

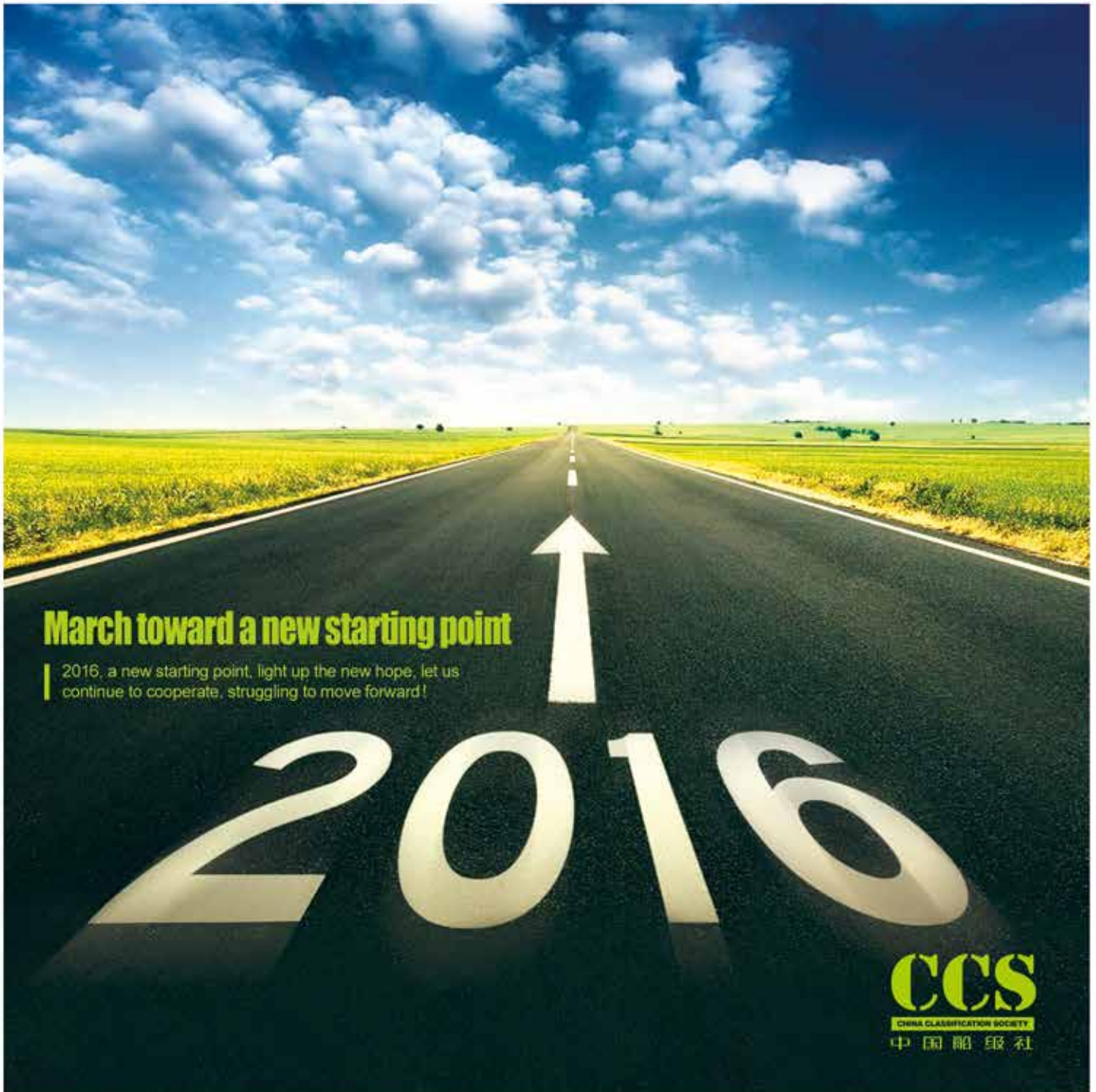
Free of charge and welcome to communicate  
Internal data

# Partnership



■ Edited and Printed by CCS

2016 . 2 / The 19<sup>th</sup> issue in total



## March toward a new starting point

2016, a new starting point, light up the new hope, let us continue to cooperate, struggling to move forward!

**CCS**  
CHINA CLASSIFICATION SOCIETY  
中国船级社

## The first issue in 2016

(The 19<sup>th</sup> issue in total)

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



Edited and Printed by CCS

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](http://www.cssponline.com)

E-mail: [ccsinfo@ccs.org.cn](mailto:ccsinfo@ccs.org.cn)

Weibo: <http://weibo.com/ccsponline>

Sender Object: Manager and technical staff

Printing party: Beijing Tiancheng Printing  
Co.,Ltd.



Wechat public ID

# Content

## Dynamics

- 01 CCS Issued the *Guidance for Construction Inspection of C-type Liquid Cargo Tank LNG Carriers*
- 01 CCS Signed Strategic Cooperation Agreement With African Carbon Exchange
- 02 CCS Won for The First Time The Bidding for Third-Party Certification and Inspection of Overseas Single-Point Mooring and Submarine Pipeline Project
- 02 CCS Signed Classification Agreements of 200 Inland-water LNG Ships

## Survey

- 03 VLCC “YUAN HUA HU”
- 03 MARIELA, the DP-2 refueling ship
- 04 “XING ZUN HAI”, the Green Environment-friendly Bulk Carrier
- 05 Triple-use Work Ship “HAI YANG SHI YOU 685”
- 05 35-feet “Xigui” Power Boat
- 06 “Rong An Cheng” Bulk and General Cargo Ship
- 06 China’s First Fully Transparent Sightseeing Submarine “HUAN DAO JIAO LONG 1”
- 07 50,000T Semi-submerged Ship “HUA YANG LONG”
- 07 South China Sea Rescue 204—High Speed Rescue Vessel

## Technology Tendency

- 08 Type of Container Ship on the Belt and Road South East Asian Feeder Line
- 12 Several Special Issues for Consideration in Design of LNG Bunkering Ships
- 15 Finite Element Calculation Technology of High Speed Ship Made of Carbon Fiber Composite Material

## Standard Research

- 16 The Highlights of the “Rules for Construction of Steel Inland Waterway Ships” (2016)

## Servicing Products

- 17 CCS Issued the First Software Assessment Certificate
- 20 CCS and CMG Jointly Developed the “Online Application System of Integrated Management System”

## CCS Issued the *Guidance for Construction Inspection of C-type Liquid Cargo Tank LNG Carriers*



Recently, CCS issued the *Guidance for Construction Inspection of C-type Liquid Cargo Tank LNG Carriers*. Based on the LNGC classification construction inspection, researches on the key hull structure and manufacturing process of spherical LNG ships, the theory, characteristics and manufacturing process of cargo transfer system of sphere LNG ships, fluid container lifting and experiment

technology of sphere LNG ships, the theory and characteristics of cargo control system of LNG ships, and the process and requests of gas experiment for LNG ships, CCS developed the related regulations for acceptance and finally formulated the *Guidance for Construction Survey of Sphere LNGC* (including hull structure inspection, cargo

transfer and control system inspection, spherical tank installation inspection) and the *Guidance/Instruction for Gas Sailing Test and Inspection for LNGC*. This guidance is the first one for C-type liquid cargo tank LNG carriers.

LNG ships are generally acknowledged as the most high-tech, high-demand and high value-added products and are hailed as the jewels on the crown of ship building industry in the world. This guidance is of great significance to the healthy and steady development of LNG ships and will therefore safeguard the smooth implementation of national energy strategy.

*The Guidance for Construction Inspection of C-type Liquid Cargo Tank LNG Carriers* applies to C-type Liquid Cargo tank LNG ships of non-restricted sailing with double-bottom, top-side-tank, single-deck and transverse-bulkhead, regardless of tonnage (including ships under 500 tons), and the design of the cargo tank structure size based on the maximum steam pressure.

## CCS Signed Strategic Cooperation Agreement With African Carbon Exchange



During Dec. 3<sup>rd</sup> to 5<sup>th</sup> of 2015, China-Africa cooperation forum Johannesburg summit was held in South Africa. President Xi Jinping and South African Premier Suma co-chaired the summit. CCSC was invited to the forum and widely communicated with Africa Carbon Exchange about carbon exchange system establishment, carbon emission inspection, carbon emission reduction inspection and capacity construction. CCSC and Africa Carbon Exchange signed strategic cooperation agreement, which is the only technical service agreement among the 22 investment agreements, strategic cooperation agreements and MoUs.

This agreement pulled open the curtain for joint establishing the first African carbon trading market, serving the Road and Belt strategy, and overseas market exploration. It also laid the foundation for sustainable development of energy conservation and emission reduction inspection service.

## CCS Won for The First Time The Bidding for Third-Party Certification and Inspection of Overseas Single-Point Mooring and Submarine Pipeline Project



On Dec. 16<sup>th</sup> of 2015, CCS received “Bid-winning notification of third-party certification and inspection of single-point mooring and submarine pipeline inspection” of PMB petrochemical project, issued by Hengyi Industry of Hengyi Group. This is the first time CCS obtained overseas third-party certification and inspection of single-point mooring and submarine pipeline inspection business through bidding.

As a leading project for the Brunei to develop its middle and

downstream oil and gas industrial chain, the project is important for the diversified development of Brunei economy, and is the win-win cooperation project advocated by China in the Road and Belt national strategy. It has great comprehensive benefits and will be up and running in 2018.

The offshore facilities of this project will be inspected by the third party, including a 300 thousand dwt CALM single-point mooring system and submarine pipeline project, located in northern open waters of PMB island, where the water is 30 meters-deep, at the east of Brunei. The submarine pipeline goes through Pelumpong sand levee to onshore storage and transportation facilities on PMB island. Main facilities includes floatation hose, mooring ropes, single-point float bowl, anchor chain, pile foundation system, underwater flexible standpipe, PLEM, submarine pipeline and relevant process equipments, meter control system, telecommunication and electrical system. etc

This landmark project is of great demonstrative significance for CCS to march into the overseas market, showcasing CCS technical strength, capability of good organization, management and service. It is also the active response and best support to China’s Road and Belt strategy.

## CCS Signed Classification Agreements of 200 Inland-water LNG Ships

CCS Zhejiang Branch signed classification agreements of 200 36-TEU inland-water LNG container ships. These ships belongs to one of the key projects of the State Council 12<sup>th</sup> Five-Year energy development plan. It is also important to energy structural transformation and upgrading of inland water ships. The construction of these 200 ships has begun since Dec.29<sup>th</sup> of 2015. (By Jia Jianxiong)



## VLCC “YUAN HUA HU”

The ship is 333 meters in total length, 320 meters between the two perpendiculars, 60 meters in molded breadth, 29.50 meters in molded depth, 160,081 gross tons, and 308,000 DWT. This ship is the second VLCC built by CSSC Offshore & Marine Engineering Co., Ltd. for Da Lian Ocean Shipping Co., Ltd., it is designed by Shanghai Merchant Ship Design and Research Institute (SDARI), plan approval and construction survey was carried out by CCS, and classed with CCS.

In addition to structural optimization to reduce ship weight and increase the effective cargo capacity, the biggest feature of this ship is that the ballast tank can be used in two modes, the traditional mode and “sediment prevention” mode. When the ballast tank is used in the traditional mode, the wing ballast tank and double bottom ballast tank can connect directly, it is generally used in clear water area. When the ballast tank is used in “sediment prevention” mode, the wing ballast tank and double bottom ballast tank will separate at the lowest point of the platform and be watertight, the ballast



water will be filled in wing ballast tank, and then overflow from top to the double bottom ballast tank, the sediment will be retained at the bottom platform. Since the platform has no structure at the front, the sediment can be removed more easily from the platform than from the double bottom tank. The “sediment prevention” mode is generally used in the water area of higher sediment content.

CCS has reviewed and approved the general arrangement plans of the two modes of ballast tank, loading handbook, damage control handbook, damage control chart, the plan for ballast water management, the calculation book of damaged stability and other technical documents, which provides the theoretical evidence for the application of this new “sediment prevention” technology.

## MARIELA, The DP-2 Refueling Ship



Akron Trade and Transport from Greece runs MARIELA, which is designed by Shanghai Suyuan

company and constructed by Taichow state-owned Haidong shipyard. It is 81.70 meters wide, 13.40 meters in molded breadth, 6.20 meters in molded depth. It was approved and inspected by CCS, non-restrictive sailing, CSA class and of Panama flag.

Though the tonnage of the ship is not big, it is advanced in many aspects. It is with double engines and propellers, adjustable propellers, main diesel engine drives cargo oil pump, two fore and one tail horizontal thrusters. In addition, DP-2 dynamic positioning system comes from GE. CCS awarded this ship DP-2 additional mark, so that it can be operated without dropping anchor. It also meets requirements of EEDI, BWM Convention and PSPC.

## “XING ZUN HAI” , the Green Environment-friendly Bulk Carrier

The environment-friendly bulk carrier “XING ZUN HAI” is built by Jiangmen Nanyang Ship Engineering Co., Ltd. (JNS), it is the first ship of a series of 39,000 DWT bulk carriers, it is designed by Shanghai Beastway Marine Engineering Design Co., Ltd. (BEASTWAY), the plan approval and construction survey of the ship is carried out by CCS. The ship is of non-restricted sailing, 179.90 meters in total length, 14.80 meters in molded depth, its scantling draft is 10.60 meters, and can carry 25 people.

Compared with bulk carriers of the same DWT, this ship has some features such as short length, small breadth, shallow draft and strong port applicability, block coefficient is bigger than regular ships but totally meets the requirements of maneuverability. This ship can carry general bulk cargo, grain, steel coil, big cargoes, timber, cement, etc. Cargo hold ventilation rate is the 6 times/h ventilation device, the ship can carry the most of the dangerous cargoes listed in IMSBC Code appendix 1.

This ship has the green mark certificate “GREEN SHIP II” of CCS. It is equipped with the emission control system of nitrogen oxides, sulfur oxides and some toxic gas to control the waste gas emission of main engine, and the sulfur content of the waste gas is much lower than the requirements of IMO; the fuel oil tank and diesel tank adopt the double hull protection to reduce the probability of oil spill due to collision and improve the efficiency of oil tank heating; it is equipped with the collection system of port sewage, space noise control system and ballast water system, etc. It takes the leading place among bulk carriers of the same type in terms of comprehensive performance indicators. The 39,000 DWT hull line is optimized based on the 32,500 DWT bulk carriers and ship speed is improved. Additionally, due to the structure optimization and the application of the new technology, the use of steel plate has been effectively controlled. This ship adopts the new type engine and new type effective propeller, greatly reducing the fuel consumption and taking the lead in energy saving.

In terms of the structure arrangement, this ship adopts the new type large opening box transverse sections in order to improve the efficiency of discharge and reduce the terminal

cycles, there is no storm ballast tank in cargo hatch so that the cargo hatch cover does not have to use the heavy pressure device, it is convenient to operate, improve the efficiency and reduce the maintenance costs; according to the loading conditions, under the condition of satisfying the immersion requirements of minimum fore draft and screw propeller, each ballast tank can be reasonably distributed, for example, in order to reduce the hogging moment to greatly reduce the ballast capacity of fore peak and after peak; the pipeline under the main deck and the crew passage are arranged in order to prevent the damage of deck outfits in the process of timber shipment, and prevent crew to pass through the deck in the bad sea condition; the base stool regularly put in the transverse bulkhead is removed in order to facilitate loading, the pressure tank adopts the new type of isosceles trapezoid design; the non-propeller Australia ladder embedded in the transverse bulkhead reduce the steel consumption, protect the Australia ladder, and there is no obvious prominent structure in cargo hatch.



## Triple-use Work Ship “HAI YANG SHI YOU 685”

This ship is a multipurpose ship with anchor-handling, tug, supply and service, the ship type is designed by Rom with UT 712 WP conventional driving. The design and construction meets the requirements of the operation and use of deepwater anchoring equipment, the anchoring depth is 300~1,000 meters. The ship is built by Shanghai Zhenhua Heavy Industries Co., Ltd.(ZPMC) for China Oilfield Services Limited (COSL).

The hull design provides this ship with good maneuverability, seaworthiness, low fuel consumption, it can sail under 12 level Beaufort wind and 9 level sea condition, even if one device or one system is broken, the ship can position under 6 level Beaufort wind and 1.5 knots current. This ship is driven by medium speed diesel engine, for non-restricted service, the ship is of 81.20 meters in total length, 19.20 meters in molded breadth, 8.30 meters in molded depth, 6.30 meters of design draft, 7.10 meters of scantling draft, 7,250 tons of full load displacement, 3,967 gross tons, and 3,522 DWT. Under the consideration of design draft and CSR main engine power, the ship speed can reach 16 knots. The ship is double bottom and double hull, with UT type passive anti-rolling tank, which



can decrease the rolling amplitude. Besides, there are two propellers with dome, one is pipe tunnel type stem propeller, the other is a telescoping propeller; two pipe tunnel stern propellers and two flap rudders. The deck has no block, the design load in the main cargo area is 10T/m<sup>2</sup>

In addition, this ship can perform tasks such as fire fighting, dynamic positioning and guard (100 people rescued). 100% MCR, bollard drag force is 191.60 T, this ship adopts unmanned engine room design, awarded the additional mark AUTO-0, provide comfort working environment to crew, the design of crew room equipment meets the requirements of Maritime Labor Convention, 2006.

## 35-foot “Xigui” Power Boat



The boat was constructed by Fujian Aigle Yacht and classed with CCS. Its width

is 10.564 meters, molded breadth is 3.56 meters, molded depth is 0.486 meters, load draught is 0.554 meter. Crew number is 12, maximum load is 1930 kg. This boat can be classified as IV. The main engine is a straight-four engine, D170s was produced by HYUNDAI SEASALL. Cylinder diameter × stroke is 87mm×92mm. Rated power is 125kw, rated speed is 3800r/min. This engine is electrically started and closed-coop cooled. Fuel tank is 700L and fresh water tank is 280L.

This boat is a negative mold fiber reinforced plastic yacht. A diesel engine is used as driving force. Steering rudder is controlled by the steering wheel in the bridge through liquid pressure control equipment.

## “Rong An Cheng” Bulk and General Cargo Ship

This 38,300-ton bulk cargo ship was the first one of the five series ships, constructed by SHGSIC for Xiamen shipping company. It meets both the requirements of dry cargo ships and CSR for bulk carriers. In addition, it also meets requirements of EDDI(II). It is the green dolphin ship and the first one to be awarded additional General Dry Cargo\Bulk Carrier notification by CCS.

The ship is 179.95 meters in width, molded width is 32 meters, molded depth is 15 meters, scantling draft is 40.5 meters, gross ton is 25,769, full load displacement is 48,862 tons, with double hull board side structure and 5 cargo holds. This large hatch ship could take containers and woods on hatch cover. A single person could operate two crane intelligent systems at



the same time, which effectively solve the problem of bulky cargo loading and unloading. It is suited for transportation of various different cargoes.

## China’s First Fully Transparent Sightseeing Submarine “HUAN DAO JIAO LONG 1”



On September 18, 2015, China’s first fully transparent sightseeing submarine “HUAN DAO JIAO LONG 1” was issued the certificate. “HUANG DAO JIAO LONG 1” is designed and built by 702 Institute, the plan approval and survey is carried out by CCS, it is the first fully transparent sightseeing submarine in China.

This submarine is designed and built based on the US standard ASMI - POHV2012 and CCS documents the “Rules for Classification and Construction of Diving System and Submarines” and the “Code for Safety of Diving System and Submarines” . Also, CCS established a special team, developed the “Principles

for the plan approval and survey of the submarine HUAN DAO JIAO LONG”, laying a good foundation for the successful construction of “HUAN DAO JIAO LONG 1”.

The design team of “HUAN DAO JIAO LONG 1” is composed of the same experts of 7000m “JIAO LONG”, with Ye Cong, China’s chief diver, the national diving hero as the chief designer, Xu Qinan-the chief designer of “JIAO LONG” as the team leader. This submarine can protect the mother ship “HUAN DAO 001”, it is mainly used for daily maintenance and supply, and for the rescue work in emergency.

This submarine has 3 groups, a total of 6 pod thrusters, having auto-navigation capability such as self-propelling, diving, and floating, with design depth of 40 meters (now limited to 32 meters, which is the maximum operating depth of Ya Long bay), at the pilot stage, it can carry 9 people (including the driver), with 3.0 knots the maximum speed.

## 50,000T Semi-submerged Ship “HUA YANG LONG”

“HUA YANG LONG” is designed by China State Shipbuilding Corporation, the 708 Research Institute, the total length is 228.12 meters. It has molded breadth of 43 meters, molded depth of 13.5 meters, and has a quota of 56 people, including 36 crew and 20 special personnel. The propulsion system has 3 ABB pod propulsions. The stem is made up of two thrusters, both of them are driven by electricity, and they have the ability of dynamic positioning. The maximum submersion capacity is 27 meters, the maximum force is about 30,000 tons, the ship is for non-restricted service. It is classed with CCS, the plan approval and construction survey of the ship is carried out by CCS.

“HUA YANG LONG” adopts the big ship type, with larger tail pontoon, which can provide bigger waterplane area when the main deck is under water, making the ship more stable and safer during diving and floating. Also, the ship adopts hybrid drive way combining the compressed air and ballast pump, combining the efficient and quick air pressure and the stable, reliable and controllable pump pressure system, which can realize quick diving and floating. The ability of positioning can reach DP-2, and can quickly locate at any draft status.

This ship is mainly used for rescue and salvage of large ships in emergency, loading



and dispatch of damage ship, the rescue and salvage of military/civilian ships, equipment and aircraft, and prevent marine oil pollution, it can also be used for the loading of oil and gas exploration devices, and the large floating installation of the upper modules. It is the reserve of China’s emergency handling capability and will greatly improve Chinese rescue and salvage ability, quick maritime emergency response and emergency wreckage clearance ability.

## South China Sea Rescue 204—High Speed Rescue Vessel



This ship can be used for offshore maritime quick salvation of social welfare rescue task, capable of searching and rescuing at night. It satisfies the related regulations of

CCS Rules for Classification and Construction of Maritime High Speed Ships and has the Rescue additional notification. This ship was designed by Guangzhou Yinghui Southern shipbuilding industry, 49.9 meters in length, molded breadth is 13.10 meters, molded depth is 4.5 meters. This 546-tons ship has 12 crew, it can rescue 200 people. Design speed is 30 knots, full-load speed is 32.8 knots, cruising distance is 700 sea miles, self-supplying capacity is 3 days. This CAS ship was approved and inspected by CCS, can be used for off-shore waters.

The ship is a double-hull ship with aluminum-made wave piercing catamaran, double engines, double gearboxes, double injection water pumps. It performs well in seaworthiness, speed ability and controllability. The hull is made with two bodies, cross structure and center bow. These two special bodies reduce correspondences between the ship and the wave, which is good for seaworthiness.

# Type of Container Ship on the Belt and Road South East Asian Feeder Line

By Chen Yongnian

From the historical and realistic view, shipping trade is undoubtedly the most immediate booster of Maritime Silk Road. The statistics of import and export container cargo in recent years show that the compound average growth rate of annual container cargo between China and the ten ASEAN members has reached 7.37%, from 5.41m TEU in 2013 to 4.07m in 2010. In addition, due to various constraints including geographic position, some ports in Southeast Asia have more limitation on main dimensions of ships. Therefore, it becomes particularly important to choose suitable ship design indices.

Upholding the service objective of creating value to customers and society, CCS keeps abreast with the trend of national strategic development, analyzes comprehensively the factors including shipping features, shipping route layout, port condition, freight source and volume, indices of ships in service and marketing potential of container ships, and then researches and introduces a ship scheme which applies to the feeder operation in Southeast Asia with excellent capability to suit ports and cargo and optimal technical index. It is based on this scheme that CCS and SDARI jointly developed the Belt-and-Road-type 3800TEU feeder container ship.

By the end of November of 2015, there are 5239 container ships in service all around the world. The total transport capacity is 19.6 million TEU. Capacity distribution is as shown in the figure below (data source: CLARKSON database). Container ships with transport capacity of 3000~4000 TEU are of little proportion, accounting for about 5.1% of all the container ships and 4.9% of total transport capacity. Due to the limitations of original Panama

Canal lock, traditional panamax container ships are of 4000~5000 TEU capacity level, which are mainly used on Asia-North America ship route. Regional container ships are widely used in Southeast Asia, China, Japan and Korea. Under this shipping market pattern, container ships of 3000~4000 TEU capacity level are in an awkward position. Regional container ships are mainly of 1000~2000 TEU capacity level. This distribution diagram shows that ships of this level take up to 23.8% of the total number of container ships.

Panama Canal extension project is almost completed. Traditional



Figure 1: Container ship distribution in the world

Panamax ships will be replaced by new ships. Global shipping pattern will also be changed. PCA released No.A-20-2013 shipping announcement, which formally informs shipping companies of requirements on ships sailing through Panama Canal lock. It is also the first time to define the new Panamax ship, the biggest ship sailing in Panama Canal: ships which are larger than Panamax or Panamax Plus, in addition the ship should be built according to new lock size being 366m long, 49m wide and with 15.2m draft. With this limitation, 10000 TEU ships will be mainstream ship types. Branch line container ships will also be updated.

The base ports are those where the freight list requires liner companies to berth ships periodically. Most of them are large ports located in regional centers. Port equipment is in good conditions, freight sources are stable. There are lots of ports in Southeast Asia with 17 base ports. These base ports are hot ports on important ship routes. In Mar. of 2015, the State Council issued the Mission and Vision of Promoting Silk Road Economic Belt and 21<sup>st</sup> century Maritime Silk Road. The 21<sup>st</sup> century Maritime Silk Road involves Shanghai, Fujian, Guangdong, Zhejiang and Hainan. By way of ASEAN and the Indian Ocean, final destinations are Africa and Europe. Quanzhou-Fuzhou-Guangzhou-Haikou-Beihai-Hanoi-Kuala Lumpur-Jakarta-Colombo-Calcutta-Nairobi-Athens-Venice ports are connected. New Panamax ship is designed based on these base ports and the ports along the Belt and Road south east Asia region and the main dimensions are decided based on port conditions.

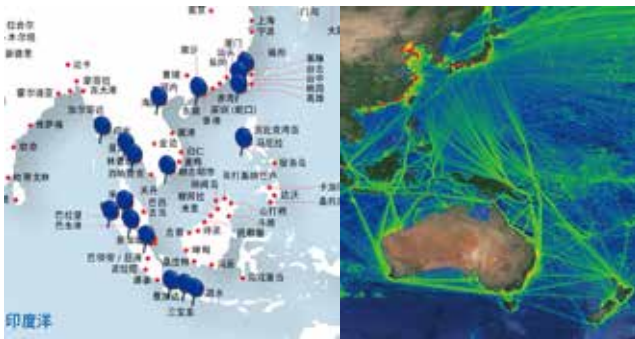


Figure 2: Base ports in Southeast Asia and regional ship route density diagram

Ship type R&D is mainly based on 17 base ports:

- Thailand: BANGKOK、LAEM CHABANG
- Indonesia: BELAWAN、JAKARTA、SEMARANG、SURABAYA
- Malaysia: PORT KELANG、PENANG
- Vietnamese: HO CHI MINH、HAIPHONG
- Burma: YANGON/RANGOON
- Philippines: MANILA
- Singapore: SINGAPORE

- China: HONGKONG、KEELUNG、KAOHSIUNG、TAICHUNG

Among these ports, Bangkok port gave birth to "Bangkok" container ships due to geographic position and port conditions. Bangkok port is located in downstream region of Menam River, 16 kilometer away from the estuary, near the northern side of Bangkok Bay, the biggest port of Bangkok, the 27<sup>th</sup> biggest container port in the world. Menam River is zigzag and shallow. Ships more than 173 meters long can not sail. Draft is limited under 8.2m, length is limited under 172m, width is limited under 25m. Ships more than 25m wide should reduce the draft. The match-up relations are as follows: B=27.5m(Tmax=7.62), B=29m(Tmax=7.31), B=30.5m(Tmax=7.01). Ships that B>30.5m should apply separately. Based on this size limitation, "Bangkok" container ships are almost of 1800~2000 TEU capacity.

In recent years, the trend of large-scale ships are definite. The Bangkok government has built LAEM CHABANG which is 60 kilometers away from Bangkok port for large container ships. At present, there are a great number of 1000~2000 TEU

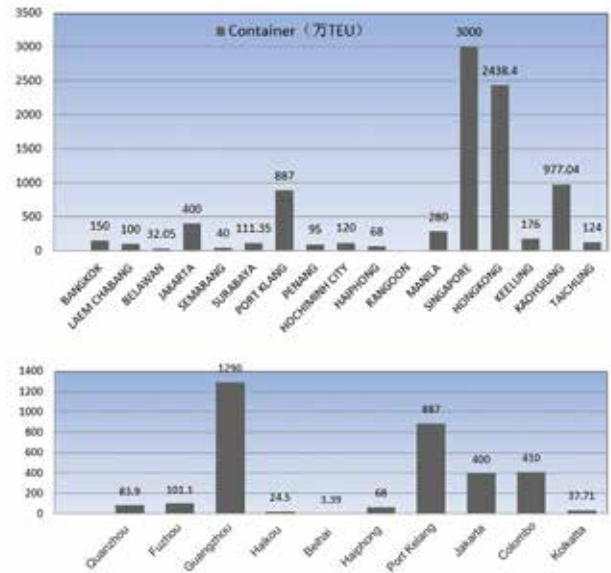


Figure 3: Container handling capacity

container ships, nearly accounting for 23.8% of all the container ships. In view of market space and shipping route layout, Bangkok type container ships are not typical ship type to meet shipping requirements of the Belt and Road.

Container handling capacities of the Belt and Road ports and base ports are as follows. Semarang port of Indonesia is located between Jakarta and the Sishui, 200 sea miles away from each other. In addition, there is not much freight source. Ships longer than 185m are limited. In view of shipping route layout, this port is not suitable. Bangkok ships can cover this sea area.

Among the Belt and Road ports, Calcutta port of India prohibits ships longer than 172m from berthing. Container handling capacity of Calcutta port is about 377 thousand TEU (data source: entering and berthing guidance). Calcutta port is located at the west of Malacca Strait, 1500 sea miles from Singapore. Geographic position is similar to Bangkok port and not along the intercontinental ship routes. Bangkok ships could also cover this area. Therefore restrictive conditions of this port do not affect the Belt and Road ship design.

Compared with draft, ship length is a mandatory index of port restrictive conditions. Once the ship is build, it can not be changed. Therefore ship length should be deliberately determined. Based on above analysis, The Belt and Road container ship length is 200m,

with considerations of port annual handling capacity and geographic position. This ship type could berth in 15 of the 17 base ports, coverage rate is 88%, excluding Calcutta port. It meets restrictive conditions of 10 Belt and Road ports in Southeast Asian region, coverage rate is 91%.

The minimum draft limitation for Southeast Asian base ports is 8.2m for Bangkok port and 9.5~11m for the other posts (some ports with draft limitations of more than 14m could accept 10000 TEU container ships). Among the Belt and Road ports, draft limitation of HAIPHONG port in Vietnam is 7.2m, other port draft limitations are larger than 10m, which meet navigation conditions of most container ships. If necessary, ships could berth after load shedding. Therefore, the Belt and Road ship draft should better be 10-11m.

Except Bangkok port, other Belt and Road ports and base ports do not make requests on ship width. At present, Panama Canal lock could accept 32.31m ship width. When the new lock is put into use, the old lock will also be used. Branch container ships are mainly used in Southeast Asia, Mediterranean Sea and sea area between Europe ports, see Figure 5. From the aspect of ship navigation applicability, ship width is suggested to be 32.2m. From the aspect of ship stability, maximum loading capacity, ship economic efficiency, ship width is suggest to be 35m.



Figure 4: Geographic position of Calcutta port

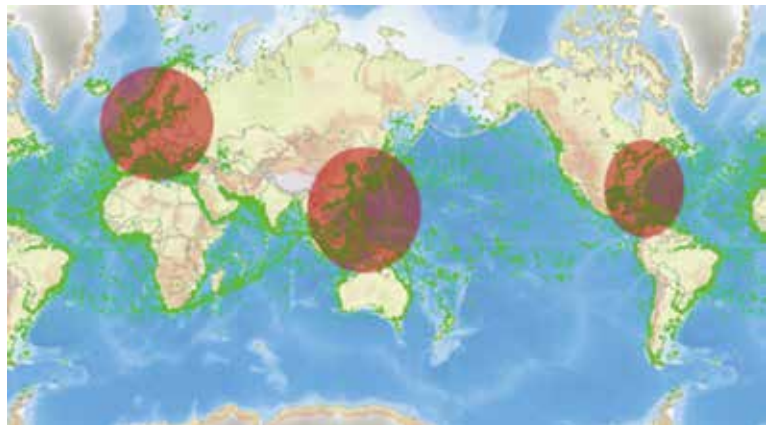


Figure 5: Operation distribution of global container ships

According to CLARKSON database, there are 2171 1000~4000 TEU container ships in service. The statistical table of ship technical index is shown in Table 1. 345 ships were built after 2010 (up to Aug. of 2015). Ship conditions that meet size limitation of Southeast Asia branch ship type are as follows:

- LOD=172m, 47 Bangkok container ships, 14 ship types
- LOA=180~190m, 36 container ships
- LOA=200m, 9 container ships, 1 ship type.

Table 1 Technical index of ships in service

	Bangkok ship	the Belt and Road ship
Length (m)	172	200
Load capacity	1300~1900	2400~2600
Draught (m)	8.5~11	ab.10 ab.11.5
Width B (m)	27~28.4	ab.30 ab.32.2
Modal D depth	13.5~15.5	16~17 (max18.8)
LBP (m)	158~169	184~190
Deck load rate	60%~65%	60%
Average loading capacity	1200~1300	1800~1900
Containers kept in cold storage	100~700	300~1100
Average weight	11.5~13.6	13~14.5
Design speed	19~21	18.5~22.5 (mostly greater than 20kn)
Kw Main motor power	12000~16000	16000 20000~22000
Fuel consumption/day	50~60	55~85
Main engine rotational speed	95~127	90~110

- LOA=208m~212m, 27 container ships, 4 ship types.

According to the above comprehensive analysis, CCS proposes a ship scheme that applies to the B&R feeder operation of container ship for the Southeast Asia Region in the future, the indices of which are as follows:

● 1. The LOA is suggested to adopt 200m, which meets the requirements of 15 ports out of 17 base ports with a coverage rate up to 88%. Except Port Kolkata in India, it meets the limitations of the other B&R ports in Southeast Asia Region with a coverage rate of 91%.

● 2. Although there is a draught limitation of 7.4m in Haiphong Port, Container ship in operation usually has residual depth, and if necessary, we can reduce the load when a ship enters. The maximum draught of B&R ships for the Belt and Road is suggested to adopt around 10-11m when designing.

● 3. Combining the shipping waters of the global feeder container ship with the port limitations, considering the lock limit of Panama Canal for a better universal performance, we suggest adopting a beam length of 32.2m. If a bigger container capacity is required, we suggest a beam of around 35m.

● 4. Benefiting from the continuous improvement of ship design technology, combining the technical index of ships under construction, we suggest a container capacity of 2900~3200 TEU for narrow-body ships (32.2m) and 3600~3900 TEU for wide-body ships (35m) to enhance its market competitiveness.

● 5. According to a number of operational data statistics of ships of the same type in service, we suggest adopting a speed of 19~21 knots. This index can be decided based on an overall consideration of owners' operation features, beam and energy efficiency.

● 6. Daily fuel consumption of ships directly influences ships' economic performance and market competitiveness. Statistical analysis of indices of ships in service shows that at present with a speed of 18kn, daily fuel consumption should be less than 50 tons.

# Several Special Issues for Consideration in Design of LNG Bunkering Ships

By Fan Hongjun, Xu Jianyong & Gan Shaowei

The Ministry of Transport of the People's Republic of China (MOT) released the "Plan for Implementation of Ship Emission Control Area in Pearl River Delta, Yangtze River Delta and Periphery Bohai Water Areas" on December 2, 2015, setting up ship emission control areas for the first time. In such areas, stricter standards for air pollutants emission will be implemented. As the substitute fuel for ships, LNG is a practical solution to deal with the air pollutant emission standard that is becoming more and more stringent.

The LNG bunkering infrastructure construction is the precondition to realize the use of LNG fuel on ships. LNG bunkering ship is a facility which requires high technology and investment and has drawn a high attention from the industry. The coming into force on December 1 2015 of CCS "Rules for LNG Bunkering Ships" indicates that CCS rules has covered all kinds of ship types related to LNG. Table 1 lists the existing global LNG bunkering ships and those on order. The table shows that the storage capacity of every LNG bunkering ship is within 10,000 cbm, with independent type C tank and membrane tank as the two types of tank. China company Enn Energy is planning to build 2 LNG bunkering ship.

In terms of water suitability, for inland water areas, due to complexity of navigation management, LNG bunkering ship will not be the main bunkering facility; for reservoir area and lake, LNG bunkering ship is a good choice; for sea, LNG bunkering ship will be the main bunkering facility.

For the design of LNG bunkering ships, consideration should be given to three aspects.

Firstly, from the perspective of serving target and work location.

1. "Diverse" receiving system need be considered for the design of LNG bunkering ships

At present, the design of LNG bunkering ship features diversity and personality, for example, there are receiving tanks with high pressure, low pressure and normal pressure, LNG bunkering ships need to provide service to such diverse systems.

2. As LNG shuttle to design

At the stage of LNG bunkering ship design, from the angle of reducing market risks, consideration should be given to using it as a LNG shuttle, which requires it to be able to discharge for small LNG terminal, LNG floating storage tank and LNG bunkering pontoon.

3. To consider "combination of oil and gas"

Since dual fuel will be the main plan during the period of initial application of LNG, so considerations should be given to the design of some bunkering ships to make them have dual functions, i.e. being capable of gas and oil bunkering.

4. To achieve "quick" bunkering operation

Fuel supplies must be fast, therefore, consideration should be given to "quickness" in the design of LNG bunkering ships. How to realize this? Equipping ship to ship quick connection, quick fender positioning and fast mooring operation could be solutions.

5. To avoid mutual influence between two ships in dangerous area

The mooring of two ships together is equivalent to "combining two into one", the outside dangerous area of one ship may become the dangerous area inside another ship. At the beginning of the design, the designer needs to consider this possibility.

6. The permitted environment for bunkering work

It is not that a LNG bunkering ship can work in any environment,

Figure I: Existing LNG carrier and order

No.	Delivery	Name	Owner	Service area	Capacity	Type of tank
1	2013	Seagas	Finland, Viking Line	Stockholm harbour	180m <sup>3</sup>	Type C
2	2016	Xin Dayunhe 01	China, ENN	Beijing–Hangzhou Canal	200m <sup>3</sup>	Type C
3	2016	LNG Prime	Netherland ,Veka–Group	ARA region	2250m <sup>3</sup>	Type C
4	2016	TBN	US,WesPac Midstream	Tacoma, Washington	2200m <sup>3</sup>	Membrane
5	2016	TBN	Japan, NKK	North Sea – Baltic Sea	5100m <sup>3</sup>	Type C
6	2017	TBN	Netherland ,SHELL	Rotterdam port	6500m <sup>3</sup>	Type C
7	2017	TBN	RUSSIA, LNG–Gorskaya	Europe	7300m <sup>3</sup>	Membrane
8	2017	TBN	RUSSIA, LNG–Gorskaya	Europe	7300m <sup>3</sup>	Membrane
9	2017	TBN	RUSSIA, LNG–Gorskaya	Europe	7300m <sup>3</sup>	Membrane
10	2018	TBN	China, ENN	Zhoushan	8000m <sup>3</sup>	Type C or Membrane
11	unknown	TBN	German, Meyer	German	2 × 2500m <sup>3</sup>	---
12	unknown	TBN	Netherland ,Argos	(inland waterway)	1,870m <sup>3</sup>	Membrane
13	unknown	TBN	China, Anhui Huaqiang	(inland waterway)	250m <sup>3</sup>	Type C
14	unknown	TBN	China, Chuangang Yukun	(inland waterway)	200m <sup>3</sup>	Type C

it needs to have the environment conditions that permit it to work, such as weather and sea condition.

#### 7. “Zero emission” design

If LNG bunkering ship works in emission control area, air pollutant emission reduction measures of the ship should be considered (lower sulfur oxides, nitrogen oxides and particulate matter, etc.). Some ports may not allow emission of methane (methane is the main greenhouse gas), which requires that LNG bunkering ship should be designed with “zero emission” of methane design in port.

#### 8. Safe distance for bunkering work between ships

There is a possibility of leakage in the process of bunkering work, a suitable LNG leakage scene according to the failure probability of the equipment should be chosen and provide the suitable safe operation distance based on 3D CFD (computational fluid dynamics) and the analysis of the spread after the leakage. Because of different working conditions in different work locations (such as wind speed, atmospheric stability, etc.), the safe distance for bunkering work is different too.



# Finite Element Calculation Technology of High Speed Ship Made of Carbon Fiber Composite Material

By Wang Min

In recent years, composite material high speed ship industry is developing fast both at home and abroad, and the ship type becomes more and more varied. There is high speed boat with maximum speed up to 70 knots and the large-scale high-speed passenger ship which can carry more than 250 persons as well as the large-scale yacht with more than 60 meters in length. These ships are taking the place of the traditional aluminum alloy high speed vessel.

These put forward higher requirements for increasing the rigidity of reinforcing material used in composite material. Composite material is composed of resin and reinforcing material. And the reinforcing material of high rigidity can reduce the weight of whole ship, and higher rigidity can withstand greater hull size. The traditional glass fiber composite material has been unable to meet the needs of large scale and light weight of boats due to its own weight and limited rigidity. Therefore, the use of new material represented by carbon fiber is becoming increasingly widespread, and currently has been widely used in high-speed ship, aerospace, super sports car and other fields.

Carbon fiber (referred to as CF), is a new type of fiber material with high strength and high modulus containing more than 95% carbon content. Carbon fiber is lighter than metal aluminum, but the strength is higher than steel, and has the characteristics of corrosion resistance, high modulus, and is an important material in the defense and civil industry. The carbon fiber plays an irreplaceable role in improving the speed and scale of the boat.

In order to promote the use of carbon fiber and other special fibers in domestic shipbuilding industry, CCS carried out the application research of carbon fiber material, mainly aimed at the minimum thickness of carbon fiber reinforced composite ships and the finite element calculation method.

1, With regard to the problem of minimum thickness, because the composite material is composed of reinforced material and resin layer after

layer, for the same thickness, we will have different performance by adopting different reinforced fiber materials, such as use of carbon fiber material can significantly enhance the strength and rigidity of the composite plate and reduce the thickness of the plate, and conventional minimum plate thickness provisions can not reflect the superiority of high performance fibers.

CCS firstly put forward the requirement to use fiber weight of unit area to replace the previous minimum thickness in the composite material shipbuilding industry in China. After simulation computation, it is equivalent to substantial reduction of the thickness requirement under the premise of ensuring the safety, and has active significance to weight reduction of high-speed craft and use of new material.

2, For the finite element calculation, CCS has studied the modeling methods, boundary conditions, load and working conditions, the criterion of building high-speed craft with composite material. CCS conducted the assignment of material properties by using leading international hierarchical assignment method. The method can give corresponding material properties according to different layer structure, and accurately assign material properties to each member. And in terms of the criterion, CCS use strain criterion to replace the traditional stress criterion aiming at the feature of composite material.

CCS updated the Rules and Regulations for the Construction and Classification of Sea-going High-speed Ships 2015 version. It makes clear the standard computational requirements for ships built of carbon fiber composite. At the same time, it added the provisions of the finite element calculation to solve the structure of the key parts of the complex hull or hull computation. The Rules enhances the structure calculation accuracy of composite high speed ship and is conducive to promoting the use of the carbon fiber and other new materials in China and the application of finite element method in the design of complex boats. The applicability of the Rules is improved.

# The Highlights of the “Rules for Construction of Steel Inland Waterway Ships” (2016)

**C**CS Rules for Construction of Steel Inland Waterway Ships (2016) will come into force on July 1, 2016, replacing its 2009 version, 2012 amendments, 2014 amendments and 2015 amendments at the same time. Compared with the previous version, the Rules has amendments on the following aspects:

**Chapter 1 Hull:** The transitional requirements of the double bottom has been improved; the permissible stress and minimum section modulus requirements at the continuous hatch coaming top plate of midship area were adjusted; the wave loads calculations of the longitudinal strength was revised; the buckling requirements for transversely framed panels were improved; the requirements of hatch covers and railings were added; the requirements of ice class ships and cement carriers were improved; the calculation requirements of hull girder loads for Asphalt Carriers and Pontoons were added; the direct calculation procedures for freeboard deck structure stretch, oil tanker structure, seat and support structures of independent gas tanks, slotted engineering ship structures and lifting equipment support structures and also requirements of temperature analyses and thermal stress calculations for relevant structures of gas carriers were added.

**Chapter 2 Main engine:** The requirements for ventilation in the main engine area was revised; the requirements for boiler installation were added, deleting the original contents of allowing boiler to use gravity method to supply fuel; According to UR M56 which was approved by IACS in October, 2013, and the CCS decision to transpose this resolution, Chapter 7 appendix 1 (the evaluation of gear strength) was revised; Z type propeller system, alarm and monitor requirements of thruster were revised.

**Chapter 3 Electrics:** Technical requirements of LFP battery of the ship were added; the requirements to supply emergency lighting in the collection station (if provided), boarding station, the storage and discharge water area of survival equipment were added; the requirements for the installation of ventilator in emergency fire pump

installation site and the lighting should be supplied by main power source and emergency power supply were added.

**Chapter 4 Control, monitor, alarm and safety system:** The technical requirements for on board computers were adjusted; According to the requirements of IACS URE 22, the requirements for the drawings of

onboard computer system that should be approved and tests that should be conducted were clarified.

**Chapter 5 Cargo refrigeration device:** The contents related to ODS R22-monochlorodifluoromethane which is banned in China were deleted.

**Chapter 7 Materials and welding:** Put the contents of the hull and related contents from other chapters into this chapter to make it easy for users; the operating requirements for hot-rolled round steel used in the rudder stock were made clear; the technical requirements for the brass used in propeller of inland vessel were added ; the general requirements for welding material, welding procedure, welder qualification, nondestructive testing about the welding of inland vessel were added, with specific requirements referred to CCS Rules for materials and Welding; general requirements for welding were added, and the technical requirements for the welding of main parts of the hull, the welding of the cross structure of twin hull and torsion box, and the welding of some important parts were added.



# CCS Issued the First Software Assessment Certificate

By Wang Xingyu

**O**n the Marintec China 2015, CCS issued the first software assessment certificate to MAN. According to GD11-2015 Guidelines for Safety and Reliability Assessment for Shipboard Software, CCS assessed the software of PrimeServ Online Service and granted the additional marking of software safety and reliability assessment, SLC2, to it. This is the first cooperation of both sides in the field of intelligent ship.

With the development of ship intellectualization, global shipping industries have to face the more and more challenges and risks caused by the application of all kinds of using intelligent systems when they are trying to improved safety and efficiency.

As a response to this change, Therefore, CCS developed detailed shipboard software safety and reliability assessment and verification rules which are of great operability. It is beneficial to improve safety and reliability of ship products and ensure safe operation of ships.

There are three key features of Guidelines for Safety and Reliability Assessment for Shipboard Software.

Firstly, system lifecycle and software development lifecycle are introduced. From the aspect

of software development, the software company integrated in safety and reliability requirements of CCS by stages. System lifecycle and software lifecycle from IEC61508 (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems) are adopted, combining with some requirements of CMMI and ISO9000-3. Requirements about function safety and safety integrity in IEC61508 are not yet added.

Secondly, according to features of software development, it abandoned the traditional model that classification society gets involved after technical designs of equipment or system and the diagnostic tests are finished has been changed. Classification society



makes requests at early stage (concept or demand analysis stage) of software development and helps or cooperates with the company if needed.

Thirdly, a verification form (handbook appendix 1 of guideline) is provided, which interrelates enterprise software development and requirements of IACS on computer systems. There are some other important concerns listing in the form. For example, Chapter Five, Quality System Requirements, indicates that the manufacturer of Category II and III shall also meet the applicable requirements in ISO9000-3. All of these requirements have been listed in the verification form. Enterprises only need to meet the relevant requirements in the form. Surveyors only need to check the requirements listed in the form. In this way, enterprises can be deemed to fulfill the requirements about computer systems and verified by classification society.

After knowing about these three features, the evaluation process is clear. Firstly, classification society gets involved at early stage, making requests at initial stage of software development and offers help or cooperates with the company; secondly, enterprise develops software based on mature and reliable system lifecycle and development model, and keeps well documents and records of all the stages; thirdly, the surveyor checks the verification form, while the enterprise collects and submits relevant data in documents and records of all the stages for approval.

On the one hand, demands and risks can be clearly analyzed are clear at the early and the most important stage of software planning, which helps to reduce or avoid wastes of time and cost due to later modification; on the other hand, by using mature and reliable ways to develop software, enterprise doesn't need to make another series of documents to cope with the review of compliance; in this way, the final verification requirements can be classified and solidified in forms, which is clear and user-friendly.

#### **Here are some common problems raised by the industry**

#### **and all parties during the investigation and discussion:**

1. Source code. With consideration of intellectual property and trade secret, source code is not required during software assessment. Classification society makes principal requirements about code while enterprises determine their own programming language and verification mode. Enterprise should submit the record of verification with satisfactory result to classification society, such as test specification, source code list, code rechecking record and test record. Certainly, special circumstances deserve special consideration. For example, if independent third-party white-box testing is necessary, code should be submitted to the independent third-party. Details about software test are omitted here.

2. Intercommunication between systems. Through splitting products or process, every module defines boundaries and interfaces, so that intercommunication between systems is not a problem. Therefore, demand and risk analyses are significant during software development.

3. Software security. Classification society always put safety and environmental protection in the first place. Here the safety refers to ship, people and equipments. With wide use of network onboard and ashore, security of information and network also becomes important. However, it's not economical for marine equipment producers and integrators to work on security fully from the very beginning. The mature commercial software, COTS, is a good choice for them.

4. Wireless application. On the one hand, there are regulations in Volume 7, Chapter 2, Part Six of CCS Rules for the Classification of Sea-going Steel Ships; on the other hand, about applications of new and unconventional technologies (not limited to wireless communication technologies), based on equivalent security principle, engineering analysis in accordance with international and domestic standards should be submitted to assess system reliability and acceptability and to gain recognition.

International standards include Chapter II-1, Regulation 55 of SOLAS, Alternative Design and Arrangements. CCS also issued Guidelines for Application of Formal Safety Assessment for Ships 2015 in March this year, which introduces how to assess the risks from aspects of implement preparations, evaluation process, hazard identification, typical risk assessment method, measurement and criterion, measures and human factors. There are also some examples provided.

5. Modification-proof. CCS has been paying attention to this problem since equipment automation. CCS makes rules and requirements on all the stages of standards, approval and verification, which on the one hand avoids mal-operation and unauthorized program modifications, on the other hand ensures every modification can be recorded and traced. Important modification must be re-submitted to CCS for approval. GD11-2015 software assessment guidance makes requests on change management from the aspect of enterprise quality control system, including software configuration management plan and software quality plan.

6. Software verification. Classification society makes

management requests on each stage of software verification from four aspects including objective, requirement, input and output, in which requirement, regulation and record are highlighted. CCS does not make compulsive requests for white-box test, independent third-party test or hardware in-the-loop test. Test measures, test methods, test organizations should be confirmed by both enterprise and classification society from aspects of software demand, importance degree, security, economical efficiency and some others.

7. Requirements on simple small systems. Appendix 2 gives simplified assessment method for simple small systems.

8. Assessment methods for existing and old systems. General marine equipments have been assessed according to existing CCS Rules for the Classification of Sea-going Steel Ships. If they are integrated into new systems, in which boundary and interface with old systems are defined, existing and old systems need only provide previous documents for reference.

Guidelines for Safety and Reliability Assessment for Shipboard Software proposes an united assessment and verification method for ship software, which contributes to standardization

of ship software quality control and management, narrows down the gap between domestic and overseas ship software industries. As a general management requirement on software security and reliability, the guidelines provide the basis for software security and reliability assessments of intelligent ship systems and strongly support CCS to better serve to owners. CCS will continue researching on ship software to provide technical support for intellectualization of Chinese ships and stand up to challenges and opportunities of shipping industry with greater courage and broader vision.



# CCS and CMG Jointly Developed the “Online Application System of Integrated Management System”

Recently, the acceptance review and assessment meeting of the “online application system of integrated management system (IMMS1.0 version)” was held in the headquarters of CCS. The “Online application system of integrated management system (IMMS1.0 version)” is developed jointly by CCS, China Merchants Group (CMG) and Hong Kong Ming Hah Shipping Co., Ltd. It is an integrated activity management platform for management systems based on IT intelligence and it is easy for search, operation and revision. It meets the demands of ISO9000, ISM Code and other safety management systems. The shore-based version can realize analysis of maintenance, management and performance of the integrated management systems, and onboard version can realize the performance and feedback of the activity of the system. The communication between shore-based and ship side is safe, controllable and traceable.

The experts of the review group had discussions on the function and performance of the software from the aspect of the demand of shipping companies and generally considered that the condition of the development and usage of the system meet shipping companies’ requirements for system management, execution, monitoring and improvement during the pilot operation period. At the same time, the software realized various functions of the software specifications. This system is the first one in China shipping industry, and it has an independent intellectual property right, it can be configured and developed according to different users’

needs, and it has a good prospect for promotion and application. It indicates that the development work of “online application system of integrated management system (IMMS1.0 version)” has been completed and has achieved the expected goals.

For this cooperation, the General Manager of Hong Kong Ming Hah Shipping Co., Ltd. Zhao Yaoming said that the online application system of integrated management system can simplify operation, and realize the function of environment protection and network information, laying a solid foundation for the standardized management of the company and quality and efficiency improvement, moreover, it makes positive contributions to CMG’s digital business and intelligent shipping.”

CCS vice president Sun Feng said: the “online application system of integrated management system” is developed by CCS and CMG, and customized for Ming Hah Shipping Co., Ltd. During the start-up process, both sides experienced a very good process by putting forward ideas, making design and plan together, developing and testing together. Based on this project, as the next step, CCS will work on energy efficiency, smart ship and risk-based ship survey. In the coming days, CCS will utilize more technologies to promote the application of shipping information and intelligence in order to make shipping operation, management and survey more targeted. In the future, CCS hope to cooperate with shipping lines to promote risk based shipping survey, large data and application of inspection measures, making the process of survey and review more intelligent.