MARITIME

DMTC personnel install an HVOF-coated hydraulic actuator on the flight deck of HMAS *Canberra*. This field trial, involving the installation of stanchion piston rods with HVOF and APS coatings, is expected to demonstrate enhanced corrosion protection and minimised surface degradation.

A focus on advancing new technologies and building Australian industry capacity is needed if the goals of the Naval Shipbuilding Plan, released by the Australian Government in 2017, are to be fully realised.

The continuation of DMTC's decade of work on technologies relevant to Naval Shipbuilding Enterprise and repair is funded by Defence's SEA 5000 Program Office, but is concentrating effort and attention on technologies that can be adopted and utilised in a range of programs across the shipbuilding enterprise.

DMTC's role to deliver industrially-ready and relevant technology outcomes for the sector involves coordination with the overall Defence S&T Plan and close collaborations with a range of stakeholders including Defence, industry primes and SMEs and research institutions.

These stakeholders are working with DMTC to deliver breakthroughs and innovations in manufacturing, to develop and integrate new cost-effective technology and to enhance skills and capacity across Australian supply chains.

DMTC, through its industry and research partners, has demonstrated capabilities in naval shipbuilding and associated technologies and is well placed to provide significant expertise to a reinvigorated Australian naval and maritime sector, including both surface ship and submarine programs.

In 2017-18, projects within DMTC's Maritime Program achieved a number of significant technology developments, ranging from technical breakthroughs in material development to on-board trials of prototype products and the creation of sovereign industrial capability in critical areas.

MARITIME PROGRAM
Highlights

GROWING YOUR OWN

DMTC's work on single-crystal piezoelectric ceramics is directly relevant and of strong interest to Australia's aspirations for its submarine and surface ship fleets into the coming decades. In this regard, it encompasses aspects relevant to the Future Frigates' anti-submarine warfare (ASW) capability as well as the SEA 1000 Future Submarine Program and continuing mid-life upgrades and sustainment requirements of the Collins submarine fleet.

The work in conjunction with industry partner Thales Australia and research partners ANSTO, UOW and UNSW is making significant in-roads, with the technology providing increasingly new results which bring it much closer to being ready for in-country commercial production. This will help guarantee access to a supply of quality crystal piezoelectric ceramics, and provide Australian industry with a world-leading capability to design and fabricate sonar transducers for the Royal Australian Navy (RAN).

Local development in Australia of single crystal piezoelectric ceramics is currently limited by issues with the supply of single crystals from overseas. In response to increasing demand and need for sovereign supply certainty, the project is developing the technology solutions to enable establishment of a manufacturing capability in Australia.

A range of technical challenges including optimising powder compositions, surface chemistry and chemical processing have been overcome, allowing for the promotion of solid state crystal growth that, in turn, is required for advanced transducer devices.

Increased single crystal growth size and performance is now closely matching that achieved by overseas suppliers, achieved by overseas suppliers, with the added potential for significant manufacturing cost savings. Continuing research is focused on fully characterising the properties that will enable the technology to be considered for commercial scale production. A new ceramic powder leaching method has also significantly simplified the manufacturing process.

The significant gains made by the team in 2017-18 has reduced the technical risk profile of the project and paved the way for a new set of research goals to be set for a further two years of project activity.

A WINDOW TO THE FUTURE

DMTC's strategic partnership with Naval Group Australia (formerly DCNS) was announced in early 2017. While Naval Group's footprint in Australia is expected to be dominated by its selection as the builder of the Future Submarines, the early engagement with DMTC has focused on sharing and building knowledge of advanced surface shipbuilding techniques.

The first DMTC project to involve Naval Group as the industrial partner was a scoping study that also included DST, UoW and ANSTO. The project investigated the feasibility of new, low distortion joining techniques and applications. An early candidate for this work has been T-joint stiffeners that are widely used in naval shipbuilding but are difficult to weld. Weld distortion can impact on assembly in the shipyard due to breaches of fabrication tolerances, issues associated with residual stress and ultimately to the vessel's rigidity.

The project team is employing a range of non-destructive testing and finite element modelling techniques, to compare the results of welding trials using both traditional gas metal arc welding (GMAW) and the Tandem GMAW (T-GMAW) method. The models are also being used to predict the weld distortion on larger ship assemblies, with the ultimate aim to eliminate distortion during production. The T-GMAW process has been developed and refined by DMTC project teams over a number of years and, having been deployed on different land and maritime platforms, has already proven to be applicable beyond shipbuilding and across defence industrial domains.

The results of this scoping study have been very positive and are of significant interest to Naval Group, with follow-on research projects under development.

PERSISTENCE PAYS OFF

Under contract with the Defence SEA 5000 program, DMTC has led collaborative technology development efforts to achieve advances in thermal spray technologies.

DMTC worked with industry partners MacTaggart Scott Australia and United Surface Technologies and research partners Swinburne University of Technology (SUT) and DST to develop and characterise high velocity oxygen fuel (HVOF) coatings for marine applications.

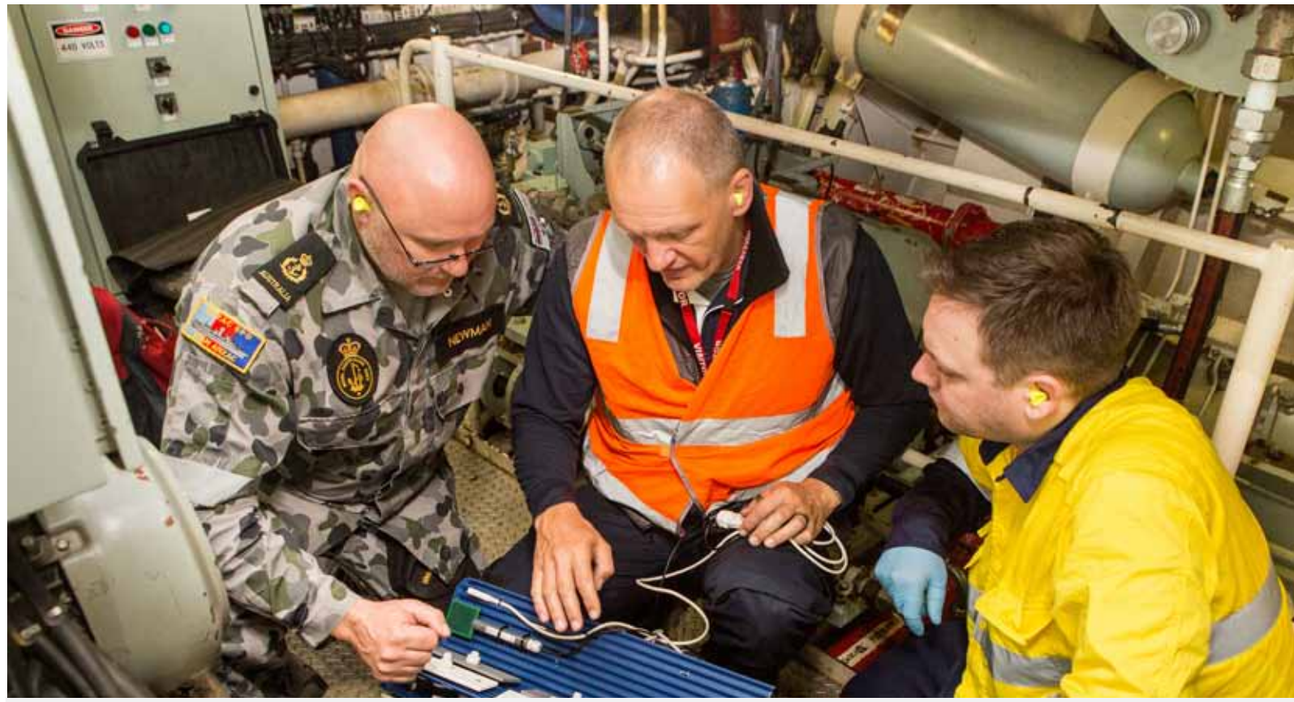
The project has demonstrated that HVOF can be used to apply single layer carbide based coatings to naval hydraulic components, and that these coatings offer improved performance and cost reductions over current coating solutions.

The benefits of this innovation include the option to repair – rather than needing to remove and replace – key marine hydraulic structures on naval platforms that are susceptible to corrosion. This promises significant benefits to Defence including reductions in through-life (sustainment) costs and improved in-service availability of platforms. The project has also shown that these coatings can be applied to new components to enhance their biofouling performance and corrosion resistance.

More than 100 samples have undergone more than 1,500 hours of in-water field testing, along with impact testing and hot-water immersion test activities, demonstrating that the new coating formula significantly out-performs existing solutions.

The project's trajectory towards TRL7-8 has recently achieved a significant boost with the RAN agreeing to trial the technology on-board HMAS *Canberra*, one of two new landing helicopter dock ships (LHDs). This involves replacing stanchion piston rod coatings with the current project's HVOF and Air Plasma Spray coatings to enhance corrosion protection and prevent surface degradation. This on-ship trial is being conducted over a period of eight to 12 months.

Consistent with the DMTC's aims in building sovereign Australian industrial capability, the project has also developed industrial capability across an in-country supply chain of SMEs.



Assoc Prof Geoffrey Will, QUT, (centre) and Dr Steven Knight, SUT (right) show Marine Technician CPO Todd Newman (left), how the corrosion prognostic monitoring system works during the systems installation in the Gas Turbine Machinery Room onboard HMAS *Parramatta*, Sydney.