WEAPONS AND EQUIPMENT

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UK tests integrated waste management for 'environmentally independent' naval vessels

UK research and technology group QinetiQ recently conducted a 45-day trial of an Integrated Waste Management System Technology Demonstrator (IWMSTD) that could lead to an 'environmentally independent' warship for the UK Royal Navy (RN) in approximately 2015. The scale demonstrator rig, running in the Auxiliary Machinery Test House at QinetiQ's Haslar facility, integrates off-the-shelf, existing naval and new technologies into a system dealing with 10 individual waste streams, representing a future warship with a complement of 204. Strachan & Henshaw and BMT Defence Services are major subcontractors for the 13-month program, which ends this month, for which QinetiQ has received funding approaching £1.5 million (US$2.3m).

The IWMSTD, sponsored by the Marine Auxiliaries and Steam Systems Integrated Project Team (MAES IPT) within the Warships Support Agency (part of the Defence Logistics Organisation), has been designed to meet several legislative and operational requirements. "Anticipated increases in the stringency of international, national and local environmental legislation, coupled with the requirement for sustained military operations in the littoral zone, necessitate improvements to the management, treatment and disposal of ships' generated wastes," explains Sarah Kenny, QinetiQ's IWMSTD project manager.

"Concurrently, the needs to reduce manning aboard ships, improve health and safety, and to reduce the reliance on port waste-reception facilities all support the requirement for advanced waste management aboard ship."

The 10 individual waste streams comprise black water (sewage from toilets and urinals); gray water (drainage from showers, laundry and wash-basins); bilge water (fluids such as seawater, oils and lubricants which collect in the hull); food waste; paper; plastic; glass; metal; clinical waste; and sanitary waste. The IWMSTD is designed to reduce these to three effluent streams, two of which will be compliant with NATO's projected discharge and emission standards for 2015. The one remaining waste stream (solid residue from a thermal destruction plant) will be of small volume that can be easily removed to port reception facilities.

Current RN warships, while technically compliant with about 95% of MARPOL 73/78 requirements, suffer from a number of shortcomings. "They include a limited ability to operate in special/littoral areas, the 'harbor hassle' incurred in offloading waste once alongside, and the increasing port costs associated with waste disposal," says Lieutenant Commander Stephen Blackburn, who is responsible for future technologies and in-service support of maritime waste management within the RN.

"Also, the need to store food waste is becoming more difficult, while larger units are also experiencing problems with the processing and storage of plastics and general-purpose garbage." Another emerging issue is NATO's future anti-terrorist posture, placing more emphasis on minimizing the shore-side interface to reduce susceptibility to terrorist threats while alongside.

According to QinetiQ, the IWMSTD has been engineered to integrate and control a series of commercial, military and emergent technologies for individual waste streams into an affordable system. "The plant has been designed to operate in an environmentally compliant manner for 45 days without the need to make a port visit, therefore reducing port offload and harbor costs while improving operational flexibility," says Kenny. "The system has also been designed to minimize manual intervention in waste handling, therefore improving health and safety aboard ship, and reducing the number of personnel required."

IWMSTD hardware includes a membrane bio-reactor (similar to a unit fitted to HMS Grafton) for treating black and gray water waste; a ceramic membrane oily-water separator (a prototype is currently aboard HMS Richmond); a galley waste unit (based on a modified commercial system and an existing macerator system); a pyrolosis unit (for disposal of sanitary waste); a commercially available autoclave (for clinical waste); and a commercial solid-waste shredder. Processed bilge water, clinical, galley and solid-waste streams are routed into a diesel-fuelled cyclonic incinerator unit operating at a

maximum temperature of 1,200ºC. The end product is clean off-gas and inert ash.

Black and gray water waste is broken down into carbon dioxide and water in an aerobic reaction. The end product is a sewage sludge - a small proportion of which is sent on to the incinerator - and a clean 'permeate' which can be expelled overboard.

The MAES IPT acknowledges that, while an incinerator is suitable for the land-based demonstrator, there is an understandable reluctance to install such a system aboard an operational warship. A future shipboard thermal-treatment plant would most probably use an alternative destruction technique, such as plasma-arc incineration, pyrolosis or wet oxidation.

Another key element of the IWMSTD is the SCADA (Supervisory, Control and Data Acquisition) application developed to manage system operation. Hosted on a PC, the SCADA application has been developed so as to enable emerging technologies to be integrated into the overall system architecture. It also allows the effects of component failures on system performance to be modeled.

As one of two key subcontractors, Strachan & Henshaw has taken responsibility for engineering design, system construction and installation, trials support and development of the control system. BMT Defence Services, meanwhile, has developed a series of systems analysis tools (including an environmental impact assessment, a safety assessment, project risk analysis, equipment value analysis, reliability and maintainability studies) and is assessing ship integration aspects.

The IWMSTD aims to meet the waste-management requirements of the Future Surface Combatant, due to enter service from 2015 and targeted by the RN as its first 'environmentally sound' warship. However, QinetiQ and its industry partners believe that the technology demonstrated in the IWMSTD will be sufficiently mature for inclusion in the Future Aircraft Carrier (CVF - due to enter service in 2012) and later batches of Type 45 destroyers (although this would require some redesign of below-decks spaces).
