

## Comparisons Between Various Search And Rescue (SAR) Systems And Their Implications To The Development Of Chinese Maritime SAR System

KONG Fan Cun, GAO De Yi and RUAN Wei  
Shanghai Maritime University  
1550# Pu Dong Da Dao, 200135, Shanghai, China  
fckong@mmc.shmtu.edu.cn, gaodeyi@shmtu.edu.cn, weiruan@mmc.shmtu.edu.cn

### ABSTRACT

Maritime Search and Rescue (SAR) is important for the control of maritime accidents and mediation of damages and losses at sea. Lots of attention has been paid and many efforts have been made by maritime nations to establish and develop their SAR systems.

China has established a SAR system. However, maritime accidents in recent years necessitate research on the further development of such a system. The essay introduces and compares important SAR systems in the world in respect of SAR management regimes, system effectiveness and efficiency, infrastructures and legislation, etc. for the purpose of providing consultancies on further development of Chinese SAR system, benefiting those nations whose SAR system needs to be further developed as well, and finally contributing to safety and pollution prevention at sea.

### Introduction

China has a maritime Search and Rescue (SAR) system in place, which is presently administered by the Ministry of Communications. However, with the fast development of the shipping industry and higher standards of maritime safety legislation, and the maritime disasters sustained in recent years, more efforts should be made to upgrade the system. This essay discusses the progress of achieving such upgrading and how to learn from other SAR systems. All the comparisons done in this paper are on the basis of the analysis of major topics of the US, UK, and Australia SAR systems because they represent a type of SAR system, and are well known for the quality of their SAR capabilities.

## 1. SAR management regimes

### 1.1 Comparison

Maritime SAR is a complicated, highly technical, and professional system, involving different parties such as professional SAR organizations, fishery departments, meteorological departments, army, medical service departments, etc. To reduce the damages and losses caused by maritime accidents, first of all, it is important to have a sound, highly effective and efficient SAR management regime. This will affect whether a system can respond to emergencies fast, follow standard SAR procedures

and therefore assure the success of SAR actions.

In such a regime, the most important thing is to designate an adequately authorized co-ordination and command center to manage the huge SAR system. Most maritime nations have such a center in their SAR system, but the authority and capabilities vary from nation to nation. (See table-1). Next, such a system should have many resources that are available from different aspects for SAR purposes, other than those professional SAR parties or special governmental agencies.

**Table 1** SAR management regimes in some countries

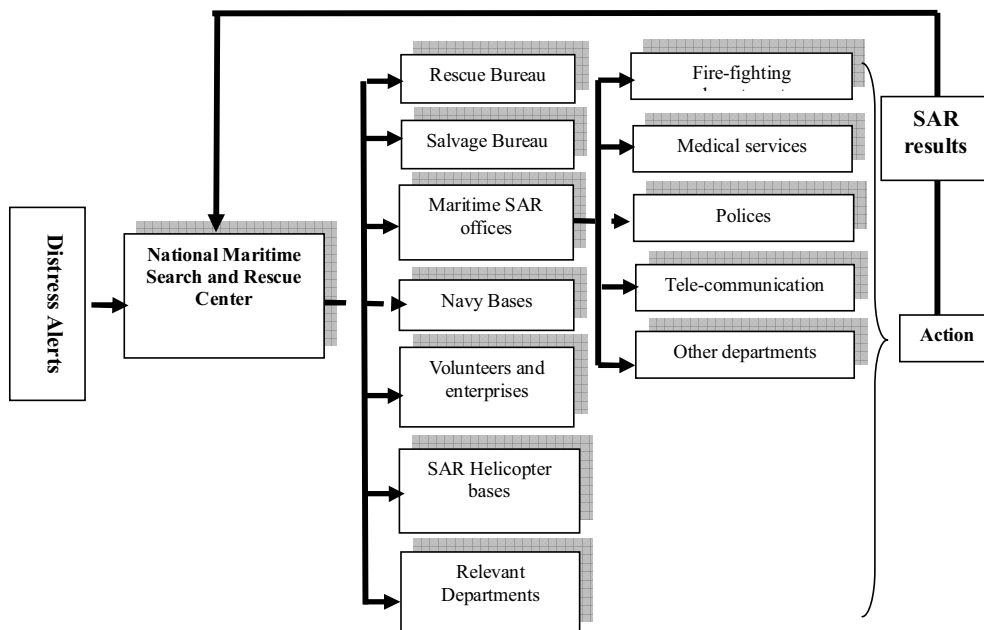
| States    | Co-ordination & command center | Superior                 | Other SAR resources or members which could be co-coordinated  |
|-----------|--------------------------------|--------------------------|---|
| The U.S   | The US Coast Guard             | Ministry of Transport    | <ul style="list-style-type: none"> <li>• The Department of Defense</li> <li>• The Federal communication committee</li> <li>• The Department of Commerce</li> <li>• The National Aeronautics and Space Administration</li> <li>• Land managing components of the Department of the Interior</li> <li>• Other parties in the SAR system via National SAR plan</li> </ul>  |
| The U.K   | HM Coast Guard                 | Department for Transport | <ul style="list-style-type: none"> <li>• Other branches of the Ministry of Transport</li> <li>• The coast guard (MCA)</li> <li>• Civil airlines</li> <li>• The Ministry of Defense, etc.</li> </ul>   |
| Australia | AusSAR                         | AMSA                     | <ul style="list-style-type: none"> <li>• The Department of Defense</li> <li>• Bureau of Meteorology</li> <li>• Australian Customs Service, and other Australian National Agencies via National Search and Rescue council</li> <li>• Resources of coastal states (by making arrangement of Responsibility between the Commonwealth and coastal states)</li> <li>• Volunteer Commercial and Private Organizations based on contractual relationship (commercial airlines, general aviation operators, oil companies, fishing companies, aero clubs, and large landholders)</li> </ul> |

**1.2 Introduction to the Chinese maritime SAR system**

The present maritime SAR system in China is basically under the management of the Ministry of Communications (MOC). The National SAR center is attached to the Maritime Safety Administration, which is under the umbrella

of the MOC. Its main functions are to respond and assign various maritime distress alerts, and to take command of, and co-ordinate SAR operations. The Rescue and Salvage Bureau, which is also under the MOC, is responsible for the execution of maritime SAR and salvage operations. In the year 2003, a reform took

**Table 2** The present maritime SAR system in China



place --- three Rescue Bureaus and three Salvage Bureaus were re-organized. The former takes care of basically life-saving matters and other tasks as assigned by the state. In return, the state government will invest continuously in them. The latter deals mainly with property salvage and other tasks as assigned by the government. However the government only promises financial support for several years following this reform. Those bureaus are under the management of the Rescue and Salvage Bureau.

Table 2 shows the present maritime SAR system in China. The above reform was developed after several maritime disasters that have occurred in recent years such as the sinking of MV DASUN and HEJIANG. In addition to the reform, the Chinese government makes every effort to promote the capabilities of its SAR system. This can be evidenced by a series of activities - joint SAR exercises in the mouth of YangZi River and HongKong, speeding up the establishment of new RCCs and Local SAR offices, etc.

### 1.3 Analysis on the Chinese SAR management regime

So by the analysis above, it is important first of all to have an integrated SAR system, together with a center that has strong capability for co-ordinating and commanding. These are the prerequisites to respond promptly to maritime emergencies, to take proper actions, and to achieve successes of SAR operations.

Most maritime nations have established SAR systems of their own and have designated a coordination and command center. However, the main problem is the capability and authority of such a center. It is easy to understand that the success of SAR operations relies on the performance of, and co-operation between various parties such as the army, fishery administration, and meteorological administration. But the following possibilities may exist and should be dealt with. For instance, those parties, particularly those belonging to different Ministries, are established with their own purposes and benefits and are operated in

their own ways. Their responsibilities in the SAR system may not be clearly defined. The communication between them may be poor. Additionally, during SAR operations, those parties may have to report to their superiors according to their reporting procedures, which may cause delay and negatively affect the results of SAR operations. ...In China, the problems listed above do exist to some extent and the reasons behind them are quite complicated. Poor capabilities and authority of National SAR co-coordinating and command center; lack of maritime SAR legislation; lack of a clear understanding of the significance of SAR by society as a whole, and/or excess bureaucracy are some of the reasons.

Another problem that exists in the Chinese SAR management regime is that the Chinese government must make more of an effort to provide social or private SAR resources. Currently the resources so provided for the SAR system are very few. The reasons could be lack of understanding of the society on the whole and of SAR legislation. Actually, the involvement of those resources is significant particularly when the central government cannot promise large investment in the SAR system.

### 1.4 The prospective ways

Theoretically, the capabilities and authority of a co-coordinating and command center could be secured in the following ways: 1). elevate the level of such a center in the national administrative system, from directorate level to ministerial level; 2). organize a national SAR committee or council, with wide participation from different governments, such as Australia and the USA, 3). delegate responsibilities and authority to the center by means of Maritime SAR legislation and a National SAR plan, such as found in Australia and the USA. Referring to the comparisons done in section 1.1, most of those centers are placed in Maritime Safety Administrations since SAR in itself is very much professional. This indicates that for China, 2) and 3) could be more realistic. In fact, the mechanism for

SAR co-coordinating and commanding in the past in China was something like the way of 2). Taking account of the fact that Chinese maritime SAR needs more legislation, the way that could overcome the present problems substantially is form 3).

As to the utilization of social and private SAR resources, China can do more. The successful experience of Australia can be borrowed in this regard. The future Chinese SAR system shall include individual volunteers, private companies, social associations, etc. instead of particular central governmental resources and professional SAR organizations. The SAR bases can be established and maintained by local governments, private companies, and social associations. This would help to mediate the financial pressure faced by the central government for a huge investment for SAR resources, and would facilitate the establishment of a net of various SAR resources. Based on this, the next step that the central government should do is to optimize the system by making it more rational, more efficient and more cost-effective.

## 2. Maritime SAR legislation

Special legislation for a maritime SAR is particularly important owing to the significance of SAR, the great risks and complex practical operations of SAR, and the benefits of different parities. In the USA and Australia, in addition to maritime conventions and guidance such as the 1979 international convention on Maritime Search and Rescue and IAMSAR, there are many other national rules and regulations regarding SAR that have been legislated, such as the Australia National Search and Rescue Manual, and National Search and Rescue Plan. Such legislation has the following features:

- Wide coverage on SAR matters, covering not only macro SAR system and micro operational procedures;
- Different levels of legislation, including national legislation and professional SAR organization's legislation;
- Clear definitions on the responsibilities of each party.

This legislation ensures a strong SAR system in these countries.

**Table 3** Maritime SAR legislation of USA (other than those international conventions contracted)

|  |
|--|
| ● National Search and Rescue Plan  |
| ● International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual (incorporated) |
| ● The United States National Search and Rescue Supplement (NSS) to the IAMSAR Manual       |
| ● The Coast Guard Addendum (CGADD) to the NSS  |
| ● Local state legislation  |

**Table 4** Maritime SAR legislation of China (other than those international conventions contracted)

|   |
|---|
| ● Maritime Safety law of the P.R.China (1983)   |
| ● Detailed rules of ship emergency communication (1987)                                     |
| ● Rules on the command and co-ordination of maritime salvage (1992)                         |
| ● Rules on the management of divers (1999)  |
| ● Rules on the management of qualifications for the salvage of wrecks and objections (1999) |
| ● Regulations on the Search and Rescue of Aircraft of the P.R.China (1992)                  |
| ● Notices on the enhancement of maritime accident reporting system (2000)                   |
| ● Rules on maritime administrative penalty (2003)   |
| ● Regulations on ship report system (2001)  |
| ● Law of safety production (2002)   |
| ● Rules on the investigation of severe accidents (1989)                                     |
| ● Basis rules of flight of the P.R.China (2001)   |
| ● Rules on the civil air traffic management (1990)  |
| ● Civil Aviation law of the P.R.China (1995)  |
| ● Maritime SAR legislation by coastal provinces   |

**Table 5** Major SAR facilities in some states

| State     | Main facilities   |
|-----------|---|
| US        | <ul style="list-style-type: none"> <li>● Various resources under the command of MRCCs</li> <li>● AMVER</li> <li>● National Distress and Response System --- the Rescue 21 System</li> <li>● All available resources of certain states and local governments, civil and volunteer organizations, and private enterprises</li> </ul>  |
| UK        | <ul style="list-style-type: none"> <li>● 3 shoreline Search Regions, 6 MRCC and 13 MRSC, and many Coastguard Auxiliary Rescue Teams</li> <li>● 4 SAR helicopter stations managed by Her Majesty coast guard, capable of providing aero-nautical SAR services 24 hours a day</li> <li>● 4 Emergency Tug Vessels deployed in high risky sea areas</li> <li>● The Royal Air Force and Royal Navy SAR Helicopters, Maritime patrol aircraft, and others possible aircrafts and vessels</li> <li>● 229 lifeboat stations provided by the Royal Navy Lifeboat Institute</li> <li>● Police, Ambulance, fire and Rescue services, British Telecom, and any other municipal resources</li> <li>● Any other vessel or person who may be able to assist with an incident</li> <li>● ...</li> </ul> |
| Australia | <ul style="list-style-type: none"> <li>● The communication system established conforming to ICAO and IMO requirements. For maritime SAR, mainly relies on the GMDSS</li> <li>● Australian Ship Reporting System (AUSREP)</li> <li>● Torres Strait and Great Barrier Reef (Inner Route) Ship Reporting System (REEFREP)</li> <li>● Other Supplementary Search and Rescue Unit (SSRU)</li> <li>● Local assets</li> <li>● Chartered Private and commercial aircrafts</li> </ul>  |
| China     | <ul style="list-style-type: none"> <li>● 18 RSC allocated along the coast</li> <li>● DSC and Radar Monitoring system for ships</li> <li>● VTS schemes adopted and operated in 16 major ports and the areas nearby</li> <li>● SAR helicopters</li> <li>● A uniform emergency call "12395" along the coast and Yangzhi River</li> <li>● 17 distress alert services at 18 coastal stations</li> <li>● 44 tugs for SAR purpose and 22 vessels for salvage purpose assigned and operated by the Rescue and Salvage Bureau.</li> </ul>  |

While looking at the maritime SAR legislation in China, the problems can be identified as follows:

- It is not integrated and systematic on the whole. Many clauses regarding SAR are isolated and incorporated in different rules or laws;
- Short of SAR legislation in terms of the quantity;
- It is not an issue of high priority in the legislation system, which affects the application thereof;
- Much of the SAR legislation is outdated. (See Table-4).

The Chinese SAR system is thus adversely affected.

Referring to the legislation in USA and Australia, the future Chinese Maritime SAR legislation should cover all SAR activities. The new framework should be topped with a National SAR law or a National SAR Plan,

and should be featured with clear definitions of the responsibilities of those parties involved in SAR, high effectiveness and efficiency, etc. It should focus on:

- The structure of SAR organizations and the management regime;
- The status and roles of professional SAR organizations, army, social associations and private companies;
- Basic requirements on the establishment of new SAR organizations;
- The rights and responsibilities of SAR organizations;
- The investment of the SAR system;
- The compensation, reward, punishment after the completion of SAR operations.

**3. Maritime SAR infrastructures**

**3.1 Comparison**

The extent of the success of SAR relies greatly on the resources put into SAR operations. So it is important to keep SAR facilities in place

in respect of their quantity, types, quality, and functions. The following table indicates roughly SAR facilities in major SAR systems.

### 3.2 Problems and Solutions

Although the Chinese SAR system has already been equipped with basic SAR infrastructure and the government promises to upgrade them continuously, problems still exist when compared with other SAR systems. Even in the circumstance of the said reform, it takes long time to develop a modern fleet, such as:

- Aging and poor technical conditions of professional SAR fleet. The average age of the vessels in the fleet is about 15 years, and some of them can only sail slowly and with low reliability. Meanwhile, the technical conditions of some vessels cannot be secured due to inadequate funding for maintenance and up-keeping;
- Insufficient number of SAR RCCs and bases. For instance, there are only 14 RCCs and 18 bases along 18,000 km coastlines (usually they are located in the same county). The distance between them is on average 1000 kilometers. So it takes by rough calculation about 15-20 hours to reach the distress position. Such a figure may be enlarged in case of rough weather certainly. Therefore currently the Chinese SAR system can mainly provide SAR services to coastal areas, instead of the deep seas;
- Low capability of joint aeronautical SAR operations. Usually such a joint operation requires very good SAR facilities, well-designed procedures and well-trained SAR personnel, and Chinese SAR system needs to develop them all;
- Low mobility and modernization of SAR infrastructures. There is limited number of helicopters exclusively for SAR purpose, and there are few SAR facilities like the DZgRS that Germany is using to put lifeboats/rescue boats into vehicles and transport them to designated places through fast land transportation.

The persistence of the existing problems will no doubt affect unfavorably the Chinese

SAR system' compliance to the 1979 SAR convention and IAMSAR. All of these problems must be settled quickly. Hopefully the Chinese government is now anxious to do something. Again, the recommendation in this respect is to learn about the experiences and practices of successful SAR systems, taking into consideration the realities of each country. By the analysis above, the conclusion is that professional SAR infrastructures must be kept satisfactory in respect to the quantity, quality, and application of high technologies by means of continuous government investment, and other SAR resources from social or private aspects must be kept always available for SAR operations by means of maritime SAR legislation and/or contracts.

### 4. Maritime SAR plan, emergency response procedures and SAR techniques

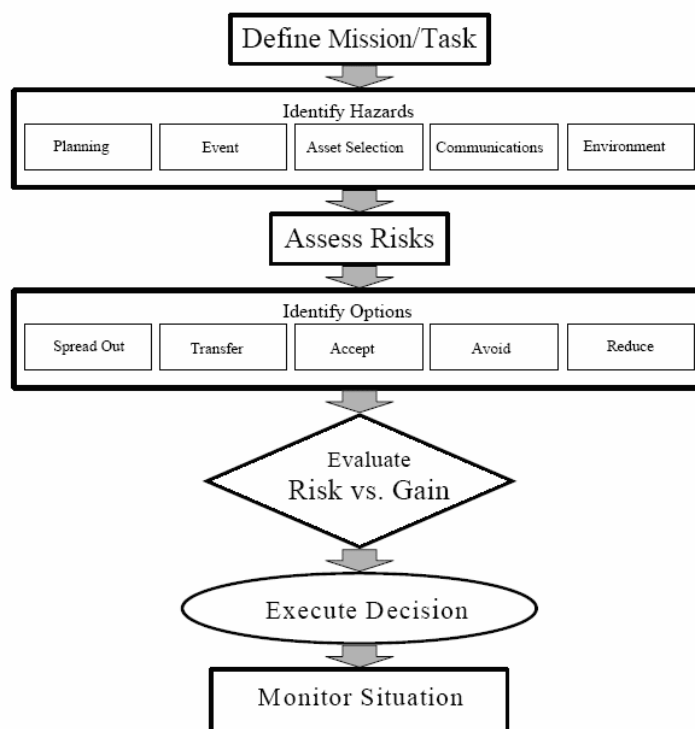
The potential seriousness of maritime accidents requires that a response be made as soon as possible. How quickly a response is made depends on the procedures formulated previously.

Attention must be paid by the current Chinese SAR system to develop a systematic, scientific and reasonable Maritime SAR plan framework. Failing to do this has caused problems in the Chinese SAR system such as low SAR efficiency and effectiveness and even failure of SAR operations. The typical example is the sinking of M/V DASUN in 1999. After this, the Chinese SAR system should re-arrange and optimize, within such a framework, various emergency plans, highlighting different levels of plans, i.e., National SAR plan, provincial SAR plans and individual SAR organizations' plans. Meanwhile, detailed emergency responding procedures should be developed, particularly in respect to pollution at sea, aeronautical accidents, and maritime security. They should be incorporated into those plans or formulated independently as the US and Australia SAR system does. Finally, regular exercises should be done according to those plans and procedures to maintain practical capability of handling maritime emergencies.

Lastly, the IAMSAR handbook as an international guidance has established many SAR techniques. But still the whole effectiveness of using such a handbook depends on the "software and hardware" of a SAR system. It should be stressed particularly that other than those techniques laid down in IAMSAR, the

application of risk management techniques shall be encouraged (see the following table-6, one of the processes for risk management and decision-making required by the USCG's SAR handbook). It will be helpful for the reduction of SAR risks and will ultimately improve the rate of success of SAR operations.

**Table 6** Operational Risk Management Process for Tactical Decision Making (Source: The Coast Guard Addendum (CGADD) to the NSS, p.35)



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### **Comparisons between various Search and Rescue (SAR) systems and their implications to the development of Chinese Maritime SAR system**

#### **KONG Fan Cun**

Mr. Kong Fan Cun spent a few years working onboard ship as senior officer and then as a master when he left the last ship he served. He is a professor in maritime navigational instruments like Radar, ARPA and ECDIS, etc.

He is also involved in many researches in respect of navigational instruments, maritime education and training (MET), and safety management, such as "The establishment of Separation Scheme in Chang Jiang Kou" (from the Shanghai Maritime Safety Administration), "The enhancement of Chinese SAR system" (from the Ministry of Communications), "Investigations on the Chinese MET legislation", etc.

Professor Kong is a postgraduate of the Dalian Maritime University.

He can be reached with following address:

Kong Fan Cun  
Principal of  
Merchant Marine College  
Shanghai Maritime University  
Pu Dong Da Dao 1550#, 200135  
Shanghai, P.R.China  
Email: [fckong@mmc.shmtu.edu.cn](mailto:fckong@mmc.shmtu.edu.cn)  
Fax: + 86 21 6862 0259  
Tel: + 86 21 5028 0188