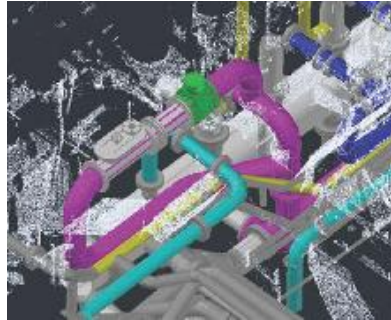


BlueZone™

Ballast Water Management System

" MICRO OZONE BUBBLE TYPE for all kinds of vessels "

1, Charilaou Trikoupi Str., Piraeus, 18536
Tel: +30 210 4539189, +30 213 0342259,
Fax: +30 210 4537341
pms@piraeusmarineservices.gr
www.piraeusmarineservices.gr



[Design & Engineering]



BlueZone™ BWMS



[Manufacturing & Installation]



1. SUNBO – Manufacturing & Installation



Sunbo Industries Co., Ltd, Sunbo Unitech Co., Ltd, Sunbo Hitech Co., Ltd

- 1) Foundation : 1986
- 2) President : G.S. Choi
- 3) Location: Busan in Korea
- 4) Yearly sale : 200 Million USD(2014)
- 5) Employee : 860 people
- 6) Customer : DSME, HHI, SHI
- 7) Products

- **Unit** for Sewage Treatment, Purifier, M/E L.O, Cooling
- **Supply Unit** for Main Engine F.O, Generator Engine F.O, Boiler F.O, F.W, Central F.W
- FGSS, PWTS, and Ballast water management system





2. DSEC – Design & Engineering



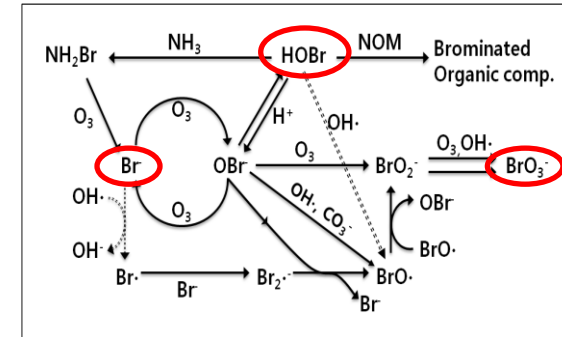
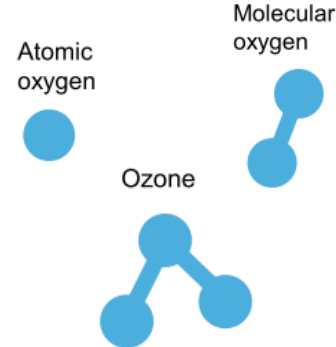
DSEC Co., Ltd.

- 1) Foundation : 2002. 04. 09
- 2) CEO: M.S. KIM
- 3) Location: Busan in Korea
- 4) Yearly Sale: 425 Million USD(2014)
- 5) Employee : 903 people



- **OZONE**

- Combined by Three(3) Atomic Oxygen
- Colorless & Specific Odor
- **Unstable state** : Release One(1) Atomic Oxygen
- **Oxidizing Power** : Ozone > Chlorine (25~1,000times)



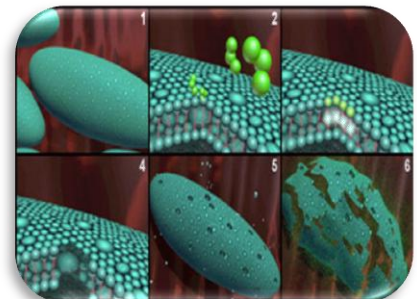
- **OZONE Reaction**

- **Reaction of Br ion and O ion in the Sea Water**
- **Production of HOBr (Hypobromous Acid), OBr⁻ (Hypobromite ion), BrO₃⁻ (Bromate)**
- **Residual Disinfection Effect**

■ The Merit of OZONE Disinfection

- **High potential disinfection** in the Sea Water
- **Eco-friendly** : After reaction, Ozone reduces to Oxygen
- **In-situ** : Use only at Ballasting mode
- **No need Other Oxidant Agent**

Oxidizing Species	Oxidizing Potential
Fluorine	3.06
Hydroxyl-free radicals	2.80
Atomic oxygen	2.42
Ozone	2.07
Potassium permanganate	1.67
Hypobromous acid	1.59
Chlorine dioxide	1.50
Hypochlorous acid	1.49
Chlorine	1.36
Oxygen	1.23
Bromine	1.09
Hypochlorite	0.94



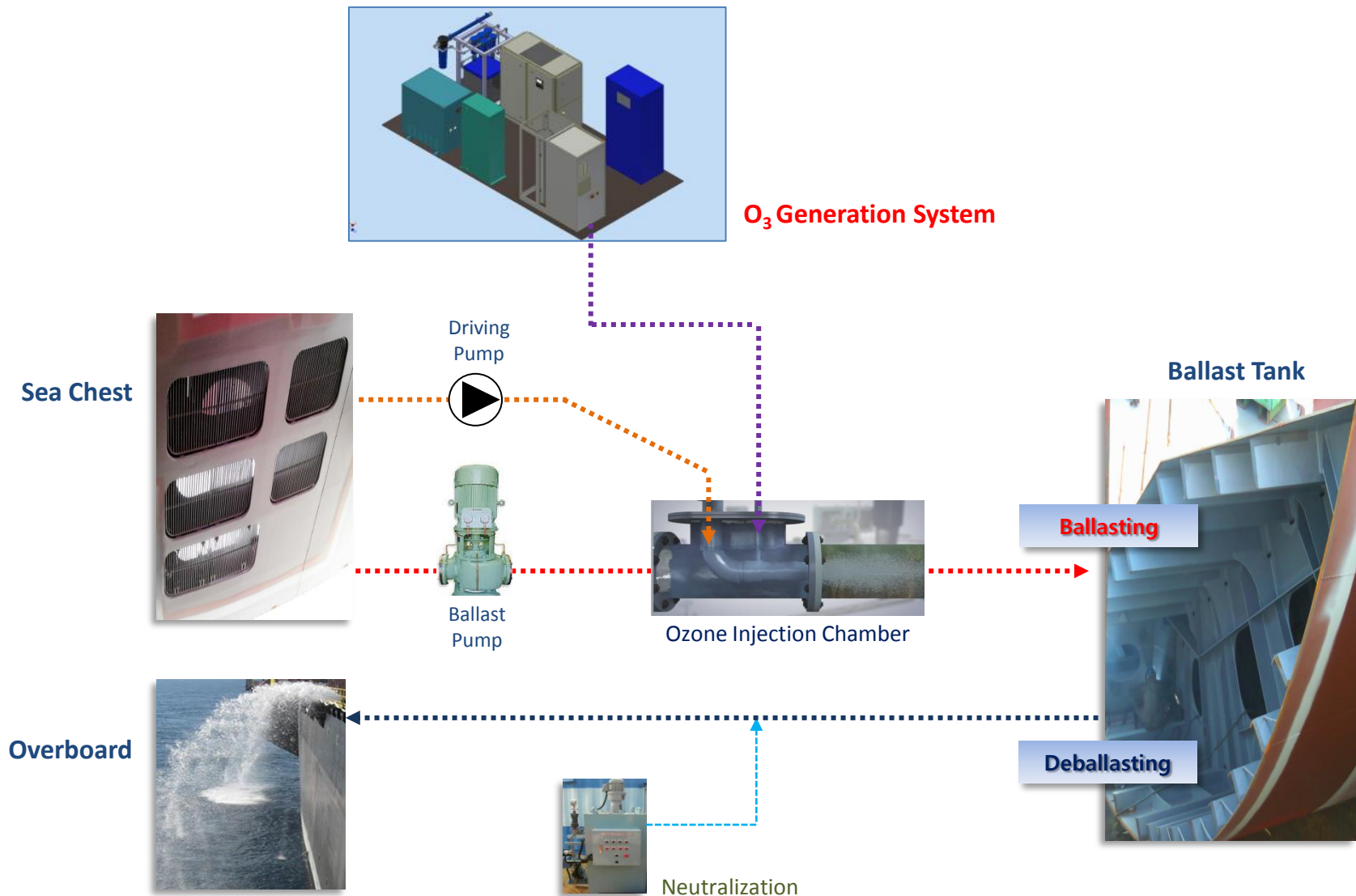
Destroy Cell-Wall by Ozone molecular

Main Components of BlueZone BWMS

▪ Ozone Generation System



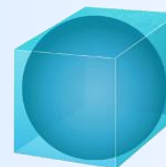
Operation Mode of BlueZone BWMS



Difference between General Bubble and **Micro Bubble**

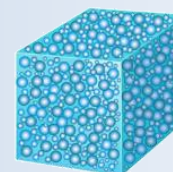
Ordinary Bubble

- Bubble Size : Over 1mm
- High buoyancy, Rise to the surface quickly
→ Extinction at the water surface
- No qualitative & Energy change

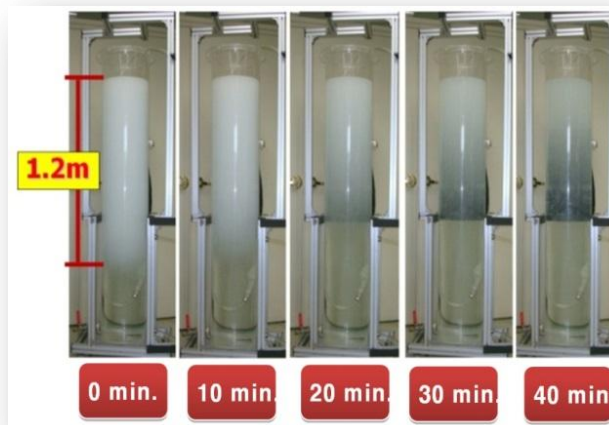
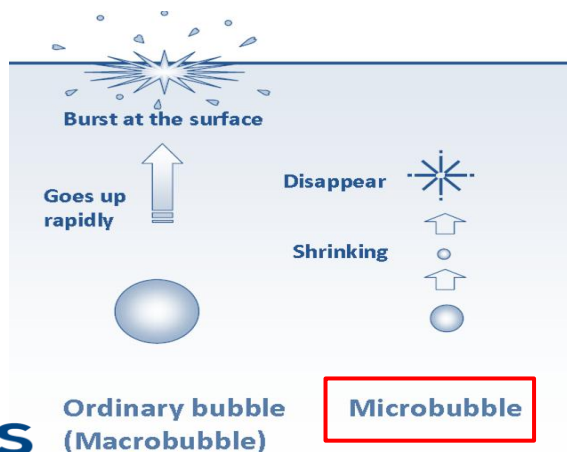


Micro Bubble

- Bubble Size : **under 50 μ m**
- **Low buoyancy, Rise to the surface slowly**
→ Dissolve completely in the water & **Long retention time**
- Occur qualitative & various Energy



- BlueZone BWMS use **Under 50 μ m Micro Bubble**
 - Long Retention Time in the ballast water by Low buoyancy
 - : Improve Residual Time in the Ballast Tank -> Disinfection to Microorganism
 - Increase the dissolved effect & contact area by the Micro bubble : Improve disinfection effect



[Ozone Injection Video]

- **Use Ozone only at Ballasting Mode : *In-situ***
 - No need other oxidants and Storage tank for Oxidants
- **Leak Test to Ozone Injection Line**
 - No need other oxidants and Storage tank for Oxidants
- **Butt Welding for Ozone pipe connection**
 - Optional : **Shield system** with Catalyst($\text{MnO}_2 + \text{CuO}$) to Welding point & Vent on the Ballast Tank
- **O_3 & O_2 Detector to be installed around O_3 Generator and O_3 Injection Chamber**

Exposure Limit of Ozone

: WHO (World Health Organization)

- PEL (Permissible Exposure Limit) : 0.1ppm TWA (Time Weighted Average) of 8 hours
- STEL (Short Term Exposure Limit) : 0.3ppm

Safety for CREW

- **0.1ppm of leakage Ozone** : **Alarm system** is Activated (& Under 19% or Excess 23% of Oxygen)
- **0.3ppm of leakage Ozone** : System should be **Shut down** (& Under 17% or Excess 25% of Oxygen)

- **Granted IMO Final Approval to the Risk Assessment of Ozone**
 - Plan Risk Assessment & HAZOP(Hazard and Operability) study with CLASS

1

SIMPLE!

- ONE SPOOL INSTALLATION
- AUTOMATIC MONITORING
- COMPACT COMPONENT

2

RELIABLE!

- USING OZONE TECHNOLOGY
- NO CORROSION
- OPTIMAL ENGINEERING & INSTALLATION

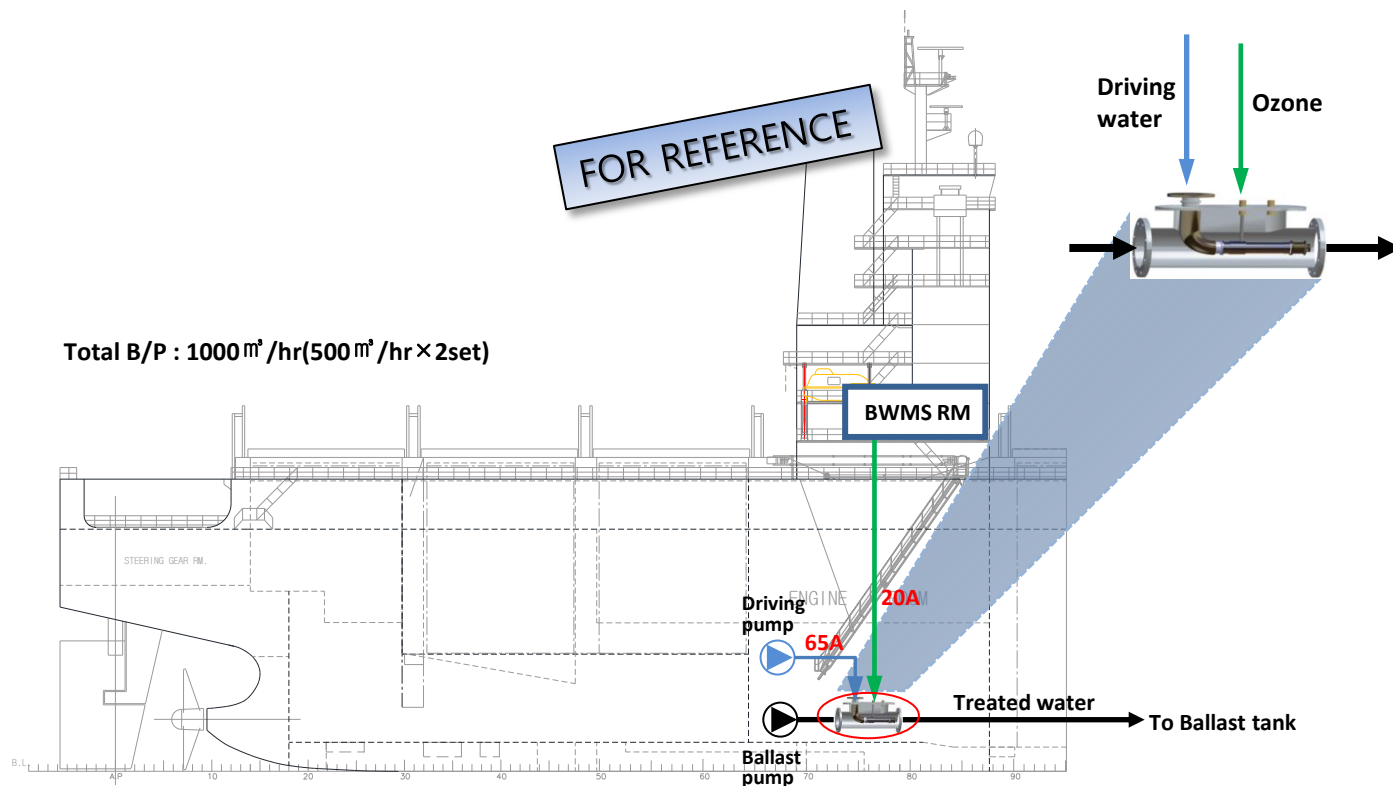
3

LOW COST!

- NO FILTER
- EASY INSTALLATION
- COST DOWN

Advantage – SIMPLE!

- **ONE SPOOL** (Ozone Injection Chamber) **Installation**
- Main Components : Modules System (CONTAINER) or Discontinuous Arrangement



Advantage – SIMPLE!

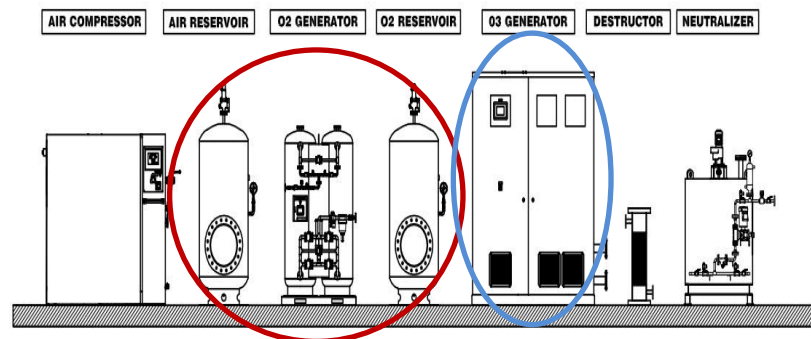
Automatic Monitoring



Real Time
Communication



Compact Components



[OXYGEN GENERATOR]



[MCP]



Cable Wiring



[Total Service Global Network]

- BWMS monitoring by communication
- Supply material & Troubleshooting by A/S Network

TCP/IP & RS 485

1

SIMPLE!

- ONE SPOOL INSTALLATION
- AUTOMATIC MONITORING
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2

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- OPTIMAL ENGINEERING & INSTALLATION

3

LOW COST!

- NO FILTER
- EASY INSTALLATION
- COST DOWN

Advantage – RELIABLE!

- **Proven Technology** in the Water Treatment for 100years



Water Purification System



Industrial Waste Water Treatment



Waste Water Treatment

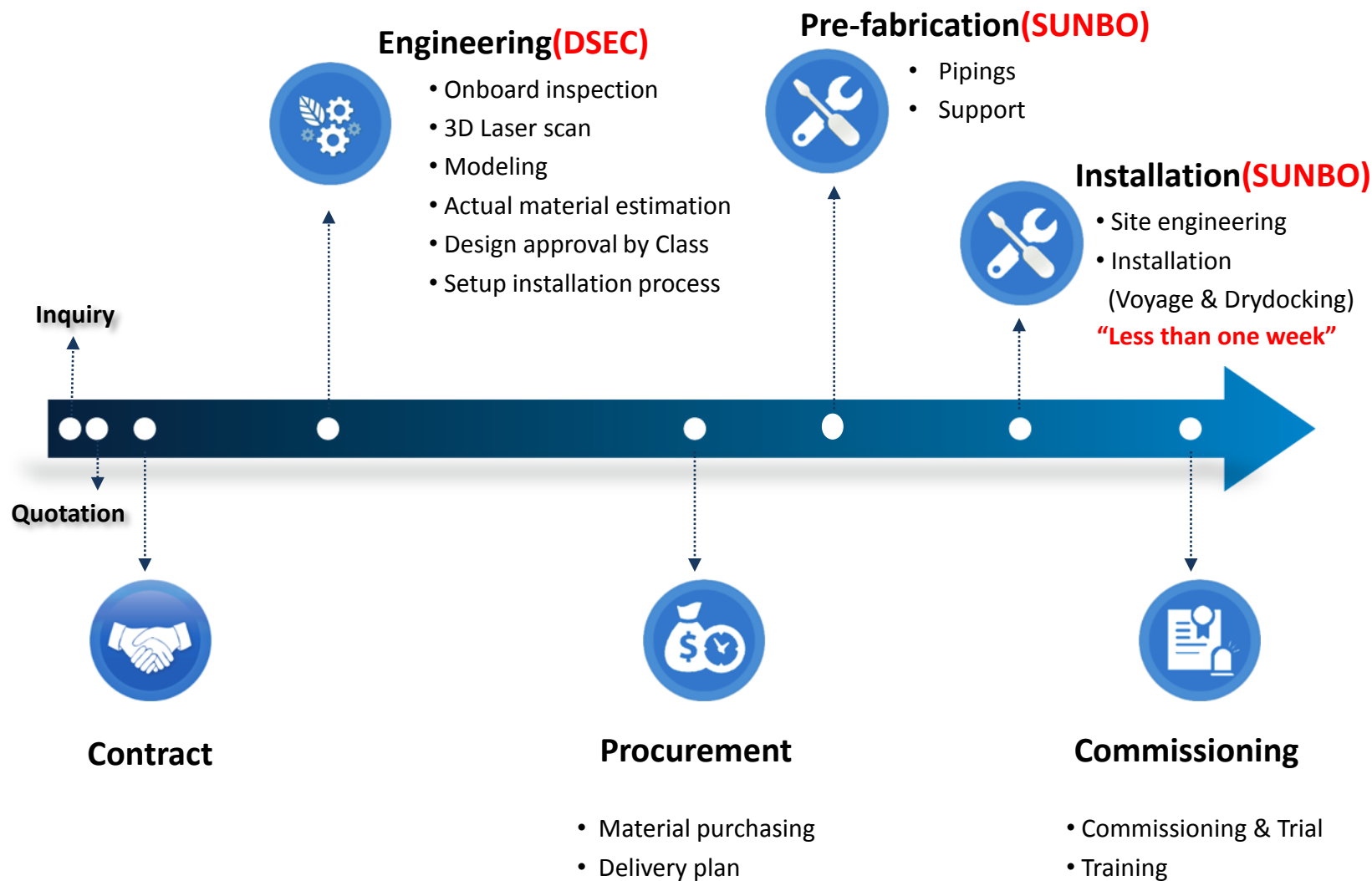
- **NO Corrosion** of Ballast Tank & Ballast Pipe Line
 - IMO 63rd IPPIC (International Paint and Printing Ink Council)
 - Journal of the JIMME Vol.45 No.4 (2010)
 - Chamber test for Six month by IMO PSPC (Performance Standard for Protective Coatings) Rule



TRO(AS, Active Substance) Concentration

- Electrolysis : 9 ~ 13ppm
- Chemical Injection : 10 ~ 15ppm
- BlueZone(Ozonation) : 2.3ppm

▪ Optimal Engineering & Installation



1

SIMPLE!

- ONE SPOOL INSTALLATION
- AUTOMATIC MONITORING
- COMPACT COMPONENT

2

RELIABLE!

- USING OZONE TECHNOLOGY
- OPTIMAL ENGINEERING & INSTALLATION

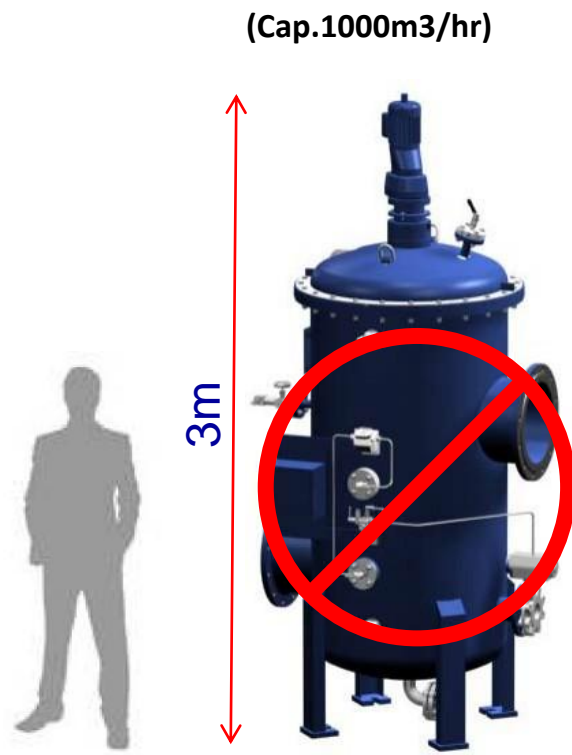
3

LOW COST!

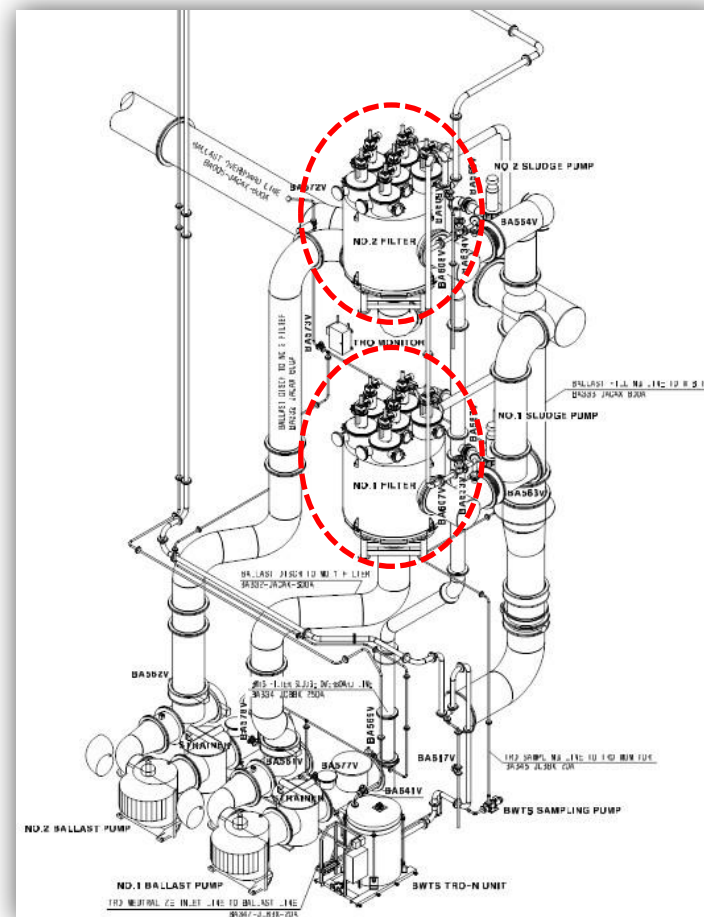
- NO FILTER
- EASY INSTALLATION
- COST DOWN

Advantage – LOW COST!

- **NO Filter** – Cost Reduction to Installation & Maintenance
- Ozone : Removal Zooplankton by Strong Oxidants



Filter Size



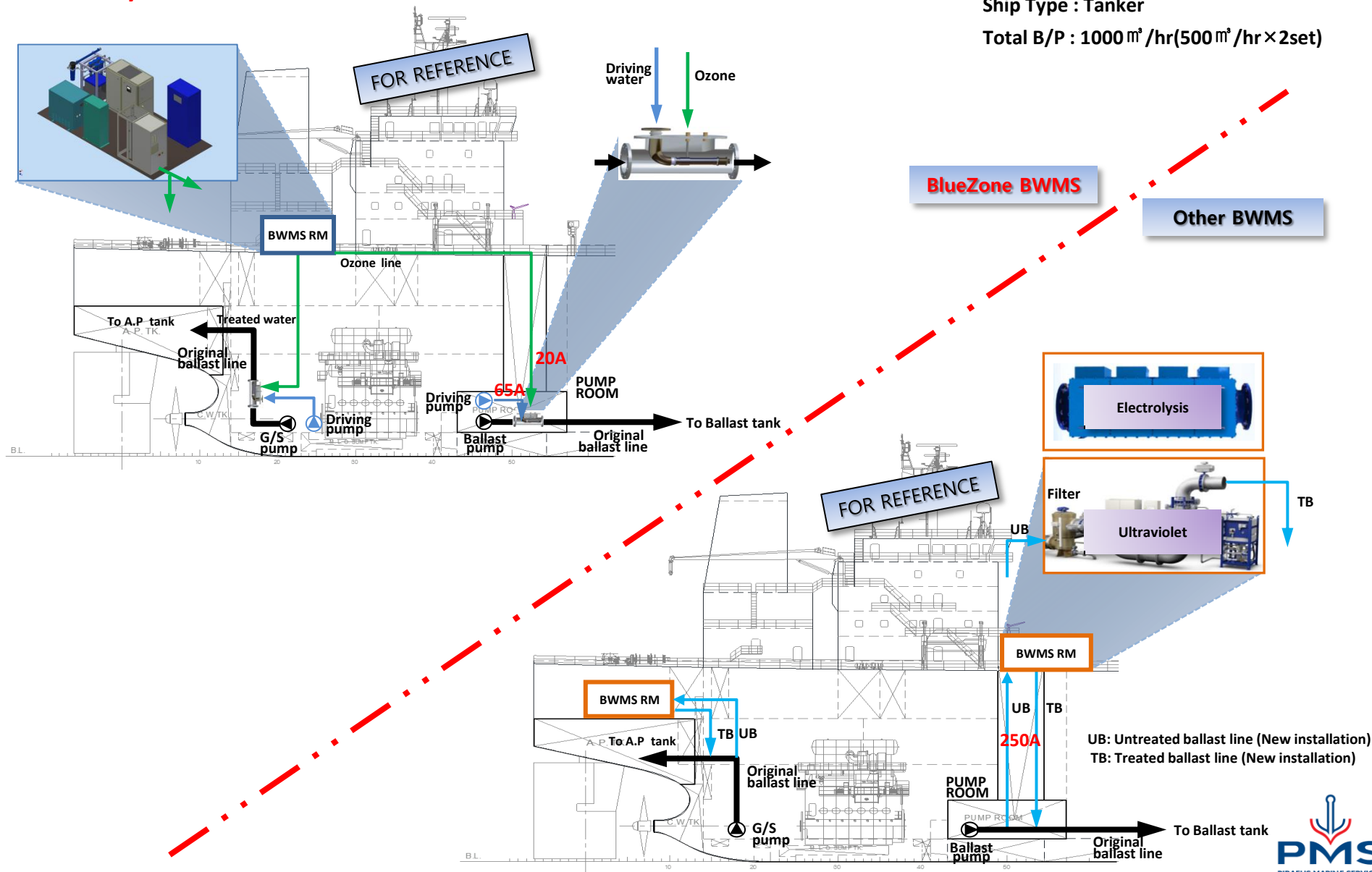
Filter Installation in the Pump Room or Engine Room

Advantage – LOW COST!

Easy Installation – Cost down of Installation Fee

Ship Type : Tanker

Total B/P : 1000 m³/hr (500 m³/hr × 2set)

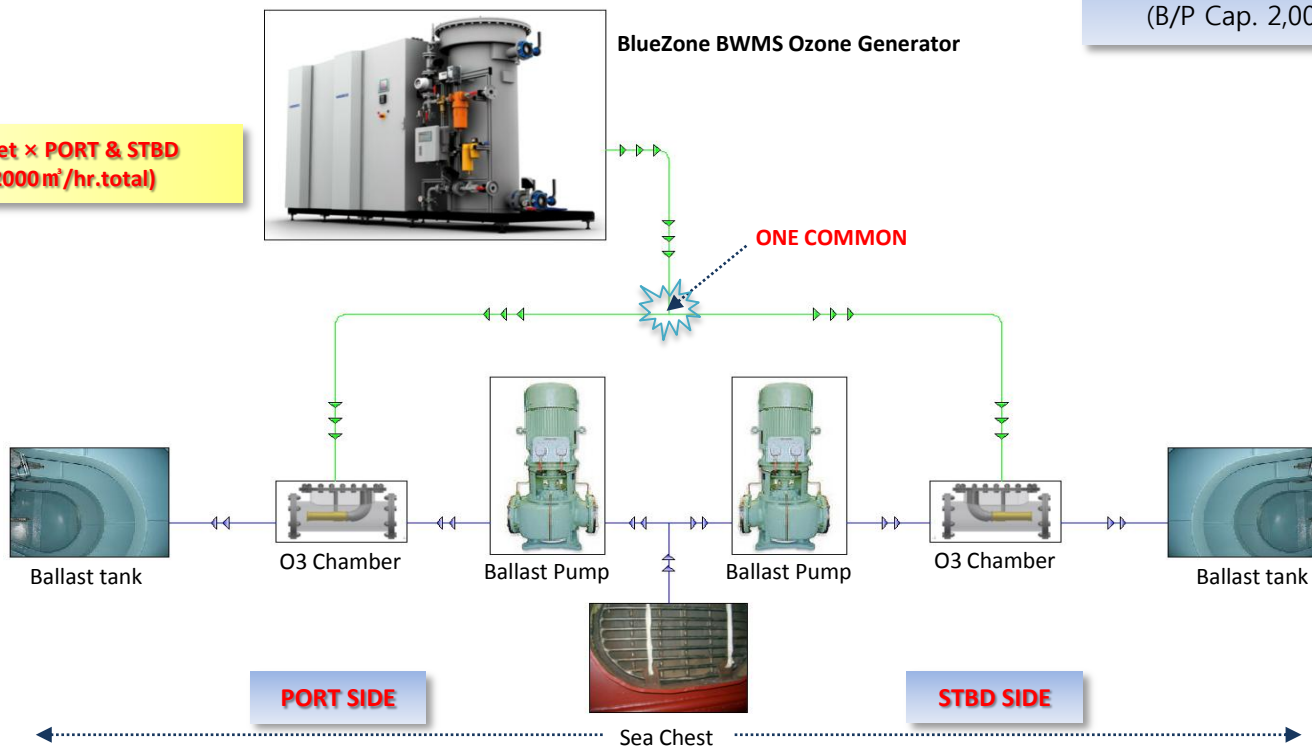


Advantage – LOW COST!

Cost Down – Components, Operating & Maintenance

For Reference : 4,000 m³/hr
(B/P Cap. 2,000 m³/hr × 2set)

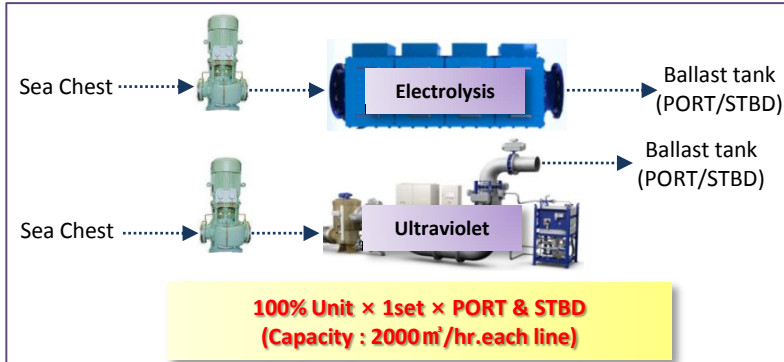
50% Unit × 1set × PORT & STBD
(Capacity : 2000 m³/hr.total)



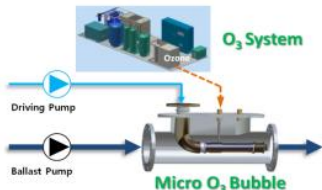

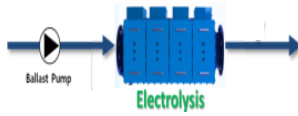
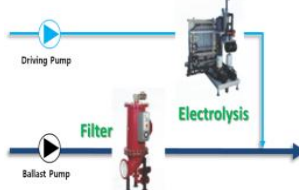
















Operation Tip of BlueZone BWMS

- BlueZone BWMS : **50% Selective Operation is available**
 - Very low Equipment Cost
 - Very low Power Consumption
 - Very low Footprint

Other BWMSytems



Comparison of Each Type

Description	Ozonation	Filter + UV	Electrolysis	Filter + Electrolysis
Feature				
Operating availability	Ballasting	Ballasting + Discharging	Ballasting	Ballasting
Neutralization system	Yes	No	Yes	Yes
Foot print (Main pipe line)				
Energy consumption (Ballasting + De-ballasting)				
Pressure loss (bar)				
Installation				

Technologies – ups & downs

Ozonation	
Ups <ul style="list-style-type: none"> • Efficient • Independent of salinity • 1-way treatment 	Downs <ul style="list-style-type: none"> • Corrosion • Safety

Technologies – ups & downs

UV	
Ups <ul style="list-style-type: none"> • Efficient • Easy installation • Minimal safety issues • Independent of salinity 	Downs <ul style="list-style-type: none"> • High sediments waters • Power consumption • 316/316L chamber • 2-ways treatment

Technologies – ups & downs

Electrolysis	
Ups <ul style="list-style-type: none"> • Onboard disinfection • Efficient • 1-way treatment 	Downs <ul style="list-style-type: none"> • Salinity • Power consumption • Hydrogen • Corrosion

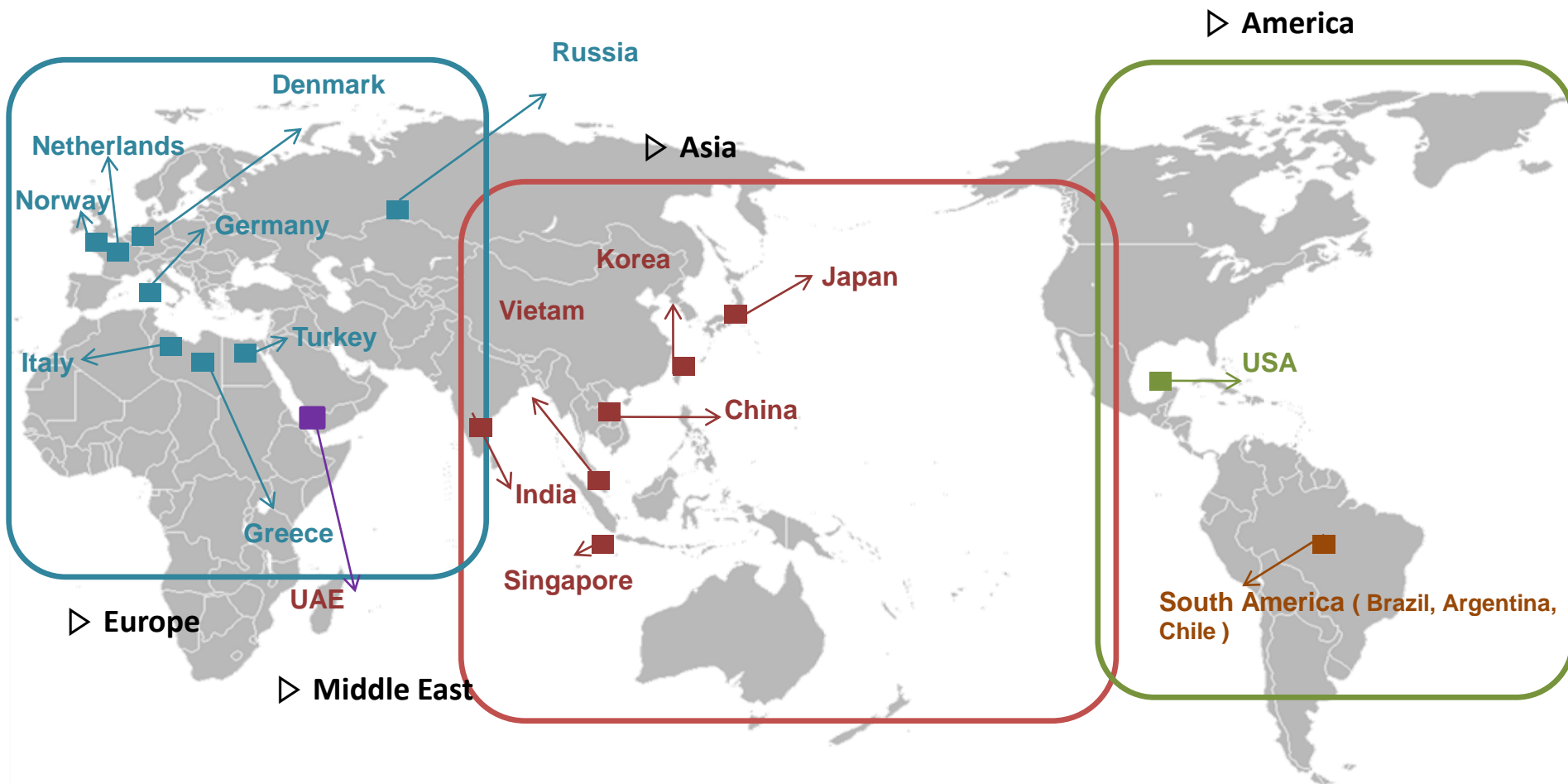
Technologies – ups & downs

Filters	
Ups <ul style="list-style-type: none"> • Self cleaning • Easy installation • Easy maintenance 	Downs <ul style="list-style-type: none"> • Efficiency in high sediments waters • Flow rate reduction • 316/316L candles • Pressure drop

BlueZone A/S Network by SUNBO



BlueZone
BALLAST WATER
MANAGEMENT SYSTEM



BlueZone A/S Network by DSEC



Unmatched Global Presence in Our Industry

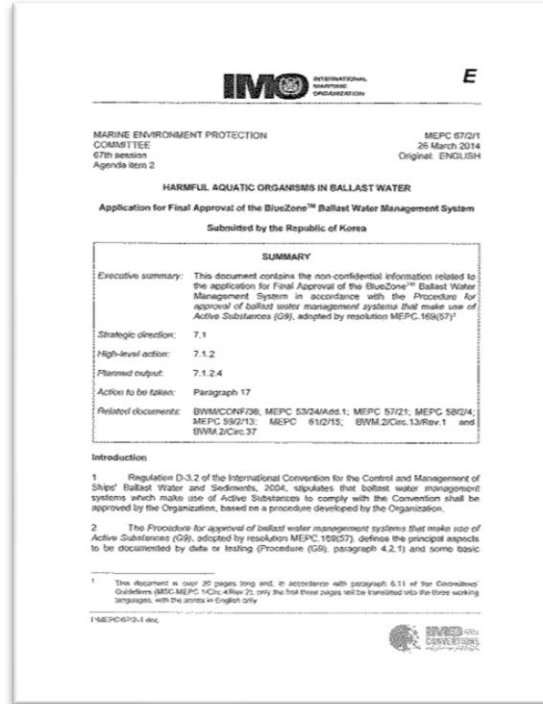


12,500 employees ... 360 global locations ... doing business in 150+ countries

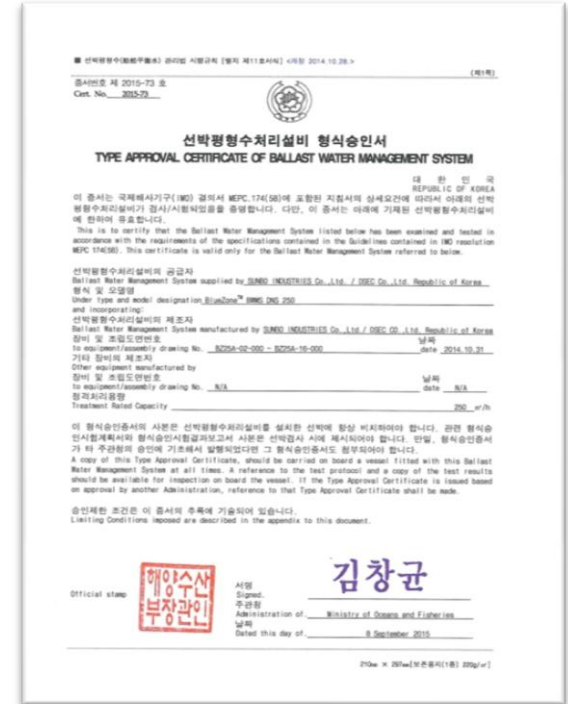
Certification of BlueZone BWMS



IMO BASIC APPROVAL
(2013. 05)



IMO FINAL APPROVAL
(2014. 10)



TYPE APPROVAL
(2015. 09)

Thank You for Your Attention !!