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CORROSION AND COATINGS IN THE RAN

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Mr Sim is Assistant Director Materials in the Directorate of Naval Platform Systems Engineering. He has been involved with materials, corrosion and coatings for many years and has participated in international information exchange and the Internaval Corrosion Conferences.

The presentation gives a broad outline of a number of issues on corrosion and coatings that are being examined in Australia. Several of these are being actively discussed in the international information exchange program which will replace IEP ABCA-8.

Organisation

Like many other countries, Australia is reviewing and changing its Defence organisation. The Defence Efficiency Review has recently been completed, with major changes to uniformed and civilian activities.

The Naval Materiel Requirements Branch, combining Naval Engineering Services and Naval Engineering Requirements branches, came into being in April 1997. It is responsible for providing engineering advice to a wide range of Defence customers, from concept through acquisition to in-service support. It is positioned to meet the expected requirements of the Defence Efficiency Review.

Materials

The RAN operates in the same marine environment as other Navies and experiences the same problems, which may also be inherited from overseas designs. The Defence Science and Technology Organisation (DSTO) has various tasks and consultancies evaluating some of these problems. The Conference has other examples of lessons not learnt, so there is little need to list more. Instead, I would mention studies that can provide useful information exchange.



The surface treatment of nickel aluminium bronze to improve the corrosion resistance of components is of major interest. DSTO is undertaking and extending some work on alloy characterisation, laser melting and heat treatments.

Crevice corrosion testing of stainless steels is another ongoing program to evaluate materials for corrosive marine applications.

Underwater Hull Painting

The RAN uses organotin self-polishing copolymer antifouling for the underwater hull of its major units, though copper-based antifouling is used on support craft and vessels under 40 metres. The Defence Science and Technology Organisation (DSTO) has a task to evaluate tin-free and non-toxic alternatives to organotin.

Because of the requirement to extend docking intervals to five years a satisfactory alternative has not been found. A number of ships have test strips of antifouling paints, which are also being tested on rotor apparatus and rafts. One product shows promise but others deteriorate too rapidly.

One non-toxic fouling release coating has been applied to a workboat and has performed satisfactorily for about three years. The product is being used on the more recent of the new COLLINS Class submarines, which are covered with elastomeric tiles. Because the submarines are still undergoing trials there is fouling buildup while they are stationary and this has to be cleaned off by divers. After a few teething problems the coating system and the cleaning procedures seem to be working well.

The standard anticorrosive coatings under the antifouling on ships has been a vinyl anticorrosive, which is single pack, easy to apply, recoat and repair. Because it is relatively soft it is easily damaged particularly at the wind and waterline area. Consequently the RAN has adopted an abrasion resistant epoxy for damage prone areas. Initially this was used at the wind and waterline area where ships were prone to fender damage etc. Soon it was extended to the entire wind and waterline area and to ship sides of patrol boats.

The use of the abrasion resisting epoxy requires a controlled sequence of overlaps to the underwater paint system and the ship side system. It is now likely that the epoxy will be adopted for the entire hull, provided relative costs and performance estimates are satisfactory.

Painting of Tanks

Several years ago requirements for painting of tanks etc. included a total dry film thickness of 300 μm . In 1994 the RAN Painting Manual changed to specifying generic

paint schemes applied in accordance with manufacturers data. This gave rise to possible problems where the manufacturers typical thickness and number of coats could turn out to be the maximum thickness applied and the actual thickness could be too low to provide adequate service.

Painting Manual - ABR 19

ABR 19 was revised in 1994 to provide a basic guidance document with generic paint systems and manufacturers approved schemes. When it was issued there was essentially only one major manufacturer listed, but other suppliers are now being included. The generic schemes referred to specifications of the Government Paint Committee, now the Australian Paint Approval Scheme, which incorporates manufacturer accreditation and audit, and product or system approvals. For predominantly naval applications ABR 19 allows Navy approvals.

It had been hoped that this would free up the painting requirements, relying on manufacturers recommendations instead of detailing hundreds of schemes to fit every need. Unfortunately this has not been entirely successful.

In the revision of the Painting Manual currently under way it is intended to subdivide schemes into build/refurbishment, major maintenance and onboard maintenance. The difficulty is that the categories overlap depending on the extent of work and it is impossible to cater for all contingencies. It would be preferable to require the application of common sense before the application of any paint.

Exterior Painting - Visual Signature and Infra-red Reflection

Comments have often been made that the RAN exterior colour of Storm Grey (Light Grey) is not suitable because it is a greenish grey. United States Navy Haze Gray has been suggested as a better colour match to sea colours. The use of full gloss paints has also been criticised, since current alkyd paints lose gloss on weathering and are polished or overcoated to restore gloss.

Consequently a trial is underway to evaluate a low gloss Haze Gray polyurethane paint on a patrol boat, HMAS WHYALLA. There was little significant difference seen from flyovers, but a large reduction in visibility for ship to ship observation. Ship staff has early concerns with the low gloss because it appeared to get dirty more quickly but they have found it easy to clean.

In addition to changing the colour and gloss of the exterior paint scheme the trial system has also changed the solar heat reflectance. This has been achieved by eliminating carbon black pigment and substituting near infra-red reflecting pigments. This has dramatically

reduced the heat build up in the vessel, with a substantial reduction in airconditioning requirements. It is possible to walk on the decks in bare feet.

The low solar absorption properties and the consequent reduction in airconditioning requirements has prompted a request that all exterior painting be changed to near infra-red reflecting.

Environment and Health and Safety

So far Australia does not have specific restrictions on Volatile Organic Compounds (VOC) for paints. The Australian Paint Approval Scheme has adopted limits, mainly for building paints. Navy has an informal requirement to lower VOC but may accept products with similar or even higher VOC if performance is better.

Water based paints are attractive because of the reduction in VOC and solvent cleanup. Single pack paints are attractive because there is not the problem of disposing of part containers of mixed paints beyond pot life.

The majority of paints in use are alkyd or epoxy. Polyurethanes are used for patrol boat exterior painting and for interior deck coatings, although there are some concerns on isocyanates. The urethanes are high performance coatings and can be applied safely in the right conditions but because of the OH&S concerns it may be necessary to use other materials. For example, ship exteriors are likely to get damage and touch up, and are painted in the open, so acrylics may be preferred. A change to water-based acrylic would give a better topcoat performance than alkyd even though not as good as polyurethane.

Cathodic protection

ABR 5023, the RAN Cathodic Protection Manual, gives policy and design guidance for cathodic protection. It is in need of an update and a draft revision has been made. This is in abeyance awaiting resources. Like the Painting Manual it was intended that the Cathodic Protection Manual would provide overall policy and guidance, but leave detailed design to contractors and ship designers. Discussions with other Navies suggest that this may not be practicable.

DSTO has a task including physical scale modelling of cathodic protection and this may lead to defining various design parameters. Experimental reference electrodes designed and made in Canada are also being purchased to measure actual cathodic protection potentials underway.

