

NAVTEC '90

INTERACTION BETWEEN NAVAL WEAPON SYSTEMS AND WARSHIP DESIGN

BY

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As part of the NAVTEC '90 series of conferences the Royal Institution of Naval Architects organized a conference addressing the subject of the interaction between naval weapon systems and warship design. This was held at the Heathrow Penta hotel on 20 and 21 November 1990. The conference was widely attended, with an interesting mix of papers being presented. The following report is an attempt to summarize the papers and to highlight the pertinent points of each.

The Role of the Naval Architect

by G. H. Fuller of British Maritime Technology Ltd

This paper formed a good scene-setter for the conference, highlighting the fundamental concepts of warship design. The paper is formed around the 'fight' function and examines the key issues involved. Interestingly it suggests that from a weapon system integration aspect the multi-role weapon discharge system should be used. This places the weapon design emphasis squarely on the actual weapon and standardizes the ship fit implications. The US Mk.41 launcher uses this concept.

A Structured Approach to Warship Design

by M. Williams of Vickers Shipbuilding and Engineering Ltd

There are several ways of approaching combat system design (including the platform as an element of the total). This paper discusses the 'system' method, using a combination of physical and logical modelling. These are run in parallel with feasibility studies and the formulation of policy papers. Little thought is given in the paper to the theme of the conference and so is a little disappointing, but is a useful thought-provoker.

The Missile Trials Craft 'Verifier'

by D. Bricknell and M. Davey of British Aerospace (Dynamics) Ltd; and P. Graville of AMGRAM Ltd

In order to verify the use of the Sea Skua missile as a ship-launched weapon, a trial was conducted by British Aerospace involving the purchase and fitting out of a fast patrol boat. Although this is a very interesting paper, it does not give much insight into the actual weapon system integration in a warship; alignment and vibration are mentioned briefly. However it does discuss the implications of fitting a weapon to a merchant vessel, particularly the registration and classification problems.

The Problems of Misalignment and Flexure and How the Weapon Designer may Overcome them

by T. P. Adams, R. M. Alger and K. Nicholson of ARE, Portsmouth

Misalignment causes a huge headache for the naval architect, particularly during the initial phases of warship development. The paper forms a useful reference document introducing the various types of error, their causes

and their measurement at a high level. The paper proposes a method for compensating for this by active correction to a missile in flight.

The Effect of Cumulative Alignment Errors on Overall Combat System Performance, and Proposals for their Reduction

by D. W. Jowett and D. L. Smith of Yarrow Shipbuilders Ltd.

The paper follows on nicely from the last one, dealing with the subject in slightly more depth. As weapon systems become more sophisticated there is a growing requirement for more accurate installation and reduced flexural errors. A large error budget increases the cost and complexity of the system. Understandably weapon projects try to shift this responsibility to the ship design. The paper suggests that a point is rapidly being approached where the required accuracies are beyond measuring and build capabilities. Active monitoring of in-service misalignment is advocated and a method utilizing laser ring gyros is put forward.

Matching Warships and Sailors

by P. E. Gillet and D. L. Northam of Vickers Shipbuilding and Engineering Ltd

This paper examines a way in which human factors should be considered during the design of the combat system architecture. Hence it has little to do with the theme of the conference other than that the naval architect must accommodate the crew.

Improvement of Destroyer Performance through Optimized Seakeeping Design

by T. C. Smith, D. A. Walden and W. L. Thomas III of the David Taylor Research Center

It is well known that the motion of a warship can greatly affect the capabilities of a weapon system. This project attempted to optimize a warship hull form based on a number of parameters. A baseline ship was selected, along with principal constraints for good towed array performance, gunnery and RAS capability. For each of these cases a hull form was developed by massaging the baseline form, using a computer program called SKOPT. These results were then compared with the baseline and conclusions drawn. The paper is an interesting addition to the topic of seakeeping and is worth consideration.

Design Techniques to Upgrade the Combat System Effectiveness of the FFG 7 Class Frigate

by E. Yanis and R. Schmitt of General Electric

There was some doubt initially whether or not this paper could be presented due to security. However this was finally resolved and a paper of benefit to the Conference was given. The changing threat environment and the array of sophisticated weapons available to third world countries has required the updating of some of the USN's warships. This paper presented a study undertaken to assess the scope for improving the FFG 7 Class. It highlighted the problems involved when designing a ship to receive a capability update and the ship impact trends of future weapon systems. The balance of affordability and capability is paramount.

Integrated Communications Systems for Capital Ships

by C. S. den Brincker and A. Kerrison of REDIFON Ltd.

C³I is an ever-increasing field; communications and CESM (Communications and Electronic Surveillance Measures) are placing greater demands on topside layout, which in turn influences the overall ship design. This paper looks at the overall problem and suggest the improvements in performance

expected in the future. However little advice is given regarding how this will be achieved.

Mutual Interference and its Role in Combat System Design

by C. Broadbent of Vickers Shipbuilding and Engineering Ltd.

This follows on from the above paper but is specific to mutual interference. It is a good reference document introducing the reader to the subject and its problems. However only a small part is devoted to ship integration, suggesting a tiered upper deck arrangement, long topside length, several layers of decks and sites for future systems, all of which are well known.

Ship Integration Concept of a Very Short Range Air Defence System

by L. D. Lowe of ARE, Portsmouth

The Very Short Range Air Defence (VSRAD) concept covers the future generation of Close in Weapons Systems. The key design driver is that the system should have minimal impact on the ship design and fit, the intention being for it to be fitted to merchant ships if necessary. This paper is very enlightening in that it presents the impact of these constraints on the weapon from the weapon project's point of view. The main areas of concern are operational risk and availability. Several examples are given and discussed.

Off-Board Command Casualty Launch

by L. Ferreiro, Z. Sansanowicz and D. Biancosino of NAVSEA

There is considerable emphasis on increasing the cost-effectiveness of today's warships. One aspect of this is the ability to 'fight hurt'. Although a ship may lose her command facility she could still have a complete weapon system or launcher section available which she could not use. This paper addresses a method to allow another vessel to take charge of certain functions of a damaged ship to increase her effectiveness in a battle scenario. The additional systems required and the ship fit implication are mentioned but in little depth.

The Role of Vulnerability Assessment in Warship Design

by R. D. Dawson and C. R. Orton of ARE, Portsmouth

Following on from above, another method of increasing the battle worthiness of a warship is to design it to increased vulnerability standards. The paper presented summarizes the areas which require consideration and is therefore a useful document, but it contains no detail.

Design Techniques used to Optimize the Combat System Effectiveness of the Type 23 Frigate

by J. H. Fraser of Yarrow Shipbuilders Ltd.

A brief history of the Type 23 frigate is given, along with the contractual procedures developed for the procurement of the ship. A discussion of the resulting problems in the design of the combat system and integration are given. These are restricted to those occurring from the contractual specification. This is a useful paper for projects trying to define a procurement strategy and contractual specifications and represents the views of YSL regarding whole ship procurement. However there is little technical content or discussion of the actual engineering of the weapon system integration.

Conclusion

I attended the conference expecting to see papers discussing the engineering implication of integrating weapons systems into a warship. This, I felt, would have been directed to the problems facing the naval architect. However, although many very excellent papers were presented, few addressed this subject directly and some failed to do so at all.