

Study on Management Countermeasures Against Self-Sinking Accidents of Solid Bulk Carriers

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Abstract. Based on the frequent occurrence of self-sinking accidents of solid bulk carriers in China's coastal areas, this paper, using accident data statistics and case analysis, analyzes the self-sinking accident of solid bulk carriers and finds out two main causes of accidents, namely, non-private bulk carriers and small bulk carriers carrying solid bulk cargos and the non-standard detection and operation of goods. It also puts forward management measures from the three aspects of regulating the conditions for non-bulk carriers and small bulk carriers to carry solid bulk cargos, standardizing the detection and operation procedures of solid bulk cargos and determining the emphasis of maritime safety supervision.

Keywords: bulk carriers; self-sinking; management; countermeasures.

1. Introduction

According to the INTERNATIONAL ASSOCIATION OF DRY CARGO SHIPOWNERS' Bulk Carrier Accident Report [1], from 2005 to 2015, a total of 71 ships, whose gross tonnage is more than 10,000, were lost worldwide, killing 255 crew members. Every year, there are more than one solid bulk cargo ship foundering accident in China's coastal areas, resulting in serious casualties and property losses [2~3].

2. Safety Situations of China's Solid Bulk Carriers

According to the traffic accidents report which was issued monthly by China Maritime Safety Administration [4], between 2002 and 2011, a total of 217 ship accidents occurred in Chinese coast area, resulting in a casualty of 491 crew members (death or missing); The total number of cargo ships and general accidents is 189, accounting for 87.10% of the total ship accidents, resulting in 459 casualty, which consists 93.48% of the crew lost. Dry and general cargo ships were the main types of ships lost in those accidents. In the above-mentioned sunk, there were 126 cases of dry and general cargo ship carrying solid bulk cargo (concentrate powder, coal, gravel, etc.), which were clearly recorded in the investigation report and they contribute 58.06% of all foundering accident - The situation of unknown 38 cases, accounting for 70.39% of all foundering accident; a total of 354 crew members were killed, accounting for 72.10% of all the crew. In term of the average number of accidents and the number of victims, during the 10 years between 2002 to 2011, the annual foundering accident of international sailing bulk carriers is 2.8, which result in the lost of 18.3 crew [5]. While the annual foundering accident of Chinese dry cargo ships or general cargo ships, carrying solid bulk cargo which were clearly recorded, is 12.6, and it lead to 35.4 crew killed in each year. So we can find that the risk of foundering accidents relating to China's coastal solid bulk cargo ships and the number of people who have been killed in those accidents are far higher than those of the international sailing bulk carriers. Thus, the safety situation of China's ships carrying solid bulk cargo in coastal area is very grim.

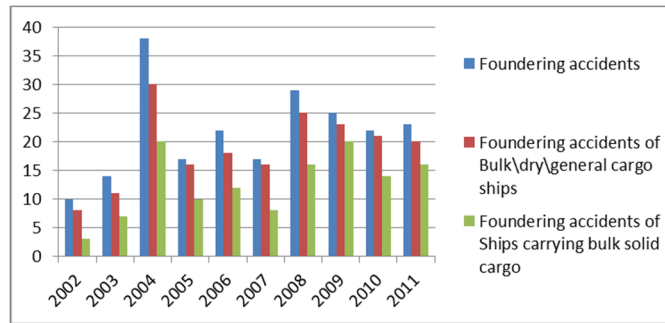


Fig. 1 Foundering accidents of ships in the coastal area of China from 2002 to 2011

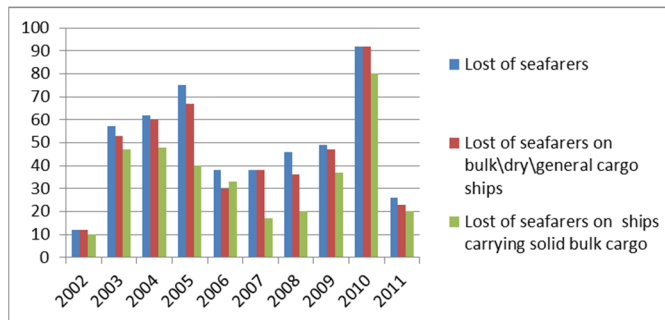


Fig. 2 Fatalities of seafarers caused by foundering accidents of ships in the coastal area of China from 2002 to 2011

3. Cause Analysis of Self-sinking Accident of Solid Bulk Carrier

3.1 Non-private Bulk Carriers and Small Bulk Carriers Carrying Solid Bulk Cargoes with Major Potential Dangers

In the history of global shipping, there was no dedicated bulk carrier initially. In the event of a large number of ship foundering accidents which carry solid bulk cargo, a special structure of bulk carrier was developed. Since 1990s, there were more and more foundering accidents of bulk carriers. When considering the special requirements of the structure or strength of ship, the International Maritime Organization (IMO) has adopted the provisions of Article XII of the SOLAS Convention--"additional safety measures for bulk carriers", and put forward the requirements for enhanced inspection of bulk carriers. The Common Code for the Structure of Bulk Carriers (2006), which was developed by the International Association of Classification Societies (IACS), proposed the construction of bulk carriers and provided for the issuance of additional operational marks to bulk carriers of 150M and above. The implementation of the relevant provisions of the above-mentioned Conventions and Codes has played a significant role in improving the safe operation of bulk carriers. There was a significant downward trend (see Figure 3) of foundering accident of International sailing bulk ship since the mid-90s.

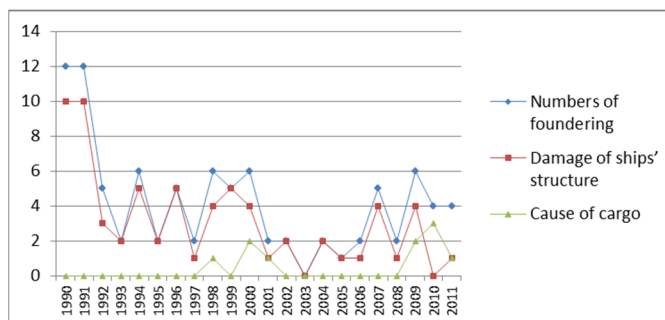


Fig. 3 Foundering accidents of international bulk carriers from 1990 to 2011

At present, most international bulk cargo is transported by dedicated bulk carriers. The main type of ships carrying solid bulk cargoes in China's coastal areas are bulk carriers, dry cargo ships and general cargo ships. By 2012, there were about 4,300 bulk carriers in the seaborne vessels registered by the China Maritime Safety Administration, of which about 2,200 vessels were more than 150M in length, and there were about 7,500 dry cargo ships, 400 of which were more than 100M in length; About 2,600 general cargo ships, 150 of which were more than 100M in length. These dry and general cargo ships are not designed and constructed in accordance with the requirements of carrying solid bulk cargoes and are not in compliance with the technical requirements for the carriage of solid bulk cargoes in terms of structure, stability, strength and equipment, nor are they required to carry out enhanced inspection and maintenance for carrying solid bulk cargo. Thus the risk of carrying solid bulk cargo is very high. Accident occurred in the dry, general cargo ship, carrying non-easy fluidized goods accounted for more than 77%. These foundering accidents can not be attributed to the flow of goods and mobility and other reasons, and should be attributed to the ship's technical conditions not meeting the standards of carrying solid bulk cargo.

There are few requirements for the bulk carriers less than 150M in domestic survey, so that these small bulk carriers have some problems in the design and construction of the structure, stability and strength. Such as M/V "XIN BAO 1", which was foundered on October 16, 2006. And M/V "SHANG YUAN 9", which was sunk on April 13, 2010. In fact, they were the same boat [6]. When "XIN BAO 1" sank, people salvaged her and changed her name to "SHANG YUAN 9" so as to navigate for business. The accident investigation report unfolded some problems in the design and construction aspects of the ship, she may have some serious flaw in the hull structure.

Nowadays, international sailing bulk carriers hold a certificate, which was issued by the classification societies and called "certificate of compliance for carrying solid bulk cargo". This certificate indicates the types of goods which are suitable to be carried by the ship. Yet, China's domestic non-bulk cargo ships (dry, general cargo ships, etc.) and bulk carrier have no such certificate or something similar. In the relevant certificate (such as the certificate or loading manual), the range of solid bulk cargoes that can be loaded is too limited and there is no list of goods which are allowed to be loaded. For dry and general cargo ships, it is not possible to confirm whether a ship is allowed to load a solid bulk or not, especially for high-density cargo, which poses a significant risk to solid bulk cargo transportation.

3.2 Non-standard Inspection and Operation of Goods and its Weak Links

The SOLAS Convention provides mandatory provisions for the carriage of solid bulk cargo. The International Maritime Solid Bulk Cargoes Code (IMSBC Code) and the Bulk Carrier Safety Handling Code (BLU Code) provide specific requirements for grouping, testing and loading and unloading procedures for solid bulk cargoes, respectively. When the "IMSBC Code" entered into force, China's Ministry of Transport issued "a safety management regulations for the transportation of solid bulk cargo which is known to be prone to liquefaction" (Jiao shui Fa [2011] No.638), clarifying requirements on the cargo testing, declaration, loading or unloading, and trimming in the process of transporting solid bulk cargoes which may liquefy.

The main problem during the process of solid bulk cargo operation in China's coastal ports is that there is no standardized cargo testing criteria or procedure. When testing the same sample, the results from different testing organizations differ greatly. Many ports can not handle the cargoes in accordance with the relevant conventions, rules and relevant documents. There is no standardized work processes between ships and the terminals in the aspect of confirming loading and unloading plan, cargo trimming and coordination work.

According to the relevant accident investigation report, the M/V "Hao Ping" and M/V "De Rong" foundering accidents occurred in 2008 are directly related to the problems of water content and the detection of moisture content [7]. The foundering accidents M/V "Ming Yangzhou 178" and M/V "Xin Bihai 27", occurred in 2005 and 2009 respectively, shown that inadequate trimming becomes the main cause of foundering accident [6]. Due to improper operation, M/V "Ming Hing" (2007) and M/V "Zhejiang Ding 55217" (2008) sank during the loading operations of sand. Therefore, it is

needed to uniform the process of cargo sampling, loading and unloading operations at the transportation of solid bulk cargo in China's coastal areas.

4. Safety Management Measures for Solid Bulk Carriers

4.1 Regulate Conditions for Non-bulk Carriers and Small Bulk Carriers to Carry Solid Bulk Cargoes

The fact that a large number of non-bulk carriers (dry, general cargo ships, etc.) and some small bulk carriers (Length of All<150M) carrying solid bulk cargoes have experienced self-surging accidents. It shown that a significant number of non-bulk carriers do not meet the requirements for carrying solid bulk cargo. And whether the stability and strength of small bulk carriers meet the needs of transporting higher density solid bulk (such as the density of 1,780kg / m³ and above) or not have determined yet. Therefore, proposals should be made to the relevant international conventions and regulations. The development of management requirements and standards for the carriage of solid bulk cargoes by non-bulk carriers and small bulk carriers shall be incorporated into the relevant ship inspection specifications, including stability, structural strength and equipment. By testing, it is necessary to determine whether non-bulk carriers and small bulk carriers can carry solid bulk cargo, as well as to allow the range of cargo density and the maximum amount of cargo carried in the relevant certificate, which is marked on the hull as an additional operating mark of the goods.

Accordingly, it is proposed to submit a proposal to the IMO to imply mandatory practice of certificating for bulk carriers, which is currently implemented by the International Classification society for international sailing bulk carriers. At the same time, these requirements should be extended to China's coastal ships. China Maritime Safety Administration shall give the power of certificating a special requirement for the carriage of solid bulk cargoes to China Classification Society or local surveying agency. So, ships carrying solid bulk cargoes are required to transport solid bulk cargoes in accordance with the list of goods in the relevant certificate and the loading manual.

4.2 Standardize Detection and Operation Procedures of China's Solid Bulk Cargos

At present, there are a number of testing bodies which are capable to test bulk cargoes in China's coastal ports (especially refined powder and other goods which are easy to fluidize), but we lack a national standards or industry standards for testing solid bulk cargo. There are some problems in the equipment and testing procedures. We should develop a solid bulk cargo testing criteria and implement the industry standards by referencing to "IMSBC Code" as soon as possible. By introducing the standard sample testing (which means giving standard samples to the testing agency and receive feedback when they finish the testing process) and other methods, we can guarantee the accuracy of the test results.

In the process of cargo handling and other operations, we should develop a procedure of solid bulk port operations and ship-shore collaboration guidance by consulting to the "BLU Code" ,so as to ensure a continuous and effective exchange of information in the aspects of ship inward or outward the port, loading or unloading of cargoes and trimming. Implementing the safety requirements, developing loading and unloading plan in accordance with the relevant operating standards, and carrying out the cargo handling process, so the trimming will be reasonable when cargo loading have been finished.

4.3 Determine the Emphasis of Maritime Safety Supervision

In view of the main risks of bulk cargo, China Maritime Safety Administration should find the focus of safety supervision and grasp the key points of solid bulk cargo transportation, namely, ship, cargo transport and cargo operation. First, if the survey criteria have been developed and a certificate of compliance for ships carrying solid bulk cargoes have been issued for the non-bulk carriers or small bulk carriers carrying solid bulk cargo, We can check whether the ship complies with requirements of carrying relevant types of cargoes or not, whether she holds a certificate of compliance for ships carrying solid bulk cargoes or not, and whether the cargo intended to be loaded

was listed in the above certificate. Secondly, if the testing standards have been developed, we can audit the key cargo parameters based on the solid bulk cargo declaration, such as Transportable Moisture Limit (TML), water content, angle and stowage factors, to ensure the safety transportation of goods. Last, We can select some items among the ship-shore safety checklist or the loading and unloading plan, which were signed both by the ship and shore representative, so as to check whether both sides are familiar with the operating standards and procedures. If necessary, we can ask the two sides to fulfill their respective duties in the operation of goods, in accordance with the standard to complete the loading and unloading operations.

5. Conclusion

The risk of China's coastal solid bulk cargo ships foundering is higher than the global international sailing bulk carriers. The primary reason is that a large number of non-bulk carriers (dry, general cargo ships, etc.) carrying solid bulk cargo, which contains significant safety risks. It is necessary to clarify the conditions for the ship carrying solid bulk cargoes and regulate the solid bulk cargo ships, and it is necessary to reverse the very serious safety situation so as to eliminate the backward production capacity and promote the orderly and sustainable development of the shipping industry. On the other hand, there are no unified operational standards in the process of solid bulk cargo testing, handling and other operations at China's coastal ports (especially cargoes which are easy to fluidize and goods with a high density) , so that the cargo liquefying, improper loading and trimming will danger the ship. Therefore, a standardized process for the implementation of solid bulk cargo testing and operation should be developed to ensure the safe and secure transport of solid bulk cargo. Maritime authorities should grasp the key aspects of solid bulk cargo transport to implement targeted supervision and management to ensure that ship and cargo operation is in accordance with safety standards. Finally, in order to further improve the safety situation of the global bulk carriers, it is proposed to submit a proposal to IMO to mandatorily practice the issuing of a certificate of compliance for ships carrying solid bulk cargoes for the international bulk carriers.

Acknowledgments

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