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NOISE REDUCTION IN SHIPYARDS

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1. INTRODUCTION

In late 1984 preliminary discussions with British Shipbuilders on the subject of Noise Reduction took place. The result was a detailed agreement for a joint sponsored work project to be undertaken by BMT. The 12 month project would begin in April 1985 and when complete would place British Shipbuilders in a position to comply with proposed EEC legislation when it comes into force in January 1990.

It is unusual for Research and Development Committees to consider the implications and the alternatives, five years before the expected application of the proposed noise legislation. Nor is it the kind of forward thinking one would expect from what is seen as a Traditional Industry. It was however an indication of the Industry's intention to have a future and to set about organising itself accordingly.

BMT undertook the task as we were the principal R & D consultant of British Shipbuilders and had been involved with the solution of many problems in the Industry including noise, for a substantial period of time. Also, we had invested considerable resource into the development and practical application of advanced manufacturing technologies. This work was to be used in the development of a workable noise avoidance strategy.

This paper will concern itself with the manner in which this was done and the relevance of the approach and the end product to other applications. The paper concentrates on the problems of implimentation of noise reduction programmes. the conclusion is that their introduction must be done in a manner which demonstrates alternative methods and procedures which do not detract from the profitability of the operation or imposes unacceptable restrictions onto the workforce. The implimentation plan concentrated on demonstrating how less noisy practices could benefit the company and operators, not in terms of noise reduction but in product quality and improved performance. In the performance of the work, close collaboration was achieved with the workforces in most of the British Shipbuilders Subsidiary Companies. The members of the BMT Project Team wish to record their sincere appreciation of the valuable assistance they received from those member firms.

2. INDENTIFICATION OF THE TASK

The project agreed with British Shipbuilders was the same as the title of this paper; Noise Reduction in the Shipyards. The first task of the BMT Project Team was to obtain a definition of existing noise levels and equally important, the work processes involved.

In practice a large number of noise surveys was not necessary. British Shipbuilders were able to supply BMT with the results of surveys already done. It was not a case of a lack of knowledge of the extent of the problem, rather an acceptance of a problem and agreement to mount a concerted effort to obtain practical solutions which would be usable by all of the Shipyards of the Company.

The Project Team were aware of the place of each of the identified noise producing processes in the ship manufacturing cycle and of the significance of each of these processes and of potential alternative methods and techniques. They were also aware of the application of different methods adopted by various shipyards which had essentially the same facilities as others. More significantly, they were aware of the probable resistance of a proud and traditional workforce to change, if reason for change could not be adequately explained and justified. Now, with the introduction of the noise legislation on the immediate horizon, some attention has been given by the news media to hearing problems experienced by workers in heavy industry. Some of this has referred obliquely to the apparent resentment which can arise with those workers who have impaired hearing and feel cut-off from others by it. BMT consultants, with experience in heavy industry, understand and sympathise with this problem and wish to stop it happening in the future.

Having examined the information supplied and the internal knowledge base available to the team, the main problem requiring resolution, was to determine the form of presentation of the output. It would have been a simple task to have produced a highly technical report of the work done. This would not have satisfied their interpretation of the task in hand.

To obtain a reduction in workplace noise levels it was accepted that the workers themselves would have to be advised in some way. Further the reasons for change would need to be adequately explained. Accepting this need it was agreed to plan to produce two levels of output, the first being an overview for senior management, the second being designed for use on the production shopfloor.

3. EXAMINING THE PROBLEM

Early analysis of the information to hand showed high machine noise levels which were generally outside the control of the machine operatives. In work areas such as Joiners Shops and Engineering Works machine operators could do little to change the noise output levels of the cutting machines. Operatives were required to perform production tasks on equipment over which they had little control, apart from switching them on or off. They did not have authority to have machines silenced or replaced. This problem was evident in a number of areas where large fixed machines were used.

Portable machines tended to present a different type of problem. Many of the machines were problems essentially only to users or other workers in the immediate vicinity. The obvious and most well known exception to this being the caulking iron, a pneumatically driven steel cutting tool used to dress material edges and welds. The noise produced by this tool could possibly be described as the signature tune of heavy industry.

Actions to curtail the use of caulking irons had been taken in most companies to the point where the use of this equipment was claimed to be a "thing of the past". This was found to be untrue, but of more interest to the Project Team was the analysis of the reasons for the use of the equipment. Some of the activities could be ascribed to individual or group working practice, others to the overall methodology or technology used in the Manufacturing Facility in the Shipyard.

Differences in the methods used in the Shipyards visited were also found. Many of these were found to exist because of differences in the trade demarcations between Companies. The resolution of this was not an action which could be considered to be within the scope of the BMT Project Team. It was however an item which could be addressed in the Executive Section of the final reporting document.

After having visited most of the production facilities and discussed the noise problem with the staff, the Project Team began the task of drafting the output documentation. This produced seven separate documents.

The largest and most complete document produced was a full report of the work completed for the Executive Management of British Shipbuilders. Complementing this document are six booklets prepared for the use of the staff at workplace level. These are designed to be both meaningful to the shopfloor operatives and portable. More will be said of these later.

4. THE EXECUTIVE SOLUTION

The main Executive Report prepared by BMT is a substantial document. This is necessary in order to contain the volume of relevant information. The detail of the report will not be discussed here.

Sections in the report deal with the legal aspects of noise as existing at the time of preparation and in prospect. The principals of noise generation, noise and its effects and the avoidance of hearing damage are all examined and options for action are discussed.

It is however in the methods of noise reduction and avoidance that the substance of the document divides. There are two major segments of detailed information, the first is provided on machine types, enclosures, silencing, the use of flexible mounts etc., the second segment deals with production methods and philosophies. Both are important but the first only requires a decision for the investment of capital, the second requires a change of attitude of mind to put into practice.

It is the second of these segments which calls upon the supporting BMT manufacturing expertise developed from extensive research and development in areas of welding technology, the significance of the control of accuracy of parts and the avoidance of distortions. All of which are interactive developments to improve the quality of workmanship and hence,of the end product.

The sub-section on welding in particular deals with welding techniques which may be employed to reduce or eliminate the need for back-chipping between weld runs. The advantages of welding from one side of the plate joint only are also addressed, the problems of the technique are also itemised.

The contribution of a distortion avoidance program to the improved fit-up of parts is also examined. Estimates of the actual extent of chipping and grinding actions vary between shipyards, figures as high as 70% have been attributed to the alignment of parts during assembly. Much of this may be put down to the correction of distortions although dimensional accuracy of parts is also an influencing factor.

The alternative technologies all produce less noise, although they were not developed initially for this reason. They are to improve the potential for the achievement of first time manufacture of products of an acceptable standard, without rework. An important consideration in todays marketplace with an increased awareness of quality assurance (BS5750). That they provide noise reduction capability is of added benefit.

Addressing the subject in this manner provides senior management with an added knowledge of the return which may be obtained from taking up the proposed technologies to improve efficiency and of course, reduce costs.

The overview thus given identifies the problem, the need for change and methods which can be beneficially adopted. It places it in the hands of those capable of making the necessary decisions. The report gives an adoptable strategy which includes the opportunity for cost improvement from what at first appears to be another piece of costly and limiting legislation.

5. THE WORKPLACE SOLUTION

Manufacturing technology is constantly being improved. The perception of the workforce to improvement and change is that they are taking place to satisfy some management whim, or someone's new ideas from having read "some book". Most often this is seen to be change for the sake of change. The benefit to the company operations is not apparent to the individual, and generally it does not directly and obviously enhance their work task.

To effect a reduction in noise levels produced in shipyards an explanation of the personal benefits needed to be highlighted for the individual. Further, for this to succeed this information should be in a form which added to the probability of consumption rather than disposal out of hand.

The method adopted was to prepare the substance of the information and have this reprocessed by a specialist consultant well versed in media type output. This led to a number of intense discussion sessions with the BMT Project Team and was not achieved without some heart-ache, but it is now believed to have been worthwhile.

The Forward from the published document is reproduced here as Figure 1. It shows the more conversational style which was adopted and the use of supporting artwork. This document, is titled "Noise and the Employee in the Shipbuilding Industry". The list of contents from the booklet is reproduced as Appendix 1.

Having dealt with the reasons for action in this general information booklet, the complementary information could be prepared in like form. Shipbuilding is a more complex business than most. The ship is required to be a self supporting system for the duration of each voyage. It must have the ability to carry and sustain the operating crew and have the capability of transporting passengers, cargo or weapons systems. It may also need to have the ability to load and unload itself.

The manufacturing process for the ship is therefore concerned with many trades performing different, interactive tasks. The product of which is ultimately assembled to create the total ship. The making of parts, bringing them together and the joining process is labour intensive and skilled people are needed.

Traditional methods used in the shipyards for the steelwork processing are very noisy. This has always been so, it is an activity involving large pieces of heavy metal needing to fit together for joining by welding.

Welding is a tolerant process but it should not be used as a metal filler. Therefore when the fit is inadequate it is common practice to adjust by trimming or applying force. If this was to be changed then the workforce would need reasons and options to do this.

The information collection was developed and prepared to complement the "Employee Booklet". Using the shipyard noise surveys supplied and other BMT sourced data, comparative information forms were prepared. These show the noise output differences between what are termed "Traditional Methods" and other methods of performing the same work task.

This collected information was divided into sets which are relevant to trade groups in the shipyards. That is, by type of work performed. Booklets were prepared for each general activity group. They are:-

1. Fairing.
2. Moving Heavy Loads, Lifting and Turning.
3. Staging and Access.
4. General Applications.
5. Noise Reduction in the Woodworking & Machine Tools Environment.

For those not familiar with shipbuilding terminology, Fairing Operations are concerned with the bringing together of parts into acceptable alignment before final welding. An example of an operation from this Booklet is reproduced as Appendix 2. This shows how the itemisation of each action performed is attributed with its associated noise production. Both methods are covered, traditional and alternative. The reduction in noise is obvious. The increased efficiency of the second method is also addressed.

An example of a lifting operation from Booklet 2 is included as Appendix 3 and of an alternate staging method from Booklet 3 as Appendix 4.

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