Introduction

Ballast Water contains a variety of organisms including bacteria, viruses, coastal plants and animals. The water is often carried onboard ships over long distances, and consequently new invasive species, bacteria and fertilisers are introduced into new eco systems when ships de-ballast. This is an increasing threat to the ecosystem and it is estimated that the already introduced invasive species have a negative impact on the world economy of annually $100Bn.

In February 2004 IMO adopted the “Ballast Water Convention”. This will enter into force 12 months after a total of 30 States, representing 35% of the world’s shipping tonnage have ratified it.

Presently 30 states representing 26.44% has ratified. Denmark is still not included. It is expected that the minimum requirement will be reached in the beginning of 2012.

Requirements:

There are two standards in the Convention:

D1: “Ballast Water change” – Means that the Ballast Water is shifted in approved areas.

D2: “Treatment Standard”: Means that the water is treated with an approved system (all organisms killed)

The requirements will enter into force in accordance to table 2. It should be noted that ships will need Ballast water plans and records from “Day One”.

Even if a system is approved samples taken by PORT STATE CONTROLL will have to be below limits. If a ship is failing, the Port State will have the right to retain the vessel.

Treatment Process

There are a number of different treatment methods; however the most common technology is to combine a “Solid-liquid separation"with Disinfection"
In the “Solid-liquid separation” solid material and larger suspended micro-organisms is separated by settling, surface filtration, or filtering. This process will produce “sediments” which are not allowed to be thrown overboard. (There will be a cost for handling Sediments; however, they could be discharged at the point where they were taken up)

The disinfection process removes the microorganisms in either a Chemical or Physical process (Filter, UV radiation etc.) or even a combination.

It must be noted that the process is more difficult in Fresh Water.

Installation Demand:
It is estimated that between 50-70.000 ships will need to install the systems. The largest demand will be in 2013-2016.

Equipment Supply
In total there are 59 systems in the market from 55 vendors, however only 29 systems have received basic approval of which only 16 have received final approval in accordance to the “G9 guidelines”.

Many of the 55 vendors have their basis in land based applications; however a few known Marine suppliers such as Alfa Laval, Hyundai Heavy Industries, Samsung Heavy Industries, Wilhelmsen Technical Solutions, Wärtsilä and Falck Formco are also represented.

Until now approximately 200 systems has been installed

CAPEX
The total industry cost is expected to be around $35 Billion, or an average of around USD 500.000 – 1,000,000 pr vessel depending on size. For vessels where the existing Aux. System is not capable of supplying sufficient power to the new equipment CAPEX is expected to be higher than average.
(Maersk has estimated internal fleet cost of USD 750M)

OPEX
Due to the fact that the experience from systems in operation does nearly not exist, and the actual OPEX cost is still only estimates. The suppliers know that this cost will be a key issue for the owners, and the owners should be careful to use the estimates as proven figures in their OPEX estimates.

Following are the main Operating Cost Items:
- Power.
- Chemicals
- Filters
- Training
- Onboard Manpower (hours)
- Maintenance
- Sediments
- Other

Exemptions
As a basic rule all ships will need a ballast water treatment system; however, there will be a few exemptions:
- Ships not designed to carry Ballast Water or with permanent Ballast Water in sealed tanks.
- Ships operations only in waters under jurisdiction of a single Flag State. (Flag States might require full compliance)
- Ships working only in the waters under jurisdiction of a single Flag State + high seas.
USA
USA is working on more restrict national rules; these are expected to be ready in late 2011. The USA phase 1 Standard is expected to be similar to IMO but with more stringent testing procedures of the systems.

It is still not known if USA in a later stage will implement a “Phase 2 standard”

Considerations, preparation and installation:

In order for the single shipping company to decide which systems they should purchase they will need to prepare the following:

- **Map:**
  - Vessel types
  - Trading patterns
  - Age / Market factors
  - Ballast capacity, and flow rate requirements.
  - Onboard Ballast Water systems characteristics (especially Oil/Chemical carriers)
  - Electrical Power Balance (existing)
  - Foot Print onboard (Space)
- **Internal considerations:**
  - Available internal project management resources
  - Time required for D2 requirements to be implemented
  - Possible latest date by moving Intermediate Survey
  - Need for Explosion proof
- **Different suppliers:**
  - Tank Coating and possible corrosion impact
  - Health and Safety
  - Crew qualifications / Operational training
  - Installation / Operational Risk and reward
    - Supplier experience with Marine installation
    - Suppliers OPEX calculation might not be right
    - Suppliers sub-supply chain (can they deliver in due time)
    - Supplier assistance available during installation
    - Yard availability
    - Yard capabilities + responsibility
- **Procurement specification:**
  - Size of systems
  - Delivering schedule and place
  - Assistance needed from supplier
  - Spare part included / future price on spare parts
  - Existing ballast systems – Pump capacity, Drawings, Electrical Diagrams, Possible space, Pipe work, Power availability etc.
  - Delivering

When the price quotes from different suppliers have been received the Company must prepare detailed CAPEX, and OPEX budgets including system purchase, Installation, Project management and procedural/manual implementation. During this process the shipping Company should consider the remaining lifetime of the individual vessel, and possible earnings in this lifetime against the CAPEX and OPEX cost. Upcoming requirements like MARPOL ANEX VI regarding Scuppers (2015) and Shore Power Connection during port operation should be brought into the considerations.

The company should risk estimate when the timing is correct for continuing the process from this stage.

- If moving to early – they might purchase the wrong system, and in addition the international time limits might move or the US-rules might change.
- If moving to late the lead time on the “best” system might be too long
After price negotiation and selecting suppliers, a project plan for the company including allocation of technical resources, supply of parts and time planning must be carried out. This process also includes negotiations and agreements/contracts with different yards.

*Special attention should be given to the liability clauses in the contracts – i.e does the yard and/or the supplier have the liability for working and performance conditions of the equipment (does the system deliver “clean” water in accordance to the standard). The rule of thumb is that if the system has a proven test record from the supplier, and if the system does not supply clean water in accordance to these test record after installation, then the yard can be claimed for negligence, and thereby they will be responsible for re-installation and in addition for consequential damages such as lost income.

Three different approved systems:

DESMI:
ALFA LAVAL:

Sea-worthy materials

- Reactor - SMO 254
- Valve - Rubber lined cast steel
- Valve - Rubber lined cast steel
- CIP Unit
- Semple valve - Ribson coated steel

WÄRTSILA

Scaling of Ballast Water Treatment Systems

- UV in the firing line in scaling debate
  - Scaling of ballast water treatment systems represents a risk to the ship owner – risk that system is undersized and may not meet port state control
  - Scaling risk eliminated by land based testing each discrete flow model – can control testing variables in land based testing