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Research on maritime Mass Rescue Operation(MRO) in China

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RESEARCH ON MARITIME MASS RESCUE OPERATION (MRO) IN CHINA

By

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The People's Republic of China

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DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University

(Signature): Chen Yichun

(Date): 29th June 2017

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ABSTRACT

Title of Research paper: **Research on maritime Mass Rescue Operation(MRO) in China**

Degree: **MSc**

Life is invaluable, but accident is merciless. International maritime community has responsibility to protect every life on the sea. so it will be a disaster when a large number of persons, more than several thousand, in distress at sea. At this time the mass rescue operation(MRO) should be carried out immediately and effectively by all parties involved, otherwise it will lead to incalculable consequences. However, there is always capability gap in every MRO.

With the trend of large passenger ships in the world and the increasingly popular cruise travel in China, the author strongly consider that there is urgent necessary to study and implement maritime MRO in China for the purpose of protecting the massive lives at sea when disaster happened in or surrounding Chinese waters.

So by the means of analyzing the current situation of cruise ships and other large passenger ships in China, learning the lessons from the cases of MRO before, introducing the practices and experiences of MRO in the world and analyzing the current situation of MRO in China, the author puts forward some countermeasures to improve the capability and level of MRO in China. Furthermore, the author hopes to arise all parties involved in MRO in China to pay high attention to the urgent need of preparation for MRO, and also hope more scholars to study this subject, and then make a good preparation of MRO when the disaster happened.

KEY WORDS: mass rescue operation, MRO, large passenger ship safety, cruise ship, safety, China.

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LIST OF ABBREVIATIONS

MRO	Mass Rescue Operation
IMO	International Maritime Organization
USCG	United States Coast Guard
EMSA	European Maritime Safety Agency
SAR	Search And Rescue
CLIA	Cruise Lines International Association
FSA	Formal safety Assessment
M/V	Motor Vessel
NGO	Non-Governmental Organization
OSC	On Scene Coordinator
SMC	SAR Mission Coordinator
ACO	Aircraft Coordinator
IMRF	International Maritime Rescue Federation
MSA	Maritime Safety Administration
GRT	Gross Register Tonnage
GT	Gross Tonnage
LRFP	Lloyds Register Fairplay accident database
ALARP	As Low As Reasonably Practicable
COMSAR	Sub- Committee on Radiocommunication and Search and Rescue
MSC	Maritime Safety Committee

OP	Only passenger
PRC	Passenger and Ro-Ro cargo
CNKI	China National Knowledge Infrastructure

CHAPTER 1

INTRODUCTION

1.1 Background

It is known that shipping plays an important role in world trade. About 90% of the world's goods are transported by shipping. Marine transportation includes passenger transportation as well as cargo transportation. The trans ocean passenger transport began with cruise transportation, when the cruise ship carried the task of transport of mails and passengers. Then, as technology developed, the transport of mails by cruise was gradually replaced by other forms of transport, such as airplanes and trains, and now most paper mails are replaced by faxes, e-mail and other social media. As a result, cruise ships are changed to the traveling transportation at sea . Cruise travel began and be popular in Europe and North America, and now the trend is growing globally. For example, in China, the increasing number of people are accepting and enjoying cruise tours now.

Although the safety of the cruise ship is very high, there are still many dangerous factors, such as human error, busy ship traffic, rough weather and so on. In addition, due to the role of economies of scale, the trend of large cruise ship is obvious,so the serious accident once happened, it will threaten the safety of a large number of

passengers and crew.

Besides, maritime rescue, unlike on land, faces many difficulties, for example: bad weather and sea conditions may bring serious difficulties in retrieving people from ships in distress ,or rescuing people on lifeboats or in water in time; it is impossible to carry out mass rescue operation (MRO) for many rescue ships at the same time for the reason of bad weather condition or limited work area; If the place of accident is far from the land, it cannot transfer the rescued people especially the serious injured or old people to landing sites timely, which may lead to further casualties. Even if the helicopter can transport personnel rescued, but due to the limited number and passenger capacity of helicopters, the large number of persons in distress can not be transfer to the safe place or hospital timely. And furthermore, there are many other problems even the large number of people be transferred to the safe place on land, such as personnel settlement, health care, transportation and so on. In addition, the passenger ships or Ro-Ro passenger ships are also becoming increasingly large,so such ships are facing the same problems of MRO with the cruise ships, once accidents happened. The only difference is that the routes of such ships may be closer to land, and there are more ships around them, so there are more rescue resources.

In a word, once a large cruise ship, passenger ship or Ro-Ro passenger ship is in distress at sea, it is necessary to provide effective maritime MRO immediately, otherwise it will lead to incalculable consequences. Just as Svenn Fjeld Olsen said:

> *Maritime disasters are not necessarily more numerous than disasters in other modes of transport, but they can be very large.*

Some of the largest transport disasters in the world, and in Europe, have been maritime disasters.

So when we mention the large passenger ship accidents, it can not be avoided to mention TITANIC, which is the largest luxury passenger ship in the early 20th century. Although it was considered "never sinking", the ship hit the iceberg and sank in the North Atlantic in its first voyage causing a large number of people buried in the sea. In addition, many serious marine accidents have occurred in the history of the world, resulting in heavy casualties, some examples of which are showed by the table 1.

Table 1-Passenger ship and ferry incidents (1980-2012)

Date	**Ship' name**	**Type of ship**	**Lives on board**	**Live lost**
04 Oct 80	Prinsendam	Passenger ship	525	0
31 Aug 86	Admiral Nakhirmov	Passenger ship	1234	448
10 Dec 87	Dona Paz	Passenger ferry	Over 4000	4341(est.)
07 Apr 90	Scandinavian Star	Pass/car ferry	UNK	159
04 Aug 91	Oceanos	Passenger ship	571	0
17 Feb 93	Neptune	Passenger ferry	1200(est.)	900(est.)
28 Sep 94	Estonia	Pass/car ferry	989	852
30 Nov 94	Achille Lauro	Passenger ship	1090	2
21 May 96	Bukoba	Passenger ferry	UNK	Over 800
26 Sep 02	Lejoola	Passenger ferry	UNK	1863(est.)
03 Feb 06	al-Salam Boccaccio 98	Pass/car ferry	1408	Over 1000
23 Mar 06	Star Princess	Passenger ship	3813	1
05 Apr 07	Sea Diamond	Passenger ship	1558	2
23 Nov 07	Explorer	Passenger ship	145	0
21 Jun 08	Princess of Stars	Passenger ferry	747(est.)	800(est.)
08 Nov 10	Camival Splendor	Passenger ship	4500(est.)	0
15 Apr 11	Ocean Star Pacific	Passenger ship	748	0
15 Sep 11	Nordlys	Passenger ship	252	2
13 Jan 12	Costa Concordia	Passenger ship	4252(est.)	30

Source: USCG. (2013). *Analysis of the challenges associated with the conduct of maritime mass rescue operation.*

Besides that, several serious passenger ship accidents occurred in the world since 2013, for example,the sinking of M/V SEWOL resulted in 295 Lives lost and only 172 Survivors in South Korea on 16 April 2014.

Although the disaster of large passenger ship happened rarely, but once it happened it will cause disastrous consequences, not only a large number of casualties, but also tremendous impact to the local community, politic and economy. Taking the disaster of M/V SEWOL as example: many problems were exposed in the emergency response when the government of the Republic of Korea dealt with the accident of M/V SEWOL. Its extensive social impact caused a serious political, social crisis and governmental trust crisis. The South Korean President Park Geun Hye apologized to the nation for three times, and Prime Minister Zheng Hongyuan resigned. The state is responsible for the dissolution of the marine police force, reorganization of the national disaster and accident prevention system. The rate of people's support to Korean government dropped from 71% to 47% , which is the lowest point in Korean history(Wang Zhijian, 2015).

As it is mentioned above that the disaster of large passenger ship will lead to disastrous consequences, once the maritime accidents happen, it is important to implement a mass rescue operation(MRO). What is MRO? It is a kind of action which is different with the rescue.The IMO defines an MRO as: *A civil search and rescue activity characterized by the need for immediate assistance to a large number of persons in distress, such that the capabilities normally available to search and rescue authorities are inadequate*. However, the rescue is the operation to retrieve

persons in distress, provide for their initial medical or other need and deliver them to a place of safety. It is also well known that SAR is a long-time core mission that many SAR authority handle very well, which is the routine work of SAR authorities. However, an MRO by definition poses special challenges. There are critical requirements for an successful MRO,such as careful & comprehensive planning, preparation and training, accounting for people involved in an MRO, and so on(Tom Gorgol, 2015).

1.2 Objective

Because China is a country with many disasters, according to the list of 10 countries with the largest number of disasters between 2005 and 2014, which was published by United Nations International Strategy Secretariat for disaster reduction, China, with a number of 286, was the country with the largest number of disasters(Leijun, 2016). Facing major catastrophic events, the government's ability to respond is a very important and arduous task related to social stability and public support.

Therefore, the purpose of this paper is to arise the concern of the Chinese government and relevant administrations for MRO with the data by statistically analyzing the change and development of world cruise, researching and analyzing the status and development trend of cruise ships and the status of large passenger ships in China, combining with the world's cruise accidents and FSA analysis of cruise ships; Secondly, the paper will analyze and introduce the the characteristics and difficulties of MRO, combined with the latest development of MRO in the world; Thirdly, it studies the situation and existing problems of MRO in current China, such as the legal system, organization, operation mechanism, search and rescue facilities and others. Lastly, this paper will put forward the countermeasures to solve the problem of MRO or improve and perfect the MRO in China, according to the

existing problems, the experience and practice of other countries about MRO.

1.2.1 The characteristics and difficulties of MRO

According to the MRO functional actions, there are three tiers: on ship, on scene and on shore(see figure 1), and see the operation section of MRO from figure 2.

Figure 1-MRO functional actions

Source: Rick Janelle 17th Coast Guard District

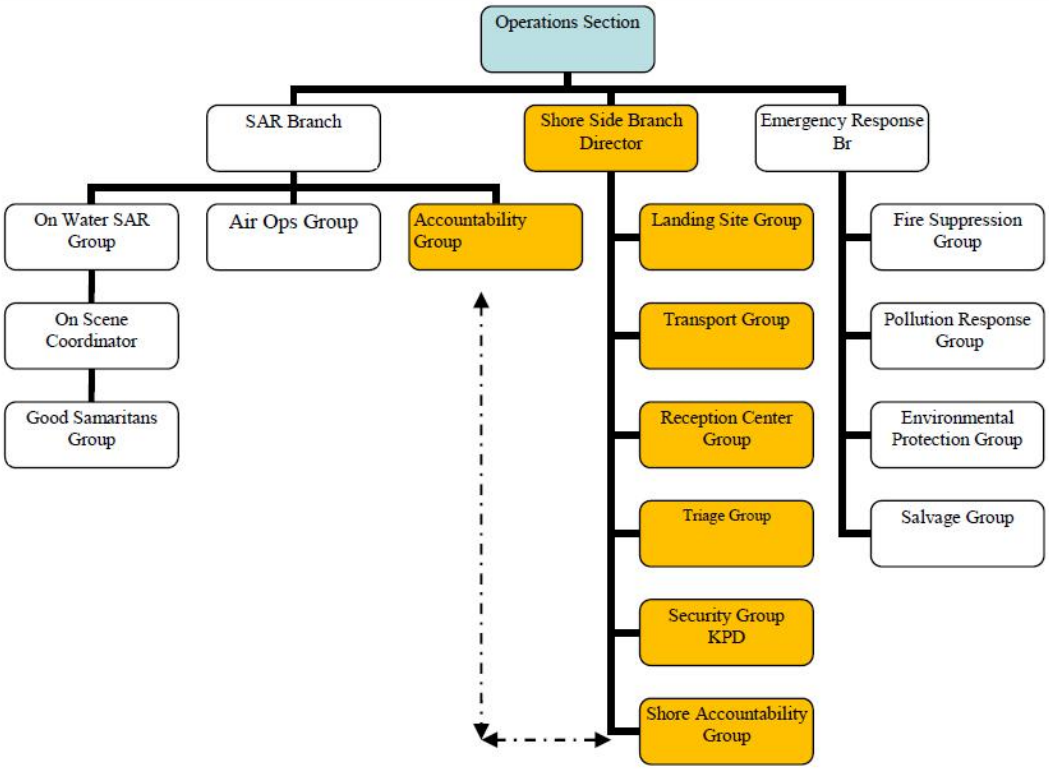

Figure 2-MRO operations section

Source: Rick Janelle 17th Coast Guard District

According to the IMRF mass rescue operation project, the features of MRO is that:

1. In an MRO, the SAR capabilities normally available is inadequate, which means there is always a capability gap in the MRO.

2. The scale,complexity and rarity of MROs are challenge for all concerned.

3. We can prepare for the challenge by recognizing the risks, and planing and training to deal with them.

4. This is not just a matter for the responsible authorities but for everyone who might become involved in MRO.

5. There are many potential causes of MRO, and the risks should be analyzed carefully, but the effect is more important than the causes.

6. MRO planing should be generic and flexible, and then the exercise is critical to the preparation of MRO.
7. Anyone who may be involved in MRO planing or response is invited to contribute. (Cornillou, 2016, p. 8)

1.2.2 The difficulties of MRO

1.2.2.1 Coordination is critical in the process of MRO

MRO incidents are not confined to a single organization, or to search and rescue (SAR) functions. There is no way for a single company or agency to own all the tools or assets required for a successful MRO. There is requirement of coordination with multiple local, province, regional, or international response partners, which exsits in the whole process of MRO, such as the maritime SAR operation, security, pollution, salvage, investigation, medical, shore side shelter and support, transportation, accounting for people, public relation and all other functional actions that will be concurrently undertaken.

So in a maritime MRO, the coordination among the different departments are very critical and difficult, which is like the jigsaw puzzle. There is need to complete the picture with all pieces of the puzzle without gaps and overlaps(see the picture)（IMRF, 2015, p.1).

1.2.2.2 Accountability is difficult

Accountability of passengers and crew will be elusive and difficult. It is impossible to accurately account the people in a uncontrolled situation, especially when the survivors are mixed with the rescue people, the public and the relatives. So an accountability process must be developed, implemented and stressed from the start, and then checked and double-checked using any chance. There will be delays, often lengthy, between rescuing and officially accounting for people. The lower accuracy

may be resulted from the pressure to speed the process of accounting.

1.2.2.3 The high requirement of communication

Communication will be overwhelming in the entire MRO process unless a process is implemented early to manage the content and flow of communications.In the process of the MRO, there are many information to be communicated, such as commands, instructions, replies, questions, suggestions, coordination and reports and so on. If there is no effective communication, we cannot implement the MRO effectively and efficiently. So there is need for good internal and external communication to ensure the effectiveness and efficiency of rescue operation, especially in the in the international cooperation of MRO.

In the structure of MRO, there are several positions needing extremely high requirement of communication, which are SMC, OSC and Tactical group(see the figure 3). For example, the SMC need to communicate with OSC, ACO, Landing site coordinator and Tactical group. So it is very difficult for SMC to communicate, which will result in SMC fatigue if the SMC works for a long time(IMRF, 2015, p.1-13)

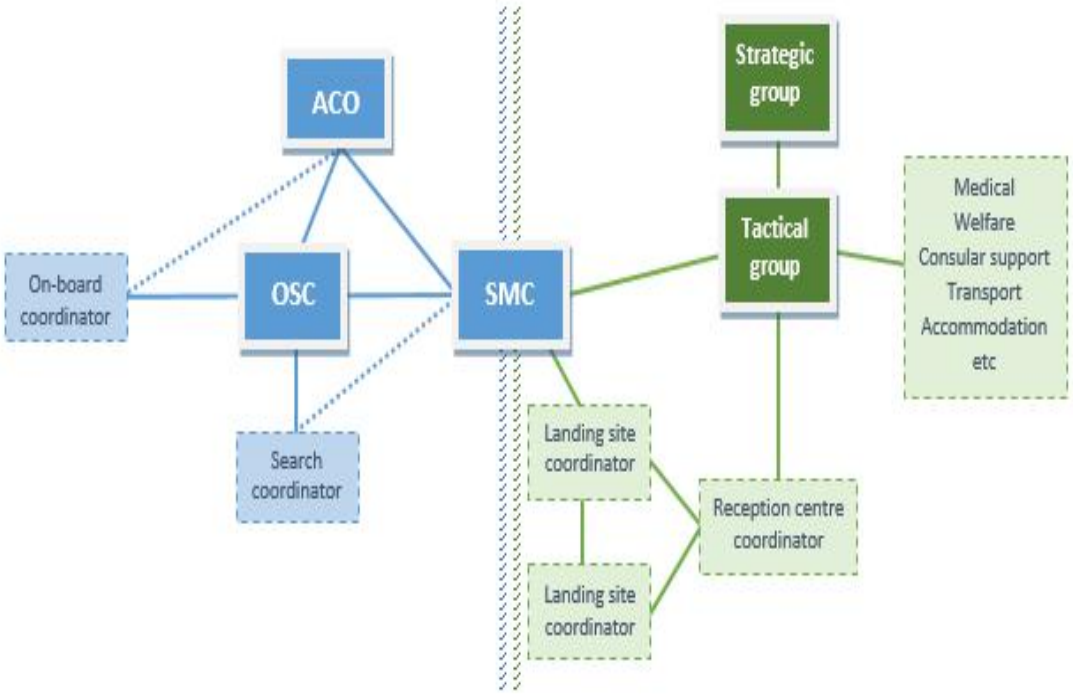

Figure 3-The structure of MRO communication

Source: IMRF. (2016). The International Maritime Rescue Federation Mass Rescue Operations Project:*The SAR Mission Coordinator.*

1.2.2.4 The huge capability gap

There always is a huge capability gap of dedicated SAR resources in the MRO, which means the SAR authorities do not have enough rescue resources to carry out a MRO. So the SAR authorities have responsibility to find the additional resource to fill the capability gap and then to conduct the successful MRO. The additional resources comprise the "Good Samaritan", which will be critical for success in the majority of incidents. The "Good Samaritan" includes the nearby merchant ships, the fishing boats, the private yachts and so on. The SAR authorities should utilize and coordinate as many as the "Good Samaritan" to fill the capability gap in the MRO.

1.2.2.5 Local communities have little guidance or training

Local communities are vital partners in providing shore side MRO response actions, especially when the disaster of the ship happened in the remote area, but most of them have little guidance or training on the functions of the MRO. Because the rescued victims need continuum of care. the functions of accountability, emergency medical care, human health, shelter, food, and other survivor support needs must be continued and coordinated when the survivors have been delivered to shore(George "Rob" Lee, Rick Janelle, 2007).

1.3 Importance of this research

China is a country with frequent natural disasters. Although China has accumulated a lot of experience in dealing with unexpected disasters and has successfully coped with many major disasters, these successful cases have mainly occurred on land. On the contrary, major disasters at sea generally lead to terrible consequences, causing significant reaction in society, bringing great suffering to the families of the victims.A qualified government should be loyal to its duties, dare to take responsibility for the people, focus on society and citizenship, and change from the "government-based" to "citizen-based" (Bai Jianguo, 2007, pp.27-28).

Therefore, protecting the safety of people's lives and property is the responsibility and obligation of the Chinese government, and in the event of a serious passenger ship accident with a large number persons in distress, it is an important test of government departments. From this point, maritime MRO is not only a serious safety problem, but also an important social and political issue, which is related to the harmony and stability of society. Furthermore, the correct understanding and management of MRO is a very necessary and urgent social engineering, and the governments at all levels need to be concerned, to solve and improve the problem

from the legal, structural and procedural aspects. Therefore, there is important practical significance for the research of MRO, by researching and analyzing the experience and practice of MRO in other countries, summarizing the existing difficulties in the implementation of MRO, the paper will put forward the proposals about MRO in China from the several aspects such as legal system, organization, operation mechanism, search and rescue facilities, equipment and so on, which can provide scientific reference for the government and relevant departments to effectively prepare MRO in China, and at last improve the effectiveness and efficiency of MRO to protect the safety of the people in distress.

1.4 Domestic and international research status about MRO

In this research, the writer found that in addition to some foreign government departments and institutions, such as IMO, USCG, IMRF, have set up some documents and project plans, and carry out some exercises, few scholars study the maritime MRO. Furthermore, there is fewer scholars studying maritime MRO in China. It is the result after my researching the resources about MRO. See table 2.

Table 2-The result of the research of the resources of MRO from the website of **CNKI**（China National Knowledge Infrastructure）

The key words of searching index	Maritime mass rescue operation	mass rescue operation	Search and rescue	safety of cruise travel	Cruise travel	Cruise economic
The searching result	2 (no master thesis or	6 (no master thesis or	590（with many master	51	2445	2065

(number of articles)	doctoral dissertation)	doctoral dissertation)	thesis or doctoral dissertation ）			
The searching website	http://kns.cnki.net/kns/brief/default_result.aspx#	http://kns.cnki.net/kns/brief/default_result.aspx#	http://kns.cnki.net/kns/brief/default_result.aspx#	http://kns.cnki.net/kns/brief/default_result.aspx#	http://kns.cnki.net/kns/brief/default_result.aspx#	http://kns.cnki.net/kns/brief/default_result.aspx#

Source: compiled by the author, 2017.

According to the table 2, there is high interest and enthusiasm about cruise tourism and cruise economy in China, but not much concern about its safety. Although there were many serious incidents of marine ships before in China, causing large number of fatalities and injuries, it is a pity that not only the administrative departments but also the scholars rarely studied the maritime MRO, who are still researching the traditional search and rescue (SAR). The reason is probably that the probability of MRO is too small, and there is no effective response once it happened, and few successful experience. Therefore, this research on maritime MRO can make up for the blank of this field in China. The writer hopes that more scholars participate in the study of marine MRO under the guidance of this research, and the paper will encourage the government to improve the relevant laws and regulations in China, rationalize the good cooperation relationship among rescue departments, and adopt

new theory and technology, which can constantly improve the ability of maritime MRO in China.

Besides in China, there are also few scholars having done academic research on maritime MRO in foreign countries. For example, when the writer searches “MRO” or “mass rescue operation” on the website of ScienceDirect, it is very regrettable that almost none is directly related to MRO, though 13914 search results showed(http://www.sciencedirect.com).

As a result, most of my resources and literature about marine MRO are found on the IMRF website, as well as from the USCG website and official handouts. For example, table 3 indicates some studies of MRO carried out by the USCG.

Table 3-Mass rescue operation scoping study (2007-2012)

SCENARIO	2007 RANKING	2012 RANKING
Domestic passenger vessel requires evacuation	1 (tie)	1
Large vessel sinks, passengers and crew must be located and rescued	1 (tie)	4
Natural disaster requiring air, land, sea rescue	3	2 (tie)
Major casualty aboard cruise ship requires evacuation	4 (tie)	6
Rescue and interdiction of large number of refugees/illegal immigrants	4 (tie)	7 (tie)
Airliner crash requiring passenger extrication and water rescue	6	5
Rescue of people from collapsed or burning waterfront building or facility	7	10
Rescue of individuals necessitated by bridge collapse or train derailment	8 (tie)	11
Small MRO (above local capability)	8 (tie)	2 (tie)
Rig sinks; crew must be located and rescued	10	12
Waterborne evacuation necessitated by large-scale terrorist action, industrial accident, natural disaster, or nuclear/biological incident	11	9
Rescue of individuals stranded on an ice floe or on a ship beset in ice	12	13
Rescue of large number of people from flooded (or flooding) tunnel or other need for rescue	13	7 (tie)

Source: United States Coast Guard(USCG). (2013, February). Analysis of the challenges

associated with the conduct of maritime mass rescue operation. Washington, DC: author

1.5 Contents and methodology of research

1.5.1 Contents of research

Being an employee of China maritime safety administration(MSA), the writer has a intuitive and comprehensive understanding of maritime rescue. As a qualified maritime officer, the writer has a strong sense of responsibility to protect safety of persons in distress at sea, so when the writer found the rapid development of large luxury cruise travel in China, with the connection of passenger ship accidents happened in China, the writer strongly feels it is necessary to research the maritime MRO in China, and found that there is a huge lack of MRO through investigation. So the writer decided to carry out this research, put forward suggestions about MRO in China, and hopes to guide the others to anticipate in the study of MRO, at last protect the safety of lives in distress by improving the capability of MRO.

1.5.2 Methods and technology of research

1.5.2.1 Literature analysis

This paper refers to the related thesis, books, newspapers, magazines and news reports in English or Chinese in library, archives and network. And this paper summarizes and analyzes the characteristics and difficulties of MRO, and practices of maritime MRO in other countries or organizations .

1.5.2.2 Investigation and research

Because the writer is from the maritime safety administration (MSA), and can participate in the command of life rescue at sea in practice, so first-hand search and rescue information could be obtained. In addition, by consulting senior commanders, the investigations could be comprehensive, accurate, thorough and detailed, and

furthermore, the analysis of the current experience and shortcomings of MRO in China could be on the macro and micro levels, and a combination of particularity and universality.

1.5.2.3 Case analysis

This paper attempts to analyze the rescue action and existing problems in the rescue by analyzing several serious marine passenger accidents occurred at home and abroad, which will be the basic data support for the proposals to the improvement of MRO.

1.5.3 The innovation and deficiency of this paper

1.5.3.1 The innovation of this paper

First of all, it is very forward-looking and innovative in terms of topic. Because in the current monographs and academic papers, few scholars study the maritime MRO, and the Chinese government is still on the stage of exploration and development, there is no specific implementation of MRO. Furthermore, in foreign countries, only some government departments and institutions, such as IMO, USCG, IMRF, have set up some documents, project plan and carry out MRO exercises.

1.5.3.2 The deficiency of this article

Because of the shortage of data, the resources collection is difficult. For example, the links with related websites of some government departments is not unhindered, the government information and data is not public or complete, and the writer's study method and knowledge is limited, so it is somewhat insufficient in the in-depth and thorough research on this subject.

CHAPTER 2

Present situation of large passenger ship transport

2.1 Cruise ship

2.1.1 International situation

Why is the cruise so popular ? Cindy D'Aoust, the president and chief executive officer of CLIA , said in a statement:" one of the reasons for the cruise industry can continue to flourish is that it can provide personalized service to passengers around the world. This industry has never been so good now, it reflects the needs of consumers. This is why we see the cruise industry continues to grow ".

2.1.1.1 Continued growth in the number of cruise

As can be seen from table 4, in 2004 the number of global cruise ships almost doubled than that in 1990, especially large cruise ships larger than 60000grt, in 2004 it was 7 times more than that in 1990, indicating that the trend of large cruise is obvious. Now the world's largest cruise ships(and passenger ships in general) are Oasis of the Seas and Allure of the Seas. These ships belong to Royal Caribbean's Oasis class formerly known as Project Genesis. See table 5, it is the characteristic of the Oasis of the Seas, which has a maximum passengers and crew of 6,296 persons. And because the continuous development of the cruise industry, the total number of cruise ships in the world has come to 448 ships in 2016 (CLIA 2016

annual report, 2016).

Table 4-Cruise fleet 1990-2004 (in fleet year)

Year	20,000 - 60,000 GRT	> 60,000 GRT	Total (> 20,000 GRT)
1990	66	11	77
1991	66	11	77
1992	66	11	77
1993	66	11	77
1994	77	12	89
1995	81	17	98
1996	84	23	107
1997	82	27	109
1998	84	34	118
1999	88	35	123
2000	91	48	139
2001	94	57	151
2002	96	66	162
2003	92	74	166
2004	89	83	172
Total	**1222**	**520**	**1742**
%	70 %	30 %	100 %

Source: Lloyd's World Fleet Statistics, volume 1991-2005

Table 5-General characteristics of cruise ship “Oasis of the Seas”

General Characteristics	
Tonnage:	225,282 GT
Length:	360 m (1,181 ft)

Beam:	47 m (154 ft) waterline; 60.5 m (198 ft) extreme
Draught:	9.3 m (31 ft)
Capacity:	5,400 passengers at double occupancy; 6,296 maximum (+ 2,394 crew members)
Speed:	22.6 knots (41.9 km/h; 26.0 mph)

Source: World's Largest Ships. Retrieved May 6 2017 from the World Wide Web:

http://maritime-connector.com/worlds-largest-ships/

Table 6 indicates that the number of cruise ship is ordered in the next ten years. Although the total number is decreased from 26 to 22 from the year of 2017 to 2019, the ocean cruises has in significantly creased from 13 to 20, which means that the ocean cruise travel will be increasingly popular, and also means that the probability of maritime MRO will increase.

Table 6- New cruise ships on order of the world

2017 NEW SHIPS

26 New Ships on Order (as of December 2016)

Total Investment of More than $6.8 Billion in New Ocean Vessels in 2017

Year	Ocean	River	Ships Ordered	New Capacity
2017	13	13	26	30,006
2018	15	2	17	29,448
2019	20	2	22	51,824
2020 – 2026	32	0	32	119,510
Total	**80**	**17**	**97**	**230,788**

Source: CLIA. (2006). 2017 cruise industry outlook

2.1.1.2 The increasing trend of the number of cruise passengers

As can be seen from figure 4, cruise passengers have been on the rise in global market since 2009, which is expected to reach 25.3 million in 2017 by Cruise Lines International Association(CLIA), which has added about 42% than the number in 2009. And the Asian cruise market is also in a rapid growth. See table 7. The annual increase rate of number of ships deployed in Asia is 12%, however which of the passenger capacity is 29.3%.

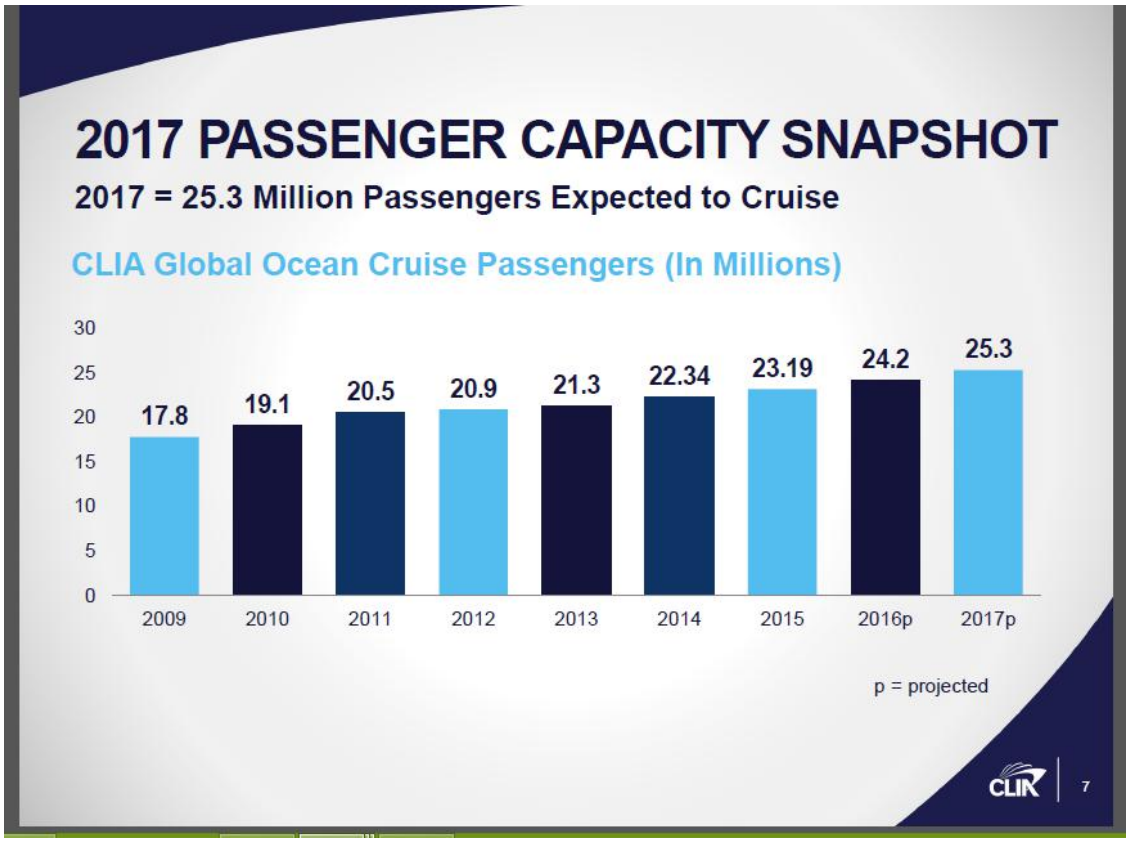

Figure 4-Passenger capacity snapshot

Source : CLIA, 2017 Cruise industry outlook

Table 7-Between 2013 and 2016, the annual growth of the cruise capacity in Asia

	Annual increase rate
Number of ships deployed in Asia	12 %

Number of cruises and voyages within and through Asia	22%
Operating days	13.6%
Passenger capacity	29.3%

Table: compiled by author, 2017

Source : CLIA 2015 annual report

2.1.2 China Cruise Market

In recent years, with the steady development of China's economy and society and the improvement of people's living standards, cruise tourism market has shown a sustained and rapid development trend, and cruise transportation is becoming a new growth point of China's waterway transportation. The characteristics of the development of cruise transportation in China is showed by following content.

2.1.2.1 Construction of cruise ship port

To supporting the development of the cruise travel, the construction of cruise port has been developed quickly in China. Until 2015, 10 cruise berths have been completed in Shanghai port, Tianjin port, Sanya port and Xiamen port with the designed annual capacity of 4.2 million passengers, and 15 cruise berths are still being built in Qingdao port, Shenzhen port and Beihai port with the designed annual capacity of 4.65million passengers. The Department of transportation proposed that there will be 2-3 cruise home-port and 12 cruise port of departure in the coastal area in 2030(National Coastal cruise port layout plan, 2015).

2.1.2.2 Rapid expansion of the market scale

In 2014, the number of cruise of call and cruise passenger have increased by 3 times

and 10 times as compared with 2006 respectively. Then from figure 5 and 6 in 2016 the number of port calls in China has increased 183% more than the that in 2015 from 300 to 850, which is a rapid development and means the hot cruise market in China.

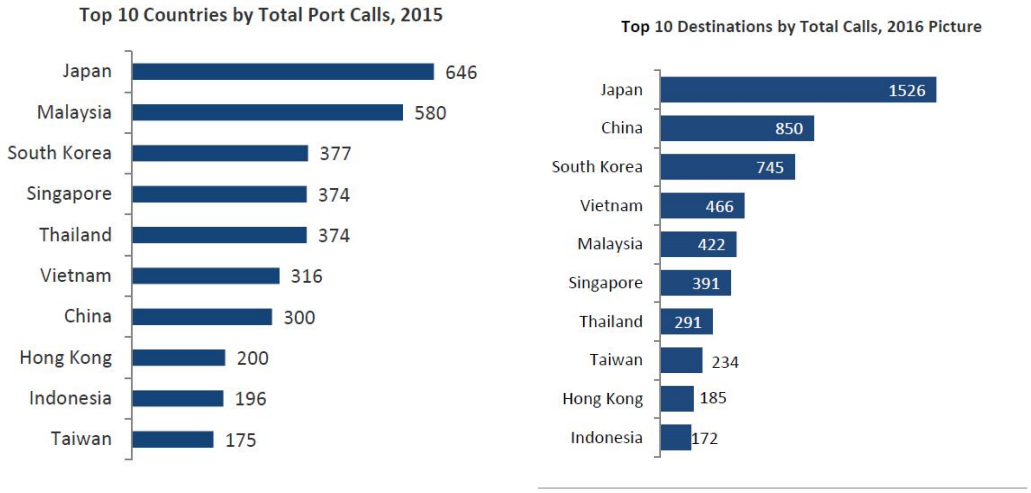

Figure 5-Top ten countries port calls,2015

Figure 6:-Top ten countries port calls,2016 picture

Source: Asia cruise trends 2016 edition CLIA

2.1.2.3 Concentrated cruise market and rapid growth of cruise ship passenger

The cruise transport mainly concentrated on the Shanghai port, Tianjin port, Sanya port and Xiamen port in 2014 . The number port of call and cruise passenger in those four ports accounted for 90% and 97%, and the proportion of Shanghai port reached 58% and 72% respectively. And furthermore, see figure 7 and 8, Shanghai, as the China mainland's largest cruise destination, the number of cruise port of call will increase from 183 in 2015 to 437 in 2016, with a rise of 138%. With the fast growth of cruise economy, China accounted for almost half of the Asian passenger volume in

2015 with a number of 986,000 , adding 770,000 more cruise passengers since 2012 – a 66 percent compound annual growth rate(Asia cruise trends, 2016). It is expected that the throughput of coastal cruise passengers in 2030 will reach about 30 million, with an average annual growth rate of about 20%(National Coastal cruise port layout plan, 2015).

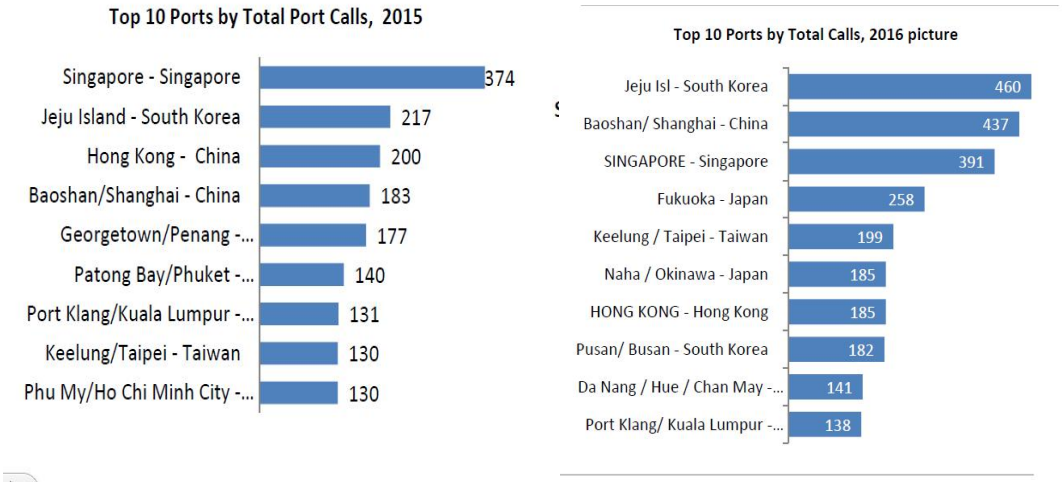

Figure 7: Top 10 ports by total calls,2015

figure 8: Top 10 ports by total calls,2016 picture

Source: Asia cruise trends 2016 edition CLIA

2.1.2.4 The trend of large cruise ships

The trend of large ships is obvious, and the largest cruise ship operating in China has developed from 30,000 GRT (1000 passengers) to 150, 000 GRT (carrying 3,800 passengers) until 2014 (National Coastal cruise port layout plan, 2015).

2.1.3 Risk analysis of cruise ships

Although the cruise ship is safer than the other ship types, the data indicated that the

trend of the frequency of cruise ship accident was obviously rising. See figure 9. And the frequency of the accident in 2004 was almost two times more than that in 1990. See table 8.

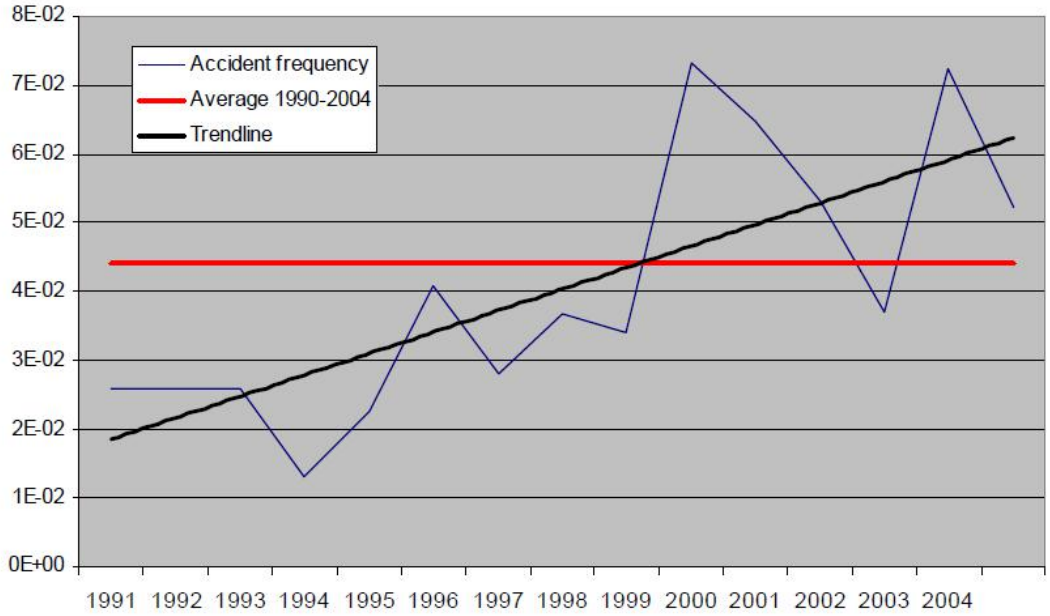

Figure 9-Historic accident frequency of cruise ship, isolated year-by-year plot(per ship-year) from 1990-2004

Source: *FSA – Cruise ships Details of the Formal Safety Assessment (MSC 85/INF.2)*

Table 8- LRFP Cruise ship annual accidents frequencies 1990-2004

Year	Ships > 20,000 GRT		
	Accidents	Ship years	Frequency [accidents / ship year]
1990	2	77	2.6E-02
1991	2	77	2.6E-02
1992	2	77	2.6E-02
1993	1	77	1.3E-02
1994	2	89	2.2E-02
1995	4	98	4.1E-02
1996	3	107	2.8E-02
1997	4	109	3.7E-02
1998	4	118	3.4E-02
1999	9	123	7.3E-02
2000	9	139	6.5E-02
2001	8	151	5.3E-02
2002	6	162	3.7E-02
2003	12	166	7.2E-02
2004	9	172	5.2E-02
Total:	77	1742	4.4E-02

Source: *FSA – Cruise ships Details of the Formal Safety Assessment (MSC 85/INF.2)*

Although not every cruise needs the maritime MRO, but the rising frequency of accident and the rapid increasing number of the cruise ship would result in the growing frequency of disaster of big cruise ship, which means the increasing frequency of maritime MRO in China. And catastrophic accidents with large number of fatalities account for 85% of the risk although the frequency for such events is very low.(IMO, 2008) This situation correspond to the statement of "Major casualty aboard cruise ship requires evacuation" remained in one of the top six MRO challenges for the U.S. Coast Guard(USCG, 2013). So there is need to analyze the rule of the cruise ship accidents and then to take measures to prepare the MRO plan in advance. From the table 9 we can find that collision and grounding account for 93 % of the risk in terms of fatalities. Therefore, when the Chines SAR authorities make the MRO plan, they should spend most consideration on the collision and

grounding accident of cruise ships.

Table 9- Risk summary-per hazard

Hazard	Accident frequency [per ship year]	% of all accidents	Fatalities [per ship year]	% of all
Collision	4,6E-03	10 %	2,4E-01	57 %
Contact	1,2E-03	3 %	9,2E-03	2 %
Grounding	9,8E-03	22 %	1,5E-01	36 %
Fire/Explosion	8,9E-03	20 %	1,5E-02	3 %
Others	2,0E-02	44 %	6,4E-03	2 %

Source: *FSA – Cruise ships Details of the Formal Safety Assessment (MSC 85/INF.2)*

2.2 Large passenger ship and Ro-Ro passenger ship

With the development of economy and society in China, the demand for the convenience and speed of transportation has increased rapidly. Therefore, most people choose to travel by plane, high-speed rail, train, car and so on. However, there are three major regions operating large passenger ships, Ro-Ro passenger ships and ferries in China, including the Bohai Strait, Yangtze River and Qiongzhou Strait in north, middle and south of China respectively. The passenger ship situation in these three regions will be introduces and analyzed by following content.

2.2.1 Bohai Straits

Bohai Straits is between the Liaoning province and Shandong province in north of China. In Bohai Straits, the passenger ships and Ro-Ro passengers ships navigates between Dalian port and Yantai port ,Weihai port. There are 22 passenger ships and Ro-Ro passengers ships navigated in the Bohai Straits. The length of the ships are from 160 meters to 180 meters, and the ships can withstand the strong

gale(http://www.cnshipnet.com/news/2/7755).

One of the biggest passenger ship companies in Bohai strait is the Bohai ferry company, which has nine Ro-Ro passenger ships(The data of these ships are indicated in table2.7) with sixteen voyages each day. All these nine ships can transport 400,000 vehicles a year accounting for 57% of the total capacity of Bohai strait, and more than three million passengers each year accounting for more than 60% of the total passenger capacity in this area(Duan Yi, 2010). From table 10, we can find that the biggest ship capacity of passenger in Bohai ferry company is 2038 persons. So if such a ship had a accident at sea, there will be need to implement a maritime MRO immediately.

Table 10-The data of ships of Bohai ferry company

Name of ship	**Gross Tonnage**	**Length (meters)**	**Capacity of passenger(persons)**	**Number of crew member(persons)**
BO HAI YIN ZHU	19847	161.2	1128	75
BO HAI BAO ZHU	24024	163.95	1571	81
BO HAI YU ZHU	24024	163.95	1571	81
BO HAI FEI ZHU	24024	163.95	1571	81
BO HAI ZHEN ZHU	24024	163.95	1571	81

BO HAI CUI ZHU	34222	178.7	2038	75
BO HAI JING ZHU	34222	178.7	2038	101
BO HAI ZUAN ZHU	33458	179.5	1804	96
BO HAI MA ZHU	33458	179.5	1804	96

Table: compiled by author, 2017

Source：Liaoning province SAR center. (2014). SAR cooperation plan between passenger ships and Liaoning SAR center. Dalian: the author.

2.2.2 Yangtze River

Yangtze River is in the middle of China. In 2015, there were 113 passenger ships with 32,852 passenger seats in the main Yangtze River, including 53 ordinary passenger ships with 17,427 passengers, 10 high speed passenger ships with 1,352 passenger seats and 50 cruise ships with 14,073 passengers. The large proportion of old ship is a long-standing problem in the Yangtze River, nearly 80% passenger ships are more than 18 years old(Feng Hao, 2015).

Table 11-The change of the number of passengers in Yangtze River from 2007- 2011

Year	**Number of total passengers(million)**	**Number of cruise passengers(million)**
2007	5.20	0.27
2008	4.32	0.18
2009	4.10	0.21
2010	2.45	0.21

2011	2.98	0.30

Table: compiled by author, 2017

Source: Chen Juehao,Li Mengmeng. (2015). *Analysis and Countermeasures of Cruise on Yangtze River.*

From table 11, we can find that the number of total passengers is decreasing from 5.20million to 2.98 million with a decrease of 42% from 2007 to 2011. However, there is a fluctuate trend in the cruise passenger in these five years and at last rise to the height of 0.30 million in 2011(Li Mengmeng, Chen Juehao, 2015), which means more and more people chose the cruise travel in Yangtze River. Furthermore, from table 2.8, we can conclude that the passenger number of ordinary passenger ships was increasingly decreased, which will reduce the income of passenger ship companies. So these companies may cut the expense on the safety of ship and the crew may reduce the safety awareness, all which will increase the probability of the accident of the ordinary passenger ships. So the MRO should be prepared well in advance.

2.2.3 Qiongzhou Strait

Qiongzhou Strait is between Guangdong province and Hainan province in south of China**.** With the rapid development of social economy on both sides of the Straits, especially the construction of Hainan international tourism island, the passenger transport of Qiongzhou Strait has developed rapidly. Qiongzhou Strait has gradually become one of the busiest waters in China. There are currently 55 Ro-Ro passenger ships in the Qiongzhou Strait in 2015, including 20 ships from 4000-8000 GRT, 10 ships from 8000-10000 GRT and 15 ships above 10,000 GRT. We can find that there are 45 ships above 4000 GRT, accounting for 81.8% of all ships and the trend of

large ship is obvious. Table 12 manifests the statistics of the north shore of Qiongzhou Strait.

Table 12-Port throughput statistics for the north shore of Qiongzhou Strait, 2006-2015

year	**Number of ships entering and leaving port(Ship times)**	**Number of passengers (million)**	**Number of vehicles (million)**
2006	41945	6.234	0.991
2007	46417	7.377	1.145
2008	46939	7.351	1.031
2009	50217	7.845	1.148
2010	54865	9.919	1.448
2011	56079	10.662	1.547
2012	52159	11.089	1.737
2013	51271	11.186	1.911
2014	43156	10.537	1.937
2015	41777	12.259	1.414

Source: Chen Shaoyong. (2016). *Study on the safety management of Ro-Ro passenger ship in Qiong zhou Strait, p.*17

From 2006 to 2015, the passenger volume increased from 6.23 million to 12.25 million per year in the Qiongzhou Strai, and vehicle volume rose from 0.99 million to 1.41 million per year, with the growth of 96.6% and 42.7% respectively. And furthermore, with the rapid growth of number of passenger and vehicles, however the Number of ships entering and leaving port almost unchanged, which indicated the trend of large Ro-Ro ships in the Qiongzhou Strai. So with the increase capability of

passenger of large Ro-Ro ships in this area, the difficulty of MRO will increase correspondingly. But the advantage is that there are so many ships in this strait which can be the effective rescue forces.

2.2.4 Risk analysis of Ro-Ro ships

Table 13- Summary risk calculations(risk model)

	Frequency (per ship year)	Frequency (%)	Individual Risk (per year)	PLL (per ship year)	PLL (%)	Fatalities (per year)
Collision	1.25E-02	28%	2.75E-05	2.34E-02	11%	31
Grounding	9.57E-03	21%	3.02E-05	2.57E-02	12%	23
Impact	1.25E-02	28%	1.63E-06	1.39E-03	1%	2
Flooding	2.39E-03	5%	1.31E-04	1.12E-01	50%	148
Fire	8.28E-03	18%	7.00E-05	5.95E-02	27%	79
TOTAL	**4.52E-02**	**100%**	**2.61E-04**	**2.22E-01**	**100%**	**282**

Source: IMO. (2008, July 21). *FSA – RoPax ships (MSC 85/17/2 /), p.*13

From table 13 we can find that the highest frequency of accident are the collision and impact, followed by grounding and fire. It should be pointed that the flooding causes the largest proportion of fatalities however with the lowest frequency of accident, so when the authorities make the MRO plan, they should pay more attention to the flooding accidents of Ro-Ro ships.

CHAPTER 3

Analysis of large passenger ship accidents cases

3.1 An overview of the accident

There are many large passenger ship accidents in the world, which caused the huge casualties. Table 14 shows some selected major passenger ship disaster.

Table 14-Sample comparison of some selected major passenger vessel disaster (for illustration)

Year	Vessel name	Ship type	Accident type	Persons on board	Fatalities	% fatalities (of total on board)
1987	HERALD OF FREE ENTERPRISE	RoPax	Capsize	539	193	36 %
1987	DOÑA PAZ	Ferry	Collision	> 4000	> 4000	99 %
1994	ESTONIA	RoPax	Capsize	989	852	86 %
2002	JOOLA	Ferry	Capsize	2000	1863	93 %
2006	AL SALAM BOCCACCIO 98	RoPax	Capsize	1408	1018	72 %

Source: http://en.wikipedia.org/wiki/List_of_disasters#Ship_and_ferry_disasters, last accessed 21.02.06

And there are some other disastrous events of the large passenger ships at sea :

- RMS Titanic sank in the Atlantic, causing 1500 drowned in 1912.
- SS Eastland tipped over in Chicago IL USA resulted in 800 fatalities in 1915.

- MS Eastern Star (China-Yangtze River cruise ship) hit by cyclone, capsized and overturned, causing 442 dead or missing in 2015 (http://www.cruiseminus.com/).
- November 24, 1999, Ro-Ro passenger ship "Dashun" with 304 (40 crew, 264 passengers) people on board capsized and sank near Yantai in China, when navigating from Yantai to Dalian, with at least 282 lives dead or lost(ZhangLi1iang,2003).

January 13 2012, recent MRO took over six hours to evacuate and recover 3,229 passengers / 1,023 crew members from M/V Costa Concordia, resulting in 32 deaths(https://en.wikipedia.org/wiki/Costa_Concordia_disaster).

3.2 Unsuccessful maritime MRO cases- MV Sewol Disaster

The M/V Sewol disaster occurred on the morning of 16 April 2014, en route from Incheon to Jeju in South Korea. The ferry capsized while carrying 476 people, mostly secondary school students from Danwon High School (Ansan City). The 6,825-ton vessel sent a distress signal at 08:58 Korea Standard Time(23:58 UTC, 15 April 2014). In total, 304 passengers and crew members died in the disaster. Of the approximately 172 survivors, more than half were rescued by fishing boats and other commercial vessels that arrived at the scene (https://en.wikipedia.org/wiki/Sinking_of_MV_Sewol).

3.2.1 Brief analysis of the rescue process

For the duration of 1 hours and 43 minutes, from 8:48 a distress signal issued to 10:31 the ship completely capsized, the maritime police command center received the alarm and had 11 calls with the captain .The maritime police boat number 113 , arrived at the scene at 9:30 am, and from 9:45 am to 10:45 am more than twenty

ships and aircraft arrived at the scene, however all of them were unable to rescue the cabin because of no professional rescue equipment. Professional rescue personnel arrived at 14:00 with related equipment, two navy rescue boats arrived in the next morning. Rescue command appeared misjudgment, emergency rescue plan did not timely start. It is difficult to form a unified command for the administrative division and overlapping responsibilities between the marine police forces and marine fisheries Department. There was no communication between the government and the rescue service, and emergency response separated from the on scene rescue operations. The government set up a central disaster response headquarters until the day after the incident. There was chaos in releasing information with 7 times changing the information related from the day of the incident to May 7th by the coast guard and the mainstream media YTN TV(Wang Zhijian, 2015).

3.2.2 Problems happened in the rescue process

3.2.2.1 On ship response failed

According the MRO functional action, the captain has the work such as accountability, information and safety management, evacuation and so on. However, in the duration between MV "Sewol" issued a distress signal at 8:48 am and capsized at 10:31 am, the broadcast of the ship repeatedly required the passengers to wear life jackets but in the cabin on standby, and not move. If the captain organized the orderly evacuation of passenger according to the risk condition of the ship, most of the passengers are likely to escape, the serious casualties may be avoided. So the on ship response was failed in this MRO.

3.2.2.2 Lack of unified command

After the accident, the South Korean coast guard carried out rescue organization, the South Korean government did not promptly launch the emergency mechanism, until the next day the Central Disaster Safety Countermeasures Headquarters was established. Because of the overlapping responsibilities and powers for segmentation among the Central Disaster Safety Countermeasures headquarters, the administrative department of security, the coast guard, Marine Fisheries Department and other departments, there is difficulty in the harmony of emergency response and command. So lack of unified command in the the rescue activities resulted in inefficient and poor rescue effect .

3.2.2.3 Professional rescue forces failed to reach the scene in time

The accident occurred at 08:48 am, the maritime police boat number 113 arrived at the scene at 09:30 am. first, then more than 20 ships and aircrafts came one after another. Because the ships and planes had no professional rescue equipment, they were unable to cope with those people who were trapped in the ship's cabin. Professional rescue forces arrived at the scene at 14:00 in the day carrying the relevant equipment , and two Navy shipwreck rescue ships arrived at the scene in the next early morning. So professional rescue forces failing to reach the scene in time led to the failure of rescuing the trapped personnel timely.

3.2.2.4 Confusion of information publication

The South Korean government announced the first error message, saying a total of more than 400 passengers on board were rescued, the Gyeonggi Do Department of education also issued a message of "Danwon high school students were all rescued" , but actually only 172 people were rescued. From the first day to May 7th South Korean coastguard and the mainstream media YTN TV changed the important information about missing persons and the number of survivors in the accident seven times. The South Korean government said it had put in nearly 600 divers for

underwater operations, but the Coast Guard said the rescue team was not so big(Wang Zhijian, 2015).

3.2.2.5 Students lack of emergency knowledge

Among the passengers, the survival rate of students in Danwon high school was 23%, and the average passenger survival rate was 69%. The main reason is that the students lacked the experience and knowledge about escape in the accident, and followed the wrong instruction by the teachers and the crew on board, which caused the organization failure(Wang Zhijian, 2015). So what we can learn is that the emergency education to students is very important and urgent.

3.3 Cases of MRO in China-MV Oriental Star

At 21:32 on June 1, 2015, M/V “Oriental Star”，belonging to the Chongqing Oriental Steamship Company, navigated from Nanjing to Chongqing. When the ship sailed at the Damazhou waterway, it capsized resulting 442 people killed and only 12 people rescued. When the "Oriental Star" was affected by the extreme weather, the instantaneous maximum wind up to hurricane, maximum rainfall up to 94.4 mm in one hour. Although the captain took measures to steady the ship in the wind, the ship continued to retreat by the strong wind and heavy rain, then the ship was out of control and capsized in more than one minute(State Administration of Work Safety, 2015).

After the shipwreck occurred, the government quickly launched an emergency response. The State Council set up a rescue and disposal working group to carry out command on scene, the Ministry of Transport, Ministry of Public Security, Health Planning Commission, Ministry of Water Resources, Meteorological Bureau, Ministry of Civil Affairs, Tourism Bureau, Insurance Regulatory Commission Related departments and Hubei province, Hunan province, Chongqing province, all

mentioned above carried out the implementation of emergency response work at once(Leijun, 2016, p.1)..

Because the ship capsized in more than one minute, there is no chance to carry out the MRO and rescue the people in distress but to do salvage work. However, there is also some experience we can learn. The first one is that the Chinese government launched the emergency response as soon as possible when the accident happened, and there were many departments working together to rescue and salvage the sunken ship. The second is that there are some successful experience in the news releasing, such as reasonable arrangements for the press conference staff, the appropriate press conference response, being initiative to hold conference.

CHAPTER 4

The present situation and problems in MRO in China

4.1 Lack of special laws and regulations about MRO

Although the current laws and regulations concerning the management of water crisis have existed such as “Law of the People's Republic of China on Maritime Traffic Safety”, “People's Republic of China Emergency Response Law”， “The emergency plan and emergency management measures”and “The international maritime search and rescue Convention 1979”, there are no special laws and regulations about MRO for all the parties involved in MRO, especial the SAR authorities, to comply with.

4.2 The concept of MRO is not clear in China

Firstly, the concept of MRO is not clear in China. The administrative departments related with the maritime MRO have the misunderstanding of maritime MRO. They consider maritime MRO as the large-scale maritime search and rescue(SAR) , who did not actually recognize the differences between MRO and SAR. However, there are entitative differences between MRO and SAR.

The IMO defines the “rescue “ and “ mass rescue operation” as follows:
“rescue” is the “ operation to retrieve persons in distress, provide for their initial medical or other needs and deliver them to the a place of safety”. “mass rescue

operation ” is “characterized by the need of immediate response to large number of persons in distress, such that the capabilities normally available to the search and rescue authorities are inadequate”(Cornillou, 2016).

Secondly , there are some examples to illustrate this problem. We take the massive search and rescue exercises initiated by Chinese maritime SAR center carried out as examples. See table 15 and 16.

Table 15-The data of the joint large passenger ship SAR exercise in 2015 in Yantai, China

Date and year	September 8th 2015	**Place**	Northern sea of Yantai, Shandong province
Subject	Joint search and rescue exercise when large passenger ship in distress	**Number of members**	12 members of the joint meeting on China maritime SAR
Number of Ships	22	**Number of helicopter**	2
Number of ambulance	2	**Number of people anticipated**	More than 900
Exercise contents	Self rescue within ships, evacuation of large personnel at sea and salvage at sea		
Remarks	The largest passenger ship in distress joint search and rescue exercises until 2015		

Table: compiled by author, 2017

Source: http://news.xinhuanet.com/mrdx/2015-09/09/c_134604531.htm

Table 16-The data of the high-speed passenger ship SAR drill in 2015 in Pearl River, China

Date and year	Octoberr 27th 2015	**Place**	The water area of the Pearl River Estuary in south of China
Subject	The first massive three dimensional joint marine SAR drill participated by Guangdong, Hongkong and Marco was conducted at the Pearl River estuary	**Number of members**	12 departments and authorities
Number of Ships	32	**Number of helicopters**	4
Duration time	1.5 hours	**Number of people anticipated**	More than 600
Sinario	A high-speed passenger ship "Pearl River" collided with the cargo ship "smooth" in the Pearl River estuary waters, the high-speed passenger ship "Pearl River" was damaged and flooded, 4 passengers fell into the water, 120 people on board needed to be transferred. MV"Smooth" caused oil pollution, followed by fire, and 1 crew member was seriously injured,		

	who was in urgent need to be sent by aircraft to the hospital for treatment.
remarks	The first massive three dimensional joint marine SAR drill participated by Guangdong, Hongkong and Marco was conducted at the Zhujiang River estuary

Table: compiled by author, 2017

source: Yao Feiyang. (2015). *The first massive three dimensional joint marine SAR drill participated by Guangdong, Hongkong and Marco was conducted at the Zhujiang River estuary,* p. 71.

Analysis:

Although China search and rescue center can organize large-scale maritime rescue exercises in many areas, the relevant administrative departments and the society are not clearly aware of substantive concept of maritime MRO comprehensively. There are several problems: One problem is that the maritime MRO is the search and rescue operations with large-scale participation at sea. However, we can not find many important subjects of MRO being planed in detail and exercised, such as detailed plans and exercises about the priority of people at recovery operation, people and evacuee accountability, landing point selection, shelter and personnel placement, media reception, reception of the families and friends of persons in distress, and foreign tourists communication and so on. The other problem is that the number of people in distress is not huge, only 124 passengers, it should be aimed at the characteristics of large cruise ships and passenger ships, and set up the scenario of the real maritime MRO for thousands of people in distress and carry out the exercise.

4.3 Search and rescue(SAR) organization structure

China's national maritime SAR emergency system consists of emergency leadership agencies, operations management agencies, advisory bodies, emergency command

bodies, on scene command, emergency rescue forces and so on. Search and rescue emergency leading agency is the national joint meeting of maritime SAR, one of whose functions is organizing and coordinating emergency response for major maritime search and rescue and serious ship pollution. The joint meeting comprises thirteen departments and units which are the Ministry of communications, Ministry of public security, the Ministry of agriculture, Ministry of health, the General Administration of customs, Civil aviation administration, Safety Supervision Bureau, Bureau of meteorology, Marine bureau, the general staff, Navy, Air force, the armed police. The Ministry of transport is the leading unit. China maritime SAR center is the office of the joint meeting, responsible for the daily work of the joint conference. The joint meeting sets up the working group with liaisons of the relevant members (Reply of the State Council, 2008).

The provincial maritime SAR agencies are responsible for the maritime SAR of the province, autonomous region and municipality directly under the Central Government of China. There are thirteen provincial maritime SAR centers in China. The maritime SAR agencies of the cities or counties are responsible for the emergency command work of maritime SAR in their administrative area. Maritime emergency response forces include government official forces, government profession forces, the army and armed police, the other social forces, such as enterprises, institutions, social organizations and individuals. (see figure 10)While the China rescue and salvage bureau is the only maritime professional rescue and salvage power in China, which undertake many missions such as emergency response to maritime accidents, salvage of human lives, salvage of ship and property, salvage of sunken ship, fire at sea, and elimination of spilled oil pollution in coastal waters of China.

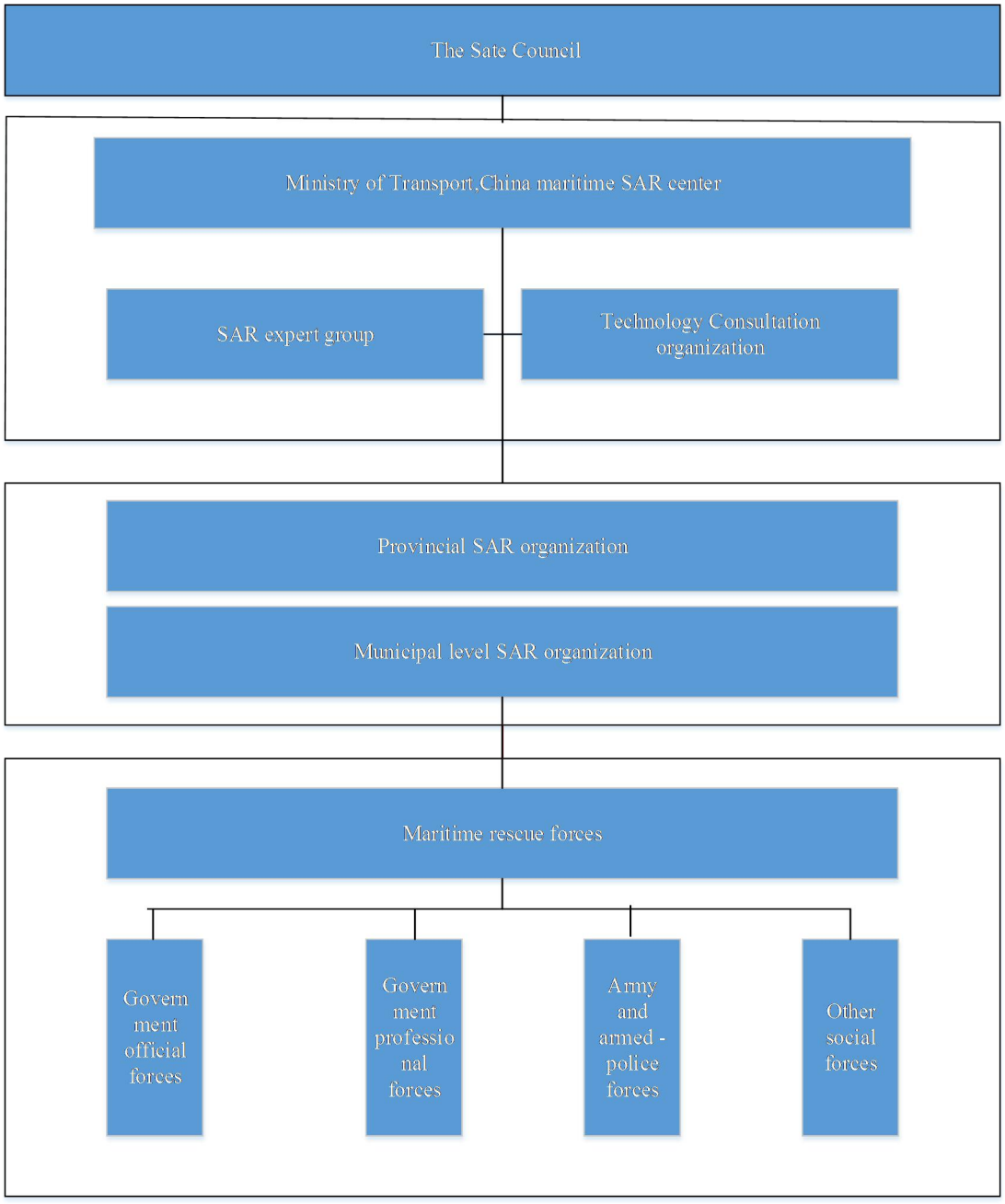

Figure 10-The organization structure of SAR in China

Figure: by author, 2017

Source: Xu zhiyuan. (2007). *Study on evaluation and countermeasure about national SAR capability*

at sea, p. 7.

4.4 Classification of emergency in the Chinese emergency response plan

Table 17- The classification of maritime emergency in China

Classification of maritime emergency	**Prerequisite**
1. General emergency	Number of people in distress within 30
2. Grave emergency	Number of people in distress between 30 and 50、Any passenger ship seriously endangers the safety of the ship and its personnel
3.Extraordinary emergency	Number of people in distress above 50， Any passenger ship in distress may not be able to determine whether or not the number of persons exceeding 50 or more in danger

Table: compiled by author, 2017

Source: Emergency response procedure for maritime emergency of China Maritime SAR center. Retrieved May 11 2017 from the World Wide Web: https://wenku.baidu.com/view/d4bdb66e1eb91a37f0115c04.html

From table 17, it is obvious that there is no concept of MRO in the classification, so MRO can only be classified as "Extraordinary emergency" . So, there is need to add a special classification of MRO emergency.

4.5 Not establish a fixed and mature management mechanism of MRO

Although the emergency response law defines that "the State Council formulates the overall state emergency response plans, organizes the formulation of national emergency special emergency plan; the relevant departments of the State Council formulates department emergency plans in accordance with their respective duties

and the State Council's relevant contingency plans". But in fact the departments did not accord with the established system to carry out search and rescue command after the serious incident occurred. However, the government decided to form a temporary headquarters with military intervention. This method is effective and powerful, but it reflects that our country has not yet formed a fixed, mature large maritime emergency management mechanism. In the disposal process, the higher-level leaders often are solely responsible for the command. This command leadership system has its scientific nature, for example, to ensure that the command is powerful, but also increase the efficiency cost of command system. Although the leaders have the highest authority and strong leadership in the command system, they do not have the professional knowledge of maritime search and rescue required for the process of maritime emergency management. Therefore, it is necessary to establish a scientific, mature and complete emergency management mechanism for the maritime MRO, which will ensure that the resources in the emergency management organized and configured most effectively.

4.6 The professional rescue forces in China

The professional rescue forces in China include that the China MSA forces, China Rescue and Salvage Bureau forces, army forces, armied police forces, China Coast Guard forces and so on. Especially, China Rescue and Salvage Bureau is responsibility for life rescue in China, which currently has three rescue bureaus including North sea rescue bureau, the East Sea rescue bureau and South Sea rescue bureau and flying brigades with the assistance of branches and the flight teams. At the same time, China Rescue and Salvage Bureau establish three Salvage Bureaus consist of Yantai Salvage Bureaus, Shanghai Salvage Bureaus, Guangzhou Salvage Bureaus, whose responsibility is to ensure water emergency rescue, salvage and clean-up task in China(Xu zhiyuan, 2007). China Rescue and Salvage Bureau is one of

the most powerful professional rescue forces in the world. See table 18.

Table 18-The data of the professional rescue forces of China Rescue and Salvage Bureau

Number of emplyee	Number of vessels	Number of aircrafts
Nearly 10,000 with 80% are professional and technical personnel, divers and crew	191, including 72 professional rescue ships and 119 salvage ships	20

source: *The introduction of China Rescue and Salvage Bureau.* Retrieved from the World Wide Webhttp://www.crs.gov.cn/jigougk_jlj/danweijj_jjgk/

Table 19-Rescue equipments of Beihai Rescue Bureau

Rescue equipments	Types	Number of equipment
Rescu boat	14000kw rescue boat	1
	10000kw rescue boat	1
	9000kw rescue boat	6
	1940kw rescue boat	1
	Offshore high speed rescue boat	2
	Coastal rescue boat	5
Maritime rescue helicopters	S76 + models	3
	Ec225 models	1

Table: compiled by author, 2017

Source: http://www.bh-rescue.cn/comcontent_detail2/&i=31&comContentId=31.html

Take Beihai Rescue Bureau as an example(see table 19).In the Bohai Strait, Tianjin,

Beihai 3 (Qinhuangdao and Lushun route central), Shidao, Dalian, Yantai, Long Island, Qingdao and other eight sea areas, Beihai Rescue Bureau perennial arrangements 8-9 rescue ships 24 hours to implement emergency rescue and dynamic standby task. So it will ensure that the rescue forces can arrive at the site of accident as soon as possible, and improve the efficiency of MRO.

4.7 Analysis of social rescue forces

In the social rescue forces, the fishing boats can be an important power besides the other social forces such as the merchant vessels at sea and the private yachts. In 2014, China has one fourth fishing boats in the world, about 960 thousands of fishing ships, which is the world's largest number of fishing vessels(Yang Xiao, 2015, p.2). According to the survey data of the national marine fishing vessels, nearly 200 thousand fishing vessels are included in the fishing license management. According to the administrative division statistics, south sea area has the most fishing vessels in the three sea areas with the number of 74598, which accounts for 38.30% of the national total number. In the coastal provinces and cities, Guangdong Province has a total of 55057 fishing ships, accounting for 28.27% of the total number of fishing boats in China(Hu Xuedong, 2008).

Although there are lots of fishing boats in China, the problem is that the comprehensive quality of fishermen is relatively low. Most of them haven't received professional life-saving and medical care training. Besides, lifesaving equipment are poor on fishing boats, for example, some small fishing boats do not even have life rafts and only have buoys, lifejackets and ropes. In addition, the communication equipment of fishing vessels is simple, there are mostly only VHF and AIS, and AIS sometimes are out of function for the poor maintenance, therefore, rescue capability of fishing boats is limited. On the other hand, because of most fishing vessels with

small size and low freeboard and the fishermen are familiar with the local water environment, so all which are conducive to rescue the drowning person at sea in not bad marine environment.

At present in China SAR compensation mechanism lacks of effective policy support, the enthusiasm of the majority of social rescue forces which participate in maritime SAR is not high, the costs of SAR are not guaranteed, but because of legal and moral pressure they have to participate in maritime SAR, so the effect of SAR is not very good. Therefore, there is urgent need to improve the compensation mechanism of maritime SAR to fully mobilize the enthusiasm of social rescue forces. At the same time there is need to promote the local government to invest and establish the maritime SAR fund for the appropriate encouragement and incentives to the units and individuals that make a significant contribution, which will help to promote the situation of social rescue forces participating in maritime SAR in China(Chen Shaoyong, 2016, p.17-18).

CHAPTER 5

Reference of MRO in International Community

5.1 Documents of MRO adopted by IMO

IMO has adopted some documents about MRO from 2003 to 2007, which play the role of guidances of MRO in the world. It is illustrated in table 20.

Table 20-The IMO documents about MRO

Date of adoption	Name of guidance documents
COMSAR Circular 31, 6 Feb 2003.	Guidance for Mass Rescue Operations
MSC Circular 1079, 10 July 2003.	Guidelines for Plans of Cooperation Between SAR Services and Passenger Ships
MSC.1 Circular 1184, 31 May 2006	Enhanced Contingency Planning Guidance for Passenger Ships Operating in Areas Remote From Facilities
Resolution A.999(25), 29 Nov 2007	Guidelines on Voyage Planning for Passenger Ships Operating In Remote Areas

Table: compiled by author, 2017

Source: IMO documents about MRO http://www.uscg.mil/hq/cg5/cg534/MassRescueOps.asp

5.2 MRO in IMRF

5.2.1 Introduction of IMRF

The IMRF is the international charity focusing on preventing loss of life in the world's waters, which works with Government and Non-Government SAR organisations. The organization now have 112 members in 48 countries paying a subscription and working together to reduce the loss of life. The membership consists of Maritime Rescue Coordination Centres, Coast Guards and the other volunteer response organisations (http://www.imrfmro.org/about-the-imrf).

5.2.2 Introduction of MRO project

Maritime mass rescue operations is one important work and object of IMRF, which considers that the MRO needs high attention at all levels, including international, national, regional and local. The Maritime SAR organisations, shoreside emergency responders, maritime industries, planners and regulators – including IMO are all the critical members.

By the means of conferences and workshops around the world, the IMRF has initiated a program for improving plan and preparation for a MRO, to reduce the loss of lives at sea. So the slogan of MRO is that "it is not if, but when. Are you ready?"

The IMRF has organized three international maritime mass rescue conferences until 2014 in Gothenburg, Sweden. And they organize the fourth conference of MRO in June of 2017 in Gothenburg, Sweden.

The MRO workshop package has been developed by IMRF to help responders discuss mass rescue issues and agree the development of their own MRO plans. The countries and regions of Uruguay, Bangladesh, Malta, China, Hong Kong and

Malaysia have held such workshops. From 2015 the IMRF began to provide the open and free source about MRO in their online MRO resource library, which is part of the IMRF's MRO project(http://www.imrfmro.org/about-the-imrf). In a word, IMRF provide many operational and technological guidance and manuals to help the implementation of MRO.

5.3 The MRO in the United States

Through the research on the website of USCG, it is obvious that the USCG has paid important attention to the maritime MRO. Besides the routine SAR requirements and operations, the USCG has separated a section of MRO （http://www.uscg.mil/hq/cg5/cg534/MassRescueOps.afsp). In this section ,we can find that the philosophy of the construction of MRO project is indicated by figure 11.

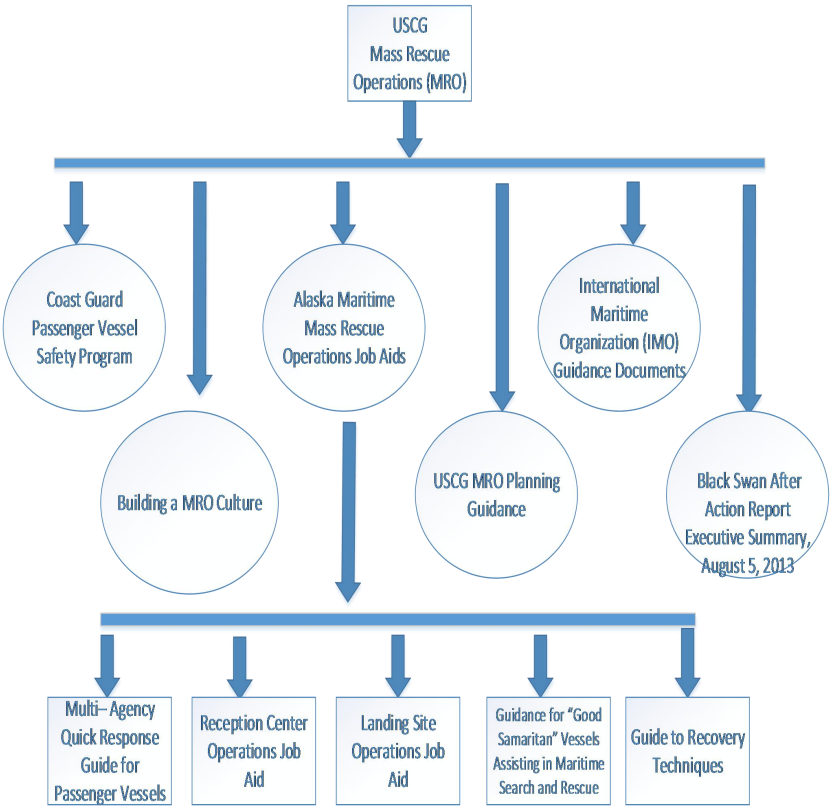

Figure: 11-The diagram of USCG mass rescue operation (MRO)

Figure: compiled by author, 2017

Source: Mass Rescue Operations(MRO). Retrieved May 5 2017 from the World Wide Web:http://www.uscg.mil/hq/cg5/cg534/MassRescueOps.asp

The website of Coast Guard Passenger Vessel Safety Program provides the information of mass rescue operations, exercises, planning, training, and other information of MRO.

Besides, the USCG recognized the importance of MRO culture building, Because they consider that the challenges in conducting a MRO,in particular, are cultural barriers.

Furthermore, the USCG knows that in the event of a MRO, no single organization is fully equipped to make an effective response. The success of an MRO is contingent upon the effective plans and the exercising of those plans, and then the seamless efforts of SAR agencies, the companies, mutual assistance assets, and good Samaritans. The object of planning guidance includes generating consistency, raising awareness, identifying stakeholders, and providing continuity in the existing emergency plans such as: Federal, State, County, City, Industry (e.g. Involved Party, Salvagers, etc.), Good Samaritan, and Volunteer Organizations.

5.3.1 *Black Swan*-the MRO exercise in United States

And then, the USCG realize the importance of MRO exercise. So they carried out the BLACK SWAN MRO exercise. It has been said “Black Swan, the largest, most complex Full Scale Exercise (FSE) in design and execution of an Offshore Mass Rescue Operation (MRO) exercise in the history of the International Maritime Community”. The exercise was successfully executed in April 1-5, 2013 with 18 distinct venues geographically spanning from Florida to Freeport, Grand Bahamas Island, Bahamas.” The timeline is shown in figure 12, which shows that the entire

process of the BLACK SWAN MRO exercise lasted for more than four months.

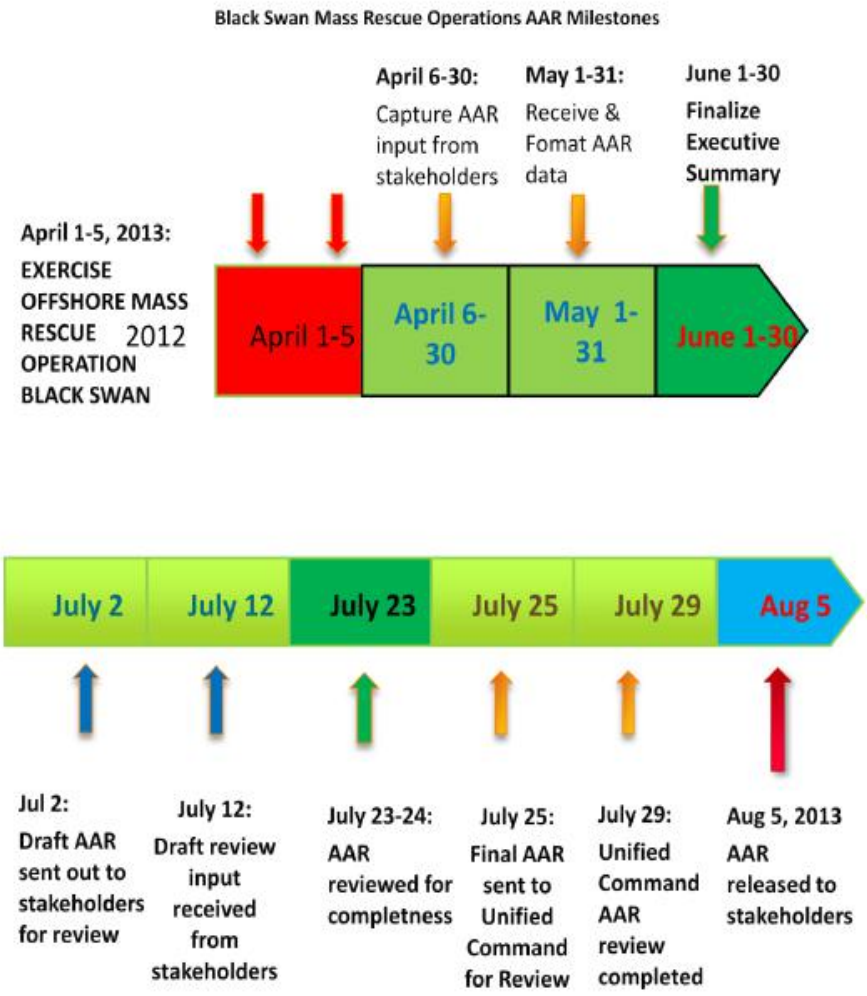

Figure 12 -The timeline of the Black Swan mass rescue operation

Source: Black Swan, after action report executive Summary, August 5, 2013

What can we learn from the BLACK SWAN exercise is the following content.

A Memorandum of Understanding (MOU) should be established by all the agencies, such as Coast Guard Headquarters Search and Rescue-CG-SAR, Cruise Lines

International Association-CLIA, to confirm the objectives, design and exercise execution guidance, funding and support for the exercise.

Training & Drills ensure no injuries or mishaps and a successful full scale exercise. Standardization is very useful which can strength the ability of shore and ship organizations to pre-plan coordination of support. Technology of accountability (electronic) Systems still has limitations, so a “pen and paper” back-up process is critical. Pre-identified landing sites should be able to accommodate the large number of evacuees and responders, and should prevent the bottle necks by medical triage, medical care, logistics care centers, transportation hubs etc(Black Swan, 2013)..

It is critical to designate a "Dock master or Landing site master"in a landing site plan to manage, order, and organize the flow of evacuee at the landing site, who should have the authority to take charge. Contingency plans must include shore and maritime based communication plans, which have been tested, exercised, and determined to be effective. Finally, the USCG pay more attention to the MRO in ALASKA. The reason may be that there are many remote places there and the bad conditions of the sea and weather, however there are so many cruise lines there(Black Swan, 2013).

CHAPTER 6

Countermeasures and suggestions to improve the level of MRO in China

6.1 Documents of MRO adopted by IMO

6.1.1 Legislation about MRO

Because there is no special laws and regulations for maritime MRO in China, which leads to the fact that the coordination organization, who is responsible for maritime MRO, cannot obtain the corresponding legal status. This condition may lead to the low effectiveness and efficiency when commanding and coordinating the other departments and rescue forces, which will decrease the success rate of maritime MRO. So it is recommended that the government of China sets up special laws and regulations concerning maritime MRO, or amend the existing laws and regulations to add the articles of maritime MRO.

6.1.2 Organizational structure

In the offshore MRO, due to large number of people in distress, the entire rescue process must ensure the unified command, efficient operations, efficient coordination, more resources. So it requires the establishment of a legal and reasonable MRO command,control and coordination mechanism to ensure the maritime SAR mission coordination center has absolute legal power and be able to fully control the entire

MRO process and clear the responsibilities and status of other institutions by the national and provincial legislation. In this way, we can avoid the unclear duty and shirk responsibility, which will lead to the disadvantageous situation for MRO.

6.2 Establish the flexible MRO plan and strengthen the MRO exercises

6.2.1 Professional MRO plan should be in accordance with the local conditions

MRO events rarely occur, but once they occur, they will lead to disastrous consequences, so it is necessary to develop contingency plans in line with local conditions after a comprehensive assessment of the risks:

All organizations who may involved in the MRO should plan together. And each named individuals or groups are given specific responsibility for developing the plan and keep it up -to-date. Everyone who may have to put the plan into effect should understand and agree with their part in it. Individuals do not need to know the whole plan, only that there is a plan, and their role in the implementing it. In the plan, there is need to identify the rescue capability gap and the means of filling those gaps. So the plan has to identify all the necessary resources.

For example, due to the large population in the plan to rescue, landing sites and reception center must be designed carefully. It is suggested that the China SAR authorities and Cruise Lines companies should develop together a standardized data base of preferred landing sites for major cruise regions such as Shanghai, which could be accessed by SAR agencies, and the data base could comprise the location, ownership, access, and basic design layouts of the landing sites.

In this way, the victim can be quickly transferred, while the victim, especially the

injured, can be placed and accommodated, and the families and friends of the victims can also be received. In addition, consideration should also be given to morgue and determine the need to establish a morgue/coroner location at the landing site. If required, ensure the site is “shielded/enclosed” and located in close proximity to triage site with proper security.

6.2.2 More exercises and assessment

If the plan has been developed, but no corresponding exercises and assessment, then it will not be able to play the role of contingency plans when the actual MRO occurs. MRO exercises provide the basis for ensuring China MRO plans are effective. Personnel of SAR authority may turnover every year. MRO exercises must continue to be a priority, conducted on a periodic basis to ensure personnel understand the challenges associated with maritime MROs (especially offshore MROs), as well as to assess MRO coordination and response procedures.

MRO exercises are a great opportunity for community and industry partners to work together to ensure inter-agency procedures are understood. These exercises should address issues such as unified command; passenger landing site(s); passenger reception center(s); passenger triage and mass casualty coordination and support; and communications. MRO exercises should incorporate a post-exercise assessment that details an objective-by-objective, as well as lessons learned, that are documented and shared within the SAR organization and with other SAR authorities and responders, as well as industry stakeholders. Therefore, in accordance with actual conditions, the MRO command and coordination center should choose any kind of the MRO exercises such as live exercises, simulation exercises, tabletop or discussion exercises, command post or coordination exercises and communication exercises(Black Swan, 2013).

6.3 Strive for more rescue resources

6.3.1 More professional rescue resources

Although China has a large professional rescue forces, however China has a very long coastline and when the MRO happened there is always a large rescue capability gap, so China still need more professional rescue resources to fill the gap. The rescue helicopter has the characteristics of quick action, wide vision and little impact by the wind and waves. It is an important component of the maritime rescue resources and plays an increasingly important role in the maritime emergency rescue. Therefore, the government should accelerate the large rescue base construction by improving the rescue helicopter aprons, large ship docks, office buildings, training bases and other facilities to build the all-weather and three-dimensional maritime rescue system, which can enhance MRO capability at sea.

Besides, the government should keep tracking and utilizing the latest scientific and technological achievements and converting them into rescue forces, or cooperate with the scientific research institutions to develop professional equipment for the maritime MRO according to the current level of technology. For example, we can utilize the latest and popular technology such as unmanned aerial vehicle to throw the lifebuoy for recovering the people in the water in the proper weather condition. The advantage of using the unmanned aerial vehicle is that the rescue team can deliver the lifebuoy to the place quickly and accurately , which is indicated by figure 13.

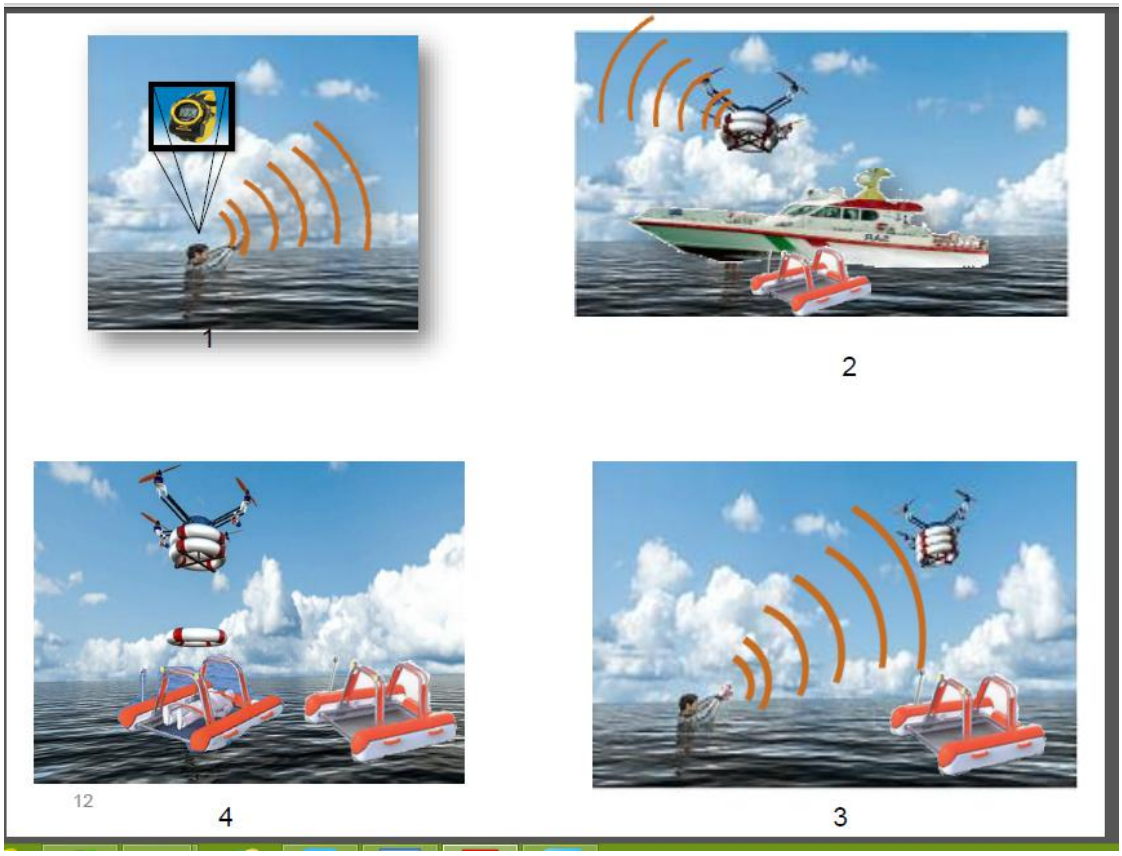

Figure 13 -The new facility applied in the rescue operation

Source: Mohammad MahdaviGorabi–EhsanEsmaili, (2014) *Mass Rescue Operations,P.12*

And the other instance is that we can use a Novel Gimini rescue people in distress, who lose their awareness or are injured or very weak, which is illustrated by figure 14.

Designing a Novel Gimini to Rescue People in Distress

Available Equipment

1. GPS System
2. Projector
3. Thermal camera & FLIR
4. Night-vision camera
5. Propelling engine
6. Motor to deploy and recover the rescue net

13

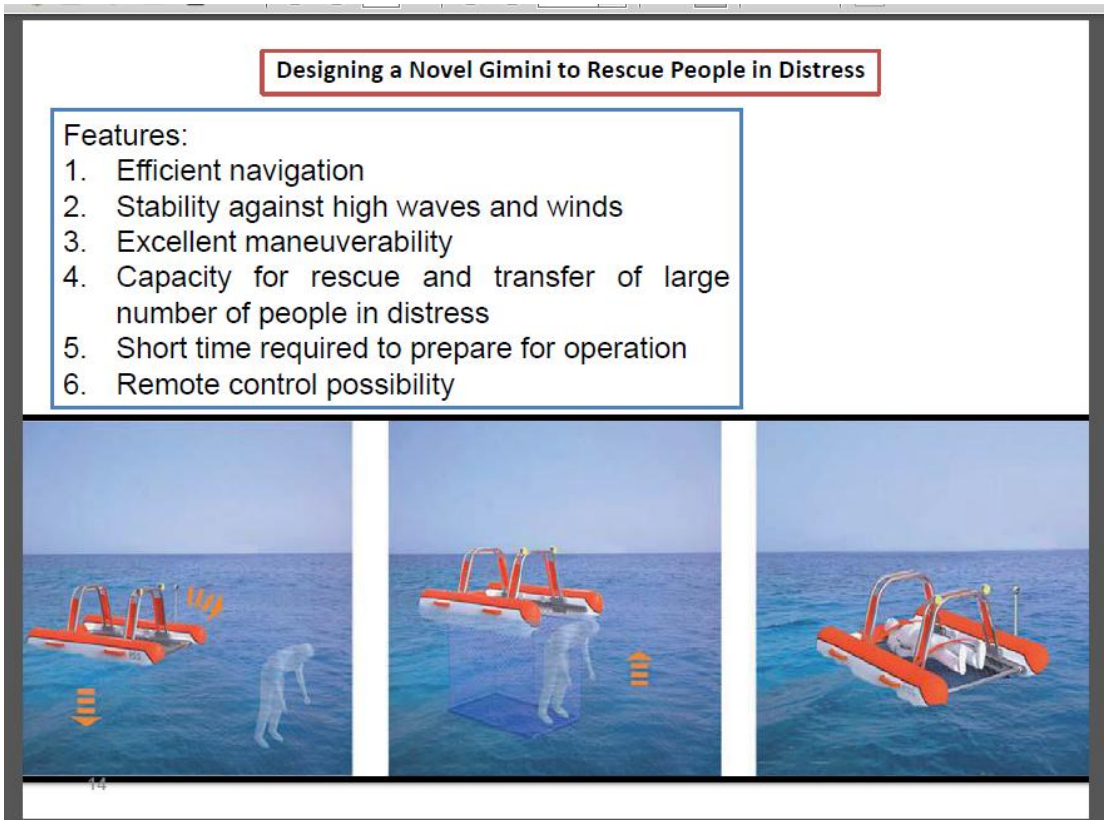

Figure 14: Designing a Novel Ginimi to Rescue People in distress

Source: Mohammad MahdaviGorabi–EhsanEsmaili, (2014) *Mass Rescue Operations,P.13-14.*

6.3.2 Play the role of non-governmental organizations and Social Assistance Forces

Non-governmental organizations and the people of the community are important supplement of rescue forces of government in disaster rescue. At present, non-governmental organizations and social public have not played a significant role in China's rescue work. Both underestimating the power of the people and not paying attention to the whole social emergency education, training and guidance make the social awareness of disasters and self-rescue ability weak, which is not helpful to the natural disaster emergency. Therefore, the government should actively train non-governmental organizations and social public, strengthen cooperation with

non-governmental organizations and social public, propose a mechanism for commendation and publicity, and attract non-governmental organizations and volunteers to join the emergency drills at maritime MRO to fill the rescue resource gap(Zhao Lan, 2008, pp. 16-17).

According to table 21, we can find that the the trend of the number of the NGO in China is rising stably and there is a large number of the NGO, for example, 289,000 social groups, 255,000 private non-enterprise organization in 2013. So the government has a great chance to cooperate with the NGO in the maritime MRO.

Table 21-The status of the number of the non-government organization(NGO) in China from the year 2007-2013

	2006	2007	2008	2009	2010	2011	2012	2013
Social group	192 thousand	212 thousand	23 thousand	239 thousand	245 thousand	255 thousand	271 thousand	289 thousand
foundation	1144	1340	1597	1843	2200	2614	3029	3549
private non-enterprise organization	161 thousand	174 thousand	182 thousand	190 thousand	198 thousand	204 thousand	225 thousand	255 thousand

Table: compiled by author, 2017

Source: Zhang xue. (2015). Research on problems and countermeasures of Chinese non-governmental organization participation in social governance.

In addition, if there is an accident of cruise with full of foreign tourists, the language communication will be very important in the implementation of the maritime MRO. At this stage, ability of communicating in English of many local government staff is not good, and the number of personnel who are familiar with other language is scarce, therefore the government should absorb university students to participate in language communication and translation work in the setting of the MRO plan. Also, more and more people like yachts, such people have more leisure time, and also like to contribute to society, so actively absorbing yacht enthusiasts to join the MRO rescue team is essential.

Although in the MRO, we need as many as possible rescue resources to fill the resource gap, however, in many conditions we Still have have to choose the social rescue resources like the merchant ships because that “following a mass evacuation or man-overboard situation, it might be plausible in some cases to throw lines from the ship to recover persons from the water, but what if you're on a bulk carrier or a tanker and you have 50ft of flat steel to hoist them up? It's impractical and dangerous and requires specialist equipment,” said Michael Lloyd, safety expert and chairman equipment supplier Salvare Worldwide(Stephen Cousins,2008).

6.3.3 Play the role of cruise industry

Shipping companies often expose themselves in a highly competitive market. Cruise business features risks which challenge the companies' efforts to stay competitive under the current economic conditions. Companies can manage their risk-taking behavior through risk assessment and financial management. However, technical and physical risks that refer to the possible break down of a vessel, mishaps, and loss of

vessel and human life will result in inevitable damage to a company's reputation(Joan P. Mileski, 2014).

When the emergency develops slowly, a full MRO response is not required in this situation, at least in the early stage, so the cruise company response team whose ship or offshore installation in distress will implement the related response. The company response team should inform the relevant authorities to the emergency situation and will help and conduct the ship or offshore installation to solve the problem with the resources of technology, information or personnel on shore. Some assistance from the SAR authorities may also be required; however the company can carry out the lead of coordination in this situation when everything is not out of control.

Transportation companies, tour companies, shore excursion companies should also play important role in the MRO, because such resources can be used to deal with many problems, such as landing large numbers of survivors into a community.

6.3.4 Reasonably distribute the rescue forces by the law of passenger ship accidents

Since when carrying out MRO, the rescue resources is always not enough, so except to adding more rescue resources, China rescue departments should also rationally allocate the professional rescue resources in the accident-prone areas through scientific analysis and summary of the occurrence regularity of passenger ship accidents. A passenger ship accident analysis by EMSA, for example, see figure 15 and 16.

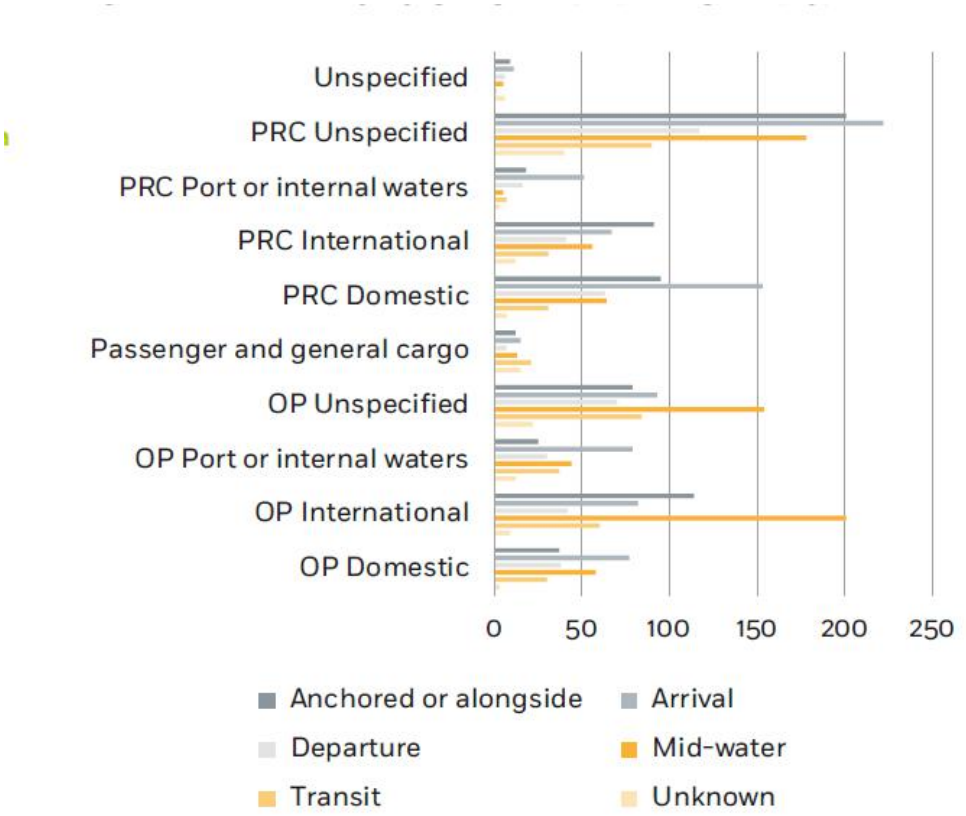

Figure 15-Distribution by voyage segment per passenger ship type 2011-2015

source: Annual overview of marine casualties and accidents in 2016, EMSA

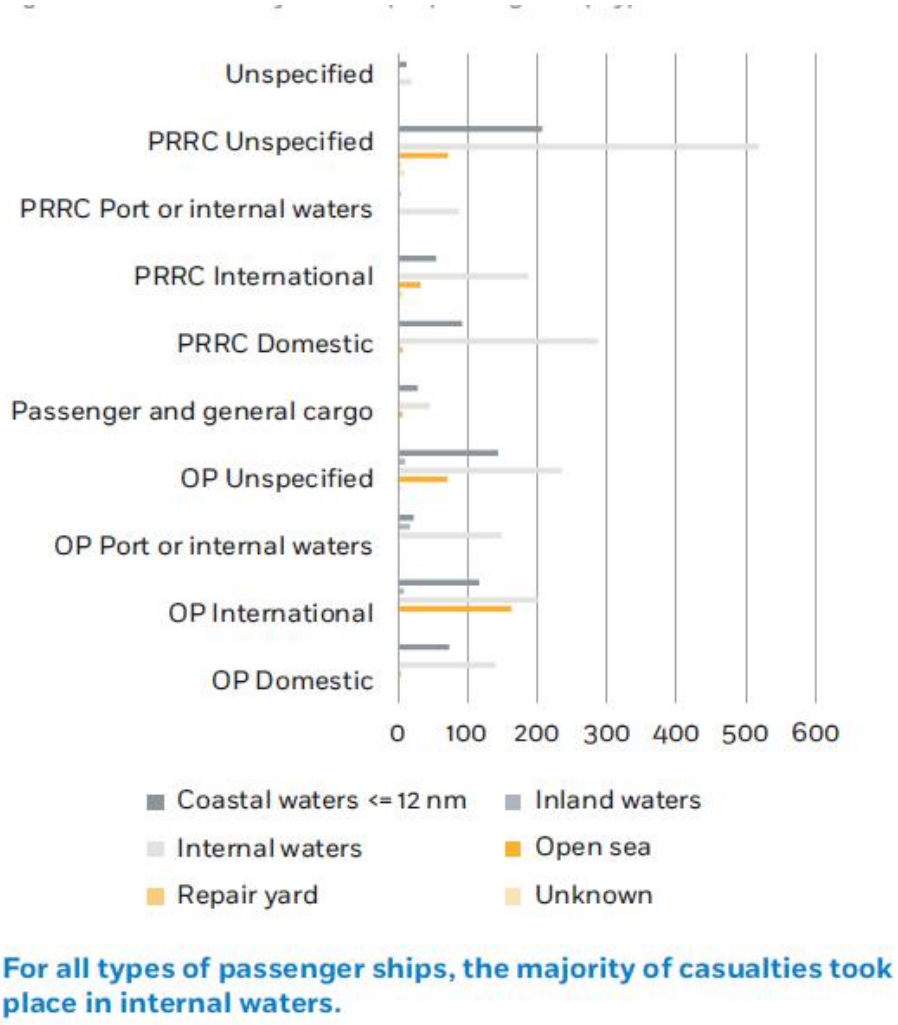

Figure 16-Distribution by location per passenger ship type 2011-2015

Source: Annual overview of marine casualties and accidents in 2016, EMSA

Through figure 16 and 17, we can see that in Europe from 2011-2015, passenger ships, Ro-Ro passenger ship accidents mainly occur in the mid-water and arrival phases, while most accidents occur at internal waters. Therefore, it will help China SAR authorities to deploy rescue forces in advance and formulate MRO plans before we have our own statistics and we should do this job at once.

6.4 Strengthen international and regional cooperation

6.4.1 International Cooperation

Strengthening exchanges and cooperation with the International Maritime Rescue Federation(IMRF) is important. At present, China Rescue and Salvage Bureau has already begun cooperating with IMRF, such as attending fourth MRO International Conference held by IMRF in 2017. At the same time China Rescue and Salvage Bureau also supports IMRF to set up an office in Shanghai,however China maritime SAR center and the China maritime safety administrations(MSA), as the RCC and SMC in China, did not have any contact with IMRF to communicate in the subject of MRO. Therefore it is suggested that Chinese maritime SAR center and China MSA should strengthen exchanges and cooperation with IMRF to learn advanced concepts and technology, and improve the level of MRO. In addition, Chinese maritime SAR center should also strengthen the communication with the advanced countries of international cruise to learn the management mechanism and advanced experience of MRO in the cruise accident.

6.4.2 Strengthen regional cooperation

Because the further development of cruise economy, there will be increasing cruise routes to Japan and Korea, the Chinese governmental departments should strengthen cooperation with Japan and South Korea in maritime MRO in Northeast Asia, by sharing search and rescue resources and carrying out MRO exercise together. It is also of importance to strengthen maritime cooperation with Chinese Taipei and Southeast Asian countries in the South China Sea and Taiwan Strait, because the South China Sea as a new cruise destination, there will be an increasing number of cruise ships traveling to the region. So for the advantage of priority of landing sites in Southeast Asia, China maritime SAR center should also strengthen maritime MRO cooperation with Southeast Asian countries. However, due to the geographical and

political reasons, there are still some problems and barriers in the cooperation between China and those countries or regions, therefore, China maritime SAR center can concentrate on establishing MRO cooperation mechanism to protect the safety of life at sea by participating in the meetings of international organizations.

6.5 The other suggestions to improve MRO

6.5.1 Increase the social publicity of MRO

It is important to increase maritime safety publicity and education to the tourists of the cruise tourism, which will help the efficiency and effectiveness of the evacuation of cruise passengers when the MRO happened. We should make tourists aware of the risk factors in cruise tourism, and improve the safety awareness and ability when the accident happened, which is an important prerequisite for tourists to start the cruising travel. The cruise enterprise or agents can explain cruise tourism safety accidents for visitors to learn from the experiences and lessons through TV media, newspapers, magazines and other media. Visitors can also be trained of the safety knowledge to promote and enhance safety awareness and ability in MRO, such as the knowledge of evacuation.

At the same time, cruise enterprise safety knowledge website can be constructed to meet the needs of customers who need to understand relevant security knowledge for example.

6.5.2 Improve safety awareness and capacity of ship crew

It is known that human factors occupy the majority of accident factors. The latest EMSA statistics shows that from a total of 159 accidental events analysis, 56% were

attributed to a human erroneous action. See the table, Shipboard operations represented the main contributing factor with 62% of the total. See figure 17 and 18.

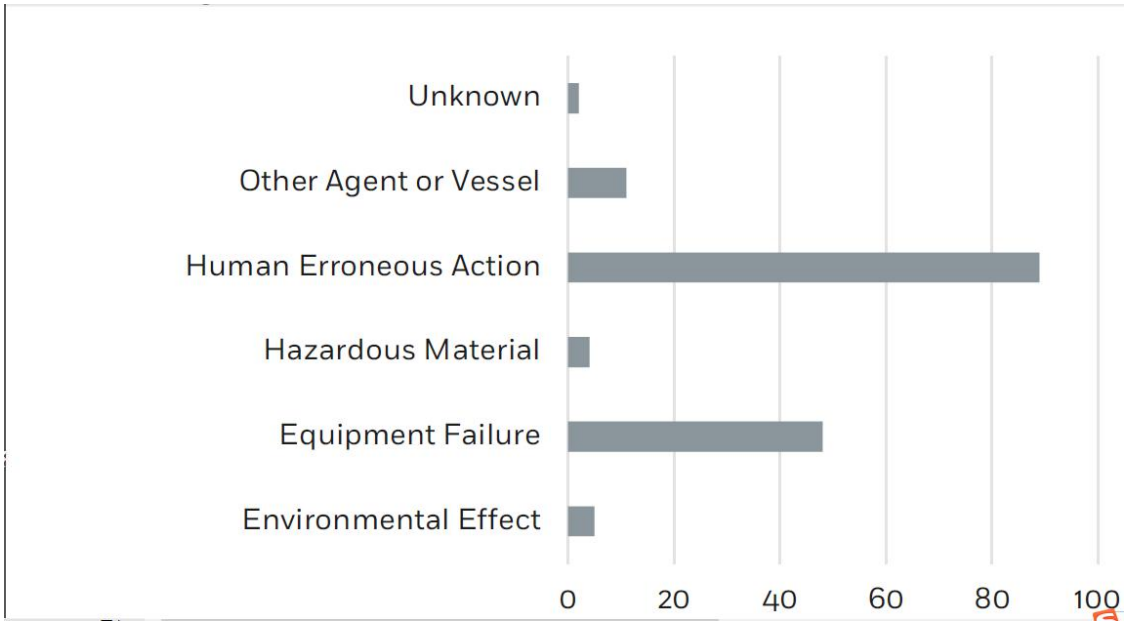

Figure 17-Accidental events 2011-2015 in Europe

Source: Annual overview of marine casualties and incidents 2016, EMSA

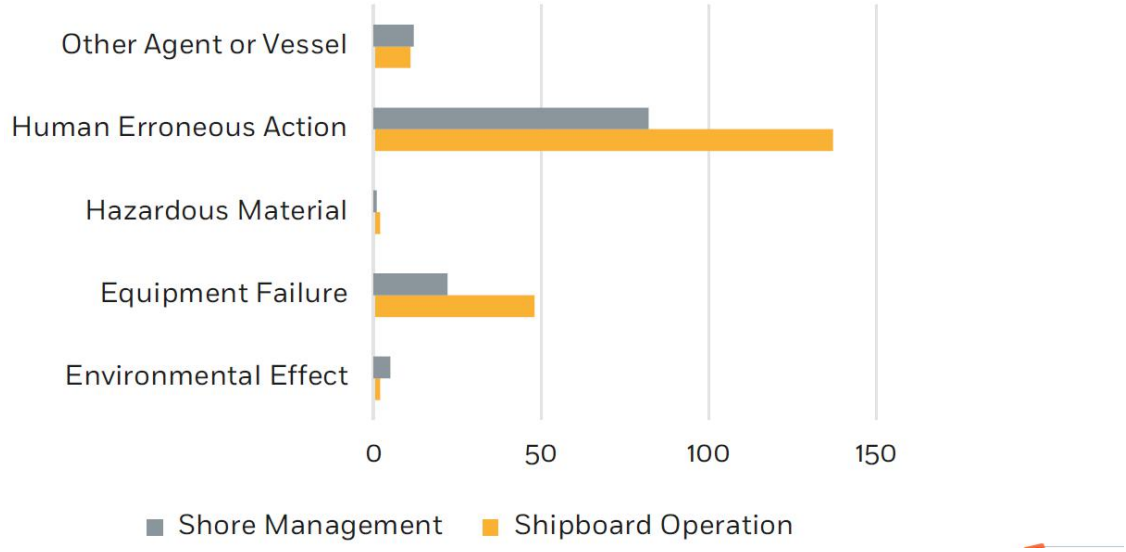

Figure 18- Annual overview of marine casualties and incidents 2016, EMSA

source: Annual overview of marine casualties and incidents 2016, EMSA

Accident prevention is more important than accident rescue, so for the purpose of reducing the occurrence of large passenger ship accidents, it is necessary to improve the safety awareness and ability of passenger ship crew, which can be referred to as the management system of Bohai ferry company in China. First, this company implements safety wages which means that personal interests are linked to ship safety levels, and the safety wages accounted for 40% of personal income; second, the personal interests are linked to the interests of the company by the means that all employees established a company holding 36.38% stakes of Bohai ferry company as the second largest shareholder of the company, besides a natural person comprising company's executives and technical mainstays holds 9.46% stakes of the company. So it can be a reference to improve the safety awareness of passenger ship crew.to decrease the human errors(Duan Yi, 2010, pp.34-35).

CHAPTER 7

CONCLUSION

In conclusion, through the research of MRO in this paper, the writer found that, although the concept of MRO has been put forward for more than ten years by IMO in 2003, there is yet no unified practices and successful experience in international and domestic level and still have many blank and lots of difficulties. Therefore, there is need that more people participate in the study of MRO, learn from each other and then jointly protect the safety of large number people in distress at sea. Especially with the Chinese economic development, increasing number of people in China began to choose the cruise travel. According to the current rate of economic growth and the population of China, it can be expected that the Chinese cruise tourism population will reach 10 million level soon. According to the 2015 China national coastal cruise port layout program, it is expected that the number of coastal cruise passenger will reach about 30 million passengers in China in 2030, with an average annual growth rate of about 20%. There will be a large number of cruise ship sailing in and surrounding the Chinese waters, thus the probability of the cruise accident will be increasing rapidly. And due to the large number of cruise passengers, if MRO can not be implemented quickly and effectively, when the cruise accident happened, it will result in serious and incalculable consequences. Of course, many large passenger ships in the Bohai Strait, Qiongzhou Strait and the Yangtze River should be also considered from the point of view of MRO. Therefore, as a Chinese Maritime Safety

Administration staff, the writer actively conducts research on maritime MRO in China with a strong awareness of the protection of life safety at sea. Because the resources about MRO is limited, the results of the research may not be perfect. It is hoped to arise enough attention of China maritime SAR authorities to MRO by this research. It is also hoped that the increasing number of scholars and all relevant parties will participate in the study of MRO. At last the laws, systems, organizations, emergency plans, rescue forces and exercise related with maritime MRO will be jointly developed and improved from by nation, government, industry and society as soon as possible to protect the safety of lives when the MRO event occurs in the Chinese waters.

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