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WORLD MARITIME UNIVERSITY

Dalian, China

**CHINA'S MARITIME SEARCH AND RESCUE
MANAGEMENT SYSTEM FROM THE
PERSPECTIVE OF CRISIS MANAGEMENT**

By

ZHONG PENG

The People's Republic of China

A research paper submitted to the World Maritime University in partial

Fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE

(MARITIME SAFETY AND ENVIRONMENT MANAGEMENT)

2018

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 Dissertation: **China's maritime search and rescue management system from the perspective of crisis management**

Degree: **MSc**

With the rapid development of shipping industry, the number of ships is increasing rapidly, and frequent maritime traffic crisis has also brought challenges to Chinese government. On one hand, because of the instability and complexity brought about by shipping industry development, sudden crisis event is intensifying; On the other hand, with the rapid development of information technology, Chinese government also optimize the processes of various maritime traffic crisis events. However, due to different economic, political, social and cultural traditions, different countries have established different maritime search and rescue management system because of different national conditions.

On the basis of collecting a great deal of literature, this paper selects Chinese maritime search and rescue management system as research object, analyzes present situation, existing problems and reasons of maritime search and rescue management system in China, and expounds the development trend of maritime search and rescue management system. By learning experiences from developed countries, this paper puts forward some suggestions on the construction of China's maritime search and rescue management system with Chinese characteristics, so as to provide necessary theoretical basis and practical support for our government to build a dynamic, digital, comprehensive, specialized, coordinated, systematic maritime search and rescue management system.

KEY WORDS: SAR, crisis management, one case three system

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LIST OF ABBREVIATIONS

MRCC	Maritime Rescue Coordination Centre
MRO	Mass Rescue Operation
OSC	On-Scene Coordinator
MSI	Maritime Safety Information
MRSC	Maritime Rescue Sub-Centre
ACO	Aircraft Coordinator
AIS	Automatic Identification System
VTs	Vessel Traffic System
SAR	Search And Rescue
IMO	International Maritime Organization
SARS	Severe Acute Respiratory Syndrome
MH370	Malaysian Airline Flight 370
IAMSAR 1	International Aviation and Maritime Search and Rescue
SOLAS	Safety of Life at Sea
USCG	United States Coast Guard
RCG	Royal Coast Guard
ICAO	International Civil Aviation Organization

CHAPTER 1

INTRODUCTION

1.1 Research background and significance

China, with more than 18000 kilometers of continental coastline, has a vast sea area of about 3 million square kilometers of territorial waters. It is a country with frequent natural disasters and various kinds of crisis. Especially after 21st century, maritime crisis is becoming more complex, which makes maritime SAR management face many new challenges. Meanwhile, the public pay more attention to maritime SAR management. This requires us to scientifically analyze the new opportunities and challenges of China's maritime SAR management to create a suitable system for China's special laws.

1.1.1 Research background

In recent years, with the continuous promotion in such areas as information, network, market, and international trade, the marine transportation industry in China has developed rapidly. As a result, the number of ships is increasing, the scope of fishing vessels is spreading, the scale of major offshore projects is gradually expanding. At the same time, it brings about the problems of global warming, deteriorating marine environment. With the wide-use of new technologies, nuclear energy, electronic networks, modern products such as high-end materials, traditional emergency management system has become more and more difficult to cope with crises under the new circumstances(Li,2010).Crisis can be grouped in very serious, serious and less serious. Very serious accidents are sinking of ship, accidents with fatal victims, as well as accidents causing solemn damage to the environment, such as the spread of oil or chemicals. Serious accidents are fire, collision, grounding, other serious maritime casualty or accident caused by a technical fault in vessel. Less serious accidents are other rigorous maritime accidents and incidents (Bilal,2017).According to statistics ,

in 2017, Ministry of Transport handled 196 serious emergencies, 190 people missing, 80 shipwrecks, 280 million yuan in direct economic loss. These numbers illustrate that current maritime traffic safety supervision takes great responsibilities for heavy-loaded emergency tasks.

Years	Search and rescue action	Dispatch boat	Dispatch aircraft	Rescued ship	Rescued personnel	Life-saving success rate
2011	2177	8600	402	1721	18712	96.7%
2012	1954	7316	352	1508	16329	96.7%
2013	2169	7515	386	1750	20712	96.79%
2014	2014	7477	297	1484	15387	96.6%
2015	1887	6626	318	1248	13728	93.38%
total	10201	37534	1755	7711	84868	96.1%

Table 1.1: Specific situation of Chinese maritime search and rescue work during the period of 12th five-year.(data source :press conference on maritime search and rescue in China 2011-2015)

How to construct a scientific and reasonable maritime SAR management system, which integrates emergency elements such as personnel, institutions, systems, operations, resources, knowledge, and technology etc, and enhances coordination between these emergency elements deserves more governments attention and scientific research. In 2006, on the basis of experience learned from SARS, Chinese government has formally proposed to build China's emergency management system in accordance with the overall requirements of "one case, three systems"."One case" means formulating and revising emergency plans; and "three systems" means establishing and improving the emergency system, mechanism and legal system (Xue,2003). However, the new-born China's maritime SAR management system inevitably exposes some shortcomings and weaknesses, including the short of professional rescue forces, the prior-risk identification, the communication and coordination between different departments, and the inactive participation of social force. In general, current maritime SAR management system can not fully meet the needs of rapid development of maritime economy. Therefore, we need to study from

the perspective of public crisis management the deficiencies and problems existing in the current maritime SAR management system in China, and learn successful experiences from developed countries so as to construct Maritime SAR management system with Chinese characteristics.

1.1.2 Research implications

(1) Theoretical significance

According to modern emergency management theory, a complete government emergency management framework should be composed of two parts: first, a complete process and work content when pre - crisis , crisis and post - crisis, and there is a relatively sound legal guarantee; Second, a clear responsibility, unified command, division of labor and coordination. This paper focuses on maritime SAR management system with "one case, three systems" as the top structure. It can be said that the system is a highly integrated system ,it not only solves the problem of the whole process management on maritime SAR, but also solves the problems of institutional mechanism and related legal system construction. This framework fully reflects the latest trend of modern maritime SAR emergency management theory research, and illuminates this paper to study the weak links in the current maritime SAR management system in China. On one hand, with regard to serious lag on maritime SAR management education in China, this paper puts forward some suggestions on how to further improve maritime SAR management system by using crisis management theory. On the other hand, by learning from advanced models of developed countries, the author points out that maritime SAR management has its particular features. Therefore, in addition to learning relevant theories from western countries, it is necessary to construct maritime SAR management system with Chinese characteristics.

(2) Practical significance

Since 2006, the government has formally put forward the construction of emergency management system in accordance with overall requirements of "one case, three systems". Maritime SAR management system has gradually become dynamic, digitized, integrated and specialized. Government's ability to cope with maritime accidents has been fully enhanced. However, with the development of society and technology, maritime emergency situations become more complex, which often causes widespread public concern and serious social consequences. For example in 2014,"MH370" and "Sewol incident" shocked international community, the impact of its consequences has gone far beyond management capacity and control available in most countries (Shan,2011). This directly causes many countries to think about the mode of their maritime SAR system. How to provide rapid rescue for ships in distress and minimize disaster losses when maritime events occur? The purpose of this paper is to use crisis management theory to propose solutions for above problems.

1.2 Literature review

As an important function of government public management, crisis management has drawn more and more attention from governments and researchers, especially in 21st century. With the rapid development of crisis management, relevant theories research are gradually maturing. In the next part, the author will make a literature review on crisis management research.

1.2.1 Status of research abroad

In ancient times, due to low level of productivity and backward technology in human society, people did not know enough about nature and often seemed powerless in face of crises. The research on crisis management by foreign researchers originated in the field of enterprise crisis. It mainly describes crisis situation faced by enterprises:(1)problems encountered by enterprises are becoming more serious.(2)enterprises are closely supervised by the press and government.(3)Problems

handicap normal operations of enterprises.(4)problems damage good images of enterprises.(5) problems influence enterprise survival.

In 1962,"Cuban Missile crisis" erupted, researchers explored public crisis from international conflicts in political field and achieved some results. For example, in 1969,Charles Hermann first introduced "crisis" as an academic concept (Charles,1969).In 1990s,With the end of Cold War, world pattern tends to be multipolar, and traditional political tensions began to ease. At the same time, with the rapid development of economy and society, unsafe factors in social system are increasing day by day, and non-traditional crisis has gradually become the focus of public attention. Accordingly, crisis management also began to enter public sight, governments and scholars extended crisis research to broader public management field. In 1996, American scholar Steven Fink published "crisis management: a plan for dealing with emergencies" , four-stage theory was put forward from medical terms: prodromal, breakout, chronic, and resolution.

At this stage, the focus of crisis research in politics and academia is more inclined to public management, so that governments have made great progress in preventing and responding to crisis, but crisis management has never been given enough attention, people still think that crisis is just a random event, as time goes by, everything will eventually return to normal. It can be said that the study of crisis management in this period is still confined to a relatively narrow field, comprehensive crisis management research has not really developed(Chen,2011).

In the new millennia, terrorists become more rampant. At the same time, due to frequent occurrence of natural disasters, global climate is deteriorating, and the use of new technologies and new energy bring about new threats, which leads to more complicated crisis form. Crisis has been paid more attention by governments and research institutions, and it has gradually become an important field of government public management. As American scholar Michael Lindell pointed out: there are three reasons for the development of emergency management.(1)With the rapid increase of disasters cost in recent years, public awareness of emergencies and disasters has increased;(2)Enterprises realize that disasters can disrupt their operations and even

lead to bankruptcy;(3)In dangerous geographical areas, people are affected by disasters, and emergency managers receive more professional training, emergency management as a profession has been developed (Michael,2007). In recent years, many western scholars have been involved in many fields of emergency management, including politics, economics, management, psychology, sociology, ecology and information science. Crisis management study has developed into a kind of interdisciplinary comprehensive research. From the perspective of the development of foreign research on crisis management, it can be divided into three stages, that is, passive crisis response, preventive risk management, and strategic emergency management.

1.2.2 Status of domestic research

For a long time, the study of crisis management has been marginalized in our country. Until the 1970s, with the occurrence of natural disasters, such as typhoons, floods, earthquakes and other natural disasters, our government and academic circle gradually realized the importance of public crisis management, and scholars began to devote themselves to the research in this field.

From the theory and practical experience of crisis management in China, most of the researches on crisis management are carried out on macro level, and scholars focus on basic framework of system, mechanism and legal system in China. As for micro level, there is little research done. Early study of crisis management started from international political crisis (Zhan,2004). The book entitled "Contemporary International Crisis Research" edited by Pan Guang is the first academic monograph about crisis in China. In "Political Stability in a Changing Society" (1997), Deng Weizhi puts forward that political stability should involve at least four levels: "Order, controllability, coordination, adaptability". Before "9.11" incident in 2001, there are also relatively few monographs on government public crisis management. In 1994, Dr. Wei Jianning published "Crisis and Crisis Management". In 1996, Professor Wang Guixiu put forward the initiative of establishing crisis management for the first time

in crisiology. These are relatively influential early papers on public crisis management (Jiang,2007).

With the large-scale outbreak of SARS virus in 2003, Chinese government was relatively weak in responding to major disasters. The existing mechanism of crisis management has been infinitely magnified by many shortcomings and weakness, which directly lead to government and academic circle to turn more focus on public crisis management. From 2003 to 2017, there were 28942 related papers, the study of public crisis management in China has entered a rapid development period.

On November 1, 2007, Chinese Emergency response Law came into effect, which marks the establishment of a comprehensive crisis management system with "one case, three systems" as the core. In 2008 , our country experienced snow disaster in the south and Wenchuan earthquake, which forced government and academic circles to re-examine the problems existing in emergency management system."Public Crisis Management" edited by Wang Hongwei; "China Emergency Management: Theory, Practice, Policy" by Tong Xing, Zhang Haibo, a large number of comprehensive books are published, which marks the mature stage of crisis management research in China (Tong,2012).

Generally speaking, the development process of crisis management theory research in China is mainly reflected in: research trend, from crisis response to risk management; research mode, from qualitative research to qualitative and quantitative combination research; research method, from single subject research to multi-disciplinary comprehensive research; research scope, from political field to social field.

1.3 Research ideas and methods

By applying crisis management theory, this paper analyzes historical evolution and development prospects of Chinese maritime SAR emergency system. From the perspective of emergency plans, systems, mechanisms and related legal systems, problems and causes are analyzed as well. By learning advanced experiences from developed countries, we can improve overall levels of maritime SAR in China.

1.3.1 Research ideas

The main framework of the thesis is as follows:

Introduction: research background and significance, domestic and foreign research status, research ideas and research methods;

Theory of maritime SAR management system: theory of crisis Management;

The development, problems and reasons of maritime SAR management system in China;

Experiences of developed countries maritime SAR management system: US, UK, Japan;

Suggestions on improving China maritime SAR public crisis management

1.3.2 Research methods

(1) Literature research method

In the early stage of thesis research, we should focus on collecting and consulting periodical articles, policies and regulations and related electronic materials, so as to fully grasp theoretical research, practice and future trends of maritime SAR management system in China.

(2)Comparative analysis

By analyzing and comparing different experiences in maritime SAR management system between China and developed countries, such as US, UK and Japan, this paper tries to find out the problems and deficiencies.

(3)Investigation research method

Through on-site interviews, expert consultation and other forms of investigation, we can understand the historical evolution and current situation of our maritime SAR management system. This paper finds out the weak links and their root causes in the

construction of maritime SAR management system in China, and puts forward suggestions to solve the problems.

Chapter 2

Concept and Theoretical Basis of Maritime SAR Management System

Maritime SAR is a special form of public crisis. The success or failure of maritime SAR depends on the establishment of a sound management system. This paper holds that a complete maritime SAR management system should include at least the following four aspects: the first is organizational structure with government leading and multiple forces participating; the second is management system with clear main functions, non-conflict and unified command. Third, there should be close cooperation and quick response management mechanism; finally, there should be a complete maritime SAR legal system (Wang,2011).

2.1 Definition of Maritime SAR Management system

This paper studies maritime SAR management system in China from the perspective of crisis management. In order to define maritime SAR management system in a scientific way, we must first define crisis management and maritime SAR.

2.1.1 Crisis management

Crisis management first appeared in the field of enterprise practice and business administration. Bentner first mentioned crisis management in his book "Enterprise Risk Theory". Since then, crisis management has come to public attention (Song,2009). In the 1960s, with the frequent outbreak of natural disasters, technological disasters, conflict crises, public health crises and other crisis events, crisis management gradually infiltrated into enterprises, public sector and various fields of society. Scholars all over the world pay more attention to crisis management and devote themselves to the research of crisis management. "Crisis management" has

increasingly become a hot word of great concern. It is generally believed that the government and other social organizations are the main body of the public crisis management, and the public crisis is the management goal. Before public crisis happened, the government should do the monitoring and early warning. In the process of crisis, the government should make an emergency rescue after assessing. Finally, reduce the crisis loss by restoration and compensation or any other measures (Shuang, 2016).

In our country, there are many documents about crisis management. Zhang Chengfu, Tang Jun, and Xie Yifan defined crisis management as "an organized, planned, continuous and dynamic management process, a series of control actions taken by government at different stages of crisis development in response to potential or current crises." It is concluded that crisis management has the following five characteristics: (1) Timeliness of crisis management; (2) the stage of crisis management process; (3) the compulsion of crisis management means; (4) the professionalism of crisis management techniques; (5) the integration of crisis management.

For the definition of crisis management, various academics have different views, scholars' views are the same in terms of basic characteristics. First, government leadership. Crisis management is a kind of public goods provided to social organizations by governments in accordance with relevant requirements of international conventions or domestic laws. It is an important function of governments (Liu, 2010). In crisis management, government could mobilize all kinds of useful social resources to participate in a series of actions from mitigation, preparation, response to recovery; Second, pluralistic nature of the subject. Crisis management emphasizes "participation of the whole society", including government departments, military, enterprises, non-profit organizations and the public. Third, the comprehensiveness of the content. Crisis management should not only cover all types of accidents, such as natural disasters, accidents, public health events and social security incidents, but also take into account pre-crisis prevention, crisis control, post-crisis recovery.

2.1.2 Maritime SAR

SAR at sea are closely linked, and SAR have different emphasis: search is more focused on the possible location in distress, high requirement of informationization; rescue shows the demand for service effectiveness provided by the rescuer(Liu,2011). Because there is no unified definition of maritime SAR, many scholars try to analyze and discuss the connotation of maritime SAR from different perspectives.

In International Convention on Maritime SAR 1979 and IAMSAR Manual, IMO divides the definition of maritime SAR into two parts,"search is usually coordinated by a rescue coordination center or a rescue sub-centre, using existing personnel and facilities to locate the person in distress; rescue is the recovery of the person in distress and the provision of initial medical care or other necessities to the person in distress, and move him or her to a safe place. "

Chinese regulations on SAR for Life at Sea redefine SAR as: "SAR is usually organized or coordinated by maritime centers at all levels, using existing human resources and facilities to determine the location of persons in distress, rescuing persons in distress, providing them with initial medical, food, communications or other services as required, and transferring them to a safe place. "

Fu Yuhui and Zhu Yuzhu, in "Maritime Safety Supervision and Administration", believe that "Maritime SAR" means any SAR action taken by salvage force at sea after obtaining information in distress, except for this ship. It consists of two parts. sea search means the action of using existing personnel and facilities to determine person position in distress by coordination center or salvage center. salvage means that rescue force can be used to save people in distress and provide them with primary medical or other needs, and move them to a safe place. Because of the continuity of work hours and contents, they are commonly referred to as maritime SAR(Fu,2010).

The first local regulation in China on maritime SAR, Guangxi Maritime SAR Regulation, defines "maritime SAR" as a sudden incident in which a ship fires, explodes, collides, aground, sinks, leaks oil or dangerous chemicals, or casualties or pollution at sea by a civil aircraft , maritime SAR coordinate and direct relevant units

and personnel, determine the location of ships in distress, civil aircraft and persons in distress, rescue persons and prevent water pollution.

In summary, this paper defines the concept of maritime SAR as: after obtaining distress information, maritime SAR agencies, according to lawful duties , organize useful forces to carry out a series of SAR actions.

2.1.3 Maritime SAR Management system

Maritime SAR management is a special form of emergency management. Until now, there are various definitions of emergency management system. There is no universally accepted concept of emergency management system in academic circles. In the paper “Construction of Emergency Management System in China”, Jiang Lan defines emergency management system as: government integrate various resources based on emergency legal system, in view of the nature, characteristics and possible social harm caused by all kinds of emergencies, a working system is established to prevent or reduce the occurrence of crisis.

Zhang Chengfu believe that management system is a government leadership and participation system. Through legal guarantee, various resources support, social assistance and whole process crisis management, the government can be promoted to effectively prevent and eliminate crises, thereby safeguarding public interest and property safety.

In summary, most domestic definitions of emergency management system are defined from organizational structure, operational mechanism, emergency resources, technology and other elements. This paper holds that, as a special form of emergency management, maritime SAR management not only covers the whole process of maritime SAR management, but also involves all levels from high-level management to grass-roots operation. First of all, from the perspective of the participants, it is composed of decision-making system ,auxiliary decision system, executive system and support system. In vertical direction, it may involve different levels from central, provincial to local government; in horizontal direction, it not only includes

government organs, but also enterprises, other social organizations and the public; Secondly, from the perspective of management object, in vertical direction, it includes different levels of maritime crisis; in horizontal direction, it includes all kinds of natural disasters and accidents at sea .From the perspective of crisis cycle, it includes four stages: preparation, prediction, rescue and rehabilitation. It can be said that academia holds different views on maritime SAR management system, but basic characteristics of comprehensiveness, full-stage, integration and hierarchy are generally recognized.

2.2 Theoretical basis of Maritime SAR Management system

In recent years, the problems related to maritime SAR management have attracted researchers' attention. People carry out the research from different views, and have achieved great achievement. This paper attempts to study the maritime SAR management system from the perspective of crisis management theory.

2.2.1 Crisis management theory

Since ancient times, there has been a crisis that has greatly affected the life of human society. In order to take the initiative in struggle against crisis, human beings have been consciously trying and adopting different crisis management methods to deal with different crisis events. However, crisis management has not really developed into an independent field until the outbreak of "Cuban missile crisis" in US and Soviet Union in 1960s. Crisis management gradually attracted the attention of western scholars and as an independent research field, it gradually developed into a more perfect theoretical system. In 1980, Steven Fink's "Crisis Management" is one of the more comprehensive and systematic works on crisis management published in US , in which Fink put forward the "F Model" of crisis life cycle. It is considered that crisis can be divided into four stages: "symptom period", "attack period", "continuation period" and "epidemic recovery period", and the book comprehensively expounds the specific contents of crisis management in different stages.

Fink's four-stage model theory has been widely used in the field of crisis management since it was published. Sturgeon uses "F Model" to explain what measures should be taken by crisis managers to deal with crisis in different crisis stages, and how to improve communication. Robt Heath divided crisis management process into four stages: "reduction", "preparation", "response" and "recovery". The book devoted to risk assessment and management, where he put the reduction phase at the heart of crisis management, it put reduction stage to the core position of crisis management, in which crisis is the easiest to control and the least cost, crisis managers should focus on how to effectively prevent the occurrence of crisis possibility; In preparatory stage, it believes that crisis managers should focus on how to train their staff to cope with crisis, so as to minimize the losses caused by the crisis and return to normal as soon as possible; In response phase, it pointed out that crisis managers should focus on how to effectively use all kinds of limited resources, so that all forces can participate in the crisis, make rapid response to the crisis to prevent crisis from further deteriorating. In recovery phase, it pointed out that crisis managers should start to deal with all kinds of aftercare work, and carry out crisis assessment to improve crisis management regarding the problems and shortcomings exposed in crisis management process.

In addition to representative crisis management theories listed above, there are other widely accepted crisis management theoretical models in academic circles. Xu Bing summarized research achievements of Chinese scholars on the theory of crisis management in "Public Crisis Management in China", for example, system theory, public relations theory, experience theory and comprehensive integration theory. Different theoretical foundations provide new ideas for the theoretical study of public crisis management, from the perspective of future development trend on public crisis management, comprehensive, normative, professional and coordination issues will become the main connotation of crisis management theory in the future.

Chapter 3

Analysis on the present situation of maritime SAR management system

For a long time, China is one of the countries with grave maritime crises. During the continuous struggle against various marine emergencies, Chinese government has accumulated rich management experience, and gradually established maritime SAR management system with Chinese characteristics.

3.1 Evolution and present situation of Chinese maritime SAR management system

The construction of maritime SAR management system in China started in 1973, and promoted especially after SARS incident in 2003. For more than four decades China has gradually established a management system with "one case, three systems" as the core framework. As a complex modern social system, it does not have a long history, but in general, China's maritime SAR management system, especially in emergency plans, systems, mechanisms and legal system construction has made much progress. It has played an important role in dealing with all kinds of maritime emergencies in China.

Aircraft type	numbers	type	numbers	Maximum take-off weight (kg)	Maximum Range (km)	Maximum speed (km / h)
helicopter	17	EC225	4	11000	943	324
		S-76C+	4	5306	1092	287
		S-76C++	4	5306	921	287
		S-76A	2	4767	1092	287
		A365N	3	4000	845	280
fixed wing aircraft	3	Y-12	3	5670	1310	300

Table 3.1: Number and specific parameters of various types of rescue aircraft (source: Ministry of Transport website)

3.1.1 Evolution of maritime SAR management system

Since 1973, maritime SAR management system has experienced the transition from

single department to a multi-sector coordinated emergency management. Its process can be divided into three stages.

stage I :Before 1989: initial stage

After the founding of New China, Chinese government attached great importance to strengthening the prevention from natural disasters, such as floods, earthquakes, typhoons etc. Ministry of Water Resources, State Seismological Bureau, National Bureau of Oceanography, Central Weather Bureau, and other specialized institutions have been established. At that time, our country gradually formed a single emergency management system to respond to emergencies, and the departments almost operated within their own jurisdiction to independently carry out disaster prevention. In 1973, Greek ship, Baltic Krev, was threatened by a typhoon when crossing Taiwan Strait and asked for help. At that time, maritime SAR management system had not been established and China had not been equipped with emergency forces to provide effective rescue to ships in distress. As a result, the ship sank with 14 crew members missing. This incident has aroused international attention and damaged China's international reputation. In order to ensure timely rescue to ships in distress, Chinese government has set up the National Maritime Safety Command, which is composed of Ministry of Transport, Navy, Air Force, National Bureau of Oceanography and Meteorological Bureau. It is responsible for unified command of ships at sea to prevent typhoons, environmental pollution, and salvage of ships in distress. At the same time, Ministry of Transport had set up three specialized maritime SAR departments in Shanghai, Yantai and Guangzhou, with 14 major rescue stations, and 17 ports which provide round-the-clock specialized emergency rescue standby. During this period, China gradually formed a rescue system to deal with maritime emergencies by a single item. The system was mainly composed of government official forces, professional salvage teams and other public forces. At that time, these forces could meet the requirements of salvage at sea. However, social forces are independent of the rescue system, and their role is greatly restricted. In addition, there are a series of problems, such as inadequate maritime emergency forces, backward SAR technology, difficulties in communication and coordination among different

departments. In this period, China maritime SAR emergency response capacity was kept at a very low level.

Besides, from the perspective of legislation, 1974 SOLAS Convention came into force in China on May 25, 1980. China has not yet acceded to the international convention on maritime SAR, until September 2, 1983, when Maritime Traffic Safety Law, the first domestic law on maritime SAR, came into being. In 1985, in order to enhance regional cooperation and communication, China joined 1979 International Convention on Maritime SAR. The lag of legal construction is an important reason for immature development of China maritime SAR management system in this period.

stage II :1989-2005: transition period

At this stage, the development of maritime SAR management system in China has begun to take shape. In 1985, China acceded to 1979 International Convention on Maritime SAR. According to convention requirements, each state Party shall, to the maximum extent possible, standardize the establishment of SAR organizations, shore-based facilities and rescue teams, SAR cooperation and continuous duty of shore station, so as to facilitate direct links between SAR organizations in various countries, and ensure effective cooperation between sea units and air units in SAR action. In order to improve the quality and success rate of rescue operations at sea, in 1989, Chinese government set up China Maritime SAR Center, it is clear that China Maritime SAR Center is responsible for unified organization and coordination of national maritime SAR work. At the same time, "Maritime Safety Command" of coastal areas such as Liaoning, Hebei, Tianjin and other provinces was renamed "Maritime SAR Center." The director of each centre is headed by the provincial governments respectively, and most of their daily work is carried out by corresponding maritime organizations. Their duties remain unchanged, and their business is guided by China Maritime SAR Center. Relevant provincial maritime SAR center has also set up several maritime SAR sub-centers according to actual situation in its jurisdiction. In this way, a vertical three-level maritime SAR network structure , that is, national , provincial and local management, is formed .Three-level maritime

SAR organization are kept on duty for 24 hours a day, so as to deal with maritime emergencies at any time.

During this period, China maritime SAR management system continued to develop. On June 28, 2003, Ministry of Transport separate rescue bureau from salvage bureau, and set up North Sea Rescue Bureau, East China Sea Rescue Bureau and South China Sea Rescue Bureau in Yantai, Shanghai and Guangzhou respectively. In addition, Ministry of Transport has also set up maritime rescue flight team in Dalian, Yantai, Shanghai, Xiamen and Zhanjiang to further improve coastal three-dimensional rescue system. However, in this period, China maritime SAR management system is still immature, there is insufficient social participation, and these forces were unable to form an effective joint effort. At the same time, some problems need to be tackled, including information resources ineffectively shared; imperfect emergency plan, weak practicability, low degree of institutionalization, legislative lag.

Stage III:2005-present: comprehensive development stage

With the development of globalization, shipping industry is developing rapidly , single-sector response to maritime emergencies has become difficult, it is of great significance to optimize organization setting, innovate management mode, improve crisis response ability, and explore a comprehensive emergency management system establishment. In May 2005, State Council had approved the establishment of Joint meeting of National Maritime SAR Ministries, joint meeting system is an important turning point of China maritime SAR management system. Joint meeting consists of 13 departments and units: Ministry of Transport, Ministry of Public Security, Ministry of Agriculture, Ministry of Health, Customs, Civil Aviation Authority, Safety Supervision Bureau, Meteorological Bureau, Oceanic Bureau, Navy, Air Force and Armed Police Force. Since 2006, China maritime SAR emergency management has been built according to "top-level design" of "one case, three systems" emergency management system, and Chinese government gradually formed a comprehensive maritime SAR management system, mainly reflected in the following three aspects: first, from the perspective of forces involved in salvage at sea, due to high degree

complexity and uncertainty of maritime emergencies, salvage at sea need to fully mobilize multiple forces to form an emergency rescue network where self-help, mutual rescue and public rescue exist side by side. National Maritime SAR Joint Conference includes government professional forces, military and armed police forces, government official forces, other social forces and other forces. Second, in terms of content of salvage, including maritime SAR and ship pollution emergency response, it is a kind of management involving high risk of maritime emergency. Third, in terms of the function of institution, preventive work includes formulation relevant policies and regulations, formulation of emergency response plans, and personnel training. Emergency work includes organizing, coordinating, commanding emergency response. It also includes reconstruction after the event. It is a whole process management that includes prevention, disposal, and reconstruction. On January 22, 2006, State Council formally promulgated National Maritime SAR Emergency Plan. The plan clearly put forward the principles of "government leadership, social participation, standardized by law, unified command, level to level response, resources sharing, unity and cooperation, people-oriented, scientific decision-making, rapidity and efficiency". With the promulgation of national general plan, each provincial maritime SAR organization has built a corresponding emergency plan system. For example, in April 2006, Zhejiang Province issued "Zhejiang Province Natural disaster Relief Emergency Plan". In July 2006, Jiangsu Province issued "Jiangsu Province Maritime SAR Emergency plan". In September 2006, Hainan Province issued "Hainan Sea Emergency Plan". The establishment of these plans gradually expands SAR coverage (Wei, 2011).

3.1.2 Status of maritime SAR management system

The existing maritime SAR management system in China began with the reform of national maritime SAR organization in May 2005. After ten years of development, SAR management gradually formed the system of government leadership, level to level response, and social participation.

3.1.2.1 Government leadership

Government is the main body of responsibility and administrative authority of national emergency management, which is responsible for commanding the prevention, response, disposal, rehabilitation and recovery of all kinds of public emergencies. China SAR system is composed of the China Maritime SAR Center, Provincial Maritime SAR Center and local maritime SAR sub-centers. China Maritime SAR Center is subject to Ministry of Transport, responsible for information collection, unified command, comprehensive coordination, policy and regulation formulation, strategic planning, guidance and supervision of national maritime SAR work. Provincial maritime SAR center is mainly under comprehensive management, and it is responsible for organizing, coordinating and directing SAR work within its jurisdiction. At the same time, it formulates local laws and regulations related to maritime SAR. Provincial SAR Center set up Local Maritime SAR sub-center according to actual situation. Local SAR centers mainly focus on micro-management, which mainly plays a role in hidden danger investigation, warning prediction and information reporting, danger disposal, construction emergency teams, implementation of local legislation and regulations. Third - level institutional setup model is very useful for maritime SAR management. At present, China has set up 12 maritime SAR centers in coastal provinces, and set up a water SAR coordination center on the Yangtze River.

3.1.2.2 Level to level response

China maritime SAR management determines response degree according to incident emergency level, that is, the nature, scope, damage degree and development trend of emergency incident. Marine danger is divided into four levels: extraordinary, great, large, general. In order to ensure rescue timely and effectively, "National Maritime SAR Emergency Preparedness Plan" clearly puts forward that "no matter what maritime emergency, the lowest first-level maritime SAR organization in the SAR area of responsibility should first respond".

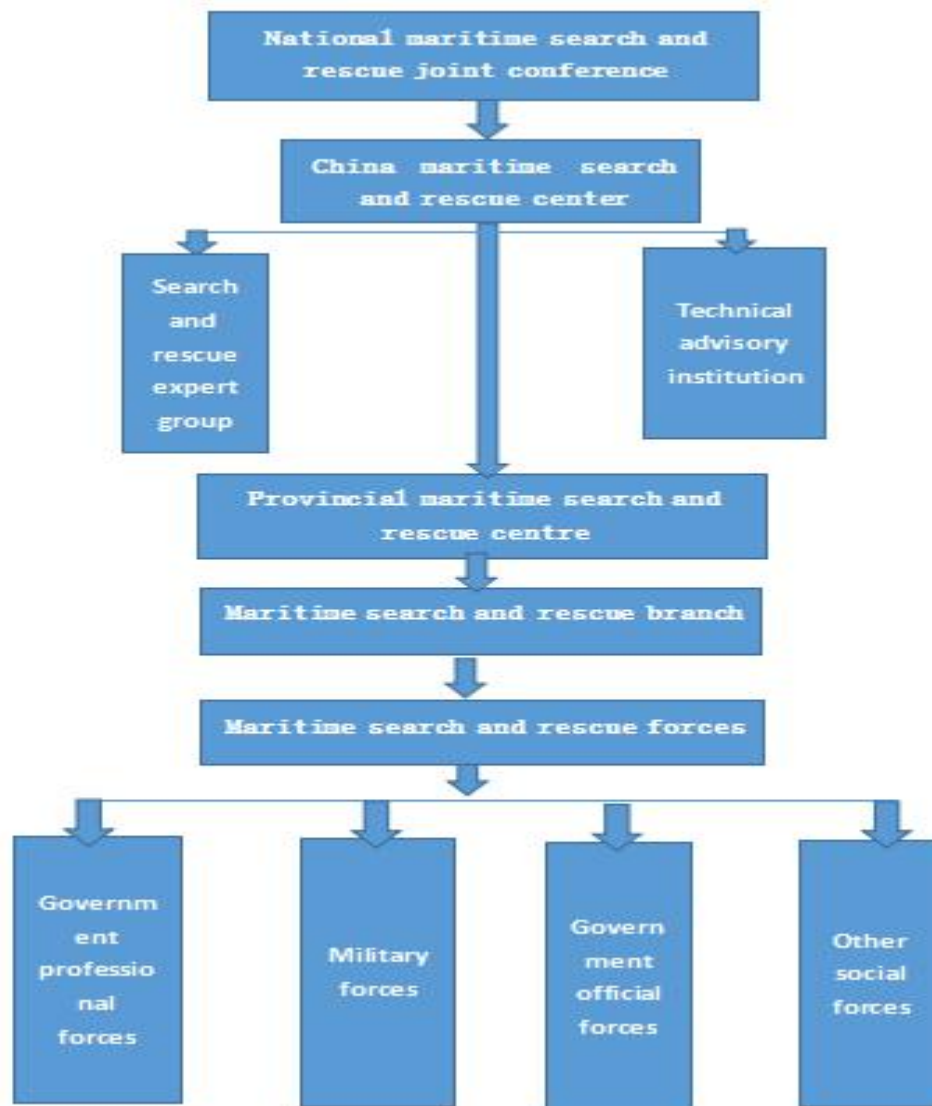


Figure 3.1: Flow chart of China's maritime emergency response

3.1.2.3 Territorial management

In order to improve the effectiveness of maritime emergency response, Chinese maritime SAR management system implements territorial management method. When maritime incidents occur, local maritime SAR centre must take measures to deal with it immediately. Local SAR centre must report promptly to local government and the search and higher level rescue center, coordinate various emergency forces and resources to rescue according to emergency plan requirements. If major events occur, it would request higher level maritime SAR center to handle it directly(Chen,2016).

3.1.2.4 Social participation

According to article 6 of Law of PRC on Emergency response, the state should establish an effective social mobilization mechanism, in order to enhance public safety consciousness and risk-averse rescue capability. Chinese maritime SAR management brings social forces into emergency management system, such as social organizations, enterprises, volunteers and citizens, which form emergency rescue network system with government forces and professional forces. First, it could make up for the shortage of national marine professional team; second, it could help the government to respond quickly and reduce rescue cost; third, it could enhance public safety consciousness and self-rescue skills. However, current system also has many imperfections, such as lack of relevant legal system, lack of unified norms for public participation in salvage, inadequate social forces equipment and low level of personnel specialization, insufficient funding guarantee and compensation mechanism.

In summary, maritime SAR management system has gradually realized the combination of government management and social governance, from Management by man to management by law, from static management to open dynamic management. A new maritime SAR management system based on government-led integration of multiple forces is basically formed.

3.1.3 Development direction of maritime SAR management system

After nearly 30 years' continuous development, great progress has been made in the construction of maritime SAR management system in China, and emergency management system with "one case, three systems" as the core has been basically established. However, with the transformation of administrative functions and continuous technique innovation in our country, existing maritime SAR management has many problems that need to be further considered. I think, the basic ideas of developing Chinese maritime SAR management system are: dynamics, digitization, integration, specialization, coordination, performance and systematization.

Perfecting the emergency plan system according to dynamic and digital requirements

Maritime crisis events change rapidly. It is difficult to solve all problems with designed action plans. Maritime SAR emergency system construction can be carried out in two steps. The first step is to institutionalize emergency system; the second step is to optimize the emergency system. At present, the framework of maritime SAR emergency system is basically formed in China. Perfect dynamic and digitization requirements is the only way to improve the effectiveness of emergency system. By establishing the database of marine emergency resources, it is helpful to realize information sharing, resource integration, and risk analysis, and ultimately improve the practicability of emergency system.

Promoting emergency management system construction according to the requirements of integration and specialization

Marine rescue actions need to fully mobilize all forces, which requires SAR center to have good comprehensive coordination and rapid response ability. If we only rely on official forces and professional power to deal with it, it will result in high administrative cost and inefficient rescue (Wang,2005). According to international experience, unified command is a popular trend of improving maritime SAR management ability in the world. At present, Chinese maritime SAR resources are very poor-organized, in accordance with the requirements of integration and specialization, we should clarify the responsibilities of leading departments, and other relevant departments should provide the necessary support and coordination.

Perfecting Emergency Management Mechanism according to the requirements of coordination and performance

At present, China's maritime search and rescue management mechanism still has poor external coordination ability and insufficient social mobilization ability. Therefore, it is necessary to further improve maritime search and rescue management mechanism and

strengthen communication. In horizontal direction, we should strengthen the internal relationship between SAR center and member units, command department and executive department. In vertical direction, it is necessary to straighten relationship between national and local authorities, and realize rational distribution of power in dealing with maritime emergencies. In addition, our country has advantages of "the Whole Nation System", we can effectively mobilize and respond quickly to resolve the crisis events, but it is easy to overreact regardless of cost, resulting in waste of resources. Therefore, the establishment of a scientific and reasonable performance evaluation mechanism for maritime search and rescue is beneficial to promote the growth of management ability.

Perfecting legal system of Emergency Management according to systematic requirements

Maritime search and rescue management must rely on legal means to adjust the relationship between the parties in a state of emergency. China has basically established legislation at the national level based on maritime traffic safety law, port law, emergency response law, marine environment protection law, territorial sea and contiguous zone law, however, there are cross regulations and conflicts in relevant laws and regulations, and there is a lack of unified command basis in dealing with maritime emergencies. Therefore, perfecting legal system of maritime SAR management and using law system to standard relevant departments, which is useful to rapid and effective mobilization resources during emergency.

3.2 Main problems in China Maritime SAR Management system

3.2.1 Inadequate use of crisis management theory in maritime SAR

In recent years, with national attention to maritime SAR management, related theoretical research has made great progress, which has greatly promoted the construction of maritime SAR management system in China. However, compared with developed countries, there is still a certain gap. On one hand, basic research is

still insufficient. At present, theoretical research on maritime SAR management in our country is relatively lagging behind. Risk management, performance management, emergency information management, emergency resource management in SAR management still lack profound cognition. Without a systematic theoretical system, it is impossible to provide strong support for sustainable development of SAR work, so it is urgent to carry out targeted basic research(Liu,2005).

3.2.2 lack of practicability of maritime SAR emergency plans

There are some weak links in Chinese maritime SAR emergency plan system: first, lack of necessary risk management. In order to fully understand risk initial form, evolution path and expected consequences, it is necessary to comprehensively evaluate the risk so as to form a scientific and reasonable allocation scheme of emergency resources. Second, the executive operation of emergency plan is not effective. When dealing with maritime emergencies, there are still interference in law enforcement. Instead of relying on the implementation of emergency plan, we rely too much on authority to coordinate actions of all departments.

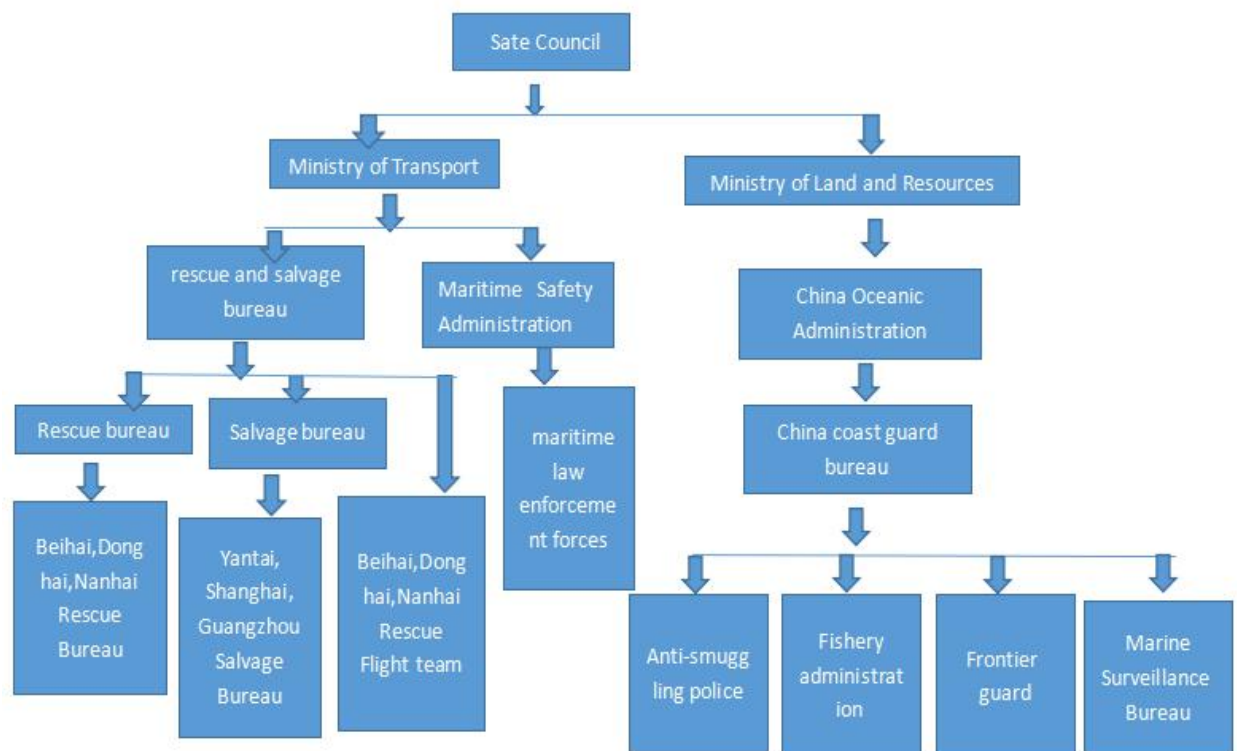


Figure 3.2: National maritime emergency management institutions

3.2.3 legal system for maritime SAR lagging behind

Although China has issued a series of laws and regulations related to maritime SAR management, most of which are relatively independent. In dealing with maritime emergencies, there is a lack of a unified command basis and procedural norms, while some provisions in other comprehensive laws and regulations are not operable. In addition, relevant legal system is not clear about the compensation of rescue funds and the rights and responsibilities of each salvage subject.

Name of law	Scope of application	Applicability
Maritime traffic safety law	Marine crisis early warning, ship and life distress rescue	stronger
Port law	Emergency response to Port crisis	general
Emergency response law	Emergency early warning and response	strong
Marine environment protection law	Early warning and disposal of Marine Environmental pollution	poor
Territorial sea and contiguous zone law	Traffic control within territorial sea	poor

Table 3.2: The relevant laws and applicability of China's Maritime crisis

3.3 Analysis problems in Chinese Maritime SAR Management System

Deficiencies in Chinese maritime SAR management system are not only the defects of inherent institutional mechanism in government, but also the influence caused by external environment change. In summary, there are the following aspects:

3.3.1 Misunderstanding of maritime SAR work

Based on experience in maritime SAR management, in dealing with maritime emergencies, the first thing is to rely on public self-help and mutual rescue. If person in distress remains calm, it will be very beneficial to control the situation. At present, our government is still lacking in training the public awareness of marine risk,

popularizing common sense of self-rescue and mutual rescue of marine disasters.

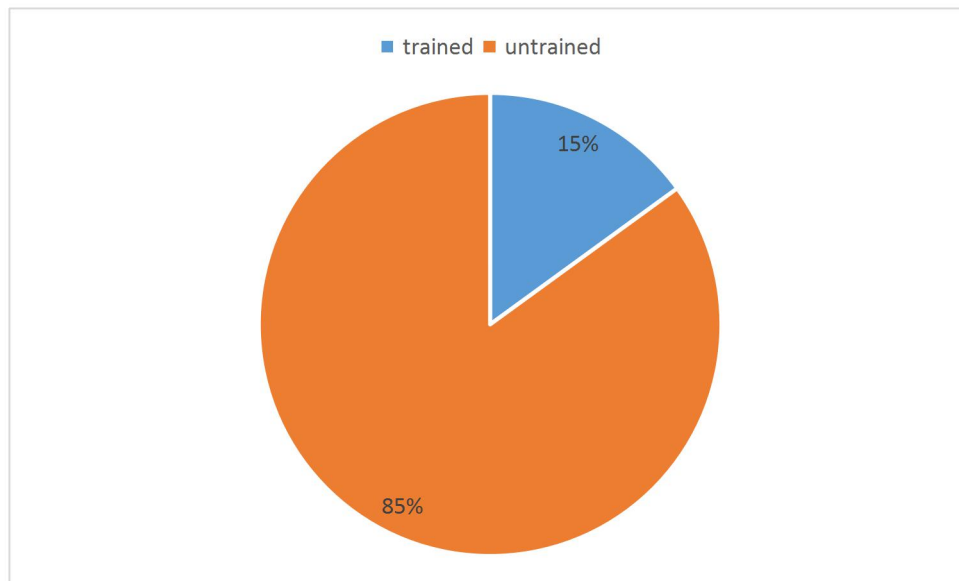


Figure 3.3: Statistics on training of maritime search and rescue volunteers

3.3.2 Increasing complexity of maritime crisis events

With the rapid development of information and network, Chinese maritime SAR management will face many new challenges. Firstly, rapid development of high technology and information industry not only brings much convenience for maritime SAR management, but also injects uncertain factors into marine crisis. In addition to traditional accidental risks, other new risks are emerging. Secondly, in the age of information network, local crisis in any place can break through regional limitation, spread rapidly into public attention, and make crisis situation more difficult to control. Thirdly, maritime SAR has a stronger demand for strengthening international cooperation. In response to "MH370 incident", it revealed that Chinese emergency rescue mechanism is not perfect. Finally, rising public expectations put higher demands on government's ability to deal with maritime crises.

Chapter 4

Experiences of maritime SAR management system in developed countries

Based on the experience of developed countries in dealing with maritime emergencies, most countries rely on the existing administrative systems. It is said that SAR management is universal to some extent. Some advanced experiences from foreign countries have important significance on our country to further improve SAR management system.

4.1 Overview of SAR Management System in Developed Countries

4.1.1 Status of US maritime search and Rescue Management system

US pays more attention to emergency management. Its emergency management organization is relatively sound and fulfills its duties relatively perfectly. The water SAR organization adopts the management mode of "division management, major sectors participation, other sectors support". US divides its national waters into three areas: internal water, offshore and high sea. Internal water is under the control of aviation rescue team sent by Ministry of Defense. National SAR Commission is not responsible for maritime SAR. It is mainly responsible for formulating laws and coordinating federal agencies to complete SAR missions. USCG is a major force in maritime SAR. US also pays special attention to various social forces in the process of emergency management and social service. According to statistics, USCG currently carries out only 4% rescue missions in the country, but with effective mobilization of resources, success rate could reach nearly 99%. Strong coordination not only fully utilized social assistance, but also saved a significant portion of expenditure. In addition, US maritime SAR management has maintained a leading position in many aspects, for example, early warning system construction, emergency resource support, information resource integration, technical support system development and application, institutionalization, and professional training(Cai,2016).

4.1.2 Status of UK Maritime SAR Management system

UK maritime SAR force is mainly composed of government and civilian forces. Government forces are dominated by army and Coast Guard; civilian force is Royal lifeboat Association. Royal lifeboat Guard is responsible for the development of maritime safety and pollution prevention standards, ship SAR, crew management training, ship registration, inspection and certification, and implementation of international maritime conventions. It has 6 maritime SAR coordination centres and 13 maritime rescue sub-centres responsible for three SAR areas (Scotland and Northern Ireland, Wales and western England, Eastern England). Non-governmental forces play an important role in British, about 90% of SAR work is done by social forces each year. Founded in 1824, Royal lifeboat Association is British largest civil society for rescue at sea. It is a charity and volunteer organization, with operating funds from social donations, mainly responsible for the implementation of SAR. The association has 232 lifeboat stations and 59 beach rescue stations throughout the country. More than 5000 volunteer crew members have received strict training and reached a certain professional level (Yang,2007).

4.1.3 Status of Japanese maritime SAR management system

In May 1948, Japanese government established Coast Guard, which includes General Affairs Department, equipment and Technology Department, Ministry of SAR, Ministry of Marine Information, and Ministry of Maritime Transport, mainly responsible for maritime security, maritime traffic safety management, maritime rescue, marine environmental protection and maritime disaster prevention and other responsibilities. In terms of personnel and equipment, Coast Guard has more than 12000 security guards, 514 boats and 75 aircrafts, and powerful three dimensional rescue ability.

Japan attaches great importance to the application of information management technology in crisis management. In information collection and analysis, Japan has established shore-based stations, satellites, remote sensing, radar, ships and buoys and

other monitoring means of full range regulatory networks. VTS center and AIS station have been set up in 86 navigation intensive ports for mastering dynamic information of ship traffic flow and providing accurate and timely data support for maritime SAR emergency operations.

4.2 Learning experiences from developed countries

Developed countries attach great importance to the construction of maritime SAR management system, and have gradually formed a mature SAR system and operational management mode. Their management models and institutional mechanisms have played an important role in the management of risks, threats, crises and disasters at sea. At the same time, their successful experiences are of great significance for our country to deal with maritime emergencies.

4.2.1 Complete organization and multi-party collaboration

Modern maritime crisis events are becoming more and more complex. It is difficult for any one department to respond and resolve crises quickly and effectively, so it is necessary to fully integrate the functions at relevant administrative departments in maritime SAR management. Each country management system and legal system are different, management mode and operating mechanism have different characteristics, but it is the common practice to establish a network of organizations with unified leadership, multi-party cooperation and clear division of labor, such as US, UK and Japan. They all have special water SAR agencies, which are responsible for the day-to-day SAR management and coordination during emergency. For example, Coast Guard in US, Royal lifeboat Guard in UK, and Coast Guard in Japan.

4.2.2 Perfect legal system

US has always attached importance to crisis response according to domestic legislation or relevant international conventions, and has formulated hundreds of laws and regulations, which forms a complete legal system involving federal law, federal

regulations, and administrative orders. The existing laws applicable to maritime SAR management include general laws and special laws, such as National Security Law, National Emergency Law, Federal disaster reduction Law and disaster Emergency Assistance Law; special laws such as Maritime Law, Merchant Shipping Law and Civil Aviation regulations. In addition to domestic legislation, US has also acceded to relevant international conventions, for example, 1974 SOLAS Convention, MARPOL Convention, ISPS Code. These conventions can be equivalent to national law as an important basis for maritime SAR management. Japanese maritime SAR management laws are also relatively complete. At present, there are more than 200 laws and regulations on emergency management(Cheng,2011).

4.2.3 Emphasizing whole process management and prevention

Maritime SAR management in developed countries is not only a response to emergency, but also an emphasis on closed-loop emergency management covering risks, threats, crises and disasters. For example, Japan's Law on disaster response fully embodies the model of whole process crisis management. The law makes clear provisions on the formulation of disaster prevention plan, disaster emergency response and post-disaster reconstruction countermeasures, and stipulates that all departments shall formulate disaster prevention plans, and conduct training and improve facilities according to disaster prevention plans; governments at all levels should constitute disaster countermeasures before and after disasters. By formulating a unified strategy, a unified emergency plan, a unified operational mechanism and a unified resource support system, effective preventive measures can be taken against the weaknesses in management, and it can greatly improve the maritime emergency response capacity.

4.2.4 Professional education and training

US has developed educational and training institutions involved in maritime SAR. Its national SAR training Center is the first training institution specialized in SAR

activities in the world. It can provide special training for all kinds of personnel. Coast guard academy is one of the existing institutions of higher learning in the United States. Training facilities are complete and coast guard personnel can receive formal emergency education and training. There are currently six other specialized training centers and one emergency training center in US. These institutions have a mature system to meet the demand for professionals. In addition, US Government conducts "National Security month" in June of each year, and popularizes disaster knowledge and self-rescue skills to the public through various forms. Japan is one of the most serious natural disasters in the world. Tsunamis, typhoons and rainstorms pose severe challenges to Japanese maritime SAR management. Therefore, Japan set up maritime security school. Japanese Government has also designated September 1 of each year as "disaster Prevention Day". On that day, disaster prevention exercises will be held throughout the country to improve government officials and the public's ability to respond to disasters. UK maritime SAR team is highly specialized. At present, UK has a relatively small number of coast guard personnel engaged in maritime SAR, but it has a large number of volunteers. Public servants and volunteers for maritime rescue are required to receive specialized training. Only after obtaining qualification certification can you participate in SAR mission at sea. In UK, regular assessment mechanisms are established to ensure that volunteers have appropriate professional knowledge and business skills.

Chapter 5

Suggestions on perfecting China Maritime SAR Management system

5.1 Improving maritime SAR as required by crisis management

According to statistics in recent years, Chinese maritime emergencies have the characteristics of high frequency, wide range, great influence and high public concern, which cause great losses to the safety of people's lives and property, and also bring great challenges to government departments. This requires us to further research and

apply maritime SAR related theories, in order to enhance marine disaster prevention capabilities.

5.1.1 Strengthening the guidance of crisis management theory to maritime SAR

Although China has made some progress in research of crisis management theory in recent years, we must fully realize that more comprehensive research needs to be further delved. On one hand, effective maritime SAR management must rely on national mechanism and legal system to achieve. Although developed countries have fully applied crisis management theory to maritime practical work, and formed a relatively mature system, some good experiences are worth learning. However, each country has its own historical tradition and political system, their maritime SAR management system also embodies its own special law, so we should not copy it completely. At the same time, with the continuous reform of service-oriented government in China, traditional maritime SAR management system still has some problems in the aspects of function, organization, mechanism, which need to be improved under the correct guidance of theory. On the other hand, a complete maritime SAR management framework should cover three processes: pre-crisis preparedness, crisis management and rescue, post-crisis recovery. System construction and technical support are also based on these three processes to establish. Therefore, in addition to learning from foreign advanced experience, we should focus on the overall framework of "one case, three systems", and construct a maritime SAR management system with Chinese characteristics.

5.1.2 Application of Crisis Management Theory in Maritime SAR

Modern public crisis management emphasizes government's leading role. Once an emergency occurs, government can effectively mobilize all forces and resources in a short time to minimize negative impacts of disasters. In recent years, with the widespread application of crisis management theory, maritime SAR management

system and operation mode in our country are becoming more powerful in dealing with all kinds of marine emergencies, and also accumulated valuable experience for further improving SAR management level. However, there are still some weak links in Chinese maritime SAR management, for example, a serious tendency to pay more attention to saving person in distress than preventing crisis, low social participation, volunteer team construction lagging behind, low degree of institutionalization, imperfect communication mechanism etc. Therefore, it is necessary to strengthen the application of crisis management theory in maritime SAR management.

5.2 Enhance the practicability of maritime SAR emergency plans in accordance with the requirements of integration

Formulating emergency plans is to sum up regular practice from historical experience and form a binding institutional provision. Emergency plan is a part of emergency management. Improving the practicability of emergency plan plays an important role in perfecting maritime SAR management system in China.

5.2.1 Increasing risk analysis of emergency plans for maritime SAR management

The role of emergency plan mainly depends on three closely linked elements of risk identification, resource allocation and action procedures, with risk analysis being the first step. Only by accurately identifying risk nature, possibility and seriousness can we take effective preventive measures according to every weaknesses in risk management. At present, Chinese maritime SAR emergency plans generally have unclear positioning and lack of basic data needed for risk analysis, which leads to the less scientific nature of the current system. Therefore, by constructing marine risk database, we should accurately grasp the initial form, evolution path and expected effects of risks, so as to eliminate the disadvantages of information island and realize resources integration to the maximum extent (Zhang,2012).

5.2.2 Promotion digitization of maritime SAR emergency plans

The digitization of maritime SAR plans is the application of modern technologies such as computers, satellite communications, electronic information, Internet and GIS to all aspects of emergency plan, thus providing technical support for risk assessment and scientific decision-making. However, we should fully recognize that it is a long way to build a digital maritime SAR emergency plan system, because maritime SAR plan system is a complex system, involving the transformation of government administrative functions, management concept renewal, emergency resource reorganization, operation mechanism reform, legal system innovation, and technology. Under the existing technological conditions, the biggest obstacle to construct digital emergency plan system is derived from government mechanism innovation rather than so-called technical problems (Zhao,2010).

5.2.3 Enhancement of drills for maritime SAR emergency plans

Because of sudden nature of maritime crisis occurrence, emergency plan needs to be adjusted and optimized in order to improve the practicability and maneuverability. Of course, emergency exercise also has its inevitable limitations, because risks and crises are unpredictable to some extent, and emergency exercise cannot actually restore the accident itself. It is difficult to find out the defects in emergency exercise. On one hand, the effective implementation of emergency plan depends on whether relevant elements about emergency plan are well known. On the other hand, it depends on whether relevant stakeholders provide resources and take action as required, and these two aspects need to be realized through emergency exercise. Through regular exercise, rescue teams and the public are widely mobilized to participate actively, so as to enhance the awareness of risk prevention, popularize emergency knowledge, improve emergency response skills and strengthen team cooperation. At the same time, emergency exercise could help us to test whether emergency procedures are reasonable, whether information flow is smooth, and whether action measures are appropriate. During emergency exercise, existing problems would be found, and be

regularly improved according to the change of actual situation, so as to improve the effectiveness of the emergency plan (Ni,2007).

5.3 Promoting the Construction of Maritime SAR Management system according to the requirements of integration

According to the experience of developed countries, when establishing an efficient modern maritime SAR management system, we should attach importance to establishing the organization system in accordance with integration requirements, so as to effectively integrate all kinds of maritime emergency resources, achieving a emergency management organizational structure involving government, military, professional and social forces as a unified command.

5.3.1 Clear command for maritime SAR work

Based on maritime management experience, our country has formed maritime SAR operation mode of "integrating various forces under government guidance ". This mode has great advantages. Under government's leadership, it can quickly and effectively deal with all kinds of maritime emergencies(Huang,2010). However, due to the lack of central authority, collaborated responsibilities between relevant functional departments is not clarified very well. As a result, it is difficult to form an effective communication and coordination mechanism.

5.3.2 Clear management functions for maritime SAR work

The dispersion of maritime law enforcement resources in China is very prominent, resulting in poor efficiency on maritime SAR management. Therefore, we should gradually promote integration development of maritime SAR management system. First, defining SAR management function in the form of law. At present, relevant legal systems are relatively vague about functional orientation of SAR Department. All localities generally rely on emergency plan contents to coordinate multi-party actions. However, emergency plan, as a part of administrative plan, lacks binding

force of law, so it is difficult to form an effective coordination mechanism. Second, combining with the reform of administrative system, we should properly integrate management functions which are still scattered in various departments at present, and establish a highly specified maritime SAR management command organization.

5.3.3 Clear management responsibilities for maritime SAR work

China Maritime SAR Center, as the leading department of maritime SAR, has not been given independent administrative authority by current law. At present, our country has not issued administrative regulations applicable to maritime SAR; performance evaluation and administrative accountability are not clear, which have greatly affected the effectiveness of maritime SAR management. Therefore, according to the principle of "equal rights and responsibilities", we should take system construction as the major task and construct maritime SAR management responsibility system suitable for our country (Zhang,2009).

5.4 Improving maritime SAR management mechanism in accordance with diversified requirements

5.4.1 Improving maritime SAR prevention and preparedness mechanism

Under the existing mechanism, people tend to pay more attention to disaster rescue, rather than disaster prevention. In order to prevent and prepare for maritime emergencies, the following aspects deserve more attention. First, strengthening maritime risk assessment. By accurate risk analysis, we could find weak links, develop prevention policies, increase basic investment and improve disaster prevention standards. Second, perfecting early warning mechanism of maritime crisis. Through continuous monitoring and objective analysis of maritime risk, we could deliver accurate early warning information to the public in time, provide information support for relevant departments to understand crisis state in advance (Zhang,2006). Third, strengthening international exchanges and cooperation. In order to improve Chinese maritime SAR emergency management ability, we should communicate with

other countries in information management, professional training, public education, social mobilization and scientific development so that we can learn successful experiences from western countries.

5.4.2 Improving the rapid response mechanism for maritime SAR management

In order to solve the problem of insufficient regional linkage and poor external coordination capacity , we should integrate marine emergency resources and give maritime SAR authoritative status by law. In addition, crisis decision making mechanism, social mobilization mechanism, volunteer participation mechanism, international cooperation mechanism, emergency fund guarantee mechanism, and information transmitting mechanism also need to be further strengthened.

5.4.3 Establishment of mechanisms for rehabilitation

The occurrence of emergency events is often the coexistence of crisis and opportunity. For a long time, in the process of maritime SAR management, our country has paid more attention to emergency operations in the event, while subsequent recovery and reconstruction have been a weak link, in short of a mature and stable operational mechanism. Therefore, it is necessary to strengthen the construction of recovery and reconstruction mechanism. I think three aspects should be taken into consideration. First, we should improve performance evaluation mechanism by establishing a unified performance evaluation system ,including crisis preparation, response and recovery of each link, personal performance, organizational performance, action performance, project performance and other aspects; Second, we should improve accountability mechanisms and define the subjects, mode, procedures, content and results of accountability. Third, we should improve compensation mechanism by increasing the compensation for active participation in maritime emergency rescue forces. It is relatively easy to arouse their enthusiasm, thus encouraging more social forces to participate in maritime rescue.

5.5 Promoting legislative process of maritime SAR according to the requirements of systematization

In order to perfect operational mode of maritime SAR management in China, we must establish a legal system in accordance with the requirements of systematization, and form a comprehensive supporting law and regulation system.

5.5.1 Promotion national level legislation based on emergency whole process management

National legislature has enacted a number of laws relating to maritime SAR management. For example, maritime traffic safety law, port law, emergency response law, marine environment protection law, territorial sea and contiguous zone law, but there are still differences and even conflicts in some rules due to the lack of link. Based on the whole process of emergency management, three stages should be considered including preparation in advance, disposal in the event, recovery and reconstruction after the event. Therefore, at the level of national legislation, it should be further improved from the scope of authority's powers and responsibilities, division of tasks in participating departments, regional cooperation mechanism, training and education, social mobilization, compensation of rescue expenses.

5.5.2 Formulation local laws based on local realities

The main function of local laws of maritime search and rescue management is to refine and supplement relevant top-level laws. At present, local legislation of maritime search and rescue in most parts of China is still blank. Only few provinces, such as Guangxi, Jiangsu and Shanghai, have issued relevant normative documents. We should encourage other places to formulate specific regulations on maritime search and rescue according to national relevant laws and local realities, so as to make up for the shortcomings of top-level laws as far as possible (Liu, 2012).

As an indispensable component of maritime search and rescue management laws and regulations, local laws should focus on solving specific measures for marine

emergencies from emergency preparedness to emergency response, and then to emergency recovery. In addition, local laws should clarify the functions, power, obligations and contents, steps and methods of their participation in maritime search and rescue management, in order to coordinate the relationship between government, social group and individual in maritime search and rescue management.

Summary and Conclusion

In recent years, focusing on basic framework of "one case, three systems", China has gradually established and perfected maritime SAR management system to a higher level. However, compared with the developed countries, there are still some gaps in the aspects of specialization, standardization, democratization, informatization, standardization, scientization and internationalization.

Based on this observation, this paper tries to find out some problems existing in Chinese maritime SAR management system by analyzing the evolution and present situation and summarizes advanced modes from US, Britain and Japan. The author thinks that different countries have established different maritime SAR management system because of different national situations. On the basis of successful experiences in developed countries, we should explore and construct a maritime SAR system with Chinese characteristics. This paper put forward five suggestions: improving maritime SAR operations in accordance with the requirements of crisis management, enhancing the practicability of maritime SAR emergency plan according to the requirement of integration, promoting the construction of maritime SAR management system in accordance with the requirements of integration, perfecting maritime SAR management mechanism according to the request of diversification, and promoting legislative process of maritime SAR management according to the requirements of systematization. These suggestions surely have a positive effect on the further improvement of maritime SAR management system in China.

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