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Partnership

Edited and Printed by CCS 2017.8 / The 28th issue in total

CCS published *Guideline for Requirement and Security Assessment of Ship Cyber System*

The Guidelines for Requirement and Security Assessment of Ship Cyber System issued by China Classification Society and took effect on July 20th, 2017 provides solutions for the increasingly serious ship cyber security problems.

CCS
CHINA CLASSIFICATION SOCIETY
中国船级社

安全、环保，
为客户和社会创造价值

Safety, environmental protection and creating value for clients and society

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Dynamics

New Deliveries

The fourth issue in 2017
(The 28th issue in total)

Edited and Printed by CCS

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Sender object: Manager and technical staff
Printing party: Beijing Tiancheng Printing Co.,Ltd.
Printing quantity: 3000

Wechat public ID

Please scan the QR code to follow

Development and Solution of Standard

New Technology Tendency

A strategic cooperation agreement was signed between CCS and Engineering Research Institute of CSSC

On July 7, 2017, China Classification Society (CCS) signed a strategic cooperation agreement with the Engineering Research Institute of CSSC in Beijing. Sun Licheng, president of CCS, Sun Feng, vice president of CCS, and Sun Wei, deputy general manager of CSSC, Xu Miao, assistant general manager of CSSC and other related people attended the signing ceremony.

The cooperation between the two sides will mainly focus on the field of intelligent ships. Cooperation will aim to guide and standardize the healthy and orderly development of intelligent ships, and realize breakthrough and solution of core problems faced by the first batch of intelligent ships, such as system integration, data analysis, system evaluation and standard establishment and etc.

The signing of the cooperation agreement will bring the cooperation between the two sides to reach a new stage. The two sides will jointly establish a research center of intelligent ships, carry out the top-level design of intelligent ships, key technologies, assessment testing technology, network security, operations management technology and cooperation in other fields.

The ceremony of CCS issuing the first EU Marine Equipment Directive (MED) certificate was held in Beijing

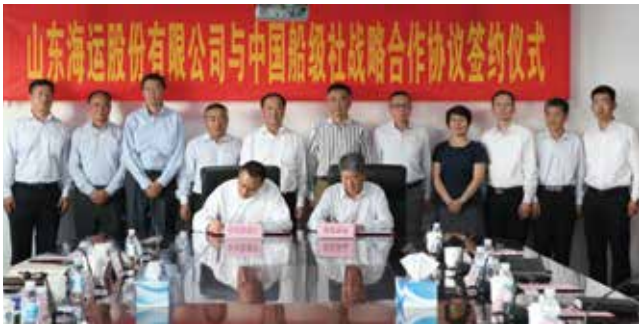
On August 15, 2017, China Classification Society (CCS) and Shanghai YONZOE Electronic Technology Co., Ltd. jointly held the ceremony of issuing the first EU Marine Equipment Directive (MED) certificate in Beijing. Mo Jianhui, party secretary of CCS, Zhu Kai, vice president of CCS, and the personnel from marine products department of CCS headquarters and Shanghai branch, Chu Renqian, general manager of Shanghai YONZOE Electronic Technology Co., Ltd. investor Jiang Peilin, and Xu Lin Ling, the deputy director of the office of the company attended the ceremony, the two sides also had friendly talks on further cooperation.

After receiving the EU MED certification qualification on March 16, 2017, CCS had been approached by many enterprises for consultation related to requirements, process and other information. Among them, the Shanghai YONZOE Electronic Technology Co., Ltd. was the first to complete the relevant testing & inspection work, and was awarded the first EC type inspection certificate for marine radar by CCS on June 29, 2017.

The renewed strategic cooperation agreement was signed between CCS and Shandong marine Co., Ltd.

Recently, China Classification Society (CCS) and the Shandong marine Co., Ltd. signed a strategic cooperation agreement in Qingdao, Sun Licheng, president of CCS, Zhu Kai, vice president and chief engineer of CCS, Bao Jianying, chairman of Shandong marine Co., Ltd. Wang Dawei, general manager of Shandong marine Co., Ltd. attended the signing ceremony.

CCS will give full play to its advantages in ship, construction of marine engineering facilities, inspection and certification, regulation establishment and scientific research, use global resources and the advanced technology and talent at home and abroad to fully support and promote the Shandong marine Co., Ltd. to realize diversification and comprehensive management in shipping, logistics, ship repair and marine engineering and other aspects in its construction of a top-class shipping & logistics enterprise to provide security for transportation of national strategic resources; enhance the management and quality of the brand, and realize the transformation and development of green industry.



CCS issued the first conformity confirmation document of the EU monitoring plan

Recently, the EU shipping carbon dioxide emissions monitoring and reporting and verification (MRV) implementation summary seminar and the awarding ceremony of monitoring plan conformity certificate to"COSCO Portugal ship" was held in CCS Shanghai branch. Related leaders and experts from CCS, COSCO Marine Container Transportation Co., Ltd., Shanghai Ocean Shipping Co., Ltd. and COSCO Marine Development Limited by Share Ltd attended the meeting.

Meng Lingyi, general manager of CCS Shanghai branch in his concluding remarks highly recognized the joint research work mode, which is another successful example of cooperation followed by the ship energy efficiency certification, the Maritime Labour Convention project between COSCO SHIPPING and CCS. The cooperation between CCS and COSCO SHIPPING has made new contributions to the industry in the ship greenhouse gas emission reduction, and the two sides will further increase the depth and breadth of cooperation in shipping greenhouse gas emissions, promoting the development of green shipping.

At the meeting, CCS issued the first EU conformity confirmation document of monitoring plan for COSCO Portugal, marking that the implementation of the CCS EU MRV certification service has started.

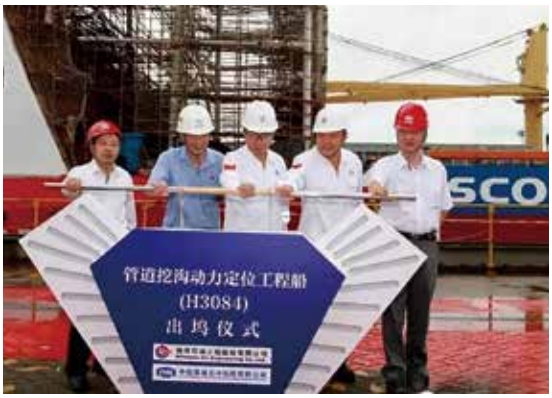
The development alliance of unmanned cargo ship was established in Shanghai

Recently, the inaugural meeting of the unmanned cargo ship development alliance and the first board of directors meeting were held in Shanghai. Related leaders and experts from HNA technology group, CCS, ABS, China Ship Research and Design Center, Hudong Zhonghua Shipbuilding Group Co. Ltd., China ship and Ocean Engineering Design Institute, Chinese Wartsila Co., attended the meeting and witnessed the signing ceremony of the association. The alliance board meeting adopted a resolution on the proposal of 2017 work plan, as the first cooperation association in China in the field of unmanned cargo ship, the establishment of the alliance marks the prelude to the reform of unmanned cargo ship in China.

The alliance, promoted by HNA technology group and CCS, co-founded by five units at home and abroad, attracted a number of world-renowned agencies to join. The alliance members will play their respective advantages, develop unmanned cargo transport autonomous navigation capabilities through the integration of domestic and foreign advanced technology, and conduct market promotion, so as to promote the development of intelligent navigation.

Combined with the accumulation of the rules and standards in the field of intelligent ships, CCS will further promote the industrial intelligent development and innovation through the development of unmanned vessels. Sun Feng, vice president of CCS said at the meeting that, CCS has initiated relevant specifications and standards research work, and will actively promote the revision of regulations. CCS is willing to work with the industry to carry out research on unmanned cargo carriers and related technologies, and contribute to the intelligence of China's major equipment.

China’s first submarine pipeline trenching dynamic positioning ship delivered



Recently, China’s first submarine pipeline trenching dynamic positioning ship was delivered in Huangpu Wenchong Longxue shipyard. The ship (H3084) is built by Huangpu Wenchong ship Co., Ltd. of CSSC for the Offshore Oil Engineering Corp, designed by the 708th research institute of CSSC, classed by CCS, with 95 meters in total length, 22.6 meters in width, 8.6 meters in depth. It is a ship with full power propulsion system, the propeller, and is a submarine pipeline trenching engineering ship with DP-2 dynamic positioning. The ship is equipped with a 100 ton folding arm heave compensation crane and helicopter platform, which is mainly used for submarine pipeline expansion bend installation, trenching, pipeline pressure test, emergency repair, submarine cable laying operations and others works. The successful construction of this ship will fill the blank at home submarine pipeline trenching professional dynamic positioning ship.

CCS attended the 2017 Maritime Day of China Forum

On July 11, 2017, China marked its 13th Maritime Day of China in Ningbo. Mo Jianhui, party secretary of CCS was invited to attend the forum of 2017 Maritime Day of China, which jointly organized by the Ningbo municipal government, China Institute of Navigation, Water Transport Science Research Institute of China MOT, and had exchanges with various leaders and guests.

This year, the maritime day activities adhered to the purpose of "love the motherland, good neighbor and friendship, scientific navigation, promote maritime development to build a strong nation", served "The Belt and Road, maritime and sea power strategy, taking the to set to sail the Silk Road, and build the blue dream" as the theme, the "Great Voyage, the new Silk Road" as the slogan. In the "Chinese international seafarer forum", CCS delivered a speech on analysis of the influence of intelligent ships on seafarers, which was well-received.

China Classification Society Santiago office officially opened

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China Classification Society Paris office officially opened

China Classification Society Paris Office officially opened on July 24, 2017. The Paris office is subordinated to the European Center and is responsible for the business implementation and expansion of France and its surrounding areas.

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Bulk carrier “JIN HAI HUI”

“JIN HAI HUI” is a 105000 DWT bulk carrier built by China Shipping Industry (Jiang Su) Co., Ltd. for Fujian Shipping Company. The carrier is 249.99 meters long, 43 meters wide and 21 meters deep. The ship powered by an 10200KW engine and has no limited navigation area. It is of 63967 tons in gross tonnage, 31118 tons in net weight. The ship was surveyed by CCS and was classed with CCS.

The ship has a total of seven cargo holds, with the ability of carrying dry bulk, coil and packaging goods. The main layout is steel, single-shell double-bottom, single deck, with a bow and deck mast room and with no ball nose, single-propeller and rudder, equipped with water treatment system, satisfying PSPC and underwater inspection requirements.

The series of 105000 DWT bulk carriers are owned by Fujian Shipping Company, CCS has carried out plan approval and construction survey, and as the second ship of the series “JIN HAI HUI “ was delivered on March 16, 2017, the ship is the second ship of the series and granted the following ship class notations:

★CSA Bulk Carrier; CSR;BC-A(Holds Nos. 2,4 &6 may beEmpty); Grab(25); PSPC(B); Loading Computer (S, I, G); ESP; In-Water Survey; FTP; BWMP

★ CSM AUT-0; BWMS; CMS; SCM; GPR

Container vessel “COSCO SHIPPING HIMALAYAS”

“COSCO SHIPPING HIMALAYAS” is the first of five 14500 DWT container vessels built by Shanghai Jiangnan Changxing Shipbuilding Co., Ltd. for China COSCO Shipping Co., Ltd. The ship is 366 meters long, 51.2 meters wide and 30.2 meters deep with a design draft of 14m. There are nine cargo holds on board with a carrying capacity of 14568 boxes. The cabin can be stacked for 18 columns 11 layers of containers and the deck can be stacked 20 columns 10 layers of containers. The ship type is designed by Hudong-Zhonghua Shipbuilding (Group) Co., Ltd. who optimized the design scheme and made several technical breakthroughs in low speed and low consumption, ship type line type and high load weight. The use of long stroke mainframe and large diameter propeller will consume less fuel which means more environmental friendly. The ship is a typical high value-added, high-tech ship for it integrated the most advanced shipbuilding technologies.

The vessel has applied for the notation of the Green Shipp II of the CCS Green Ship and the Declaration of Harmful Substances of Hong Kong Convention and meets the technical requirements of the latest Ballast Water Convention. At the same time, the bridge design of driving sole is a collection of today's most advanced navigation control system. It is particularly worth mentioning that the ship was awarded CCS’ latest CLC (V) entry symbol for the specific route binding force and the container consolidation ECL entry symbol meeting the latest Code Of Safe Practice For Cargo Stowage And Securing (CSS CODE), thus it conforms to the world’s development trend of green, environmental friendly, low-carbon, modern and meet a series of demands of the owners such as optimized operation performance, improves safety factor and reduces operating costs.

General dry cargo ship “Da Xiang”

“Da Xiang”, a general dry cargo ship is built by CSSC Shanghai Shipyard Co., Ltd. for COSCO Shipping Specialized Carriers Co., Ltd, which was designed by Shanghai Marine & Offshore Design Co., Ltd. The ship is driven by low-speed diesel engine with no limited navigation area. It is 179.67 meters long, 28 meters wide, 14.8 meters deep with a design draft of 9.2m, structure draft of 10.5m, full load of 28216 tons, 21992 tons in gross, 9390 tons in net. The multi-purpose heavy lift ship is independently designed, researched and developed in China. The ship was subject to CCS and was classified with CCS.

The ship is in fully welded steel structure. As an multipurpose heavy lift driven by low-speed diesel-powered single engine and propeller, it has a square tail and a bowling bow. Cab is located in the first floor of the deck divided into A to E 5 layers of the deck rooms with internal lift. The tail deck can be boxed and the chimney is located in the left side of the ship within which at the rear there is an room for emergency generator. In the bow a tubular side push device is provided. The left and right sides of the ship's yard are equipped with gravity-backed lifeboats and inflatable life rafts that meet the requirements of the Convention, and the lifeboats on the right side are also used as rescue boat, thus guaranteeing the safety of the ship.

The ship class notation is as follows:

★CSA General dry cargo ship; ERS; GRAB(20); PSPC(B,D); SOLAS II-2 Reg19; Ice Class B; Equipped with Container Securing Arrangement; Load computer(S,I,G,D); In-water survey; BWMP

★CSM AUT-O; SCM; EEDI(III); GPR; BWMS

High speed passenger ship “Peng Xing 1”

“Peng Xing 1” is a high speed passenger ship built in Afai Southern Shipyard for Shenzhen Shipping Group. The stylish and beautiful ship is a uniquely designed class A passenger vessel. It is 41.98 meters long, 10 meters wide and 3.4 meters deep with design speed of 28 knots and the capacity of 300 passengers. As a type of short-distance sea passenger transport, the ship classified by CCS can navigate in Pearl River to Hong Kong and Macao and domestic coastal areas with radio equipped for A1 + A2 sea area.

The ship is a full aluminum alloy catamaran with double engine, gear boxes, and water jet propellers. It has spacious deck area with good airworthiness, fastness and maneuverability. The whole ship's emergency power supply is a storage battery and the host and the pump can work properly at 24 volts. In each piece of machine’s cabin, a storage battery is set for startup. The ship also has the ability to navigate at night for it is equipped with a searchlight in the cab, night vision and other equipment.

Ptototype chemical / refined oil carrier “LIAN HUAN HU”

“LIAN HUAN HU” is the first of three 50000 DWT chemical / refined oil carriers built by Guangzhou Shipyard International Co., Ltd. for COSCO Shipping Tanker (Da Lian) Co., Ltd. The carrier is 183.2 meters long, 32.26 meters wide and 18.2 meters deep The ship is powered by a 7618KW engine and has no limited navigation area. It is 29848 in gross tonnage, 14477 tons in net weight. The construction survey is carried out by CCS and is classed with CCS.

The main layout: steel, double-shell double-bottom, single deck, with single engine, propeller and rudder. The ship has a total of 12 type II integral chemical cargo tanks with carbon steel + special coating type and the tank bulkhead is subdivided.

The ship complies with Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (2009) and International Convention for the Control and Management of Ships' Ballast Water and Sediments.

The ship was successfully completed on January 16, 2017 and granted the following ship class notations:

★CSA Chemical/Oil Tanker, Double Hull, F.P. ≤ 60°C; Type 2; CSR; PSPC(B); Emergency Towing Arrangements; Loading Computer (S, I, D); Equipped with Single Point Mooring Connecting installation; ESP; In-Water Survey; FTP; AFS; BWMP

★CSM AUT-0; SCM; VCS; BWMS

Bulk carrier “XIN LI HAI”

“XIN LI HAI” is a bulk carrier built by Tianjin Xingang Shipbuilding Heavy Industry Co., Ltd. for China COSCO Shipping Co., Ltd. The ship is driven by low-speed diesel engine with single propeller, mainly used for transportation of coal, grain and ore. The construction survey of the ship is carried out by CCS and is classed with CCS.

The boat has a single-layer continuous upper deck with a forecastle, a vertical first column without a ball, a square stern, an open stern, a semi-balanced rudder and a fixed pitch propeller driven by a low speed diesel engine. Shrouds for stern ball are set on both sides and vortex fins are equipped after the propeller even in the stern of living area and cabin. There are nine cargo holds, with double bottom, bottom side cabin and top side cabin. It has a structure draft of 18.3 meters and DWT of 179,200 tons when the proportion of seawater is 1.025 tons / cubic meter, and it is of 156,900 tons in DWT when the design draft is 16.5 meters.

The ship is powered by a single marine diesel engine directly through a shaft to drive the propeller which meets the IMO NOx Tier II emission requirements. The ship is equipped with an exhaust and fuel combination boiler to provide steam and heating for the equipment. Three main generators driven by diesel engines are installed in the cabin and each of which output power of 900kW at speed of 900rpm in 450V, 60Hz, three-phase power supply. A set of emergency diesel generators are placed in the emergency generator room. When the main power station failure, the emergency generator will supply power for the broadcasting equipment, intercom equipment, navigation equipment, emergency lighting, a steering gear, emergency fire pump and so on.

General cargo and bulk carrier “Ping An Cheng”

“Ping An Cheng” is a general cargo and bulk carrier for international voyage built by Shanhaiguan Shipbuilding Industry Co., Ltd. and its owner is Xiamen Ocean Shipping Co. The carrier is 179.95 meters long, 32 meters wide and 15 meters deep with a design draft of 10.5m and rated crew of 29 people. The ship is powered by an 18600KW engine and has no limited navigation area with DWT of 37930 tons and gross tonnage of 25769 tons. The construction survey of the ship is carried out by CCS and is classed with CCS.

The stern model ship is steel, double-shell double-bottom, and single deck, with mixed skeleton, a bow, single propeller and rudder. The main deck is fitted with four cranes. There are five cargo holds from the bow to the stern and the trough structure is used as transverse bulkhead of cargo holds. 264 standard containers can be loaded on the main deck. NO.1 cargo compartment can be used to load with packaged dangerous goods of class 1 and 3 defined in the IMDG rules. NO.2 / NO.4 cargo compartment has removable double-deck decks. NO.3 cargo compartment can be divided according to the needs of loading, which increases the flexibility of cargo loading, and improves the utilization of cargo space in the ship.

Ro-ro ship “CSC Jiang He”

“CSC Jiang He “is a Ro-Ro ship built by CSC Wuhan Automobile Logistics Co., Ltd. especially used for automobile transportation. The construction survey of the ship is carried out by CCS and is classed with CCS.

The ship is available for A, B, C-class inland river navigation areas, and can load various types of cars, also it can load and unload smoothly in any ports along Yangtze River. The double stern line type tail ship is designed with steel hull, double engine, single propeller, ball nose bow, double streamlined suspension rudder. The cab is located in the bow and the cabin is equipped with a layer of carriage. There are six layers of car decks above the main deck.

The ship is equipped with two main engines and they are connected with the speed reduction gearbox by using high elastic couplings. The cabin is located in the rear of the ship, and a cabin control room is set to monitor mechanical and electrical equipment. Two medium speed inline diesel engines are used to promote the host with rated power at 1000kW, speed 750r / min each.

Two main diesel generator sets consist of the power station, each with output power of 132kW and 1500rpm of speed. In order to meet the requirements such as fuel tank heating, the ship is equipped with two exhaust gas thermal oil boilers. The engine and diesel generators use separate fresh water cooling systems. The cabin uses mechanical ventilation. The main propulsion system of the ship is controlled by the cab remotely or on site. The monitor of speed reduction gearbox and engine by the steering room and duty room meets all regulatory requirements.

Passenger and container carrier “Ocean Blue Whale”

“Ocean Blue Whale” which was built by Huanghai shipbuilding Co. , Ltd. for Bohai International Ferry (Hong Kong) Co. Ltd. is the world's modernized passenger ship of the largest deadweight, which is researched, developed, designed and built by China independently. The ship is 182.6 meters long, 25.2 meters wide and 12.1 meters deep with the fasted speed of 23 knots and loading capacity of 800 passengers and 460 containers, namely 19000 DWT in total. The ship is equipped with two MAN B&W 9S50ME-C8.5 Tier II low speed diesel engines and other advanced equipment and facilities such as double adjustable pitch propeller, double flap rudder, fin stabilizer and tilting tank. The ship meets other new international norms such as SOLAS2009, safe return to the port and new requirements for container lashing. The ship was subject to CCS and was classified with CCS.

“Ocean Blue Whale” is mainly for international navigation between China and South Korea, used for carrying passengers and containers. There are plenty of facilities on board such as duty-free shops, bars, video / auditorium, KTV, video game hall, chess room, buffet restaurant, open-air barbecue, VIP sea view room and tatami. “Ocean Blue Whale” focuses on passenger experience and comfortable entertainment, with superior loading capacity and flexibility.

CCS launches technical guideline to deal with cyber threat

By Yu Chun & Deng Linyi

At the beginning of April 2017, China Classification Society (CCS) organized the review meeting before issuing the "Guideline for Requirement and Security Assessment of Ship Cyber System" (hereinafter referred to as the "guideline"). This is the first technical standard in China to apply to ship cyber system.

Cyber security is not far from shipping industry

With the popularity of mobile Internet and Internet of things, "all things to interconnect" has made our life convenient, it has also inevitably brought potential security risks caused by continuous joining up the "components" (system, equipment, people and organizations). For shipping industry, with the application of new technologies and the reduction of communication costs, onboard systems and equipment connecting to the internet have increased significantly.

In recent years, more and more industry organizations and experts expressed concern about the security of the ship network and have taken actions. In January 2016, BIMCO firstly proposed and issued marine network security guidelines; the International Association of Classification Societies (IACS) established the Cyber Security Panel in December 2015, developed unified requirement for ship cyber system, which will be incorporated into in classification rules in the future; the IMO MSC discussed the urgent need to improve the awareness of information network risk and vulnerability at its ninety-sixth conference, approved the interim guidelines for maritime cyber risk management (MSC.1/Circ.1526), helping maritime industry to deal with the severe challenges form network security.

Aiming at ship network security, CCS has issued a technical circular to bring shipowners and ship management companies attention to the security of the network and related systems of ships and offshore facilities. As the next step, how to provide constructive guidance to the specific situation of the ship network, and establish a quantitative evaluation system will become the focus of CCS' work, and it's also the starting point of CCS issuing the guideline.

Provide specific requirements for complex ship network system

The guideline puts forward the requirements focusing on four aspects for cyber security and related work.

The first is general requirements and inspection. The guideline made clear the application and scope, and put forward specific requirements for the drawings and documents necessary in carrying out the assessment. Ships meeting the requirements of the guideline will be awarded the corresponding class notation "Cyber Security".

The second is the requirement for cyber system. There are many stakeholders to connect to the ship network, therefore the right way to control the threat from the source is to put forward requirement for the developer and the manager. In this section, CCS classify the many elements related to ship network, and put forward requirements in aspect of resource, risk, and procedure.

The third is the evaluation of cyber system product. Aiming at the application from the developer of ship network systems, CCS provides evaluation service for design, development and installation of the network system products. For the scope of the system product, CCS controls the design and development process of the network architecture. In this section, CCS also focuses on three aspects i.e. resources, risk, procedures, to make index evaluation of the network system product. In order to improve the evaluation pertinence by using technical means, CCS propose to use professional security measurement tools to meet the requirement for scanning and penetration testing of network system products.

The fourth is the evaluation of ship network system. Aiming at the application from ship owner / ship management companies, CCS provides the evaluation service for the operation, management and maintenance of real ship network system. In view of the different cyber management level of domestic shipowners, before assessment, the shipowners need to do a "self-evaluation" to quickly understand the management level and ship network condition of the company. For ships meeting the "threshold" of self-evalustion, CCS will carry out index evaluation.

Safe cyber system is the basic factor for ship's future development

CCS hopes that the guideline can promote the regulation of ship network development and management by the industry, especially the recognition once again of the following issues. Firstly, we should not only pay more attention to the intended network destruction and invasion means, but the network threats caused by improper operation and insufficient safety awareness; secondly, the improper system design, integration, maintenance, and lack of network management regulations will also lead to system vulnerabilities and threats; thirdly, sensitive and privacy information the data should be properly protected, related vulnerabilities should be dealt with in advance; fourthly, the problem of network security is not limited to smart ships, ships equipped with systems and equipment connecting to the Internet should also be considered and be under risk control based on the actual condition. With the introduction of the guideline, CCS will simultaneously launch the assessment, testing and accreditation services to ship cyber system.

With the development and application of new technologies, the "platform" management and control of ship operation system, and even real-time data sharing between ship and shore will become mainstream. On the one hand, this model is conducive to shore side full control of the ship condition, and to enhance the transparency of management; on the other hand, it will be conducive to data collection and comprehensive analysis. Under the trend of the platformization, giving priority to the security of the ship cyber system will provide basic guarantee for the development of the new technology.

CCS believes that the development pace of intelligent ships has exceeded the industry's expectations, especially since 2016, the scientific research projects and the application and implementation hot points in the industry constantly arise. In March 2017, the shipping industry has set up the development alliance of unmanned cargo ship. Gradually increasing dependence on ship cyber system and great reduction of ship manning will help the industry's understanding of ship safety quickly transit to the security of system and network from originally emphasizing the safety of life at sea.

Explanations on implementation of *the Polar Code*

By Zhong Chenkang

In order to guarantee the navigation safety of ships sailing in north and south polar waters and reduce the environment pollution of waters, IMO published The International Code for Ships Sailing in Polar Waters (the Polar Code), and entered into force on 1 January 2017 by means of SOLAS Chapter XIV (MSC.386 (94)) and MARPOL Annex I, II, IV and V Amendments (MEPC.265 (68)). All ships docked at Arctic ports of the United States, Canada and Russia and those entering the Arctic waters or crossing the Arctic routes should comply with the relevant requirements of the Polar Code.

1. Application of *the Polar Code*

The Polar Code is goal-based regulation, its application depends on operating conditions of the polar waters for specific ships, such as ice condition, low temperature, icing, latitude, distance, escort and so on. The need for expected operating conditions determine the operational capability of the ship design, including ice class, polar service temperature (PST) and maximum waiting time (MaxETR); on the contrary, the polar operation capability of the ship design limits its polar water operating conditions and determines the polar operating limits.

The presence of sea ice in polar waters is the major challenge for ship navigation safety. The environmental condition of polar waters has significant difference in geographical and seasonal conditions, so ships that engaged in polar waters should choose operational capacity to adapt to tasks, areas and seasons, especially ice class. According to the expected navigation water situation, the Polar Code divide ships which enter into polar waters into A, B and C three categories, and determine the required ice grade, among which the ship of Class C should choose the ice conditions of the expected navigable waters, such as CCS Ice B series of ice grade, including ice-free grade.

The Polar Code is divided into PI safety measures and PII environmental measures, and their taking force and application are as follows:

(1) apply to ships certificated according to SOLAS Chapter I and sail in polar waters, the date of PI-A safety measures is as follows:

- ships built after January 1,2017 (newbuildings);
- ships built before January 1, 2017 (existing ships) should comply after 1 January 2018 at the first intermediate or renewal survey

(2) According to related Annex of MARPOL, PII-A environmental measures apply for ships operating in polar waters on and after January 1, 2017:

- Annex I: All ships (whether or not certificated in accordance with Annex I);
- Annex II: all ships carrying NLS in bulk;
- Annex IV: All ships certificated under this Annex (more than 400GT or carrying more than 15 passengers. International voyage);
- Annex V: All ships to which this Annex applies.

(3) Existing ships are exempted from the structural requirements of the Polar Code, such as breakage stability, closed bridge wing bridges, double shell protection for contaminant tanks, and so on.

2. Survey, Certification and Documentation

The compliance survey of the Polar code has no independent survey system, and adopts various types of survey of SOLAS and MARPOL:

(1) Polar Ship Certificate (PSC) and Record of Equipment (RoE)

The plan approval and survey are carried out concurrently with the other certificates of the SOLAS Convention. The validity, inspection date and signature of the Polar Ship Certificate shall be coordinated with the relevant SOLAS certificate in accordance with Clause I / 14 of the SOLAS Convention, as shown in Table 1 below.

Except for Class C cargo ships as described in the Polar Code 1.3.3, all ships which firstly apply for the issuance of polar ship certificates need plan approval, no matter it's a new or an existing vessel. For an existing ship, the extent of plan approval depends on the intended operating capacity and operational limits, i.e. ice level, polar service temperature, and maximum latitude of the navigation area, maximum rescue time, and icebreaker escort. If the ship ice level is polarized (PC), the structural strength review process can be

Table 1

No.	SOLAS Chapter I Certificate		Polar Code	
	Category	Chapter	Supplement	Section
1	Cargo Ship Safety Construction Certificate (SC)	I/12，II-1、II-2	Polar Ship Certificate (PSC) and Record of Equipment (RoE)	PI-A/Ch3、4、5、6、7
2	Cargo Ship Safety Equipment Certificate (SE)	I/12，II-1、II-2、III、V		PI-A/Ch7、8、9
3	Cargo Ship Radio Safety Certificate (SR)	I/12、III、IV		PI-A/Ch8、10
4	Passenger Ship Safety Certificate	I/12、II-1、II-2、III、IV		PI-A/Ch3、4、5、6、7、8、9、10

simplified, otherwise the ice equivalent evaluation results need to be reviewed. If the ship's polar service temperature is set above -10 ° C, the inspection requirements for winter protection can be simplified, but compliance with the winter protection and anti-icing measures shall be reviewed. The existing ship plan approval shall approve the ship's polar operation capability and restrictions.

(2) The Polar Water Operation Manual (PWOM) is under the responsibility of the shipowner and is based on operational assessment of ship, onboard equipment and systems. PWOM does not require the approval of the Administration or its RO, but it is one of the prerequisite for issuing the Polar Ship Certificate (PSC).The following aspects need to be confirmed:

- PWOM structure and content comply with Polar Code PI-A Chapter 2 requirements with the consideration of PI-B guidance;
- Information on ship operating capacity and restrictions in PWOM should be consistent with approved drawings and information;
- PWOM includes assessment methods for ice zone operation restrictions;
- PWOM contains risk-based procedures, taking into account the operational assessment report.

(3) The modification of International Oil Pollution Prevention (IOPP) certificate format. Ships for polar area navigation built on and after 1 January 2017 should be issued IOPP certificate as amended according to MARPOL Annex I. Existing ships engaged in polar water navigation:

- The original IOPP certificate can still be used, and should be issued with IOPP certificate as amended by MARPOL Annex I on renewal.
- For those existing Class A polar ships with the oil-like cargo in the equipment space not meeting the zero emission requirements for oil mixture, but having to operate over 30 days in the polar area, they need to comply with zero emission requirement on the first intermediate survey or renewal survey after 1 January 2018. An approval letter may be used to replace IOPP certificate approval.

(4) The ships sailing into the polar waters after January 1st, 2017 should use modified format of documents, including oil / garbage record, Shipboard Oil Pollution Emergency Plan (SOPEP), waste management plan. And In case of documents replacement, it is recommended to use new format documents.

3. Special Tips for implementation (Summary)

(1) Ships entering the Arctic zone after January 1, 2017 need to follow the polar code PII-A environmental protection measures, particularly the requirements for zero emission requirements for oil mixture:

- The IOPP certificate can continue to be used before it expires. Upon expiration, the owner is required to apply for renewal of the IOPP certificate in accordance with the Polar Code;
- Shipowners need to modify the ship's garbage record, garbage management plan format, and make records;
- Shipowners need to modify SOPEP on board.

(2) Ships entering the Arctic zone after January 1, 2018 need to pay attention to the implementation time (intermediate survey / renewal survey) to prepare in advance the safety measures in accordance with polar code PII-A. The ship owner needs to do the following:

- Operational assessment report, submitted to the competent authority / RO for review;
- Prepare the operating manual in the language understood by the crew and submit it to competent authority / RO for verification, but no need for approval;
- For Class C cargo ships which are considered to meet the polar code with no need of transformation or installation of equipment after the operational evaluation, if the document submitted by the owner has been validated, polar ship certificate can be issued without on board inspection.
- If the ship is not a PC ice level, an equivalent ice rating assessment is required and submitted to the Administration / RO.

Introduction of *EU MRV*

By Li Wenrui

The regulation on the monitoring, reporting and verification (MRV) of greenhouse gas emissions from maritime transport of the European Parliament and the Council (2015/757) has taken effect on July 1, 2015, and has required the company to submit the "Monitoring Plan" for each ship to the verifier approved by the EU national certification body to be evaluated by August 31, 2017.

The EU MRV regulation has entered into the implementation stage. In order to provide guidance for the implementation of the regulation, European Union Sustainable Development Forum (ESSF) has set up two expert groups on monitoring and reporting and on accreditation, and developed a series of documents to guide the implementation of the regulation from June 2015 to May 2017. As a member of ESSF accreditation expert group, CCS has been involved in the discussion and formulation of the guidance documents. At the same time, as the verifier approved by the Danish national certification body, CCS has also begun to accept the assessment of the "*Monitoring Plan*".

On June 30, 2017, the expert group of ESSF published 10 guidance documents for companies, verifiers and EU national certification bodies on the European Commission's Climate Action website, with two guidance documents for the company: "Guidelines for Formulation of the Monitoring Program" and "Guidelines for Monitoring and reporting of Fuel Consumption, Carbon Dioxide Emissions and Other Data". In order to assist clients to better understand and meet relevant contents and requirements, this article mainly explains and summarizes these two guidelines.

Guidelines for Formulation of the Monitoring Program

1.To use appropriate templates and languages

The company can use any template, but the contents shall be in accordance with Schedule 1 of the 2016/1927 Commission Implementation Rules;

The company may divide the monitoring plan into the company part and the ship part in accordance with Chapter 2 of the 2016/1927 Commission Implementation Rules and indicate that those forms belong to the company part at the beginning of the template.

If the monitoring plan is written in a language other than English, there should be an English translation.

2. To refer to existing procedures

When the contents and procedures of the existing management system are part of the monitoring plan, the company may refer to:

International Safety Management (*ISM Code*)

Ship Energy Efficiency Management Plan (*SEEMP*);

Quality, environment or energy management standards (ISO 9001: 2015, ISO 14001: 2015 or ISO: 50001: 2011);

Other internal procedures.

3. The description of the voluntary part

This section may focus on information related to the characteristics of the ship's business activities, such as cruise ships;

The information of this section can help people to understand the potential fluctuations of CO_2 emissions better during a particular voyage or reporting period, such as ship dock repair and ship failure, etc.;

The company may also add other technical features that affect the efficiency of ships, such as deck surface coating and the use of antifouling primers, etc.

Guidelines for Monitoring and Reporting of Fuel Consumption, Carbon Dioxide Emissions and Other Data

1. For ships not applicable to the requirements of Ship Efficient Design Index (EEDI), the Estimated Index Value (EIV) of the ships must be estimated according to the following ship reports:

a) Paragraph 3 of MEPC.231 (65): Bulk carriers, gas carriers, tankers, container ships, general cargo ships, refrigerated vessels, ships (bulk cargo/ liquid cargo), ro-ro cargo ships, ro-

ro vehicle carriers, passenger ro-ro ships, liquefied natural gas (LNG) ships;

b) Paragraph 5 of MEPC.233 (65): Cruise ships using non-traditional propulsion devices, including diesel propulsion, turbine propulsion and hybrid propulsion systems.

Regarding ships not covered in the above requirements, it is unnecessary to report EIV and please fill in with "NOT APPLICABLE." The calculation of EIV should be referred to MEPC.231 (65) and MEPC.233 (65).

2、The use of monitoring methods and related levels of uncertainty

Taking into account the measuring accuracy of a single measuring device (such as the flow meter at the time of refueling, the determination of density and the fuel storage in the tank), all the uncertainties of the fuel treatment process on board cannot be fully reflected. Therefore, the uncertainty level is adjusted as follows:

The monitoring method in EU 2015/757	The overall maximum uncertainty level
Method A	± 10%
Method B	± 10%
Method C	± 10%

If more specific uncertainty level is needed, you can calculate the synthetic uncertainty level according to the following formula:

$$u_c(V) = \sqrt{u(V, bunkering)^2 + u(V, density)^2 + u(\dots)^2 + \cdots}$$

3、Considerations on the monitoring of voyage and port of call for activity data

Voyage refers to the transportation of cargos/ passengers from one loading and unloading port to the next loading and unloading port. The starting point for the voyage is from the last berth (port anchorage or berth) in the loading and unloading port, and the ending point of the voyage is sailing to the first berth (the anchorage or berth in the harbor) in the next loading and unloading port. If one or two of the loading and unloading ports are both the EU ports, the voyage is the EU voyage.

Berthing at a port half way with no loading or unloading cargos or passengers can only be considered as berthing on the voyage and cannot be the starting point or ending point of the voyage.

4、Determination of the density

ASTM D 1250-80 standard, other equivalent standards or utility software shall be used to modify the air pressure and fuel density and calculate fuel quality. As an alternative, the following standard conversion factors may be used, but it should be agreed by the verifier.

0.96：RME180，RMG 180/380/500/700 or RMK 380/500/700

0.88：MGO/MDO

When two or more kinds of oil are mixed and stored in a fuel tank, the density of the mixed oil is calculated as follows:

$$\frac{\text{'A' fuel volume x Density (A)} + \text{'B' fuel volume x Density (B)}}{\text{'A' fuel volume} + \text{'B' fuel volume}} = \text{mixed fuel Density}$$

In few cases, different concentrations of fuel are mixed in a compartment. Unless the density of the oil sample is analyzed, the average density of the oil is calculated by the following formula:

$$\rho_w = \rho_{add} \times \frac{m_{add}}{m_{total}} + \rho_{exist} \times \frac{m_{exist}}{m_{total}}$$

5、Emission factors of the non-standard oil

The number of ships providing ultra-low sulfur oil (ULSFO) has increased year by year from January 1, 2015. As a new product, it has not been classified in ISO 8217. With regard to the conversion factor of such oil, the vast majority of such products have been tested between the RMA-RMD grades, with only one to two at the DMB level according to the certification laboratories.

In order to be simple and consistent, it is recommended that such new fuels use the standard CO_2 conversion factor. If the density is between RMA and RMK, the LFO emission factor 3.151 is used. If the density is between DMA and DMZ, the MGO / MDO emission factor 3.206 is used.

The formulation and publication of the guidelines by ESSF will push the implementation of MRV regulation. They are of practical guidance in clarifying the requirements for formulation of the monitoring plan and monitoring of the follow-up activity data.

The interpretation of revising the reversing test of the propulsion device in the seventh edition of *IACS UR Z18*

By Liu Zhenbing

The first edition of the uniform requirements of *IACS UR Z18* was issued in November 2001, entitled "Periodical Survey of Machinery". UR Z18 is usually associated with UR M series, and is attributed to the Survey Panel of IACS. The seventh version is simultaneously coordinated and updated based on the 4th version of UR M25, the two of which were approved synchronously in June 2017,and were published in the blue book and on the IACS website, the amendment will come into effect in July 2018 and be implemented by members of the IACS.

The background of this revision is based on the two accident reports i.e. 09/2012 and 31/2014 released by British Maritime Investigation Bureau (MAIB). Both of the accidents were due to collision between ship and tug in port and wharf caused by out of control of the reverse of the adjustable pitch propeller (CPP). After the accident, British ports and related ROs and institutions provided prevention and notification of such events, but have not formed the industry consensus. Therefore, the British Maritime Bureau of investigation consulted with IACS about the accident, considering to add requirements for trial of adjustable pitch propeller (CPP), especially the response frequency of advance and reverse should meet the expected requirements of the CPP manufacturers

After discussion, IACS GPG decided to task the machinery and survey panels to update *UR M25* and *UR Z18* to unify the trial requirements for propulsion equipment of IACS member societies, so as to eliminate safety hazards. After continued analysis and discussion, IACS survey panel eventually decided to update the existing *UR Z18* to incorporate the requirements for reversing test of *M25 UR*, at the same time to adjust the contents of the UR and revised for the first time the title of *UR Z18* as "survey of machinery", thus expanding the scope of application.

This revision is mainly about the *UR Z18* fourth section "turbine test verification". The newly added item 4.2 is as follows: if the host or auxiliary is under major repair, and the society believes that it has impact on the response parameters of the propulsion device, then the trial scope should be the same as the new ship delivery trials of similar equipment, making reverse response parameter test plan. The test requirement shall comply with the test requirements for the reversing power of the *UR M25* "main propulsion". The test is designed to test the ability to move forward and reverse as much as possible in accordance with the actual operating conditions of the propulsion device. Of course, according to the actual extent of the repair, the classification society may, as appropriate, reduce the scope of the test plan. At the same time, the original footnote at the end of the text was removed and replaced by the new clause 1.4 "inspection of merchant ships for military use". The title of the UR is revised as "machinery survey".

Among them, *UR Z18.4.2* quoted the specific requirements of *UR M25.4* and *M25.5* as follows:

1. The test shall cover the operating range of the propulsion device and take into account all the operating positions;

2. The test plan shall be established by the shipyard and confirmed by the surveyor after approval;

3. The test plan shall incorporat the specific operating parameters provided by the manufacturer;

4. Reversing parameters of the propulsion device (including variable pitch propeller blade pitch system) shall be verified and recorded in the test.

The overturn and sinking of a domestic ship during trial has once again sounded the alarm to waterborne safety. The tragedy was due to the failure to realize the risk of capsize during navigation performance test, and the unfamiliarity of the operating personnel with the performance of the propulsion system. The root of the cause was not as simple as weather and ocean current flow and other natural factors. The investigation results show that the sister ship of this type has already seen instability during reverse test when the engine rotating speed and the rudder angle reach a certain value, the reason is that the whole propulsion device parameters are not set in accordance with the manufacturer's safety value, and that the coupling risk of the dual propulsion device has not been taken into account. According to incomplete statistics, many accidents are caused by the out of control or unreasonable operation of propulsion devices, especially in bad sea conditions or narrow waterways. Various sea condition tests are based on national and industrial standards, these standards are constantly revised in order to ensure that ship's propulsion performance be satisfied and under effective control when it in the process of berthing, towing and other working conditions, by way of real condition simulation and drill under different navigation conditions.

With the revision of *UR Z18* and *M25*, in order to eliminate hidden dangers, the on-site inspection units and ship owners are suggested to collect accurately the parameters of propulsion device for new shipbuildings and ships under repair, especially the adjustable pitch propeller, at the same time to compile trial test plan according to actual conditions, and strengthen verification of reversing test of propulsion device during trial navigation or test in dock. In view of the coming into force of the polar rule MEPC.385 (94) at the beginning of this year, for the mechanical propulsion device operated in polar area, the expected environmental conditions specified in the sixth chapter, such as extreme conditions of icing, liquid freezing and increasing viscosity should be considered and corresponding functions shall be satisfied.

In Chapter 1 Section 5 item 5.9.4.9 of the "*Rules for Classification of Steel Ocean-going Ships*" issued by CCS, it clearly specifies that sea trials should be carried out and meet the satisfaction of field surveyors if the main and auxiliary machinery or steering device are under major repair. In view of the approval of the revision of the *UR Z18*, the relevant sections of the rules will be supplemented and revised, further defining the inspection requirements for shipowners and shipyards, thereby strengthening risk control and creating value for customers and society.

Requirements of *CCS Rules for Cruise Ships* to safeguard passengers' health

By Gu Yajuan

The key of cruise design is to realize the three goals as follows: safety design of luxury passenger ship, functional design for passengers' leisure experience, and design to safeguard passengers' health and safety. *CCS Rules for Cruise Ships* which went into effect on 1 January 2017 grasps accurately these three goals, provides additional notation for cruises and identifies specifically the safety requirements for cruise design; the rules also provides cruising experience design index and the requirements for passenger space, degree of comfort and passenger leisure facilities, with each part providing separately the specific requirements of different level. The rules also provides sanitation insurance design index(SEDI) and identifies the requirements of different level for passenger health and safety.

SEDI is an index to determine the health and safety capability during design and construction period, which includes three levels of 3, 4 and 5.

The facilities and equipment to guarantee healthy on cruise ships are very detailed and complicated, which involve six aspects of kitchen and dining rooms (e.g. disinfection facilities, waste bins), food storage, drinking water (e.g. water pipes, valves, halogenated / chlorination systems), waste, solid and medical waste, medical facilities and indoor air quality.

Take the case of kitchen and dining rooms, the arrangement of food treatment area, the provision to disinfection facilities or measures of public appliances and food processing and storage appliances and allocation of washing station, special-purpose garbage bin and ash bin are clearly defined in the *CCS Rules for Cruise Ships*.

Take another example, in the aspect of drinking water, the rules clearly specify the material requirements, such as drinking water tank, delivery system facilities, laboratory faucet backflow preventer requirements of transportation system, such as water pipes, valves and equipment, the requirement that drinking water storage tanks and other non-drinking water tanks or liquid tanks should not share bulkhead and the requirements that the ventilation pipes for drinking water tanks and non- drinking water tanks are forbidden to be connected with each other.

At the same time, in order to guarantee the health of passengers, the rule specifies the standard of air pollutant limit in internal spaces of cruise ship.

2017 is the first year of design of domestic cruise ships, as the research on cruise ship technology goes deeply, CCS will continue to improve the cruise technology and service capabilities, goes hand in hand with relevant enterprises and organizations to make breakthroughs in the core technology of cruise design, and to get the pearl on the imperial crown of cruise ship.

Application of alternative design method in cruise ship design

By Zhuang Lei

As a high-end passenger ship for tourism, cruise ship integrates the functions of culture, sports, catering, shopping, accommodation and sightseeing. It is staff intensive, complex in structure and compact in layout. The International Maritime Organization (IMO) convention has strict rules on large passenger ships including cruise, but to meet the specific needs and cost benefit function operation, the cruise often has innovative design which is deviated from the rules of convention requirements, for example:

(1) SOLAS convention specified that the average length and width is no less than 40 meters of main vertical zone on any deck, the total area of any deck is not more than 1600 square meters under the condition that the length and width of the maximum can be extended to 48 meters. But the cruise is usually equipped with theaters, ballrooms, banquet halls, shopping streets and other large public places, in order to avoid more bulkheads and escape stairways due to conventional design, as well as the narrowness of cabins and public places, we need to design a large main vertical zone of more than 1600 square meters /48 meters.

(2) The SOLAS Convention provides that the life-saving boats should accomodate no less than 37.5% of the total number of persons, and that the International Code for Life-saving Appliances (LSA) provides that the fixed number of members of a lifeboat shall not exceed 150. However, due to the large number of passengers on board, it is necessary to design larger lifeboats which can be accommodate more than 150 in order to avoid the problems of large number of lifeboats, loss of the cabin space and the reduction of balcony rooms brought by conventional design.

Therefore, as an effective complement to rule based ship design, alternative design methods have been widely used in cruise ship design. At present, multiple articles of the SOLAS convention allow alternative designs, including SOLAS, I/5, SOLAS, II-1/4.2, SOLAS, II-1/55, SOLAS, II-2/17, and SOLAS III/38. This provides a legal basis for the application of alternative design methods in the design of cruise ships.

Alternative design refers to measures that deviate from the prescriptive requirements of the Convention, but are intended to satisfy the stated requirements (objectives and functional requirements) with direct or indirect alternative. Different from the ship design based on the rules, alternative design method is a kind of ship design method based on the target, it breaks the limits of rule requirements

and puts safety as the design goals rather than constraints, through quantitative risk analysis, it provides a more flexible and effective selection of design and gets the optimal design scheme and the most reasonable (cost-effective) safety protection under the equivalent safety level required by the specifications.

To carry out alternative design, first of all, it is necessary to understand the intention of the Convention's requirements in a comprehensive and correct way, and then to determine the evaluation criteria of the design. Taking the application of the major vertical areas as an example, the determination process of the evaluation criteria has four steps: the first is the safety objective, which is to reduce the life risk caused by the fire. The second is the loss target, there is no one died outside the fire compartment. The third is the design objective, which is to ensure that the escape channel is in the condition of the person can bear, the personnel fled to the security zone. The fourth is performance criterion, human life safety performance criterion, and content is clearly seen in MSC.1/Circ.1552.

In the alternative design, the most widely used fire safety objective is to ensure the safety of personnel life, that is, the SOLAS convention specified to reduce the life risk caused by fire. In order to determine whether to achieve this goal, it is necessary to introduce ASET and RSET to analyze and evaluate safety of all personnel, i.e.:

(1) If the ASET is greater than RSET in all accident scenarios, no further analysis is necessary. Corresponding control measures (such as smoke management systems and equipment) can be provided to help achieve this result.

(2) If any balance in the process of withdrawal (temperature, thermal radiation, visibility and CO concentration) exceeds the numerical suggested by MSC.1/Circ.1552 (ASET<RSET), which means that the design scheme cannot ensure the safety of personnel, and need to further modified.

In terms of determining the evaluation criteria, it is necessary for ship design and layout to comprehensively analyze hazard identification. Setting up accident scenarios must take into account all the potential hazards of rationality, severity, and frequency, and consider accidents with high frequency, low risk, low frequency, high risk, and special conditions.

In setting the accident scenario, the core task of alternative design is to determine the two values i.e. ASET and RSET.

(1) determine ASET: ASET is the time to reach the human life safety performance threshold from set fire:

1) public places mean on deck above 0 to 2 meters (0~2 m);

2) other areas mean on deck above 0 to 8 meters (0~1.8 m);

ASET can be obtained by computer simulation of fire smoke spread analysis, and the commonly used computer simulation software includes FDS, SMART, Fire and so on.

(2) determine RSET:RSET through the advanced evacuation analysis method in the MSC.1/Circ.1238 circular letter to determine the maximum RSET of the fully evacuated premises. The commonly used computer simulation software includes Maritime, EXODUS and so on.

In the design of real ship substitution, the general measures that may be taken to set up ASET>RSET are:

(1) measures to increase ASET: control the fire scale, strengthen and optimize the smoke management system and etc.;

(2) measures to reduce the RSET: improve evacuation conditions, control the density of personnel, and strengthen early warning of fire.

These different measures can be combined into different design plans, and on the basis of achieving personnel safety goals, cost-benefit analysis of different design options is carried out to determine the optimal final design.

Of course, the alternative design is a kind of "Case by Case" design method, different applications have different solutions and ideas, but the basic design process is the same.

In recent years, CCS, through scientific research project and technical achievements in the high-tech ship research projects of the Ministry of Industry and Information Technology, has commanded the independent technical ability to assess alternative design, including risk assessment methods, simulation tools etc.. This provides strong technical support and guarantee to the development of luxury cruise ships and other high-tech ships in China.

Safety assessment system for application of LNG

By Tian Yuzhong

At present, relevant departments and the public have limited awareness and assessment measures for the risk of LNG accidents, which seriously restrict the rapid development of LNG industry, especially the LNG ship fuel filling industry, which has just started in recent years. The industry involves many water application projects and links, including LNG water transport, usage, port filling, filling stations and filling vessels. Its application technology is rather new with less accident cases, the risk analysis and safety assessment have not yet formed a sound system, and continuous exploring and practice are needed in the formulating process of the standard specification. Therefore, CCS cooperated with CNOOC Gas and Power Group to carry out research on LNG safe application. Based on risk analysis, accident model selection and the establishment of LNG application database, LNG quantitative risk assessment calculation program has been developed. Furthermore, LNG safe application assessment system has been developed to lay the foundation for quantitative assessment of LNG application risk, help relative personnel do rapid quantitative analysis regarding risks in the LNG application process, promote application of quantitative risk assessment in the field of LNG and push forward more rapid development of the LNG industry.

The system is designed to provide quantitative analysis for risk assessment of waterborne application of LNG. The full sense of risk assessment includes three parts of risk identification, risk assessment and risk management. The software system can be used in the relevant analysis and assessment work of the first two parts, namely, identification and assessment. The system includes three parts: the risk assessment database module, the quantitative risk analysis module and the risk assessment method module.

Risk assessment database Module

The module is mainly used for providing services for LNG safe application assessment. According to the basic process of quantitative risk assessment, the LNG application risk assessment database is divided into four types: the accident information database, the failure probability database, the physical property database and the standard specification database.

Accident Information Database: It is applied to the preparation and risk identification stage of risk assessment. In the preparation stage, it involves the acquisition of the assessment object data, the collection of historical data, the scope of the problem. In the risk identification phase, it involves the identification of potential hazards, the qualitative analysis of consequences of the accident. According to the needs of the risk assessment process, the accident information database can provide historical accident information and provide help, valuable enlightenment and guidance for the personnel involved in the risk assessment to get familiar with the object and form perceptual knowledge, helping them quickly identify working priorities and methods.

In addition, it can provide reference for qualitative analysis of consequences of the accident. The database collects and stores historical accident information, including LNG transportation, filling, utilization and production, transportation, handling and utilization of land-based natural gas and other types of accident information. At present, nearly 200 LNG carriers accidents information has been collected in domestic and foreign.

Failure probability database: It is applied to the key link of risk assessment, that is the quantitative analysis stage of consequences of the accident and the probability of the accident can be analyzed. The failure probability database can provide the failure probability of the equipment and components and the occurrence probability of the initial event, analyze the occurrence probability of the accident, and then evaluate the risk level of the accident combined with the analysis result of the consequences of the accident.

Physical property database: Another key link of quantitative analysis of risk assessment accident consequences is the post-accident quantitative analysis, mainly through numerical analysis, test analysis and other means. At present, the database mainly includes some basic physical and chemical properties of natural gas, and the component information of domestic common gas sources.

Standard Specification Database: The entire process of risk assessment will involve the selection of analytical methods, the selective principles of data, the balance of analytical results and even the arrangement of the entire process, so as to ensure the accuracy of risk assessment results, comparability and credibility. Standard specification database should be able to provide standard support for all aspects of the risk assessment to ensure that the assessment is objective and accurate. At present, the database mainly includes guidelines of CCS and LNG-related norms and the international public risk assessment standards, including relevant standards of the British Health and Safety Administration (HSE), relevant guidelines of the Netherlands National Institute of Applied Sciences (TNO) and relevant standards of the domestic chemical industry and the General Administration.

Quantitative analysis module of consequences of the accident

LNG accidents include leakage, pool fire, spray fire, diffusion and explosion. The prediction model of thermal radiation wave of different kinds of accidents, the scope prediction model, the explosion wave model and the scope model have been established. According to the calculation procedure compiled by the theoretical model, the safety distance is given by calculating the degree of harm and influence scope of the accident on the surrounding environment.

Consequence calculation of pool fire: In order to improve the application

range of the system, the consequence calculation model of pool fire increases point source model, Shokri-Beyler model, Mudan model and some other common algorithm models in terms of thermal radiation intensity, mass burning rate, tank diameter and pool fire height calculation.

Consequence calculation of spray fire: In the consequence calculation model of spray fire, the Thornton model is selected, which belongs to one of the solid flame models. In the model, the thermal radiation intensity can be calculated from the flame shape, which is more in line with the characteristic that the spray fire is longer compared with the point source model. The Thornton model has been subjected to wind tunnel experiments and field experiments, and a large number of experiments have been carried out on land and water. The consequence calculation model of spray fire has added the leakage calculation module, which can be used alone to calculate the gas leakage rate in the pressure vessel as input to the diffusion model.

Consequence calculation of the expansion of boiling liquid to BLEVE: The consequence calculation model of BLEVE is mainly used to calculate its thermal radiation intensity. The calculation model includes 5 sub-models, the maximum diameter of the fireball model, the duration time model, the lifting height model, the heat radiation flux of the fireball surface model and the target heat radiation flux model.

Consequence calculation of VCE (VCE): The VCE consequence calculation model in the system is mainly used to calculate the overpressure intensity caused by its explosion, including the calculation of the total fuel mass, TNT conversion equivalent and overpressure key parameters. The relevant calculation model mainly includes TNT equivalent model, TNO multi-energy method and multi-energy model. The system uses TNT equivalent model recommended by the safety supervision bureau. This function sets the omnidirectional scale associated with the result of calculation, allowing us to adjust the layout chart or map.

Risk Level Calculation: the various quantitative value of the accidental consequences should be analyzed through the previous disaster accidental calculation. The value also needs to be further converted to the impact of people, so as to further assess the extent of the impact of the accident and the acceptable range. HSE related algorithm model is used in the analysis of the hazards and consequences of the accident in the system. The personal risk value has been calculated and personal risk equivalent curve has been drawn in the system.

The risk assessment system includes risk identification, risk assessment and risk management. The LNG application safety assessment system will focus on the basic process of risk assessment and provide relevant auxiliary tools for risk identification and risk assessment, which includes hazard identification, consequence analysis, probability analysis and risk level calculation, as well as the basic functions of the relevant database, including the following functional modules:

- Database (data maintenance, data analysis)
- Consequences analysis (pool fire, jet fire, BLEVE, VCE consequences calculation model)
- Hazard identification (HAZID hazard identification)
- Risk level calculation (personal risk calculation model)
- Probabilistic analysis (event tree analysis model, fault tree analysis model)

Although the system is intended to provide quantitative analysis means to the risk assessment of waterborne application of LNG, its scope of application is not limited to that. Associated risk assessments such as qualitative risk assessment, semi-quantitative risk assessment and quantitative risk assessment can be achieved through the system. e.g.: hazard identification based on HAZID method; analysis through the accident tree / event tree on the accident or failure probability; accident consequences quantitative calculation of other combustible liquid or gas material leakage, diffusion, fire and explosion based on the relevant accident consequences analysis algorithm and so on.

Research on emplacement ability analysis technolgy of deep-water self-elevating drilling platform

By Xu Hui & Li Hongtao

Self-elevating drilling platform is the most widely used in the offshore oil and gas exploration, since the 1950s when the world's first self-elevating drilling platform came into use, it has been occupying an important position in the oil and gas exploration of 200m in continental shelf waters due to its strong positioning capability and good operational stability. With continuous progress and improvement of the design level, the level of construction and steel materials, the operational depth of self-elevating drilling platform has made continuous breakthroughs, Le Tourneau, F&G in America, Gusto MSC in Holland, Keppel in Singapore and other companies have launched new brand platforms which can work in waters as deep as above 350ft.

The development of self-elevating drilling platform in our country started late. For a long time, the design of self-elevating drilling platform in China

has been developed by introducing the mature design plan of foreign design companies, and then built by domestic shipyards. The operating depth of self-elevating drilling platform developed in the past is mostly within 300ft, and these platforms are unable to meet the needs of offshore oil and gas exploration as Chinese offshore oil and gas exploitation expands to the Yellow Sea, East China Sea and South China Sea and even the world from the Gulf of Bohai bay. To this end, the Ministry of Industry and Information Technology launched the scientific project on "self-elevating drilling platform brand engineering", to overcome the core technology and key system of self-elevating drilling platform of 300ft above operating depth, improving the professional manufacturing capability and localization rate of key system and supporting components, forming independent design ability, and launching our own brand of self-elevating drilling platform.

In the project of "self-elevating drilling platform brand engineering" approved by the Ministry of Industry and Information Technology, China Classification Society (CCS) was responsible for the emplacement ability research of self-elevating drilling platform. In the research of this topic, CCS combines the complex mechanism of seabed soil and platform pile boots with the actual needs of the project, forming the following key technologies:

Firstly, the ultimate bearing capacity analysis technology of seabed soil layer can be used to calculate the ultimate vertical bearing capacity and lateral anti sliding capability of soil under different depths of seabed soil according to the type and size of pile boots and the parameters of seabed soil;

Secondly, platform bottom load analysis technology, through the study on the leg into the mud depth calculation method, the specific process, analysis principle and acceptance criteria of leg penetration depth analysis is established, which can be used for calculating the lowering speed of different legs and the bottom load response of the platform under the speed during positioning.

Thirdly, platform instrumentation capability analysis technology, the specific procedures to analyze leg penetration depth, the principle of analysis and acceptance criteria are developed, the relationship between the instrumentation resistance and instrumentation speed, soil strength ratio, soil thickness are established, which can optimize the depth of the leg into the mud and evaluate the puncture depth analysis according to the soil geological conditions;

Fourthly, platform uplift resistance analysis technology, through the study of the pile pulling resistance and the elastic model of soil, the depth of the pile boots and the influence mechanism of the non-speed, the calculation method of the pile pulling resistance of the platform is formed;

The above analysis technology has important significance to ensure the safety in the process of platform emplacement, the seabed soil ultimate bearing capacity analysis can calculate the bearing capacity of the soil at different depths, ensuring that during the platform operation process, pile foundation has sufficient compressive strength and anti-sliding ability; the calculation of platform bottom load can avoid damage caused by collision between leg / pile boots and seabed; analysis of instrumentation can calculate Platform inserting resistance, forecast leg penetration depth and prevent puncture risk of platform; the pile pulling analysis can avoid pile pulling accident caused by platform pile shoe too deep into the mud.

With the depth of operating water of the platform increasing, the length of the platform leg has also increased, risk prediction during assembling process becomes more difficult. The study outcome can effectively assess the platform puncture risk in emplacement process, collision risk, and uplift risk for platform from the position, to effectively guarantee the safety of emplacement/off position of platforms.