

Ship demonstrator tests new waterjet technology

The US Navy's advanced electric ship demonstrator will enable evaluation of the Rolls-Royce AWJ-21™ waterjet and determine its possible role on future platforms.

Sea Jet is a quarter-size model of an advanced hullform destroyer, and is the 'advanced electric ship demonstrator' (AESD) funded by the US Office of Naval Research to test electric ship and propulsor technologies. Rolls-Royce was prime contractor for the vessel that was constructed by shipbuilder Dakota Creek Industries.

Other Sea Jet team members include General Dynamics Electric Boat and CSC. The demonstrator is at the US Navy's Naval Surface Warfare Center Acoustic Research Detachment, based at Lake Pend Oreille, northern Idaho.

Sea Jet resembles the revolutionary DD(X) multi-mission destroyer. The steel platform displaces about 120 tonnes, is 40m in length and has two interchangeable superstructures, one of aluminium and one of composite material.

The first series of tests will be used to optimise and validate the underwater-discharge AWJ-21™ waterjet pump and propulsion module design. After AWJ-21™ testing is completed, Sea Jet will be used to test the hydroacoustic and hydrodynamic performance of other advanced propulsors. A new high-resolution measurement array has been positioned in Lake Pend Oreille to collect data for quiet surface ship noise investigations. Verification of the accuracy of this equipment is also part of the test schedule.

The AESD is an electric-drive vessel, powered from either a small diesel generator set or from batteries. Its two 300kW (400hp) AWJ-21™ waterjets are turned by electric motors. A 720-cell battery bank will power the AESD for acoustic trials, eliminating the diesel as a noise source for quiet operation and high-speed tests. The demonstrator will have a crew of two and achieve top speeds of 8 knots on diesel, or 16 knots on batteries. A small diesel is used to recharge the batteries or facilitate transiting.

The Rolls-Royce AWJ-21™ advanced waterjet is designed to operate 4m to

5m below the surface of the water but above the vessel's baseline, which allows significant reduction in navigational draft. The propulsor is protected from grounding damage by the pump nacelle; it also allows the ship designer to eliminate the rudder and waterborne shafting, and is expected to provide more compact propulsion systems with reduced weight and volume.

The US Navy has limited experience in waterjet application, although use is increasing. The 11m rigid inflatable craft operated by the Special Operations Command is one of the few waterjet powered vessels in service. Other waterjet ships now include the recently built USS *Sea Fighter* – of a similar size to a commercial catamaran fast ferry, and the Littoral Combat Ship (LCS) currently in build. These employ standard commercial waterjets that discharge above the waterline. The AWJ-21™ underwater discharge design is focused on reducing ship signatures, noise and wake, while at the same time delivering improved efficiency and manoeuvrability.

In addition to testing the propulsion systems, the Office of Naval Research will use the demonstration results to validate the results of the Navy's design tools, as the electrically powered waterjet systems are a radical departure from conventional systems design.

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Sea Jet will be used to evaluate AWJ-21 waterjet performance on Lake Pend Oreille, northern Idaho. (image courtesy of US Navy)