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Shipboard Reverse Osmosis Desalination – SROD Mk IV

By Daniel Murphy

The recent repair and overhaul of the Mk III shipboard reverse osmosis desalination (SROD) system in HMCS *Halifax* (FFH-330) using new Mk IV technology is a prime example of efforts to keep the current Royal Canadian Navy (RCN) fleet up to date with state-of-the-art equipment. This newly overhauled SROD system will pave the way for new desalination technologies on board ship, and will put the RCN ahead of the currently fitted Mk III system in *Halifax*-class vessels. The Mk IV SROD promises to provide the navy with the means to meet future mission requirements, while enhancing efficiency and reducing maintenance.

Managing Ballast Water Requirements

Ballast water management is evolving to be at the forefront of environmental considerations, and harmful aquatic organisms in ballast water must be fully considered as we operate our current fleet and design new ships.

Ballast water brought on board to provide stability and manoeuvrability to a ship can contain thousands of aquatic species, including bacteria and other microbes. When ships discharge ballast water, this action introduces potentially alien species to the receiving water. In order to protect the water ecosystem from alien species, the International Maritime Organization (IMO) is establishing a Ballast Water Management Convention (BWMC). Regulation D2 of the BWMC will require ballast water be treated rather than exchanged. The BWMC is expected to be ratified this year (2016) and come into force one year later.

Technology combinations applied in the ballast water treatment system vary, but typically include two stages: physical solid-liquid separation (i.e. disc filter); and disinfection (i.e. chlorine, UV, and ozone). The BWMC will also allow alternative ballast such as fresh water provided the water meets BWMC ballast discharge standards. The ultrafiltration (UF) system used in the *Halifax*-class Mk IV SROD system provides a treatment solution that meets BWMC standards, while also providing a freshwater production capability that outperforms conventional solid-liquid separation technologies in many aspects, including reduced operating costs and footprint.



Photo by Brian McCullough

The Mk IV SROD from BluMetric Environmental Inc. offers significant improvements over the Mk III system currently installed in the RCN's *Halifax*-class frigates.

Increasing Scope of Water Production

In July 2008 the Directorate of Force Health Protection and the Naval Engineering Test Establishment performed a study of the Mk III SROD's ability to filter contaminated source water to provide safe drinking water. The source water was engineered to contain a five-times-higher level of contaminants than one would normally see in the most polluted harbours of the world. The results validated that the Mk III SROD could produce safe drinking water well within Canadian drinking water guidelines. The greatest obstacle was the increased consumption of filters and membranes.

By leveraging successful trials and research done by ADM(Mat)/DGLEPM through the same R&O contractor (**BluMetric Environmental Inc.** of Carp, Ontario), DGMEPM was able to automate the self-cleaning of the new SROD UF pre-filters to mitigate the burden on the maintainers. Automatic monitoring of equipment parameters allows for auto-cleaning sequences to eliminate

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the need for filter change-outs. Automatic self-cleaning strainers were also introduced prior to the UF pre-filters to eliminate operator intervention during the strainer cleaning mode. According to BluMetric's Managing Director of Military Systems, **James Thomas**, the level of pre-filtration on the new Mk IV SROD thus allows for continuous operation in littoral waters without any decrease in system performance or increase in operating costs or maintenance.

Reduced Maintenance Time and Decreased Operational Costs

With the introduction of the self-cleaning strainers and automatic back-flushed UF filters, membrane source water going into the reverse osmosis membranes is filtered to a near-pure quality. The purified salt water extends the operational life of the high-pressure process pump and greatly reduces organic fouling of the membranes. This results in significantly reduced cleaning and maintenance cycles.

All of this equates to fewer spares required on board, and fewer maintenance hours. First- and second-pass process pumps have all been changed out in the fleet to a new Danfoss pump that has demonstrated high

dependability and comparatively low rebuild complexity and costs. These same pumps are being re-used in the conversion from the Mk III to the Mk IV SROD. Such changes, in addition to proactive efforts to manage other obsolescence issues are enhancing SROD availability.

Greener Solution Initiative

The increase in self-cleaning pre-filtration and the change to more efficient process pumps have allowed the use of modern reverse osmosis membranes. These changes will increase potable water production to a projected 48 to 50 tonnes per unit per day that, combined with an energy savings of the new pumps, results in a 36-percent efficiency increase. This provides savings in the area of power, fuel consumption, maintenance hours, and spares costs. The "greener" unit encapsulates the innovative direction DGMEPM is taking to produce operationally effective, reliable engineering solutions for the fleet of today and tomorrow.

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NCM Awards – Recognizing Excellence

T.M. Pallas Memorial Prize

This prize, sponsored by the Canadian Institute of Marine Engineering (CIMarE), recognizes top performance by students on the Marine Engineering Certificate 4 (Engineering Charge ticket) and Certificate 3 (Engineering Officer of the Watch) courses in Halifax.

The Cert 4 awardee, **Chief Petty Officer Second Class Jamie Stead**, was posted to HMCS Athabaskan as Chief Engineer of the Marine System Engineering department in March. Prior to this, he was the Care and Custody Chief of HMCS Iroquois, responsible to the officer-in-charge for the safety and security of the platform while the ship is alongside in Halifax awaiting disposal. This involved supervising equipment removals, and conducting preventive and corrective maintenance on systems needed to keep the ship habitable.

Bravo Zulu Chief Stead!



CPO2 Jamie Stead (left) receives his award from Cmdr Craig Baines, Commander Canadian Fleet Atlantic.