Retrofitting Systems
– Technical Complexities & Shipyards Capacity to Meet the Demand

Zheng Yu
Jiujiang Precision Measuring Technology Institute (JPMTI) of

Directory

1. Background information
2. Retrofitting process
3. Technical Complexities
4. Shipyards Capacity to Meet the Demand
Background information

Sep.8/2016 BWM Convention already meet the conditions:

<table>
<thead>
<tr>
<th>Countries</th>
<th>52</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35.14%</td>
<td>35%</td>
</tr>
<tr>
<td>World GRT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

That means huge BWMS demanding:

From Sep.8/2017 to Sep.8/2022
About 30,000~50,000 Vessels need BWMS retrofit when docking

Background information

China State Shipbuilding Corporation

There are 2 shipyards which undertake repair business

ChengXi Shipyard (JiangYin)
ChengXi Shipyard (GuangZhou)

29 vessels had finished BWMS retrofitting in these 2 shipyards
Retrofitting process

Technical process, regardless of business, class issues

Information collection
1. Vessel type
2. Capacity of pump
3. Ballast piping drawings
4. Available Space in vessel

Choose BWMS type
1. Space required
2. Power required
3. Other required: fresh water, cold water, voyages line

Design
1. On board inspection
2. Space confirm (piping & electric)
3. 3D scanning
4. Detailed design

Retrofitting
1. Prefabrication (Piping and so on)
2. Retrofitting

Need cooperation among ship owner, shipyard, BWMS manufacturer

Technical Complexities

Information collection
1. Vessel type
2. Capacity of pump
3. Ballast piping drawings
4. Available Space in vessel

Choose BWMS type
1. Space required
2. Power required
3. Other required: fresh water, cold water, voyages line

Design
1. On board inspection
2. Space confirm (piping & electric)
3. 3D scanning
4. Detailed design

Retrofitting
1. Prefabrication (Piping and so on)
2. Retrofitting
Technical Complexities: How to Choose

**BWMS Technology**

The vast majority of BWMS manufacturers use 2 stage method:

**Stage 1**
- Filtration

**Stage 2**
- UV type: Ultra Violet, Photo catalysis
- EC type: Electro-Chlorination, Electro-catalysis
- Others: Ozone, De-oxygenation

(choose one tech. below)

BWMS purchasing In CSSC, UV & EC type are the most common

---

**Technical Complexities: How to Choose**

**BWMS Choices**

(Base on 163 vessels data from CSSC New building & Retrofitting project)

- 66% EC Type
- 27% UV Type
- 6% Ozone Type
- 1% Other Type
### Technical Complexities: How to Choose

<table>
<thead>
<tr>
<th>Vessel Category</th>
<th>Pump Capacity (m³/hr)</th>
<th>Vessel Type</th>
<th>BWMS Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Ballast Dependent Vessels</td>
<td>Below 1,000</td>
<td>Container</td>
<td>(Most) UV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bulk Carrier</td>
<td>Handy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tanker</td>
<td>(Rare)</td>
</tr>
<tr>
<td>Middle Ballast Dependent Vessels</td>
<td>1,000 ~ 2,000</td>
<td>Container</td>
<td>Ultra Large UV&amp;EC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bulk Carrier</td>
<td>Panamax</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tanker</td>
<td>Handy</td>
</tr>
<tr>
<td>High Ballast Dependent Vessels</td>
<td>Above 2,000</td>
<td>Container</td>
<td>(Rare) EC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bulk Carrier</td>
<td>Capasize</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tanker</td>
<td>(Most)</td>
</tr>
</tbody>
</table>

Pump rate below 1,000 m³/h, UV type has advantages in space require, power require, price; Pump rate above 3,000 m³/h, EC type has advantages in space require, Power require, price.

### Technical Complexities: How to Choose

**Ship Owner concerns**

- **Quality**: Meets To IMO&USCG Regulation
- **Cost**: Buy & retrofit
- **Service**: Daily operation, After sale

**Workload**

Less workload can ensure project quality; save docking time, reduce material consumption, Less labor cost

**Shipyard concerns in retrofitting**
Technical Complexities: How to Choose

Make the decision
Owner

Shipyard
Suggestion

Technical Complexities: Design & Retrofitting

Two retrofitting cases

"Tan Suo Yi Hao"
Scientific research vessel
BWMS capacity: 350 m³/h
BWMS Tech.: UV type
Brand: OceanDoctor
JPMTI of CSSC

"Kai Chuan"
318,000 DWT VLCC
BWMS capacity: 3000 m³/h
BWMS Tech.: EC type
Brand: Balclor
Sunrui of CSIC
Step 1: Retrofitting schematic design

“Tan Suo Yi Hao” UV Type

“Kai Chuan” EC Type

Technical Complexities: Design & Retrofitting

Step 2: Detailed design

“Tan Suo Yi Hao” UV Type

“Kai Chuan” EC Type

Design base on 3D scanning
Engine room remodeling

Design base on new building detailed drawings
(“Kai Chuan” Vessel build in SWS of CSSC
Retrofitting in Chengxi shipyard of CSSC)
Technical Complexities: Design & Retrofitting

Step 2: Detailed design

"Tan Suo Yi Hao" UV Type

"Kai Chuan" EC Type

Technical Complexities: Design & Retrofitting

Step 3: Retrofitting

"Tan Suo Yi Hao" UV Type

"Kai Chuan" EC Type
Technical Complexities: Design & Retrofitting

Workload Comparison

“Tan Suo Yi Hao” UV Type
- Only 3 parts integrated in one location of the engine room which occupied small area.
- 3D scanning needs remodeling vessel.

“Kai Chuan” EC Type
- About 10 parts decentralized installed in 3 different areas of the engine room and the pump room.
- Drawings of new building make the retrofit design work easier, but more parts make the design work more complicated.

Both UV and EC retrofitting finished in 2 weeks when docking. The workload for UV type BWMS retrofit installation is less than that for EC type.

Shipyard Capacity to Meet the Demand

1. Professional Advice
- Shipyard is experienced in retrofitting. It has been cooperated with different BWMS manufacturers.
- Shipyard have accurate retrofitting specifications of BWMS: different types and different bands.
- Shipyard’s suggestion will help ship owner to make a better choice of BWMS.

2. Coordinate
- Retrofitting is a system project which needs ship owner, shipyard, Class, BWMS manufacturer work together.
- As the project executor, shipyard is preferred to play the role of coordinating with each relevant party.
3. Detailed Design

Two solutions:
Detailed design based on 3D scanning and vessel remodeling.
Detailed design based on new building detailed drawings.
Our shipyard can handle the design work with high proficiency.

4. Retrofitting project

Based on a accurate detailed design, retrofitting project is exactly what the shipyard good at.

Thank you!

Zheng Yu

E-mail: 327y@163.com

Jiujiang Precision Measuring Technology Institute of