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CCS
CHINA CLASSIFICATION SOCIETY
中国船级社

The second issue in 2015
(The 14th issue in total)

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Content

Dynamics

- 01 CCS Signed Strategic Cooperation Agreement With Chinese ECIC
- 01 China Classification Society Opened Jakarta Office
- 02 CCS Issued First Approval Certificate of Testing Organization for Ship's Hazardous Materials of Hong Kong Convention
- 02 CCSC Issued First Certificate of Aviation Energy Management System Certification
- 03 CCS HCSR Software Improvement Review Meeting Held in Beijing
- 03 CCSC Obtained the First Institution Qualification for Assessing Management System of Integration of Informatization and Industrialization of MIIT
- 04 CCS Bergen Office Opened in Norway
- 04 CCS Held Seminar about International Code for Ships Operating in Polar Waters

Technical Tendency

- 05 RBI Technology Used in Offshore Storage Tank Risk Control
- 08 Evolution and Development Trend of Oil Tanker Condition Assessment Method

Servicing Products



- 11 CCS Wave Load Software Development Made Phased
- 14 CCS Steel Plate E-Visa Platform is Getting Online

CCS Signed Strategic Cooperation Agreement With Chinese ECIC

On March 19, Chinese Classification Society (CCS) signed strategic cooperation agreement with China Export and Credit Insurance Corp (hereinafter referred to as Chinese ECIC) in Beijing. CCS President Sun Licheng, CCS Vice President Sun Feng, China ECIC deputy General Manager Cha Weimin, and the General Manager of Project Insurance Market Development Department Chen Xin and other leaders attended the signing ceremony.

CCS and Chinese ECIC believed that both sides have a wide range of cooperation in financing of marine offshore engineering, risk prevention, marine technical communication, customer resource sharing, information sharing and other aspects, and the cooperation will be positive to shipbuilding, shipping, financial services and other related industries in China. To establish and maintain long-term and stable strategic cooperative relations, and construct smooth and good information and business communication and cooperation platform will play a very important role for the business of both sides.

According to the agreement, the two sides will cooperate in ship and



marine engineering information exchange, recommendation of quality customers and market projects, training and exchange of talents, technology and information exchange and etc.

China Classification Society Opened Jakarta Office

On March 10, the opening ceremony of Jakarta new office of China Classification Society (CCS) was held in Jakarta, the capital of Indonesia. Mr. Tan Shufu, the counselor of the Mission of the People's Republic of China to ASEAN, Mrs. Carmelita Hartoto, the President of Indonesia shipowners' association, Mr. Eddy K. Logam, the President of Indonesia shipbuilding and offshore engineering association, Mr. Zhang Min, Vice President of Indonesian Chinese enterprises association, representatives of Indonesia local shipowners and shipyards and other related industries, and Chinese enterprises institutions in Indonesia attended the opening ceremony.

Sun Feng, the Vice President of CCS delivered a speech at the opening ceremony, extending his gratitude to the parties who have supported the



business development of CCS for a long time and to those who have assisted the preparation of Jakarta office. He said, China put forward the strategic vision of building the "21 century maritime silk road" jointly with ASEAN countries and Indonesian government proposed a plan of building a sea power and sea highway; in order to meet the expectations and requirements raised by the related industry and better serve local shipyards, owners and related industries, CCS decided to open an office in Jakarta. He stressed that CCS Jakarta office will strictly abide by the local laws and regulations and carry out business in accordance with laws. At the same time, CCS will be adhering to the objective of "safety, environmental protection and create value for customers and society", cooperate with our peer and close partner--- PT. Biro Klasifikasi Indonesia, in order to provide local Indonesia customers with high quality, efficient and pragmatic services.

Counselor Tan Shufu, President Zhang Min, chairman EDDY and local owner representative Mr. Oentoro Surya respectively delivered a speech at the opening ceremony. Delegates expressed warm congratulations for CCS Jakarta office, and said that they will actively cooperate and make common development in the future. At the same time, it is sincerely expected that CCS, by the Jakarta office window, will provide tangible support and help for the development of local Indonesia shipbuilding and shipping and related industries.

CCS Issued First Approval Certificate of Testing Organization for Ship's Hazardous Materials of Hong Kong Convention

On March 26, CCS Jiangsu Branch issued to the testing center of CNOOC Changzhou coating chemical industry research institute the first Approval Certificate of Testing Organization for Ship's Hazardous Materials of Hong Kong Convention, which demonstrates that domestic testing organizations have possessed the ability of conducting complete testing of ship's hazardous materials required in Hong Kong Convention and Regulation (EU) 1257/2013, and that CCS took a solid step in promoting domestic shipbuilding and ship recycling industry to smoothly implement Hong Kong Convention.

It is understood that at a diplomatic conference on ship recycling which was held in Hong Kong in 2009, the International Maritime Organization (IMO) adopted by a resolution the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (hereinafter

referred to as the "Hong Kong Convention"). The most important concept of Hong Kong Convention is the whole process control

of the ship's hazardous materials, and it is expected that the Convention will enter into force in 2016 at the earliest. In order to promote the Hong Kong Convention to enter into force as soon as possible, European Union (EU) 1257/2013 ship recycling regulation (hereinafter referred to as the EU regulation) took effect on December 30, 2013, and is expected to be implemented from December 31, 2015 at the earliest.



CCSC Issued First Certificate of Aviation Energy Management System Certification

Recently, China Classification Society Certification Company (CCSC) completed the certification of energy management system of Hainan Airlines Co., Ltd (HNA). On January 22nd, CCSC issued energy management system certification to Hainan Airlines Co., Ltd. This is the first energy management system certification obtained by China's civil aviation sector.

HNA fulfills green development concept, has the courage to shoulder social responsibility and shares common values with CCSC in energy conservation, emissions reduction and energy management system construction. Since management work for energy conservation and emissions reduction is initiated, HNA has saved 200,000 tons of fuel oil and reduced carbon emissions by more than 600,000 tons. It has become the first airline to obtain energy management system certification, which has developed "new silk road" for the green development of civil aviation, and at the same time opened up a broader world for certification company to develop business in the field of civil aviation.



CCS HCSR Software Improvement Review Meeting Held in Beijing

On February 5, 2015, HCSR software improvement review and outsource mid-term review meeting was held at the headquarters of CCS. HCSR software development project team of CCS R&D center, by targeting the identified problems and user feedback during the process of commissioning, improved CSR software by working with China ship scientific research center and Harbin engineering university.

The improvement work emphasizes on the research of efficiency of software, stability, and friendliness on the basis of guaranteeing the calculation accuracy, functional completeness and rules coverage at the early stage. Through the past six-month work, the efficiency and stability of the DSA software module are greatly improved, of which the efficiency of “load cloud picture show” could be improved by more than 30 times, “sub-model mapping” efficiency could be improved by more than 7 times and software-jump times fell by 89%; SDP software stability and friendliness are further improved, of which blurred screen and crash frequency decreased by 84%; the security of data was greatly improved by adopting a new means of storage, and calculation report was more intuitive and more practical.

After the trial on many ship types, all user feedbacks show that experience was improved significantly, and HCSR software is more stable and efficient. Review panel agreed that the work had achieved the intended purpose.



HCSR software is CCS rules calculation software with independent intellectual property rights, and it is updated by closely following updating steps of IACS HCSR. It will provide strong support for application of HCSR in China shipping industry. 1157 software registration codes have been issued since 2011, of which, 307 were issued from 2014. HCSR software development project team of CCS R&D center sticks to the idea that technology is the core, and the concept of customer first and quality service, actively responds to the needs of users through the “one-stop” work style service.

This software is available for free download on CCS website (www.ccs.org.cn).

CCSC Obtained the First Institution Qualification for Assessing Management System of Integration of Informatization and Industrialization of MIIT

Recently, by the assessment of the league secretariat of consulting services of integration of informatization and industrialization of MIIT, China Classification Society Certification Company (CCSC) obtained the institution qualification for assessing management system of integration of informatization and industrialization of MIIT (Ministry of Industry and Information Technology), and has become one of the first ten assessment institutions.

The obtained institution qualification for assessing management system of integration of informatization and industrialization provides opportunity for new business development of management system of certification company, and at the same time creates new challenges. CCSC will grasp the opportunity, have the courage to meet the challenge, actively carry out work, and take efforts to achieve the new breakthrough in management system assessment business of integration of informatization and industrialization.

CCS Bergen Office Opened in Norway

On February 26th 2015, the opening ceremony of CCS Bergen office was officially held at Bergen in Norway. More than 20 distinguished guests from Economic and Commercial Counsellor's Office of the Embassy of People's Republic of China in the kingdom of Norway, Chinatown Chamber of Commerce, the Association of Chinese Enterprise in Norway, DNV-GL, COSL (Europe), AVIC INTERNATIONAL Representative Office in Norway, GexCon, YANI, PWC, WEIKBORG REIN, China Classification Society European Center, Hamburg office and Goteborg office attended the ceremony.

Mr. Zhang Hui, the Director of China Classification Society European Center delivered a speech on the opening ceremony. He said that the establishment of Bergen office means CCS will provide customers in Norway and even the whole Northern Europe with more extensive technology service, aiming to promote mutual cooperation and development between China and Norway's maritime community. Mr. Feng Chunling, the ambassador of Embassy of the People's Republic of China to the Kingdom of Norway said in his speech that the Embassy will continue to support CCS in Norway and North Europe Area, and hoped Bergen office would give full play to the advantage

in technical services, develop continuously, and make contributions to marine transportation safety and environmental protection. Representatives expressed their warm congratulations to the opening of the CCS Bergen office. They also agreed that it was a new landmark in the global development of CCS, and they would establish sincere cooperative relationship with CCS to enjoy mutual development and make unremitting efforts to achieve the common objective and vision of marine safety and environment protection.



CCS Held Seminar about International Code for Ships Operating in Polar Waters

To promote China's new polar research ships, existing polar research ships and merchant ships engaged in shipping in the Arctic to make preparations for implementation of the Polar Code, China Classification Society (CCS) Rules and Technical Center organized and held small seminar about the Polar Code on March 17 in Shanghai, which was attended by the representatives from CCS business departments, COSCO group, CSSC 708, polar research center of China in order to jointly study the implementation of the Polar Code and technical preparation requirements.

During the seminar, CCS research team, by combining the condition of long-term research in the field of Polar Code, made interpretation of main contents of Polar Code, analyzed the influence on the design and construction of China's new polar research ships when the Code takes effect; Polar research center, by combining the practical experience of "Xue Long" navigating in polar waters,

introduced the environmental characteristics such as equipment, system provision and the polar ice condition which are applicable for operation in the Arctic by "Xue Long" and operating characteristics of arctic navigation.

The meeting's special reports attracted the delegates' interest, and then thorough discussion was carried out on the key issues such as operation assessment related to the Polar Code, design and test temperature of materials and equipment, low temperature performance certification of equipment and system, operation manual for the polar waters, documents audit and certification for class C polar sailing ship, and a series of questions related to implementation, implementation requirements and suggestions were put forward, and cooperation consensus was reached, so as to speed up formulating guidance document of Polar Code implementation.

RBI Technology Used in Offshore Storage Tank Risk Control

By Wang Li & Wang Zhenyu

The operation stability of offshore tank is closely related to the production status of the offshore oilfield; it is the major prerequisite for offshore oilfield safe production. Due to professional characteristics of offshore storage tanks, they are barely covered by the facility integrity management developed by operators. Currently there is hardly any integrity management for the offshore storage tanks in service in China.

Because of its applicability, the RBI technology has been successfully used in land storage tank risk control and integrity management ever since it was born. The advanced risk control ideology of RBI technology has gradually made it attract the attention of offshore oilfield operators, government supervision departments and inspection organizations. As a mainstream inspection organization in China, CCS set out several years ago to carry out related inspection technology research with RBI inspection technology of offshore platform land facilities as the breakthrough, and has made some achievements.

RBI technology

RBI is the abbreviation of Risk-Based Inspection, dealing mainly with the accidents of pressure vessels and industrial pipelines caused

by loss of material. RBI technology involves two aspects: leak of internal material of pressure vessels caused by material failure and risk control through inspection.

In recent years, the operation of domestic offshore storage tanks is generally stable. However, there are still some problems in early, mid-term and late service stages of offshore storage tanks during the routine production process. Some of these problems even pose great threats to safety of offshore platforms.

General failure frequency

Case 1: A round leaking point was found on under-part wallboard of a atmospheric storage tank of a fixed oil storage platform, one year before next periodical inspection. The analysis result indicated that the water in spill channel has resulted in external corrosion.



Picture1 : case I Leaking point

Considering the service life of the storage tank, the tank was repaired through plate flitching and cement injection.

Case 2: A leaking point was found at bottom T-shape welding line on an atmospheric storage tank of a fixed oil storage platform, which was in the second 5-year inspection period of mid-term service life. Analysis result indicated that the leaking point was caused by welding defect and long-term internal corrosion. The tank was later repaired through welding the leaking stopping box inside the tank.

These two above cases indicate that marine engineering project failure may be reflected at certain places of offshore storage tanks caused by one or multiple reasons. This kind of failure is always hard to find and detect. These failure cases of offshore storage tanks reflect that general failure probability of offshore storage tanks can not be ignored.



Picture2: case II Leaking point



Picture3: case III Corrosion on top of tank



Picture4: case III Cracking on the top of tank

Damage factors

Damage factors can be classified as internal damage, external damage, stress crack, brittle fracture, environmental crack and high temperature damage. External damage is obviously the major damage for offshore storage tanks. And it can be subdivided into atmospheric corrosion and under-insulation corrosion.

Case 1: A large area of water and corrosion were found on south top of an atmospheric pressure oil storage tank, which was in the second 5-year inspection period of mid-term service. There were even some cracks.

Analysis indicated that there was no drainage channel on top of the tank, which has resulted in water collection, together with sea water salt corrosion and sunshine in the south, the corrosion on the top was aggravated. In addition, the tank top was covered by grating plates, and the corrosion

has not been detected in time. This problem was later resolved by changing the whole plate. This was a typical case in which the damage factor is magnified due to design defect.

Case 2: A large area of corrosion was found on top of an atmospheric-pressure tank of a fixed oil storage platform. There was still one year before next periodical inspection. A large area near the tank wall was rusted through.

Preliminary analysis indicated that rain could easily penetrate on tank top. In addition, the temperature inside the insulating layer was relatively high, and there was corrosion between insulating layer and the top plate. This was not detected in time by daily inspection which has failed to be a thorough one. This is a typical damage case caused by inadequate daily inspection.

Is a common external damage factor of storage tank, API RP 58 has a detailed

introduction of it, and indicates that wall corrosion may be aggravated due to insulating layer. Some oil storage tank operators have planned to remove part of insulation layer after realizing the severity of “corrosion under insulating layer”. In this way, damage factor can be greatly reduced.



Picture7: case V Cracking on the top of tank



Picture8: case V The position of hose box

Enterprise management coefficient

Case 1: Cracks were found near fire water tank on top of an atmospheric-pressure tank of a fixed oil storage platform, which was in the second 5-year inspection period of mid-term service.

Analysis result indicated that the cracks were caused by seawater leaked from water hose after fire-fighting drills. The cracks were covered by the fire water tank and can not be easily detected. The operators did not notice this until hazard gas was leaked into



Picture5: case IV Corrosion on top of tank



Picture6: case IV Corrosion on top of tank

the fire water tank. This case exposed that the offshore storage tank is not well managed.

Case 2: A fixed oil storage platform, equipped with 2 6000m³ quadrate storage tanks, which were on service of the first 5-year inspection period. The platform operator has realized the significance of offshore storage tank risk management and has been trying to establish an effective integrated management system. However, the operator has not introduced the concept of RBI analysis. Therefore, there was still some argument about inspection methods, inspection cycle, and some other key points.

Failure consequence

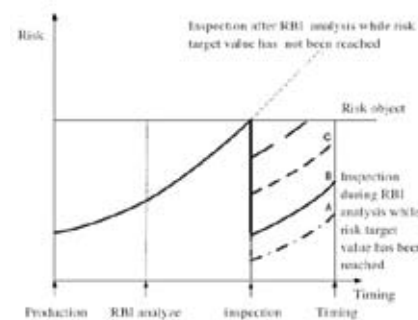
Due to special operation environment, the severity of failure consequence of offshore storage tank is one degree higher than that of land storage tank: local fire and platform explosion caused by hazard gas leakage, marine pollution and eco-catastrophe caused by oil and other hazardous substance leakage, as well as the associated damages are more serious than land storage tanks.

In addition, failure consequence formula shows that equipment maintenance, production-suspension loss, pollution harnessing cost and environment pollution punishment are also expensive. Operators mostly pay more attention to equipment maintenance and production-suspension loss. However, it is the pollution harnessing cost and environment pollution punishment that will deal a big blow to the operators. In addition, the reputation damage caused by environmental pollution will bring negative influence for the operators.

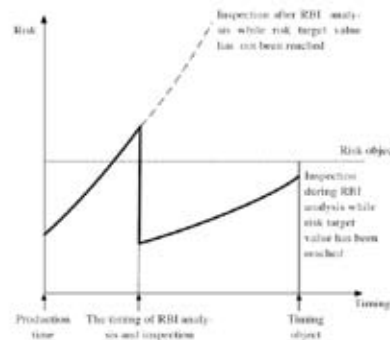
From the aspect of risk analysis, inspection cycle is a dynamic value, which

is related to current risk, risk acceptance and risk on control date. Inspection cycles can be classified into 3 cases: inspection after RBI analysis while risk target value has been reached, inspection during RBI analysis while risk target value has been reached and non-inspection while risk target value has not been reached.

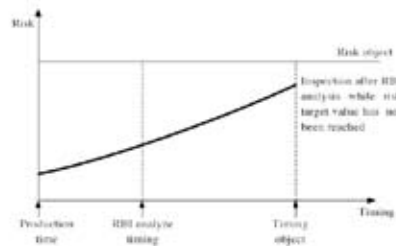
Through RBI assessment, offshore storage tank risk and risk classification are proposed. What is more important is that



Picture9: situation I After RBI analysis



Picture10: situation II During RBI analysis



Picture11: situation III Risk

risk management measures will be adopted according to the analysis and classification of the assessment result, so that the optimum inspection cycle will be determined to ensure that the risk during the continuous operation of offshore storage tank is kept under control.

Another function of RBI assessment is reflected in offshore storage tank inspection strategy establishment. On basis of failure mode analysis and probability parameters, high-risk failure mode can be predicted. In this way, targeted inspection methods can be used to improve inspection effects. It is proposed that:

1. RBI technology is mature enough to be used in offshore facility inspection, its completed theory system and rich data provide forceful support for offshore facility risk assessment;

2. Since there is no clear regulation either about offshore storage tank inspection cycle in our country or about the international standard that can be used as reference, offshore oil field operators should actively introduce RBI offshore storage tank assessment technology, in order to optimize inspection cycle and improve strategy pertinence. A complete offshore storage tank management system contributes to safe operation of offshore storage tanks.

3. In view of special failure probability and high-level failure consequence, specialized RIB technical specifications are necessary, which provide guidance for offshore storage tank RBI assessment.

4. Experts of domestic marine engineering industry should consider developing offshore storage tank RBI assessment software and establish risk assessment archives of offshore storage tanks on service, to realize quantitative RBI assessment.

Evolution and Development Trend of Oil Tanker Condition Assessment Method

By Xin Jicheng

Oiler tanker safety has always been the focus of international maritime industry. Modern super oil tanker can carry more than 300 thousand tons of cargo on each voyage. Once accident happens, there will be huge economic loss. In addition, oil leakage caused by accidents may bring devastation to the ecological environment of the local area. Statistics of recent years indicate that structural failures have increasingly been blamed for oil tanker accidents, especially for old ships.

Structural strength and fatigue are the two principal factors that impact on steel structure and service life. Anti-corrosion performance and fatigue resistance of the ship decrease with age, and when the ship is older than 10 years, the speed of decrease of structural performance will significantly increase. Effective test and maintenance could detect at an early time and eliminate structure defects and ensure the safety of the ship. Some well-maintained ships older than 20 years can still sail safely around the world. Thus it can be seen that a complete scientific oil tanker condition assessment method is important to international oil transportation safety.

■ Limitations of traditional assessment method

Oil tankers used to be tested periodically, mainly by classification societies before 1980s. According to classification requirements, the ship should be tested each year. In addition, 2 docking inspections, 1 intermediate inspection and 1 special inspection are also necessary in a 5 year testing cycle. Ship structural inspection includes overall inspection, close-up inspection, thickness measurement and cabin structural test. It has been found that ship structure defects can be detected by these methods. Every 5 years, a special inspection is conducted, which covers a wide range. This test range always extends with the increase of age of the ship.

Traditional periodical inspection is very useful for general dry cargo carriers, but it is insufficient for large oil tankers, mainly because of two reasons. Crude oil is very thick at room temperature, which needs to be heated before loading and discharging. This may accelerate corrosion rate of these cargo tanks. Experimental data indicates that corrosion rate doubles with 10°C rise in temperature. Therefore, oil holds and

ballast tanks next to them are more easily corroded than the same type of tanks of other ships. According to existing data, ballast components in 15 years old oil tankers are corroded 20%-30% more quickly than that in dry cargo carriers. With decline of coating protective capability, this phenomenon becomes more evident. Some oil tanks, though in good condition during the second special inspection, are badly corroded in the third special inspection.

Structure fatigue is another problem. Compared with other ships, oil tankers are uniformly loaded. Body component sizes of oil tankers are relatively smaller than that in other ships. Oil tankers with low structural strength are easily deformed. Since the year of 1990, because of wide use of high-strength material, structure size of oil tankers is further reduced. Hull rigidity is also reduced. Under the same external load, low-rigidity component will be deformed more easily. As time passes, fatigue cracks gradually emerge. In addition, impacts caused by liquid cargo and high-power tank washing machine aggravate fatigue degree. Generally, cracks exist at the points where the structure is not continuous. It is difficult to detect these

cracks in 10~15 years old oil tankers by traditional classification survey.

■ Limitations of current assessment method

A series of maritime pollution accidents caused by oil tanker accidents in 1980s raised public concern for safety problems of oil tankers, especially the tankers older than 10 years. Lots of international organizations related to maritime oil transportation safety established and completed their own oil tanker inspection systems. The current oil tanker condition assessment methods are characteristic of diversification and test range magnification.

■ Inspection systems established by stakeholders:

Based on their self-interests and risk controls, some parties having interests in maritime oil transportation have begun to establish their own Vetting Organizations and Vetting systems. OCIMF is one of them, its oil tanker vetting and assessment system lay particular emphasis on certifications of management system, inspection status and mooring equipment certification. OCIMF is more rigorous than requirements of classification societies. Oil tankers passed the inspection of OCIMF are listed in a database of SIRE, maintained and managed by SIRE, which provides important references for charterers to evaluate the condition of tankers.

USCG has implemented CAIP “Critical Area Inspection Plans” for all the American-flag oil tankers since 1990s. CAIP was proposed because of the cracks were found on oil tankers operating in west coast. This kind of oil tanker is of small-to-medium size, sea conditions of its operation area are relatively good and these tankers are under light load. However, lots of cracks have been found on these tankers when their service life is less than 15 years. These cracks raised concern of USCG to hull structure fatigue, thus inspection plan aimed at structure fatigue cracks was proposed. According to CAIP requirements, critical structural areas of American-flag oil tankers should be checked every year. The inspection record should be kept abroad. As for tankers with serious fatigue cracks, ship owners must take effective measures. As for the ships with particularly serious fatigue problems, USUG will list these ships in focus list and check them every six months. Modern double-hull oil tankers (such as oil tankers of IACS HCSR) can be checked 2 times every 5 years.

■ Enhanced survey plan of IACS (ESP):

At the requests of IMO, ICS, INTERTANKO and OCIMF, IACS began to improve traditional oil tanker test methods. ESP is the most important measure. IACS UR Z10.4 stipulates oil tanker enhanced survey cycle, classifications and the range. According to IACS UR Z10.4, the

intermediate inspections of tankers older than 10 years should be conducted as special survey. In other words, tankers older than 10 years should take special inspections every 2.5 years. The inspection range of close-up inspection, thickness measurement and cabin structure tests significantly extends. In this way, structural defects caused by corrosion and fatigue can be found as early as possible.

In addition, traditional test program has also been adjusted. For traditional classification survey ship owners generally applied several days or weeks before the test. Surveyors need to determine the cabins to be tested, the close-up survey method and the thickness measurement range when they get onboard for the first time. Ship owners and shipyards have not enough time to get prepared. The surveyors also do not have time to get familiar with the ships and there might be omissions in determining the test range. ESP stipulates that ship owners should confirm the inspection plan with classification society 6 months before intermediate surveys or the special surveys, including the cabins to be tested, the close-up survey method and the thickness measurement range. In this way, ship owners and classification society will have enough time to make preparations and make sure that early structural defects can be found.

Different classification societies have different requirements about design service life of the components and renewing standard. Once the ship has

changed classification society, assessment requirements will also be different. Especially when the ship transferred from a rigorous classification society to one that is less so. To solve the problem, IACS published common structure rules (CSR) and unified oil tanker design and test standards. In addition, CSR brought Permanent Means of Access of SOLAS into the regulations to better approach structural critical regions and conduct thickness measurements. These requirements in CSR provide convenience for future oil tanker structural inspections and condition assessments.

Current oil tanker assessment methods are characteristic of frequent and wide inspections which are aimed to dig out the early structural defects that traditional oil tanker condition assessments are unable to detect. However, with expansion of test range and the growing number of inspection organizations, there are some problems. On one hand, requirements about the test range are based on historical experiences, which bring randomness to the inspections. On the other hand, discharging, inerting, degassing and ventilating which should be taken before the structural inspection take lots of time, and frequent inspections carried out by numerous inspection organizations certainly will reduce the operation time of the tankers and have impact on profits. In fact, inspections of different organizations are basically the same, and duplicate inspections will result in waste of resources and energy.

Future development trend

Based on the above analysis, future oil tanker condition assessment method should be scientific, accurate, economic and environment friendly. Condition Assessment Program is a good start. CAP is a kind of engineering inspection and assessment, aimed at old oil tankers and it is different from traditional classification survey. It involves ship structure assessment and equipment assessment, such as electromechanical devices, safety devices and pollution-control devices. According to ship assessment, coating condition, thickness measurement, strength analysis, fatigue analysis and conditions of electromechanical devices, CAP gives a comprehensive evaluation. There are some organizations that provide CAP service, the results are basically the same. The ships are classified in 4 levels. CAP1 refers to good condition, CAP4 refers to bad condition. Oil tankers of CAP2 or over for 3 consecutive years can be rented.

Compared with traditional classification survey, CAP gives a scientific test range and result assessment. Traditional test range is mainly based on regulations of classifications, experiences of surveyors and demands of ship owners, thus lacking pertinence. Some CAP organizations now use 3D computing technology to find out hot spot regions that may be corroded and determine the test range, combining with inspection

result and operating conditions. Compared with traditional classification survey, CAP is more representative and comprehensive. In addition, organizations that provide CAP service will establish corresponding database after assessment.

Future oil tanker condition assessment may adopt a kind of method like CAP, classification societies may combine existing ship survey information and modern computer technology. Testing cycle and range are determined based on structural features, service lives, operating conditions and damage history. In this way, the testing range will be more representative. In addition, customized inspection scheme at low cost is also feasible, which is made on basis of conditions of ships. Man-made influence can be avoided with modern computer technology, assessment result is more accurate and fair. The key point of this technology is to conduct comprehensive analysis on existing ship inspecting information and establish operation rules according to relevant rules. One thing to note here is traditional periodical inspection is irreplaceable. The scientific and efficient method established by combining traditional inspection experience with modern 3D computing technology, irregularly scheduled customized inspection determined by computer with traditional periodical inspection will be the trend for future oil tanker condition assessment.

CCS Wave Load Software Development Made Phased

By Liu Riming



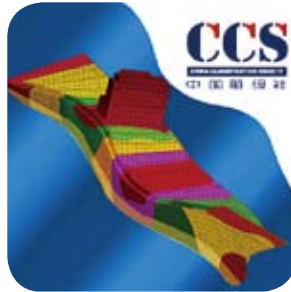
Wave load means the external force such as bending moment, shear force, pressure on ship structure due to the mutual effect between waves and ships. In the safety assessment of ship structure, determining the load on the structure, analyzing the stress, deformation and fatigue life of structure under the condition of known load cases and developing the corresponding evaluation criterion are three indispensable aspects related to each other. Of which, how to reasonably determine the load is the foundation and the key to correctly assessing the safety of ship structure. For ships sailing in offshore, wave load is the most important among all ship loads.

With the development of science and technology, higher requirements are put forward to the ship and offshore structure in

terms of safety and economy. With ships getting constantly large and offshore structures developing to deep water in order to obtain higher economic returns, the design of ship and offshore structure meets some new problems, such as water elastic problems of large ship, the motion and the load forecast of the deep water offshore unit. How to accurately forecast the wave load in order to ensure the safety of ship and offshore structures has become an important challenge, which requires the calculation theory of wave load to continuously develop and improve, and calculation software to be more accurate and efficient.

In order to be able to master the key technology of direct calculation of wave load of ship and offshore engineering, manage related frontier problems, cultivate related professional and technical

personnel and improve the market service ability, at the end of December 2012, CCS and Harbin engineering university signed the “cooperation agreement of China classification society and Harbin engineering university on development and application of ship and offshore engineering wave load calculation software”. Later, the two parties established joint innovation team of development and application of ship and offshore engineering research and wave load calculation software in



order to cooperatively develop COMPASS - WALCS wave load calculation software.

At present, CCS has completed the COMPASS - WALCS - BASIC software (CCS ship and offshore engineering linear wave load direct calculation software) and COMPASS - WALCS - LE software (CCS large ship three dimensional linear hydro-elastic analysis software) development. COMPASS - WALCS - BASIC software was released in December 2013 and COMPASS - WALCS - LE software will be released soon. With the completion of development of the two software, CCS will provide the industry with wave load forecast for unconventional vessels (such as super long, super scale ship) and wave induced vibrations, and conduct analysis of fatigue and ultimate strength of large container ship and ore carrier, etc.

COMPASS - WALCS - BASIC software: it takes the three dimensional linear frequency domain potential flow theory as the basis, combines the surface element method and the method of wave source distribution to solve the radiation hydrodynamic coefficients and the diffraction force of three dimensional floating body, and then gets the motion response of floating body through six degrees of freedom motion equations of the floating body, and for a given sea state information it can make short-term and long-term prediction for the movement and load component, which is suitable for wave load



calculation of 3D zero-speed floating body and conventional floating speed of the ship and provides basis for the determination of the wave load design value of for a variety of offshore structures under various design environments .

The main function modules include parametric modeling of floating body shell; automatic calculation of the float state of floating body and automatic generation of wet surface mesh; three-dimensional numerical zero speed frequency domain green's function; large dense matrix iterative calculation; solution of the first-order velocity potential; floating body hydrodynamic coefficients and wave exciting force calculation; linear restoring force stiffness matrix of cable system solution; roll damping approximate estimation; floating body movement, pressure and profile load response function calculation; motion and load spectrum and long and short-term forecast; the finite element software load file output; graph output of the calculation results.

The main features of the software include:

1. Implementing the partition piece of polynomial approximation algorithm of green's function, at the same time considering field point and source point symmetry of the field green's, significantly improving the calculation efficiency and stability of the green's function;
2. Making the symmetry of floating wet body surface blend into

the simplified solving matrix so that the dimensions of the solving matrix is greatly reduced and calculation efficiency is significantly improved;

3. Implementing the iterative algorithm of large dense matrix so that the efficiency of solving matrix is improved significantly;

4. Integrating model establishment, response calculation in regular waves, both short-term and long-term statistical forecast, the generation of structural model loading files, the result data display and output into an organic whole, meeting the demand of integration of load and structure analysis, easy to master and apply. Having carried out detailed comparative verification to the relevant model test and the well-known wave load calculation software at home and abroad, results show that the software calculation is of high stability, high precision and good reliability.

COMPASS - WALCS - LE software: based on the three dimensional frequency potential flow theory, it can be used for analysis and calculation of wave induced vibration of large container ships and ore carriers.

In addition to including the related content of COMPASS - WALCS - BASIC software, i.e. before and after processing functions, green function calculation and matrix solution, this software also has the following function modules: hull girder form state calculation based on the transfer matrix method; hull girder form mode fitting based on the three-dimensional finite element modal analysis results; first-order velocity potential calculation module based on the modal superposition method; elastic modal coordinate calculation of the main and output module; floating body movement, pressure and profile load response function calculation based on the modal superposition method.

COMPASS - WALCS - LE software also incorporates the application of the polynomial approximation algorithm, symmetry of green's function, large matrix iteration algorithm advanced calculation theory, and comparative verification is carried out to related model test of CCS large oil tanker, bulk carrier and ore carrier, in order to ensure the calculation precision and stability of the software.

In order to make wave load calculation software better serve the shipbuilding industry, related technical personnel of CCS and Harbin

engineering university has carried out the COMPASS - WALCS - BASIC software training and promotion in Guangzhou, Dalian, Shanghai, Wuhan, Tianjin, and Nanjing during the period from July 16 to September 19, 2014. The main content of the training includes the background and theories introduction of software, the functions of the software interface and instance operation. A total of 186 people from 74 units attended the training and up to 123 trial encryption locks were issued.

On January 30, 2015 when the annual conference of COMPASS - WALCS wave load calculation software 2015 was held, COMPASS - WALCS software subscribers issuing ceremony was held in Harbin, and Chinese heavy ship design research center co., ltd. (hereinafter referred to as civilian center) has become the first formal user for the software.

In 2015, CCS and Harbin engineering university's joint innovation team will complete the tail-in work of FPSO stem analysis, three-dimensional nonlinear hydro-elastic calculation software, and three-dimensional floating body and mooring system coupling analysis software and the development of three-dimensional nonlinear time domain analysis software. Of which, the three-dimensional nonlinear hydro-elastic calculation software is used for the whipping of large ship which has effect on wave load and the structural strength; three-dimensional floating body and mooring system coupling analysis software is mainly used for floating unit and coupling movement of mooring and riser and load analysis; three-dimensional nonlinear time domain analysis software is mainly used for motion and wave load calculation of various types of high speed ships and the slender floating body.

With the completion of development of other function modules of COMPASS - WALCS software, CCS will further enhance the analysis of effect of slamming vibration on fatigue and ultimate strength of large container ship and ore carrier, coupling motion analysis of offshore unit, the riser and mooring system, provide more comprehensive and reliable services for wave loads and motion response prediction of new ships and offshore structure.

CCS Steel Plate E-Visa Platform is Getting Online

By Xu Bowen, Wang Jiankai & Qi Ming



Today with the computer and network technology changing rapidly, electronic certificate has been in fashion because of its efficiency and environmental friendliness. The "plate warranty online visa platform (ECP)" developed by the Product Department of CCS Dalian Branch integrates functions such as test data collection and storage, data exchange and qualification judgment, certificate security and issuance, self-service certificate query, data collection and analysis and other functions, and further enhances service efficiency.

Electronic report

The check and audit of test data of plate electronic certificate is automatically completed by the system, therefore the surveyors are

required to produce electronic report and transmit to the system after completing the filed inspection. When the platform accepts and stores the report information, it will be arranged to put into the server space under factory categories and it is not allowed to modify the existing data or to transmit such data repeatedly.

The interaction of certificate data

Both the manufacturer and CCS offer Webservice service. The manufacturer issues warranty data package through the Webservice service, CCS downloads the data package through the Webservice service provided by the manufacturer; the warranty data package that has obtained CCS electronic visa will be published by the Webservice and can be downloaded by the manufacturer. For those

certificates that are not signed due to various reasons, CCS will mark them and send them back to the manufacturer through WebService service.

■ Audit of certificate data

Audit is the core link of this system, which involves digital transformation of all the rule requirements and scope of accreditation. This can not only complete the comparison of consistency between certificate information and test report, but also can complete the audit of the various contents of the certificate as to their compliance with rule requirements and accreditation scope. It can complete the complex audit work for surveyors and do some work which can hardly be finished manually. Meanwhile, for some special steel such as corrosion resistant steel for crude oil tankers, the system can also automatically complete audit and verification of the special resistance components, so as to ensure the reliability of test steel.

■ Certificate security

Electronic certificate also has the risk of being tampered and counterfeited, therefore, it is necessary to introduce the CA (Certificate Authority) in the signature of the digital certificate. The function of CA certificate is to examine the validity of certificate holder's identity in order to prevent forgery or alteration. CCS does not build the CA center, it only uses the legal digital certificate provided by the third party. The certificate includes the name of applicant and related information, digital signature of signing CA certificate and validity period of certificate etc. After introduction of CA certificate, once the electronic certificate with the signature of CCS is modified maliciously, there would be warning in network environment. At the same time, the authenticity of CA certificate can also be checked by secret key to eliminate the possibility of false certificate.

■ Certificate release and query

As mentioned above, the signed certificate will be sent to the manufacturer by the WebService, after receiving the certificate, the manufacturer can send electronic certificate to their customers. At the same time, CCS will also provide a platform for users for the purpose of query, and this platform will also serve as the only way to determine the validity of the certificate.

■ Data analysis and collection

This function is intended to solve two problems, one is inspection statistics, the other is technical reservation. In the past, we could only have a rough estimate of steel use for a project, whilst this function will enable us to have accurate statistics of the use of steel plate of each brand and even each size for each project. The function of technical reservation fills a blank technology area of CCS.

Currently, The electronic visa system of steel plate warranty has been successfully developed and launched online, and CCS Dalian Branch has issued the first marine steel plate electronic warranty to Anshan Iron and Steel Group. CCS has since then formally entered the era of electronic certificate.

