Partnership

Edited and Printed by CCS 2016.8 / The 22nd issue in total

Warmly Celebrate the 60th Anniversary of the Founding of CCS

60

Always on the road

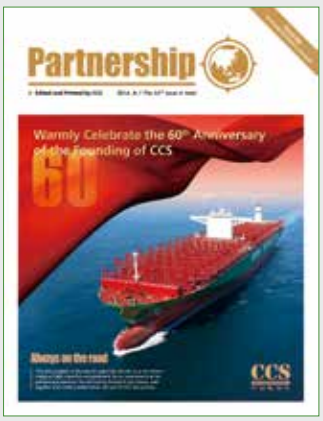
The accumulation of the past 60 years has left with us a rich history; made our faith more firm and persistent; let us understand that the partners are precious. We are looking forward to join hands, walk together and create a better future with you for the new journey.

CCS
CHINA CLASSIFICATION SOCIETY
中国船级社

Partnership

The Forth issue in 2016
(The 22nd issue in total)

(Internal data, free of charge and welcome to communicate)



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Sender Object: Manager and technical staff
Printing party: Beijing Tiancheng Printing Co.,Ltd.

微信号：cssp1999

Wechat public ID

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Content

CCS Fleet Exceeded One Hundred Million Tonnage

On July 28, 2016, with the VOLC "YUAN ZHEN HAI" entering China Classification Society (CCS) fleet, CCS survey fleet broke the record of one hundred million in gross tonnage. As a significant milestone on the way towards international first-class classification society, it opened CCS rapidly-progressing new journey.

At this new starting point, behind "one-hundred-million-ton classification society", there are CCS standards and rules widely recognized by the world, business-skilled and highly-specialized and qualified ship survey team, governments' authorization by 40 countries or regions and 34 overseas branches worldwide; there are stronger strength, firmer faith and milestone in realizing the dream of being "world-class". It is like a new impetus injected into the new voyage, which will certainly inspire our people to stride forward towards the new goal.

CCS Mr. Sun Licheng Takes Over IACS Chair

On June 29, 2016, CCS President Sun Licheng was elected as the new Council Chairman at the IACS 73rd Council Meeting in Washington. The term is from 1 July 2016 to 30 June 2017.

The IACS Chairmanship has been handed over to CCS President Sun Licheng from ABS President Christopher J. Wiernicki. Regarding Christopher's contribution, Dr. Sun Licheng commended:

Under Christopher's chair, IACS established Cyber System Committee, smoothly completed the IMO GBS audit of HCRS on tankers & bulk carriers, maintained coordination with international maritime legislators and industries and strengthened cooperation between IACS and IMO.

Dr. Sun continued to express: I will devote to IACS in making active development and meeting various challenges. In the future year, IACS will make efforts in promoting several key issues, including further work on compliance with IMO Goal-based Standards, deepening application and research of cyber system and promoting application and research of new generation survey technologies, in order to give full play to IACS technical leadership, strengthen good cooperative relationship with IMO and maritime industries, optimize the IACS organization and workflows and continue to improve the members'quality performances.

CCS 2016 Extraordinary Council Meeting & 60th Anniversary Symposium Held in Beijing

On the afternoon of August 1, the CCS 2016 Extraordinary Council Meeting & 60th Anniversary Symposium was held at CCS Mansion, Beijing.

He Jianzhong, Vice Minister of Transport, attended the meeting and delivered an important speech. Leaders from competent authorities, military and police units as well as related enterprises from industries of shipping, shipbuilding, energy and financing participated in the event.

He Jianzhong spoke highly of CCS' achievements over the past 60 years, its unique role in the fields of shipping, shipbuilding and offshore engineering, and its important contributions in ensuring the waterborne transport safety of the country and in helping the country enhance the shipping competitiveness and the ability of international maritime discourse. He also required CCS to continue its exploration in technology leadership, globalization and talent training so as to move up to a new level.

After making scientific analysis of the new situation faced by shipping development, He Jianzhong stressed that firstly CCS should take advantage of the supply-side structural reform to enhance technical level, give rules and standards a leading role, constantly optimize the standard for smart ships and green ships and better serve the transformation and development of shipping and shipbuilding based on more scientific standard, more strict quality system, more advanced technical application and more solid technical survey; secondly CCS should be oriented by serving the national strategy implementation, seize the new opportunities of international capacity cooperation to accelerate the internationalization process, increase distribution network, increase international talents cultivation, play a greater role in the international maritime stage, actively take part in the establishment of international maritime technical standards, and constantly improve our international voice and influence to solve maritime technical problems; thirdly, CCS is to enhance competency as the basis, comprehensively strengthen the talent team construction, further improve talent incentive mechanism, strengthen establishment of high-tech personnel, especially leading talent, ship surveyor team and the management talent team, to provide personnel guarantee to promote construction of first rate international classification society.

Sun Licheng, CCS Chairman and President, delivered a report recalling the development of CCS over the past 60 years. He systematically reviewed the course of development and achievements of CCS since establishment, summarized the development experience accumulated over the period, and looked into the development vision and target in the coming “Thirteenth Five-year Plan” period.

Sun Licheng said, during the past 60 years, CCS has always been sharing a common fate with the nation and industry to achieve leap-forward development and made a brilliant performance: classed fleet has covered all kinds of ships and high-tech ships, the fleet has over 100 million tons; rule and standard system, technical service ability have been widely accepted by domestic industry; CCS has released the world's first "Rules for Green Ships", “Rules for Intelligent Ships" and other standards; has chaired the International Association of Classification Societies for three times, actively participate in the activities of the International Maritime Organization, promote the upgrade of China maritime status in the global maritime domain, contribute our powers to the sustainable development of international maritime affairs; in the offshore marine engineering service area, CCS has become one of the few classification societies to carry out deep-sea marine services; CCS has always

considered serving the national strategy as its mission, dedicate itself to the "four development" in transportation; actively serve transformation and upgrading of related industry; provide technical service and support for national strategy such as "the Belt and Road", "building a marine power", "the Yangtze River economic belt", "national energy security strategy" and etc.; provide powerful technical support for some major events and incidents such as "Libya evacuation", "Gulf of Aden escort", "Oriental Star rescue" and etc.

Sun Licheng said, during the "13th Five-Year" plan period, CCS will fully implement the line, principles and policies of the 18th CPC National Congress, serve the "four development" in transportation in accordance with the requirements of "innovation, harmony, green, open and sharing" concept, put into practice the general requirements of "internationalization, modernization, socialization, good service", take "building a marine power, shipping power, shipbuilding power" as its mission and stand on the strategic height of internationalization to maintain industry-leading business scale and good performance, continuously enhance the technical and service capacity and level in order to become the most popular international classification society, and realize the objective of building the world's first rate classification society.

Cao Gang, Deputy Inspector of the Equipment Department, Ministry of Industry and Information Technology; Wang Daning, Deputy Director of the Certification and Accreditation Administration of the People's Republic of China; Zhou Yanli, Vice Chairman of the China Insurance Regulatory Commission; Wan Min, President of China COSCO Shipping Corporation Limited (COSCO Shipping); Dong Qiang, Chairman of China State Shipbuilding Corporation (CSSC); Sun Bo, President of China Shipbuilding Industry Corporation (CSIC); Yuan Guangyu, Vice President of China National Offshore Oil Corporation; Sun Ping, Vice President of the Export-Import Bank of China; and other executives delivered speeches from their respective perspectives. They reviewed the long-term, deep and friendly cooperation with CCS, analyzing the new situation and characteristics of relevant industries, expecting CCS to continue exerting its role of technical guidance to accelerate technical innovation and deepen mutual cooperation, in a bid to make greater contributions to the building of China into a strong ocean, shipping, shipbuilding and quality country.

During the meeting, CCS signed strategic cooperation agreements with China COSCO Shipping, China Merchants, CSSC, CSIC, Dalian Maritime University, and also a survey service agreement with Sinomarine.

CCS Signed Bilateral Agreements with Five Units

On August 1, on the occasion of her 60th anniversary, CCS signed strategic cooperation agreements with China COSCO Shipping Corporation Limited (COSCO Shipping), China Merchants Group, China State Shipbuilding Corporation, China Shipbuilding Industry Corporation, Dalian Maritime University, and a survey service agreement with Sinomarine.

In the future, CCS will work together with the agreement signing parties to further deepen mutual cooperation and support them to enhance competitive edge in the world and promote their position in the global market through complementing each other with respective advantages in the field of technology, research, management and training, with a view to making contributions to the transitional development of shipping and shipbuilding and other related industries.

CCS Released the World's First Implementation Guideline for LNG Carrier Serving as Floating Storage Unit

Recently, China Classification Society (CCS) released the world's first Implementation Guideline for LNG Carrier Serving as Floating Storage Unit, which will come into effect on September 1, 2016. The guideline includes technical requirements in aspects of assignment of class notation, adaptability condition evaluation, connecting system, communication system, emergency system, mooring systems, compatibility assessment, cargo handling safety and risk assessment. The guideline closely relates to the latest needs of the industrial sector and follows the global development hotspots and combines theory with practice, playing an important role in promoting and guiding the development of LNG floating storage unit.

CCS Will Release *Guideline for VLGC Construction Survey*

Recently, a key research project of China Classification Society (CCS), Research on Key Technologies of Very Large Gas Carrier (VLGC) Survey, was successfully approved by experts.

The project relies on CCS's first VLGC survey of an 83000m^3 very large full-cool LPG carrier with an A-shaped independent liquid cargo hold tank. Based on the successful completion of every field inspection and conscientious sum-up of experiences, the project carried out deep research in aspects of construction and installation of A-shaped independent liquid cargo hold tank, low temperature steel welding technology, diamond-shaped tank insulation materials and laying technology, cargo handling systems and ship gas test, making a breakthrough in key technologies of construction survey.

According to the results of the project, CCS will prepare and publish Guideline for VLGC Construction Survey. As the first CCS technical guidance document on VLGC construction survey, the guideline will put forward clear requirements on hull structure, cargo containment systems, cargo handling systems, gas test and other survey points and procedure. Being informative, clear and strongly operational, the guideline will provide quality standard and controlling instruction for the construction of very large full-cool LPG carrier with an A-shaped independent liquid cargo hold tank, and will also technically support surveyors during their construction survey.

CCS is Authorized by MCI to Issue Ship Survey Certificates

Maritime Cook Islands (MCI) approved and authorized China Classification Society (CCS) the authority of issuing survey certificates for Cook Islands flag vessels. This will increase opportunities for Cook Islands flag vessels open up in China and the ship owners from the Cook Islands will also benefit.

Cook Islands Owners can enjoy CCS certification services, including International Safety Management (ISM), International Ship and Port Facility Security (ISPS) as well as Maritime Labor Certificate (MLC). To save cost for ship owners, the more important thing is to uphold the highest standards of certification, promote and protect the safety of life and property at sea, and prevent marine pollution.

The CEO of MCI, Mr. Glenn Armstrong, said, "We are very pleased to be working with China Classification Society and we look forward to continuing improving our products and services." The president of CCS, Mr. Sun Licheng also expressed the satisfaction about the cooperation. He said, "It's our pleasure to cooperate with MCI, and we will continue to provide better services to the maritime industry to ensure safe transport and clean ocean."

CCS Will Provide the Industry with Ship Type Technical Services Basing on the Latest Requirements in Large Container Ship Rules

Basing on the recent-year container ship accidents and requirements of international maritime community, the International Association of Classification Societies (IACS) released the Uniform Requirements (UR) S11A and S34 for container ships in 2015, which will come into effect from July 1, 2016 .

S11A makes requirements for container ships' longitudinal strength; S34 is about functional requirements for finite element analysis of container ship. Compared with S11, S11A adjusted wave loads, which means the strength requirement of some areas has increased, while S34 added direct calculation to verify operating condition of container ship.

China Classification Society (CCS) took full participation in the formulation of S34 and S11A, and made a comprehensive upgrade of the large container ships specification (including descriptive rules and direct computational requirements) combining research results of related research projects in large container ship, while incorporating the S11A and S34 requirements. CCS 2016 Amendments to Rules for Classification of Sea-Going Steel Ships which includes S34 and S11A has been published on the official website of CCS, and it will take effect on July 1, 2016. At the same time, in order to coordinate the launch of the new specification for container ship, CCS developed special calculation software to meet the new container ship UR.

Based on the full technical preparations, CCS provides the industry with the technology services of ship type development. Recently, CCS completed the ship type approval evaluation for a 14500TEU container ship of CSSC, the result of which shows that the type of container ship is in compliance with CCS rules and also meets the requirements of S34 and S11A.

In addition, through a series of container ships classification services, CCS has developed large container ships assessment techniques like lashing, slamming, springing, whipping, vibration and noise for specific route and formulated risk control measures and technical requirements, and will continuously provide the industry with comprehensive technical services in the design and development of container ship.

Launch of CCS Ship Construction File Archive Center Website

China Classification Society Ship Construction File Archive Center (CCS SCF Archive Center) website (http://www.ccsscfac.org.cn) was formally launched on August 1, 2016.

The center was approved by Ministry of Transport and Ministry of Industry and Information Technology, established and independently operated by CCS. As a public welfare ship archive information service institute, it aims to assist the global shipbuilding and shipping industry to fulfill the mandatory requirements on goal-based ship construction standards (GBS) in item II-1 / 3-10 of Safety of Life at Sea Convention (SOLAS), which came into effect on July 1, 2016. Construction and operation of the center is in accordance with SCF Industry Standard and its Supplementary Guidance (SCF IS/SG) established by the shipbuilding and shipping industries together with CCS, and also in accordance with requirements of ISO/IEC 27001/20002/20000.

The Center provides 24-hour safety management applications and emergency services of global ship construction files for shipping industry customers from shipbuilding, shipping, classification societies and maritime authorities. Users can upload, maintain and browse ship data and documentation on the website. The centre takes multiple security measures to protect intellectual property; the website only allows access right holders to operate online.

The center will provide safe, convenient and real-time file services to the maritime community. Applications for shipbuilding files from global customers will be accepted from this date.

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An MOU was Signed Between CCS and Fujian Cruise Ship Company

July 26, 2016, an MOU signing ceremony between China Classification Society (CCS) and Fujian Cruise Ship Investment Corp. was held in Fujian Shipping Company. Mr. Sun Feng, vice president of CCS, Mr. Chen Shi, head of CCS Rules & Technology Center, Mr. Zong Dafa, general manager of CCS Fuzhou Branch, Mr. Yang Jinchang, deputy general manager of Fujian Provincial Communication Transportation Group, general manager of Fujian Shipping Company and managing director of Fujian Cruise Ship Investment Co., Ltd., Mr. Chen Guangcan, deputy general manager of Fujian Shipbuilding Industry Group, Mr. Li Zhenjun, managing director of Xiamen shipbuilding Industry Company and other responsible persons from CCS Classed Ship in Service Department, Cruise Project Team, Fujian Shipping Company and Fujian Cruise Ship Company, in total more than 20 people, attended the signing ceremony.

Fujian Cruise Ship Company was set up on April 6 this year. The signing of MOU between Fujian Cruise Ship Company and CCS is an important measure to accelerate the construction of cruise ship body. After the signing, the two parties will carry out in-depth cooperation in the field of cruise ship development, design, construction and operation, giving full play to the advantages of backwardness like more accurate positioning and higher technology starting point, and lead Chinese cruise industry chain to become bigger and stronger.

In the several months since the setup of Fujian Cruise Ship Company, Fujian Shipping Company earnestly fulfilled its management responsibilities as the cruise company's largest shareholder, promoted the cruise ship project by carrying out multi-round, multi-level, multi-angle and in-depth discussions with CCS, foreign classification societies, Japanese cruise inside building company, CSSC and many other professional organizations, and helped and guided the cruise company to research comprehensively regarding the relevant tourism market, the cruise construction program, ship type selecting, the ship's main dimensions, the onboard function set, etc., laying a solid foundation for cruise building.

In the future, Fujian Cruise Ship Company will be based on domestic demand and overlook international market, with the goal of providing experience combing both Chinese cultural characteristics and international luxury cruise, works on building Chinese best luxury cruise brand in the southeast coastal area.

9,400TEU Container Leading Ships Surveyed by CCS Undocked

Recently, 5 container leading ships H3015 of 9,400TEU surveyed by CCS were undocked smoothly. These ships are built by Shanghai Jiangnan Changxing Shipbuilding Co., Ltd. for China Cosco Shipping, with 299.9 m in length, 48.2 m in moulded breadth, 24.8 m in moulded depth, design draft of 13 m and design speed of 21.5 knots. By integrating the most advanced shipbuilding technology, they are the typical ships with high added value and high technology.

This ship type is the main ship type of new panamax. Under the premise of keeping the original principal dimension and loading capacity, and based on cargo types, speed range and loading demands of target routes, hull lines and layout are optimized and main performance index and green environmental protection level have been significantly improved.

This ship applied for the class notations of CCS green ships and declaration of hazardous materials of Hong Kong convention, with ballast water treatment device installed in advance. At the same time, the one-person pilot bridge is designed by integrating the most advanced navigation control system. In addition, this ship adopted CCS new class notations of lashing force calculation in specific routes for the first time, met the new requirements of CSS CODE convention, complied with the development trend of green, environmental protection, low carbon and modernization, met a series of requirements including optimizing the operational performance, improving safety factors and reducing operational costs for ship owners.

"Shandong Zheng Tong" Surveyed by CCS was Selected in the World's Best 50 Ships

Recently, the 250,000 ton ore carrier "Shandong Zheng Tong" surveyed by CCS during construction was selected in the world's best 50 ships of the world's boutique ship type magazine SIGNIFICANT SHIPS, which became the design benchmark of new generation of VLOC. As the world's first 250,000 ton ore carrier, "Shandong Zheng Tong" is designed by Shanghai Merchant Ship Design and Research Institute (SDARI), built by Qingdao Beihai Shipbuilding Heavy Industry Co., Ltd., and classed with CCS.

In terms of design technique, through improving ship lines and the efficiency of propeller, optimized bulb bow and other advanced technologies, ship resistance is reduced and ship speed is improved so that the fuel consumption can be reduced by 25% compared with the same capacity; in terms of operational efficiency, this ship can realize rapid loading in single tank and single time and shorten the time of loading and unloading to the maximum extent, so as to improve ship operational efficiency and reduce ship operational costs; in terms of safety and environmental protection, EEDI met the requirements for 2024 of IMO, and renewable materials were adopted, for ensuring that in the process of scrapping ships, the materials can be recycled and reused to the maximum extent. In addition, "Shandong Zheng Tong" is provided with the high voltage shore power system, which has reduced the energy consumption when the ship is calling at the port, and reduced pollution. This system has been selected in the terminal ship shore power demonstration project of Ministry of Transport.

SIGNIFICANT SHIPS is sponsored by The Royal Institution of Naval Architects (RINA), which each year conducts screening and comprehensive consideration for the design technique, technology proportion, ship operations of newly delivered ships from all over the world in that year, and then selects the world's best 50 ships.

China's Most Advanced Comprehensive Marine Scientific Research Vessel "Xiang Yang Hong 01" Surveyed by CCS Put into Use

Recently, China's most advanced comprehensive marine scientific research vessel "Xiang Yang Hong 01" surveyed by CCS was delivered to the First Institute of Oceanography, Soa in Qingdao; at the same time, this ship was listed to China marine research vessels, and will undertake research task of the whole water depth of global waters.

"Xiang Yang Hong 01" is a scientific research vessel of unrestricted service, with full load displacement of 4,980 tons, 99.8 m in length, 17.8 m in moulded breadth and endurance of 15,000 miles. It has electrical propulsion and dynamic positioning ability, integrating multi-disciplinary, multi-function and multi-technology means. By meeting the demand of deep sea multi-disciplinary cross-over studies, it is a marine mobile laboratory and test platform for marine science basic research and high-tech research and development.

The shipborne survey equipment of "Xiang Yang Hong 01" are divided into water detection system, air detection system, seabed detection system, deep sea detection system and remote sensing information field verification system, covering some subjects like geophysics, physical oceanography, marine remote sensing, marine acoustics, marine atmosphere, marine meteorology observation, marine organism and marine chemistry. It has three-dimensional comprehensive ocean detection ability for atmosphere, sea level, water and seabed, and the detection depth can reach 10,000m, meeting the investigation demand of global marine environment and resource science. This ship has a high level of automation and informationization, characterized by one person navigation, unattended machinery space, and full automation of monitoring and alarm; it has satellite broadband network, meets marine communication and achieves ship-shore video conference.

CCS Completed the First Ship Matching Project of the Republic of Uzbekistan Aid by Ministry of Commerce

Under the guidance of national strategic policy of "the Belt and Road", in order to realize the principle of "co-discussion, co-construction, sharing", after the Ministry of Commence organized experts to carry out a series of investigation for the Amu Darya water system of the Republic of Uzbekistan, which is an important country of Silk Road Economic Belt and Shanghai Cooperation Organization (SCO), Chinese Ministry of Commence and Uzbekistan Ministry of Foreign Trade and Economic cooperation signed a cooperation agreement of 20 dredgers and ship matching project on September 9, 2013 during President Xi Jinping's visit to the Republic of Uzbekistan.

At present, the first ship matching (2 dredgers, 2 life pontoons) passed the mid-term check and acceptance which were organized by Ministry of Commence in May, 2016, and then Chongqing Donggang Marine Industry Co,. Ltd. of CSIC completed ship modular decomposition, painting, packaging, loaded from the shipyard on June 12, 2016 and then shipped to Uzbekistan through Huoerguos ports in Xinjiang, which set off a new journey of the silk road of Chinese shipping industry and presented a lavish gift to the comprehensive strategic partnership between the two countries.

Chinese Ministry of Commerce paid high attention to this project, designated China Classification Society to carry out survey and certification and entrusted China Classification Society Industry Corporation (CCSI) as the supervision unit. CCS attached great importance to survey service of "the Belt and Road" Uzbekistan aid project which formally started on November 5, 2015. In order to ensure smooth implementation of the project and the construction quality of the whole sets of ships, CCS adhered to the principle of "mature technology, safety and reliability, economical and practical, energy conservation and environmental protection" proposed by the Ministry of Commence. Plan approval and site surveyors were conscientious and checked the quality very seriously; for the technical quality difficulties in the process of construction, they carried out project analysis, coordinated and communicated with related parties, and provided CCS systematic technical support services. Through the joint efforts of ship type design units, key products matching enterprises, shipyard and supervision parties, ship type compliance certificate was issued on May 24, 2016, which laid a solid foundation for the smooth shipment of this project. Subsequently, surveyors will go to Uzbekistan to carry out validation test after reshipment according to the progress of the project, and continue to provide high quality survey technology service to this batch of dredgers and matching ships.

CCS Issued the World's First Approval Certificate of Middle-low-speed SCR System Principle

Recently, CCS issued the world's first approval certificate of middle-low-speed SCR system principle to Sunrui Marine Environment Engineering Co., Ltd. It filled the blank of the field of national low speed SCR system, successfully broke through the monopoly of foreign manufacturers in this field, and improved the development and manufacturing ability on domestic ship matching equipment.

CCS Boosts the Construction of Wuhan Shipping Center

On July 22, 2016, the "ship technology and marine products online trading platform" founded by Wuhan Shipping Exchange were opened. Through this platform, shipping companies can carry out online ship technology trade, publish and purchase related marine products.

The conference was attended by Wuhan Xingang Management Committee vice director Li Huaijun, chief engineer Liu Zhenxing, Wuhan Shipping Exchange director Li Biwu, Wuhan Science and Technology Bureau vice director Zhao Feng, CCS Wuhan branch general manager Wang Zhigang, Wuchang Shipbuilding Industry Group Co., Ltd. vice manager Wang Weiling, Changjiang Ship Design Institute director Xu Wei.

It is understood that shipbuilding and ship design are the prominent advantages of Hubei ship industry. In 2015, the shipbuilding ability exceeded 4 million DWT in Hubei province and the overall output in ship industry reached up to 70.47 billion yuan, ranking in the front of this area domestically.

Qubo, minister of the department of ship trade, Wuhan Shipping Exchange, said, now the ship technology and marine products trading market are relatively fragmented, and the concentration is not very high; because resources cannot be shared, there is no multilateral cooperation; characterized by high technology, this niche market is a sunrise industry with high potential, which needs a powerful platform to step in.

Wuhan Shipping Exchange is an important gripper of Wuhan Shipping Center and the head of the development of Wuhan modern shipping services. In order to promote the healthy and rapid development of the industry, Wuhan Shipping Exchange and Wuchang Shipbuilding Industry, Qingshan shipyard and other shipbuilding industry, CSIC 461 yard, China Space Sanjiang Group, Hubei Difeng Ship Technology, Wuhan Jiangnan Anchor Chain Co., Ltd. and other marine products production enterprises, Wuhan University of Technology, CSIC 712 Institue, Changjiang Ship Design Institute and other universities and research institutions, jointly created ship technology and marine products trade market.

At the same time, Wuhan Shipping Exchange signed a strategic cooperation agreement with CCS Wuhan branch. The two sides will cooperate with each other on promoting ship technology commercialization and marketization and jointly developing marine insurance and other businesses, exploit the resource advantage, jointly promote the structural reform of ship market, expand ship trade market and rapidly promote the construction of Wuhan Shipping Center.

Marine Navigation Radar Product Technology and Survey Training was Held in Shanghai

From June 20 to 22, 2016, CCS navigation radar product technology and survey training was held in Shanghai.

As the implementation of the national marine development strategy and rapid development of national shipbuilding industry, national ship matching equipment is increasing. The domestic research and development of navigation radar which integrated analysis calculation, image processing, microwave receive and dispatch, signal processing and other technologies with high-tech added values is too less, which is in the short slab condition of ship matching. But under the vigorous support of the country for shipping industry, it is undergoing the fundamental change. Now the domestic navigation radar enterprise has successfully developed the advanced marine navigation radar (including those with independent intellectual property rights) on ships engaged on international voyages. Therefore, survey technology and service demand is the top priority and need to be improved.

There are 37 people who are from the survey business departments of products, ships in service, construction and plan approval participated in the training. The contents of training were from the basic knowledge of marine navigation radar to the convention requirements background; from key components, key technology to the recognition and survey key points and the latest convention and standard requirements; from the comparison between national and international radar to the technology analysis of the development trend of radar in the future.

“Marine Oil 643” Three-purpose Working Boat

As a deep-water three-purpose working ship and designed by Shanghai Ship Research and Design Institute, "Marine oil 643" is built by Fujian Mawei Shipbuilding Limited for China Oilfield Services Limit. The ship meets the related requirements and regulations on sea-going tugs, supply ship, cast anchor handling vessel and oilfield guarding ship issued by CCS and China National Offshore Oil Corporation.

As a deep-water three-purpose working ship and designed by Shanghai Ship Research and Design Institute, "Marine oil 643" is built by Fujian Mawei Shipbuilding Limited for China Oilfield Services Limit. The ship meets the related requirements and regulations on sea-going tugs, supply ship, cast anchor handling vessel and oilfield guarding ship issued by CCS and China National Offshore Oil Corporation.

The whole ship has fully welded steel hull, transverse frame and a continuous main deck. The main deck is equipped with a layer of long forecastle and a short forecastle and on the second forecastle deck there is a three tier deckhouse. There are double bottom and the local platform deck under the main deck, and the cabin area is double bottom and double hull.

The vessel (including hull, marine engine, electric and special equipment) are designed, constructed and tested according to the rules and regulations of China

Classification Society (CCS), and has obtained the following class notations:

★ CSA Offshore Tug / Supply Ship, Stand-By Ship, Anchor Handling, Ice Class B,In-Water Survey

★ CSM AUT-0 , DP-2,

“Nan Yu 6” Full Pressure Liquid Ammonia Transport Ship

On April 18, 2016, China's first full pressure liquid ammonia transport ship was successfully delivered in Zhejiang Eastroc Shipbuilding Co. ltd. The ship is 99.97 meters in length, 7.20 meters in depth, full load displacement of 5854 tons, design speed of 13.5 knots, unlimited navigation area, and an additional notation of navigation in moderate ice condition area. Goods maintenance system adopts C type independent liquid tank, cargo tank is made of low alloy steel and loading condition minus 30 DEG C, pressure 1.76Mpa, single pot weighs more than 370 tons with capacity of 1800 cubic meters. It is currently the liquid ammonia tank vessel with the largest volume. The total capacity of the ship is 3600 cubic meters, and it can meet the domestic demand for ammonia transport after putting into use.

“NEW MINGZHOU 60” Container Ship

“New MINGZHOU 60”, is an international sea-going container ship built by Guangzhou Wenchong Shipyard Co., Ltd. and owned by Ningbo Ocean (Hong Kong) Co., Ltd. The ship is of 147.90m in length, 23.35m in width, 11.50m in depth, 9998 tons in total, 5122 in net ton, 13280.70 dwt, and 1098 TEU, 21rated crew, unlimited navigation area, 8730kw host power. The ship is stern engine container ship with steel, single deck, combination framing style, equipped with forecastle deck poop, single propeller, rudder and single diesel engine with gear box drive. The hull structure is strengthened according to the class B ice area navigation, with underwater inspection mark, can be loaded with dangerous goods and hold the international harmful substances list compliance certificate. The whole ship is equipped with 5 cargo holds, the container stacking layer is 7 on the deck, and 4 layers inside the cargo hold.

“Ding Heng 15” Chemical / Oil Tanker

“Ding Heng 15”, owned by Shanghai Dingheng Shipping Co., Ltd., is an international sea-going chemicals / oil tanker built by Ningbo Zhenhe Shipbuilding Co., Ltd. The vessel is 83.50m in length, 12.20m in width, 6.00m in depth, 4.60m in design draft, 15rated crew, unlimited sailing area, design load capacity of 2000 tons, gross tonnage of 1821, the host power of 1324kw. The ship is steel, double hull and double bottom, single deck, combination framing style, equipped with forecastle deck poop, single propeller, rudder and single diesel engine with gear box drive, stern engine type II chemicals ship, at the same time it can load oil with flash point below 60 DEG C.

“Tian Zhen” 36 Thousand Ton Multi-purpose Cargo Ship

“Tian Zhen” is the first ship of four multi-purpose ships built by Huangpu Wenchong Shipyard Co., Ltd. for COSCO Shipping Co. This is a series of ship named “Tian Zhen”, “Tian Le”, “TianQi”, “Tian Jian” and the plan approval and construction survey were conducted by China Classification Society. The ship is 189.99m in length, 28.5m in width, 15.8m in depth, 26770 tons in total, net ton of 11416, with four cargo holds, strong loading capacity, and can carry a variety of bulk cargo, complete sets of equipment, containers and other large components. The ship is arranged with movable second deck hatch cover, which can be adjusted according to the size of the goods.

“Ruian Sity” General & Bulk Cargo Combination Ship

“Ruian City”, owned by Xiamen ocean shipping company, is an international sea-going general & bulk cargo combination ship built by Shanhaiguan Shipbuilding Industry Co., Ltd., The ship is 179.95 meters in length, 32 meters in width, 15 meters in depth, 10.50 meters of draft design, 29 rated crew, unlimited navigation area, and carrying capacity of 37930 tons, 25769 in gross tonnage, and host power of 6100 kilowatts. The ship is stern engine ship with steel, double hull and double bottom, single deck, combination framing style, forecastle, single propeller rudder, and 4 cranes on the main deck installation. There are five cargo holds in the whole ship from bow to stern. No.1 cargo hold can be loaded with class 1 and 3 packed dangerous goods defined in IMDG Code definition, NO.2/NO.4 cargo holds have two decks that can be removed, No.3 cargo hold can be subdivided according to the loading requirement, which will increase the flexibility of goods loading, and improve cargo space utilization rate.

The World's First Implementation Guidelines for LNG-FSU was Published by CCS

By Qi Guili, Cheng Kang & Gan Shaowei

In early 2016, CNOOC "Hai Yang Shi You 301" navigated to Indonesia to operate as a floating storage unit (FSU). In order to ensure the safety of operation, CNOOC entrusted China Classification Society (CCS) to carry out the adaptability research. After two months' study, CCS conducted a comprehensive analysis for LNG-FSU from the angle of safety, reliability, feasibility and operability of technical requirements, and completed the Adaptability Research Report for "Hai Yang Shi You 301" as FSU, the Operational Guidelines for "Hai Yang Shi You 301" as LNG-FSU, and Hazard Identification (HAZID) of Design Plan of "Hai Yang Shi You 301" as FSU. Based on the results of three special research projects, CCS published Implementation Guidelines for LNG-FSU (hereinafter referred to as LNG-FSU guidelines), which satisfactorily passed the review by more than 30 experts and representatives from maritime regulators, shipping companies, energy companies etc. At present, LNG-FSU guidelines have been formally published as the world's first Implementation Guidelines for LNG-FSU, and will come into force on September 1st.

Figure 1: "Hai Yang Shi You 301" operated in Indonesia as FSU

The overview of the guidelines

LNG-FSU guidelines are divided into three parts, i.e. general, LNG-FSU technical requirements and LNG-FSU special requirements. With LNG carriers as the original version, additional technical requirements for FSU were added, so as to ensure the safety of LNG-FSU from three aspects. The specific framework of guidelines is as shown in figure 2.

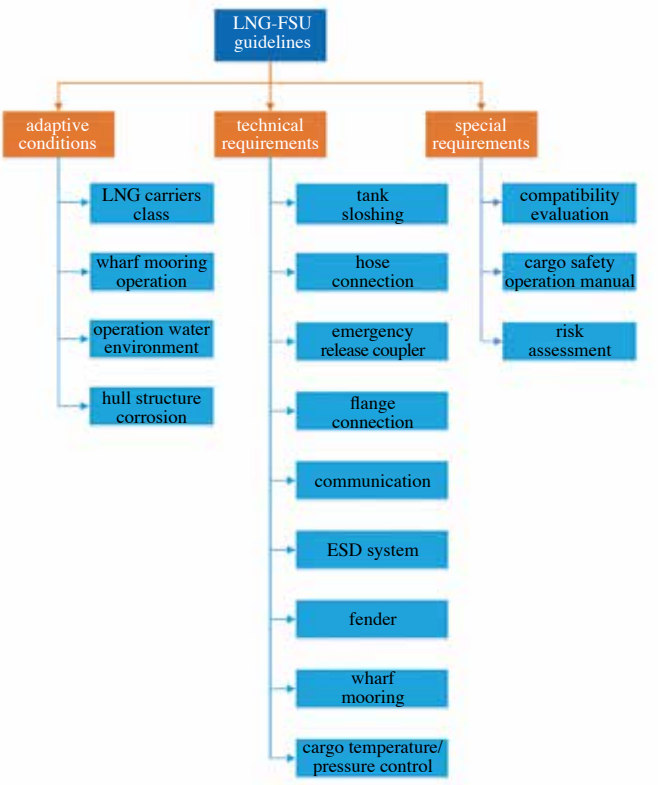

Figure 2: framework of LNG-FSU guidelines

General

This part clearly defines the adaptive conditions for LNG-FSU, Ships that do not meet the adaptive conditions cannot be used as FSU currently. The evaluation process of adaptive conditions is as shown in figure 3.

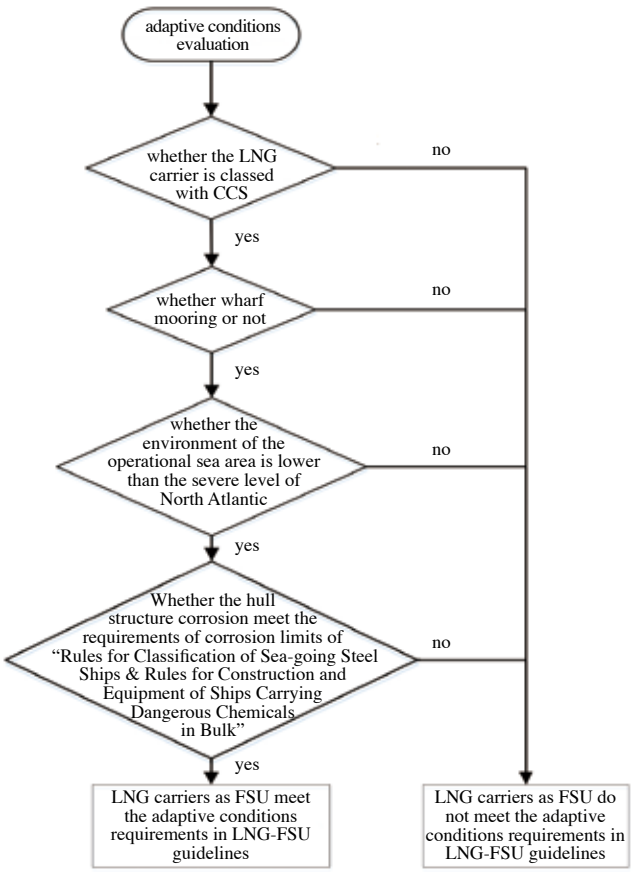

Figure 3: adaptive conditions evaluation diagram of LNG-FSU

Technical requirements for LNG-FSU

This part clearly defines the technical requirements for connection system, communication system, emergency system, mooring system and cargo temperature control system required to be provided for FSU operation. FSU operation is different from general LNG carriers in that the tank level no longer has only two loading level status, i.e. full load and empty. Instead all kinds of loading levels ranging from empty to full load could happen; therefore it is necessary to evaluate the sloshing load and size of structural members at different tank levels of FSU.

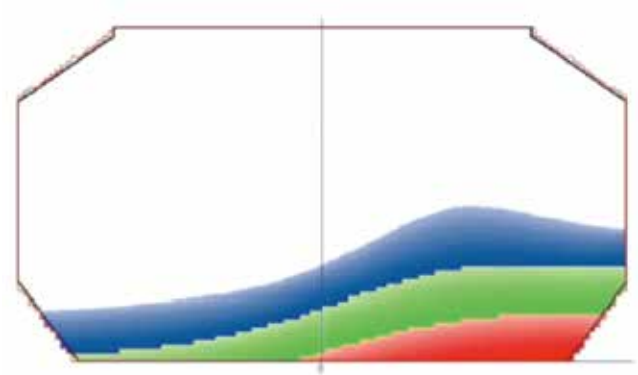

Figure 4: tank sloshing

The guidelines contain specific technical requirements for manifold, hose, emergency release coupler, flange connection and other equipment of FSU and terminal/supply ship. The determined connection type and equipment parameters should guarantee the reliability and security of the connection. FSU should be provided with ship-shore and ship-ship communication systems with terminal and supply ships, including the necessary data communications, Emergency shutdown (ESD) communications, emergency release (ERS) communications and voice communications. ESD system should send a signal to the shore station and supply ship through communication system, and receive the ESD signal from shore station and supply ship for safety and protection operations as appropriate.

Figure 5: FSU cargo transfer operation

Because FSU conducts wharf mooring operation for a long time, the selection of fender and mooring ways is particularly important. During the process of FSU berthing at the terminal, fender is mainly subject to the impact energy from the first berthing and the lateral pressure due to the wind flow from daily work. The guidelines give calculation methods for the two parameters as follows based on descriptive formula and clearly define the basis of fender type selection. The ship-shore and ship-ship fender which was selected by "Hai Yang Shi You 301" as FSU according to the guidelines method is as shown in figure 6.

Figure 6: fender

berthing impact energy : $E = \frac{1}{2}M \times V^2 \times SF$

lateral pressure : $P = \frac{F_{YW}+F_{YC}}{N \times A}$

Another technical key point of FSU mooring is the selection of mooring schemes. For ensuring safety, the mooring system should be provided with emergency release equipment and mooring equipment and its supporting structure should withstand the load applied when the mooring rope reaches the breaking strength. Adopting the dynamic analysis method to analyse the mooring system, the storm duration time should be not less than 3 hours. Considering the operating mode and self-storage working condition, FoS should be not less than 1.67, so as to ensure the safety of the mooring system. The model and results of mooring analysis of "Hai Yang Shi You 301" as FSU according to the method of the guidelines are as shown in figure 7. The final mooring scheme has been applied to "Hai Yang Shi You 301" operating as FSU in Indonesia with good effect.

$$FoS = \frac{MBL}{T_{mzx}}$$

The cargo temperature control system should adopt control measures to deal with BOG which is produced by FSU, ensuring that the cargo temperature and pressure are always maintained within the design range. The control measures include BOG reliquefaction, burning, pressure accumulation and liquid cargo

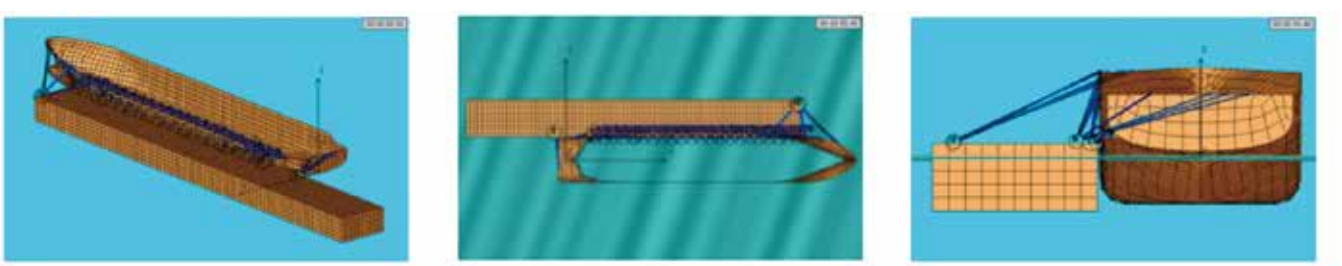

Figure 7: FSU mooring analysis

refrigeration, etc. The intermittent pressurization is carried out by "Hai Yang Shi You 301" to transfer BOG to the shore gas facilities.

Special requirements for LNG-FSU

This part contains specific technical requirements based on FSU operating characteristics, such as compatibility evaluation, cargo safety operational guidelines and risk assessment. Compatibility evaluation is to be carried out before the operation to ship-shore/ ship-ship fender, mooring arrangement, cargo transfer procedures, hose operating range and the matching of communication system, cargo system and ESD system. Considering the cryogenic flammable characteristics of LNG and FSU is different from general LNG carriers' cargo operation, special cargo operation manual is to be developed for FSU. Such manual should contain all kinds of cargo operation for FSU, daily maintenance, normal termination, emergency termination and emergency plan, etc. LNG-FSU is a new product in industrial chain and the application of practical experience is not extensive, so the guidelines require that risk assessment should be carried out for the risks that were not covered by the guidelines according to actual situation.

LNG carriers which meet all technical requirements for the use of FSU can apply for assignment of LNG-FSU notation to CCS, and operate as FSU in target waters.

Market outlook for FSU/FSRU

Currently, the LNG carrier market suffers from the downturn period. The introduction of LNG-FSU guidelines make LNG-FSU operation possible, provide technical support for ship owner following the market hot demands, and adapt to attention from the industry. The ships with LNG-FSU notation will open new breakthrough point for ship owners in the expansion of ship operation market, and provide more opportunities for ship owners in LNG area; at the same time, considering from the economic benefit, LNG-FSU is also a good choice.

At present, the onshore LNG receiving terminal is too expensive, with long construction period and complex approval. These factors lead to significant lack of LNG receiving facilities in most regions (especially islands area) around the world. With the booming of global LNG trade, FSU, as a LNG receiving terminal and its advantages in lower price, shorter construction period and more flexible operation than other onshore receiving terminals, has become a focus in the field of global LNG area. The publication of LNG-FSU guidelines has broken through the barrier of LNG import trade and the pattern of monopoly by onshore LNG receiving terminal industry, and laid a solid foundation for the development of LNG floating-type receiving terminals.

In the long run, the development of LNG-FSU will play a great role in promoting the global LNG trade. Now the application of LNG is more and more wide and global LNG import trade has developed rapidly. For example, as a large country of LNG import, China's demand for LNG receiving terminals is very urgent, but due to the onshore receiving terminals which are expensive and have long construction period, now most regions lack onshore LNG receiving terminals; at the same time affected by seasonal heating in the north, "coal to gas" in national power plants and the demand of power generation in Paracel Islands, the expenditure of building onshore LNG receiving terminals will be very huge. FSU can effectively solve gas supply problems in these areas due to its lower cost, shorter construction period and more flexible operation. At present, the global market is interested in LNG-FSU, it can be seen that FSU as the floating receiving terminal will play a more and more important role in natural gas import trade in the future.

CCS Provides Risk Assessment Services of Offshore Platform Falling Objects

By Qi Kuili & Fan Hongjun

Considering that offshore platforms or equipment are located in a focused area, risk sources are concentrated and the lifting, loading and unloading operations are frequent on the platform or equipment, the frequency of risks caused by falling objects is high with severe results. In order to identify the falling loads, the objects falling risk analysis mainly take following factors into consideration: falling location (crash site), falling objects weight ,lifting areas, and two specific falling cases:(1) falling objects hit against the structure or equipment above sea surface;(2) falling objects hit against the structure or equipment below sea surface (including pipeline, riser, etc.).

Additionally, the risk analysis is usually composed of security objectives, acceptable criteria, system description, risk identification, risk assessment, risk mitigation measures and so on.

Risk analysis of objects falling on sea

Objects falling risk analysis on deck of offshore platform or devices generally consists of two steps: Preliminary risk assessment and detailed risk assessment. Preliminary risk assessment aims to define potential falling events and assess the risk preliminarily. The detailed risk assessment often starts from preliminary risk assessment and a filtering method is used to reduce the expensive evaluation quantities in consideration of the large number of objects falling events. Preliminary screening rules out events of low risk possibility .Except for determining whether the risk reduction measures can reduce the risk or frequency, the remaining events can be verified through complex analysis technology .Commonly used technical methods include quasi static method and the finite element method (FEM) which can simulate consequences of objects falling.

Risk reduction measures mainly aim at acceptable activities and strengthen facilities with potential collisions possibilities. Methods are generally included in the following:

- Change the upper equipment modules or the location of structural components, reduce the relevance falling objects during the crane operation;
- Limit drilling and crane operation when weather will directly increase the frequency ;
- Increase energy absorption structures or protection equipment;
- Some risk reduction measures are applicable in novel design , such as change layout.

Risk analysis of objects falling below sea surface

when lifting operations, objects are likely to fall into the sea and damage submarine pipeline/riser and equipment. In the risk analysis process, the acceptable criteria shall be in accordance with security goals of the activities. The acceptable criteria of single-pipeline and multiple-pipelines should be considered separately.

Before the risk assessment, complete system description is necessary. Above description should include the whole pipeline/riser life cycle and following contents should be taken into consideration:

● Activities may affect the integrity of pipeline/riser potentially, such as drilling or lifting operations on plat, the fishing (bottom trawling), examine the tender waters or nearby and general passing vessels and underwater operation (operations such as drilling, completion, and debugging) at the same time, other (plan of construction, etc.).

● The physical characteristic of pipeline/riser , includes type (steel tube, flexible pipe or riser); diameter, wall thickness, coating thickness; material (steel and coating); construction details (fittings, elbow, etc.) and medium (oil, gas, condensate, etc.).

Discriminate possible risks that may cause the damage of pipelines and risers based on the activities investigation of certain areas. Risk identification should be systematically identify all external accident scene and subsequent possible consequences. Generally, accidents are not possible in the pipe protection and vertical pipe installation process. So in making operation plans for such activities risk reduction method should be especially taken into consideration. The submarine pipeline through fishing areas should be designed to avoid the trawl. If the pipeline is installed avoid all temporary or permanent trawl, the risk of it can be ignored.

An initial accident (such as container fall) may develop into an important event (e.g., hit the pipe).In general, risk assessment is made up of frequency estimation and events consequence assessment. The frequency can be calculated by the detailed information; also it can be estimated based on engineering judgment or experience of the operator. The frequency can be divided into five levels, and 1 means low frequency while 5 means high. Similarly, the consequences obtained by calculation or estimation, can also be divided into five levels, and 1 means vital important while 5 means general important.

In the risk matrix, risk assessment of events can be obtained by frequency and consequences assessment .Risk matrix method can be used to compare the risk of different events even if the level of details are different. For some independent operation, such as independent key operations (large heavy lifting), the risk assessment method may not be applicable. Due to the relatively limited experience, reasonable failure frequency is hard to estimate for those scenarios, so the risk assessment method is not suitable. While HAZOP, FMEA, or other relevant methods can be used to identify critical operation conditions when operation or equipment failure for those operations. Normally, the assessment of most dangerous cases can only be determined by the actual consequences, rather than the corresponding frequencies. If any basic parameters relate to the risk change, such as activity level, design, parameters and operating procedures, it is necessary to reappraisal the risk so as to reflect the changes .The lowest feasible areas represent a risk acceptable area, but the risk need to be reduced on the basis of cost benefit assessment.

If the result of risk assessment exceeds acceptance criteria, the following measures can be used to lower risk:1) reduce the frequency; 2) reduce the consequences; 3) the combination of two above. The risk should be controlled in the lowest feasible region in each project and it means that even if the risk is in an acceptable range, low cost of risk reduction measures should also be adopted. Relative to the consequences reducing measures, reducing the frequency is preferred.

Case analysis

This case is mainly about the risk analysis of a falling object from a small platform hit against a 20-inch pipeline Additionally, the crane can only operate in the west of the platform while tender vessels come closer to the platform from the north .The pipeline is disposed towards the east of the platform and turn north 40 meters away. As table 1 shows main parameters of risk analysis.

1. Acceptable criteria

High safety level is preferred in this case and annual failure

Table 1 main parameters

Category	Name	Value	Unit
Pipe parameters	Diameter of the outer wall	508	mm
	Wall thickness	18	mm
	Yield strength	450	mm
	Thickness of the concrete	60	mm
Environmental parameters	Depth of the water	100	m

frequency shall be less than 1E-05.

2. Classification of objects

The platform has only one crane and the operating radius is limited. As table 2 shows annual objects lifting times. Based on the simplified principles, it is assumed that the internal lifting may only cause impacts of the platform structure or equipment and the object will not fall in the sea.

3. Frequency

Usual falling frequency of lifting activities can be referred in table 3.All lifting objects in the case are under 20 tons while the frequency of falling into the sea is 1.2E-5 each time .

4. The object movement

Pick up a most likely crash site based on the position of the crane, ship and platform who is near the deck .The crash site is 10 meters south and 20 meters west of the platform. This case has noticed shelter effect of the platform leg.

Objects falling movement is a random event and each trajectory can be described by using normal distribution. The effect of flow is neglect due to the fact that the platform is located in water areas of finite depth and the flow's influence is limited to the movement of the falling objects.

Start from the crash site; draw a series of concentric circles with radius increases 10 meters successively. Calculate the conditional probability of each object falling into the seabed of concentric circles and the probability analysis of the first circles is as follows:

When the water depth of 100 meters, the first class of falling objects transverse offset is δ and the deviation angle is α which equal to 15 °,

$$\delta = d \cdot \tan\alpha = 100 \cdot \tan 15 = 26.8\text{m}$$

Probability of the first class objects falling into the first concentric circles

$$P_{\text{hit},10}(x \le 10\text{m}) = \int_{-10}^{10} p(x)dx = \int_{-10}^{10} \frac{1}{\sqrt{2\pi}\delta} e^{-\frac{1}{2}\left(\frac{x}{\delta}\right)^2} dx = 0.2910$$

The probability of falling into unit seabed equals the probability divided by the area of the same concentric circles,

$$P_{\text{hit},Ar,10} = \frac{P_{hit,10}}{A_r} = \frac{0.2910}{\pi \cdot (10)^2} = 0.000926m^{-2}$$

The conditional probability of each falling objects are shown in table 4, among which, the seventh class objects are not lifted on the platform.

Table 3 frequencies of objects falling into the sea

Lifting type	The frequency of an objects falling into the sea each time.
Use platform cranes and any lifting relate to the related tender	1.2E-5
Use platform cranes and any lifting >20 tons relate to the related tender	1.6E-5
Drilling lifting operation system with load < 100 tons	2.2E-5
Drilling lifting operation system with load >100 tons or BOP	1.5E-5

Table 2 annual lifting load objects classification related to the tender vessel

Serial number	Description	Air weight (tons)	Typical objects	Annual hoisting times
1	Flat / Strip	<2	The drilling bit/casing, scaffolding	700
2		2-8	Drilling bit/casing	50
3		>8	The drilling riser, crane cradle	5
4	Square / circle	<2	Container (food, spare parts), basket, lifting blocks	500
5		2-8	Container (spare parts), baskets, lifting test piece	2500
6		>8	Container (equipment), the basket	250
7	Square / circle	>>8	Large objects, such as BOP, pipe coil, etc	0
Sum				4005

Table 4 conditional probability of each kind of falling objects hitting the seabed of concentric circles

Object				Probability per square (m^2)						
Serial number	Description	Deviation		0-10	10-20	20-30	30-40	40-50	50-60	60-70
		Deviation Angle	Transverse deviation							
1	Flat / Strip	15	26.8	9.26E-4	2.69E-4	1.23E-4	5.79E-5	2.6E-5	1.07E-5	3.95E-6
2		9	15.8	1.5E-3	3.41E-4	9.45E-5	2.12E-5	3.52E-6	4.18E-7	3.47E-8
3		5	8.8	2.378E-3	2.45E-4	1.38E-5	2.73E-7	1.71E-9	3.18E-12	2.83E-19
4	Square / circle	10	17.6	1.367E-3	3.33E-4	1.07E-4	2.98E-5	6.62E-6	1.13E-6	1.46E-7
5		5	8.8	2.378E-3	2.45E-4	1.38E-5	2.73E-7	1.71E-9	3.18E-12	1.72E-15
6		3	5.2	3.004E-3	5.97E-5	8.63E-8	4.74E-12	8.25E-18	0	0
Serial number	Description	Deviation		70-80	80-90	90-100	100-110	110-120	120-130	
		Deviation Angle	Transverse deviation							
1	Flat / Strip	15	26.8	1.31E-6	3.83E-7	9.93E-8	2.27E-8	4.55E-9	8.02E-10	
2		9	15.8	2.01E-9	7.99E-11	2.19E-12	4.09E-14	5.22E-16	4.52E-18	
3		5	8.8	0	0	0	0	0	0	
4	Square / circle	10	17.6	1.41E-8	1.01E-9	5.34E-11	2.09E-12	6.0E-14	1.27E-15	
5		5	8.8	2.8E-19	0	0	0	0	0	
6		3	5.2	0	0	0	0	0	0	

5. Hit probability

Hit probability depends on the result of falling objects in table 4, pipe length, diameter and falling objects size within each concentric circle.the shelter effects of platform leg and support artifacts are considered while the circle area whose radii are between 40-50 m and 50-60 m are neglected. Pipe diameter is 0.63 m, including coating thickness. Assume that the slender falling object is 12 m long and the length of the square falling object is 5 m .

Table 5 pipeline length on the seabed within concentric circles

Pipe length within each concentric circles													
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
Length (m)	0	0	0	0	0*	0*	11	51	41	21	17	15	14

Conditional probability of the first class objects which fall into the concentric circles with radius between 60-70m is calculated as follows:

Table 4 shows that the conditional probabilities of objects falling in the seabed area within the concentric circles is $P_{hit,Ar,70}$=3.95E-06m^{-2}. Table 5 shows that exposed pipe length is 11m and the width equals to the total conservative pipe length, 12m.Conditional probability of objects hitting the pipeline is:

$$P_{\mathrm{hit},sl,70} = \frac{P_{hit,70}}{A_r} \cdot L_{sl} \cdot (D + B) = 3.95 \cdot 10^{-6} \cdot 11 \cdot (0.63 + 12) = 0.00055$$

Conditional probability of each falling objects hitting the seabed within the concentric circles is shown in table 6.

Table 6 conditional probability of each falling objects hitting the seabed within the concentric circles

Object			Probability per square (m^2)						
Serial number	Description	Width (m)	0-10	10-20	20-30	30-40	40-50	50-60	60-70
1	Flat / Strip	12	0	0	0	0	0	0	5.5E-4
2		12	0	0	0	0	0	0	4.83E-6
3		12	0	0	0	0	0	0	2.39E-13
4	Square / circle	5	0	0	0	0	0	0	9.02E-6
5		5	0	0	0	0	0	0	1.06E-13
6		5	0	0	0	0	0	0	0
Serial number	Description	Width (m)	70-80	80-90	90-100	100-110	110-120	120-130	Sum
1	Flat / Strip	12	8.42E-4	2E-4	2.63E-5	4.87E-6	8.62E-7	1.42E-7	1.62E-3
2		12	1.29E-6	4.14E-8	5.8E-10	8.78E-12	9.88E-14	8E-16	6.2E-6
3		12	1.82E-16	0	0	0	0	0	2.4E-13
4	Square / circle	5	4.03E-6	2.32E-7	6.31E-9	2E-10	5.07E-12	9.99E-14	1.3E-5
5		5	8.11E-17	0	0	0	0	0	1.1E-13
6		5	0	0	0	0	0	0	0

The final hit frequency, as shown in table 7 can be obtained by multiplying lifting numbers, falling frequency (1.2E-5) and the conditional hit probability.

table 7 hit frequency of falling objects

Object			Annual lifting times	Falling frequency of each lift	Conditional probability of hit	Hit frequency
Serial number	Description	Weight (ton) in the air				
1	Flat / Strip	<2	700	1.2E-5	1.62E-3	1.36E-5
2		2-8	50	1.2E-5	6.2E-6	3.72E-9
3		>8	5	1.2E-5	2.4E-13	0
4	Square / circle	<2	500	1.2E-5	1.3E-5	7.8E-8
5		2-8	2500	1.2E-5	1.1E-13	3.3E-15
6		>8	250	1.2E-5	0	0
Sum						1.368E-5

Judging from the chart above, annual hit probability is 1.368E-5. In order to determine the failure frequency, energy of the object and pipe resistance need to be considered.

6. Hit frequency vs. energy

Based on the collision energy distribution in table 8, collision energy of each object can be obtained. In combination with the hit frequency results shown in table 8 and table 7, different hit frequency can be set according to different energy levels. For each object, the relationship of hit frequency and impact energy can be seen in table 9 while the relationship of accumulative hit frequency and impact energy can be seen in table 10.

Table 8 conditional probability of collision energy

Description	Energy band (KJ)						
	<50	50-100	100-200	200-400	400-800	>800	
Flat / Strip	< 2 tons	30%	18%	14%	12%	11%	15%
	2-8 tons	5%	8%	15%	19%	25%	28%
	> 8 tons	-	-	10%	15%	30%	45%
Square / circle	< 2 tons	50%	30%	20%	-	-	-
	2-8 tons	-	20%	30%	40%	10%	-

	> 8 tons	-	-	10%	15%	30%	45%
Square / circle	< 2 tons	50%	30%	20%	-	-	-
	2-8 tons	-	20%	30%	40%	10%	-
	> 8 tons	-	-	-	-	70%	30%
Square / circle	> > 8 tons	-	-	-	-	30%	70%

Table 9 hit frequency of different collision energy levels

Object			Energy levels (KJ)					
Serial number	Description	Weight (ton) in the air	<50	50-100	100-200	200-400	400-800	>800
1	Flat / Strip	<2	4.09E-6	2.45E-6	1.91E-6	1.63E-6	1.50E-6	2.04E-6
2		2-8	1.85E-10	2.96E-10	5.54E-10	7.02E-10	9.24E-10	1.03E-9
3		>8	0	0	1.53E-18	2.29E-18	4.59E-18	6.88E-18
4	Square / circle	<2	3.99E-8	2.39E-8	1.60E-8	0	0	0
5		2-8	0	6.39E-16	9.59E-16	1.28E-15	3.2E-16	0
6		>8	0	0	0	0	0	0

Table 10 cumulative hit frequency of different collision energy levels

	Energy levels (KJ)					
	>0	>50	>100	>200	>400	>800
Annual hit frequency	1.37E-5	9.58E-6	7.1E-6	5.18E-6	3.54E-6	2.04E-6

7. Damage resistance ability vs energy

Conditional probabilities of pipeline damage are different for each damage degree. The collision energy required to cause 5% dent is:

$$E = 16 \cdot \left(\frac{2\pi}{9}\right)^{\frac{1}{2}} \cdot m_p \cdot \left(\frac{D}{t}\right)^{\frac{1}{2}} \cdot D \cdot \left(\frac{\delta}{D}\right)^{\frac{3}{2}}$$

$$= 13.37 \cdot 0.25 \cdot 450 \cdot 10^6 \cdot 0.018^2 \cdot \left(\frac{0.508}{0.018}\right)^{\frac{1}{2}} \cdot 0.508 \cdot (0.05)^{\frac{3}{2}} = 14.7KJ$$

Table 11 shows the result of bigger dents. Additionally, 60 mm concrete coating has the ability to resist collision impact and the collision resistance ability is:

$$E_K = \left(Y \cdot b \cdot h \cdot x_0;\ Y \cdot b \cdot \frac{4}{3} \cdot \sqrt{D \cdot x_0^3}\right)$$

$$= \left(3 \cdot 35 \cdot 10^6 \cdot 0.03 \cdot 0.3 \cdot 0.06;3 \cdot 35 \cdot 10^6 \cdot 0.03 \cdot \frac{4}{3} \cdot \sqrt{0.63 \cdot 0.06^3}\right)$$

$$= (56.7KJ;48.9KJ) = 50KJ$$

Among which, the width and height of the collision object are taken as 30 mm and 300 mm respectively. Therefore, the impact resistance of concrete coating is nearly 50 KJ. Collision resistance of the pipes and coating are shown in table 11.

8. Damage vs. Frequency

Relationship between damage and frequency can be determined by the relationship between hit frequency and energy and that between anti-damage ability and energy.

Table 10 and 12 tell us that the annual failure frequency of 8.7E-6 complies with the acceptable criteria 1E-5. The failure frequency is within the acceptable range, therefore, the pipeline protective measures adopted are sufficient.

Table 11 conditional collision resistance of the pipes and coating

Dent/diameter (%)	Collision energy (KJ)		Damage description	Conditional probability		
	Steel pipe only	Entire coating included		D1	D2	D3
<5	<15	<65	Slight damage	1.0	0	0
5-10	15-40	65-90	Major damage, may leak	0.1	0.8	0.1
10-15	40-75	90-125	Major damage, may leak	0	0.75	0.25
15-20	75-115	125-165	Major damage, may leak or rupture	0	0.25	0.75
>20	>115	>165	Rupture	0	0.1	0.9

Table 12 the relation between failure frequency and damage type

Dent/diameter (%)	Collision energy (KJ)		Damage description	Frequency		
	Steel tube only	Entire coating included		D1	D2	D3
<5	<15	<65	Slight damage	4.87E-6	0	0
5-10	15-40	65-90	Major damage, may leak	1.24E-7	9.91E-7	1.24E-7
10-15	40-75	90-125	Major damage, may leak	0	7.32E-7	2.44E-7
15-20	75-115	125-165	Major damage, may leak or rupture	0	1.92E-7	5.77E-7
>20	>115	>165	Rupture	0	5.85E-7	5.27E-6
Sum				4.99E-6	2.5E-6	6.21E-6

CCS Issued Finite Element Calculation Software of Containership Cabin Regions Based on Latest Requirements of (UR) S11A and S34

By Tang Mingwen & Xu Min

Based on structural damage of large containers and attention and concern of the international maritime community on structural safety of ships, the International Association of Classification Society (IACS) issued unified requirements (UR) S11A and S34 with regard to container ships in 2015, which entered into force on July 1st, 2016.S11A focuses on requirements of ship longitudinal strength and S34 focuses on functional requirements of finite element analysis of container ships. Compared with S11, S11A makes related adjustments as to wave loading and strength of some parts is increased. While S34 adds finite element calculation of cargo hold region of container ships to verify the condition. Combined with research achievements of large container ship research projects, China Classification Society (CCS) fully participated in the formulation of S11A and S34 and comprehensively upgraded specifications of large container ships, including descriptive specifications and direct calculation requirements, incorporating the requirements of S11A and S34.This part was included in the CCS steel ship classification specifications (2016 edition communications) and the specification has been published on the official website of CCS. Furthermore, it was entered into force on July 1st, 2016.Meanwhile, in line with the new specification of container ships entering into force, CCS upgraded special calculation software meeting requirements of latest UR of container ships.

The software is based on MSC/PATRAN platform and the main function modules include:

1. main parameters definitions: Captain, ship width, draft and other parameter definitions.

2. model parameter definitions: Model location, model type, still water bending moment, wave bending moment, the neutral axis location and other parameter definitions.

3. structural definitions and search: Definitions of the hull structure, and automatically searches for units included in the structure.

4. compartment definition and recognition: Definitions of various types of hull compartments and automatically searches for compartment borders and the internal units.

5. unit property definition: Definitions of unit construction thickness and material yield limit.

6. load calculation and apply: Open loading model, distributed loading definition, working conditions, automatically imposed load, calculation of nodal force.

7. boundary conditions imposed: Local boundary conditions, the general boundary conditions.

8. yield strength evaluation: Automatic evaluation of unit yield strength.

9. buckling strength evaluation: Automatic dividing of buckling plate, automatic property acquisition, resulting images and factor display.

The main features of the software are:

1. Automatically calculations of (UR) S11A vertical wave bending moment of the request.

Figure 1:automatic calculation of vertical wave bending moments

2. Automatically structural searching, automatic recognition of compartments and other automatic model "pretreatment" tools can help save users' time and improve efficiency.

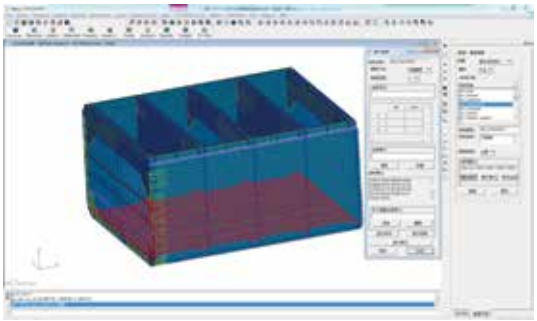

Figure 2:automatically structural searches

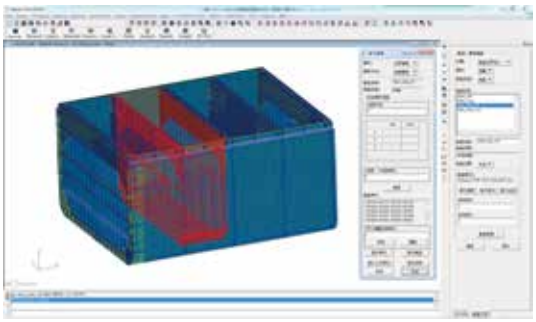

Figure 3:automatic recognition of compartments

3. Distributed imposed load definition and loads automatically applied, eliminating tedious formula, "one-click" completed.

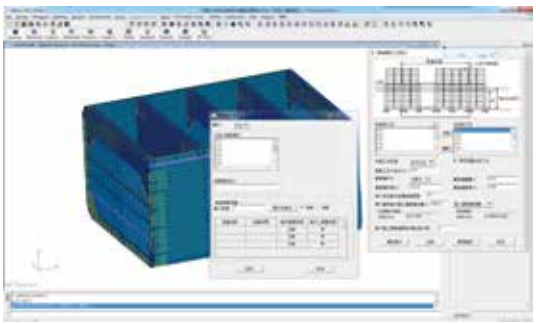

Figure 4:working condition is automatically generated

4. Display the specific load conditions and facilitate review and analysis.

Figure 5:load display

5. Independent post-processing database, completely out of PATRAN platform data storage, safe, fast and reliable yield buckling check.

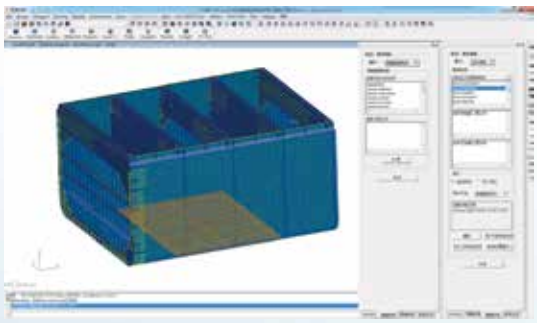

Figure 6:yeild buckling Assessment

6. Yield buckling strength evaluation of cargo fuel tanks hold arranged between the two cargo holds.

Figure 7: select calculation model category

Based on latest UR S11A and S34 requirements, China Classification Society (CCS) upgraded and developed finite element calculation software of containerships cabin regions. Furthermore, the software has been applied to structural strength key technology researches of large container ships and board ship calculations. It played an important role in technical support for structural safety of critical areas of the container ships. The software fills the blank in finite element calculation software as to the latest requirements of CCS in UR S11A and S34, marking the complete technical service capabilities of CCS in the structural strength segment of container ships. The software will be an important tool for CCS serving in the industry, making due contributions for structural safety of large container ships.