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WORLD MARITIME UNIVERSITY

Dalian, China

**Research and Countermeasures on Improving the
Capability of Chinese Maritime Search and Rescue**

By

Mo Binyang

China

A research paper submitted to the World Maritime University in partial
Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

(MARITIME SAFETY AND ENVIRONMENTAL MANAGEMENT)

2015

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

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ABSTRACT

Title of Research paper: **Research and Countermeasures on Improving the Capability of Chinese Maritime Search and Rescue**

Degree: **MSC**

Maritime search and rescue, as a complex action often needs a large number of government public and private resources, cost a lot. At present, the dilemma of China's maritime emergency search and rescue is how to make more effective research while reduce the resources cost. In this paper, first of all, it will introduce the domestic maritime search and rescue situation, to compare with the foreign advanced experience, so that the basic connotation of scientific maritime search and rescue is clear. Secondly, the laws and regulations, resources allocation, command and coordination, social forces, rewards and compensation of the maritime search and rescue system in China are shown to express the specific status. After the analysis and evaluation, the main problems in the process of scientific search and rescue would be worked out. Finally, focusing on the key problems of China's maritime search and rescue in resources optimal allocation, organization and command, reasonable dispatch and termination time, the scientific rescue methods would be discussed, so as to get the countermeasures. Through the research of this paper, it could further strengthen the understanding of the concept of scientific maritime search and rescue, having important reference and guiding significance for the future development of China's maritime search and rescue work.

Key words: Search and Rescue, Domestic and Foreign, Countermeasures

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List of Abbreviations

RCC	Rescue Coordination Centers
SC	State Council
NPA	National Police Agency
NMS	National Maritime Search
MTRSB	Ministry of Transport Rescue and Salvage Bureau
RFS	Rescue Flying Service
MTSB	Ministry of Transport Salvage Bureau
RMB	RenMinBi
USA	United States of American
IAMSAR	International Air and Maritime Search and Rescue
IMO	International Maritime Organization
NSARC	National Rescue Committee
USCG	United States Coast Guard
COSCO	China Ocean Shipping Company
MOT	Ministry of Transport
MSA	Maritime Safety Administration
MARPOL	International Convention for the Prevention of Pollution from Ships

Chapter 1 Introduction

1.1 Background of Research

Maritime search and rescue refer to when an emergency occurs at sea, the national Rescue Coordination Centers (RCC) coordinates the public and private resources, expanding the work of search, then determining the position of personnel in distress, and transferring lives and objects to a safe location. Maritime search and rescue is social and public welfare whose job is to save people's lives and property safety, having the important meaning to the promotion of economic development, social development, and social stability to build a harmonious society (SOLAS, 1974).

At present, China's maritime search and rescue forces have their respective advantages under the unified command of maritime search and rescue centers at all levels, which effectively safeguards the stability of maritime transport security. In 2013, the State Council put on the implementation of the reform of the administrative system related to the departments of sea, established the National Police Agency, but the improvement of maritime search and rescue capability is not significant. In recent years, the major emergencies of the sea call higher requirements to the maritime search and rescue capability.

1.1.1 Saving Life on Large Scale

As the scale of the development of the ocean expanding, the number of people at sea is increasing, when the probability of the sudden accidents relates to the mass of life and safety is also increasing. In April, 2014, Korea passenger ship “Years” sank, resulting to the tragedy of 284 deaths and 8 missing, the support rate of South Korean government dropped significantly, which lead to the resignation of the prime minister. The maritime police agency was canceled, and the international images were severely damaged. In this case, government should take the main responsibility of maritime search and rescue.

1.1.2 Deep Scans of Search and Rescue

The search and rescue of the Malaysia Airlines passenger plane MH370 which lost contact during its flight, reveals the shortage of large depth scan search and salvage capacity of our country. The maximum depth of the South China Sea is 5576 meters, while the maximum depth of the East China Sea is 2719 meters. The deep-sea activity of our country is becoming more and more frequent, which motivates us to strengthen the construction of the large depth scanning search and salvage capability. The capability of maritime search and rescue is indispensable for China to become a maritime powerful.

1.1.3 Emergency Disposal of Oil Spill and Chemicals Pollution

In April 2010, the oil spill accident of U.S. “Deep Horizon Offshore” made the devastating blow to the Gulf of Mexico marine ecological environment. At present, the annual voyage of different kinds of oil tankers in coastal waters of China amounted to around 16 million, all kinds of dangerous goods transport ships up to

approximate 10 thousand, the risk of large oil spill and dangerous chemicals pollution at sea is continually increasing, which brought severe challenges to the safety of marine transportation and the protection of the marine environment. Maritime search and rescue at the same time also takes the responsibility of protecting the marine environment.

1.2 Meaning of Research

With the changes in the internal and external environment of China nowadays, accelerating construction of domestic maritime search and rescue capabilities and the effective response to the marine major emergencies is an important manifest the ability and level of administration, which is directly related to the reputation of the government and its international image. Over the years, China's maritime emergency rescue forces in response to the sudden incidents at sea have accumulated a wealth of experience, but at the same time they are facing a growing challenge. Therefore, the research on the improvement of the maritime search and rescue capability in China becomes more and more urgent and important, and it has the following meanings:

1.2.1 Requirement of the International Conventions

In 1985, China formally joined the *1979 National Maritime Search and Rescue Convention*, which commit to provide the rescue services to distress personnel in the coastal and inland waters of China. The Ministry of transport determined the overall goal of “full coverage, all weather monitoring, fast response to the maritime security system, implementing fast and effective search and rescue of the maritime dangerous situation within the area of our search and rescue responsibility”. To fulfill the commitment, and the obligations, highlight the international image of a responsible

power, are also the value of maritime search and rescue.

1.2.2 Social Public Welfare

According to the international practice and relevant laws of our country, the life rescue of the maritime distress personnel is a public service, and cannot be compensated by the personnel who were rescued. The sources of the relief funds include two aspects, one is the government budget, including the central finance and local finance; the other is the social donation, including enterprise and volunteer participation in disaster relief. As a public service, the salvage of human life is the top priority regardless of cost, especially when a large ship in distress, people falling which overboard, dangerous goods leakage lead to the water pollution and serious disasters often requires coordinating the deployment of a large number of search and rescue forces working for quite a long time, the difficulty and the cost of rescue is unable to calculate.

1.2.3 Improving Safety and Rescue

Since the sixteenth conference of the party of China, the Party Central Committee and the State Council have always put the emergency rescue work in an important position, making a series of decisions and arrangements, proposing the annual key objectives and tasks clearly. Maritime search and rescue as the important part of the national emergency rescue system, is the significant embodiment of national public management capabilities, the *Emergency Response Law*, *The National Maritime Search and rescue emergency plan* and so on have made the relevant provisions to the National Maritime Search and rescue emergency organization and command system and responsibilities and tasks. In recent years, the strategy of maritime search

and rescue is improving continuously, and meanwhile the maritime search and rescue capabilities are also constantly enhancing.

With the implementation of the national strategy “maritime power”, the development of China's marine transportation grows rapidly, the marine traffic volume and traffic density grow further, and the navigation environment is becoming more complicated, which make maritime traffic safety accidents growing. In the meantime the existence of a lot of poor technical conditions, low quality and old ships, which are contributing factors for the increase of maritime traffic safety accidents, thus, increasing the pressure of maritime search and rescue. With the rapid development of China's national strength, the state pay special attention to the development and the utilization of marine, marine economic development, offshore oil and gas resources development, marine fishing, marine engineering, aquaculture and other activities related to sea, which will become a new growth point of the maritime activities. With the increase of the global climate change activities, the coastal areas of our country often have to face the strong typhoon, strong cold air and other natural disasters, the risk of offshore safety operation almost shows the synchronous growth of activities related to the sea, the number of persons at sea and ships in distress has increasing tendency year by year.

From the year of 2001 to 2012, the number of person who were in distress in the maritime search and rescue responsible area was 1.6~2.5 million in our country, the number of distress ship were basically 1500~3600, which apparently reflect the arduous missions of maritime search and rescue. At the same time, the increasing marine transport and marine resource development activities result in the sharp growing of domestic and foreign ships, and all types of maritime activities of Chinese coastal and inland, which put forward new and higher requirements for

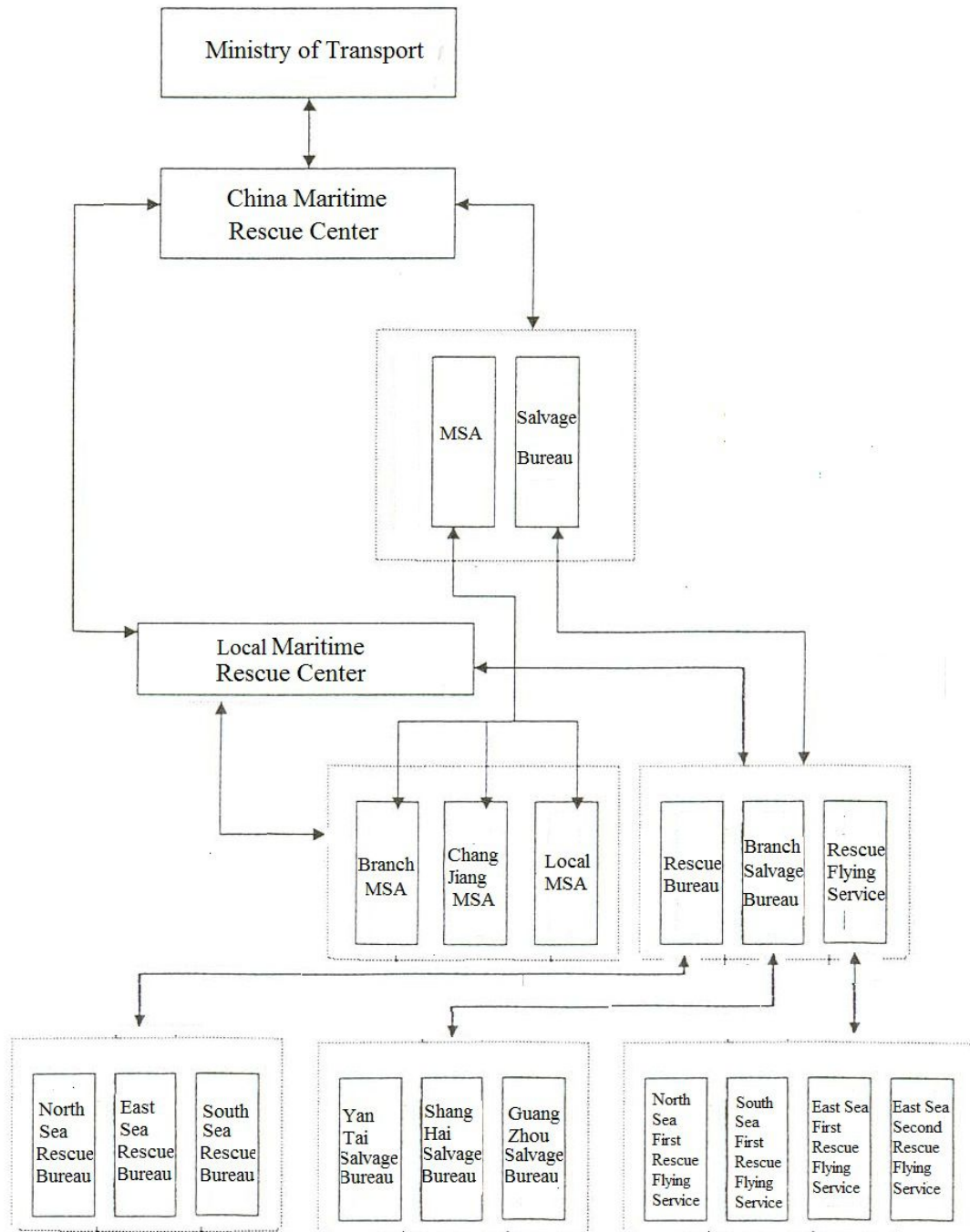
search and rescue, so that the research of improving China's maritime search and rescue capability shoulders heavy responsibilities (Li, 2001)

Chapter 2 Analysis and Research on the Rescue Capability of China

2.1 The Present Status of Professional Rescue Capability

In China, there are Ministry of Transport Rescue and Salvage Bureau and its three branches, the North Sea, the East Sea and the South Sea Rescue Bureau. Under the bureaus, there are 4 teams: the North Sea First, the East Sea First, the South Sea First and the East Sea Second Rescue Flying Service which make the most professional maritime rescue efforts in our country. As a supplementary force of rescue, Yantai, Shanghai, Guangzhou set up 3 Salvage Bureaus, shown in Figure 1. In addition, maritime law enforcement vessels in the maritime search and rescue undertake on-site coordination and rescue missions, is also one of the important government forces of maritime search and rescue.

Figure1 The Search and Rescue System in China



Source: (Emergency Plan, 2006)

According to the requirements of maritime search and rescue operation, under the

unified organization and the coordination of the China Maritime Search and Rescue Center, Ministry of Transport Rescue and Salvage Bureau is responsible for the mobilization and subordinate professional rescue and salvage force in maritime search and rescue operation, Rescue Bureau which are directly under the Ministry of Transport, Rescue Flying Service offer professional assistance in maritime emergency search and rescue operation. Salvage Bureau of Ministry of Transport participates in the maritime search and rescue operations according to the requirements. According to the requirements of China Maritime Search and rescue center, the Ministry of maritime bureau is responsible for motivating ships under subordinate maritime law enforcement in maritime search and rescue operations in the cross area. According to the action task issued by the local maritime search and rescue agency, the Maritime Bureau Department is directly under the Ministry of transport who assigns its ships, aircrafts, personnel and other maritime search and rescue forces to participate in maritime search and rescue operation. The statuses are shown as Table 1, 2, 3, 4, 5, and the China's rescue layout is shown as Figure 2.

Table1 Statistical table for the maritime search and rescue in 2006 - 2012

Year	Search and Rescue (times)	Ships for search and rescue	Aircraft for search and rescue	Distress vessels	Rescued vessels	Sunken vessels	Distress persons	Rescued persons	Missing persons	Success rate of distress rescue (%)
2012	1954	7361	352	1863	1508	355	16957	16392	565	96.7
2011	2177	8600	402	2150	1721	429	19352	18712	641	96.7
2010	2218	8095	345	2348	1865	493	24513	23555	958	96.1
2009	1964	7708	302	2090	1588	502	19128	18397	731	96.2
2008	1784	6320	199	2045	1620	425	20280	19565	715	96.5
2007	1861	7830	245	3665	3226	439	25087	24277	810	96.8

2006	1620	5322	121	2240	1797	443	17498	16753	745	95.7
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Source: (Rescue Center, 2015)

Table2 Professional Rescue Ship Configuration (2012)

	Total	North Sea Rescue Bureau	East Sea Rescue Bureau	South Sea Rescue Bureau
14000KW Large ocean salvage tug	3	1	1	1
9000KW Large ocean salvage tug	16	6	5	5
3000~7000KW Medium ocean salvage tug	15	4	5	6
Under 1940KW salvage tug	17	4	6	7
Fast rescue boat	18	5	7	6
Rubber boat	9		2	7
Total	78	20	26	32

Source: (Rescue Center, 2015)

Table3 Maritime patrol ships mechanism configuration (2012)

Department	10 Meter long	15 Meter long	20 Meter long	30 Meter long	40 Meter long	60 Meter long	80 Meter long	100 Meter long	Total
Heilongjiang MSA	28	20	3	6	2				59
Liaoning MSA	11		4	9	2	1			27
Hebei MSA	10	2		6	2	1			21
Tianjing		6	2	1	1	2			12

MSA									
Shandong MSA		13	9	11	3	2		1	39
Jiangsu MSA	4	36	27	37	1	1			106
Shanghai MSA	1	11	34	25	8	1		1	81
Zhejiang MSA	9	29	33	15	10	2			98
Fujian MSA	9	14	20	10	2	1			56
Guangdong MSA	143	41	74	32	4	3		1	298
Shenzhen MSA		2	7	3	2	1			15
Guangxi MSA	5	57	38	7	1	1			109
Hainan MSA		1	6	3	1	1		1	13
Changjiang MSA		62	56	25	7				150
Total	220	294	313	190	46	17	0	4	1084

Source: (MSA, 2015)

Table4 Professional rescue aircraft quantity and configuration (2012)

Department	Configuration of Aircraft		Aircraft amount
	Owe	Rent	
North sea first rescue flying team			4
Dalian Base	S-76C+ 2		2
Penglai Base	S-76C+ 1 EC225 1		2

East sea first rescue flying team			4
Shanghai Base	EC225 1 S-76C++ 3		4
East sea second rescue flying team			4
Xiamen Base	S-76C+ 1	Y-12 1	2
Fuzhou Base	S-76C++ 1	SA365N 1	2
South sea first rescue flying team			6
Zhuhai Base	EC225 2	S-76A 1	3
Zhanjiang Base		EC155 1	1
Sanya Base		S-76A 1	1
Shantou Base		SA365N 1	1
Total			18

Source: (Salvage Bureau, 2015)

Table5 Professional salvage ship configuration (2012)

	Total	Yantai Salvage Bureau	Shanghai Salvage Bureau	Guangzhou Salvage Bureau
Hoisting vessel	15	4	4	7
Self propelled barge	1	1		
Semi submersible barge	1			1
Deep dive working mother ship	1		1	
Total	18	5	5	8

Source: (Salvage Bureau, 2015)

Figure2 China Maritime Search and Rescue force layout



Source: (Guo, 2014)

2.2 Weakness of Professional Rescue Team

2.2.1 Lack of Remote Rescue

Existing maritime ships mainly consider about maritime cruise demand for the positioning function, although there are a lot of maritime boats, maritime personnel do not have professional training in search and rescue, and lack of professional search and rescue skills. It is difficult to launch effective search and rescue activities separately when there happened to find the shipwreck, especially most of the maritime vessels are short of resisting storm ability, and it is hard for them to implement remote assistance, which reduces the comprehensive efficiency of maritime vessels at last. Although through the ways of developing new hull and a number of new ship constructions, the needs of the coastal search and rescue are met to some extent, the capabilities of maritime search and rescue are still limited. The equipment and configuration of maritime vessels, the capabilities of remote search and rescue should have been further strengthened (Shi, Huang, Chen, 2008).

2.2.2 Not Reasonable Configuration of Ships

Professional rescue ships are facing the problems of unreasonable, obsolete model structure, and need to upgrade urgently. Since 2005, nearly 20 major horsepower professional rescue ships have been put into use, but the medium and small rescue ships have been neglected. In recent years, from the point of view that maritime distress accident prone areas, accident type and rescue effects, so that only relying on the few large professional rescue ships still cannot meet the needs of China's vast sea emergency relief. If the layouts of rescue helicopters are based on the situation of the sea, a moderate deployment of medium and small professional rescue ships are available anytime, the effect of rescue will be better. In addition, there are 15 professional rescue ships of 2600 horsepower are close to the retirement age in the professional rescue team, the replacement has not been built or imported, resulting in

the professional rescue force suffering from insufficient quantity of medium and small professional rescue ships, which cannot meet the urgent need of sea professional emergency rescue in China's 18000 km long coastline.

2.2.3 Not Reasonable Configuration of Aircraft

As the air force of rescue, the configuration of small and medium rescue helicopters are not reasonable in rescue flying service team, and also lack of small rescue helicopters. Currently, the North Sea first rescue flying service, the East Sea first rescue flying service, the East Sea second rescue flying service, the South Sea first rescue flying service, these 4 professional rescue teams have the rescue aircraft models are mainly S-76 and EC225 and fixed wing aircraft, type S-76 is medium-sized rescue helicopter, EC225 helicopters are used for large-scale rescue. For some search and rescue operations just using a small rescue helicopter can complete the search and rescue missions, when using the large and medium-sized aircraft to complete the search and rescue will cause too high search and rescue cost. At the same time, the pilots must be in accordance with the provisions of the subjects of flight training, and the flight training of each rescue flying service team should use the aircrafts in flying base, so if use large rescue aircraft flight for training frequently, the training cost would be very high. This problem is more prominent in the South Sea First Rescue Flying Service team, as they only have EC225 helicopters now. So using small rescue helicopter for training can significantly reduce the cost.

2.2.4 Imperfect Training Mechanism

Since the time from the reform of rescue and salvage system, the rescue equipment and technical level of China's professional rescue and search team have had a very

big improvement, and become a crucial strength of China's maritime search and rescue. However, with the increase of large ship, large passenger ships and dangerous goods transportation ships, the professional strength of the ship rescue in the process is obviously weak in organization, coordination and technology. Currently, although some provinces and municipalities have carried out the maritime search and rescue service training, it still has not yet formed a long-term mechanism for a regular search and rescue training. There is lack of regular training funds to enhance the expertise of the search and rescue skills and ability to deal with emergencies. Such as the chemical ship fire professional training for the crew of rescue, and night search and rescue, land island search and rescue training for rescue helicopters and so on (Li, 2012).

In addition, the Convention of International Maritime Search and Rescue are clearly regulated. The coordinators who are engaged in maritime search and rescue should be professional trained to improve the ability of coordination command of on-site search and rescue. People participating in professional and social forces for the assistance should also be trained, namely maritime ship crew and law enforcement officers and rescue boat professional search and rescue personnel, and other social forces search and rescue personnel and rescue service personnel should all participate in the corresponding training, to improve the on-site search and rescue skills.

2.2.5 Poor Rescue Ability in other Water Area

The search and rescue forces of the river tributaries, mountainous rivers and reservoir areas are mainly dependant on the local maritime bureau, and the participation of other units and departments is not very much. The local maritime bureau has a certain number of sea patrol boats, economically developed areas have also relatively

developed the inland waterway transport, the number and performance of sea patrol boat distributed by the local maritime bureau is relatively better, but for some river tributaries, mountainous rivers and reservoir areas, especially the area of local economy undeveloped, the power of local maritime boat is very limited, search and rescue resources are very scarce, in the event of danger occurring on the water, it is very difficult to deal with the emergency with the existing search and rescue forces (Yu, 2002).

2.3 Status of Social Rescue Capability

China Maritime Search and Rescue Center statistics show: from the year 2009 to 2012, the proportion of implementation for dispatching social forces to salvage was more than 66%, dispatching maritime patrol boats is about 25% and the proportion of mobilizing professional salvage is about 10%. While from Shandong maritime bureau, Tianjin Maritime Bureau statistics, the number of distress rescued by social forces reached 70% (Yu, 2013). Therefore, the social forces are very important auxiliary power of maritime search and rescue, the initiative of social force to participate in maritime search and rescue should be considered seriously. The data of different types of forces mentioned above is shown as Table 6.

Table6 Search and Rescue Operations Statistics

Year	Maritime vessels	Salvage vessels	Army forces	Social forces	Fishing boat	Passing vessels
2012	1906	509	147	2108	1453	1193
2011	2162	669	91	2080	2358	1276
2010	2241	688	125	1941	2286	1041
2009	2012	562	102	1921	2037	1074

Source: (Rescue Center, 2015)

Social power is an integral part of maritime search and rescue, the features of maritime search and rescue appear large range, high efficiency, intricate danger, so combination of special groups, military and civilian forces combined which are in line with the characteristics of China's maritime search and rescue work. The social forces' participation in maritime search and rescue operations is particularly important. As a public service, the social relief power plays a very important role in the maritime search and rescue. But social forces in the search and rescue, owing to obligations, have cost heavy for ship schedules, oil prices, property damage and other expenses, and also bear the enormous risks (Chen, 2005). In contrast, social forces can seldom be compensated in search and rescue, let alone the corresponding incentive and compensation mechanism, which results in the less activity for social forces to rescue.

In recent years, coastal provinces and maritime departments and rescue bureau have recruited the maritime rescue volunteers, are both in formation of the volunteer team, but distinctive development pattern has not yet been established, which should be regulated as soon as possible. These volunteers are not supported by the related special funds, and lack of basic search and rescue equipments that social assistance ships should be equipped with, necessary rescue skills training for search and rescue volunteers are still not enough. In the actual maritime search and rescue operations, the performance of the non professional rescue force is not satisfied, sometimes they may also cause the second damage to the distress personnel. In addition, when the rescued ships with hazardous chemicals, the non professional rescue force seems more helpless.

2.4 Weakness of Social Rescue

According to China's current situation of maritime search and rescue, administrative law enforcement procedure in China is not perfect, all priority is to save life, public interests are above all else, which lead to the violent expropriation or destruction of society private property at any time. In fact, this is a violation to citizen's property rights. The most common phenomenon is the rescue without time limitation, the requirement of rescue assistance provided is high, the amount of manpower and material resources dispatched is large, but the compensation, if any is very little, let alone the power abuse. The expropriation of others rights and interests illegally is destruction to the harmony and progress of the society, and also is a strike to the enthusiasm of the civil relief organizations, and will influence the normal performance of life rescue at sea.

2.4.1 Small Scope

According to *Interim Measures for the administration of special funds for marine search and rescue Award*: “The scope of rewards is serious maritime search and rescue operations which was organized under the command by the China Maritime Search and rescue center; the object of reward is the social rescue power who have made outstanding contributions to search and rescue operations.” From the provisions we could see that, serious dangerous rescue or who has made outstanding contribution to the search and rescue is the objects of the reward, but in fact, they tend to be general dangerous and large dangerous rescue (Mi, 2012).

2.4.2 Less Compensation

At present, China's rescue compensation is only bonus, there is no other non profitable incentives, such as certificates, titles, honor and so on.

2.4.3 Low Amount of Compensation

According to *Interim Measures for the administration of special funds for marine search and rescue Award* the social forces which participate in serious emergency rescue should be given at least 30 thousand RMB per time or 40 thousand RMB per time as reward respectively. If the social forces participate in the search and rescue with important social impact or huge risk, or for a long time, should be appropriate to increase the standard of reward, the highest individual reward standard of search and rescue action should not exceed 10 million RMB. Social forces for long-term participating the maritime search and rescue with the outstanding results, shall be given no more than 30 thousand RMB reward. From the regulations it can be found, the award amount is not in tune with the market purchasing power, and as the quantity of ships for rescue increase, the compensation of rescue could be described as a drop in the bucket, and the amount is very far from the international compensation (Liu, 2000).

Above all, the capability of China Maritime Search and rescue under the support of national finance has made certain achievements, but at the same time it is limited by the constraint mechanism, there still exist the problems like the lacking of legal specification, the ability of decision making and command is uncoordinated, the allocation of rescue force is unreasonable, the strength of social assistance is not mature, the rescue compensation mechanism is not standard and so on (Wang, 2013). These problems are largely caused by the inefficient operation of resource allocation, which restrict the promotion of China Maritime Search and rescue capability.

Chapter 3 The Foreign Experience of Maritime Rescue

3.1 Introduction of American Search and Rescue

The United States is the first country in the world to start building maritime search and rescue system, the first Coast Guard was established in the world in 1915. And before the coast guard, the United States has already established the U.S. Lighthouse Service (belong to business institutions), the revenue cutter service (belong to maritime law enforcement agencies), the Steamboat Inspection Service (belong to steamboat Safety Agency), as they belong to different departments, the management cost of maritime search and rescue is very high, so in 1915 they merged into the coast guard, and eventually belongs to the new Department of homeland security which was established in 2003.

3.1.1 Laws and Regulations

U.S. maritime search and rescue is mainly in accordance with the three levels of the laws and regulations to carry out. The first level is the *1979 International Convention for Maritime Rescue of Human Life* and the *International Aeronautical and Maritime Search and Rescue Manual* (IAMSAR manual) issued by the International Maritime Organization (IMO); the second level is the *National Search and Rescue Plan* and

IAMSAR Manual Makeup, which is the supplementary description to the first level; the third level is the *Coast Guard Makeup*, which is a standard reference for specific maritime search and rescue operations, and the policies, procedures and standards for search and rescue should be set (Zhang, 2008).

3.1.2 The Organization

U.S. maritime search and rescue agencies are separated into two levels: the first level system is the National Rescue Committee (NSARC), the second level system is the U.S. Coast Guard (USCG). The national search and rescue committee does not undertake the actual search and rescue affairs. It is only responsible for the formulation and coordination of the national rescue policy. The United States Coast Guard is the executive body of the United States maritime search and rescue policy, which mainly responsible for the development, construction, maintenance and use of the national search and rescue resources, strengthening the safety of international waters and the sea, the surface of water, and the underwater in jurisdiction area of the United States of America.

3.1.3 U.S Coast Guard

3.1.3.1 The Configuration

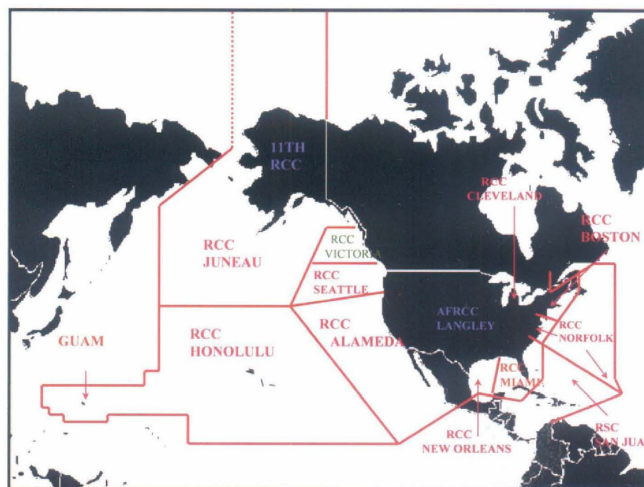
U.S Coast Guard is responsible for the coastal waters, channel safety, rescue, pollution control and other tasks. It is a comprehensive military law enforcement team. The configuration of search and rescue force includes COSCO voyage ship, 87 feet and 110 feet patrol boats, navigation assistant ships and tugs, standard type of boat, rigid inflatable boat and non standard boat. The air force includes remote

searching fixed wing aircraft, medium range searching fixed wing aircraft, medium range searching helicopter and short-range helicopters, equipped with an aviation management institution and 26 air bases. The cooperation among the marine, air force, land force and air and U.S Coast Guard is very scientific, which focuses on the three-dimensional search and rescue. The coast guard also has a maritime search and rescue team that has absorbed a lot of college and industry personnel, including active duty, reserve personnel, civilian personnel and assistant personnel (Li, 2005).

3.1.3.2 Coordinated Command Mechanism

In order to strengthen the command and coordination of maritime search and rescue, the United States Coast Guard established a total of 11 Rescue Coordination Center (RCC) in Boston and Norfolk, Miami, which is shown in Figure 3. The coordination center is responsible for the coordination of the organization, and assigning coordinator to take charge of specific search and rescue when there is a mission. The timely adjustment of coordinator is very important for the judgment to the changing scene and the rescue events which cannot afford a minute's delay.

Figure 3 Rescue Coordination Center by U.S. Coast Guard



Source: (Yang, 2004)

3.1.3.3 Rescue Mechanism

The rescue of U.S. Coast Guard is divided into five stages, which are early warning, rapid response, the development of rescue plan, and the implementation of the action and the termination of action. Normally, the RCC receive the alarm information by its communications device or its associated communications base station. After receiving the report, RCC will assess the danger to determine its validity and danger rating (uncertain state, alert state and dangerous state). At the same time RCC designates search and rescue mission coordinator, notifies the relevant personnel and equipment. In 5 minutes of receiving the distress location information, RCC will develop a detailed search and rescue plan, make specific search and rescue scheme in 15 minutes after the plan was made, including the identification of the center area of search and rescue operations, personnel, and equipment deployment. In 1.5 hours after the plan, departments carry out the actions in an orderly way, at the same time, the coordinator of search and rescue mission shall ensure rescue plan to various departments and ensure the smooth flow of information.

3.1.4 Social Force

As the surveyor's benchmark of global maritime search and rescue, there is no doubt about the level of search and rescue of the U.S. Coast Guard, but the country's search and rescue mission only takes on 4% of the rescue. Volunteer teams and volunteers staff take on 41% to nearly 35000 people in the auxiliary work, whose assistant work are mostly supporting offshore search and rescue work. They have played a important role in the safety, information monitoring and distress release. In addition, some commercial organizations and associations will also actively participate in

maritime search and rescue operations. The mainly include some oil companies, fisheries companies and aviation clubs, national search and Rescue Association, diving alarm network and so on. The coast guard can rely on its strong organization coordination ability, fully mobilize and use social forces to carry out rescue operations, and have saved a lot of expenses for the country.

Overall, the maritime search and rescue in the United States has the efficient search and rescue command system, scientific equipments, perfect personnel training system and nearly universal participation of social forces, these are all the areas that are worth learning and using for reference in our country during the research process of improving maritime search and rescue capability.

3.2 Experiences for Reference

From the point of view of maritime search and rescue in the United States, with sound search and rescue laws and regulations, perfect search and rescue command and coordination mechanism, the advanced search and rescue equipment and technology, extensive social participation and mature staff training system, which is worth learning and using for reference for our country in the process of studying how to improve the capabilities of search and rescue:

3.2.1 Legal Guarantee

The advanced search and rescue system of the country are almost based on the *1979 International Maritime Search and Rescue Convention* and other international conventions as the guiding principle, which establishes the perfect maritime search and rescue system of legislation, provide the necessary legal basis for the smooth

development of maritime search and rescue. The *United States Coast Guard Makeup*, which has the detailed provisions to carry out policies, procedures and standards on maritime search and rescue, makes all the part of the entire search and rescue operations such as decision-making, command, on-site rescue. In contrast, the law of China's maritime search and rescue is still not perfect, many important problems are lacking of clear legal definition, such as search and rescue disclaimer, compulsory salvage, termination of search and rescue, compensation for rescue and so on, resulting in the role of professional search and rescue forces being difficult to define, and many problems being difficult to timely terminate search and rescue, unlimited expansion of search and rescue, which impact the efficient use of resources and the rescue effect of the search and rescue (Yang, 2008).

3.2.2 Perfect Command and Coordination Mechanism

Because maritime search and rescue is joint operations including different agencies, departments, and regions, closely coordination is required between the rear command and front scene, so the command coordination of search and rescue is particularly important. At present, the United States has established very good search and rescue command and coordination mechanism, which has set up 11 rescue coordination centers responsible for the jurisdiction of the maritime search and rescue individually, and the field coordinator system is adopted in the actual search and rescue operations, the mission coordinator of search and rescue is assigned to be solely responsible for work site. As the coordinator is on the spot, he could adjust the search and rescue operations to ensure the efficiency of the search and rescue operations according to the changing situation. On the other hand, developed countries have made response time in strict through the links of receiving alarm in the operations of search and rescue, making rescue plan and dispatching the search and rescue forces, ensuring

the timely and rapid response of danger. While in China's maritime search and rescue work, the emergency coordination mechanism between the search and rescue units need to be further improved, multi search and rescue forces at different level lack of unified command on the spot, and the response time of a distress accident also needs to be further decreased.

3.2.3 Wide Application of Equipment and Technology

When the United States launches search and rescue operations, they focus on using advanced search and rescue equipment and technology. Such as the marine, land force and air force, three-dimensional cruise rescue of U.S Coast Guard, the successful implementation of the night cruise rescue, they use high diving technology for the wreck of victims in distress, specialized equipment for dangerous goods transport at sea. In contrast, although in China the construction of rescue flying service team, the techniques of saturated diving, and the salvage technology for large shipwrecks have made some achievements, in general, there is still a gap in the professional rescue equipments and the technical level of China Maritime Search compared to the developed countries.

3.2.4 Extensive Social Participation

Social force is an important part of maritime search and rescue. For example, the proportion of United States Coast Guard personally involved in the rescue mission accounts for only a quarter of all the rescue, and the rest are carried out through mobilizing social forces. In addition, due to the perfect social search and rescue reward and compensation mechanism, the passing fishing boats, merchant ships participation is also very high. The wide participation of social forces greatly saves

the cost of marine search and rescue. However, the domestic social search and rescue reward and compensation mechanism is not perfect. There is no awareness of social forces participation, which influence the rescue effect of social forces to participate (Yang, 2006).

3.2.5 Good Training System

In order to ensure the skills of maritime search and rescue to be mature and improved, a comprehensive maritime search and rescue training system should be constructed. The volunteers of search and rescue shall not only need the professional training, but also need to carry out regular training and assessment after getting the certificate of previous training. In addition, the establishment of a specialized training institution or school supplying the regular professional training to search and rescue command staff and on-site search and rescue personnel, so as to constantly improve the skills of maritime search and rescue, such as the United States Coast Guard Academy. But our country currently only focuses on the professional training to personnel in maritime system and maritime search and rescue system. Even worse, the training neither formed a system, nor is equipped with specialized schools and teachers.

China Maritime Search and Rescue System construction started very late, with the poor foundation and the weak capability of rescue that the gap between developed and developing countries is obvious in all areas. Through a comparative study, combined with national conditions and international advanced search and rescue experience which are worthy our country learning and researching.

Chapter 4 Suggestions for Further Improving China's Maritime Rescue

Improve the capabilities of maritime search and rescue must be systematic with a global perspective, including scientific planning, construction, configuration, organizations and assessment. This not only refers to the operations of search and rescue in the smooth communications and transmission, strong organization and coordination command, scientific design of rescue plan, reasonable search and rescue force deployment, effective command at the scene, advanced search and rescue equipment and technology, but also needs to have a perfect legislation of search and rescue and emergency plan, scientific allocation of search and rescue resources, smooth rescue mechanism, active volunteer team of search and rescue , the sound reward compensation mechanism of search and rescue and rigorous evaluation system after the search and rescue.

Rescuing people in distress at sea is a public service, each search and rescue operation needs to organize a lot of government public and private resources and spends a lot of social recourses. How to properly invoke a variety of search and rescue forces, optimize the limited rescue resources, and get the most effective relief effect with the most appropriate aid cost, realizing the scientific way of search and rescue, needs to sustainable development of maritime emergency search and rescue work. According to foreign policy, this chapter provides the following suggestions at

the basement of China's search and rescue work state, which would improve the capabilities of our maritime search and rescue (Yang, 2003).

4.1 Suggestions for Improvement of Professional Rescue Force

4.1.1 Key Point: Accelerate the Legislation

At present, the Ministry of Transport is working on the revision of the *Maritime Traffic Safety Law* and *Maritime Law*, the search and rescue legislation should be combined with the law revision mentioned above, strive for making clear of some problems of the legal relationship of maritime search and rescue related in the *Maritime Traffic Safety Law* and *Maritime Law*, which could give strict legal definition to the legal status of professional rescue force, and the scope of the liability of maritime search and rescue.

The first step, the emergency plan for maritime search and rescue should be improved, and in large the implementation of the emergency plan should be focused. Emergency plan is the action program of the maritime search and rescue, the organizations of search and rescue should strengthen the construction and improvement of maritime search and rescue emergency plan, solve the problems in the plan through experience in the actual search and rescue operations, make the rescue plan more scientific and practical. In the light of the special ships and aircraft in distress accidents (cruise, yacht, oil and hazardous chemicals ship), the relevant industry experts should be organized to make out more specific emergency plan of the maritime search and rescue. At the same time, the implementation of the emergency plan should be strengthened (Shi, 2002).

4.1.2 Basic Point: Resources Allocation

Secondly, the scientific development of positioning and planning plays a guiding role to the allocation of maritime search and rescue resources. It needs to analyze the scientific allocation of resources from the nature of strategy, to understand the development direction of search and rescue forces, to make the top-level design and system planning of the search and rescue equipment allocation.

Professional rescue force is the tough and special rescue forces of the maritime distress in China. In heavy storms and extreme weather conditions and other ships can not be dispatched or unable to move close, professional rescue ship is often able to do its best to rush to the scene for search and rescue, while the professional rescue aircraft is the most effective and fast way to save life. Often the most dangerous, urgent, and difficult maritime rescue missions are mostly accomplished by professional rescue force. Especially the implementation of the air, water, underwater three-dimensional rescue is a special feature of professional rescue force.

4.1.2.1 Rescue Ship Combined

Large, medium and small ships should be developed and combined with each other. The high horsepower rescue ship, medium and small rescue ship should be applied to different situations, and enhancing its high-tech and multi-function, which would be suitable for advanced scientific search and rescue.

4.1.2.2 Research on the Reasonable Configuration

From the current actual effect of aircraft rescue of maritime distress search and

rescue, aircraft has the advantage of very high speed, and small influence of sea conditions and so on, which are especially suitable for the critical moment of maritime search and rescue of human life, and the implementation of marine, land force and air force, three-dimensional relief (Ye, Mei, 2009). For example, the U.S. Coast Guard has more than 200 rescue aircrafts nowadays, according to the weight and endurance of the aircrafts, which are separated into 5 levels in order to perform different rescue and cruise missions. According to the marine situations of China and the capabilities of air search and rescue, the author of this paper suggests that the pace of the construction of the flying rescue team should be increased in the future, combining with the reasonable allocation of the large-medium-small aircrafts and helicopters with fixed wing, which would meet the needs of maritime search and rescue mission.

4.1.2.3 New Equipment for Search Function

To make full use of the characteristics of wide distribution and flexibility of maritime boat, firstly the maritime boat design should be given full consideration according to the characteristics of task in execution sea area, and it meets the needs of wind resistant performance on the search and rescue mission; secondly the maritime boat should be equipped with necessary rescue equipment, meeting the requirements of the executive search and rescue mission; thirdly when the rescue boat power is not enough in certain areas, the number of boats and their function should be of the complementary assistance.

4.1.2.4 Professional Salvage Strength

When the rescue ship from salvage system performs emergency rescue and salvage

or other engineering activities, when there occurred the event of water emergencies at the near sea, according to the *National Professional Salvage Forces to Deal with the Water Emergencies Emergency Plan* requirement, the salvage ships should participate in maritime emergency rescue in time.

4.1.3 Present Point: Establish New Coordination Mechanism

Thirdly, the coordination mechanism is necessary. Under the unified organization and coordination of the China Maritime Search and rescue center, the maritime search and rescue centers of provinces, autonomous regions and municipalities are responsible for organizing, coordinating, directing and guiding the jurisdiction area of maritime search and rescue operations, department maritime bureau is responsible for the mobilization and subordination of maritime search and rescue forces to participate in the cross area of maritime search and rescue operations, each agency is directly under maritime in charge of mobilizing its ships, aircrafts, personnel, and other maritime search and rescue forces to attend the jurisdiction area of the maritime search and rescue operations. Department rescue and salvage bureau is responsible for the mobilization and subordination of professional rescue force and salvage force in maritime search and rescue operations, each directly under rescue bureau and Salvage Bureau is responsible for mobilizing the ships, aircrafts, emergency teams to participate in search and rescue operations at sea. The organization and command of Maritime search and rescue are not only relating to the coordination between search and rescue units, but also relating to coordination with many local governments, frontier defense, public security, fire, medical, meteorology, military, civil aviation and other departments (Xu, Zhou, Hou, 2008).

4.1.3.1 Strengthen Communication

At present, China's maritime search and rescue has established a relatively perfect hierarchical command mechanism, which should further strengthen the assistance and communication between command center and various search and rescue forces. Aiming at the substandard transition of the rescue scene information, and the untimely information feedback, it is recommended that in accordance with the principles of management classification, to determine the corresponding coordination of search and rescue command system according to the level of maritime distress incidents. Furthermore, enhancing the transmission of information between the on-site search and rescue command, especially the visual information transmission in the field, it is convenient for the search and rescue command personnel to understand about the situation, checking the scene situation of search and rescue for comprehensive analysis, making the rescue command become more effective. For the significant maritime search and rescue operations, China Maritime Search and rescue center should get information of search and rescue on-site in time, and organize, coordinate, command search and rescue operations, which will improve the efficiency of on-site command, and ensure rapid development and implementation of significant search and rescue operations. And for general large maritime search and rescue operations, China Maritime Search and rescue center is responsible for the notification and coordination of distress message, specifically organized by the provincial maritime search and rescue center, coordinating ministerial joint meeting units, dispatched rescue forces to complete the mission and reporting to China Maritime Search and rescue center total duty room by professional rescue bureau and maritime units.

4.1.3.2 Increase the Linking up

China needs to establish a long-term mechanism for regular exchanges and cross training, to be familiar with the most concerned problems about the coordination and command of maritime search and rescue, to improve the tacit degree during the operations of coordination and command in search and rescue. Meanwhile, it also needs to improve the transmission speed of the rescue site information between the search and rescue center and rescue commanding department, to complete the initial assessment of danger at sea in a shorter period of time, and with the faster speed to develop reasonable search and rescue decision-making, to improve the efficiency of the search and rescue, and the command and coordination mechanism of maritime search and rescue will be more scientific and reasonable.

4.1.3.3 Further Regional Cooperation

At present, the region cooperation linkage mechanism of China's maritime search and rescue has achieved initial success, and should continue to deepen the coordination and cooperation mechanisms between regional maritime search and rescue, establishing more effective communication channels for maritime search and rescue across regions, which could further improve the efficiency of cross regional maritime search and rescue operations. At the same time, according to recent frequent accidents happened in adjacent sea and boundary river, the new mode for cooperation of neighboring countries should be actively explored in maritime search and rescue, improving the coordination ability and emergency response capabilities of international maritime search and rescue (Xu, 2009).

4.1.4 Future Plan: New Model of Rescue Flying Service System

The fourth step is to get a new flying program. At present, the construction of

Ministry of Transport rescue flying service team has begun to take practice unified management by the Ministry of Rescue and Salvage Bureau. The maritime system is also building a cruise rescue flying team, for example, the Guangdong maritime bureau has brought in 2 helicopters. Air rescue is a high risk and strong professional industry, from the angle of using resources to the fall, from the standardized management and safe operation level, from the height of science and sustainable development, it is very necessary to study the mode of construction and development of rescue flying service team in transportation system. For example, the flying service team can be built together, and the aircrafts can be managed in unify by the Ministry of Transport. Making full use of the successful model and experience from the management of the maritime rescue flying service team of MOT, strengthening the effective utilization and utility maximization of resources will be our aim. At the same time, the type structure of aircrafts should be suitable, large, medium and small aircrafts should be scientifically allocated. When the large and medium sized professional rescue aircrafts perform the rescue missions, fixed wing aircraft could execute search task and lock target, small aircraft can be used for pilot training, and training for pilots and maritime cruise can also be combined together. In the case of emergency rescue, the existing aircraft in the rescue flying service team can be put to use, the maritime cruise function could be appropriately increased (Zhen, 2012).

Specifically, from the point of view of pilot training, each pilot must be trained strictly in accordance with the subjects prescribed by the civil aviation department, completing the provisions time of flight (more than 1000 hours), in order to be eligible in captain test, and have the ability to form a unit to execute rescue mission independently. The time for training each pilot is at least 8 years, and the cost of training nearly reach 10 million. The pilot also needs to carry out training when there is no rescue mission, and the training time is far more than the rescue time. The

different type of aircrafts or different ways of training, make the cost of training different, for example if pilots go to France or Australia for simulate machine training regularly, the cost is about 20-50 thousand per hour.

Speaking from the building of rescue flying service team, regardless of how many aircrafts they own, rescue flying service team must improve the organization and professional team, not only the pilots, but also the maintenance staff, air traffic controller and other flight security personnel, which means a perfect rescue flying organization system. Taking the safety construction as the top priority in the flight team, everything would be focused on the building of security.

4.1.5 Reserve Plan: Establish Training Mechanism and Strengthen Cultivation

Lastly, training scientifically is good at the search and rescue. The ability and experience of the coordination commander of search and rescue organization is related to the ability to develop the scientific search and rescue program, and whether s/he can scientifically and reasonably deploy rescue efforts. The rescue effectiveness and efficiency in the rescue on-site are related to the command personnel quality, the rescue skills of personnel at scene are related to whether she or he can quickly and effectively to do rescue. In view of the fact that in the China Maritime Search and Rescue Organization, the actual search and rescue skills of the command coordinator or commander at the scene, limited by their knowledge and experience in sailing, would have obvious differences. So that the search and rescue personnel training mechanism need to be built, and the cultivation of special search and rescue teams also need to be strengthened.

Establishing maritime search and rescue personnel professional training and

education mechanism; and establishing the cross training mechanisms of search and rescue center, maritime, rescue, salvage, rescue flying teams and other search and rescue departments, further improving coordination and the extent of understanding between the units in the process of search and rescue; strengthening the training and exercises of non professional rescue force but which often participate in search and rescue operations, and making the professional skills training and exercises of search and rescue to volunteer teams; strengthening the professional skills training of rescuing special ships, including the professional skills training of rescuing large passenger ships, tankers, dangerous chemical ships in distress; and the investment of maritime search and rescue training facilities should be increased (Zhou, 2006).

Above all, the cultivation of the maritime search and rescue team mainly contains the following contents: the establishment of the professional training and education mechanism for marine search and rescue personnel. Improve the level of organization commanders and on-site coordinators in professional search and rescue, improve the rescue skills of rescue personnel on-site, strengthen the search and rescue skills training for maritime crew in particular. At the same time, strengthen the psychological training for rescue personnel. The establishment of the cross training mechanism of search and rescue center, maritime, rescue, salvage, and rescue flying team and so on, which further improve the coordination and tacit degree of each unit in the search and rescue process. Strengthen the professional skills training for rescuing special ships, organize learning knowledge of the *International Transport of Dangerous Goods Regulations*, and strengthen the professional training of fire extinguishing and other aspects of chemicals ships. So that to improve the professional level of maritime search and rescue.

4.2 Suggestions for Improvement of Social Rescue Force

4.2.1 More Training and Publicity for Social Rescue Force

Social forces are very important forces of maritime search and rescue. China Maritime Search and rescue center statistics show that, the proportion of dispatched social force implementing rescue accounted for around 2/3 over the years. According to Shandong and Tianjin Maritime Bureau, the number of social forces to rescue people in distress has reached 70 percent. Therefore, we should encourage social forces to participate in the maritime search and rescue.

We should strengthen the training and exercises of the non professional rescue forces but who are frequently participate in search and rescue operations, as well as the professional skills training and exercises of the search and rescue for the volunteer team. We should also strengthen the publicity and training of rescue awareness to the staff involved in maritime rescue, improving the reorganization of the relevant personnel about maritime search and rescue. With media publicity, we promote “Chinese wisdom”, in better way of the implementation of maritime search and rescue.

4.2.2 More Reward and Compensation for Social Rescue Force

Due to the particularity of the maritime search and rescue, even the advanced search and rescue countries in the west can not guarantee the strength of professional rescue assistance can fully cover all areas, maritime search and rescue still can not be separated from the support of social forces. While the compensation of social forces mainly has the following four forms: the first is enough government funding for search and rescue; the second is the rescue association mechanism which can raise

capital; the third is a perfect insurance compensation mechanism, the damage loss of rescue can be compensated by the insurance companies; the fourth is support by the measures of social donation and tax deductibility of government. While in this regard, our country and part of the local maritime department have already arranged special funds to reward the social forces with outstanding contribution in the maritime search and rescue operations at present, which has a great affirmation and encouragement to the social forces who participate in maritime search and rescue, and achieved good results, to a certain extent it encourages social forces to participate in search and rescue. But most of the local government did not arrange special funds to reward the social forces participate in the maritime search and rescue operations. So that the maritime search and rescue center at all levels still have to go through the ways of publicity, report, discussion and so on, introducing the situations of search and rescue, the practice and experience of other local government, the influence of maritime search and rescue operations, the importance participation of social forces to these local government.

Considering the role of social forces in the maritime search and rescue operations, learning from the successful experience of the developed countries, our country should actively promote to establish the compensation mechanism of maritime search and rescue operations which could encourage the social forces' participation, central government and local government to arrange some special funds to reward and compensate the social forces to participate in maritime search and rescue operations, making sure that all parts of the country have special funds which are used to compensate and reward social forces to participate, and expanding the scope of the special fund compensation, increasing the intensity of compensation. At the same time, exploring the establishment of the search and rescue fund system, through the search and rescue fund incentive and compensation to reward social forces in the

maritime search and rescue operations, the search and rescue fund sources can include government funds, corporate sponsorship, the donor community and so on.

Chapter 5 Conclusion and Prospect

This paper studies the main problems in the maritime search and rescue in China, and discusses the measures to improve the capability of maritime search and rescue. Firstly, the paper introduces the domestic present state of maritime search and rescue, and the advanced foreign experience on foreign search and rescue. Secondly, focusing on rescue laws and regulations, search and rescue resources allocation, the command and coordination, social forces rewards and compensation of our country, the paper systematically analyses and evaluates the state of maritime professional and civil search and rescue, and analyses the main problems in the process of search and rescue in depth. Finally, the key points such as the optimization and allocation of professional and civilian search and rescue resources, the organization command, the reasonable dispatch of rescue forces and other key problems of the maritime search and rescue in our country are put forward and given suggestions. This paper can further strengthen the understanding of the concept of scientific marine search and rescue, and has important reference and guidance for maritime search and rescue in China. Specifically, the main points are as following:

5.1 Emergency Rescue as Public Service

The government takes the leading role in China's maritime search and rescue, each search and rescue operation needs to call for government public resources and

private resources, which would spend a lot of social costs. How to properly invoke a variety of search and rescue forces, optimize the limited rescue resources, realize the most effective rescue by the most appropriate and reasonable cost, improve the ability of maritime search and rescue, these problems still need to be studied. And also the requirement for sustainable development of marine emergency rescue work. At the same time, the maritime search and rescue operation has a lot of uncertainty, the danger and risk of rescue must be considered.

5.2 Immature China Search and Rescue

Although China has joined the various conventions of maritime search and rescue, after many years of accumulation, the maritime search and rescue have made some certain achievements. However, due to China's specific national conditions, the laws and regulations, social compensation, search and rescue methods have not yet been fully connected with the international rails. In another way, as the domestic rescue resources are relatively scattered, and the coordination command mechanism has failed to be effectively integrated, the ability of maritime search and rescue has no longer met the needs of marine economic social development, it is urgent to strengthen the research of improving the capability of maritime search and rescue, using the reference from the rich experiences of American maritime search and rescue, research the countermeasures of improving the capability of maritime search and rescue with the actual national conditions, to guarantee the modernization of offshore operations and strengthen the preservation of maritime rights and interests.

5.3 Problems of Research and Rescue

For the universal problems of China's maritime search and rescue, there is urgent

need to tackle the problems, on one hand the departmental rules and search and rescue work guidelines can be the breakthrough point for perfecting the laws and regulations construction, developing reserve plans and commander serving qualification system, improving the rescue compensation scheme and so on, on the other hand there is need to plan reasonable layout of search and rescue resources, strengthening the training of search and rescue teams and emergency drills mechanism, updating marine, land force and air force rescue equipments variously.

5.4 Practical Meaning

The practical meaning of the research lies in: by absorbing the advanced experience of maritime search and rescue from developed countries, we may enrich the research the target and countermeasures and improve the ability of China Maritime Search and rescue. For the further development of maritime search and rescue strategy which are suitable for national conditions, we need to improve the efficient utilization of search and rescue resources in all aspects, enhancing the level of China's maritime search and rescue, providing a solid guarantee for the construction of maritime power.

5.5 Countermeasures

The innovation of this paper lies in: combining the goal of building China into a powerful marine country and the country under the rule of law, providing methods and ideas to improve the rescue capability in research, especially in the strength of maritime search and rescue team, making the position and responsibilities to professional and civil search and rescue forces clear. At the same time, especially in the arrangement of legal system, some researches should be done with the actual

difficulties in the process of maritime search and rescue.

5.6 Limitation and Prospect

The limitations and the future prospects of the research: related to the complex sea conditions, each area has some differences, for example the Bohai Sea is domestic inland sea, there is no problem of sovereignty, which needs to pay more attention to the environment rescue; South China Sea involves larger sovereignty dispute, which needs pay more attention to the issue of sovereignty.

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