THE ROYAL INSTITUTION OF NAVAL ARCHITECTS
(AUSTRALIAN DIVISION)

THE KUMMERMAN LECTURE
1989

A Report from the RINA Spring Meetings 1989

BY

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THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

Spring Meetings 1989

The issue of this copy of the paper is on the express understanding that an abstract only may be published after the paper has been read at the meeting to be held in the Weir Lecture Hall, 10 Upper Belgrave Street, London SW1X 8BQ, on April 17, 1989.

THE ESTIMATION OF FLOW OVER A THREE DIMENSIONAL BODY IN STEADY MOTION

by R.K. Burcher*, PhD, RCNC, FEng (Fellow).

SUMMARY: This paper offers a rationale for the estimation of the direction of flow over the surface of an arbitrary three dimensional body in steady motion. It provides guidance to the designer on how the geometric properties of the surface influence the direction of flow and hence how changes could be made to the surface to improve the flow. This permits, at an early stage, the alignment of appendages and provides guidance on the shaping of fairings to the main hull to obtain smooth flow and reduce the probability of premature turbulence and separation.

MOTIONS OF A STEERED MODEL WARSHIP IN OBLIQUE WAVES

by A.R.J.M. Lloyd*, BSc, PhD (Fellow) and P. Crossland*, BSc.

SUMMARY: The naval architect needs to assess seakeeping at an early stage in the design of a new ship. This is often achieved with strip theory computer programs.

While these have been extensively validated for motions in the vertical plane much less data are available for lateral plane motions and the available data are often flawed by inappropriate model restraints or steering.

This paper describes model experiments conducted at ARE Haslar to study the motion of a typical modern warship. The model was steered using a well defined linear autopilot in regular oblique waves. Measurements of heave, pitch, sway, roll, yaw and rudder amplitudes and phases were made and compared with theoretical predictions computed using the PAT-86 suite of seakeeping computer programs.

These experiments yield a useful set of data for the validation of seakeeping computer programs. The results of the PAT-86 validation show that vertical motions were predicted very well. Yaw and rudder motions were predicted quite well except in quartering waves where the prediction deteriorates. Predictions of roll and sway motions in quartering waves were unsatisfactory.

EVALUATION OF THEORETICAL METHODS FOR DETERMINING ROLL DAMPING COEFFICIENTS

by A.K. Brook*, BSc, MSc (Member).

SUMMARY: Theoretical methods for determining the roll damping of a vessel are evaluated from correlations with model tests and full-scale trials undertaken in 1939 on the Tribal Class destroyer HMS Nubian. The correlations indicate that there can be significant differences in the coefficients obtained from available theoretical methods. The dependence of the coefficients on roll amplitude and forward speed differ significantly between the different methods.

The theoretical roll response of the Nubian in regular waves is also compared with model test results, where experimental and theoretical roll damping coefficients have been used in the motion response calculations. This correlation indicates that the accuracy of roll response calculations could be improved by developing more reliable theoretical roll damping methods. The paper concludes by suggesting that a series of experiments on uniform ship sections could provide data to enhance existing theoretical methods. Particular attention would be given to the roll damping dependence on roll amplitude, speed, scale and three-dimensional effects.

THE ANALYSIS OF UNSTEADY PROPELLER CAVITATION AND HULL SURFACE PRESSURES FOR DUCTED PROPELLERS

by J.A. Szantyr*, PhD, DSc and E.J. Glover**, BSc, PhD (Fellow).

SUMMARY: This paper presents the application of the unsteady deformable lifting surface theory to the analysis of unsteady propeller cavitation and hull surface pressures for ducted propellers. An outline of the basic theoretical relations employed in the algorithm is given. The algorithm is converted into an efficient computer program. The cavitation tunnel experiments performed in order to supply data for verification of the theoretical method are described. An extensive comparison of experimental and theoretical results is presented and discussed.

ETHICS AND FASHION IN DESIGN

by K.J. Rawson* MSc, FEng, FCSD, RCNC, FRSA, (Fellow).

SUMMARY

The author considers the ethical stances available to a designer and, in particular, a maritime designer. Historical perspective provides some insight into the conflicting pressures upon the establishment of standards and the increasing speed at which change is engendered. Influences of the law, pressure groups, the media and politics are considered. Responsibilities of learned societies, companies and the individual are examined in relation to the adoption of standards and the morality of design for profit or war.

THE EVOLUTION OF THE MODERN CRUISE LINER

by S.M. Payne, * B.Sc.(Eng) (Graduate)

SUMMARY: Despite the general depression within shipping and shipbuilding industries, the cruise industry continues to support an ever increasing number of cruise ships. The cruising slump of the mid 1970's, due mainly to the oil crisis, has been reversed and several newbuildings are approaching historic size.

The purpose of this paper is to provide some background and insight into the present day cruise industry by charting it's conception in 1835 through the 20th. Century to the present day with an appreciation of the cruise ships themselves and how they have adapted to modern requirements.

THE DESIGN AND PERFORMANCE OF A PNEUMATIC CRANE COMPENSATION SYSTEM

by J.A. Witz*, BSc, PhD (Graduate) and M.H. Patel*, BSc, PhD (Member).

SUMMARY

The lifting and repositioning of a load from a crane vessel induces large disturbing forces and moments which need to be compensated so that the crane vessel's mean attitude in heel or trim remains close to level. This paper describes the design and operation of a pneumatic crane compensation system which is used to counteract crane disturbing forces. The system consists of a set of open bottom tanks located within the vessel's hull. The tanks are connected to a pneumatic power and control system which controls the air pressures within the tanks through actuation of electro-pneumatic valves. The paper describes the design and performance calculations for the first application of this pneumatic crane compensation system installed on the monohull crane vessel 'DB50' (formerly 'Challenger'), recently completed by Sunderland Shipbuilders Ltd (NSEL).

SYSTEM DESIGN OF FLOATING OFFSHORE STRUCTURES

by J.-S. Lee*, BSc, MSc and D. Faulkner*, PhD, RCNC, FEng (Fellow).

SUMMARY An extended incremental load method has been developed to derive the most probable failure path for continuous plated structures, such as the assembly of stiffened rectangular and cylindrical cross-sections used in Tension Leg Platforms (TLPs) and Semi-Submersibles. The method allows for load redistribution as structural components strain beyond their maximum loads so that a system of elasto-plastic moments developed in sufficient cross-sections to form a failure mechanism for the whole structural system under a variety of possible combined loads.

The method has been coupled to a reliability based treatment of load effects and state-of-the-art strength equations and incorporates a search routine to obtain the most probable failure path giving the lowest system safety index. The process is illustrated with results for the Hutton TLP and one variant. Sensitivity studies show, for any given level of safety, the economic importance of reducing the uncertainties associated with component strength modelling and with post-ultimate behaviour characteristics. The results of several such parametric studies lead to important conclusions relating to the adoption of a systems approach coupled also to component behaviour for economic design, and for in service re-assessments of such structures.

Although the paper emphasises ultimate strength the frame work for including fatigue behaviour has also been established.

A STRUCTURAL ROLE FOR ADHESIVES IN SHIPBUILDING?

by S.A. Hashim*, BSc, MSc, I.E. Winkle*, BSc (Member) and M.J. Cowling*, BEng, PhD, MIM.

SUMMARY: Hot cured epoxy adhesives have a significant role to play in marine structural applications. This paper describes the results of a programme of research carried out at the University of Glasgow under joint SERC and industrial funding to explore the possibility of using high strength adhesives for structural fabrication in shipbuilding and similar structural steel applications. The bonding of stiffeners to relatively thin plating has been shown to be feasible at least for lightweight and/or lightly loaded structures where many of the problems associated with welding can be effectively overcome.

The paper outlines possible roles for adhesives in the shipbuilding industry and indicates the range of materials currently available for consideration. The reasons for focusing the research programme to one particular group of single part heat cured epoxy adhesives are described in relation to manufacturers' stated specifications. The need for a structural programme of testing to enhance the information available to designers on the behaviour of this interesting group of materials is also described.

THE MANAGEMENT OF SAFETY OF WARSHIPS IN THE UK

by D.K. Brown*, MEng, RCNC (Fellow) and D.W. Chalmers**, OBE, PhD, RCNC (Fellow).

SUMMARY: This paper outlines the procedure set up by the Chief Naval Architect of the Ministry of Defence to ensure the safety in service of surface warships and submarines from deficiencies in design and maintenance. The philosophy for each aspect, such as fire resistance or structural strength, is outlined and the means by which it is monitored described. Safety Certificates are issued against documented evidence for which individuals are personally responsible. The Chief Naval Architect has the sole authority to issue or withdraw the Safety Certificates.

ETHICS & FASHION IN DESIGN
A REPORT FROM THE R.I.N.A. SPRING MEETINGS 1989

INTRODUCTION

The paper titled 'Ethics and Fashion in Design' by Professor Ken Rawson was presented to the RINA Spring Meeting on the 18th April, 1989. Of the ten papers presented at the Meetings, it was this one that generated the most discussion and attracted the largest audience.

The purpose of this report is to summarise some of the concepts raised by Professor Rawson and then to add some of this author's ideas. The author is not, and does not claim to be an authority on Ethics, Fashion or Design. However, there are developments in Australia that can hopefully add to Professor Rawson's treatise and pose even more questions for Australia's naval architects, and designers in general, to consider and make their own judgements.

THE TWO CULTURES (OR IS IT THREE?)

Dr. Arnold (of Rugby School fame) in the 1850's established the pattern of English public school education as, "first religious and moral principle, secondly gentlemanly conduct and thirdly intellectual ability". Linking that philosophy to the universities of Oxford and Cambridge allowed the classics to dominate education and as a result, recruitment to the Civil Service. With so strong a principle, it is not surprising that industry, economics and politics came to be managed by an arts culture which regarded science as deficient in addressing Dr. Arnold's standards. As late as 1967, 85% of the graduate recruits to the British Civil Service were graduates of the humanities from Oxford or Cambridge.

In a report in "The Designer" in 1983, Sir Geoffrey Chandler stated:

> "We are now beginning to understand that what we regard as causes of our relative decline are in fact symptoms of a society whose attitudes and culture have been at worst hostile, at best indifferent, to industrial society. They are symptoms of an education which favours the academic over the practical.... They are symptoms of a society which fails to understand that industry is fundamental to just about everything we do. We have become an industrial country with an anti-industrial culture."

The author would suggest that a similar situation applies in Australia today, albeit with an different dimension. Media headlines often centre on the wheeling and dealing of corporate Australia; not the technology behind the companies but the financial manoeuvres to obtain maximum profits (or other goals). Such media coverage has the insidious effect

of inducing school leavers into the legal and financial professions rather than science and technology. This can lead to corporate and political decisions being made by the ill-informed.

ETHICAL DETERMINATES

Professor Rawson went on to discuss how crucial the press and television are in the development of our society's ethical standards. They use their power in a variety of ways. Often they hound the unfortunate, provide unfounded criticism, political bias and selective reporting. Careful presentations are able to insinuate an acceptability (or unacceptability) which may not be warranted by the content.

Another increasing influence on Britain's (and Australia's) supposedly democratic society is the pressure group. A government that is technologically ignorant and a Civil Service deeply depleted of expert scientific talent, forces ministers to rely on pressure groups and favoured advisers. These pressure groups and lobbyists may not represent any ethical view point beyond their own (or their sponsors) profits. Hence government decisions may be expected to represent short term votes rather than long term humanity. In the author's opinion, present Australian governments are not as bereft as Prof. Rawson believes is the case in the U.K. However some elements relating to Australia's possible third culture (the "money men") are certainly apparent in current decisions.

The laws that determine our safety are often driven in some haste by disaster and public outrage. The U.K. Merchant Shipping Act of 1854 required ships to have transverse watertight subdivision. This was enacted as a direct result of the loss of the 'BIRKENHEAD' in 1852 with the loss of almost 500 women and children. However in 1862, the shipowners' pressure group succeeded in getting the Act repealed, "because it was mischievous". Within three years, two more ships sank with the loss of over 230 lives because of inadequate subdivision. Such was, and probably still is, the power of the pressure group.

THE DESIGNER'S DILEMMA.

Few designers can regard their role as simply satisfying their client's requirements just within the law. On occasions, the designer must feel obliged to make a stand against a favourable, rather than a moral, interpretation of the law. There are circumstances where designing 'down to the rules' may significantly increase the risk of failure of the design.

In the interests of public safety and the designer's liability, risk evaluation is becoming an important design tool. At the least, it provides an exposure of the design to all those who contribute to it (including the client). Full quantification by risk analysis is not often possible or

necessary, but a qualitative assessment by making overt the risks considered and the way in which they are dealt with, can be beneficial to a project.

Professor Rawson stated the definitions of professional liability, but offered little guidance. Professional competence was defined as:-

> "the standard of the ordinary skilled man, exercising and professing to have that skill. A man need not possess the highest expert skill. Therefore it would not be expected for a defendant to be an expert in all the technology relating to his activity.

In addition, in the U.K., similarly to N.S.W., the Health and Safety at Work Act requires that the designer must ensure the product is without risk to health or safety and has been properly tested.

From the author's knowledge, it appears that the Health and Safety Acts (or equivalent) are more demanding than the professional competance guidelines and need to be recognised by all designers.

Professor Rawson concluded his paper with a challenge (There are no easy solutions):-

> "The adoption of a code of ethics remains substantially a personal matter which the rest of society will judge. Society and each practitioner cannot, ultimately avoid making moral judgements in the establishment of this position of equilibrium and relief."

DISCUSSION

The discussion after the paper centred on the 'two culture' concept and who makes the decisions that affect technology. To some extent the attitude was;-

> "why are 'they' doing this - don't 'they' understand the implications."

The 'they' could refer to government, financiers, corporate heads and educators.

An understanding of everyone's point of view and priorities is necessary to obtain balanced decisions. But how to break down the two (or three) culture concept? Prof. Rawson believes that it is happening as society is demanding more of its educators. In the U.K. many schools now have design and technology centres, which are very popular with the students.

The other main point of the Discussion was the affect that the media have on the law makers. The media tend to highlight the outlandish rather than the established views and items are sensationalised. Often this can work to the

betterment of society by forcing politicians to act in more haste than they may otherwise. However, there is always the danger that the full implications may not have been satisfactorily addressed. One important point was that the lessons of history must be learnt, but also that the lessons must be accurate and fully considered.

CONCLUSION

The paper and its ensuing discussion was the focus of the Spring Meetings in that it posed a number of questions that we, as people involved in technology, must face. How we address them will determine our professional status in society and the place of technology in the world, and in particular, Australia.

THE AUTHOR'S VIEWS

Professor Rawson raised two basic issues that are relevant to us in Australia.

The first is the question of ethical standards, such as designing 'down to the rules'. Individuals must make their own decision, which will be based on their own education, experience, perceptions of society and vision for the future. The latter two are dependent on an individual's understanding of society. Hence it is incumbent on all of us who make technical decisions to be well versed in the fashions of our times and the predictions for our future. After all, it is we who are creating it.

The second point related to professional negligence, liability and culpability. Current society, through our legal system is placing far greater responsibility for accidents on the designers, producers and operators of equipment than the traditional 'acts of God'. Professor Rawson offered little guidance on this aspect beyond "keeping up to date on professional matters". Litigation experience in the U.K. has shown that organisations that operate to extensive procedures that are regularly reviewed for adequacy, are considered more favourably in court. The organisation that attempts to foresee problems and implements a management system to reduce the likelihood of errors is less likely to have problems.

These basic management and procedural systems are available as Quality Management Systems and are defined by International (and Australian) Standards, e.g. ISO9001 to 9003 and AS3901 to 3903. Many organisations are now implementing these Standards to improve the quality of their product. In this case 'quality' has a very broad definition to include every aspect (including safety) of the product or service. It was interesting to note that one of the comments that came from the RINA Conference on Ro-Ro Safety (December 1988) was that while a ship is physically surveyed for compliance to regulations, the management system is taken for granted (eg the 'Herald of Free Enterprise').

The use of the Design elements of these Systems not surprisingly link in with the issue of design standards discussed above. To have confidence that a design is suitable it must be verified and reviewed. These activities necessarily involve independent people assessing the design, so the designer has some protection against mistakes. It is to be hoped that Quality Management Systems will become more commonplace in organisations because of the benefits they bring to the smoother operation of the organisation.

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