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By John Boylston

Ballast Water Treatment – An Alternative

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The introduction of invasive marine species into new environments by ballast water from ships has been identified as a great threat to the world's oceans. IMO adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments in 2004.

The Ballast Water Management (BWM) Convention applies to all ships and offshore structures that carry ballast water and are engaged in international voyages, and requires:

• Ballast water exchange (Regulation D-1), or,

• An approved ballast water treatment system (Regulation D-2)

The Convention stipulates two standards for discharged ballast water. The D-1 standard covers ballast water exchange while the D-2 standard covers ballast water treatment. Depending on the ship's date of construction and ballast water capacity, D-1 will be phased out and replaced by D-2. The minimum treatment efficiency required by IMO is outlined in the D-2 standard and type approval is necessary to demonstrate compliance.

However, such approval is no guarantee that the selected treatment system will perform properly in all the areas where a ship might trade. Several countries have also established local restrictions on ships calling into their ports or sailing in waters under their jurisdiction causing confusion and concern in the market.

The careful selection of a treatment system is also important in order to ensure that the system meets the ship-specific requirements, such as the ballast water transfer rate, power limitations, compatibility of treated ballast water with tank coatings, etc. Another important aspect is also to gain insight into the manufacturer's commercial reliability, support network and quality of equipment.

The power requirements for UV systems are considerable (several hundred kW for a medium size containership). Certain systems employ chemicals that will present a logistics problem and, in some cases, the chemically treated ballast water must be held for some period, as the initially treated ballast water is toxic if discharged. There are a sizable number of operating decisions that must be made. Internationally there is concern because, as no system was approved when the act was initiated, and no extension for implementation has been granted, now that some interim approvals have been granted there may be a glut of customers for refit and not enough yards to carry out the work.

How the USCG Has Reacted

The USCG has required that all ships calling at US ports will have identical requirements, thus domestic ships are included.

As a temporary measure, the USCG may accept BWTS that have been type approved by another flag state according to the IMO BWM Convention criteria. The USCG calls this an Alternate Management System (AMS).

In the middle of April 2013, the USCG published the first list of accepted "IMO" type-approved BWTS as AMS. The list contains nine models from eight different manufacturers. AMS acceptance means that the BWTS model may be used for up to five years after the vessel-specific date when the ballast water treatment method has to be used in US waters. After this interim five-year period, the BWTS model must have been granted a USCG type approval in order to be accepted for future use.

The Alternative

It is proposed that certain types of vessels not be required to operate under the BWM Convention in either the D-1 or D-2 mode, if salt water ballast is removed from the vessel and replaced with locked-in fresh water ballast that can be transferred internally, permanent ballast, or some combination of the two. Such systems can prolong the life of the ship, as internal tank corrosion can be eliminated.

While tankers and bulkers cannot be considered for this approach, due to the huge amounts of ballast they require, there are still a considerable number of other ship types that may be able to use this alternative.

Ro/Ros

Ro/Ros carry a lighter cargo than, for instance, a container ship and generally their ballast requirements for stability are considerably less. If a modest size ro/ro required 1800 tons of ballast in full load, located just forward of midships, to trim the vessel out and for stability, and in a lighter return loading required 1600 tons of ballast, aft to gain stability and propeller immersion, it might be possible with 1700 tons to meet both conditions. Rather than discharge the full load ballast and then reload the return load ballast, using the same internal ballast system it would be possible to transfer ballast from one set of tanks to another. Rather than using salt water, if treated, locked-in fresh water were used, the life of tank coatings and the life of the hull structure would be increased.

Container ships

In a moderate size containership, ballast is normally used for two purposes, stability and the reduction of the generally high hogging bending moment such ships have when they are loaded. The ideal location for stability and bending moment control is to place ballast in midships, double-bottom tanks. However, if the bending moment reduction requires more midships ballast than available tankage, then midships wing ballast tanks might have to be used. As the center of gravity of wing ballast tanks is much higher than that of double bottom tanks, while this added ballast is useful in reducing bending moment, it is not very useful in improving stability. Extending the double bottom ballast into additional double bottom tanks, fore and aft from midships, will help stability efficiently, but is less efficient in the reduction of bending moment. Depending on ship proportions, some of these container ships may carry ballast weight equivalent to container deadweight.

If we consider a fixed ballast of a density of 3 times that of salt water, it would be possible to concentrate, in one midships set of double bottom tanks, the approximate equivalent of 3 sets of double bottom tanks or some combination of double bottom and wing ballast tanks. It should therefore be possible to carry less ballast, as the carriage is more efficient for both stability and bending moment control. The only caution is dry dock block loading under such a tank.

As an example, if originally using saltwater ballast, 10,000 tons of ballast was needed for the least ballast condition and 12,000 tons for the greatest ballast condition, then it might be possible to cover all ballast requirements with 9,000 tons of fixed ballast and 1,000 tons of locked-in fresh water ballast for trim purposes. While the total is identical to the previous least ballast condition, for the heavier ballast conditions the ship will ride higher than it did with saltwater ballast, reducing horsepower and fuel.

There are numerous other vessel types where the ballast requirements are less dramatic than with tankers and bulkers where such an approach might work. Car carriers, ferries, OSV's, livestock carriers, cruise ships and a number of types of military ships are some examples.

Reducing BWTS Requirements

Even if it is not possible to cover all ballast requirements with fixed and/or locked-in fresh water ballast, if a large percentage of the ship's ballast requirements can be covered by such ballast arrangements, then the amount of saltwater ballast should be dramatically reduced. This will reduce the size of required BWT systems.

John Boylston is a retired Naval Architect whose last project, before retirement, was the TOTE Orca-class vessels for the Alaskan trade. Having been involved in the design and construction of 100 ships and having some design and operational LNG experience, he was asked to assist TOTE on their new LNG fueled vessels, described in this article.

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