UNIVERSITY COLLEGE LONDON POST GRADUATE PROJECTS 1995/96

NAVAL ARCHITECTURE

Consideration of warship costs
by LIEUTENANT G. DIRKSEN, South African Navy

This report investigates the nature of warship costs. It begins by providing a historical perspective considering the evolvement of warship costs over the past century. After considering developments of the last decade, future warship design trends are identified and expanded upon. A unit production cost basis is then proposed for use by future MSc Naval Architecture students at UCL. The merits of through life costing are discussed and an approach to through life cost analysis aimed at producing more cost effective ship designs is proposed. Functional costing is also discussed as a method of measuring the cost effectiveness of a warship design as well as an aid to assessing the cost implications of design options. The UCL weight and cost group information is also linked to a functional analysis approach. Further recommendations are made, aimed at improving the quality of the information provided, after which it is concluded that valuable baseline data has been provided for students use and further studies at UCL.

Sensitivity of Stability Analysis to Hull Form Geometry
by P. DUGGAN, MoD UK

This report describes the results of an initial study into the sensitivity of stability analysis to hull form geometry. The work involved covers a review of the past and present techniques in hullform development. It identifies the application of computers as the main tool in today's industry and how it has the capability to create highly sophisticated hull models. Linked to this graphical ability, the analysis focuses on the subject of stability, and in particular how, by varying the hull shape, the corresponding stability characteristics are affected.

Design methodology for small fast planning craft
by T.H. GRAHAM, Private Student British

The design process is normally illustrated via the design spiral. Whilst it is clear that design is an iterative process, this dissertation proposes a more structured methodology to the designer. The objective being to achieve a balanced design and consequently a satisfactory compromise between the conflicting design issues.

The dissertation is divided into sections which discuss various aspects such as design concepts and general principles and finally demonstrates the proposed methodology by working through a practical example of the design of a small fast patrol craft.

The methodology can best be summarized as a 'layout' driven approach. This means that the layout is planned at a very early stage and its validity is investigated as the design develops. Although the example given was based on a specific application, it is thought that the proposed methodology would be of use to the designer of planning craft from any sector of the marine industry.

Glass Reinforced Plastic superstructures
by J. HARE, MoD UK

The research carried out in the preparation of this thesis is aimed at identifying the key advantages and disadvantages of using Glass Reinforced Plastic (GRP) as the primary superstructure construction material.

Comparisons have been made with steel and aluminium superstructures as a means of identifying the viability of using GRP. Design results are summarized to provide quantitative differences in weight, cost and deflection under transverse load when using these different materials.

The report concludes that GRP superstructures are a viable option which can contribute a number of advantages to many ship designs.

Transient Flooding
by LIEUTENANT S. ILYAS, Pakistan Navy

Rapid heeling of a sea going vessel due to transient symmetric or asymmetric flooding can lead to fatal consequences. Therefore there is a need to develop numeric techniques to predict this phenomena without the use of long and expensive model tests. The amount of data these numeric techniques can generate in a short time will be of great value to the designer in improving the design and for operators to have confidence in the damage fighting capabilities of the vessel.

A modest tool based on the block movement of water mass is proposed. Though the numeric code requires rigorous testing, initial results are encouraging. The procedure does predict higher heel angles due to the transient effect of flooding before the barge under test comes to its final equilibrium angle.

The numeric procedure is implemented as FORTRAN program named UCLFLOOD. The program solves the ship roll equation by first formulating the moment term on the right hand side and then using central difference method to predict the angle of heel.

Consideration of the longitudinal strength of damaged oil tankers
by Miss S. PALIOS, Private Student Greece

The growing pressure for quick and efficient response to salvaging a damaged ship imposed by owners, coast guards, international organizations and the general public, demands the reassessment of the simplified longitudinal strength calculations for damaged ships. A methodology is presented for the evaluation of the longitudinal strength of a damaged and/or inclined ship

which takes into account the rotation and translation of the principal axes due to the damage and the resolution of the bending moment about the new principal axes. The results of this proposed method are compared to those produced by the traditional approach. Real case salvage scenarios are examined and the determining strength factors identified. This report shows that the extent and location of the damage, as well as the magnitude of angle of heel, can lead to significantly increases stresses ignored by the traditional methodology. It is shown that the stress increases for the points further away from the new principal axes and the contribution of the bending moment about the new vertical principal axis becomes significant with the increasing angle of heel. It is found that the longitudinal stress predicted by the proposed method produced stress magnitudes greater than that produced by the traditional approach. The greatest increase of stress of approximately 34% was found for the case where a ship was flooded at starboard due to grounding and the vessel heeled at an angle of 29 degrees starboard in a sea state 8.

The development of a design methodology for the initial sizing of Trimarans
by N. PAPALOS, Private Student Cyprus

This report contains the description of the first methodology for the initial sizing of trimarans. This methodology was based on a database of 14 designs, which apart from one were produced at the UCL.

Importantly the application of the methodology on previous designs showed that they were underestimated in terms of weight, so this report was naturally extended to investigate why this happened. The results of that investigation highlighted the need for an initial methodology since there were serious mistakes in the initial sizing process of previous designs.

The initial methodology proved to be a very useful tool since it enables a designer to realise from this early stage the impact that different parameters have on the final design.

Trimaran propulsion options
by LIEUTENANT S. SMITH, Norwegian Navy

The aim of this project was to investigate possible distribution between hulls, type of propulsor have been considered by evaluating against criteria of manoeuvrability, ARM, efficiency, practicality, cost and ship design impact for frigate applications. The ship design impacts of the outriggers have been given special attention.

After identification of possible propulsion plant configurations, the most promising options have been evaluated using a 4300 tonne frigate designed during the UCL Ship Design Exercise '96. This design has been used as a baseline and reference for the propulsion options identified. Relative changes, negative or positive, have been used when absolute numbers have not been available. This has also been the case when existing mono hull models or formulae have been applied, not sufficiently tested or proven for trimaran applications.

Investigation of the structural efficiency of the trimaran hull form
M. SELFRIDGE, MoD UK

This project involved Finite Element Analysis of the trimaran hull form, under various loadcases and with varying structural configurations in an attempt to determine the behaviour of the structure and nature of the stress distribution, particularly in the forward transition region.

The Finite Element software used was I-DEARS (Integrated Design Engineering Analysis Software). The research started with an evaluation of previous Finite Element work, followed by an intensive period of learning to use the software. Various testmodels were used to gain experience and clarification of I-DEARS specific techniques.

The main analysis considered issues such as different structural arrangements, various loadcases and scenarios, application of loading and physical properties, access openings and smaller more refined models.

Included is a full description of the analysis undertaken and the results obtained. Numerous XY-Graphs and contour plots of stress are included together with recommendations for future research.