R.M.N. COASTAL MINESWEEPERS EXTENSION OF LIFE

BY

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Introduction

Those who have been connected in any way with the *Coniston* Class minesweeper and particularly those of the technical branches who have played any part in the history of the design problems associated with their composite construction may find this article of particular interest.

It may not be too widely known that the Royal Malaysian Navy purchased six of these craft; the first, which arrived in 1963, was H.M.S. *Darlaston* (renamed K.D. *Mahamiru*) and over a period of the next three years was followed by *Hexton*, *Essington*, *Lullington*, *Dilston* and *Thankerton*.

By the late sixties and after consistent service, it was apparent that the hull condition of these craft was deteriorating rapidly, it was therefore decided that they should undergo a long refit. This decision was viewed with scepticism in certain circles and many thought that the damage was so comprehensive and advanced that they should be scrapped.

This article is intended to convey some of the difficulties that have confronted the refitting authority, Vosper Thornycroft Limited, who are at present embarking on their fifth long refit, that of K.D. *Kinabalu* (ex-*Essington*).

Long Refit Policy

The original intention was to carry out sufficient repair work to prolong the life expectancy of the hull by four years; phasing out would occur during the late seventies. This proved to be impractical and certainly not cost-effective.

With experience, it has been realized that a compromise with the minimum of work being carried out is not the answer, and consequently the work load on the hull has more than doubled between the first and the fifth craft to be refitted. As each defect list has increased in length, so has the life expectancy of the hull. Even if phasing out does take place as originally intended, the resale value of the craft should be very high especially when one considers the spiralling prices in S.E. Asia today. It is without doubt a very good investment.

FIG. 1—HYDRATED ALUMINIUM OXYCHLORIDE
This portion was taken from deposits found in the area adjacent to the rudder bushes.

FIG. 2—TYPICAL CONDITION OF FRAME LINER
The frame itself is generally in good condition but the majority of liners have been renewed; in this case very little of the ¼-in. plate remains.

Reasons for Repair

Corrosion

This was reported as early as 1964, long before the craft were purchased by the Malaysian Government. In all cases, it is electro-chemical in principle and is caused by the ingress of salt water, usually through the seams of the hull planking; the majority of the damage is confined to aluminium structural members below the waterline. The corrosion salts produced, hydrated aluminium oxychloride (HAO), are very bulky and far worse than their appearance suggests; if the salt deposit is divided by forty, this is the actual amount of aluminium that has been corroded away. The deposit illustrated in FIG. 1. was taken from the soleplates adjacent to the rudder bushes; the thickness shown, which was fairly general in this area, demonstrates the advanced state of the corrosion damage with all its implications. The intensity of the attack generally appears to increase from forward to aft. The logical explanation for this is the associated increase in vibration which would cause more seepage and therefore an accelerated rate of corrosion.

The corrosion is generated from three different sources:

(*a*) Aluminium plating has inherent anodic and cathodic spots which, when coupled with sea-water as an electrolyte, creates an infinitesimal number of corrosion cells. These have been active for a very long time. The plating in the majority of cases being heavily corroded and holed.

(*b*) As the ships have got older, the zinc and cadmium coating on all steel fastenings has broken down and in so doing, more corrosion cells have been created. Aluminium being anodic to steel in the presence of sea-water has again brought about heavy corrosion of the aluminium plating. FIG. 2 and 3 illustrate quite clearly the heavy corrosion damage that has occured to the frame liners and soleplates generally.

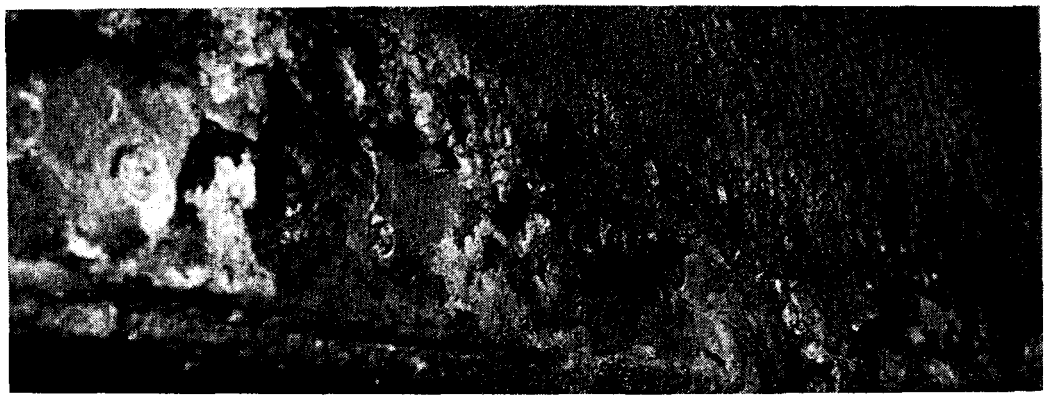

FIG. 3—TRANSOM SOLE PLATING
Original thickness was $\frac{1}{4}$ in.; 3 in. of the lower edge has been completely corroded away and the remainder is paper thin.

(*c*) Rivets have also been very badly attacked and in most cases have been reduced to solid lumps of HAO. FIGS. 4 and 5 give some idea of the consistancy of this defect. The reason for this is that Grade 6 rivets were coupled with Grade 6 plating when the ship was first built. No consideration was given to the work hardness that would occur on the rivet during the hardening up process. Changing the material state of the rivets gave in effect a combination of dissimilar materials. Even though they were both aluminium, an electrical potential difference existed between them and when immersed in sea-water produced active corrosion cells. The rivets being the anodic material in the combination became sacrificial and were corroded away.

To combat the corrosion that has taken place generally, all exposed aluminium soleplates, stringer plates and frame liners that have been renewed are coated with epoxy resin (Araldite) providing an electrically inert barrier that protects the material from further corrosion far more efficiently than any conventional paint or preservative coating.

FIG. 4—DOUBLER BUTTSTRAP
Completely corroded away together with the associated rivets.

FIG. 5—RIVET FAILURES ADJACENT TO THE STERN TUBE CASTING
This defect was consistent throughout.

Distortion

The bulky corrosion products have caused an enormous amount of damage to adjacent structure. FIG. 6 shows the distortion that has occurred at the keel plate angle. Far more serious consequences between the keelpate and keel can be seen in FIG. 7; these have been forced apart by a deposit approximately three inches thick. As the lower palms of the 'A' brackets are secured at this point, the mystery of the serious shaft misalignments which have occurred frequently over recent years is solved.

Similar damage has also occurred to the hull planking for the same reasons. FIG. 8 illustrates how the timber has been forced away from the stringer plate and frame liner, etc. resulting in the fastenings being pulled through the timber. Although the physical condition of the timber is good, in the majority of cases the damage is so bad that renewal is the only solution. When complete, approximately 80 per cent. of the planking below the waterline will have been replaced.

FIG. 6—SECTION OF KEEL ANGLE
Distortion due to build-up of HAO between aluminium and hull planking.

FIG. 7—THE KEEL TO WHICH THE LOWER PALM PLATES OF THE A-BRACKETS ARE SECURED
Note thickness of HAO deposit and the distorted timber.

FIG. 8—SECTION OF GARBOARD STRAKE
HAO deposits are forcing it away from the keel-plate and pulling the securing bolts through.

Rot

Wood rot, both wet and dry, has been a constant problem and, of course, is not unique to these craft. The amounts of rot found vary from ship to ship; in some cases complete deck areas have to be renewed. When timber that has been covered since building is exposed, in many cases it is found to be badly deteriorated. This particularly applies to external structure and decks, although a large amount of rot also occurs in the internal decks. It is hoped that the general policy recently adopted of preserving new timber before painting will result in a substantial reduction in the instances of rot which occur. In comparison to the price of repair work, it is an extremely cheap method of guaranteeing the physical condition of timber for a period of at least twenty years. Moisture is extracted from the material which is then pressure impregnated with a chemical solution. Where this is not practical, antifungal brushing solutions are employed and, although they are not quite so effective, still give a life expectancy of ten years plus. Although the cost of material is increased by approximately 15 per cent., it is a small price to pay after seeing the damage caused to craft in this part of the world after as little as five years afloat.

Marine Borers

The hull structure below the waterline has always been sheathed with creosote-impregnated timber. The instances of attack by worm have, therefore, been few; nevertheless, they do add to the workload and are therefore worth mentioning.

Although this protection has been reasonably successful, worm can still penetrate the joints, etc. Moreover, this type of sheathing does not prevent seepage through hull planking which is of non-watertight construction. To overcome this problem and to give the hull complete protection, it was decided to remove the timber sheathing and replace it with 'Cascover' nylon. Although this is a very expensive process which involves extensive preparation, in the long term the advantages are very attractive. The process is, of course, well known in the Royal Navy and has been used for a number of years. In the case of these craft, it is a pity that re-sheathing was not carried out very much earlier for then most probably the circumstances that we found could have been avoided or at least reduced in severity.

Expenditure

In terms of cost, repair is much cheaper than new construction and is, therefore, more attractive. The price of skilled labour is at present very low, and the cost of the hull repair is about $400,000 while the cost of the refit is in the region of $1,200,000 (£200,000); this represents a very small percentage of the cost of a replacement vessel or, for that matter, of the repair bill had the work been carried out in Europe. Although prices are rising in Singapore, it will be many years before there is anything approaching parity.

Conclusion

The pattern of damage in each case is very similar and only differs in severity where repairs have been carried out in the past. The rebuilding is so comprehensive that the life expectancy of the hull is now quoted as ten years—which I feel to be a conservative estimate. They could, and most probably will, go on for much longer, be it under a different flag. One fact is certain, their familiar silhouette will remain a common sight in the Far East for many years to come.