

Summary of Session 2 Environment

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Items	Country	Organization	Name	Title
GHG	Korea	KIOST .	Myung-Soo Shin	On the Current Correction Method of Sea Trail Tests
	Japan	Japan Marine United Corporation	Tsuyoshi Ishiguro	Current status on revision work of ISO 15016 for EEDI verification – Conduct and analysis procedure of speed trial
Air pollution	Japan	Mitsubishi Heavy Industry	Naohiro Hiraoka	Latest technologies for environmental measure in 2 stroke diesel engine
	Japan	Hitachi Zosen Corporation	Toru Nakao	Effect of Sox and NOx Regulation/ Implementation, ECA's and NOx Tier III/ Current Developments in General
BWM	China	Dalian Shipbuilding Industry Corporation	Bao Yan	Less ballast water ships
	China	Jiujiang Equipment Research Institute	Zhang Daiyi	Application of photo-catalytic technology in ships' ballast water treatment

1. Mr. Myung-Soo Shin working for KIOST in Korea, made a presentation with the title of “On the Current Correction Method of Sea Trail Tests”.

Introduction

- Near Korean Peninsula, the speed of currents is very strong. To improve the accuracy of sea trial tests, the accurate method for the current speed is very important.
- By the Minutes at the ISO/TC 8/SC 6/WG 17 3rd Meeting held on 2013-09-16/17 in London,
 - The group agreed to include both iterative method and mean of means method.
 - iterative method
 - three(3) different power settings + additional double runs around EEDI power; 4 double runs

- mean of means method

→ Five(5) double runs at three(3) different power settings are required;
over 5 double runs

- To validate the iterative method, the comparison between the current simulation and estimated current in sea trial test by BSRA(British Ship Research Association) method was discussed.

Simulation of Real Time Currents

- Currents are composed of three components.
 - OC : Oceanic Currents
 - TC : Tidal Currents
 - WDC : Wind Driven Currents
- Currents = OC + TC + WDC

Current Simulation : Tidal Currents

- The speaker explained Momentum and Continuity Equations and Previous Tidal Currents Prediction, and pointed out Problems of Previous Technology.
 - consideration of 4~6 major components because of difficulty in specifying open boundary condition
 - inaccuracy of predicted currents

Current Simulation : Wind Driven Currents

- The speaker emphasized that WDC(Wind Driven Currents, so called Skin Drifts) effect seems small.

Input Data

Speed Trial Analysis Results by ISO 15016:2002

- Speed trial analysis results by ISO 15016:2002 without Currents were used as an input data for the comparison between iterative method and simulation.

Conclusion

- Validation of iterative method on ISO Working Draft
 - Input data : sea trial analysis data by ISO 15016:2002 without current correction
 - Comparison between the iterative method and real time current simulation shows good agreement.
 - The discrepancy between them seems within allowable range of error.
 - The faired curve of Speed-Power by iterative method seems quite reasonable.
- The speaker emphasized that iterative method based on BSRA(British Ship Research Association) Standard in ISO 15016 Working Draft provides enough accuracy for the EEDI speed verification.

2. Mr. Tsuyoshi Ishiguro working for Japan Marine United Corporation in Japan, made a presentation with the title of “Current status on revision work of ISO 15016 for EEDI verification – Conduct and analysis procedure of speed trial”.

Background

- Norway requested to revise the existing ISO 15016 analysis method referring to STA method(2011.4, MEPC62).
- Japan and ITTC proposed to review the analysis method, and special committee(PSS, Performance of Ships in Service) started their study(2011.12).

- IMO MEPC65(May, 2013) assigned two international methods.

In the Guidelines on a survey and certification of the EEDI, the results of the sea trial analysis should be modified in accordance with ITTC method or ISO 15016:2002.

* ITTC method is considered as preferable.

- Since July 2012, ISO started the revision of ISO 15016:2002 by experts including ITTC.
- IMO welcomed the collaborative efforts made by ISO and ITTC to harmonize their standards and urged ISO to submit the revised ISO 15016 by early 2014.
- The speaker pointed out some problems.
 - As for ISO 15016:2002, it is too complicated, and its results are ambiguous.
 - As for ITTC method, it contains black box, and inaccurate.
 - Harmonized Standard to solve these problems is essential.

Basic Concept of harmonized ISO 15016

- The speaker emphasized “No room for arbitrary/ambiguous calculation as for ISO 15016:2002.”

The revised Working Draft 15016 has been improved to eliminate room for arbitrary/ambiguous calculation, whose procedure can be confirmed by the calculation program in the form of a transparent excel spread sheet.

- The speaker emphasized “the incorporation of Direct power method in ITTC guideline”.

The revised Working Draft 15016 has been incorporated with the direct power method under the advice of ITTC, and was accepted as a basis for the harmonization in the ITTC Advisory Council held on 5 and 6 September, 2013.

- The speaker also stressed that, based on the propeller open characteristics, power increase by environmental forces: ΔP is directly corrected, using the additional resistance: ΔR and change of propeller efficiency.
 - adding that basic concept for power correction is identical between existing ISO 15016:2002 and the harmonized ISO.

- The speaker also explained iterative method and mean of means method as for current correction method, and said that iterative method is free from possible problem that wrong estimation may occur, and that iterative method, being also used in BSRA method, can keep the same or better accuracy than mean of means method with half number of runs.

- The speaker touched Calculation method for resistance increase in waves, Calculation method for wind resistance, Evaluation of the accuracy of harmonized ISO method, and Point of compromise in London meeting.

- The speaker raised two hurdles to be cleared.
 - According to the Resolution MEPC234(65), "Revised version of ISO 15016 should be available by early 2014.
 - Revised ISO 15016 should be an acceptable way for sea trial in the EEDI guidelines.

- The speaker expressed that, if ISO 15016 is revised and considered to be an acceptable way for sea trials, work under ISO/TC8 will meet the expectations not only from IMO but also from maritime industry.

Conclusion

- According to the establishment of EEDI regulation, transparent correction method for speed trial is required by verifiers(Class).

- Harmonized method between ISO and ITTC is thus essential. Troublesome affairs could occur if harmonized ISO is deleted at MEPC66 by any possibility.

- SAJ confirmed the accuracy of the harmonized ISO, and considers it to be a reliable and transparent method, analysis results of which are always sole and can be derived even by non-experts.
- Although compromised issues still exist, ASEF members who occupy the major part of shipbuilding industry can overcome this situation by our close cooperation.
- Finally, the speaker requested ASEF members' kind assistance to the DIS ballot for harmonized ISO.
- Now revised Working Draft 15016 is being developed under ISO/Technical Committee 8(Ships and marine technology)/Subcommittee 6(Navigation and ship operations)/Working Group 17(Speed trial data analysis) whose convener is Professor Ken Takagi, The University of Tokyo.
- Additionally, let me introduce the result of the 32nd ISO/TC8 Plenary Meeting held in Singapore in October, 2013, regarding ISO 15016 development.

ISO/TC 8 Resolution 287

ISO/TC 8 decides to register the text of revision of ISO 15016 as DIS and to start the DIS ballot in October 2013, a document to this respect shall be submitted to IMO MEPC directly. Upon successful ballot on DIS, this shall be published without FDIS stage.

There was one question from the floor.

Q : ISO voting scheme was changed from PAS to DIS this October. Question arose about the effect of this alternation on the future perspective to achieve the standardization of harmonized draft.

A : It is fact that DIS voting requires more period(5 months) and hurdle is higher(number of approving P members, etc.). ISO and ITTC plan to submit the joint status report to the next MEPC together with the present harmonized draft as information paper. This information paper means 'WD is publicly available'

which would satisfy the IMO requirement. Needless to say, close cooperation among ASEF members for successful DIS voting is highly appreciated.

3. Mr. Naohiro Hiraoka working for Mitsubishi Heavy Industries in Japan, made a presentation with the title of “Latest technologies for environmental measure in 2 stroke diesel engine”.

Background

- Marine 2 stroke diesel engine can use Heavy Oil as a fuel that is a residue by petroleum refinery process, and it is very economic for users and it has high heat efficiency of approximately 50%. So, it is “eco-” prime mover originally.
- However, because of diffusion combustion in high temperature and high pressure, NOx production is in large amounts. Also, combustion using HFO, SOx and PM are produced in large amounts, too. Therefore, emission regulation is getting harder by IMO.
- And, CO₂ emission is also needed to reduce further.
- The speaker explained ECA(Emission Control Areas) with pictures.
- He also touched EEDI(Energy Efficiency Design Index) regulation, and said EEDI limitation will go up gradually after 1/1/2015 with Phase 1 as you see below.

Ship type	Ship size (DWT)	EEDI reduction rate			
		Phase 0	Phase 1	Phase 2	Phase 3
		2013/1/1 ~	2015/1/1 ~	2020/1/1 ~	2025/1/1 ~
Bulk Carrier	20,000 ~	0	10	20	30
Container Ship	15,000 ~	0	10	20	30
General Cargo Ship	15,000 ~	0	10	15	30

- The speaker introduced comparison of NO_x reduction technology including CAPEX(Capital Expenditure) and OPEX(Operating expenditure).
- The speaker introduced the results and future schedule of Super Clean Marine Diesel(SCMD) Project regarding SCR(Selective Catalytic Reduction) development.
 - SCMD project confirmed DeNO_x rate more than 80% by onboard test.
 - The results have already been submitted to IMO/MEPC.
 - With regard to implementation of long-term durability test,
 - Quantification is needed for performance changing rate.
 - With regard to optimization of commercial SCR system,
 - The viewpoint is to improve the prediction accuracy of SCR lifetime and to minimize life cycle cost.
- SCR is one of the most effective NO_x reduction technologies. High pressure SCR system is also under operating in actual vessel.
- The speaker also touched EGR(Exhaust Gas Recirculation) and explained System outline and Test Result.
- EGR is a NO_x reduction technology by recirculating a part of exhaust gas as scavenging air, and EGR system on-engine is under developing.
- The speaker said that SO_x Scrubber has confirmed the stable SO_x reduction rate is more than 98%.
 - Applying entire exhaust gas Sox scrubber, enables us to use heavy fuel oil not only at Global area but also in ECA.
- He also showed us the comparison of before/after treatment and sludge with pictures regarding water treatment system.

- The speaker explained Speed reduction, Optimizing vessel & propeller, Air lubricating system, De-rated engine, Waste heat recovery, Gas fueled engine, Renewable energy, etc. as EEDI reduction possibilities, and dual fuel engine using both heavy oil and LNG as fuel.
- The speaker introduced Super Long Stroke Engine as CO₂ reduction, MET-VTI(Variable Turbine Inlet) Turbocharger, WHR(Waste Heat Recovery) system, and Development of ORC(Organic Rankine Cycle) system.
- Especially, the speaker emphasized the features of Hybrid Turbocharger.
 - no need for diesel generator running, so
 - less fuel oil consumption
 - less noise
 - less maintenance work on diesel generator

Conclusion

- Regarding NO_x, drastic reduction technologies such as SCR and EGR are now under developing.
- As for SO_x, in addition to changing fuel oil, scrubber can adapt the regulation.
- Aiming for CO₂ reduction, there are several technologies under developing or in commercial such as Dual Fuel engine(gas fueled), WHR system, new Turbocharger application, etc.

4. Mr. Toru Nakao working for Hitachi Zosen Corporation in Japan, made a presentation with the title of “Effect of Sox and NO_x Regulation /Implementation, ECA’s and NO_x Tier III/Current Developments in General”.

- The speaker showed the status of ECA with a table.

ECA (Annex VI: Prevention of air pollution by ships)	In Effect From
Baltic Sea(SOx)	19 May 2006
North Sea(SOx)	22 Nov 2007
North America(SOx and NOx)	1 Aug 2012 (NOx from 2016)
United States Caribbean Sea ECA(SOx and NOx)	1 Jan 2014 (NOx from 2016)

- Regarding SOx regulation, the speaker explained Regulation 14 of MARPOL Annex VI.
 - sulfur content limit in fuel
 - 0.5%wt globally in 2020
 - 0.1%wt in ECA in 2015

- The speaker suggested 3 ways of solutions for SOx regulation, such as Use of Low Sulfur Fuel, SOx Scrubber, and LNG-fuelled Vessel.

- The speaker introduced Wet SOx Scrubbers; Open-loop type, Closed-loop type, and Hybrid type.

- The speaker also pointed out that dry SOx Scrubber is too large, which is a problem.

- The speaker explained IMO NOx Regulation Tier III, MARPOL Annex VI, Reg 13 with a graph.

- The speaker showed EGR system layout with/without auxiliary systems with diagrams, and emphasized that EGR makes SOx scrubber smaller, adding that EGR is a method related with combustion process.
 - The speaker stressed that
 - Currently more than 2000 running hours with EGR in operation were achieved.

- The crew onboard is operating the EGR system.
- EGR system is integrated in Engine, so there is no need for cleaning.

- As for SCR, the speaker compared 2 ways of SCR; SCR after turbine(low pressure SCR), and SCR before turbine(high pressure SCR),
 - saying that SCR before turbine
 - is more compact
 - no heating is needed
 - low CO₂
 - more than 520 vessels are equipped with SCR

Summary

- With regard to NOx reduction,
 - EGR can meet Tier 3, and
 - SCR can meet Tier 3.
- Regarding cost,
 - In terms of CAPEX, EGR is greater than SCR.
 - In terms of OPEX, SCR is greater than EGR.
 - Totally, it depends on time to sail in ECA.

5. Mr. Bao Yan working for Dalian Shipbuilding Industry Corporation in China, made a presentation with the title of “Less Ballast Water Ships”.

- The speaker introduced his company, Dalian Shipbuilding Industry Co., Ltd.(DSIC).

- The speaker pointed out the invasion of ballast-spread species, energy loss in ballast water transporting, and fuel oil consumption of ballast condition, as the influence of ballast water.

- The characteristics of “Less Ballast Water Ships” are,
 - About 50% ballast water can be reduced.

- More energy can be saved in ballast condition sailing.
- All the current rules and regulations are fulfilled.
- Only wing water ballast tanks are arranged.

- The speaker showed us the comparison between conventional VLCC and less ballast water VLCC, including model test pictures and tank arrangement, emphasizing,
 - Less ballast water VLCC is satisfying Phase 2 in terms of EEDI.
 - Structure design has been approved by LR.

- The feature is that inclined bottom with narrower flat part can achieve much less ballast water than conventional ship.

- Additionally, the speaker introduced the feasibility for loading and unloading, and the method of single point mooring.

Conclusion

Less Ballast Water Ships

- Total volume of ballast water is reduced by 50%.
- satisfy all the current rules and regulations
- In terms of EEDI, it satisfies the requirement of Phase 2.
- Maintenance is easy for cleaning.
- Operating and construction are OK.

- There were two questions from the floor.

1) Q : if there is some problem in intact stability

A : no problem because of wider beam compared to conventional VLCC

2) Q : how about scantling draft

A : a little less than conventional VLCC

6. Mr. Zhang Daiyi working for Jiujiang Equipment Research Institute in China, made a presentation with the title of “Application of photo-catalytic technology in ships’ ballast water treatment”.

- Ballast water is indispensable to keep a safe, stable and reliable sailing of ship.
- The unlimited ballast water discharging could induce serious ecological, economic and public health impact to the receiving environment.
- IMO introduced “International convention for the Control and Management of Ships’ Ballast Water and Sediment” in 2004.
- USCG and New York have established discharge standards of their own.
- The speaker explained the current status of the Convention.
 - Entry into Force : 30 States/35% of the world’s tonnage
 - To date : ratified by 38 countries representing just over 30% of the world tonnage
 - USCG AMS(Alternate Management System) entry into force : 2013-12-01
- The speaker says the Photo-Catalytic Technology(PCT) is combination of UV irradiation and photo-catalytic oxidation to disinfect organisms in ballast water.
- The treated ballast water is in compliance with the requirements prescribed in regulation D-2 of the Convention.
- The speaker introduced Ocean Doctor BWMS which, mainly based on photo catalytic technology, uses a combination of UV irradiation and photo-catalytic oxidation to kill organism with low operation cost and high efficiency.
 - It is less power consuming, probably 25% to 30% less than other treatment technologies. It saves energy by 25% to 30% when compared with UV technology. The speaker stressed the advantages of the system, for example, great biological efficacy, economic, environment benign, and wide application.

Conclusion

- Photo-catalytic disinfection is a highly promising technology in ballast water treatment. It is featured with high disinfection efficiency, low operation cost and environmental friendly. It is greener, cleaner and more economic.

- There was one comment from the floor.
 - Including Ballast Water Management System, all kinds of technologies could be developed, but the product or technology should be cheap for adoption from the viewpoint of owner.
 - If it is expensive, there is no big advantage.