used in a naval environment whilst still maintaining the essential geometric standards that allow them to seamlessly utilise the international ISO container logistics environment. Finally it reviews activities addressing impact on ship design and operation, maintenance, logistics and training, before concluding with a discussion of the future NATO programme.

14.55-15.30 THE IMPLICATIONS OF ADAPTABILITY, FLEXIBILITY AND MODULARITY FOR THE RN, *Malcolm Courts, BAE Systems, UK, C N Broadbent, Defence Science and Technology Laboratory, UK.* The paper summarises the results from a series of studies performed by BAE and DSTL on the implications of Adaptability, Flexibility and Modularity on RN warships in terms of their main advantages and disadvantages. It considers the approaches taken to illustrate potential solutions using modularity. It reviews the approaches and the interdependencies between them and identifies the benefits that can be expected in terms of production, operation and through life upgrade. Reference is made to studies performed by BAE and DSTL which attempted to quantify the potential effect of some of these features on representative warship designs. Payload modularity is shown to be a subset of, and to an extent dependent upon, many of the identified features. The pros and cons of payload modularity are discussed and a potential strategy for future RN warships identified. The paper concludes with the results of a study on a range of combatant concepts with varying degrees of flexibility and multi mi ssion capability, using the FASIP tool to evaluate the resultant fleet mix. This showed that the right mission capability mixes in potentially larger designs can lead to a more cost effective overall fleet mix than traditional more minimal ship concepts.

15.30-15.55 COFFEE

15.55-16.30 THE NEXT GENERATION MCM PLATFORM-NOT YET FULL AUTONOMY, *Alex Aitken, BMT, UK.* The move to using unmanned systems for mine countermeasures (MCM) is necessitating a change to the whole concept of operations (CONOPS) for naval minewarfare. However, the current rate of development of autonomous systems has led BMT to conclude that, for the foreseeable future, a need shall remain for a specialist mine counter-measures (MCM) platform from which the autonomous systems can be hosted and operated. These ships shall form an integral element of a nation's maritime MCM capability and the new operating concept requires a very different platform to the existing ships. The paper will examine the features required of the next generation of MCM ships and how that is balanced against the need to provide an affordable, capable and safe national asset. It shall summarise the findings of BMT's R&D studies into near-future autonomous minewarfare which identified the need for a specialist MCM platform and set the requirements that underpinned the development of its Venari-85 design. Using Venari as a basis, the author shall discuss the design's naval architectural, marine engineering, combat systems and survivability features and how these are achieved while meeting navies' needs to have a lean manned platform that can be adapted through life to continue to support the ever-developing autonomous MCM systems. Inherent to the design's development was the conscious effort to ensure that a flexible platform was provided which enables its key attributes to be beneficial for alternative military roles.

16.30-17.05 BRINGING MEDICAL FACILITIES TO THE FOREFRONT OF NAVAL SHIP DESIGN, FOCUSING ON MISSION ADAPTABILITY AND THE INTEGRATION OF MODULAR MEDICAL FACILITIES, *Pilar Morales, Harry Schweidler, Babcock International Group, UK.* The provision of dedicated medical facilities on naval ships has long been established, however the design of these facilities rarely makes the top list of priorities for the Naval Architect and is often overlooked in its importance due to emphasis on other platform capabilities. Medical facilities are traditionally designed to provide a capability in times of conflict, however there has been a recent increase in Humanitarian and Disaster Relief Operations (HADRO) (for example; Africa with the Ebola outbreak, the Caribbean in the aftermath of Hurricane Irma and the rescue of refugees in the Mediterranean) where naval vessels have provided a key medical capability which may have been outside of their original design intent. This paper uses two multi role vessel concept designs of different size and medical role to investigate how the functionality of the medical capability can be improved through optimal layout of medical facilities and vessel arrangement itself. It also explores how the provision of modular medical units (in regular use for field hospitals) can be best exploited within the confines of a naval vessel. The overall aim is to provide a basis for a more adaptable and flexible shipboard medical facility, capable of addressing the ongoing need to support HADRO without compromising the other aspects of a warship.

17.05- GENERAL DISCUSSION & EVENING DRINKS RECEPTION

DAY 2 PAPERS:

08.55-09.25 COFFEE AND REGISTRATION

09.25-10.00 SMART WARSHIPS IN THE NETWORKED BATTLEFIELD, *Lewis Griffiths, BMT, UK.* The relentless advance of technology forces warship designers to continually adapt and improve warship design in order to remain capable and credible against modern adversaries. The emergence of fast, accurate detection and targeting systems coupled with hypersonic and anti-ship ballistic missiles will force ships to adapt in order to survive future force level engagements. This paper analyses a mixture capabilities and assets that can help warships to fight and survive in future battlefields. The paper acknowledges the increasing prevalence of remote sensors and effectors and the enabling technologies required to make best use of these assets while remaining cognizant manpower and cost limitations.

10.00-10.35 VIRTUAL REALITY FOR DESIGN OF NEW WARSHIP CONCEPTS, *Ken Goh, Knud E Hansen Australia P/L, Australia.* Virtual Reality (VR) technology, although in its infancy, is already showing great promise for naval training. Use of VR for development of vessel requirements and design is also proving to be exceptionally useful. This is especially relevant when exploring new concepts of vessel types that do not currently exist. The Australian Submarine Force faces many unique operational challenges. Naval architects at KNUD E HANSEN, with the assistance of Australian submarine experts, have over the past two years developed a Submarine Support Ship to support future operations of conventional submarines. This paper demonstrates, through new design processes, how ShipSpace Virtual Reality tools have enabled designers and engineers to develop a new class of warship. Virtual reality tools allows better engagement of experts and stakeholders in the concept design, which is crucial given the unique vessel features required to support submarines. What might seem to work on a computer screen or on paper may not be practical or work as intended in operation. The immersive and realistic nature of VR enables people to experience the design with exceptional realism and use their whole-body cognition when providing design input.

10.35-11.10 THE ADVANCED TECHNOLOGY CORVETTE (RAILGUN): A CONCEPT EXPLORATION OF FUTURE WARSHIPS, *Dr Rachel Pawling, Luke Farrier, Dr Nick Bradbeer, University College London, UK.* High-power electric weapons, such as the electromagnetic railgun (EMRG), laser and High Power Microwave (HPM) devices are moving ever closer to practical utilisation by navies and prototype EMRG systems are being tested at militarily useful energy levels. Previous work in the UCL Department of Mechanical Engineering has included preliminary design studies for surface combatants with an all-electric weapons outfit, and detailed marine engineering analysis, to PhD level of the implications for future power and propulsion systems of these future weapons. The EMRG in particular may lead to new concepts of operation due to the range and relatively low cost of their projectiles. Particular aspects of interest include the possibility of dual-purpose weapons and the question of effect on target. Marine engineering and broader ship design integration issues require an exploratory approach if the possibilities for a fully developed EMRG are to be understood. This paper, however, describes a concept design study, making use of a new concept exploration approach developed at UCL, for a small corvette-sized combatant, developed as the “minimum sized ship” capable of supporting an EMRG as its primary armament and additionally making use of Uncrewed Vehicles (UxVs) for target acquisition. The paper describes possible concepts of operation for a small EMRG-equipped combatant, the design approach, proposed range of possible ship designs and also covers aspects such as marine engineering integration.

10.10-11.35 COFFEE

11.35-12.10 TRENDS IN ENVIRONMENTAL REQUIREMENTS AND THEIR IMPACT ON THE FUTURE SURFACE VESSEL, *James Livingstone, BAE System, UK.* Navies benefit from exemptions to many international and national environmental regulations. Through changes to these regulations and governments’ policies, navies are now expected to meet or exceed the standards set by environmental laws. These changes can manifest themselves as restrictions to operations, a change in how navies can operate and changes to naval ship design. Designing and building a complex naval warship is a long process and by the time a warship comes into service the design can be a number of years old. Together with the long service life of naval vessels, can we ensure that known and future environmental requirements are identified and embodied into the design to avoid future re-work or limitations and restrictions on operations? The challenge for naval ship design and construction is to provide unrestricted and continued operation in the light of changing environmental legislation. This paper will review the history of environmental requirements for ships and navies and look forward to attempt to predict the trends in requirements. Using examples from the Type 26 GCS it will illustrate how the design has mitigated the impact of these future trends and the potential implications for a warship whose primary role is a warfighting capability.

12.10-12.45 THE FUTURE WARSHIP: GREEN & MISSION CAPABLE
Cody Lyster, Babcock International Group, UK. In the early 21st century, change is often intrinsically linked to public opinion and the developing array of Legislation and Regulation. The environment and its protection is thrusting to the forefront of how we think, develop, engineer and operate marine craft. The way we develop future ship design needs to reflect the current landscape of environmental legislation, whilst learning from the past to anticipate future Regulation and constraints. This must also be sensitively balanced with other operational requirements, such as; speed, weapons, sensors and safety. The successful operation of ships of war, during peace, is dependent on flexibility and the ability to uphold government and international policy throughout the seaways of the world. A lack of capability to comply with a foreign nation's environmental legislation could preclude vessels from entering national waters, ports or harbours. Denial of entry could represent an inconvenience, or perhaps compromise a military exercise or the wellbeing of the crew. This paper considers the changing legislative narrative, its impact on how we think, design and operate tomorrow's warship.

12.45-13.40 LUNCH

13.40-14.15 THE USE OF PAYLOAD FACTOR AS A DESIGN PARAMETER FOR THE PAYLOAD EFFICIENCY OF WARSHIPS, *Berkay Çilli Dr Nurhan Kahyaoglu, Piri Reis University, Turkey.* The purpose of this study is to develop a design approach in the early stage design phase of war ships, to be able to evaluate the payload efficiency which will indicate the amount of payload that can be deployed as combat systems on board the ship. The basic ship design of naval combatants is mainly be interested to ad hoc main specifications, characteristics and functionality (design objectives). Payload factor defines fraction of each combat capability for different naval combatant types like corvettes, frigates, destroyers and cruisers at variable displacements and speed ranges. This provides a design phenomenon including functions of speed (Fr number), displacement (Δ) and payload (WPL). The aim of this paper is to make proper maximum payload predictions for different speeds, and for displacement ranges at the concept design stage of war ships which have similar performance parameters. Payload factor for selected naval combatant types are also combined with Transport Factor approach introduced by Kennell (1998). As a result of this combination, a design space is created for different speeds and lengths with maximum payload (efficient payload) in accordance with the naval ship’s mission and operational effectiveness.

14.15-14.50 DESIGNING TO SUPPORT THROUGH LIFE ASSURANCE: A WELDING AND NDT PERSPECTIVE, *Mark Sansom, James Clarke, Veronica Williams, Babcock International Group, UK.* Modern Warships are expensive assets to build and maintain; this is exacerbated by an uncertain scope of operations governed by a changing geopolitical climate. Throughout the life of these assets there is a requirement for continued assurance with the potential for this to extend as they are sold on to other navies. Meeting these requirements is becoming increasingly challenging upon a backdrop of reduced funding and a skills gap in the STEM sector. It is therefore necessary to invest in technologies during the design phase of projects – where modifications have a much lower cost compared to modifications undertaken in service. This paper will review how advancements in Welding, Non-Destructive Testing (NDT) and Engineering Assessment can be incorporated by designers to enable this demand to be met. To aid future welding productivity, certain design and build activities can be adopted which will give better access and scope to the vessel. Similarly, by engaging with future NDT trends, designers can allow for newer inspection techniques to be used. It will also explore how a comprehensive engineering data management strategy alleviates some of the challenges associated with through life assurance and how in its own right it can be an exportable product alongside the asset.

14.50-15.25 CERTIFYING THE NATIONS FLAGSHIP - A GREATER LEVEL OF ASSURANCE, Stuart Hunt, BAE System, UK
On the 26th June 2017 HMS Queen Elizabeth departed Rosyth on her maiden sea trials. At 65,000t she is the largest Warship to be built in the UK. Three weeks prior to this, seven hundred members of the ships company moved onboard the ship to both work and live, the largest number of ship's staff moved onboard an RN vessel that BAE Systems Naval Ships have had to manage. How can such a large and complex vessel be certified safe from a design perspective to meet each critical milestone? In both these key and subsequent milestones, the Aircraft Carrier Alliance developed an enhanced method of assuring that the ship was both safe to work & live on and also to proceed to sea. The ACA Engineering team developed a new system to provide an objective measure of the design intent and ship's material state. Hence, it was agreed to create a serious of documents across the product hierarchy called Certificates of Design (C of D). This is the first time that BAE Naval Ships have followed this process for vessel in build and acceptance. This paper will outline the processes involved highlighting some of the challenges met along the way. In parallel to this the ship was also the first warship to carry extensive LR Classification. Whilst this is common for commercial shipping, this was an unprecedented level of Classification for a warship, significantly enhancing the no of class notations attributed to Type 45. The paper will also indicate the process of achieving LR Classification to support these key events.

15.25-15.50 COFFEE

15.50-16.25 EXPERIMENTAL INVESTIGATION OF FLOW OVER THE FLIGHT DECK OF A GENERIC AIRCRAFT CARRIER, *K Vignesh Kumar, M P Mathew, S S Sinha, Indian Institute of Technology Delhi, India, R Vijayakumar, Indian Institute of Technology Madras, India.* This paper presents experimental studies carried out in wind-tunnel at IIT Delhi to measure the airflow over a generic aircraft carrier model and establish benchmark data over the flight deck (without and with superstructure). Several pressure-taps embedded over the deck report flow parameters at various locations which are extracted for data analysis. These studies offer valuable insight into the flow conditions over the flight deck and provide the logical start point to extend the work to qualify multiple geometries and locations of the island for optimizing airflow. The explication of flow physics thus obtained is a prerequisite to understanding the influence of these structures in the wake of the carrier, in the critical ‘burble’ zone of aircraft landing approach.

16.25-17.00 SCL's PURPLE FIRE SURVIVABILITY/LETHALITY ASSESSMENT TOOL, *James Schofield, Survivability Consulting Limited, UK.* Survivability management is a well-established part of naval procurement. Even when budget and timescales are constrained, the advice delivered early in the design process can provide substantial performance improvements. At the heart of timely and accurate advice is the existence of efficient assessment software backed up by expert users. This paper introduces Survivability Consulting Limited's (SCL's) new Purple Fire assessment tool. Under development since 2013, it has been designed from the outset to facilitate the sorts of assessment required for modern platform designs, weapon programmes and operational analysis in support of the fleet. It provides the analyst with the ability to construct platform representations very quickly, meaning less model build time and more analysis time. It automates the consideration of large parameter spaces allowing in-depth assessments to be conducted quicker than ever.

17.00- GENERAL DISCUSSION

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