Internal data
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Partnership

Edited and Printed by CCS 2016.6 / The 21st issue in total

Hand in Hand to Build Harmonious Maritime Industry

On July 1, 2016, CCS will assume the chairmanship of IACS. It will be the third time for CCS to stand on this stage in its history. Let's hand in hand, make contributions to a better future of the international maritime industry.

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The third issue in 2016
(The 21st issue in total)

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Add: CCS Mansion, 9 Dong Zhimen Nan Dajie, Beijing China.
Postcode: 100007
Tel: +86 10 58112206 / 58112218
Fax: +86 10 58112902
Websit: www.cssponline.com
E-mail: ccsinfo@ccs.org.cn
Weibo: http://weibo.com/ccsponline

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CCS CHINA CLASSIFICATION SOCIETY 中国船级社

Content

AMSA CEO Visited CCS

Recently, Michael Kinley, the chief executive officer of Australian Maritime Safety Authority (AMSA) visited the Headquarters of China Classification Society (CCS). Mr. Sun Licheng, the President of CCS held pleasant and friendly talks with Mr. Michael Kinley. They reviewed the long-term good cooperation, confirmed the positive role that both sides have played in jointly promoting bilateral maritime trade, shipping safety and marine environmental protection, and also exchanged views on port state control, statutory survey and audit, etc. Both sides said they would take advantage of this opportunity to further strengthen technological exchanges and develop further cooperation for the future.

Director General of Danish Maritime Authority Visited CCS

On May 18, 2016, Mr. Sun Licheng, the President of China Classification Society (CCS) held friendly talks with Andreas Nordseth, the Director General of Danish Maritime Authority (DMA). Since CCS signed statutory authorization agreement with DMA in March 2015, the two sides have kept good cooperation in the fields of the statutory survey authorization, high-level visits and technology exchanges, etc., and achieved good results. The two sides conducted in-depth discussion on future establishment of survey offices in Denmark by CCS, joint promotion of China-Demark maritime exchange, shipbuilding and shipping cooperation and so on. Both sides have expressed the desire to further strengthen cooperation and exchanges, so as to promote CCS business development in Denmark.

Iranian Government Authorizes CCS to Conduct Statutory Survey of Iranian Flag Vessel

On May 30, 2016, China Classification Society (CCS) signed authorization agreement with Iranian Ports and Maritime Organization (PMO) on authorizing CCS to conduct statutory survey of Iranian flag vessel. This is the first formal authorization agreement the Iranian government has signed with a member of International Association of Classification Societies after Europe and the United States lifted their sanctions against Iran. Mr. Sun, President of CCS and vice chairman of PMO respectively signed the agreement on behalf of both sides. Pang Sen, China's ambassador to Iran, and Mohammad Saeed Nejad, Deputy Minister of the Ministry of Road & Urban Development and the Managing Director of Ports and Maritime Organization of the Islamic Republic of Iran, witnessed the signing ceremony and delivered a speech, affirming the significance of cooperation between CCS and PMO, and said they would give necessary support to the future cooperation.

CCS Won "Special Contribution Award"

On May 6, 2016, the British sea trade group (Seatrade) held the 28th sea trade awards ceremony in London. China Classification Society (CCS) was awarded the "special contribution award" due to the outstanding contribution it has made in improving China's shipbuilding enterprise technology level and ensuring quality of ship construction. "Special contribution award" is strictly selected by the Seatrade jury to award the organization or individual who is recognized as making special contribution in the industry challenge. Zhang Hui, the director of CCS European center accepted the prize on behalf of CCS.

In recent years, CCS has gripped global shipping and shipbuilding industrial structure adjustment and the historic opportunity of China's transition of economy, has implemented and carried out the "belt and road" and "walk out" national strategies, comprehensively promoting green ship plan, promotion of new products, develop new business growth point, played an important role in promoting the industry to jointly cope with challenges and walk out of the industry slump hand in hand.

The awards ceremony was held in London City Hall which has nearly 600 years history, where more than 300 well-known international organizations and senior management from the world maritime and port authorities, shipping companies, offshore oil company, dockyard, service providers, classification societies, port companies, related financing banks, research institutions, education and training institutions and other international organizations attended the award ceremony.

Seatrade Awards is founded in 1989 and launched by the British sea trade group, which enjoys high reputation in the industry, and aims at celebrating outstanding achievements of companies, organizations and individuals in shipping, shipbuilding and maritime services. As the most authoritative awards ceremony in world's maritime industry, it is held once a year and very influential in the global maritime industry.

CCS and ICBC Asia Pacific Shipping Financial Headquarters Signed Bilateral Cooperation Agreement

On June 7, 2016, the day on which Asia Pacific shipping financial headquarters of Industrial and Commercial Bank of China (ICBC) were established, China Classification Society (CCS) signed bilateral cooperation agreement with them in Singapore. CCS will use its own professional advantage and information advantage, to cooperate extensively with the other party in financing, risk prevention, ship technology, maritime information, etc. ICBC Asia Pacific shipping financial headquarters will take advantage of Asia-pacific hub in Singapore, and provide financing services for Singapore's local and surrounding countries' ship owners, shipping companies, liner company and offshore engineering shipping companies.

CCS Bulk Carrier, Oil Tanker Structure Rules Smoothly Passed IMO Audit

On May 13, 2016, the Maritime Safety Committee of International Maritime Organization (IMO) at its 96th session announced that the bulk carrier and oil tanker structure rules summited by China Classification Society (CCS) and other eleven members of the International Association of Classification Societies (IACS) comply with the goals and functional requirements of IMO goal-based ship construction standards for bulk carriers and oil tankers, and notified IMO members and related parties with MSC. 1 / Circ. 1518.

This is the first time IMO organized the audit of structure rules of classification society to confirm they satisfy safety goals which are set by IMO, and the decision of the Maritime Safety Committee is full affirmation of the joint efforts exerted by the IACS, IMO member states and the industry to improve the safety of ships over the past 14 years. CCS will take this audit as an opportunity to further provide more high quality technical services for the industry in terms of GBS standard implementation and continuous improvement.

CCS Issued the First Safety Management Certificate for Domestic Scientific Research Vessel

On May 31, 2016, China Classification Society (CCS) satisfactorily completed certification and audit of safety management system for one of the most advanced scientific research vessels in China, i.e. "XIANG YANG HONG 18", and issued the first ship safety management certificate of domestic vessel.

The ship owner of "XIANG YANG HONG 18" is the first institute of oceanography, state oceanic administration (SOA). The ship was completed for delivery on December 20, 2015, and it is the advanced scientific research vessel engaged on international voyages in China. To continually improve the ship safety management level, ensure the safety of ship operation and preventing marine pollution, the first institute of oceanography, SOA commissioned professional ship management company to establish safety management system in accordance with the ship type features and special operational requirements for the scientific research vessel, and applied for CCS ship safety management system audit, which has opened a new chapter for research ship and public service ship to voluntarily comply the requirements of the ISM code.

The issue of the first certificate lays a good foundation for the scientific, standardized management of scientific research vessel and continuous improvement of the safety of navigation. CCS has played a leading role of safety management system audit certification for scientific research ship and public service ship.

CCS Issued Classification Certificate for "Hidden Dragon II"

On June 4, 2016, the classification certificate ceremony of "hidden dragon II", the 4500-meter autonomous exploration system of deep-sea resources was held in Beijing. "Hidden dragon II" is China's first 4500-meter deep-sea unmanned underwater vehicle which has obtained CCS classification certificate, demonstrating that the design and manufacture of unmanned and wireless submersible has stepped into the international advanced level. CCS carried out survey of "hidden dragon II" and issued classification certificate, which has further broadened the service field of CCS and fully shown CCS service purpose and value pursuit of "safety, environmental protection, creating value for customers and the society".

CCS Completed Exxon/Mitsui OSK LNG Carrier Project

In early April 2016, the naming ceremony of "KUMUL", the fourth LNG carrier of 172,000 m^3 which was the first foreign trade large LNG carrier shipbuilding project China Classification Society (CCS) undertook, and was built by Hudong-Zhong Hua Shipbuilding Co., Ltd for Exxon Mobil/Mitsui OSK was held. Exxon Mobil/Mitsui OSK LNG carrier project was the first LNG carrier project of foreign trade in China, mainly engaged in LNG trade transportation from Papua New Guinea to China, Japan and South Korea. "KUMUL" is the last one in Exxon/Mitsui OSK LNG project of Hudong-Zhong Hua Shipbuilding Co., Ltd.

The World's Advanced Scientific Research Ship "Jia Geng" Launched

On May 8, 2016, Xiamen university scientific research vessel of 3000 ton surveyed by and classed with China Classification Society (CCS), and built by GuangChuan International Co., Ltd completed the launching and naming ceremony. The ship has class notations such as "dynamic positioning", "one person pilo" and "green passport", etc., and equipped with advanced maritime scientific research devices. It is China's first ocean science comprehensive research vessel for which foreign design is adopted and transformed into detailed design domestically and whose intellectual property rights are fully owned by Xiamen University. M/V "Jia Geng" is 77.7 meters in length, 16.24 meters in breadth, with ship design draft of 5.2 meters, about 3500 gross tonnage, economic speed of 11 knots, maximum speed of 14 knots, endurance range of about 10000 nm, holding force of 50 days. For this ship, whether the comprehensive and advanced research equipment, or the universality and flexibility of the laboratory on ships, they all reach the world advanced level. It has excellent handling and release ability of marine observation equipment, and provided with high-performance acoustic detection equipment. The ship will participate in the world maritime research, experiment research, teaching practice and related engineering work when it is completed, and play its proper role in the construction of national marine power.

The Latest Luxury Passenger Ro-ro Ship of China and South Korea Route Successfully Launched

Recently, M/V "HUA DONG MING ZHU 8" which was surveyed by China Classification Society (CCS) and built by Huanghai Shipyard entrusted by East China shipping Co., Ltd was successfully launched in Huanghai Shipyard Co., Ltd . "HUADONG PEARL VIII", is the first China-South Korea international passenger and cargo liner. CCS Qingdao branch was responsible for its construction survey and inspection. The commencement of construction of the vessel was on April 28, 2015, and the completion is expected to be in August 2016. The vessel is 196.2 meters in length overall, with gross tonnage of about 34722, 28.6 meters in breadth, and design speed of 22 knots. It can accommodate 1500 passengers, and cargo lane is 2500 meters. Internal facilities are well-equipped with luxurious decoration. "HUADONG PEARL VIII" satisfies the requirements for safe return to port in SOLAS and is Asia's largest and most luxurious passenger ro-ro ship built with the latest safety design concept. The successful launch of "HUADONG PEARL VIII" has set up a more convenient sea lanes for China and South Korea trade, personnel exchange and logistics, and played a positive role in the construction of China and South Korea free trade area and the development of Shandong peninsula blue economic zone.

CCSC Signed IRIS Certification Corporation Agreement with UNIFE

On April 28, 2016, IRIS cooperation signing ceremony of international railway industry quality management system IRIS international communication was held in Beijing. China classification society certification company (CCSC) signed IRIS certification cooperation agreement with Bernard Kaufmann, general manager of IRIS, UNIFE, which marks that CCSC became China's first agency that obtained IRIS certification qualifications.

In the recent decade, Chinese railway industry has developed rapidly. With China's strategic development plan of "belt & road" coming out, the speed of China's railway going towards the world will be faster and more stable. CCSC will continue to take servicing national railway industry development as its own duty, make full use of certification and accreditation credit tools in this market economy, promote railway industry technical standard system dock with the international ones, and constantly improve the quality of Chinese railway industry enterprises. Kaufmann, general manager of IRIS, said that UNIFE is really looking forward to cooperating with CCSC, hoping to use CCSC high quality and high level service to boost the better development of railway sector. The signing of the agreement marks that CCSC officially became the16th IRIS certification organizations of UNIFE, and is also the first IRIS certification agency in China. With the excellent technical strength and combining with UNIFE in the field of IRIS certification, CCSC will empower Chinese railway industry to go out to the world under the background of development strategy of "belt & road".

Pont Hong Kong-Zhuhai-Macao Qingzhou Channel Bridge Supervised by CCSI Achieved Successful Closure

On April 12, 2016, Pont Hong Kong-Zhuhai-Macao qingzhou channel bridge supervised by China Classification Society Industrial Company (CCSI) achieved successful closure. Qingzhou channel bridge is cable plane steel box girder cable-stayed bridge with the twin towers, with the span length of 1150 meters and the tower height of 163 meters. Qingzhou channel bridge is designed as "Chinese knot" and is the landmark building of Pont Hong Kong-Zhuhai-Macao. With the successful closure, CCSI will, as always, strictly supervise, complete follow-up anti-collision railing, inspection trolley, fill besmear, bridge deck pavement and other construction supervision work, to ensure the bridge will be successfully completed.

CCS Participated in the 47th International Marine Engineering Technology Conference

On May 2, 2016, the 47th international marine engineering conference was opened in Houston, the United States. In the conference, CCS, holding the "whole field, whole life cycle" service concept, fully showed CCS technical level and service capabilities of mobile facilities classification service, fixed facilities third-party services and offshore engineering consulting services, mainly introduced the Engineering Critical Analysis (ECA) technical services, the South China Sea marine environment database, tanker conversion FPSO technical service, risk-based inspection (RBI), and other new types of ocean engineering service product.

CCS Won "Touching Person of the Year in Transportation in 2015" Best Organization Award

Recently, the Ministry of Transport and All-China Federation of Trade Unions jointly organized the "touching person of the year in transportation in 2015" elected campaign. After application recommendations, experts screening, public voting and expert evaluation procedure, China Classification Society (CCS) won the "touching person of the year in transportation in 2015" best organization award; Lin Li from CCS Shanghai Rules & Research Institute won the prize of "touching person in transportation of the year".

NEW CONSTANT: the VLCC with 319,000 DWT

The ship is 332.95 m in length, 60.00 m in width and 30.50 m in moulded depth. With a complement for 37 crew and unrestricted services, its scantling draft and designed draft is 22.45 m and 20.50 m respectively and its designed speed is 15.50 knot. The full displacement of it is 363,892.5 t and the gross tonnage is 165,592 t. As the fifth VLCC sister ship built by DSIC(Dalian Shipping Industry Co., Ltd.) for China Merchants Entergy Shipping Co., Ltd., it's classed in CCS. CCS is in charge of its classification survey and statutory survey.

Driven by single engine and single screw, the ship is designed to equip with small bulbous bow, open stern bulb and semi-hanging rudderstock. The cargo hold is structured in double bottoms and double skins. It applies anti-sediment energy-efficient design, which is, to prevent sediment, setting seven pairs of ballast tanks. The No.2, No. 3 and No. 4 ballast tanks area is interconnected space allowing overflow and sediment, while the No. 1 and No. 5 ballast tanks area is divided into separate pods and bottom ballast tanks. Ballast water in the

overflow pods flows circularly around the route as designed.

To meet the requirements of energy-saving design, the ship applies a thinner transom hull line and rubber blades with bulb, and the hull stern tube in front of propeller is equipped with energy-saving cutting guide wheel. To increase rudder area, the top gudgeon on the rudder horn is welded together with hull plate; to improve propulsive efficiency of the propeller, the air intake prerotation of the propeller should be adjusted to reduce wake rotational energy loss. In addition, the range of ballast tank, cargo oil tank and slop tank on the ship is in accordance of PSPC.

Deep Ocean Research Vessel TAN SUO YI HAO

The ship design gave enough thought to green, environmental protection, energy conservation, took advanced and effective measures in aspects of energy efficiency in sailing, noise reduction and vibration reduction to meet the requirements of existing green norms. LOA 94.45 meters, with unlimited navigation area, a dynamic positioning capability, a range of more than 10,000 miles and an endurance of 60 days, it is a wholly-domestically-made supporting vessel of 4,500 m manned submersible, will also serve as offshore platform or supporting ship of our ten-thousand-meter manned/unmanned submersible. The boat has more than a dozen laboratories like geological lab and geophysical lab, also two detachable laboratories are set on the main deck, which is suitable for different research projects and allows simultaneously carrying several researchers and aquanauts.

The modification drawing of TAN SUO YI HAO was designed by CSSC and the modification was carried out by Chengxi Shipyard Guangzhou. CCS is in charge of drawing approval and conversion survey. Launched from March 2015, the ship modifications lasted 13 months. Although construction process involved multi-disciplinary cross-operation and technical and management problems including linking old and new phases and integrating hardware and software, ultimately the technical parameters and indicators had met or even exceeded the original design requirements.

The Large Multi-purpose Patrol Ship NAN HAI JIU 102

LOA 127.65 m, breadth 16.00 m, depth 8.10 m, sailing in unrestricted navigation area, the ship is used for maintaining our maritime rights and interests, taking obligations conferred by international conventions, saving lives at sea from vessels in distress, rescuing vessels for the purpose of saving life at sea and other salvage operations like towing and fire fighting. It has a strong capacity of saving life at sea, maritime control, integrated command, information collection and processing and transmission; for vessels in distress, it has salvage operation capability including battening down, plugging, drainage, air diving and towing; it has the top external fire fighting capacity; it has DP- 2 dynamic positioning capability; it can carry out the salvage operation of oil spill recovery at sea; it also can search, rescue and salvage at sea at night; it has the ability to rescue operations, being capable of carrying 200 rescued people and being able to carry out simple medication, devices and surgical treatment to the wounded; it can carry medium helicopters and can support large helicopters to take off and land, refuel, search and rescue.

This is a mono-hull square-tuck ship, using double bottom, double hull in the middle part and raked stern. Powered by diesel, equipped with double hull, twin controllable pitch propeller(with dome), double rudders, the ship configures shaft generator and shaft fire pump, bilge keel, retractable fin stabilizer and passive controllable anti-rolling tank to improve seaworthiness. In order to improve handling performance, especially the turning ability when it is rescuing in and out of the terminal and the storm and during fire fighting operations, the ship set two bow thrusters and one stern thruster. This 12000KW large multifunction cruise salvage vessel was built by CSSC Huangpu Wenchong Shipbuilding Company Limited for Nanhai Rescue Bureau of the Ministry of Transport, classed in CCS and construction surveyed by CCS.

The 50,000-ton Semi-submersible Vessel HUA YANG LONG

It's a 50,000-ton self-propelled semi-submersible ship with DP2 dynamic positioning and full-revolving electric propulsion. The vessel features a total length of 228.12 m, a molded breadth of 43.00 m, a depth 13.50 m and a draft of 27 meters dive. Its electric propulsion system configures three 4500KW podded propulsion permanent magnet motors; there are four main 5760KW diesel generators with a total capacity of 23040KW, 6600V medium-voltage; bow is equipped with two 2750KW tunnel thrusters. The ship can sail and work in unrestricted navigation area, being used mainly for emergency rescue and salvage of large-scale ship, loading and disposal of damaged ships and overall salvage of 80,000-ton transport ship. Besides, it can load and transport large offshore equipments which are required in exploration and exploitation of the offshore oil and gas(such as large pieces of steel structures, various platforms, platform jackets, platform blocks, etc.), large vessels and navy vessels, as well as carries out uplift installation of large upper modules. The vessel was built by CSSC Huangpu Wenchong Shipbuilding Company Limited for Guangzhou Salvage Bureau of the Ministry of Communications, classed in CCS and construction surveyed by CCS.

6,000 Ton Refrigerator Ship YONG FA YUN 10

This is a leading ship as an overseas refrigerator ship and the classification survey was carried out by CCS. It's 120.80 m in length, 18.00 m in width and 10.20 m in moulded depth. With a complement for 34 crew and unrestricted services, its design draft is 7.00 m. The gross tonnage is 5784GT and the net toonage is 2645NT. The boat is a steel-made, single-hull, double-bottom, three-decks, combined-frame, single-engine, single-propeller, stern-engine refrigerated transport vessel. The double bottom and the main deck are of longitudinally framed system; while the side, platform deck, fore and aft end and the superstructure are of transversely framed system. With the Ice B notation, the refrigerating installation can maintain the lowest temperature -25°C of the cargo hold in the highest seawater temperature 35°C.

There are four sets of marine hydraulic winches and cargo derricks being set on the main deck, the speed of which is 35 m / sec. For loading fishes from fishing boats into refrigerated cargo and unloading, each derrick has a safe working load of 2.5T and a maximum working radius of 18.5m. The boat has four refrigerated cargos and each of them is divided into upper, middle and lower layers. Each bulkhead is airtight and covered with foam insulation materials, so that the adjacent compartments won't be thermal and meet the different requirements of different kinds of goods on temperature.

Azimuthing Tug QIONG YIN 11

This high-power azimuthing tug was built by Jiangsu Zhenjiang Shipyard (Group) Co., Ltd. for Bank of Communications Financial Leasing Co., Ltd. and surveyed by CCS. It's 32.28 m in length, 10.40 m in width and 4.90 m in moulded depth. With a complement for 14 crews, its full displacement is 720 t and its gross tonnage is 481GT. The tug is allowed to operate in offshore area AI+A2.

The tug is equipped with two highly-reliable Rolls-Royce US 205/3305 FP azimuthing thrusters, which will ensure the tug to be of rapid operating performance and strong stationary pull. At the same time, it has a set of SLTY80 towing system, of which the maximum safe working load is up to 784KN while the actual test site maximum towing force is 616KN. It is now the largest one among the azimuthing tugs delivered to Hainan Harbor & Shipping for operation.

The Structure Life Extension Evaluation Technology of Aging Offshore Platform

By Xu Hui, Gao Chang & Yang Qingxia

Due to the requirement of actual production and need for mining cost solution, aging platform often has a high value in use when it gets to its design life, and owners often put forward demand of extending the service time for these aging platforms. However, the structure of these platforms has sustained different degrees of damage and corrosion due to long-term service. How to ensure the safety, reliability and integrity of these platforms becomes an urgent subject of great significance for ocean engineering industry.

Since 1966 when the first offshore fixed platform was built in Bohai Bay, China's offshore engineering has gone through more than 40 years, as of 2016, there are more than 360 offshore fixed platforms in total in service in China. 32 of the platforms have served more than 20 years, and another 73 platforms have served nearly 20 years. The design life of offshore platform is generally 15-25 years due to its complex structure and expensive cost. Currently, 93 platforms that are over age are still in service, including 22 in Bohai Bay, and 63 in Shengli shallow sea area.

Currently, there has been a considerable amount of platform entering the end of the service time or serving for extended time , in the future, with the time passing by, there will be more and more aging platforms, especially when the platforms produced during the exploitation peak period become aging at the same time, the phenomenon of platform serving for extended time will be more prominent.

The main risk faced by the structure of aging platforms

Offshore platforms are affected for long times during the service life by the bad environment such as wind, wave, current and ice. With the extension of the service life of the platform, problems of aging platforms such as material corrosion, fatigue cracking platform will become prominent, resulting in platform structure safety and durability weakening and safety risks to the platform operation. If effective security measures are not taken timely, there will be not only huge economic losses and casualties, but also serious environment pollution.

Aged offshore platforms will sustain different damage and risks in the long-term action of wind, wave, current and ice and the ship collision and other harsh marine environment, including waves panting, rare typhoon, ship collision, topside weight increase and other reasons which will lead to structural damage and deformation of the platform, overall strength reduction of the platform, thereby affecting seriously the mechanical properties of the platform structure and the safety of offshore platform; the long-term attachment of sea creatures will increase platform weight, increase platform wave load, and will corrode the platform.

A considerable number of platforms have got near or exceeded the designed life period, whose structure usually have different degrees of crack, corrosion defects. For most of the time, because of continued exploitation due to production of the platform exceeding expectations, or because of the special geographical position of the platform that can save a lot of development costs for development area adjacent to the newly discovered oil reserves, the owners often demand for extended service for these aging platforms. Through the extension of the old platform, it is possible to use the original production facilities, develop new oil and gas resources, thereby significantly reducing the production cost.

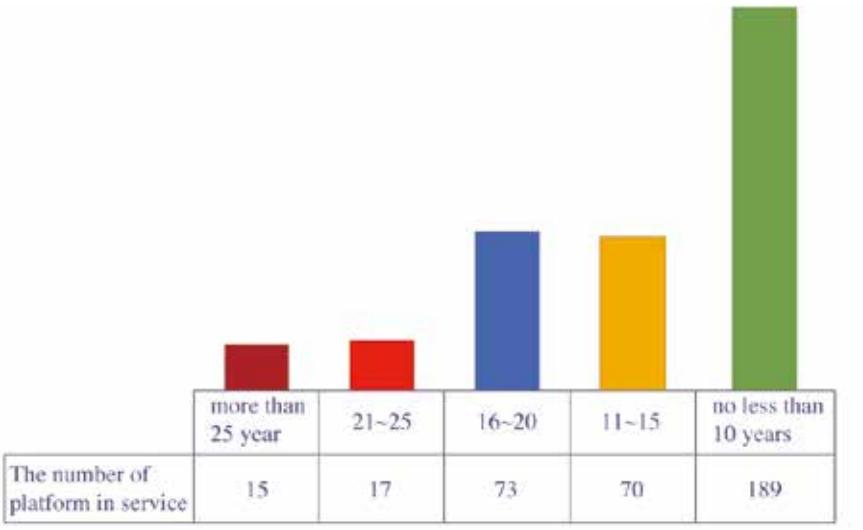
At the same time, due to long service, aged platforms usually have defects of multiple structural deformations, material corrosion and crack propagation, the degree of safety and durability of aged platforms has been reduced to a certain degree comparing with new platforms. How to ensure the safety, reliability and integrity of the platforms has become a very urgent and significant task in order to extend the service life of the aging platform. If

we can effectively prolong the service life of offshore oil platform at the premise of ensuring oceanic oil platform safety, it can greatly reduce the cost of offshore oil development and improve economic efficiency. It needs to carry out comprehensive and comprehensive safety assessment to the platform, to provide reliable basis for use of the platform, and give the platform operator a comprehensive understanding of the platform's safety situation.

The life extension technology of aging platforms

Many countries abroad usually attach great importance to the research on aged platform life extension technology. In the evaluation of life extension, Walker A.C. proposed using nonlinear finite element method to calculate the stress condition of the platform under the ultimate load, which makes the result more accurate. Wan Mahmood, BEA RG and other scholars also put forward residual ultimate strength assessment method for existing platform, and develop a number of application software on platform remaining life and strength evaluation. Nowadays, a complete set of application technology system has been formed and applied in Beihai and Mexico Bay offshore oil field with remarkable results.

In the 1990s, China National Offshore Oil Corporation organized relevant units in China such as Harbin Institute of technology, Tsinghua University, Shanghai Jiaotong University and Dalian University of Technology etc., to implement the scientific research projects on "offshore structures inspection, maintenance and repair", and got multiple research achievements including damaged members repair and evaluation, crack defect assessment



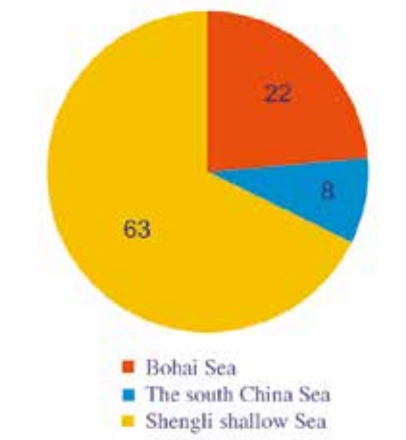
Picture 1: Summary of service life of marine platform in China

and service life prediction technology, offshore platform maintenance decision technology etc., and was awarded the second prize of 2003 national scientific and technological progress.

Evaluation process

1. The evaluation of aging platform life extension is conducted according to the influence led by factors such as safety of life and the consequences of failure, early test results and others, in accordance with the corresponding standards to analyze and evaluate the platform structure safety, reliability and integrity . Life extension assessment is usually divided into five parts to consider, namely platform choice, platform classification, condition assessment, detailed assessment of structure, reinforcement and mitigation measures.

The choice of platform. The reason of assessment of platform life extension: platform age is beyond design life; fatigue life is



Picture 2: the situation

lower than the required use life; the structure degradation caused by corrosion has occurred or is likely to occur in the period of prolonged use life.

Owners can determine whether it is valuable to continue to use the platform, and make decision on whether to have life extension evaluation according to comprehensive evaluation such as remaining oil reserve,

comparison of offshore fields supporting development cost and so on.

2. platform classification. Platform classification is made according to the importance of the two aspects i.e. life safety and failure consequences to platform structure, to confirm the evaluation standard of life extension evaluation, and make it adapt to the intended function. According to the combination of human life safety and failure consequences, the platform is divided into 3 types of exposure classification: L-1, L-2, L-3.

3. Condition assessment. Condition assessment refers to confirmation of the current state of the platform through collecting all kinds of assessment data, judging preliminarily whether detailed structural evaluation and corresponding evaluation is needed and planning for platform according to the relevant acceptance criteria. Confirming acceptance criteria for condition assessment is in accordance with the platform's exposure classification, relevant legal requirements, company's policies, industry standards / practices, etc..

4. Detailed structural assessment. If the conclusion of condition evaluation concludes that the platform should carry out a detailed analysis to further assess its actual state, then the design level analysis and ultimate strength analysis of platform should be carried out. Before checking detailed analysis, it is necessary to evaluate structure corrosion protection system including anode block, anticorrosion coating state according to historical testing results of platform.

The content of detailed checking analysis may include structural static analysis, dynamic analysis of wave, seismic analysis and the fatigue analysis of the overall strength analysis, it may also include the local structure strength analysis such as waves panting, vortex-induced vibration etc.

5. Reinforcement and mitigation measures. If the platform can not get through structural evaluations, appropriate mitigation measures can be taken, such as reducing hydrocarbon storage capacity, reducing the number of persons on platform, and reducing the load of the platform and / or overall, local strengthening or repair, enabling the platform to pass the assessment. The mitigation measures usually are: to reduce the load, such as to reduce the superstructure of excess equipment or structure, remove excess water pipe, subsidiary structure, control thickness of marine organism and timely clear off;

Better evaluate structural resistance strength by using materials proof or materials test, and designedly track and detect to the fatigue and sensitive parts.

Challenges faced by evaluation

Over the next few years, China will have a number of platforms stepping into the aging service period, ocean platform life extension assessment business will usher in a spurt of outbreak. However, in terms of the evaluation of aging platform life extension, there are still many difficulties, mainly in the four aspects as follows:

Firstly, China has not carried out extensive research on the aging platform life extension assessment and relevant norms and professional software are lacking; secondly, for the earlier platforms such as the ones put into production in 1990s, there is no complete information regarding their original design and completion, record of transformation during service period, so it is difficult to accurately simulate the actual state of the platform; thirdly, precise theory and method to effectively assess defects of existing platform are lacking, such as corrosion, crack, depression etc.; fourthly, for platforms serving in deep oceans, such as the East Sea, South China sea, the accumulation of sea creature remains at the bottom of platform is serious, the structure state of skirt piles can not be fully tested, which makes life extension assessment unable to accurately predict the actual capacity of the skirt pile.

These difficulties indeed bring challenges to evaluation accuracy for aged platform life extension. It needs relevant industry parties including platform management, testing, construction and rule and research department to pay attention and effort for proper solution. Guidelines need be established to adapt to our national condition. Meanwhile, the platform management should do platform integrity management, grasp the latest real-time state of the platform, the testing parties need to further strengthen testing method and increase testing accuracy, overcoming difficulties in the testing process and providing comprehensive and real first-hand data for evaluation of life extension. Only in this way can the result of life extension assessment be more reliable, and be more significant to provide guidance to safe operation of the aging platform.

With the deepening of the aging trend of offshore platforms in China , the demand of extended service for platforms will increase, life extension assessment for aging platforms will become the important means to protect the safe operation of offshore oil platforms in the future.

Analysis of Cargo Loading and Unloading Safe Zone Under Ship to Ship Refueling Operation

By Fan Hongjun, Chengkang & Wu Shunping

For large ships, due to large amount of LNG refueling, cargo loading and unloading can be carried out at the same time to reduce berth time. However, if there was a fuel leak and spark within the range of spread of inflammable gas due to cargo loading and unloading, there will be a fire risk. Taking a 10000m^3 LNG refueling ship fueling a 18000 TEU container ship at the port as an example, this paper analyzes cargo loading and unloading safe zone during ship to ship refueling.

Enlightenments of LNG refueling accidents

ned in the past are meaningful to act as direct warnings for safe LNG refueling. LNG ship to ship refueling is still a new practice in the world, with only 15 years' history and the experience in operation is still not much. Up to now, there have been reports of two accidents in Norway.

On May 9th of 2014, in Risavika port of Norway, a quick disconnect coupling leakage accident happened in filling station when ropax ferry of MS Bergensfjord was refueled by a tanker. About 130kg of LNG leaked in catch tray. Several reasons caused the accident. Firstly, anti-tipping system of MS Bergensfjord was not opened during refueling operation; secondly, refueling flexible pipe was installed on a lifting arm which was fixed on the wharf and it could not move flexibly, when the ship moved, the quick disconnect coupling could not bear the stress. During the accident, ESD system was also not applicable.

Another accident happened on July 13 of 2014, when MF Landegode was refueled in Moskenes port in Norway. The stern shifted away from the wharf, LNG flexible pipe was stretched, lifting arm was damaged, LNG fuel leaked. The lifting was broke the next day. There was a serious leakage risk in this accident. The damaged flexible pile may cause LNG leakage at the flow rate of 1500L/min. There was not a break away coupling in the pipe. Berthing failure caused the accident.

These two accident gave lessons to learn to STS refueling: firstly there should be operation safe zone, LNG catch tray is effective; secondly, the hose should be able to move freely; thirdly, detection and monitoring during LNG filling process should be enhanced; Fourth, test of ESD system should be done before bunkering; Fifth, bunkering hose should be set to pull off valve; sixth, the anchor / mooring safety of the LNG refueling ship should be ensured; Seventh, personnel training should be strengthened. These lessons are to be considered in the project described in this article.

Overview of LNG bunkering and refueling ships

The LNG refueling ship selected in the article is a 18000 TEU container ship, whose basic layout and parameters are shown in figure 1 and table 1.

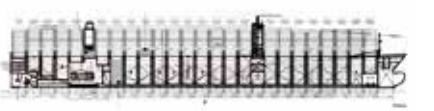


Figure 1: the elevation LNG refueling ship

Table 1: basic parameters of the LNG refueling ship

parameter	The parameter value	parameter	The parameter value
General length/m	403.40	Molded depth/m	30.20
Between the vertical height/m	384.00	Designed draft/m	14.00
Molded breadth/m	58.50	LNG storage tank capacity/m^3	10000
Speed/kn	20	Main motor power/kW	56800

Table 2: the basic parameters of the LNG bunkering ship

parameter	The parameter value	parameter	The parameter value
General length/m	113.50	Molded depth/m	5.80
Between the vertical height/m	106.00	Designed draft/m	12.00
Molded breadth/m	20.30	LNG capacity/m^3	10000
Maximum filling speed/$m^3 \cdot h^{-1}$	600	Tank type	Membrane

The LNG bunkering ship selected in the article is one with 10000 cubic meters capacity and a new filling arm (arm + hard tube + hose) its basic layout and parameters are shown in table 2.

The determination of LNG leakage risk scene based on the analysis of the failure frequency

For the analysis of LNG leakage between ships in the process of filling, not only the filling system of bunkering ship and refueling ship, but also the isolated valves between cargo systems should be paid special attention. As this study only focuses on the analysis of safety zone of fuel filling and cargo unloading, only open area of the leakage source is considered. According to the experience and previous data, the leakage of combustible gas diffusion has no effect on the safety span of the STS operation, so only liquid leakage is discussed.

About the risk assessment of the LNG project , there is more and more tendency that the leakage and position should be based on the leakage frequency. Such as a memo issued in 2012 by the federal energy regulatory commission (FERC) which pointed out that the failure frequency greater than 3 x 10^{-5} times a year must be considered. This paper selects the guidelines as a criterion to determine the dangerous scene. At present, internationally there are some of the available LNG pipeline and equipment failure frequency database, for example, the FERC data, the international association of oil and gas producers (OGP) database, the Netherlands, quantitative risk assessment of the purple leather book database, the health/safety/environmental executive (HSE) database, etc. Table 3 ~ table 5 summarize the failure frequency data within the scope of this paper, a revised LNG hose failure frequency is presented in table 6, also with the operating time.

The failure frequency calculation of

Table 3: pipeline failure frequency in FERC

Dpipe/mm diameter	Failure frequency, time/year, m^{-1}		
	Whole cross section of fracture	Dhole = 1/3 dpipe broken hole diameter	Break the Dhole=25mm hole diameter
$d_{pipe}<50$	10×10^{-7}	—	50×10^{-7}
$50<d_{pipe}<149$	5×10^{-7}	—	20×10^{-7}
$150<d_{pipe}<299$	2×10^{-7}	4×10^{-7}	7×10^{-7}

Table 4: Manual valve leakage probability in OGP

Leakage aperture/mm	Leakage probability (time/year)		
	DN 50	DN 150	DN 300
1~3	2.0×10^{-5}	3.1×10^{-5}	4.3×10^{-5}
3~10	7.7×10^{-6}	1.2×10^{-5}	1.7×10^{-5}
10~50	4.9×10^{-6}	4.7×10^{-6}	6.5×10^{-6}
50~150	—	2.4×10^{-6}	1.2×10^{-6}
>150	—	—	1.7×10^{-6}

Table 5: Remote control valve leakage probability in OGP

Leakage aperture/mm	Leakage probability (time/year)		
	DN / 50 years	DN 150 / year	DN 300 / year
1~3	2.4×10^{-5}	2.2×10^{-4}	2.1×10^{-4}
3~10	7.3×10^{-5}	6.6×10^{-5}	6.3×10^{-5}
10~50	3.0×10^{-5}	1.9×10^{-5}	1.8×10^{-5}
50~150	—	8.6×10^{-6}	2.4×10^{-6}
>150	—	—	6.0×10^{-6}

Table 6: LNG hose failure frequency and operation time

parameter	The parameter value
Leakage probability/h	4.0×10^{-7} (aperture leakage:10%D~50 mm)
Each time the filling operation times/h	16 (according to the charging scheme to estimate)
Filling times every year	20
Filling operation total time/h each year	320

Table 7: parameters and failure frequency of the LNG filling system pipeline and valves in open areas

The serial number	type	Length or number	pecifications	Failure frequency calculation results
1	The liquid pipe	25m	DN 200	Whole cross section:5.0×10^{-6}; Leakage aperture of 67mm:1.0×10^{-5}; Leakage aperture 25mm:1.75×10^{-5}
2	Refill arm The liquid pipe	14m	DN 200	Whole cross section:2.8×10^{-6}; Leakage aperture of 67mm:5.6×10^{-6}; Leakage aperture 25mm:9.8×10^{-6}
3	Refill arm Liquid hose	20m	DN 200	Leakage aperture 50mm:1.28×10^{-4}
4	Remote control valve (liquid)	eight	DN 200	Leakage aperture 1mm~3mm:2.2×10^{-4}; Leakage aperture 3mm to 10mm:6.6×10^{-5}; Leakage aperture 10mm to 50mm:1.9×10^{-5}; Leakage aperture 50mm to 150mm:8.6×10^{-6}
5	Manual valve (liquid)	1	DN 200	Leakage aperture 1mm~3mm:3.1×10^{-5}; Leakage aperture 3mm to 10mm:1.2×10^{-5}; Leakage aperture 10mm to 50mm:4.7×10^{-6}; Leakage aperture 50mm to 150mm:2.4×10^{-6}

Table 8: The danger of LNG leakage scenario

Serial number	Dangerous scene description	Duration of leakage/s	Leakage/kg
Scenario 1	Filling liquid hose leakage on the arm of the leak diameter of 50 mm	90	1 082.7
Scenario 2	Remote control in the note ship filling valve leakage, leakage aperture to 10 mm	90	91.3
Scenario 3	Remote control valve in the note ship filling or manual valve leakage, leakage aperture is 3 mm	90	8.2
Scenario 4	Filling liquid tank relief valve jump ship	2.5 (see holdings)	15.0

Table 9: Environmental conditions of LNG filling site

The serial number	parameter	The numerical
1	The annual average wind speed/m.s^{-1}	3.15
2	The annual average temperature / ℃	16
3	Atmospheric pressure/Pa	101 325
4	Relative humidity/(%)	75
5	The intensity of solar radiation/w.m^{-2}	583
6	The atmospheric stability	D

liquid pipe and valves between the bunkering ship and the refueling ship in open zone is shown in table 7. Because there is no specification for the DN 200 valve failure frequency data, so the specifications for the DN 150 valve is used in the partial conservatively failure frequency data. The result shows that the failure frequency of LNG hoses is the highest.

The dangerous scenario according to the evaluation criterion mentioned above (the failure frequency is more than a year 3 x 10 - five scenarios as a dangerous scenario) is listed in table 8. During LNG filling, due to the connection of refueling and bunkering ships, and the scale of the refueling ship is relatively small, if the filling liquid cargo ship safety valve rotate by breathable mast, emission of flammable gases may affect the ship, so the dangerous scenario 4 is analyzed as a risk analysis. According to experience, 60s is the longest time to detect gas leakage, time for ESD cut off is 30 s, so 90s is set to be the duration time for the dangerous scene of LNG leakage.

CFD Analysis of LNG vapor cloud diffusion

Three-dimensional computational fluid dynamics (CFD) software FLACS is used in LNG leakage dangerous scene simulation, the software is one of the authoritative softwares of the LNG vapor cloud diffusion analysis software with high international recognition. The U.S. department of transportation approved that FLACS can be used to replace LNG vapor cloud diffusion model for execution of the federal regulation 49 CFR 193.2059 (a).

STS filling site environmental conditions is shown in table 9, these data will serve as

input data for CFD analysis.

The establishment of calculation model

The three-dimensional vertical view and perspective of the calculation model is shown in figure 2.The nozzle form of the bunkering ship's breathable mast has significant effects on gas emissions, so the nozzle type has been considered accurately during modeling. Breathable mast and its 3D model of the nozzle are shown in figure 3.

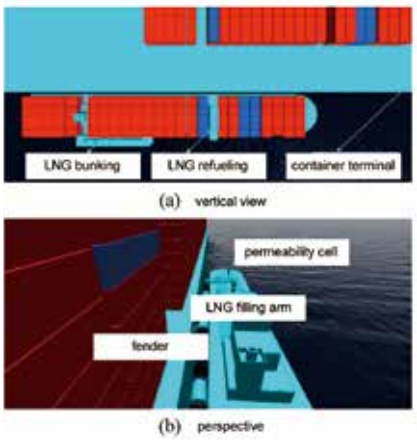


Figure 2: Three-dimensional calculation model

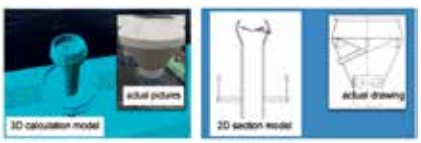


Figure 3: Breathable mast and nozzle 3D model

The calculation analysis and results

This article selects half the minimum volume concentration of gas burning (2.5%) as the boundary of the combustible gas diffusion range.

1. the liquid leakage of tubes on filling arms.

LNG liquid leakage of filling arm hose is in table 8 "scenario 1".Due to the large leakage and wide range spread of the combustible gas, which is more sensitive to surrounding obstacles, so it is needed to consider light ship and full loading two situations in order to evaluate the effect of containers (obstacles) on the spread of gas.It is considered the influence of three different wind direction ,that is the east, west and north in computation, (due to the shield of the refueling ship, the danger of the south wind blowing is relatively low. Model directions are shown in figure 2).

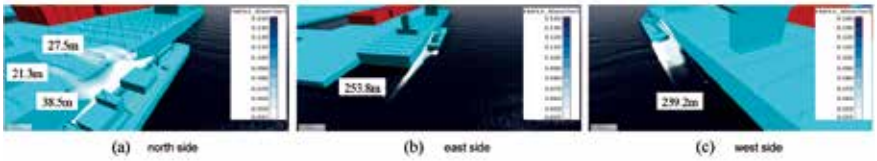


Figure 4: The spread range of the combustible gas (volume concentration 2.5% ~ 15%) when LNG leak to the refueling station.

1) empty ship

The situation is refueling the ship while loading, LNG leakage occurs at the beginning of the loading.Figure 4 shows the diffusion LNG leakage within the ship hold by the filling and catch tray (1.2 m * 1.2 m * 1.2 m) .

The figure 4 shows that when the north wind blowing, combustible gas crept over the edge on the side, and spread as far as 27.5 m;When the east wind and west wind blowing, combustible gas is always located in the edge on the side, and had no influence on the safety of the loading.

Another situation is that when LNG leakage into water directly and combustible gas is gathered on the side the under the upper

Figure 5: The spread range of the combustible gas when LNG leak to the refueling station (the north wind, volume concentration 2.5% ~ 15%)

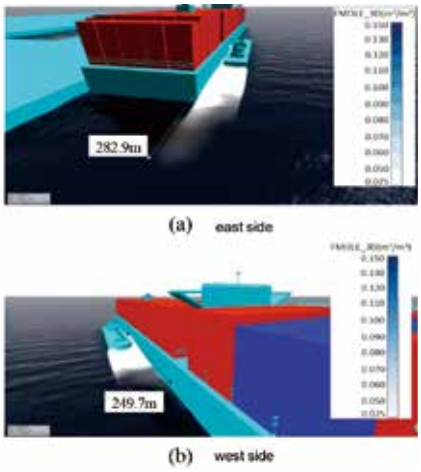


Figure 6: The spread range of the combustible gas when LNG leak on the water (volume concentration 2.5% ~ 15%)

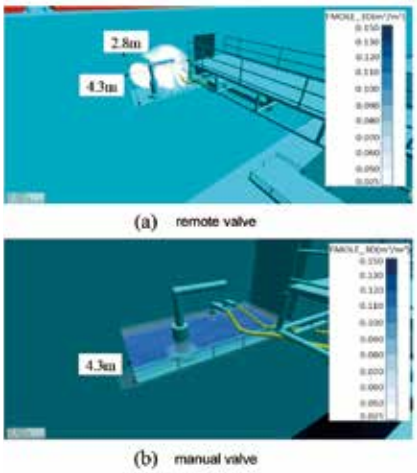


Figure 7: combustible gas diffusion area after LNG valve leakage (the north wind, volume concentration 2.5% ~ 15%)

Table 10: Gas emission rate of the relief valve

Time/s	Release rate/kg · s^{-1}	Time/s	Release rate/kg · s^{-1}
0	6.762 1	1.5	6.336 4
0.5	6.593 7	2	6.076 2
1	6.424 2		

edge which has no influence on the safety of the loading either.

2) fully-loaded ship

The situation is refueling the ship while unloading, LNG leakage occurs at the beginning of the unloading. Figure 5 shows the spread range of the combustible gas when LNG leak to the refueling station. Figure 6 shows the spread range of the combustible gas when LNG leak on the water.

Figure 5 and figure 6 show that when the north wind blows, combustible gas diffuse over the edge on the side and laterally spread as far as 14.0m along the ship; When the east wind and west wind blow, combustible gas is always located in the edge on the side, no influence on the safety of the loading.

2. The leakage of valve.

The filling valve leakage of refueling ship

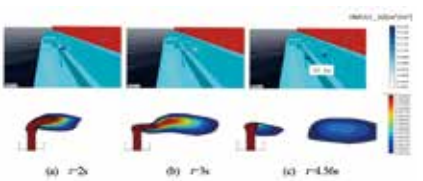


Figure 8: flammable gas diffusion of the bunkering ship after relief valve discharging

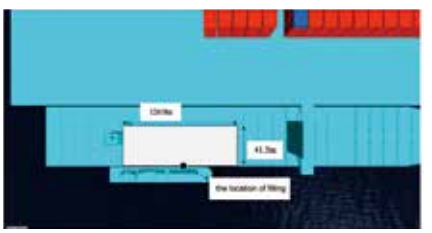


Figure 9: Dangerous scope

are considered in “scenario 2” and “scenario 3” which are listed in table 8. LNG leakage is hold by the filling and catch tray .

Calculation is carried out only under the condition of the north wind (after the trial, the east wind and west wind are less dangerous). The calculation result shows that the influence of valve leakage is very small and will not affect cargo operations (figure 7).

3. liquid cargo safety valve discharge of bunkering ship.

The valve of bunkering ship liquid tank starts at pressure 25 kPa and back at 23 kPa with circulation area 31400mm2.This article uses the gas equation and FLACS software built-in tools to calculate gas release rate of the relief valve.by using gas equation[10] , the gas emission rate is 6.76 kg/s.Using leak FLACS software wizard to calculate discharge rate and the results are shown in table 10. When releasing for 2.5 s, the total amount is about 15.0 kg, in which demonstrates that FLACS calculation result is reasonable.

Figure 8 shows combustible gas diffusion of the takeoff time t with different relief valve when the bunkering ship safety valve discharges. From figure 8 it can be summarized that the furthest distance of flammable vapor cloud is 10.1m , and the breathable hole of bunkering ship is 12.7m away vertically from the deck edge, so can it eliminate flammable risk due to relief valve jump.

Figure 8:flammable gas diffusion of the bunkering ship after relief valve discharging

4. safety area.

Based on the above calculation, the partial conservatively envelope gets a rectangular danger zone, namely the 27.5 m * 84.0 m, 27.5 m from the figure 4 (a), 84.0 m from the figure 5, figure 5 is only the case of blowing north wind and when considering the situation of the south wind, it is necessary to amplify the 42.0 m by two times. The side length of the rectangle of the dangerous area multiplied by the coefficient of 1.5 times is used as dangerous areas of refueling area between ships, namely 41.3 m * 126.0 m (figure 9), the safety zone for simultaneous LNG fueling and cargo unloading is outside of this dangerous area.

From what has been discussed above, we can draw the following conclusion:

LNG leakage and combustible gas diffusion are dominantly influenced by ship design and environmental conditions such as the length of the charging line, choice of the reliable product, wind speed of working location, atmospheric stability, temperature/ humidity environment and so on. Hence the establishment of safety area during simultaneous LNG bunkering and cargo unloading cannot be generally made, but to give specific figures according to specific design plan.

Summarized from the failure frequency calculation, it is known that the leakage frequency of LNG charging hose is the highest; summarized from combustible gas diffusion analysis, it is known that the range of spread of combustible gas is farther when the liquid cargo of the bunkering ship safety valve discharges. So, when analyzing this kind of problems, LNG hose leakage and the liquid cargo relief valve of the bunkering ship should not be ignored .

2016 Amendments to Rules for Classification of Mobile Offshore Units

This revision is mainly based on the industry feedback on the Rules for Classification of Mobile Offshore Units (2012) and its 2013, 2014 amendments, feedback from CCS related offshore engineering inspection, plan approval and scientific research units, and the new requirement of 2015 amendments to CCS "Rules for Classification of Sea-going Steel Ships" and IACS PR1C, MODU1 and UR Z15, revised the content of the corresponding section of the rules. At the same time, the drafting group made some modification for editing problems of the rules. The main contents are as follows:

1. Chapter 3 of PART ONE "product inspection" had more changes. At present, the list of certified products in this chapter only keeps the content of products exclusively used on offshore mobile unit, and the general related contents of ship all refer to CCS "Rules for Classification of Sea-going Steel Ships". This revised chapter will facilitate the owner to clarify CCS technical requirements for offshore engineering product inspection and on-site inspection of surveyors.

2. According to the latest version of the IACS UR Z15, the content of "survey after construction" of Chapter 5 of PART ONE has been subjected to comprehensive sorting out and writing by considering our actual inspection situation. After revision, this chapter content of CCS is consistent with IACS unified requirements, conforms to the requirements of the audit, and is advantageous for the on-site inspection.

3. According to the actual demand for inspection, appendix 2 "guidelines for mechanical planned maintenance system (PMS) of mobile units" is added. This content can form external service products, complete survey and grant PMS notations.

4. According to the actual situation of inspection, rewrote "1.4.2 structure component classification" of PART TWO, to make it easier to use.

5. Based on IACS MODU1, the content of "1.8.2.1 provision of means of access" of PART TWO was revised, adding "(4) jack-up unit pile shoe and elevation basis could be exempted from the provisions of the above requirements."

6. According to CCS scientific achievements, the technical requirements of "2.3.2 design wave height" of PART TWO was revised.

7. According to the practical design construction case, in Chapter 3 of PART FOUR the technical content of "section 19 steam system" was added.

8. According to the feedback, combined with the content of IMO MODU Code 2009, related technical content in paragraph 5.2.2 in Section 2 "windlass device", Chapter 5, PART FOUR was revised, of which, the terms and technical requirements require to be more accurate.

9. According to the "IEC 61892-1 portable and stationary offshore installation", technical requirements of 1.2.3.1 of PART FIVE was revised as follows: "the voltage total harmonic in the power distribution system should not exceed 8%, single-phase harmonic should not exceed 5%."

10. In PART SIX, "Chapter 4 requirements for automation notation of attended machinery space", a new paragraph is added as follows: "4.1.2 if unit apply for the BRC notations, the requirements of Chapter 4 of PART SEVEN of CCS Rules for Classification of Sea-going Steel Ships are also to be complied with".

2016 Amendments to "Rules for classification of mobile offshore units" will take effect on July 1, 2016.

CCS Developed Ultra-Large Ore Carrier (ULOC) Engine Room Finite Element Direct Calculation Software

By Liu Yuchuan

In the hull structure of Ultra-Large Ore Carrier (ULOC), the structure of engine room is especially complex, the conventional rule calibration method cannot ensure enough structural strength. Moreover, in order to improve the ship performance, the optimized engine room shell curve will shrink further, but many longitudinal components in the cargo area will be interrupted in engine room area, so detailed and reliable assessment methods and results are particularly important. The existing actual ship calculation has also witnessed engine room structure damages, such as buckling in engine room platform deck, and buckling in engine room strong frame opening, etc. Therefore, direct calculation method should be adopted to evaluate the engine room structural strength on the basis of conventional descriptive rule design.

To this end, CCS Rule and Technology Center established ULOC engine room finite element direct calculation method from the aspect of modeling principles and boundary conditions, load and load combination, hull girder target load adjustment method and strength evaluation criterion. Since the calculation process of these methods is very complex, it cannot be finished by way of manual calculation, therefore, CCS R&D Center developed a software which can be used exclusively for ULOC engine room finite element direct calculation.

This software is developed on MSC's PATRAN finite element platform, the main function modules include:

1. Definition of ship type parameters: ship types, ship notations, analysis area, assessment type, etc.

2. Definition of main parameters: length, breadth, draft, etc.

3. Structure definition and search: defining each structure type of the hull, searching automatically the unit which is included in the structure.

4. Engine room definition and identification: defining each engine room type of the hull, searching automatically engine room's boundary and its internal unit.

5. Definition of unit attribution: unit building thickness, definition of material yield limit, automatic corrosion deduction.

6. Load calculation and imposing: open load mode, definition of distributed load, definition of condition, automatic load imposing, nodal force calculation.

7. The automatic hull girder adjustment: points including part of load, target value calculation and correct load imposing method.

8. Boundary condition imposing: the cantilever type boundary condition especially used in engine room.

9. The assessment of yield strength: automatic assessment of rough and fine grid unit.

10. The assessment of buckling strength: calibration of the buckling capacity of stiffened plate and non-stiffened plate, automatic division of the buckling plate, automatic obtaining of the attribution, the cloud chart and factor display of the results.

11. Detailed analysis: sub-model method automatic mapping tool.

The main characteristics of the software are:

1. Fully integrated with the ULOC tank calculation module,

it doesn't need to install separately, switch can be made through choosing the "assessment area", it is easy for users to install and use.

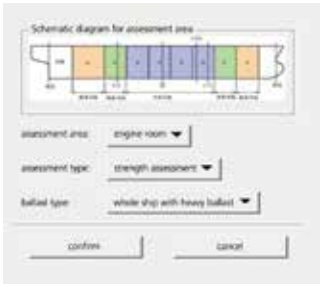


Figure 1: switch is made through the "assessment area"

2. Automatic structure search, engine room automatic identification, automatic corrosion deduction and many automatic model "pretreatment" tools, saving users' modeling time and improving efficiency.

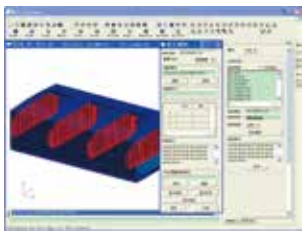


Figure 2: automatic structure search

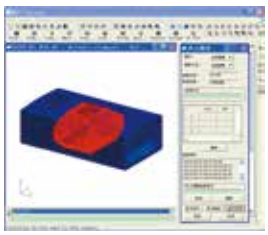


Figure 3: engine room automatic identification

3. Distributed load definition and automatic load imposing, saving complex formula calculation to enable "one click"completion.

Figure 4: distributed load definition

4. Automatic hull girder load adjustment, boundary conditions imposing, leave out the complex load adjustment calculation process, the operation will be convenient and quick, the result will be accurate and reliable.

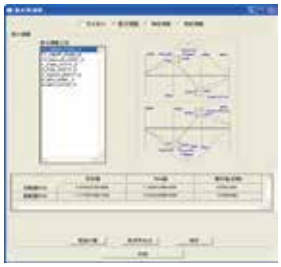


Figure 5: hull girder adjustment module

5. The independent post-processing database, complete breakaway from the PATRAN platform's data storage method, safe, quick, and reliable.

Figure 6: read results

6. A variety of grid automatic refinement tools, including: general grid refinement, angle type, hatch corner, openings, toes, horizontal girder roots, aggregate plate elements, etc. The tools have high degree of automation, high speed, and high quality, which can save a lot of time on grid refinement for users.

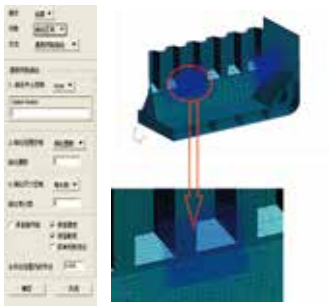


Figure 7: automatic grid refinement tools

At present, CCS ULOC engine room finite element direct calculation software has been used in ULOC structure strength technology research and real ship calculation, indicating that CCS has obtained full technology and service ability on ULOC structure strength finite element calculation. And this software will be an important tool for CCS to serve the industry.

CCS Launched Assessment Software to Secure Ultra-Large Ore Carrier (ULOC) Key Structure Safety

By Luo Haidong & Lv Yining

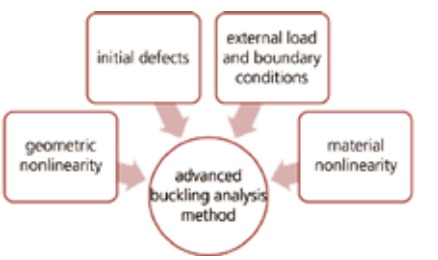
Stiffened plate is the basic strength component for ships and offshore engineering structures, which is usually composed of the board and one-way or two-way stiffeners on the side of the board. The overall failure of ship structure and ultimate strength is mainly decided by the buckling and ultimate strength of stiffened plate structure in the area of deck, bottom and shipboard. Therefore, calculating precisely the buckling and ultimate strength of stiffened plate structure is the basic requirement for the assessment of ship structure safety.

At present, with ships getting larger and the extensive use of high strength steel, the buckling of hull stiffened plate and ultimate strength have more influence on the ultimate bearing capacity of the hull structure. Moreover, in recent years, the rules assessment for ULOC, containerships and other super large ships also shows that the rule requirements for buckling strength often play a decisive role in the size of many key structures in the hull, including the thickness of the board.

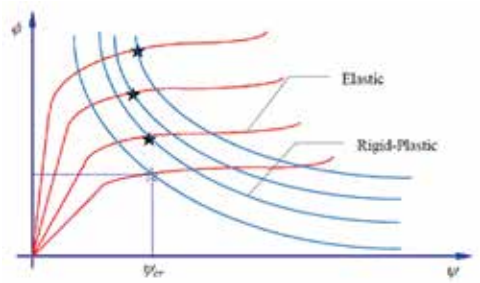
Whether for sea-going ships, river-going ships or offshore structures like FPSO, the hull grillage usually undergoes in-plane and lateral load effect. The in-plane load is mainly produced due to hull bending, transverse shear or torsion, while the lateral load mainly comes from water pressure and cargo pressure. Under the effect of a certain load or several forms of load, there are always many load components which interact with each other in the grillage structure.

Therefore, in order to obtain safe, economic and environment-friendly hull structure, especially to ensure the safety of the structure of new type and large type ships, there is a need for analyzing as far as precisely the buckling capacity and ultimate bearing capacity of hull structure under the complex loading effect. To this end, China Classification Society (CCS) and China Ship Scientific Research Center developed an advanced buckling assessment software COMPASS – ABA which has higher precision in calculation and analysis.

This software can reasonably consider the effect of geometric nonlinearity, material nonlinearity, initial defects, welding residual stress, different direction load combination and the boundary conditions on structure elastic buckling and post-buckling characteristics, which can be used as a practical tool to conduct buckling strength, ultimate strength assessment and optimum design for large ships, new type of ships and offshore engineering structures.

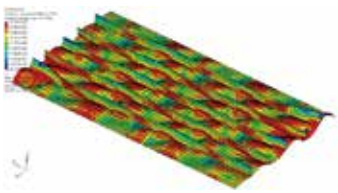


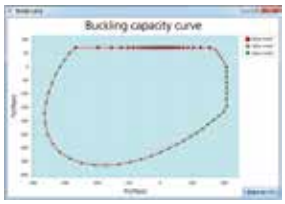
This software is based on the elasticity large deflection theory and rigid-plastic analysis, and absorbs especially the results of related research on structural elastoplastic analysis method at home and abroad, and puts forward the buckling and ultimate strength calculation assessment method for non-stiffened plate with initial defects under the combined effect of two-way lateral pressure, axial compression and in-plane pressure. At the same time, based on the typical failure mode analysis and orthogonal anisotropic theory, this software gives the buckling and ultimate strength calculation assessment method for stiffened plate with initial defects under the combined loading effect.



Based on the fast calculation and analysis function of COMPASS-ABA advanced buckling assessment software, after obtaining the structural loading in the different area of the hull, the overall assessment for buckling strength of grillage structure can be given by combining with ship type rules and requirements,. For the stiffened plate which does not meet the requirements, parameters such as thickness can be recommended through the function of revised design and optimum design.

The main function modules of this software include: 1) automatic division of buckling plate grid; 2) the parameters, assessment methods, criteria definition and external interface for the stiffened plate grid and non-stiffened plate grid; 3) the elastic buckling and ultimate capacity solution for non-stiffened plate grid; 4) elastic buckling and ultimate capacity solution for one-way stiffened plate grid; 5) elastic buckling and ultimate capacity solution for two-way stiffened plate grid; 6) the buckling model and condition and the deformation under the ultimate condition; 7) the cloud chart for assessment result; 8) capacity curve calculation function, etc.





The scope of application of COMPASS-ABA software is very wide, especially for solving the hot and difficult technical problems in terms of buckling assessment for new, large ships and offshore engineering structures. At present, this software has been preliminarily applied and verified in buckling assessment of 400,000 ton VLOC's structure, playing an important technical support role in the safety of some key area structure design. The release of this software indicates that CCS has the ability to develop senior buckling analysis and technical service on its own. The COMPASS-ABA software will surely become an important tool and mean for CCS to serve the industry, and also will make its share of contributions to improving the safety of new, large ships and offshore engineering structures.