MARITIME
Overview

The Naval Shipbuilding Plan released by Government in 2017 set an ambitious agenda of establishing a continuous naval shipbuilding and sustainment program for Australia. With the Arafura Class Offshore Patrol Vessels and Guardian Class Patrol Boat build programs now in full swing and design efforts ramping up for the Hunter Class Frigate and Attack Class Submarine programs, attention is turning to how Australian Industry Capability can be enhanced to maximise Australian industry participation in current and future programs.

The Naval Shipbuilding Plan (*As at October 2020 work is underway on a substantial revision to the Plan which will be known as the Naval Shipbuilding and Sustainment Plan*) provides both an appetite, and the necessary lead-time, for Australia's industrial capacity and capability to be built up so that Australian industry is well positioned to take full advantage of supply chain opportunities in shipbuilding and sustainment.

DMTC is central to this mission, providing industrial innovation leadership alongside the science and technology strategy led by DSTG. DMTC and DSTG's efforts are coordinated, complementary and designed to evolve as shipbuilding programs progress. This has seen DMTC work with Navy, CASG and DSTG on how themes of work from different Defence programs can be managed under one umbrella.

An example is DMTC's work in the development of piezoelectric materials for sonar applications that aligns directly with DSTG's STaR Shots mission focused on Remote Undersea Surveillance. The creation of an *Advanced Piezoelectric Materials and Applications Program* will establish a strategic national capability in advanced piezoelectric materials. Such an innovation pipeline from investment in strategic sovereign scientific capabilities through to the development of specific Defence applications would not be possible if programs operated in isolation. This model has the potential to be applied in other areas of the Naval Shipbuilding Enterprise.

Pictured opposite: Collins Class submarines HMAS *Collins*, HMAS *Farncomb*, HMAS *Dechaineux* and HMAS *Sheean* in formation while transiting through Cockburn Sound, Western Australia. DMTC's work with partners ASC and CSIRO aims to advance repair technologies that will allow Australian submarines to remain at sea longer, without the need to dock for lengthy repairs. More details on Page 21.

MARITIME
Highlights

Hunting for solutions

As mine warfare countermeasure systems in modern naval platforms are upgraded to account for evolving threat environments, design constraints with power, weight and space margins are ever-present. Advances in technology that increase countermeasure capability without compromising these design constraints will play an important role in current and next generation maritime platforms. High Temperature Superconductors (HTS) and their application to minesweeping systems possess the ability to address a number of these issues concurrently.

Queensland University of Technology (QUT), Siemens Energy and DSTG Group are currently engaged with DMTC on understanding the risks of utilising cryocoolers in a naval environment. To complement this research, a scoping study was conducted, led by Systems Planning and Analysis Australia, and incorporating input from existing program partners, into the feasibility and application of HTS for minesweeping. The study concluded that HTS could provide the ADF with an effective, supportable and deployable magnetic influence minesweep solution. Phase 2 of the project is currently being defined to align with the SEA1905 Maritime Mine Countermeasures program to revolutionise the ADF's approach to mine warfare.

Each of the DMTC program partners bring unique experience and expertise to minesweep technologies; Thales Australia manufactures and sells minesweeping systems internationally; Siemens and QUT have been on the forefront on the application of HTS technology for over 15 years in the maritime domain and DSTG has undertaken studies to evaluate the trapping of magnetic flux in superconducting materials as a potential evolution in technology.

As navies embrace operations that seek to increase tempo, organic mine countermeasures will be a critical enabler, especially when deployed through autonomous systems.

Improving material grades

Australian Naval Infrastructure's development of the Osborne Shipyard in South Australia is providing ASC Shipbuilding, now a subsidiary of BAE Systems, with a world-class facility that will be an integral part of the Hunter Class Frigate Program, but also of Australia's sovereign capability in naval shipbuilding for decades to come.

The welding equipment being installed at the Osborne Shipyard is state-of-the-art and trials have shown that the twin wire systems being installed for panel construction leads to minimal panel distortion. ASC Shipbuilding continue to look for ways to maximise shipyard productivity and have identified opportunities to further improve both weld sequencing and the robotic programming required for curved panels. These are both areas in which DMTC and its partners at ANSTO and University of Wollongong (UoW) have extensive experience. DMTC is excited to be working with ASC Shipbuilding to embed this expertise in the Hunter Class Frigate Program.

DMTC is also working with ASC Shipbuilding to better understand how Statistical Process Control can be implemented into their shipyard welding processes. By utilising real-time weld data, defects may be identified at the source instead of downstream at an inspection or rework station, which has the potential to greatly increase productivity and weld quality.

DMTC is also working with BlueScope Steel, DSTG Group and UoW to improve the capability of naval platforms through development of an Australian solution for the production of DH36 or EH36 shipbuilding steel grades, with improved microstructure and inclusion characteristics. In a significant step towards a sovereign capability solution, ASC Shipbuilding has purchased a quantity of the new steel for production trials.

MARITIME
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Modernised manufacturing

Additive manufacturing (AM) in the maritime domain is naturally focused on large scale components with an emphasis on repeatability, certification, design and engineering aspects that are required for successful integration of AM products onto platforms. AM techniques that lend themselves to large components include the welding process of wire arc additive manufacturing (WAAM) and the cold spray process.

DMTC has a long history of working with partners MacTaggart Scott Australia, UoW and DSTG in the use of WAAM for the production of subsea components made from Nickel Aluminium Bronze (NAB). The team is now adapting WAAM for use in defect repair on large casted NAB components, including scanning of the defective region and automated deposition techniques to fill the void regions, with sensing systems and post process heat treatment incorporated, to ensure the repaired component can maintain their qualification against relevant standards.

DMTC is expanding its work in maritime AM with one project underway and further activities in the pipeline. DMTC is currently working with partners ASC and CSIRO to develop and specify cold spray repair methodologies for Collins Class submarine components and the AM of weld consumables, to prove that cold spray repair methods are suited to repairing components to the level required for their in-service environment. Cold spray repairs allow for the repair of components without causing distortion or microstructural changes in the base metal. Successful development of the cold spray technique for this specific application will allow Australian submarines to remain at sea longer, without the need to dock for lengthy repairs.

UNSW PhD candidate, Miss Scarlet Kong measures the electrical charge output from a textured piezoelectric ceramic sample (pictured in inset image). This work is part of a DMTC project investigating textured piezoelectric ceramics for next-generation sonar systems with enhanced performance and large-scale processing capability.