Internal publications

Partnership

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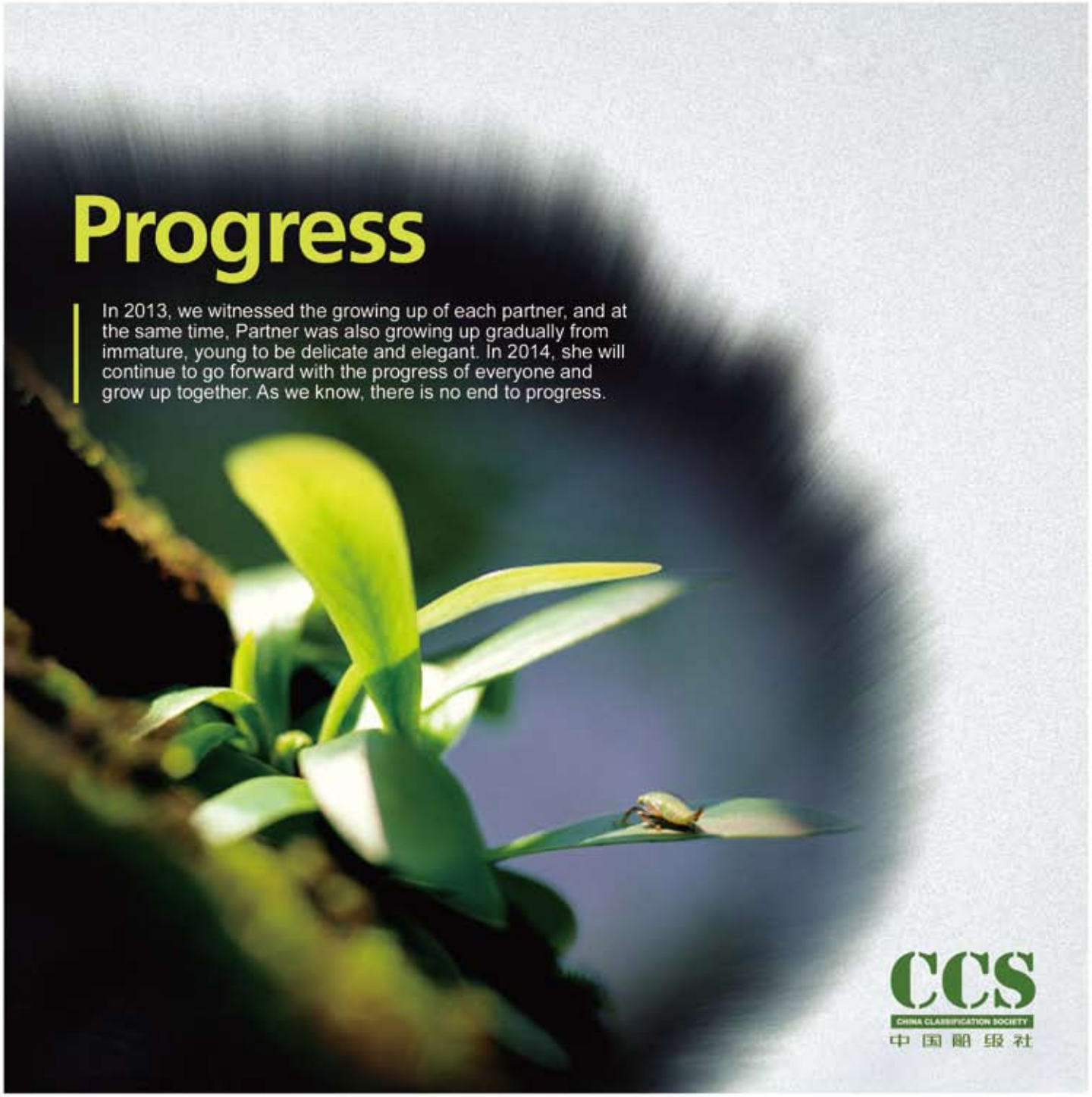
2014.2 / The 7th issue in total

Progress

In 2013, we witnessed the growing up of each partner, and at the same time, Partner was also growing up gradually from immature, young to be delicate and elegant. In 2014, she will continue to go forward with the progress of everyone and grow up together. As we know, there is no end to progress.



CCS
CHINA CLASSIFICATION SOCIETY
中国船级社

Partnership

The first issue in 2014
(The 7th issue in total)

Sponsored by CCS

Co-organized by China Ship Survey

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Internal Publications

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CCS President Sun Licheng Was Awarded 2013 "Top Ten Influential People of Chinese Shipping Industry"

On December 21, 2013, the much noted awarding ceremony of 2013 "top ten influential people of Chinese shipping industry" was held in the International Conference Center, Beijing. China Classification Society (CCS) President Sun Licheng was awarded as the 2013 "top ten influential people of Chinese shipping industry". Mr. Qian Yongchang, the President of China Transportation Association presented the trophy and honor certificate to Sun Licheng. This event is sponsored by the China Shipping Gazette. At the same time, the Vice Minister of MOT He Jianzhong, the Chairman of Chinese Ocean Shipping (Group) Corporation Ma Zehua, the President of Shanghai Maritime University Huang Youfang, the President of Traffic Department of Transportation Water Science Research Institute Zhang Baochen, the Vice President of China Merchants Group Limited Su Xingang, the President of Sinotrans Limited Zhang Jianwei, the Chairman of Lianyungang Port Holdings Ltd Bai Liqun, the President of ICBC Financial Leasing Co., Ltd. Cong Lin and the China Salvage Team are all in the list.

The Second Strategic Cooperation Agreement Was Signed Between CCS and ICBC Financial Leasing Co., Ltd.

On January 8, 2014, the second strategic cooperation agreement was signed between China Classification Society (CCS) and ICBC Financial Leasing Co., Ltd. in CCS Beijing headquarters. CCS Vice President Sun Feng and Vice President of ICBC Financial leasing Co., Ltd. signed the agreement on behalf of each party. In view of the strategic cooperative relationship established between the two sides in 2008, the move indicates that the two sides will continue to deepen the all-round long-term

strategic cooperative relationship based on the original cooperation.

As the pilot project of the State Council and the first financial releasing cooperation which was approved by the CBRC and established by commercial bank, the ICBC Financial Leasing Co., Ltd. has always been committed to the development of shipping finance, and is one of the most influential shipping and offshore leasing institutions in China, playing an important role in supporting development of Chinese shipbuilding and shipping industry. CCS appreciates the significant role of ICBC Financial Releasing Co., Ltd. in supporting the development of Chinese shipping and shipbuilding industry.

CCS and ICBC Financial Leasing Co., Ltd. has broad cooperation basis in ship leasing, risk prevention, ship technology exchange and customer information sharing. The cooperation will have positive influence on shipbuilding, shipping, financial service and related industries in China. Both of the two sides believe that the establishment and maintenance of long-term and stable strategic cooperative relationship and the construction of smooth and good platform for information and business exchange and cooperation will be important for the development of both sides' business.

CCS Signed a Strategic Cooperation Agreement with Shanghai BESTWAY

Recently, China Classification Society (CCS) and Shanghai Bestway Marine Engineering Design Co., Ltd. (BESTWAY) signed a "strategic cooperation agreement" in Shanghai. Chen Shi, deputy chief engineer & director of plan approval center of CCS, and Liu Nan, chairman and general manager of BESTWAY signed the agreement on behalf of both sides, which indicates that both sides will establish a comprehensive, multidisciplinary and long-term strategic cooperative relationship.

CCS and BESTWAY have cooperated well over the years, jointly making obvious contribution to the development of China's shipping, shipbuilding and the related industries. Based on the common understanding of the development trend of the international and domestic shipbuilding and offshore engineering industries and other related industries, both sides will establish a close strategic cooperation relationship in terms of ship type (including offshore engineering) development and optimization, technical standards, joint research, design and plan approval, technical communication and information sharing, talent training, enterprise culture construction and other fields for the purpose of mutual promotion and common development.

Shanghai Bestway Marine Engineering Design Co., Ltd. is a first-class domestic professional enterprise providing comprehensive technical service in terms of civil ships and offshore engineering, which was listed on the Shenzhen stock exchange in 2009. The business scope covers ship and offshore engineering R&D and design, engineering consultation and supervision, engineering general contracting, yacht manufacturing and operations, etc. BESTWAY is a national high-tech enterprise, which is furnished with the certificate of CCS "Design Qualification for Vessels and Offshore Installation", and has established QHSE (quality, health, safety and environment) management system. The main products include the development and design of civil transport ship, cruise ship, special vessel, hydraulic work ship and offshore engineering ship.

CCS Held the First Technical Training on New International Conventions, Rules and Standards for Shipbuilding

On December 30, 2013, the first technical training and the opening meeting for training on new international conventions, rules and standards for shipbuilding, which was jointly organized by the Ministry of Industry and Information Technology of PRC, Ministry of Transport, National Development and Reform Commission, was held in CCS. The meeting was presided over by Zhu Kai, Vice President and Chief Engineer of CCS. Li Dong, the Deputy Director of the Equipment Department of MIIT, Wang Hongwei, the Division Chief of MOT International Division and other related people attended the meeting and delivered important speech on the purpose and the overall arrangement of the technical training.

The meeting is to implement the requirement of the "notice of the State Council of issuing the implementation plan (2013-2015) of speeding up structural adjustment and promoting transformation and upgrading of shipbuilding industry". Led by the Ministry of Industry and Information Technology of PRC, MOT, National Development and Reform Commission, and sponsored by CCS and CANSI, the meeting is aimed at helping shipbuilding enterprises understand deeply the new conventions, rules and standards which will exert great influence on shipbuilding industry, understand accurately the relevant requirements, grasp quickly the technology and methods to comply with the requirements, so as to improve the level of ship design and manufacture, and enhance the international competitiveness of products.

The meeting was held via CCS video system. The main meeting venue is in Beijing headquarters and there are 30 sessions in CCS branches located in major provinces and cities. 663 people in total from the enterprises constructing ships of international navigation, design units, scientific research institutions, related marine equipment manufacturing enterprises, international shipping enterprises, relevant government departments and other units participated in the video training conference.

Li Zhiyuan, Deputy Director of CCS Technical and Management Department and Yang Zhongmin, Director of CCS Shanghai Rules & Research Institute gave lectures on 18 hot issues on safety and environmental protection including the trend of international maritime legislation, GBS, HCSR, ship energy efficiency, NOx/SOx emission, Hongkong Convention and etc.

The meeting raised the level of understanding of the participants of the overall trend and key requirements of new international conventions, rules and standards for shipbuilding, and promoted the accurate understanding and effective implementation of the main points of legislation by the industry. The conference was fruitful and successful.

According to the plan, five concentrated training in five sections and one video training will be held in China in 2014 and 2015. Details of relevant documents and references can be found in "transformation and upgrading of shipbuilding industry" newly opened at CCS official website (www.ccs.org.cn).

New Fashion of Domestic Yacht Classification

By Li Xiaochuan

On October 11, 2013, at the opening ceremony of Hainan cruise and yacht industry development summit, China Classification Society (CCS) issued the first batch of classification certificates and classification medals to the owners of domestic luxury yachts including "WANDA 3", "FENG" and "HUA RI". The classification of the first batch of domestic luxury yachts shows that the development of yacht industry opens up a new journey.

As the technical standard developer in China, CCS has conducted a lot of fruitful exploration and practices in recent years. As early as in 2003, CCS started research project on the technical standard of yacht. After years of research for domestic yacht manufacturers, as well as the collection and research on international yacht standards, rules and service experience, CCS developed and issued Rules for Construction of Yachst, 2008, filling the blank of domestic yacht construction. The rules highlight the characteristics of non commercial purpose, adopts the yacht rules unifying sea and river, distinguishing between the yacht design categories based on limiting conditions in operating waters, regulates the yacht structural design and stability criterion standard according to the design categories respectively, and at the same time considers the technical requirements for multiple hull material and power fuel of yachts, adopting the type survey mode, in compliance with the actual situation of batch manufacturing of ordinary yachts.

In 2012, in order to meet the rapid development demand of the yacht industry, and at the same time coordinate with the Technical Regulations for Statutory Survey of Yachts, 2013 which will be issued by Maritime Safety Administration, CCS timely developed and issued Rules for Classification and Construction of Yachts and Guidelines of Survey of Sail Yachts, 2012, laying the foundation for developing yacht classification work in later period. New rules and guidelines made division of yachts based on the limits of 24m, adjusted design categories combined with the research results home and abroad, and introduced the corresponding classification regulations; In addition, in view that the sail yacht has many characteristics such as ballast keel, sail and rigging, on the basis of Rules for Classification and Construction of Yachts, 2012 and combining research results home and abroad and international standards, CCS developed Guidelines of Survey of Sail Yachts, 2012, which makes CCS yacht rules more perfect.

In terms of survey service products, CCS has accumulated rich experience in research and development of rules and standard, plan approval, initial survey, factory evaluation, type approval, etc., and service products have become increasingly mature, becoming the leader in the yacht survey industry. CCS began to accept the yacht survey business in 2010, escorting the rapid development of domestic yacht industry. At present, CCS has completed survey and certification service for about 200 yachts distributed in 11 provinces and cities including Hainan, Fujian, Dalian, Shanghai, Guangdong etc., and conducted factory evaluation for 27 yacht manufacturers in Guangdong, Fujian, Zhejiang, Shanghai and other places.

After recent years' gradual maturing of the yacht survey business, CCS established guiding ideology for the future yacht survey businesses --- comprehensively and positively promote the yacht survey business, encourage medium-end and high-end yacht to be classed. For this, CCS has carried out a series of work to introduce classification service measures for the medium and high-end yachts. CCS intends to cooperate with some of domestic yacht factories, conducted classification service for luxury yacht manufactured by yacht factory with advanced production technology, and at the same time intended to accept classification applications for some imported branded yachts, so as to improve the added value of the yachts; Carry out researches on classed yachts in terms of luxury, comfort, maneuverability, safety, environmental protection and other aspects, and plans to introduce European Union directive requirements on the yacht's engine service life, noise level, automation and others, and incorporates the comfortable and luxury performance required for medium and high-end yachts into CCS classification rules as soon as possible; Establish a professional yacht survey service team, in order to provide the medium and high-end yachts with the more sophisticated and professional survey service; Plan to launch newbuildings survey services for overseas yacht, supplemented by the plan approval, training and other supporting survey service. In addition, CCS will continue to follow up the development of yacht industry, and carry out further study and research on the detailed content of the standards related to safety, green environmental protection and comfort, put forward a scientific and feasible definition and quantitative standard, add the corresponding class notations, revise classification rules to promote the yacht classification work.

The Security Strategy of Arctic Northeast Passage

By Zhong Chenkang

The Arctic Northeast Passage (NEP) generally refers to a route set which starts from the northwest of Europe near the north point of Norway, passes through the northern coast of Eurasia and Siberia, runs across the Bering Strait and reaches the Pacific Ocean. Due to the concept that the NEP always exists only in one area without a fixed route, now there are many unknown security risks. From August to September 2013, the author was on board the COSCO M/V"YONG SHENG" engaged on its maiden voyage to NEP. In connection with my experience, this paper contains my personal views on a series of issues regarding operations during navigation in ice that the industry is concerned about.

Identify an Iceberg with "Two Hands"

The experience of M/V"YONG SHENG" tells us that there is no absolutely accurate method to identify whether a ship is navigating close to an iceberg and the entire reliance on the radar will give rise to certain danger. It is only reliable when you actually see the iceberg.

For the visibility of an iceberg, although the iceberg is large, it is difficult to distinguish in a specific environment. In the fog, if there is sunshine, the iceberg will show itself as a bright and white object, but if there is no sunshine, it resembles a black object which is approaching the ship. On a clear night without moon, the iceberg can be seen within one to two nautical miles, showing itself as a black or white object. But the ship may encounter ice islands, and often finds ice reef near the iceberg. On a clear night, watching carefully is needed and even if the radar does not sound any alarm, the speed should be reduced without hesitation at the sight of the iceberg. In the moonlight, if the moon is behind the observer, the iceberg is easier to see. On a cloudy night with intermittent moonlight, it is more difficult to see iceberg, and we should keep watching. On a dark night with cloudy weather, an iceberg miscalculation can be produced.

Taking the experience of M/V"YONG SHENG" as an example, the author sums up some possible signals to recognize the iceberg. If the iceberg splits, or ice breaks, and falls into the sea, it will produce great roar, sounding like opening fire in the distance. If ice reef or small pieces of ice is discovered, it is the sign that an iceberg exists near by and possibly in the upwind. In this way, in case of limited visibility, the iceberg can be detected. Sailing slowly on a quiet night, if the iceberg is nearby, the snap

can be heard and we should keep listening.

Comparatively, there are some unreliable signals of identifying iceberg during the arctic voyage. The change of air temperature or ocean temperature does not mean there is an iceberg nearby. Sonar can be used to confirm the iceberg location, but because of the distribution of water temperature and salinity, especially near the boundary of the flow, excessive refraction may be produced which will stop the sonar signal from reaching ship or iceberg, so it is not reliable.

Items of Attention regarding Ship Freezing Protection

For polar ships, ship freezing protection is very important. Of which, there are 21 ship freezing protection points that are particularly worthy of attention.

1. Draft, trim and stability conform to the ice class;

2. Ensure that all the heating and air bubble systems are in normal operation;

3. Check the state of fuel, particularly the quantity of diesel and gasoline, consider increasing the maneuverability and low temperature additives;

4. Ensure the rudder and rudder angle indicator is consistent;

5. Run all the radars, and the function of scanner heating device is normal;

6. All the searchlights are available, and provided with spare bulbs;

7. Ensure that the function of main and standby out of control lights is normal;

8. The function of bridge windows heating and window wiper heating system is perfectly normal;

9. Prevent anchoring equipment and ropes freezing;

10. Test the normal operation of any superstructure heating equipment;

11. Drain the liquid in the exposure parts of the fire main pipe and deck pipes;

12. Ensure that all the deck machinery is protected by low temperature oil and antifreeze agent;

13. Ensure that all the life-saving equipment is available in frozen state, the fuel oil tank of lifeboat engine is protected against freezing and heated by water tank;

14. All the crew members are provided with cold-proof and life-saving equipment. Consider the additional requirements for abandoning ship on pack ice, and melting ice salt and slip resistance sand should be prepared;

15. Ensure the wood mallet or maul, snow shovel are effective and available to deice;

16. Ensure all the rigging is installed correctly, in order to withstand the vibration due to impact of ice;

17. Ensure low level water suction is available, check the heating/compressed air purging system and sea water recirculation system;

18. Ensure oil tank heating system is normal;

19. Ensure all heating systems of the main/auxiliary machinery/steering gear/thruster/CPP machinery spaces are completely normal;

20. Ensure the condition of cathode protection and impressed current is suitable for operation in ice;

21. In port, don't stop the hydraulic pump of controllable pitch propeller.

Navigation Operation Skills

Ice is an obstacle to all ships, even for the icebreaker. The well-equipped ship is able to be successfully operated in ice covered area, and the first principle of passing through the ice zone successfully is to keep free maneuverability. Once the ship is limited, it would move along with ice. Ice operation requires a lot of patience, which is a fatigue operation no matter with or without ice-breaker escorting ships. In a difficult area with unclear situation, it is often the safest and fastest way to take a long detour in ice-free area. The author thinks that when sailing on the ice,

considered. If the speed is too slow, there is the risk of being trapped; if it is too fast, there is the risk of damage. Ice density is variable, a vessel sails from the pack ice, through the open area or open waters of drift ice, returns to the pack ice. When entering into a more open area, the engine should slow down. If it is to be maintained, the ship will speed up as it does in open waters, so that the speed is too fast to safely enter into the pack ice area. Navigation in ice must be careful including strengthening watching, use of the searchlight and continuous radar observation.

the following golden rule must be followed: keep moving, even if it is slow; sail down ice rather than sail against ice; Ice damage is caused by over speed; Always try to have a correct point to touch floating ice; ensure the helm before back off; Avoid anchoring in mobile pack ice zone.

It is worth mentioning that before the ship tries to pass through the ice, the master must determine the ice type, thickness, hardness, size and density of floating ice, which can be determined by visual inspection. In addition, before the ship enters the ice, the following factors should also be considered, the first is the recent report of detailed ice density and type. This includes the time per year, climate and temperature; Followed by operating areas, which includes the availability of ice operation mode in all equipment and machinery space; Icebreaker availability; The availability of any air support; The availability of mutual support/advice of other vessels in the area; The ice class in relation of ice type; The condition of the hull, machinery and equipment, and access to fuel and material quantity; Draft, relevant ice belt, the immersion depth of propeller and rudder blade, as well as the experience of the bridge with regard to operation in ice.

In addition, ice speed is also a key point during navigation in ice. Ice impact force depends on the tonnage and speed of the ship, which is a quadratic of speed. The ice speed needs to be carefully

Communication Equipment is the Key Point

Because this is the first time for "YONG SHENG" to navigate into A4 sea area and the arctic high latitude area, in view of the fact that it is likely to reach north latitude 80 °, which is the northernmost of Severnaya Zemlya of Kara Sea, a lot of communication and navigational equipment suitable for sea voyage at high latitude and communication is provided additionally. Why does the arctic navigation area have such a high requirement for communications equipment? As you can see from the feedback of M/V YONG SHENG" using communication and navigational equipment at high latitude, once the ship navigates in the sea area at high latitude, communication equipment is certain to have some limitations.

First of all, M/V "YONG SHENG"'s maritime satellite communication equipment can work normally in the waters south of northern latitude 77°. According to the records, maritime satellite communication equipment can normally communicate in the waters with a latitude less than north 77°. For areas higher than 77° north latitude, occurs the abnormal situation.

Secondly, M/V "YONG SHENG"'s newly installed gyrocompass which is verified by the deviation of high latitude worked basically normally in the waters south of north latitude 75.5°, the deviation is -1 ° compared with GPS gyrocompass. The

deviation is within the range of 2°—5° between north latitudes 75.5°—77.9° (the highest latitude of this voyage).

At last, the magnetic compass deviation is relatively higher. This time M/V "YONG SHENG" started from the Bering Strait and entered into the arctic, that is, from south to north, from low latitude to high latitude, and the magnetic compass was essentially normal near the northern latitude 73°. But when ship sailed from north to south, from high latitude to low latitude, magnetic compass has not been restored to normal condition when the ship reached north latitude 69°, and the deviation is still relatively higher.

In addition, because the ship sails at high latitudes, which are closer to the poles, meridian line and horizon line lose positioning reference function. As fog and low clouds are common, white-out occurs at any time. In view of the potential danger which affects ship communication and brings great impact on the ship safety, M/V "YONG SHENG" is specially equipped with the following communication and navigational equipment which can satisfy the navigation requirements at high latitude area, including DSC NBDP, suitable for A4 sea area; Iridium phone, used for area communication more than north latitude 75 °; GPS compass, used for compass deviation calibration more than north latitude 70 °; High frequency of 122.5 MHz used in the arctic waters to contact with planes and helicopter; Gyrocompass ANSCHUTZ, a German brand, type DIGITAL GYRO STD22, which is verified by the deviation of high latitude.

Key Point of Operating of Icebreaker Escort

When ships sail in the polar, it is unavoidable for the icebreaker to escort fleet. Therefore what should the ice breaker do, in order to better help fleet pass through the ice region? The author summarizes several key points for the industry reference.

For the icebreaker, the first thing is to control. The master of icebreaker has superb skills and experience in professional field such as navigation in ice, icebreaking and escort in ice. Therefore, the master of icebreaker directly conducts any escort operation in ice. Icebreaker uses aerial reconnaissance to find channel and open waters. Some ship borne helicopters can guide the ships to pass through the ice region along the best route through direct communication. The escorted ships must follow the route opened by icebreaker, not to venture into ice region; Ensure that the towing device is available at any time; Ensure that the officer who completely understands signals of icebreakers (International Code of Signals) is available on bridge; Once the ice is confirmed, immediately implement the signal sent from the icebreaker; After applying for the icebreaker assistance, the vessel must keep a continuous radio watch.

Secondly, icebreakers should also pay attention to some of the details in open channels. When one icebreaker passes through severe ice area to open a channel with slow speed, the channel width generated is 30%~ 40% of the breadth of icebreaker. If icebreaker's high-speed wake is able to break the ice, the width of channel will be three times its breadth. Crushed ice and small ice floe left in the channel could significantly decrease the speed of ship following icebreaker, or block the passage. On the contrary, for the ordinary ships, if there is bulge old ice in the channel which the ship can not avoid, the ice-breaker shall be required to broaden the channel.

In the end, both icebreakers and fleet should pay attention to the distance between the ships. If the ships under escort cannot keep their distance, the icebreaker should be immediately notified. When the drift ice density is less than 7/10, it is easy for ship to maintain the position relative to the icebreaker. In terms of the density of pack ice more than 10/10, the channel behind icebreaker is quickly closed, and close distance to escort is required. If there is ice pressure, the distance must be adjusted to a few meters, because the channel will quickly be covered by ice.

In order to force open the passage of pack ice, icebreaker needs to increase the speed to strike ice. The following vessel must maintain a careful watch on distance, trying to enter before channel is closed.

Technical Characteristics of Construction of Dual Fuel Powered Ship

By Yu Jianwu, Zhang Yunbin, Xiao Jinhe, Chen Zhengqing

LNG used as the marine fuel is originated from northern Europe at the earliest, its main purpose is to deal with increasingly stringent emission requirements in the emission control area (ECA). According to the statistical information from DNV, by 2013, the Nordic has 38 LNG-fueled ships in operation and in construction, and another 2 ships which will be converted to LNG fuel power. Some developed countries such as America and Japan are speeding up to enter this field. In 2010, China began to pilot LNG application on waters, and at present it is appearing a relatively strong development trend. In June 2013, the first new-building LNG-diesel duel fuel powered ship- "Hai Chuan 3" with 3100 dwt, which was surveyed by CCS was successfully completed and was delivered to owner after being awarded CCS certificate. It marks the gradual establishment and improvement of related rules and regulations for duel fuel power ships in China, LNG application on waters is moving from exploring toward developing legislations.

Currently, as clean energy, the application research of LNG used on inland river ships is developing quickly. In terms of safety features, LNG has the features of low temperature destruction, rapid volatility and explosion risk. Therefore, LNG fueled ships would be different from common ships in structural layout, model selection and installation of electrical and mechanical equipment.

Tank and machinery spaces

LNG-powered ship has strict requirements for division of various safety distance and dangerous spaces, reasonable arrangement of tank spaces is very important. For inland river ships, due to small scantlings and limited spaces, it is more difficult for them to arrange tank spaces.

The distance between gas tank and the hull stern and gunwale. The air tank of the ship is installed on the open areas of the main deck tail, and the safety distance between storage tanks (storage tank groups), and between all gas pipelines and ship board should be no less than 760mm.

The horizontal distance between the tank pressure release mouth and the fan outlet of engine room and outlet of main auxiliary exhaust valve. The main auxiliary engine uses tail exhaust, and the exhaust pipe outlet is horizontally laid out in the stern plate. The fan outlet of engine room is arranged vertically upwards from engine room. Based on the analysis of on-site inspection, this arrangement mode which is commonly seen in inland river bulk carriers has brought great difficulties to the arrangement of the outlet of the tank pressure relief valve. As part of the tank, the tank pressure relief valve exhaust outlet should be arranged according to the minimum safety distance between hull stern and gunwale.

The requirements for distance between accommodation spaces, service premises, the machinery spaces and entrances of control stations, air entry and other open mouths. In addition, all open mouths setting should not face the position where storage tank or filling contact locates, and meet the requirement for safety distance.

The special requirements for steering engine hatch and ventilation window within the 4.5m hazardous tank area. As the ship main deck space is limited, the steering engine hatch and the ventilation windows are arranged within the 4.5m dangerous tank region.

Particular consideration should be giving to the stern mooring and mooring equipment. Since non explosion proof equipment and equipment easy to spark are not allowed to be arranged in the hazardous area of main deck aft, it was cancelled after consultation with various parties.

In addition, more attention should be paid to the fire separation in tank zone and installation of drain tray.

And then it is the type and arrangement in machinery space. The engine room of this ship uses the type of enhanced security machinery space. Compared with the engine room arrangement of conventional bulk carriers, apart from the main and auxiliary engine using dual fuel engine (ECU), the ship has independent big volume ventilation system and independent fuel gas detection system. In addition, the draught fan, the lighting device, detection device, alarm device and other electrical facilities in the engine room should be explosion-proof according to the requirements of relevant guidelines.

Arrangement and installation of gas pipes in machinery spaces. Gas pipes should directly enter into the engine room from the main deck, and is not allowed to pass through any living, service spaces or control stations. The gas pipeline in the engine room should be connected by full welding; on the gas pipeline of each engine nacelle, valves, flanges and pressure gauges and other equipment should be installed in their valve box beside the engine room.

Selection of the model of engine room air suction. The 2 sets of double fuel engines of the ship uses supercharger turbocharger air intake, and the supercharger is no-spark type; the 2 original motivation generating units use natural suction inlet. During on-site inspection, attention should be given to check the installation of the related accessories of the engine.

Classification of hazardous areas

Classification of hazardous areas shall strictly meet the relevant requirements of the "Guidance for Inspection of LNG Powered Ships", particular attention shall be paid to the fact that the engine room of this ship is machinery spaces of enhanced safety type, it should be regarded as a non hazardous area under normal circumstances, however, when there is gas leak, it should be regarded as 1 category area.

According to the risk of LNG, the requirements for explosion-proof category of electrical equipment and temperature group in the dangerous zones of the ship shall be IIA, T2 and above. In particular, the electrical equipment located in cabin top should use explosion-proof electrical equipment.

Test of mooring and navigation system

The main auxiliary engine of this ship is diesel -LNG dual fuel engine, to avoid fire and explosion risks brought about by mechanical processing in follow-up construction and fire operation, mooring and sea trials should be carried out separately. The mooring trial in pure diesel model should be firstly carried out, and after the successful pure diesel test, and under the condition that all fire projects have been completed, LNG gas can be installed to carry out dual fuel mooring test.

Summing up, we propose the following suggestions with regard to the ship construction and conversion.

The first is about the general layout and the selection of cabin type. The main scale of inland river ship is generally small, and the space is limited. Judging from this ship, it is very difficult to satisfy the partition of dangerous zones and to meet the requirement for distance and open mouth.

The second is about position, distance and open mouth. The requirements for relevant position, distance and open mouth aforementioned in the paper is very high for inland river ships with small deck area and narrow engine room. Attention shall be paid to the rationality of design.

The third is about the selection of equipment. Since it is still in the beginning for LNG used as ship fuel, the approval and inspection of LNG marine products is not yet systematic. Therefore, in the process of selecting equipment, we should make full preparations to the certification situation of products and equipment, and require equipment manufacturers to apply to CCS for accreditation and inspection of products.

The fourth is about site coordination of ship construction and inspection. Judging from the construction of the ship, site coordination should get full attention during the construction and conversion of LNG-powered ships, which includes mainly the coordination between shipyard and subcontractor, and the coordination between shipyard and design units and product manufacturers.

The Trend of International Maritime Safety Legislation

With future ships developing toward those of larger-scale and higher technology, the legislation mode of IMO for future shipping safety is also changing quietly. The new trends such as new technology, alternative energy, and call for the legislation to become increasingly systematic, scientific, forward-looking and transparent are driving the maritime industry to change the currently mandatory legislation pattern, and make future safety legislation to keep up with the time pace to become science, risk and goal based. Nowadays, what are the new problems the maritime safety filed is focusing in the transition process? And what new changes will be brought by the new rules to the shipping enterprises who are the actual operators? The magazine in this issue has summarized the top ten hot issues of international maritime legislation in shipping safety based on related information and is introducing them one by one to readers.

High criteria and multiple approaches

The appearance of "new criteria" of SLA GBS indicates that the maritime safety is gradually moving toward a new trend of thought, i.e. the introduction of risk analysis method as the basic methodology for the development of international conventions and classification rules in the future. Compared with the prescriptive requirements for ship safety in many international conventions, these "new criteria" is gradually replacing the prescriptive text.

All these new criteria and methodology will ultimately lead to the diversity of solutions to conform to rules and standards and release to a certain extent the innovation capability of designers. They will also bring difficulties to solution criteria and verification. Therefore, it will be a challenge to designers and judgers in terms of their technical capability.

Noise reduction ensures safety

The SOLAS Convention II-1 3-12 amendment (MSC.338 (91)) adopted by IMO MSC91 will make the implementation of the “Rules for Onboard Noise Level” mandatory for new buildings above 1600 GT contracted after July 1, 2014, or with keels laid down on and after

January 1, 2015, or delivered on and after July 1 2018.

The mandatory rule on the one hand is leading to cooperative development of noise friendly ship type, on the other hand it means that the industry will be faced with the challenge of increasing shipbuilding cost and difficulty of ship delivery. We not only need to remind the shipowners and shipyards to consider the influence of the rule and pay more attention to the mandatory and non mandatory part of the rule when singing contracts, we should also suggest that ship design and construction units carry out related research to provide technical support to deal with the new rule.

Mandatory rules for polar ships

With the changing climate, the exploration of Arctic resources and Arctic shipping has become hot spots. Due to the extraordinary polar water environment, and existing IMO documents are not enough to cover the special risks of polar shipping, and IMO began to establish mandatory safety rules for polar ships from 2009.

Due to wide coverage and relatively complex technical problems, various international parties have widely different opinions, therefore, the development of mandatory safety rules for polar ships will be divided into two stages: the first stage will be applicable to passenger and cargo ships of SOLAS, which is expected to be completed in 2014 and be implemented in the first place; the second stage will target non-SOLAS ships including fishing ships and is scheduled to be completed in 2016. The mandatory polar rules in the future will consist of three parts i.e. general, safety and environmental protection.

The new polar regulation will have greater impacts on existing shipping mode. For China, selection of seasonal operations, for example, in summer and autumn, will make ice class requirement for ships and construction cost more economic and feasible. So, it is worth considering from the market angle for shipbuilding enterprises to choose to design and construct ships of CCS B1 or B1* ice class.

The guidance for tank and tightness bulkhead testing procedure

According to article II-1/11 of SOLAS, all double bottom spaces, the inner shell, fore peak tank and tank of each ship should be subject to hydrostatic test. In order to reflect the existing shipbuilding technology, improve shipbuilding efficiency and save resources, and at the same time maintain the criteria of control for construction quality, together with some nations, IACS put forward proposals to modify this article in order to include the above as equivalence of the existing requirements. Whether the proposal will be adopted will be decided by the discussion in IMO in 2014.

It is necessary to note that at present the “Guidelines for Effectiveness of Watertight Hold Test” submitted by IACS is a relaxation to SOLAS requirements. Notwithstandingly, according to the current situation, if the new scheme is implemented, the quality control in shipyards may face special audit from flag states and /RO. Therefore, there are two possible options in front of the shipyards: strictly implement the existing SOLAS requirements for hold test, or implement the new guideline for watertight hold test but accept the special audit from flag states /RO for quality control.

International safety rules for gas, low flash point liquid fuel powered ships

Influenced by multiple factors such as the global energy crisis, the new requirements for EEDI, NOx, SOx/PM, and driven by the

current advantage of gas fuel price and gas fuel technology becoming more mature, IMO is stepping up to develop the international safety rules for gas, low flash point liquid fuel powered ship (IGF rules). The drafting of the rules is basically completed, and will be submitted to MEPC and MSC in 2014 for approval. It is expected to enter into force on July 1, 2016. IGF rules has clear specifications on equipment safety, manufacturing, techniques and testing, training and operational requirements, fuel filling and other operations.

In consideration of the rules involving a lot of new technology, new equipment (such as gas fuel engine), new method (such as risk assessment method), the industry need to speed up to research fuel equipment, gas powered ship design, effectively take part in the formulation and discussion of the IGF rules. Shipowners are proposed to construct LNG powered ship and bunkering ship.

The safety of passenger ships

On January 13, 2012, after the accident of COSTA CONCORDIA, IMO MSC issued MSC.1/Circ.1446 circulars and revised edition, and encouraged shipowners to perform temporary measures on enhancing passenger ship safety, including passenger weight fixed, the navigation bridge sailing program coordination etc, and also aimed to actively guide the owners to improve passenger ship safety criterion.

At present, the studies on safety of passenger ship engaged by IMO are as follows: the newshipbuildings will provide double hull protection for watertight compartments with installation of important propulsion and electrical equipment; research the problem on enhancing survival ability after passenger cabin broken, which advanced by EU, namely enhance the subdivision index R; and so on. These measures above will have a greater impact on the requirements of structure, equipment and safety management for international passenger ships.

The safety of container ships

The accident of "MSC Napoli" led by the front buckling result in structural failure in 2007 and the "MOL Comfort" due to the fracture of the ship middle region set people thinking. The two accidents shocked the whole container shipping industry, and triggered the industry wide concerns to the safety of container ships especially the large-scaled container ships.

At the end of 2013, IACS decided to take positive action to strengthen the security of container ship, including review to the standards of design, construction and inspection of existing hull structure, and began to establish IACS unified requirements for super Panama container ship. The requirement will cover two important areas including the evaluation of hull girder strength and loading condition. The industry in China was proposed to continually track the progress of IACS related work and develop research on the key and advanced technology aiming at super Panama container ship including the hull girder strength, loading condition, welding material etc.

The second generation intact stability criteria

On December 4, 2008, IMO approved the "2008 intact stability rule". As the first generation rule, the rule is the standard which is applicable to all types of ships after summing up the experience and lessons of many marine accidents. The first generation of intact stability rule, which is based on prescription rules on ship operation statistics and weather criteria formulation collected in the mid twentieth Century, not only can not reflect the complexity of modern environmental condition, but also not reflect the new achievement of

modern water dynamics. As the result, IMO together with academic circles began to improve existing intact stability criteria system to solve the problem of stability accurate assessment for large-sized ship in complex condition, forming the second generation of intact stability criteria.

The formulation and implementation of the second generation of the intact stability criteria in the future will have a significant impact on ship design, which will need to provide digital simulation and direct evaluation method. At the same time of providing better help for ship design and operational control, it will put forward higher requirements for ship design, and increase technology threshold for ship type development and design cost.

The safety of surveyors

In June 2011, IACS approved and promulgated the "IACS professional safety and health provisions", at the same time announced a unified security policy and standards of IACS to the industry. Now IACS is formulating the relevant requirements which are as follows: firstly, the procedural requirements on entering the restricted premises (PR 37) has been come into force on June 30, 2013, which has provided provisions for the training, entering program and corresponding equipment etc; Secondly, transshipment of person and ships has entered into the final deliberation stage; Thirdly, other requirements are under formulation such as high-place operation, extreme temperature, test for pressure system, drug evaluation / health etc.

The surveyor safety standard issued by IACS is not only benefitial to safety of surveyors, but also to operation safety of shipyards. The standard will promote shipyards to upgrade safety standard and will make it conform with current international standard continuously, which includes relevant adapting requirements for safety person in shipyards. It is necessary to pay more attention that production schedule would be affected if shipyard can not fall short of the conditions. Moreover, it would lead to refuse inspection and general information in IACS if anyone membership classification society of IACS considered the safety standard is not enough, and the others membership would also take united actions. So, we need to advise shipyards especially the medium and small-sized shipyards to seriously treat on and practically do well safety work.

The evaluation of lifeboat hook

To prevent frequent lifeboat accidents caused by lifeboat hook design defects, in May 2011, IMO approved the Amendment to SOLAS convention and lifesaving equipment rules (MSC.317(89), MSC.320 (89)) and system evaluation and replace the guidelines on lifeboat release and recovery (MSC.1/Circ.1392).

The new evaluation of new lifeboat hook is safer in its technical requirements. One of the most important thing is the "lock" function of boat hook, which means that the control components of boat hook under loading condition should not become one of the load bearing members. In other words, the boat hook should not open automatically if dismantled control components of boat hook under loading conditions. The requirement is available to new boat hook and retroactive application to existing boat hook.

Proposals to the industry:

1. Boat hook for newshipbuildings

The lifeboat hook for international navigational ships built on and after July 1, 2014 should comply with the new requirements (recommend that shipowners choose the lifeboat meeting the new requirements from now on, to avoid evaluation and modification / replacement after the convention entering into force).

2. Traceability of boat hook for existing ships

The on load release lifeboat hook for international ships built before July 1, 2014 should comply with the relevant traceability requirements during the first docking after July 1, 2014 but not later than July 1, 2019;

It is suggested shipowners verify lifeboat of existing ships according to the assessment result published by IMO, and contact manufacturing factory to take modification or replacement measures as soon as possible in case of noncompliance.

How Does Risk Control Suit the Remedy to the Case?

By Li Mingliang

All projects have risks, and thus how to avoid and reduce risks is very important. Risk analysis technology is one of the most widely used technologies to guarantee the safety of projects. Firstly the types of risks are defined, and then corresponding measures are taken to suit the remedy to the case, in order to finally minimize the risks. Only by strengthening the consciousness of risk control, conducting scientific management and control, and establishing corresponding rules and regulations can the occurrence of risk be effectively avoided or reduced.

The rules developed by CCS or the regulations which CCS helps government to develop, is a set of measures for the reduction of risks. Risk control measures can be generally divided into seven categories according to its property, including risk prevention measures, or the measures of reducing the occurrence probability of risk, the measures of reducing risk consequence, the measures of increasing the credibility, hardware measures, software measures, internal cause measures, and external cause measures. After classifying the risks and risk control measures, the control measure for each risk can be identified one by one in accordance with the category of risk control measures. The fire risk is taken as an example below to demonstrate how to select risk measures which can effectively control the fire.

Firstly, the measures of reducing the probability of fire occurrence. The occurrence of fire requires three conditions, namely, the fuel source, ignition source and air source. The rules are to stipulate the detailed measures to control and isolate the three sources. For example, limiting the oil in the enclosed system, limiting open flame operation and inerting of the oil tank is a typical measure to control three sources and effectively reduce the probability of fire occurrence.

Secondly, the measures of reducing fire consequences. In case of fire, fire detection measure is often taken in order to mitigate the consequences; fire extinguishing measures, such as portable fire extinguishers, large fire extinguisher, local and fixed extinguishing systems; structural fire protection measures; escape measures; life-saving and communication measures.

Thirdly, measures of enhancing the credibility. After the "two reduction" measures above are developed, the next step is to conduct reliability analysis of each measure, adopting six measures with high reliability such as redundancy risk control measures, the difference risk control measures, passive risk control measures, the independent risk control measures, mature risk control measures and the failure safety measures.

The "two reduction and one enhancement" measures above are the most fundamental ones to control risk.

Fourthly, the hardware and software measures. The "two reduction and one enhancement" measures above already contain the measures of hardware and software, which are to be sorted out respectively, and particularly great importance is to be attached to the operation, the maintenance procedures, manning and personnel qualifications, emergency response procedures and exercises of the software measure.

Fifthly, measures of internal and external cause. Internal cause refers to the fire risk due to the failure of hardware and software on platform, and the external cause refers to the fire risk due to factors outside of the platform, such as platform fire caused by lightning, collision and kindling carried by the outside personnel. Although more than ninety-nine percent of the platform fire was caused by internal cause, prevention measures of the fire caused by external cause cannot be ignored.

To sum up, risk control measure is to be so selected that "two reduction and one enhancement" measures, hardware and software combination measures as well as measures dealing with both internal and external cause are taken for each risk, in order that the control and management of risk follow a strict technology program. By using this technique, the risk control scheme can be of strong integrity and systematic. At the same time, this technique can also be used to check whether the existing risk control scheme is complete and reasonable.

Maritime Technology Electronic "Library"

By Ma Yuxin

As the international community is increasingly concerned about the maritime safety and marine environment protection, various international and regional maritime laws and technical regulations emerge one after another, which are revised frequently. How to timely understand the development of relevant maritime laws and regulations and to take appropriate measures to cope with the situation among the vast technical files has become a difficult problem that the maritime industry faces. In view of the current status quo that informationization degree of the print and electronic technical data is low, check is inconvenient, data is complex, and the reliability of sources is low, China Classification Society (CCS) has independently researched and developed CCS Expert System, by starting from the characteristics and actual needs of ship survey business, and comprehensively taking into account the requirement of the maritime authorities, shipping companies and shipyards and other relevant industries,.

CCS Expert System intelligently breaks down and classifies the relevant maritime technical standards data which is developed and adopted by IMO, IACS, CCS and the relevant industries, sets reasonable query parameters and friendly human-computer interaction interface. The system not only can be used to provide CCS survey and management personnel with digital, intelligent, and personalized technical support services of survey, in order to strengthen the survey guidance, improve work efficiency and survey quality for the purpose of improving the level of general technical service of CCS; At the same time, it also can be used as an information management and application platform which provides maritime technical query, retrieval service to the external customers such as the maritime authorities, shipping companies, design unit, repair yard, shipyard, and product manufacturers so that it is convenient for the industry to timely, accurately and quickly retrieve and query the latest technical standards information home and abroad.

CCS Expert System includes all sorts of maritime conventions, codes, resolutions, rules, guidelines and other technical documents, has established a complete technical information database, and realized the intelligent retrieval and query of technical data. CCS Expert System has realized the personalization of technology and survey requirements by means of the application of standard code of ship structure and equipment which is independently developed. The system provides the industry with efficient and personalized technical support platform, filled the gap of China's maritime industry.

Technical data module contains the latest technical documents (including the historical revision, technical background,

as well as the latest consolidated texts) issued by CCS, IMO, IACS, the authorizing flag State Administration, the port state control authority and the relevant regional organizations. The core module is equivalent to a professional maritime technology "library", through which the industry can retrieve and query technical data in"one-stop"without leaving home.

Intelligent retrieval module, which carries out retrieval by inputting parameter. In this module, you can find out the technical data that meets the requirements of the parameters within a selected scope. For example, the users can according to their own needs, check the intelligent "real-time"consolidated texts with regard to technical data corresponding to selected certificates, ship type and tonnage for a certain construction time without carrying out artificial query among the vast documents.

Survey project module, this module is the organic combination of ship survey items and the corresponding technical rules, and lists detailed technical requirements and survey instructions related to survey items. It provides a solid technical support platform for the vessel surveyors.

Custom-made reports module, this module is targeted at specific ships, and provides "personalized" survey report for it, and at the same time provides professional guidance for surveyors.

After CCS Expert System is put into use, it won the industry high praise. The characteristics of the system are embodied in the following aspects:

Firstly, friendly interface and easy to use. The software of Expert System is the B/S structure, and meets the user's requirement under the network condition. User interface design using common or similar IE browser can be simply operated and is convenient for users to use.

Secondly, detailed and wide coverage. System currently includes international conventions (such as SOLAS, Load Line Convention, MARPOL, MLC, etc.), international codes (IBC Code, IGC Code, IMSBC Code, etc.), IMO resolutions (IMO Assembly resolution, MSC resolution, MEPC resolution, etc.), the IMO circular; The system also includes all the rules of CCS (including the real-time consolidated text of rules), guidelines, circular, notice, the requirements of the flag state and the port state and other technical documents. The materials in Chinese are comprehensive with official authoritativeness and have a guiding significance for China's industry and even the entire Chinese circle. The System also covers the detailed survey item lists of various ship types. Currently the system includes more than 30,000 technical items, providing the industry with "one stop" query of maritime technical information.

Thirdly, powerful function and personalization. It can "custom-make" suitable technology database for specific ship or fleet. It can generate "real time" consolidated texts of convention corresponding to the time point by inputting keel laying date or construction completion date. The Expert System can provide specific ships with "custom-made" specific survey report.

Fourthly, data accuracy and reliability. The system data is maintained in a real-time by CCS expert working group, to ensure the technical data in the system will be the latest and effective.

CCS Expert System provides the industry with a "library" which is full of broad and complete maritime technical data, and through the construction and maintenance of the paperless "library", it saves a lot of resources for the industry. The system also provides a highly intelligent and professional technical support platform for the maritime industry, and greatly improves the working efficiency.

On the Applicability of the Wave Spectrums Under Typhoon Conditions in the South China Sea

By Li Linbin

Sea-surface elevation in deep water can be considered as a narrow-banded zero-mean Gaussian random process. It's ergodic and commonly described by the linear random wave theory with the frequency spectrum as a core. The offshore structures can be treated as linear dynamic system whose response, displacement or load, to the random linear wave excitation also follows narrow-banded zero-mean Gaussian random process. The response spectrum can be derived by combination of wave spectrum and the transferring function of response with respect to the frequency. The response variable will follow Rayleigh distribution and its characteristic values will be given by the moments of the response spectrum, so that the structural response to the wave load will be predicted. The relations of the wave spectrum $S(\omega)$, the transferring function $T(\omega)$ and the structural response spectrum $R(\omega)$ are given by

$$R(\omega) = S(\omega)[T(\omega)]^2 \quad (1)$$

Where ω is the frequency in RPS. The above relationship can be illustrated by the Figure-1.

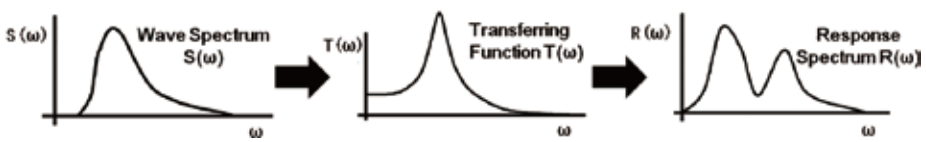

Figure-1 Wave spectrum, transferring function and response spectrum

The wave spectrum shape is of fundamental importance for structural dynamic analysis. The techniques used to acquire the spectrum are essentially the following: measure the sea-surface elevation with in situ or remote-sensing techniques and analyse the records using the FFT (Fast Fourier Transition) technique; or predict the spectrum with numerical wave models using wind, tide and seabed topography information. With the maturity of the numeric simulation technology, the latter technique has been increasingly used to obtain the metocean parameters in a large-scale and efficient manner. Wave spectrum contains most of the wave information, and almost all the commonly used oceanic parameters can be given by the moments of the spectrum as

$$\text{The } n^{th} \text{ specturm moment: } m_n = \int_0^\infty \omega^n S(\omega) d\omega \quad (2)$$

$$\text{Significant wave height: } H_{m0} = 4\sqrt{m_0} \quad (3)$$

$$\text{Mean wave period: } T_{m01} = m_1/m_0 \quad (4)$$

$$\text{Mean zero up crosssing wave period: } T_{m02} = \sqrt{m_2/m_0} \quad (5)$$

$$\text{Band width factor: } \upsilon = \sqrt{m_0 m_2/m_1^2 - 1} \quad (6)$$

The original spectrum for real sea is so complicated that it can't be expressed by a single analytical formula. In most engineering cases only some of the metocean parameters like significant wave height and characteristic wave period of the design sea sates are available. We need to adopt an applicable spectrum model to represent the real sea to carry out the dynamic analysis of marine systems. The applicability of the selected spectrum is of vital importance in offshore structures design and analysis.

The commonly used spectrums and their applicability

The spectrum can be classed into wind sea spectrum and swell spectrum. The former is the local wind generated wave while the latter is the swell travelling from far areas where waves are generated

by the storms. All discussions of this paper are only for the wind sea. The following are the spectrum models widely used in ships and offshore structures industry.

1. Pierson-Moskowitz (P-M) Spectrum

$$S_{PM}(\omega)=0.0081\frac{g^2}{\omega^5}\exp\left[-\frac{0.032(g/H_{m0})^2}{\omega^4}\right] \quad (7)$$

or

$$S_{PM}(\omega)=0.0081\frac{g^2}{\omega^5}exp[-1.25(\omega_m/\omega)^4] \quad (8)$$

Where ω_m is the peak frequency in RPS.

P-M spectrum is derived from measurements for the North Atlantic by Pierson and Moskowitz in 1964. It's applicable for the fully developed sea.

2. Generalized P-M spectrum

$$S_{GPM}(\omega)=0.3125H_{m0}^2\frac{\omega_m^4}{\omega^5}exp[-1.25(\omega_m/\omega)^4] \quad (9)$$

Generalized P-M spectrum is also called as double parameters P-M spectrum or Bretschneider spectrum. It's applicable for the fully developed sea as well as developing sea. The ISSC in 1964 recommended the generalized P-M spectrum to do the dynamic calculation of ships. It is commonly used in the offshore structural fatigue analysis.

3. JONSWAP spectrum

$$S_J(\omega)=A_\gamma S_{GPM}(\omega)\gamma^{\exp\left[-0.5\left(\frac{\omega-\omega_m}{\sigma\omega_m}\right)^2\right]} \quad (10)$$

Where

$S_{GPM}(\omega)$ is the generalized P-M spectrum;

γ is a non-dimensional peak shape parameter which follows a Gaussian distribution with mean value of 3.3 and standard deviation of 0.79;

σ is a numerical parameter. $\sigma=0.07(\omega\leqslant\omega_m)$, $\sigma=0.09(\omega>\omega_m)$ while $\gamma=3.3$;

A_γ is a normalizing factor, $A_\gamma=1-0.287\ln(\gamma)$;

The JONSWAP spectrum represents wind-generated seas with fetch limitation. The formulation is based on an extensive wave measurement program known as the Joint North Sea Wave Project carried out in 1968 and 1969 along a line extending over 160 km into the North Sea. It's the most systematical oceanic measurement project with 2,500 spectrums obtained. Because in most cases the wind sea is fetch limited and not fully developed, the spectrum has extensive applicability and utilization in ships and offshore industry. The ISSC in 1979 recommended JONSWAP as the input spectrum for dynamic analysis of ships.

4. Modified JONSWAP Spectrum

$$S_{MJ}(\omega)=\frac{4.5}{(2\pi)^4}(H_{m0}g)^2(\omega_m^4/\omega^5)exp[-1.25(\omega_m/\omega)^4]\left(\frac{9.5}{2\pi}H_{m0}^{0.34}\omega_m\right)^{\exp\left[-0.5\left(\frac{\omega-\omega_m}{\sigma\omega_m}\right)^2\right]} \quad (11)$$

Where

σ is the band width factor $\sigma=0.07(\omega\leqslant\omega_m)$, $\sigma=0.09(\omega>\omega_m)$;

Waves under tropical cyclone conditions still follow the JONSWAP shape, but it is different on how the spectrum parameters are derived compared to the conventional wind sea JONSWAP. The Modified JONSWAP was developed by considerable observations in the Gulf of Mexico. The tropical cyclone waves in the South China Sea should be well described by this model because of the similar weather mechanism in the two areas.

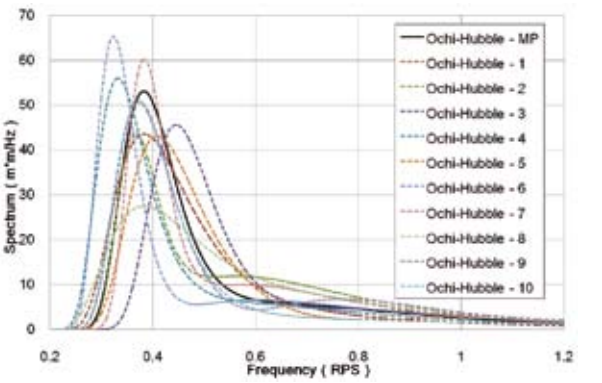

Figure-2 Ochi-Hubble Spectrum (H_{m0} =13.2 m)

5. Ochi-Hubble Spectrum

$$S_{OH}(\omega)=\sum_{j=1,2}\left\{\frac{H_{m0,j}^2}{4\Gamma(\lambda_j)}\left[\frac{4\lambda_j+1}{4}\omega_{m,j}^4\right]^{\lambda_j}\frac{1}{\omega^{4\lambda_j+1}}exp\left[-\frac{4\lambda_j+1}{4}\left(\frac{\omega_{m,j}}{\omega}\right)^4\right]\right\} \quad (12)$$

Where

$\Gamma(\ )$ is the Gamma function;

$H_{m0,1}$、$H_{m0,2}$、λ_1、λ_2、$\omega_{m,1}$ and $\omega_{m,2}$ are parameters all of which can be expressed by significant wave height as Table-1.

Ochi-Hubble spectrum family consists of eleven members each of which has high frequency part and low frequency part. The parameters were developed based on the 800 spectrums measured in North Atlantic. For a desired sea severity (significant wave height), a family of wave spectra consisting of eleven members is generated with the confidence coefficient of 0.95 with one member representing the most possible case. Observations for the hurricanes in the Gulf of Mexico demonstrated that Ochi-Hubble spectrum matched the actual

No.	$H_{m0,1}$	$H_{m0,2}$	$\omega_{m,1}$	$\omega_{m,2}$	λ_1	λ_2
OH-MP	$0.84H_{m0}$	$0.54H_{m0}$	$0.70e^{-0.046H_{m0}}$	$1.15e^{-0.039H_{m0}}$	3.00	$1.54e^{-0.062H_{m0}}$
OH-1	$0.95H_{m0}$	$0.31H_{m0}$	$0.70e^{-0.046H_{m0}}$	$1.50e^{-0.046H_{m0}}$	1.35	$2.48e^{-0.102H_{m0}}$
OH-2	$0.65H_{m0}$	$0.76H_{m0}$	$0.61e^{-0.039H_{m0}}$	$0.94e^{-0.036H_{m0}}$	4.95	$2.48e^{-0.102H_{m0}}$
OH-3	$0.84H_{m0}$	$0.54H_{m0}$	$0.93e^{-0.056H_{m0}}$	$1.50e^{-0.046H_{m0}}$	3.00	$2.77e^{-0.112H_{m0}}$
OH-4	$0.84H_{m0}$	$0.54H_{m0}$	$0.41e^{-0.016H_{m0}}$	$0.88e^{-0.026H_{m0}}$	2.55	$1.82e^{-0.089H_{m0}}$
OH-5	$0.90H_{m0}$	$0.44H_{m0}$	$0.81e^{-0.052H_{m0}}$	$1.60e^{-0.033H_{m0}}$	1.80	$2.95e^{-0.105H_{m0}}$
OH-6	$0.77H_{m0}$	$0.64H_{m0}$	$0.54e^{-0.039H_{m0}}$	0.61	4.50	$1.95e^{-0.082H_{m0}}$
OH-7	$0.73H_{m0}$	$0.68H_{m0}$	$0.70e^{-0.046H_{m0}}$	$0.99e^{-0.039H_{m0}}$	6.40	$1.78e^{-0.069H_{m0}}$
OH-8	$0.92H_{m0}$	$0.39H_{m0}$	$0.70e^{-0.046H_{m0}}$	$1.37e^{-0.039H_{m0}}$	0.70	$1.78e^{-0.069H_{m0}}$
OH-9	$0.84H_{m0}$	$0.54H_{m0}$	$0.74e^{-0.052H_{m0}}$	$1.30e^{-0.039H_{m0}}$	2.65	$3.90e^{-0.085H_{m0}}$
OH-10	$0.84H_{m0}$	$0.54H_{m0}$	$0.62e^{-0.039H_{m0}}$	$1.03e^{-0.030H_{m0}}$	2.60	$0.53e^{-0.069H_{m0}}$

Table-1 Values of the six parameters of Ochi-Hubble Spectrum as a function of significant wave height in meters

waves better than the models of P-M, JONSWAP and Modified JONSWAP. Figure-2 below shows the spectrum family for the sea with significant wave height of 13.2 m.

Comparison with the hindcasted wave spectrums

To validate the spectrum model under tropical cyclone conditions in the South China Sea, we contracted with the State Oceanic Administration of China to conduct the numeric simulation for the No.14 typhoon in 2008 (Hagupit) and provide the original wave spectrum data as well as the corresponding parameters including the significant wave height and peak frequency wave period for the two studied points on the right side of the typhoon track. Figure-4 shows the time series of the significant wave height and Table-2 shows the parameters nearby the wave peaks.

The below figures (Figure-5 to Figure-14) show the comparisons of the original spectrum data with the models of JONSWAP, Modified JONSWAP and Ochi-Hubble. For the JONSWAP we use

Figure-3 The track of typhoon Hagupit and the studied point P1 and point P2

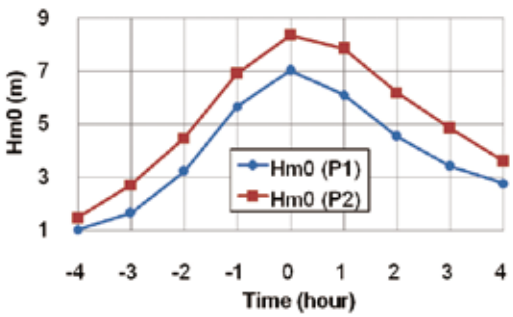

Figure-4 H_{m0} series of the typhoon Hagupit

Time	H_{m0}(P1)	Tp(P1)	H_{m0}(P2)	Tp(P2)
-2	3.2m	12.3s	4.5m	14.9s
-1	5.7m	13.5s	6.9m	14.9s
0(Peak)	7.0m	12.3s	8.4m	13.5s
+1	6.1m	12.3s	7.9m	13.5s
+2	4.6m	12.3s	6.2m	13.5s

Table-2 The metocean parameters nearby the wave peaks

the peak shape parameter γ =2.0, which is consistent with the recent floating structure projects in the South China Sea. For the Ochi-Hubble model, we select the member closing most with the original spectrum curve.

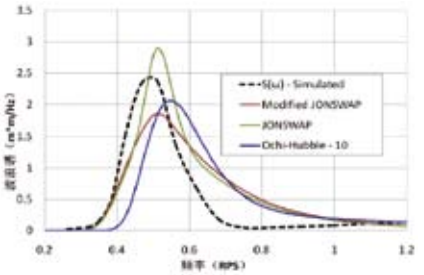

Figure-5 Wave of 2 hrs before the peak at P1

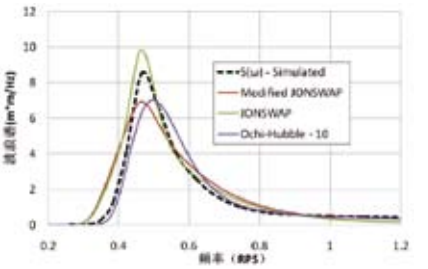

Figure-6 Wave of 1 hr before the peak at P1

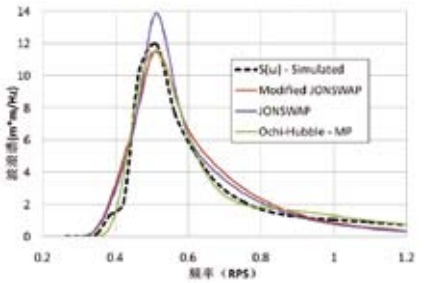

Figure-7 Wave of the peak at P1

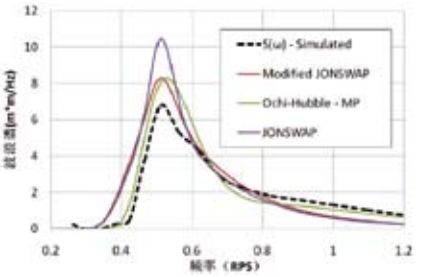

Figure-8 Wave of 1 hr after the peak at P1

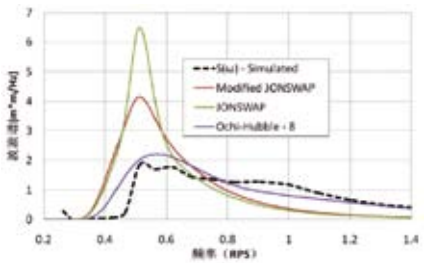

Figure-9 Wave of 2 hrs after the peak at P1

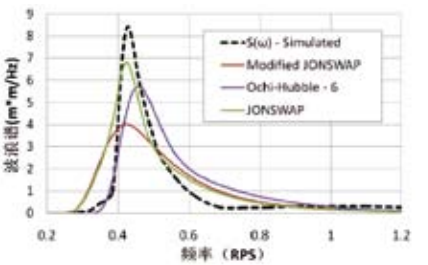

Figure-10 Wave of 2 hrs before the peak at P2

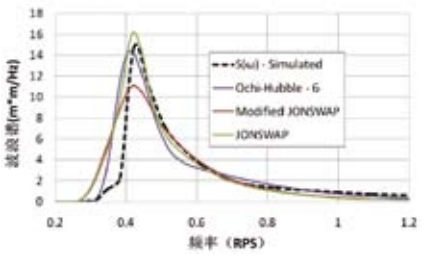

Figure-11 Wave of 1 hr before the peak at P2

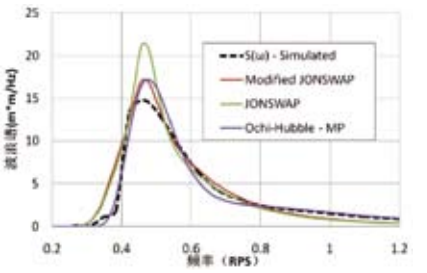

Figure-12 Wave of the peak at P2

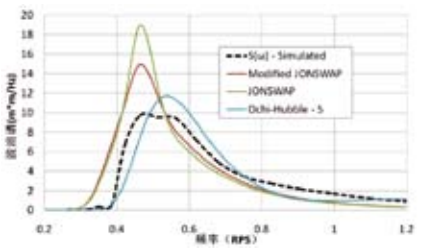

Figure-13 Wave of 1 hr after the peak at P2

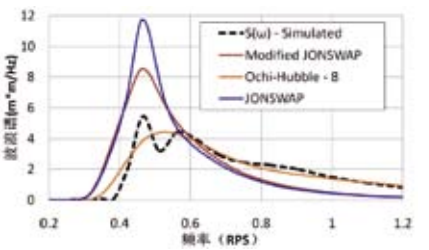

Figure-14 Wave of 2 hrs after the peak at P2

The following conclusion can be drawn from the above comparison studies:

(1) The original spectrums for the real sea are uncertain and can't be expressed by analytical formulas.

(2) The China's practice using the peak shape parameter γ from 1.9 to 2.4, 2.0 in this paper, would, except for Figure-10, overestimate the spectrum peak frequency values especially for the typhoon wave peaks.

(3)For the wave peak seas, the Modified JONSWAP matches satisfactorily with the original spectrum data. This is consistent with the observations in the Gulf of Mexico, so it is recommended for the cyclone conditions in the South China Sea.

(4) We can always find a member from the Ochi-Hubble family matching well with the actual wave spectrum curve. Extensive observations indicated that Ochi-Hubble model is applicable for almost all areas and conditions including the sea states composing of wind sea waves and swells. A significant advantage of using a family of spectra for design of marine systems is that one of the family members yields the largest response while another yields the smallest response with confidence coefficient of 0.95. Considering the complication and uncertainty of the spectrums of the real sea, this is of special significance for the design and analysis for the marine systems.