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WORLD MARITIME UNIVERSITY

Malmö, Sweden

**PRINCIPLES AND PRACTICES TOWARDS SAR
SERVICES: A COMPARATIVE STUDY ON
STATES' APPROACHES TO IMPROVING
MARITIME SAR**

By

WANG CHAO

People's Republic of China

A Dissertation submitted to the World Maritime University in partial
Fulfilment of the requirement for the award of the degree of

MASTER OF SCIENCE

In

MARITIME AFFAIRS

(MARITIME ADMINISTRATION)

2006

DECLARATION

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

The content of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

Title of Dissertation: Principles and practices towards SAR services:
A comparative study on States' approaches to improving
maritime SAR

Degree: MSc

The provision of maritime SAR services is a very practical, rather than theoretical, issue concerning the comprehensive scope of matters including legal responsibilities under relevant international law, suitable SAR resources, communications arrangement, SAR personnel training, SAR management, etc. All these matters are highly sophisticated in themselves; as such the disparity of states' practices regarding these matters is unavoidable.

This paper examines the variety of approaches to providing SAR services adopted in 8 states from 4 regions through a survey which is supplemented by a survey conducted by New Zealand, and a review of the literature, to generalize basic principles and good practices and identify weak areas with the purpose of improving maritime SAR services. A framework covering states' legal framework, SAR resources, SAR training and management is used for comparison. Under this framework, the study indicates that powerful RCCs, making use of all available resources, functional-based SAR training and reducing SAR problems through management, are the general principles which should be followed in an effective SAR system but are subject to changes depending on an individual state's practices.

KEYWORDS: maritime, search and rescue, rescue coordination centre, search and rescue units, communications, management.

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List of Abbreviations

AIS	Automatic Identification System
AOP	Area of Operations
ARCC	Aeronautical Mobile Satellite Service
CCG	Canadian Coast Guard
CCGA	Canadian Coast Guard Auxiliary
CMSA	China Maritime Safety Administration
CNSMM	China National SAR Ministerial Meeting
COMSAR	Sub-Committee On Radiocommunications and Search and Rescue
CRS	China Rescue and Salvage Bureau
DF	Direction Finding
DFO	(Canadian) Department of Fisheries and Oceans
DGzRS	the German Maritime Search and Rescue Service
EPIRB	Emergency Position-indicating Radio Beacon
GMDSS	Global Maritime Distress Safety System
GNI	Gross National Income
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	the International Civil Aviation Organization
IAMSAR	the International Aeronautical and Maritime Search and Rescue Manuals
ILF	International Lifeboat Federation
IMO	International Maritime Organization

IMOSAR	International Maritime Organization Search and Rescue Manual
ISPS	International Ship & Port Facility Security Code
JRCC	Joint (Aeronautical and Maritime) Rescue Coordination Centre
KNRM	the Royal Netherlands Sea Rescue Institution
LRIT	Long range identification and tracking
MAS	Maritime Assistance Service
MERSAR	Merchant Ship Search and Rescue Manual
MET	Maritime Education and Training
MOC	(China) Ministry of Communications
MOU	Memorandum of Understanding
MRCC	Maritime Rescue Coordination Centre
MRSC	Maritime Rescue Sub-centre
MSC	Maritime Safety Committee
NGO	Non-governmental Organization
NLRI	National Lake Rescue Institute (Uganda)
NSA	National Self-assessment
NSSR	Norwegian Society for Sea Rescue
OSC	On-scene Coordinator
PSCO	Port State Control Officer
RBDM	Risk-Based Decision Making
RCC	Rescue Coordination Centre
RNLI	Royal National Lifeboat Institution
RSC	Rescue Sub-center

SAR	Search and Rescue
SART	Search and Rescue Transponder
SAR 79	International Convention on Maritime Search and Rescue 1979
SLA	Services Level Agreements
SOLAS	International Convention for the Safety of Life at Sea
SRR	Search and Rescue Regions
SRS	Search and Rescue Sub-regions
SRU	Search and Rescue Unit
SSAS	Ship Security Alert System
SSRS	Swedish Sea Rescue Society
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended
STCW (F)	International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, 1995
UNCLOS	United Nations Convention on the Law of the Sea
USCG	United States Coast Guard
VTs	Vessel Traffic Services
WMU	World Maritime University

Chapter 1 Introduction and research methodologies

1. Introduction

The history of navigation since ancient times is always accompanied by frequent occurrence of shipwrecks. In the wake of accidents and disasters, the concept of a maritime safety system came gradually to the fore. However, it was not until the adoption of the first Convention on Safety of Life at Sea (SOLAS) convention 1914, which can be considered as the response of the international community to the sinking of the Titanic where more than 1500 passengers and crew members died, that the notion of a maritime safety system came into being. The adoption of SOLAS was also a sign that human life at sea had priority over property, as had often not been the case before.

At the very beginning, the maritime safety system was composed of ships' safety and the safety of distressed people only¹, which was more confined within onboard safety issues. With technological innovations, more and more elements, including maritime search and rescue (SAR), were introduced into the maritime safety system to cope with the increasing risks at sea, due to the greater number, size and faster speed of the vessels engaged in trade thus the higher frequency and the worsening consequences of shipwrecks.

¹ Z. Kopacz, W. Morgas and J. Urban Ski. The Maritime Safety System, its Main Components and Elements. WMU maritime PDF database.

During the relatively short period of time of evolution, SAR has matured as a comprehensive system, which is made up of following functional components², including:

- 1) communications network throughout the SAR region (SRR) and collecting with external SAR services;
- 2) a rescue coordination centre(RCC) for the co-ordination of SAR services, and one or more rescue sub-centres(RSCs) to support an RCC within its SRR, if necessary;
- 3) SAR facilities, including SAR units(SRUs) with specialized equipment and trained personnel, as well as other resources which can be used to conduct SAR operations;
- 4) On-scene coordinators(OSCs) assigned, as necessary, for co-ordinating the on-scene activities of all participating facilities; and
- 5) support facilities that provide services in support of SAR operations.

Among these components, the RCC and/or RSC is the hub to get other components working together to realize the SAR system's objective i.e. to rescue the crew and persons from a ship in distress, and/or to find and rescue shipwrecked persons in as short time as possible. The RCC and/or RSC also takes the overall responsibilities of establishing, maintaining and managing a state's SAR system, including building up the SAR system's capabilities to receive alerts and to co-ordinate and provide SAR services within its SRR.

The SAR system is important in the maritime safety system because the maritime SAR system has long been served as the last shackle of the maritime safety chain since it came into being, without which maritime activities are to be exposed to various dangers and lack a sense of safety. As far as the maritime industry is concerned, the maritime activity is still very risky and the perils of the sea remain omnipresent, and can not be rooted out by man. It could be argued that no matter how the maritime industry tries its best to raise technological standards, an external means of protection or remedy is always necessary. A series of sea accidents can be good examples to show the failures which the maritime industry itself can not

² IAMSAR Manual Volume I, chapter 2 PP.2-1

overcome. For example, the Ro-Ro passenger vessel Al-Salam Boccaccio 98³, which sank on 3rd February, 2006 in the Red Sea en route from Duba, Saudi Arabia to Safaga in southern Egypt, claimed more than 1000 person's lives. Similar tragic cases can be found in various scenarios although some *ex post* measures have been taken to enhance safety.

The SAR system cannot be substituted due to its humanitarian characteristics. Measures adopted by the maritime industries to ensure maritime safety can be categorized as measures to reduce risks such as vessel traffic service(VTS) and measures to reduce the consequences, such as salvage and SAR, of which SAR services was theoretically used as one of the risk control options and was put into the cost and benefit environment⁴. The author argues that the theory of risk-based decision making (RBDM) may not be applicable for SAR issues, particularly in terms of cost and benefit analysis because of its humanitarian characteristics. No matter how expensive it is to provide SAR services in some regions, SAR services must be there, although the capabilities of an individual state's SAR system can be low or high.

Nowadays, the provision of SAR services has evolved into not only an international humanitarian obligation, which is enshrined in the customary practices of navigation such as Good Samaritan and regulated in various international treaties, such as United Nations Convention on the Law of the Sea 1982(UNCLOS 82), SOLAS 1974 and SAR 1979, but also an important element of a safer and more secure environment for a state' development of its economy, particularly with the trend of the movement of urbanization towards coastal areas and more ocean related resources exploiting activities. As stated by Prof. Malek Pourzanjani, "Protecting and saving lives is a macro-economic investment of growing importance and it is a national comparative competitive advantage in global economy"⁵.

³ For further details, see world web site: http://en.wikipedia.org/wiki/Al-Salam_Boccaccio_'98 , retrieved on 20th May, 2006.

⁴ Boisson P. (1999). Safety at Sea – Politics, Regulations and International Law. Paris: Edition Bureau Veritas.

⁵ Pourzanjani, M (2005). Administration, management and training of SAR. Unpublished lecture notes. WMU, Malmo, Sweden.

2. Literature review

Although SAR services cannot be purely used as one of the risk control options in terms of cost and benefit analysis in applying RBDM theory, how to establish and run a SAR system in a cost-effective way without losing the service quality is a question that deserves to be researched and answered. Some states have shown good capabilities of providing SAR services while some other states' SAR services are poor. To meet a state's own SAR needs and the obligations they accept under relevant international conventions, states have shown a variety of practices in providing SAR services, which have offered the opportunity for a literature review. However, there is minimal research and the literature addressing it, although the literature review is not confined to the states' practices only.

To narrow this study's scope, only the most critical elements of the SAR system, namely, a state's national policy on SAR, SAR resources, SAR personnel training and SAR management, are to be examined in this research. However, this subjective arrangement of excluding other elements such as communications does not mean that other elements are less important or less useful⁶.

2.1 Regarding a state's national policy on SAR

A state's national policy is fundamental in establishing SAR services.

The International Aeronautical and Maritime SAR (IAMSAR) manual, which was jointly developed by the International Civil Aviation Organization (ICAO) and IMO, has provided guidelines for a common aviation and maritime approach to organizing and providing SAR services. The manual has been reviewed continuously by the annual conference of the Sub-Committee on Radiocommunications and SAR (COMSAR) and amended several times. Although it is recommendatory, most states follow it. However, the IAMSAR manual is so general that it cannot give users a better and easier understanding. For example, it gives sample legislation in

⁶SAR communication has been largely improved since the adoption of GMDSS in 1998 and it has matured in recent years. Only some parts of GMDSS will be discussed in this paper.

Volume I with some simple clauses. The author has the perception that this may not be the case in practice since a SAR authority needs quite a lot of other inter-agency resources and support.

At the regional level, seminars, workshops or conferences have been organized in world wide regions such as Chennai (India), Fiji and Manila, Africa, the Baltic Sea, the Caribbean area and the South Pacific region. The outcome of these regional activities have usually been reported to and discussed at COMSAR meetings. These regional SAR meetings mainly focus on self-assessing states' own SAR service capabilities and discussing regional co-operation issues, but not so much comparison has been made to identify general national policies on providing SAR services which could benefit other SAR services as well.

Capt. Sven-Åke Wernhult has reviewed the obligation of ships to respond to distress messages and signals from other ships in danger and the roots of current international practices in SAR⁷. In his paper, he describes very comprehensively the general obligations of both flag states and coastal states laid down in the relevant international conventions. However, some of the articles and/or provisions such as those in the SOLAS and SAR 79 conventions have been recently amended or changed substantively; therefore his paper needs to be updated. Moreover, his research does not go deeper into the area of how contracting states give effect to these international conventions in practice.

2.2 Regarding SAR resources

SAR resources are the primary means with which a SAR authority heavily relies on providing SAR services. The IAMSAR manual Volume I states that “a SAR system can be created without dedicated SRUs”, but how to do it is unanswered. Dan Lemon argues⁸ that responsibilities to assist persons, vessels, or aircraft in distress are based on humanitarian considerations and are very well established international practices; therefore all available resources should be used by the SAR

⁷ Wernhult, S. Maritime Search and Rescue, WMU Alumni Journal 1999. PP.80-86.

⁸ USCG, Search & Rescue, Search and Rescue Responsibilities: the Big Picture. Proceedings of the Marine Safety & Security Council. Fall.2004.PP.35

authority to discharge such responsibilities. This is a good argument but fails to answer how to make relevant SAR resources available to SAR authorities practically.

2.3 Regarding SAR personnel training

SAR personnel training covers a wide range of training matters, including different training requirements for various posts from new entries to SAR top managers, training curricula, training assessments, etc.

As far as SRUs' crew are concerned, International lifeboat Federation (ILF⁹), together with the German Maritime Search and Rescue Service (DGzRS), the Royal Netherlands Sea Rescue Institution (KNRM), Norwegian Society for Sea Rescue (NSSR), Swedish Sea Rescue Society (SSRS), the Royal National Lifeboat Institution (RNLI, UK), developed "*A Common Standard of Training for Maritime SAR Unit Coxswains, Mechanics & Crew Members*"¹⁰. This common standard is based on STCW(F) but deletes references to fishing and substitutes with items specific to SAR and makes other such amendments as are deemed necessary to cover all the operational aspects of SAR specialized tasks. It could be suggested that this common standard be used as a recommended minimum base for the training of all crew members manning maritime SRUs, minus the limitations arising from the units.

Regarding the training of shore-based personnel, the IAMSAR manual has provided a list of what contents are to be covered in training generally, but how to train and assess is still obscure. The "*SAR Training—Team Leader Handbook*"¹¹ did touch on some important elements including leadership, situation management, health and safety as well as rescue law such as duty of care, but it can not be ranked as a formal training guide. In states' own practices of SAR personnel training, there are some arrangements on SAR training; however, most of them are not carried out in a

⁹ ILF has changed its name as the International Maritime Rescue Federation (IMRF).

¹⁰ ILF, *A Common Standard of Training for Maritime SAR Unit Coxswains, Mechanics & Crew Members*, November 2002.

¹¹ 2003-2005 SAR Training-ST-002-01V2.2

formal way either. Generally, SAR training can be argued to be a blurred area which needs to be researched.

2.4 Regarding SAR management

Some research projects relevant to this research which have been initiated by individual states are discussed as follows.

An article by Capt. Dee Norton, “*Benchmarking the Coast Guard’s Search and Rescue System Against the World’s Best*”¹², studied 5 countries’ RCCs “with the goal of improving U.S SAR controllers’ SAR planning, watchstanding and competence by learning how other worldwide leaders accomplish the same in their SAR program”. This research provided a good view on world leading maritime states’ RCC staffing standards by examining their training and workloads. Obviously, it was coloured with USCG’s own demands and only addressed some parts of the RCC issues.

A comparison of the SAR boat fleet in the UK and USA is made by Capt. Dean Lee¹³ in respect of the coxswain and crew qualification process, response boats, research and development, maintenance philosophies, training and professional development, and operations, etc. Some best practices regarding managing the boat fleet from both countries are highlighted. This comparison is very heuristic in SAR boat management but incomprehensive in terms of considering SAR services as a whole.

UK conducted research into assessing the operational effectiveness of HM Coastguard coordination centres over the period 1995-1998 before closing some MRCCs in order to improve the overall efficiency of the Coastguard SAR services¹⁴. This research discusses the principles of determining the number and distribution of

¹² USCG, Search & Rescue, Always Ready for the Call. Proceedings of the Marine Safety & Security Council. Fall.2004.

¹³ Capt. Dean Lee, Two Countries, Two Boat Forces, One Common Cause—Who leads the pack? Search & Rescue, Always Ready for the Call. Proceedings of the Marine Safety & Security Council. Fall.2004.

¹⁴ Lord Donaldson of Lymington, Review of the Five Year Strategy for HM Coastguard. 1999

SAR coordination centres along the UK coastline in respect of maximum coverage, RCC's work load, acquiring local knowledge and flexibility in the delivery of the SAR services, etc. It could be argued that these principles are also beneficial for other states when considering and establishing their domestic SAR infrastructure although a lot of the UK's own special considerations, such as coping with rapidly increasing leisure activity during the summer season are embedded into this research.

Other SAR projects, such as improving and utilizing SAR techniques like night vision goggles, optimal SRUs allocations, mass rescue operations, AIS's impact on SAR services, etc, are very helpful in improving SAR system performance but are commonly narrowed to a specific subject which cannot reflect the big picture of a SAR system.

Generally, the multifarious states' initiatives provide the opportunity of probing into common principles that can benefit others in providing SAR services, although some defects exist.

3. Purpose of this research

By targeting these most critical elements of the SAR system in representative states from North America (USA, Canada), Europe (Denmark, Sweden, Germany, UK) and Asia (India and China), this research is intended to examine and generalize the principles of establishing and running a SAR system under the relevant international law framework, such as SAR 79 and SOLAS, to compare and analyze how the SAR services are provided in these countries, to benchmark their performance, then to draw conclusions on how to maintain and improve the quality of SAR services.

To assist this process, the following objectives have been established for study:

- To examine the legal obligations imposed on states under relevant international instruments as well as customary law
- To survey states' practices of fulfilling their obligations
- To investigate and evaluate their practices in the light of SAR principles
- To identify the weak areas of maritime SAR services

- To probe into possible solutions to enhancing formal maritime education and training (MET) regarding SAR personnel

For these purposes, the study is structured with four main chapters based on the previous literature review.

Chapter Two studies the legal obligations of providing SAR services under various international laws, and compares the ways of how the states discharge such obligations through their SAR system. States' national policies regarding the basic elements of the SAR system such as RCC structure, interagency cooperation arrangements and international cooperation are examined. The objective of this chapter is to show what a good national policy for SAR should be.

Chapter Three analyzes SAR resource related issues, of which SRUs, being the most important one, are discussed. States' options of primary SRUs are compared and the possible reasons of such options are analyzed. Based on the survey, the ways of acquiring SRUs are generalized to provide a basic understanding of how to make scarce SAR resource available for SAR authorities.

SAR training is discussed in Chapter Four. Compared with merchant ship crew training, some salient features of SAR personnel training are identified and the functional requirements of main posts in the SAR operations including SCs, SMCs, AOCs, OSCs and SRUs commanders are prescribed. States' practices of training on SAR personnel are also examined and compared in this chapter.

From the management point of view, Chapter Five discusses the problems that could influence SAR performance, including the issues of RCC establishment, staffing standards, communications arrangements, the policy of charging for SAR services, and refuge at sea.

Obviously, this study is practical rather than theoretical. Many of the findings and statements in the study are practice-oriented then followed by the author's own observations and opinions. The study is intended to provide many of the SAR organizations in the world with a clear picture of how SAR services are conducted in other countries. It is hoped that the whole SAR community will gain mutual benefits from considering the ways in which SAR services are provided in other parts of the

world and learn from each other so as to enable them to run their own SAR services effectively. To compare states' practices in providing SAR services and generalize on some common principles can be very helpful in achieving such goals i.e. to improve the quality of SAR services.

4. Research methodologies

One of the major tasks of this research was to conduct a survey to collect states' practices on the provision of SAR services in order to analyse and generalize what would be the best approaches. Therefore, a questionnaire¹⁵ based on the national self-assessment (NSA) on SAR in appendix H of IAMSAR manual Volume I was designed and distributed to targeted states. The questionnaire mainly covers four aspects of SAR services: national policy, SAR resources, SAR training and RCC management issues. Before this questionnaire was sent out, a test on the questionnaire had been carried out by inviting some World Maritime University (WMU) students to respond to this questionnaire and collecting their comments and feedback to redesign the questionnaire. Their comments are quite helpful and valuable in respect of clearness and the difficulties of relevant questions, the time-consumption of answering the questionnaire, and the possibilities of getting back the response. After being tested and redesigned, a sample questionnaire was sent out to DGzRS to request evaluating and nominating suitable contact candidates to facilitate collecting the data. DGzRS made a rapid response to the questionnaire so that it was released to targeted states very quickly.

All the targeted states responded to the questionnaire promptly and provided valuable data. The data from China is based on the author's own collection except for several items which are obtained through the contacting person in China MRCC. Among the seven candidates who answered the questionnaire, six of them are current SMCs or administrators and the other one is the executive director of DGzRS. Therefore, there is no ground to suspect the validity of the data provided by them.

In order to compare the results of the survey and increase its credibility, the questionnaire was also sent to other states which were not considered in this

research. The survey is also supported by New Zealand maritime RCC, who just finished its SAR System Resourcing Survey in the beginning of 2006. References is also made to these survey results but used as second hand materials only.

Based on this survey, a qualitative research method is used to clarify states' legal responsibilities and identify the principles in providing SAR services, whereas a quantitative method is also used to assess maritime RCC's efficiency and effectiveness through relevant SAR statistics analysis. To make the statistics analysis easier, a series of common parameters are established to put targeted states' practices on the same benchmark.

Some critical issues which may influence the SAR system's effectiveness and efficiency are examined through reviewing and comparing states' practices, or discussed with SAR experts. Some SAR cases are examined to illustrate SAR system performance and identify its weaknesses.

¹⁵ See the appendix.

Chapter 2 Legal Framework on SAR

2.1 Introduction

One of the oldest forms of humanitarian tradition at sea is the practice of ships responding to distress messages and signals from other ships in danger. This long-standing maritime tradition lays an obligation on those who may safely do so without imperilling their own vessel, passengers or crew to assist those in peril of the sea. This customary duty imposed on ships or ship masters is further expanded, and then passed to states, which is required to provide SAR services under various treaty laws.

2.2 Review of international legal frameworks on SAR

The legal responsibility regarding SAR defined in international instruments mainly involves two areas: coastal states and flag states. Coastal states are obligated to provide SAR services as a government duty while flag states' responsibility usually is transferred to the master whose ship flies their flag, to proceed to distressed targets, wherever they may be and no matter whom they are, to give necessary support.

2.2.1 Salvage Conventions 1910 and 1989

The Brussels Convention on Assistance and Salvage of 1910, Article 11 states the tradition of brotherhood at sea as follows:

“Every master is bound, so far as he can do so without serious danger to his vessel, her crew and her passengers, to render assistance to everybody even though an enemy found at sea in danger of being lost”.

A new Convention on Salvage was adopted in 1989 to replace the Brussels Convention. This new Convention also imposed the duty of ship master to render assistance. Article 10 says that:

“Every master is bound, so far as he can do so without serious danger to his vessel and persons thereon, to render assistance to any person in danger of being lost at sea”.

Further, the Convention prescribed the states parties shall adopt the measures necessary to enforce this duty and the owner of the vessel shall incur no liability for a breach of the duty of the master due to render assistance.

2.2.2 The Law of the Sea

The obligation to render assistance to persons in distress at sea is also codified in other international conventions, firstly in the Convention on the High Seas, which was adopted by the United Nations in 1958. Codifying customary international law, Article 12 of the 1958 High Seas Convention states:

“Every state shall require the Master of a ship sailing under its flag, in so far as he can do so without serious danger to the ship, the crew, or the passengers,
to render assistance to any person found at sea in danger of being lost;
to proceed with all possible speed to the rescue of persons in distress if informed of their need of assistance, in so far as such action may reasonably be expected of him;
after a collision, to render assistance to the other ship, her crew and her passengers and, where possible, to inform the other ship of the name of his own ship, her port of registry and the nearest port at which she will call.”

“Every coastal state shall promote the establishment and maintenance of an adequate and effective search and rescue service regarding safety on and over the sea and -- where circumstances so require -- by way of

mutual regional arrangements cooperate with neighbouring states for this purpose.”

Article 98 of UNCLOS 82 states similarly to the High Sea Convention 1958 the obligation of the flag state as well as that of the coastal state.

2.2.3 SOLAS Convention

SOLAS Convention 1974 as amended which currently has 156 contracting states, whose tonnage comprises of 98.79% of the world's total tonnage¹⁶, is the most important maritime safety instrument. Regulations about SAR appear mainly in Chapter V. Safety of Navigation¹⁷.

Regulation 7 on Search and Rescue Services states that:

“Each Contracting Government undertakes to ensure that necessary arrangements are made for distress communication and co-ordination in their area of responsibility and for the rescue of persons in distress at sea around its coasts. These arrangements shall include the establishment, operation and maintenance of such search and rescue facilities as are deemed practicable and necessary, having regard to the density of the seagoing traffic and the navigational dangers and shall, so far as possible, provide adequate means of locating and rescuing such persons”.

Paragraph 3 of Regulation 7 regulates that:

“Passenger ships to which chapter 1 applies shall have on board a plan for co-operation with appropriate search and rescue services in the event of an emergency. The plan shall be developed in co-

¹⁶World web site: http://www.imo.org/Conventions/mainframe.asp?topic_id=247, retrieved on 15th June, 2006.

¹⁷ Other parts of SOLAS also regulate some aspects or issues which are quite relevant to SAR issues such as GMDSS. For further detail, please refer to SOLAS convention.

operation between the ship, the company, as defined in regulation IX/1, and the search and rescue services. The plan shall include provisions for periodic exercises to be undertaken to test its effectiveness. The plan shall be developed based on the guidelines¹⁸ developed by the Organization”.

Continuously, Regulation 8 requires Contracting Governments undertake to arrange that life-saving signals are used by SAR facilities to communicate with ships or persons in distress when conducting SAR operation. Regulation 21 requires that all ships carry an up-to-date copy of Volume III of the IAMSAR manual on board. Regulation 33 describes the obligations and procedures for merchant ship masters when they are responding to a SAR case or request SAR services for themselves, saying that the “master of a ship at sea which is in a position to be able to provide assistance, on receiving information from any source that persons are in distress at sea, is bound to proceed with all speed to their assistance, if possible informing them or the search and rescue service that the ship is doing so.”

Although the obligation of a ship to go to assist other ships in distress is enshrined, as earlier mentioned, as a moral obligation, a tradition, and an example of brotherhood at sea, as well as the coastal states’ obligation of providing SAR services, is regulated in various international treaties such as SOLAS, there is, until the adoption of the SAR convention¹⁹ in 1979, no international legal framework covering SAR operations. In practice, before the adoption of SAR 79, big differences existed in SAR operations. Therefore, a special international convention was badly needed to lay down basic principles and rules regarding SAR matters.

2.2.4 SAR 79

SAR 79 entered into force on 22nd June, 1985. Before the adoption of SAR 79, the co-ordination and control of SAR operations were organized by each individual

¹⁸ Guidelines for preparing plans for co-operation between search and rescue services and passenger ships on fixed routes were issued in MSC/Circ. 864.

¹⁹ Currently it has 86 contracting states, representing 52.33% of world tonnage, see http://www.imo.org/Conventions/mainframe.asp?topic_id=247

country in accordance with its own demands and its own resources. This resulted in national organizational plans being developed along different lines. Dissimilarities of plans and a lack of agreed global procedures created many difficulties, particularly at the initial stages of an alert. Consequently, the uneconomical use of SAR resources and, sometimes, duplication of efforts were very often the result. To harmonize the different practices of individual states, SAR 79 was created to adopt international procedures which were required to be followed by contracting states. It was designed to improve existing arrangements, to provide a framework for carrying out SAR operations at sea and to develop an international SAR plan so that no matter where an accident occurs, the rescue of persons in distress at sea will be coordinated by a SAR organization and, when necessary, by cooperation between neighbouring SAR organizations. These arrangements and framework were further supported by introducing GMDSS as a mandatory requirement in SOLAS. The harmonized procedures, framework regulated in SAR 79, together with GMDSS Master Plan, have depicted the big picture of SAR framework at the international level.

Chapter II of the Annex to SAR 79 lays down state Parties' general duties. Paragraph 2.1.1 states that:

“Parties shall, as they are able to do so individually or in co-operation with other states and, as appropriate, with the Organization, participate in the development of search and rescue services to ensure that assistance is rendered to any person in distress at sea. On receiving information that any person is, or appears to be, in distress at sea, the responsible authorities of a Party shall take urgent steps to ensure that the necessary assistance is provided”.

Other basic principles regarding delimitation of SRRs, establishing and running national SAR system, etc, are also prescribed in the Convention.

Following the adoption of SAR 79, the world's oceans were divided into 13 search and rescue areas, in each of which the countries concerned are required to delimit

their respective SRRs for which they are responsible. Most, but not all of permanent or provisional search and rescue region lines were mutual-agreed during a series of regional conferences held around the world. However, due to the considerable obligations imposed on Parties such as setting up the shore installations, the implementation of SAR 79 experienced a slow process.

To facilitate and guide states Parties as well as their ship masters to follow SAR 79, two manuals (IMOSAR manual and MERSAR manual) were respectively published so that SAR operations could be conducted with maximum speed and efficiency. However, the effectiveness of SAR operations depends almost entirely on how well SAR 79 is implemented and in turn the implementation largely relies on the action taken by Parties themselves. Subsequently, with the development and change of maritime technology, the IMOSAR and MERSAR manual has been replaced by IAMSAR manual, published in three volumes covering Organization and Management, Mission Co-ordination, and Mobile Facilities, which are used by the majority of SAR services worldwide.

Today, SAR 79 together with SOLAS 74(GMDSS and some parts of Navigational Safety) which has established a basic legal framework of SAR should ensure the successful rescue of persons in distress at sea. However, the quality of SAR services is heavily dependent on the individual state's commitment and their practices. In some areas, there are well-established SAR organizations which are able to provide assistance promptly and efficiently, while in other areas there is nothing at all. In between, many states are in bad need of improving their SAR services, not only to fulfil their obligations under relevant international conventions, but also to foster a better social environment to develop their economy.

Conclusively, the ship is under a duty to search and attempt a rescue when the master knows or in the exercise of reasonable care should have known the situation²⁰. This duty has become customary practice which are codified in the UNCLOS 82 and reflected in various international instruments as well. As far as

SAR services are concerned, similarly, states parties to these treaties (taking SAR 79 as an example) are obligated to make necessary arrangements on SAR under their respective national legislation i.e. to give full effect to these instruments and to provide SAR services in their SRRs.

2.3 National policies on providing SAR services

2.3.1 Proposed framework for the comparison of states' policies of establishing and providing SAR services

SAR 79 has laid down similarly rigid obligations as what other international treaties have imposed upon their contracting states. States have shown various approaches to discharge such duties due to “the set of specific problems for SAR operations in one SRR such as topography, climate, socio-economic and culture differences”²¹. Nevertheless, the basic requirements prescribed in the Convention should be followed in the implementation of SAR 79 if a state is seriously committed to it.

To fulfil its international obligations prescribed under SAR 79, the state should incorporate the following basic elements as defined in paragraph 2.1.2 of SAR 79 into its SAR services.

- Legal framework
- Assignment of a responsible authority
- Optimization of available resources
- Communication arrangement
- Co-ordination and operational functions
- Mechanism to improve the SAR services

By no means should these elements be understood as the whole matters of SAR services. They are just a part of basic elements without which the SAR services can not work well therefore should be reflected in states' national legislative framework.

²⁰ Marjorie J.ABBOTT v. United States Lines, INC. No.74-1319. United States Court of Appeals, Fourth Circuit.

²¹ Fox, U.H. (2006). *Advances in administration, management and training of SAR*. Unpublished lecture notes. WMU, Malmo, Sweden.

The rationale is that if they are incorporated into states' legal framework and such framework works well, it can be argued that such state's legislative framework on SAR is effective and efficacious and the SAR authority has got substantive foundations to start work, putting the further enforcement of such state's national law aside.

To narrow the scope of comparison on the individual state's policy of providing SAR services, a basic framework is designed to depict their practices, i.e. (1) approaches to establishing SAR system; (2) inter-agency arrangements; (3) SAR authority's power and its responsibility, and (4) SRRs and international cooperation issues. Based on the survey, the states' national policies on SAR are compared and analyzed as follows.

2.3.2 Comparative analysis of states' national policies on SAR authorities

All states considered in the analysis are parties to SOLAS and SAR 79. According to the survey, all of them have identified their national authorities responsible for SAR operation either in their national law or with a national SAR plan. However, the structures and functions of such national SAR authorities are quite different.

1) USA

- USA has adopted a multi-functional SAR system. USCG is endowed with various responsibilities including maritime law enforcement, marine environmental protection, aids to navigation, security and almost all the maritime safety and security matters²² while the RCC function is performed as part of a Command Center and the watchstanders for SAR are specifically provided.
- USA National SAR Plan has been signed by 6 federal agencies that can provide for the coordination of using all their available resources. The Plan has defined the role and responsibility of each agency

²² Poulin, S. (2005). Realigning Coast Guard Enhanced Maritime Capabilities: A Lesson Learned From The U.S. Special Operations Command. Published master' thesis in U.S. Army War College, Carlisle, USA

involved and been served as the overall interagency plan for SAR coordination.

- The SRR of USA has been clearly delimited and the agreements or MoUs with some of its neighbour states have been entered.
- MRCCs or RSCs have the power to deploy all SRUs assigned to USCG. SAR resources from other organizations and states, if requested, can be coordinated to make timely response to SAR incidents.

2) UK

- HM Coastguard is responsible for coordinating a comprehensive SAR services through its network of 19 MRCCs. MRCCs are not pure RCCs and they not only handle their own communications but also perform all the functions of Maritime Assistance including counter-pollution, salvage control operations, the dissemination of maritime safety information, etc. They also provide various support functions to PSCOs and surveyors, and are tasked with accident prevention work and collection of meteorological data, etc.
- The SAR Framework²³ for the UK defines that the SAR services shall be organized in an amalgam way of involving government departments, the emergency services and other similar organizations, a number of charities, and voluntary organisations dedicated to SAR.
- The SRR of UK has been clearly delimited and cooperation with other neighbour states has been established.
- MRCCs coordinate all SAR units and additional facilities, but they retain their own command structures so MRCCs do not “order” them as such. Nevertheless, the coordination is, timely, effective and efficient.

3) Canada

²³ Search and Rescue Framework for the United Kingdom of Great Britain and Northern Ireland, world web site: http://www.mcga.gov.uk/c4mca/mcga-hmcg_rescue/mcga-hmcg-sar.htm, retrieved on 18th June, 2006.

- The minister of National Defence is identified as the Lead Minister and spoke person for the government on SAR. The responsibility for the provision of the maritime component rest with DFO via Canadian Coast Guard. This responsibility is assigned through the Canada Ocean Act and described in the Canadian National Search and Rescue Manual.
- Canada has a National SAR Manual that states the responsibilities of each involved party (including government agencies and NGOs).
- All of RSCs are fully dedicated to SAR coordination mission except for one RSC which assumes others duties in support of Icebreaking services during a quiet period for SAR mission coordination.
- SAR coordinators have full authority to deploy primary SAR resources and under the Canada Oceans Act, SAR coordinators are empowered to requisition any vessel of opportunity to participate in a SAR mission.

4) Denmark

- Denmark has mirrored some aspects from USCG system²⁴. Its responsible SAR authority is the Ministry of Defence and JRCC Denmark is incorporated into the Danish Navy. The navy duty officer has to deal with everything coming into the office.
- There is a national SAR plan called SAR DANMARK (in Danish) which has laid down the roles of all government agencies and NGOs involved in SAR services.
- SAR areas (not SRRs) have been clearly delimited and bilateral agreements at the operational level with all the Baltic States have been very well established.
- All SRUs both primary and secondary are deployed by JRCC or MRSC without additional coordination.

5) Sweden

- The Swedish Maritime Administration is the governing body responsible for maritime SAR within the Swedish SRR. SAR business

is a part of function of Swedish Maritime Administration, managed by one of its departments. MRCC Göteborg performs multi-functions. Besides SAR service as defined in SAR 79, MRCC also serves as the point of contact for MAS and the alert post for the SSAS alert (ISPS) , assists other authorities (fire departments, police, aviation authority and coastguard) on request , receives/stores dangerous cargo reports, etc.

- The National SAR Coordination Committee is participated in by 10 national agencies or organizations, including Maritime Administration, Sea Rescue Society, Coast Guard, National Police, Defence Forces, etc. The Swedish Manual for SAR services has laid down the role and responsibility of various agencies or organizations involved. Its organizational structure is planned and implemented in accordance with the IAMSAR manual.
- MRCC Göteborg orders the deployment of all primary SRUs, but some of them like coast guard air units and vessels, military helicopters and fixed wing aircraft, must be requisitioned through their respective managing centre²⁵.
- The Swedish SRR is clearly delimited and is further divided into 14 SRSs²⁶. However, except for MRCC in Göteborg, no MRSC is associated with its own SRS. SAR agreements are in force with all neighbouring countries except Denmark and Estonia.

6) Germany

- Germany has shown a specific approach in establishing its national SAR system. In Germany, the task of provision of SAR services has been delegated by Ministerial decree to the DGzRS who is a private

²⁴ Danish Defence, world web site: <http://forsvaret.dk/FKO/eng/>, retrieved on 19th, June 2006.

²⁵ MRCC Göteborg shares premises with the Aeronautical Rescue Coordination Centre (ARCC), the Swedish Coast Guard Regional Command and the Swedish Armed Forces Maritime Information Centre.

²⁶ The Swedish coast is divided into seven separate Traffic Areas, each associated with a Traffic Area Director. The coastline has, furthermore, been divided into fifteen SAR Areas. It is the duty of each Traffic Area Director to ensure that there are adequate and manned SRUs within their area to fulfil the above-mentioned SAR objective in Sweden. Arrangements have been made both at national and regional level to ensure to make use of all available resources for SAR services.

charity which receives no governmental funding. Financing the service is done through private means only, such as donations. This delegation is described in the National SAR Plan and declared to the IMO. The DGzRS only focus on SAR related issues including SAR, technical assistance (fire fighting and emergency towing) and assistance for disaster management.

- National SAR plan has been put into function for a long time.
- SRR is clearly defined and the cooperative agreements with all neighbouring states have been entered into.
- The DGzRS has direct access to all declared SAR facilities.

7) India

- Indian Ministry of Shipping is responsible for coordination of maritime SAR. However, it has delegated the SAR authority to Indian Coast Guard, which is heavily dependent on its own navy forces to conduct SAR operations. MRCC in the Indian Coast Guard is a stand-alone department while RSCs mostly are co-located with CG operational centres and tasked to handle all kinds of emergencies.
- Indian National SAR Plan is available but no formal/written agreements to regulate interagency coordination. Mechanism exists to requisition SAR assets from other agencies in the Plan.
- SRRs have been delimited but no answers about cooperation agreements with neighbouring states.
- RCCs or RSCs have established certain requisition formats for calling in secondary SAR resources.

8) China

- MOC²⁷ defined as the leading ministry in the China National SAR Ministerial Meeting (CNSMM) is responsible for SAR services. This Meeting usually is to be attended by representatives from 15 ministries or military members which can contribute to SAR services in various manners. China MRCC is one of the departments of MOC

²⁷ MOC mainly is in charge land and waterway transportations, not communication issue as the name may imply.

but its authority is delegated to China Maritime Safety Administration (CMSA), who is one of the maritime law-enforcement bodies in China. China MRCC deals with SAR incidents as well as the prevention of loss of property such as fire-fighting, counter-pollution, etc.

- There is a National Maritime SAR Plan available which to a certain degree has established coordination procedures. However, the Plan is mainly based on the MOC's own resources and other involved ministerial departments and organizations have not signed it officially thus the inter-relationships among various agencies are left to the CNSMM.
- China hasn't delimited its SRR with its neighbouring states formally. But at the operational level, cooperation and mutual-assistance between neighbouring states have existed for a long time. Formal bilateral agreements with Korea and USA have been established and efforts are being made to enter into formal SAR cooperation with other neighbouring states.
- MRCC and CRS²⁸ co-ordinate to deploy dedicated SRUs. Normally, secondary SAR resources can be called in a timely manner.

2.3.3 Some salient features of states' SAR policies

2.3.3.1 Historic approaches verse modern alternatives

Historically, a state national SAR system is made up of an individual SRR, one responsible agency and its own resources. In this sense, Germany, Denmark, India can be categorized as having taken this approach. Alternatives such as global, regional or multi-agency SAR system can be seen in states' practices. In this research, USA, UK, Sweden, Canada and China seem to have adopted a multi-agency system, i.e. several governmental or military agencies are brought together

²⁸ CRS is a unique government-oriented SAR and salvage services provider in China. Dedicated or specialized SRUs are invested by government and put under CRS's direct command. CRS is obliged to be responsible for SAR matters as well as emergency oil pollution responding along Chinese coastal water on behalf of government, according to its statute.

under the umbrella of SAR. This arrangement is reflected either in national legislation or management structure of SAR organizations.

Considering these approaches or alternatives, there is no answer to the question of which approach is better. However, regarding multi-agency approach, it could be argued that:

From a legal point of view, to fulfil a state's international obligation of providing SAR services is the whole nation's obligation and should not be understood as being incumbent on a specific government agency only. To clarify who should do what is just a good practice for the management, and the arrangement of designating a leading and responsible agency can be hardly construed as there is nothing to do with other agencies or organizations or its citizens. Therefore, every citizen, every agency or organization is legally bound if the state is a party to such an international convention. Even the states, who have adopted the historical approach of providing SAR services, have made such arrangement in their SAR system, more or less. The only difference between these approaches is to what extent that these government agencies and NGOs should be involved in SAR services and make their contributions.

From an economic point of view, the multi-agency SAR framework can save SAR cost. To maintain a big fleet of SRUs by one agency is not only costly but also may still be insufficient for SAR services no matter how big such fleet might be. Under the umbrella of SAR, the agencies involved can be required to pool their resources which may not be owned by the SAR authority and usually these agencies cover the cost by themselves. Therefore, it may be better if various agencies or organizations that have contributable resources for SAR can be actively involved in SAR system. For example, USCG is the biggest coast guard in the world in terms of fleet of SRUs, but it is still a permanent strategy for USCG to look for other useful resources from outside in providing its SAR services. Support from other federal agencies is still very important for USCG to conduct SAR operation, like the Federal

Communications Commission²⁹. In case no effective communication can be established with the distressed target except detecting some radio signals, the Federal Communications Commission can become the critical player who can assist to locate distressed target radio by its direction finding equipments.

Conclusively, the multi-agency structure of SAR has some advantages, but it may have weakness too, such as bureaucracy and complex SAR management, particularly when the national SAR committee is composed of so many agencies. However, if putting SAR system in a specific nation's social-economic environment, the format of approach selected by an individual state may be not so critical if such a system can work. German MRCC is a private one but it works because it has established a very mature funding system during its more than 140 years history. Its marketing and financial system works so well that the money collected from the public society through donations or other legal means is probably sufficient to keep its performance at high quality. This practice has got national legislation support while it may not work in most of the developing countries.

2.3.3.2 Authorities of MRCC or MRSC

It is more helpful for MRCC or MRSC if they themselves or their parent management agencies have more power which may put MRCC or MRSC in a better position during coordinating SAR operations like calling in SAR resources from other agencies or organizations. A good example can be the ship reporting system. One of this system's functions is to identify the available ship in the vicinity of a SAR incident, direct such ship to proceed to the distressed target and provide necessary assistance. Although ships have a duty to rescue the distressed person at sea, not all ships are willing to do so particularly when it is a big bulk carrier or fixed scheduled big container vessel sailing in the high sea where adjacent coastal states who have assumed the responsibility of providing SAR services but usually no other

²⁹ The Federal Communications Commission (FCC) promulgates rules and regulations for non-government use of wire and radio facilities for promoting safety of life and property, and cooperates in SAR operations through its long-range direction finder network. See further details, refer to US National SAR Plan 1999, PP.3

suitable SAR resources are available if the incident happens in the open sea. The flag state may take action against the master after the case if he or she fails to take care of such a duty, but usually it doesn't make so much sense to this specific SAR case. However, if the responsible MRCC or MRSC is operated by a powerful agency or organization such as USCG, CMSA, CCG, who are the maritime law enforcement body, it can deter such requisitioned ship not to do so, although sometimes it has nothing to do with law enforcement at all.

Similarly, if MRCC is a sub-ordinate of powerful government or military agency, it may make the coordination much easier too. Selected states' practices show that five out of eight states put their MRCC into military or paramilitary system. Another two states, Sweden and China, incorporate MRCC into its maritime administration network. These military and/or paramilitary organizations as well as maritime administration agencies are very powerful in their respective domestic administrative or military hierarchy. German MRCC is unique one that also works well in most of its SAR operations, but they have experienced some "unhappy" stories. For example, in one SAR case³⁰ about searching a sailing man who was overdue to come back, when inquired by the SMC of DGzRS, the local police refused to provide this sailing man's relevant information like family members, frequent sailing areas, which may help to locate him, because the police thought private organizations had no power to access the private information. To a certain degree, that MRCC is attached to a powerful national body will not only make MRCC's work easier, but also save SAR cost quite a lot because its superior organization often has a fleet of units which are usually engaged in other businesses like law enforcement and can be called directly to conduct SAR operations.

2.3.3.3 SRRs and cooperation with neighboring states

The delimitation of SRRs with neighbouring nations should be negotiated, documented in an official manner, and reported in the relevant reference documents of IMO and ICAO in accordance with applicable procedures of those Organizations. It is customary to avoid the use of the term "boundaries" in the context of SAR

³⁰ Supra. See note 21 at pp.18.

because of political connotations, but rather to speak of SRR “limits” or “lines separating” SRRs. As stated in the SAR 79, the purposes of establishing SRRs are to ensure the provision of adequate land-based communications infrastructure, efficient distress alert routing, and proper operational coordination to effectively support SAR services. SRR limits should never be viewed as a basis to restrict, delay, or limit in any way the prompt and effective action necessary to relieve distress situations. Nevertheless, the notion of SRRs effects an understanding where nations have accepted primary responsibility for coordinating or providing SAR services in that specific area.

An SRR may have one or more sub-divisions called SRSs, within which all or part of the RCC’s function is assumed by a RSC under the oversight of the RCC. SCs may also wish to establish an RSC with specified functional duties, but no geographic responsibilities, e.g., to handle a subset of a RCCs’ communications or SAR responsibilities. RSCs with sub-region responsibilities are more popular in states’ practices than RSCs with sub-functions since SAR operations usually need all the functions of an RCC.

States’ practices show that five out of eight states have successfully established SRRs with their neighbour states; as such their primary responsibility of providing SAR services could have been defined according to their respective SRR. Sweden and Denmark have not entered into an official agreement regarding delimitating their respective SRR but at the operational level, they have an effective SAR arrangement in respect of who should be responsible for where. China entered into an agreement with Vietnam in 2004 regarding delimitating sea boundary, rather than SRR. Till now, the formal agreement on clarifying SRRs has not been established with all of its neighbours. It is perhaps due to the sensitivity of territory disputes between China and its neighbouring states although under the SAR 79 as mentioned before, the delimitation of SRR has nothing to do with the boundary delimitation³¹. However, to respond to a SAR incident happened in a blurred area, SRUs from both sides are usually dispatched to the scene in practice.

³¹ See SAR 79 convention, Chapter 2, paragraph 2.1.7

Cooperation in SAR services has become a customary practice even if the SRRs may not have been delimited. Six out of eight states in the survey³² have entered into various agreements with their neighbour states regarding cooperation in SAR services. The Baltic States (Germany, Denmark, Sweden) have reached a comprehensive consensus in SAR cooperation among their neighbours, either bilateral or multi-lateral. This is just the global SAR picture that SAR 79 has described. In fact, one single state may face severe shortage of SAR resources when facing big disasters, like Tsunami and typhoon Katrina of 2005 in USA. The international assistance may fill in the shortage if SAR cooperation has been in place with neighbouring states.

2.3.3.4 SRUs' legal characteristics

On the legal aspect, it is largely a matter of national policy to regulate whether SRUs can be treated as the government-operated units when they are conducting SAR operations thus are entitled to have certain immunity from safety inspection, crew's certificates, paying port dues, third party insurances, etc. This character of SRUs is very important because it will not only reduce SAR operational cost but also facilitate SRUs to conduct SAR operations and give the public a sense of higher priority of SAR operations. However, the survey shows that all of the states focus more on how to acquire and make use of various SRUs, almost no or very little attention is given to regulate and support SRUs in this respect.

At the international level, some of water-surface SRUs such as dedicated rescue tugs and boats are obviously non-conventional vessels in terms of not engaging international trading businesses. Surely, SRUs should comply with relevant safety standards but at the same time they should have some privileges. According to STCW convention, ships owned or operated by a state and engaged only on governmental non-commercial services are exempted from compliance with STCW convention³³. But the complexity is that not all water-surface SRUs who may be

³² India did not answer the question of cooperation with neighbour states in the survey.

³³ Article III of STCW convention.

potentially involved for the purpose of SAR operation are owned or operated by government, such as auxiliary SAR organizations which are private in nature but non-profitably oriented. For this matter, it seems to be an obscure area in both international instruments and national policies.

2.3.3.5 The relationship between SRUs' providers and MRCCs

Generally, the relationship between SRUs' providers and MRCCs should be cooperative. More encouragement and motivation should be given to SRUs and its providers because the essentials of this relationship are to seek for cooperation with SRUs providers to contribute to SAR services rather than to regulate and encumber them. The basic principle of using all available resources does not specify to what extent MRCCs should control and use these available resources.

For the MRCCs' own SRUs, MRCCs have exclusively administrative power on SRUs including deploying, certificating and managing, etc. However, it can be the case that not all of SRUs belong to MRCCs, such as designated SRUs from other sources. In some states' practices such as in China, even the dedicated SRUs may not belong to MRCC. The survey shows that although UK relies heavily on RNLI's SRUs to conduct SAR operations, HM Coastguard does not order them. RNLI even retains its own command structures. In Germany, whenever there is a need to go out for a SAR incident, the crew of SRUs are never forced to go. The final decision on whether or not to go out is up to the SRU master's professional discretion. However, in China, under the National Maritime SAR Plan, the dedicated SRUs are required to be equipped according to the standards established by MRCC, their SAR personnel are to be certified by MRCC. CRS, the managing agency of dedicated SRUs, should report to MRCC its stand-by plan, etc, although CRS is neither a branch of MRCC nor has administrative relationship with it. The reason behind these encumbrances might be the power struggle but it will surely cause detriments to the quality of SAR services.

2.4 Summary

To rescue distressed people at sea is very well regulated in various international instruments. In order to fulfil their obligation under these international instruments, state parties shall implement such conventions in their national law and most of them have done this very well.

Serving as the foundation of the SAR system, national policies on SAR depict the structure of the SAR system and describe the authority and responsibility of SAR organizations. Whether or not a SAR system could work well heavily relies on these policies. Through examining states' policies on SAR, a set of salient features which represent basic principles of SAR services have been discussed. These principles could be used in reverse as the indicators to evaluate and identify other SAR systems' weak areas. Further considerations of these weak areas should focus on possible solutions to these weaknesses. This is a cross-reference and complementary process to improve the quality of SAR services, which will not only benefit states considered in this research, but also open a broad view for the global SAR community as a whole.

Chapter 3 SAR resources

An international principle for providing SAR services: *Use all available resources*.³⁴

3.1 Introduction

The term of resource is defined as a source of supply or support that can be drawn on when needed³⁵. SAR resources include all of those resources which perform distress monitoring, communications, co-ordination, and response functions, provide or arrange for medical advice, initial medical assistance, or medical evacuation, if necessary³⁶. Basic SAR resources needed for a SAR system are SRUs (aircraft and vessels), SAR personnel, communication networks and other support facilities such as training facilities, SAR data providers, and medical assistance. RCCs or RSCs are the knots that collect all of these resources together and coordinate SAR operations.

The adequacy, availability as well as capacity of SAR resources are important factors that influence SAR system's performance. Lack of SAR resources can be caused by crew fatigue, the need for SRU maintenance, or involvement in another operation. A system for monitoring the status of all SRUs should be available to RCC or RSC. To acquire SAR resources is always a matter that entangles the SAR authorities. States should use existing resources to the fullest extent, no matter whether they belong to governmental agencies or NGOs, and can even request SAR resources from international sources³⁷. But how it can be realized and how

³⁴ USCG, Search & Rescue, Search and Rescue Responsibilities: the Big Picture. *Proceedings of the Marine Safety & Security Council*. Fall.2004.PP.35

³⁵ Merriam-Webster Online Dictionary

³⁶ Possible SAR resources providers are listed in the IAMSAR Volume I appendix C.

³⁷ IAMSAR Manual Volume II Chapter 1, 1.3 SAR resources

these resources can be used in a cost-effective way is not easy. The capacity of SAR resources is related to the set of specific problems of each SRR such as its unique transportation, climate, topography and physical characteristics. Therefore, the choice and composition of SRUs, facilities, equipments and staffs required by each SAR service is usually different, but there are some common features in states' practices in choosing and composing SAR resources, particularly the SRUs.

3.2 SAR units

3.2.1 Characteristics of SRUs

Technically, SRUs are composed of trained personnel and provided with equipment suitable for the expeditious and efficient conduct of search and rescue. Trained personnel mean that the personnel on board are able to fulfill SAR functions such as the OSC who should be familiar with principles of conducting SAR. An SRU can be an air, maritime, or land-based facility. SAR facility is defined as any mobile resource, including designated SRUs, used to conduct search and rescue operations. Facilities selected as SRUs should be able to reach the scene of distress quickly and, in particular, be suitable for a certain SAR operations³⁸. Although these SRUs may not be used for SAR exclusively, SAR operations should always have the priority.

There are commonly 3 types of SRUs³⁹:

- 1) Declared/designated SRUs⁴⁰ are commonly understood as these SAR units which provide the services on demand without further negotiations (they will go out when they are called). They may or may not be controlled by a MRCC directly but they are usually primary means for a MRCC to respond to SAR

³⁸ See IAMSAR Manual Volume I Chapter 2, 2.5 SAR facilities.

³⁹ Ibid

⁴⁰ Capt. Udo Fox, executive director of DGzRS, argues that IMO uses the term “designated”, “declared” and “dedicated” SRUs synonymously while some WMU staffs hold the view that the interpretation of these terms is subject to states' understanding. The “declared” SRUs could be understood as those SRUs which would be reported to IMO in accordance with the Convention, but not necessarily confirmed by anyone else. And the “dedicated” SRUs could also refer to the SRUs which are exclusively tasked with SAR services, such as RNLI's life boats, DGzRS's rescue boats.

incidents. To ensure these SRUs responding to SAR incidents properly, RCCs or RSCs need to negotiate and make appropriate arrangements with SRUs providers for timely dispatching out their units before they are really called in.

- 2) Dedicated SRUs are those who are dedicated solely to SAR operations. They are usually invested and managed by governmental agencies and used for critical SAR incidents.
- 3) Specialized SRUs are teams with specialized training and equipment created for specific rescue scenarios, e.g. diver rescue teams. Similarly, SAR authority needs either to develop its own specialized SRUs or to establish cooperative mechanism with these organizations that can provide these specific services to meet the demand of its SAR operations.

3.2.2 Comparative analysis of states' options of primary SRUs

Before starting to acquire SAR resources, SAR authority must firstly consider the questions as to what types of SRUs are suitable in a specific SRR and how many they are needed. Based on the author's survey, responding to the questions about "what are your primary SRUs which you reply on carrying out SAR operation?" and "how frequently are they involved carrying out SAR operation?", the practices of surveyed states are:

- USA: fixed-wing aircraft including the C-130; helicopters (short and medium range)⁴¹; ships; patrol boats; and boats⁴². Boats do the majority of responses and helicopters are also very active. USCG has over 30,000 cases a year on average, so the U.S. SAR system is busy but it also varies based on the

⁴¹ There are approximately 211 aircraft in CG inventory, number fluctuates. For further details, see world web site: <http://www.uscg.mil/datasheet/index.shtm>, retrieved on 2nd July, 2006.

⁴² All vessels under 65 feet in length are classified as boats and usually operate near shore and on inland waterways. There are approximately 1400 boats <http://www.uscg.mil/datasheet/index.shtm>, retrieved on 2nd July, 2006.

geographical location and season. SAR statistics are used to determine where to locate suitable resources and how many.

- UK: the RNLI is the main water surface SRUs provider who has an active fleet of 332 lifeboats, ranging from 5m to 17m in length, and a relief fleet of 112 additional lifeboats. The fleet also includes four active and one relief hovercraft.⁴³ RNLI lifeboats were launched 8,273 times and rescued 8,104 persons in 2005(2004: 7,656 launches and 7,507 people rescued)⁴⁴. Other primary SRUs are military helicopters, the HM Coastguard Rescue Team as well as contracted SAR helicopters by MCA.
- Canada: Cape Class vessel units of 47'(14.7m) with self-righting capacity, inshore Rescue boat (fast rescue craft 8m) and offshore patrol boat⁴⁵ . SAR primary resources are responding to 45% of all SAR incidents.
- Sweden: MRCC Göteborg keeps an extensive register of all units that can be used in SAR operations, including the telephone numbers to contact the units and their governing organization, what equipment they have onboard and what type/speed/draft/length/breadth/engine capacity the unit is/has as well as where it is stationed. MRCC Göteborg orders the deployment of all primary SRUs:
 - Via Mayday relay (ships in the vicinity contact "Sweden rescue" on CH16)
 - Via Selective call (SSRS vessels⁴⁶)
 - Via Regional alarm center (municipal rescue forces, police, ambulance, fire departments)

⁴³ World web site:

http://www.rnli.org.uk/who_we_are/boats_and_stations/lifeboats/current_lifeboats/current_lifeboats , retrieved on 2nd July, 2006.

⁴⁴ RNLI Annual Report and Account 2005, pp.1

⁴⁵ High endurance all weather, full patrol capability up to 400 nautical miles offshore, usually from 62m to 72 m in length, with helicopter accommodation. http://www.ccg-gcc.gc.ca/vessels-navires/main_e.asp, retrieved on 2nd July, 2006.

⁴⁶ The Swedish Lifeboat Association (SSRS) is a voluntary organization with SRUs stationed along the Swedish coastline. Swedish Lifeboat Association has vessels and boats of variable sizes. Further details see <http://www.ssrs.se/page/1196/english.htm> .

Via coast guard regional command centers (coast guard air units and vessels)

Via ARCC (SAR helicopters, military helicopters and fixed wing aircrafts)

Via Swedish defence force command centres (vessels and radar-surveillance)

- Denmark: navy units and air force helicopters⁴⁷, the rescue boats from the rescue stations, the units from the Naval Homeguard.
- Germany: MRCC's own SAR facilities⁴⁸ and declared SAR facilities of the German Navy on a daily base.
- India: Coast Guard boats⁴⁹, helicopters and fixed wing aircraft
- China: CRS's SRUs⁵⁰ solely tasked for SAR and designated SRUs from various other sources.

Apparently, the primary SRUs used by the states considered in this research are mixtures of various types of SRUs. It appears that different states have different priorities in selecting primary SRUs because of the set of specific problems as mentioned before.

USA has a big fleet of air craft because of its big SRR and heavy load of SAR operations. An average of handling over 30,000 cases annually makes its SRUs quite busy. Its heavy work load is augmented not only by the quantity of SAR cases,

⁴⁷ For further details, see Danish Defence, available on the world web site: <http://forsvaret.dk/NR/rdonlyres/2D9BB74B-8333-45E9-80B9-D208AB4D6C92/0/DanishDefence2004.pdf>.

⁴⁸ The fleet of the DGzRS consists of 21 rescue cruisers between 23 m and 46 m, manned by 184 specially trained full time professionals, cooperating with 40 rescue boats partly on trailers with a staff of about 800 volunteers. They are deployed in 54 stations.

⁴⁹ India Coast Guard has a total of 93 surface vessels in various size and 21 helicopters. The majority of them are militarily tasked with a part of SAR mission. For further details, see *Indian Coast Guard 25 Glorious Years*, Ed P.Paler PTM, TM. The Coast Guard Headquarters. Also see: <http://www.indiancoastguard.nic.in/>.

⁵⁰ SRUs are mainly tugs from 60m to 100m in length, main engines' HP from 1940Kw to 10000 Kw, 8 helicopters and 1 fixed wing aircraft. In 2005, 8 fast rescue boats which were previously operated by RNLI were bought by CRS and put into services. For further details, see http://www.moc.gov.cn/rescue_salvage/.

but also by the difficulty of SAR incidents, particularly when the SAR incidents happen in open seas. Comparatively, air craft are more frequently tasked because they are more efficient than water surface SRUs and the fast speed of air craft saves the response time. In responding to the heavy workload, USA has also initiated and maintained the famous AMVER system, which is served purely as a supplementary means to requisition the merchant fleets of opportunity to respond to SAR incidents⁵¹. In contrast, Germany has a relatively small SRR adjacent to its coast area therefore small fast boats with a few big ones may be probably enough to meet the demand of SAR operations.

China has also assumed a big SRR although its SRR has not been officially reported to IMO. Within its SRR, an average of 600 water traffic accidents every year is reported⁵². However, there are about 15,000 distressed people who need SAR services either at sea or in-land waters. Comparing with other SAR colleagues, China SAR authority is facing an imminent shortage of SRUs, particularly SAR aircraft. This problem has been put into high profile of Chinese government and more SRUs including both water surfaces SRUs and SAR aircraft are to be purchased to equip Chinese SAR team⁵³.

India almost solely relies on its navy forces to conduct SAR operations; however their navy forces are initially built for the purpose of military services, with only a part of mission of SAR, therefore there is not so much space left for Indian SAR authority (the Indian Coastguard) to select better and cost-effective SRUs. Denmark also incorporates its SAR services into its military system, but Danish navy has

⁵¹ See further details on world web site: <http://www.amver.com/>, retrieved on 19th June, 2006.

⁵² The data refers to the total number of traffic accidents which have caused big loss of lives or property, or both. Small cases are not included, according to CMSA's statistics rule.

⁵³ China to 'ramp-up' SAR service, <http://www.shephard.co.uk/Search.aspx?Action=-187126550&ID=2cf6fa13-566e-4b42-b720-f55eb90e6f63&Section=Rotorhub>, retrieved on 19th June, 2006.

established a very good cooperation with its voluntary organizations (the Navy Homeguard), which play an important role in SAR operations.

Swedish response to the survey shows that they have good procedures in place to acquire and coordinate possible SRUs to respond to SAR cases. The Swedish can do so in this way probably because of the relatively high density of traffic flow in Baltic Sea as well as its well established voluntary SAR organization system, such as the SSRS. According to the survey, the facing problem of Swedish SAR authority is to determine which SRU is more suitable to respond to a SAR incident rather than the lack of SRUs. When several SRUs are available, SMC will choose a suitable or several SRUs to conduct SAR operations, based on the capacity of SRUs that they have known about as well as the demand of such a specific SAR case. However, what type of primary SRUs they are using is not clear.

The survey has also shown that small surface boats play an important role in terms of the quantity of responses to SAR cases. This is exactly the case in USA, UK, Canada, and Germany, but not in China. China's SRUs are comparatively bigger in terms of vessel dimensions and main engines' power.

One probable reason of such option of SRUs may be due to the facts that the people in distress at sea to be rescued in China are different from those of developed countries where most of the people who need rescue services are pleasure boats crew. In the past 50 years, people rescued at sea by the Chinese SAR authority are mainly crew members of merchant ships and fishing vessels, taking a lion-share of 98.4 % of the total lives saved. Usually they are saved together with their vessels and the pure rescue operations without the involvement of the distressed ships only share the remaining 1.6% of the total lives saved. It means that the majority of human lives rescued have been carried out in a way of rescuing vessels too. This mode of life rescue will probably continue for a comparatively long term in China as the country is still a developing country, and the

crew, the shipping companies and insurance companies strongly request to save or salvage the properties as long as there is a little hope to do so. This special demand for SAR operation may be the main factor that determines the choice and composition of Chinese fleet of SRUs, that is, powerful tugs which can withstand strong wind and are equipped with towing gears are still the main SRUs. On the opposite side, taking Sweden as an example, approximately 85% of all missions responded by SSRS boats is towards distressed pleasure boats. Commercial vessels stand for the remaining 15%⁵⁴.

Another reason can be the economic consideration. SRUs are usually high value property and big SRUs such as SAR cruisers or powerful rescue tugs are even more costly in respect of both the initiative investments and running cost. The initiative investment of building a 10,000HPs rescue tug may amount to 3 or 4 all-weather rescue boats whose speed is usually much faster than that of the big rescue tug. Further, it could be hardly debatable that the capacity of one big powerful tug is higher than the total capacity of 3 or 4 rescue boats since they are more in quantity and they are faster, thus a bigger watching area can be covered. Regarding the running cost of these two options, taking the capital costs as an example, 10 crews or even more are needed to man a big rescue tug while a minimum of 3 or 4 crews can operate a fast rescue boat. It seems that the cost is not so much different between these two options in terms of manning cost but the outcome is obviously different although big rescue tugs have their own advantages too. Therefore, most western states considered in this research prefer to have small rescue boats. In contrast, even though currently Chinese SAR operational cost is not so high due to her comparatively low man power cost in general, but it may not be the case in the future. Its operational cost may be increased at the same pace as the fast

⁵⁴ World Web Site: <http://www.ssrs.se/page/1196/english.htm>, retrieved on 2nd July, 2006.

improvement of Chinese national economy and this trend shall also be multiplied by its SRUs' solely function of SAR.

3.3 The methods of acquiring SRUs

No SAR system, domestic or otherwise, is built overnight. Neither is there, nor will there ever be, sufficient SAR resources to ensure successful response to every distress incident. Therefore, the SAR authority must first identify the available resources, either under its direct control or through co-operative arrangements, and ensure that these resources are being used to their full potential to support or carry out SAR operations. Then, the processes that enable continuous improvement in the use in respect of these units' capabilities, qualities and quantities should be employed. A SAR system always begins with available resources and then works with others who can help to plan and improve the services. This is just what the NLRI has done in Uganda⁵⁵.

To pool potential SRUs under the umbrella of SAR, it could be observed from states' practices that four ways are usually utilized.

3.3.1 Establishing a SAR authority's own fleet of SRUs

A traditional way to obtain SRUs is to develop SAR authority's own SRUs i.e. to build up its own fleet of SRUs. In the survey, all the states except for China have some types of SRUs under its SAR authorities' direct jurisdiction. China MRCC is one of the Ministry's departments while CRS, the dedicated SRUs provider in China, has the similar rank to China MRCC in the administrative hierarchy. All the dedicated SRUs are available for China MRCC, but they are not managed by MRCC.

MRCCs or MRSCs' own SRUs are the most reliable forces for conducting SAR operations; however, it would be rather costly to establish all the SAR resources by SAR authority itself. Even though that could be established, they may not be

⁵⁵NILI started to build up its SAR services in 2002 without any resources at hands except for a team of good Samaritan, for further details, see <http://www.lake-rescue.org/>.

sufficient to cover its SRR and respond to big disasters. Other problems can be that SAR authority's fleet usually standby near coastal areas. Comparing with the merchant ships or fishing boats that are usually sailing off the coast, these standby SRUs need longer response time to reach the scene of distress if the scene of SAR incident is not the coastal area.

A good example is the case of Estonia. The ESTONIA sank on September 28, 1994 in international water which belongs to Finnish SRR. The first distress call was received from the ESTONIA at about 0122 hrs by the MARIELLA ,a pass-by passenger ship which was also the first unit to reach the scene of the accident at 0212 hrs, almost 1 hour before the first dedicated SRUs, SAR helicopter OH-HVG which was alerted by Turku MRCC at 0135 hrs and arrived at the scene of the accident at 0305 hrs. The dedicated water surface SRU, coast guard patrol vessel TURSAS that was alerted at 0126 hours arrived at the scene at 0500hrs⁵⁶.The last survivor was rescued at about 0900 hrs. At that time, totally 17 helicopters and 12 vessels joined the SAR operations.

In this case, totally 19 helicopters (three of them were dispatched from Finland) and 19 vessels from various sources participated in the SAR operations before 1200hrs of that day but the missing persons still tolled as high as 757 people. For the 19 SAR helicopters which had played a major role in rescuing survivors (the helicopters rescued the majority of 104 survivors while the vessels rescued 34 survivors), it is impossible for Finland to establish such a big fleet by itself. The only dedicated SRU TURSAS had reasonably made prompt response to the disaster but it arrived at the scene almost 3.5 hours later after the first distress call. In contrast, the merchant vessels in the vicinity arrived at the scene faster than TURSAS. Obviously, in this case, it may be argued that the dedicated water surface SRUs such as TURSAS were not the best ones that could be reliable, and the demand of SAR helicopters could hardly be met if Finnish SAR authority relied on its resources.

⁵⁶For further details, see world web sit: http://www.onnettomuustutkinta.fi/estonia/chapt07_1.html, retrieved on 2nd July, 2006.

3.3.2 Designating SRUs from other resources

Designating specific and suitable facilities as SAR resources (if they exist) is another way to obtain SAR resources. “A successful SAR organization can be created without having designated, full-time SRUs”⁵⁷. SRUs may not be necessarily controlled by SAR authority directly, either. With a few exceptions, SRUs are multi-mission facilities, that is, they perform SAR functions in addition to other missions. They can be obliged to respond to SAR incidents with a higher priority although they are usually controlled by other agencies or organizations rather than RCCs or RSCs. To make these resources available for the purpose of SAR operation, designating SAR resources or entering into an agreement or MOU with their respective controlling agencies or organization, whether formal or informal, is always necessary. Usually, it should be clearly defined in various domestic or international agreements and plans such as national SAR plan or manual.

To designate SRUs, states can use existing facilities established for tasks relevant to marine activities. Existing facilities may often be used for SAR operations with just some minimal modifications, added equipment or additional crew training. Examples include: teaching look-out scanning techniques to volunteers and auxiliary organizations; installing radiotelephone equipment on fishing vessels, yachts and other small craft; and using isolated stations as alerting posts, etc⁵⁸. By providing training, installing some low-cost equipment and integrating all facilities into the SAR system, an efficient SAR service may be set up with limited need for SRUs that are exclusively dedicated to SAR services.

This method of acquiring SAR resources through designation has become a popular trend in establishing a SAR service. New Zealand’s SAR Resourcing Survey shows that it is a common practice to designate SRUs from aviation asset providers and marine surface vessel asset providers. Regarding the questions of (1) to what extent they are involved; (2) levels of services agreements, the results of 14 surveyed states are presented and analyzed as follows.

⁵⁷ IAMSAR Manuals Volume I.

⁵⁸ Supra. See note 21 at pp.18.

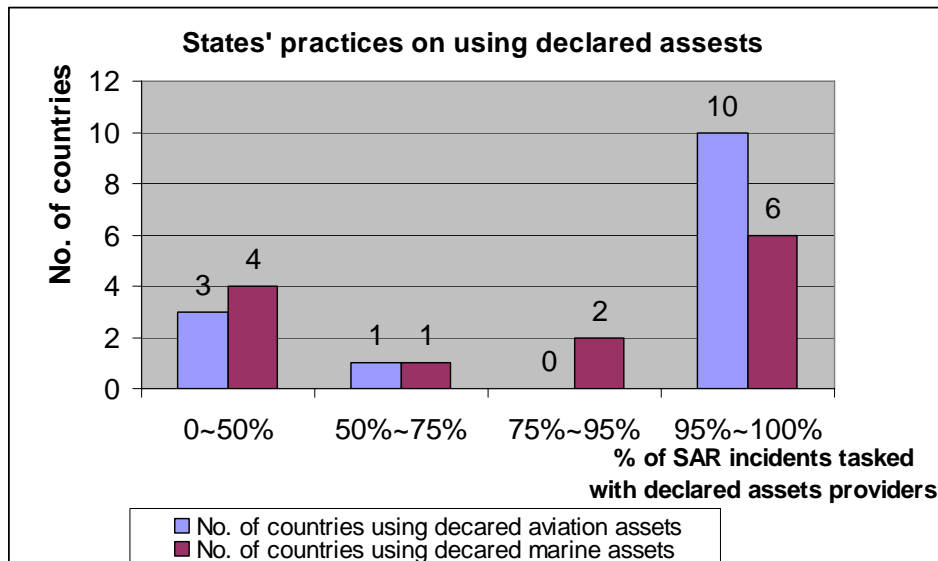


Figure 1 : States' practices on using declared assets
(Source: Chao Wang, 2006, WMU)

This figure has shown that using declared/designated marine and aviation assets to respond to SAR incidents is commonly practiced among the 14 states considered in the survey. 71.4% states rely on declared aviation asset providers to respond to more than 95% of SAR incidents requiring air assets and 66.7% states depend on declared marine asset providers to respond more than 75% of SAR incidents requiring marine assets. The opposite side of this trend can be logically deduced as the using of SAR authority's own assets for SAR services is becoming less and less.

Associated with the practices of using declared/designated assets, different levels of service agreements have been established. The survey results are presented in the following figure.

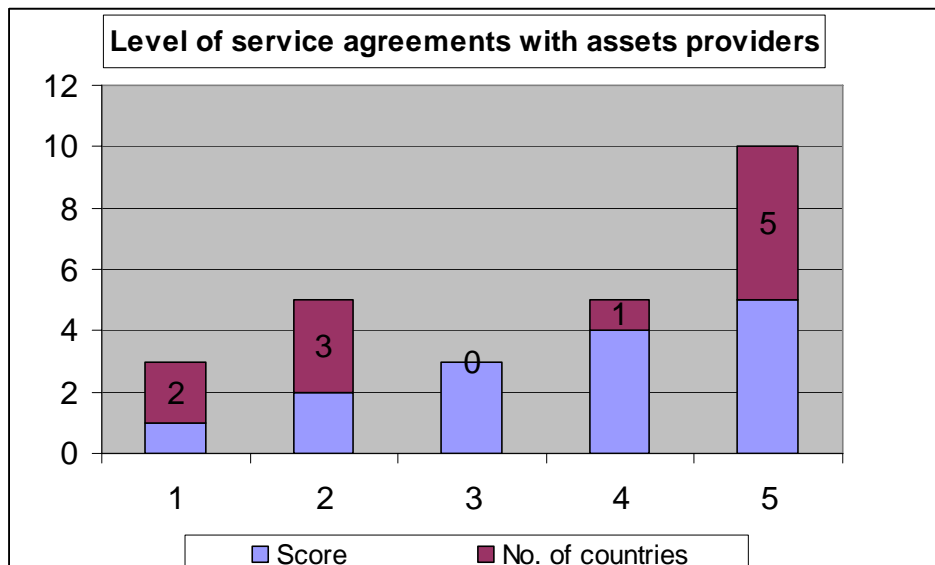


Figure 2 : States' practices on level of service agreements with assets providers
(Source: Chao Wang, 2006, WMU)

In this figure, the scores used to benchmark the service level agreement (SLA) are established in a qualitative manner. The marks are given by states themselves. The levels of service agreement denote:

- Score 1: no formal agreements of any kind
- Score 2: some agreements but mainly of a general 'MoU' nature
- Score 3: at least 50 % of SAR incidents requiring marine assets are tasked from asset providers with comprehensive SLAs in place
- Score 4: at least 75 % of SAR incidents requiring marine assets are tasked from asset providers with comprehensive SLAs in place
- Score 5: at least 95 % of SAR incidents requiring marine assets are tasked from asset providers with comprehensive SLAs in place.

From this figure, it can be observed that 54.5% states have successfully established comprehensive SLAs with assets providers to use their assets in responding to SAR incidents. It also shows that almost half of states need to establish SLAs or improve the level of SLAs for the SAR purpose.

3.3.3 Developing a voluntary SAR system

In western countries, voluntary SAR organizations have become an important SAR resource for states to provide SAR services. Voluntary SAR forces or auxiliary SAR system, not only are a reliable force multiplier for SAR missions because of its exclusive character, i.e. solely engaged in SAR services, but also open a new dimension for SAR authority to establish its SAR system. Voluntary SAR forces usually become dedicated or declared SRUs available for MRCCs or MRSCs after they have been established.

The SAR Volunteer is commonly defined as “someone who willingly gives unpaid help in SAR services, in the form of time, service or skills, through an organization or group. An organization or group is any body with a formal structure. Purely ad hoc, informal and temporary gatherings of people do not constitute an organization”. “The definition of volunteering that is most widely accepted currently includes three important concepts: 1) the provision of a service to the community; 2) freedom of choice to become involved; 3) non-payment of the service provided.”⁵⁹

In the survey, except for India and China, all the states concerned in the research have a certain scale of voluntary SAR system. One of the main reasons is perhaps the national economy. As illustrated by the figure below, the gross national income (GNI) per capita of 2004 in China and in India is almost 10 times lower than that of other countries considered in this research. If the nationals are so poor that they are still struggling for basic living demands, it can be very hard to motivate them to become a volunteer. Even they want to do so, the lack of basic equipments such as boats may defeat such willingness in practice.

⁵⁹ World Web site, <http://www.sarinfo.bc.ca/SARCoordinator.htm>, retrieved on 2nd, July, 2006.

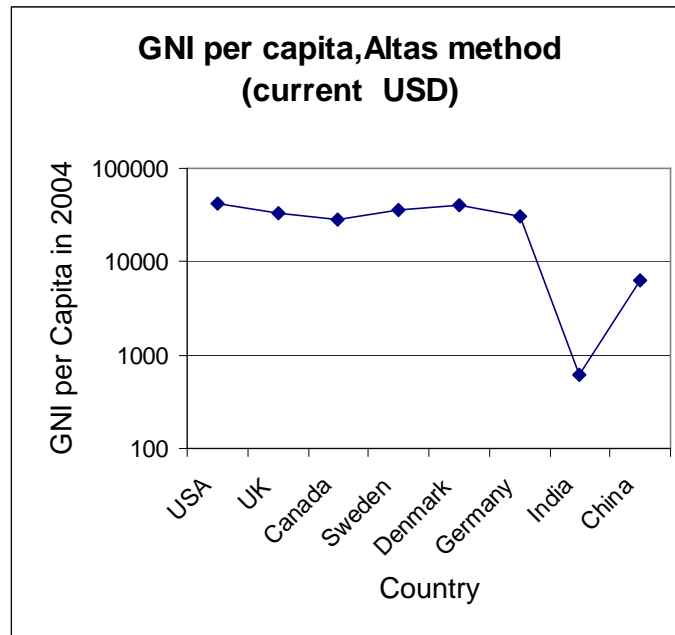


Figure 3 : GNI levels of 2004

(Source: Chao Wang, 2006, WMU. Compiled from World Bank's Key Development Data & Statistics, 2004.⁶⁰)

However, a country's economic level may not be the determining factor of developing a voluntary system. Not all the people in developing countries are poor and some of them may be rich and may be the owners who have processed suitable assets that could be contributed to SAR services. As mentioned before, Uganda's NLNI is also a voluntary SAR organization while it can be hardly arguable that Indian and Chinese economic situations are worse than that of Ugandan. The author holds the view that the development and the scale of a country's voluntary SAR system are very much depending on its national demand as well as municipal law i.e. whether or not there is a role for voluntary SAR organization to play and whether or not they can be supported and motivated by its domestic law and its SAR authorities. Examples are:

⁶⁰ World Web Site:
<http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20535285~menuPK:1192694~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html>, retrieved on 18th June, 2006.

In Canada, National SAR Program Plan 2005 clearly defined that one of CCG's management functions is to develop and support CCGA policy. In the Canadian National SAR Manual, it describes that

“.....CCGA—the Canadian Coast Guard Auxiliary (CCGA) associations have contractual agreements to provide members/vessels to augment existing search and rescue units in search and rescue (SAR) operations and to assist the CCG in SAR Loss-Of-Life prevention activities. Tasking of Auxiliary units is to be considered in the absence of more appropriate SAR facilities or when it is perceived that by utilizing Auxiliary units the SAR objectives can be achieved more quickly”.

Nowadays, five CCGA associations have 4500 members and 1274 boats to support SAR missions. CCGA's number of taskings has been steadily increasing and their increasing presence on Canada's waters has alleviated the CCG of pressures relating to SAR. CCGA staff has become better trained and more qualified to tackle more complicated SAR operations as efforts have been put into improving training programs over the past few years. The CCGA responded to 2029 SAR incidents in 2003⁶¹.

Similarly, US Coast Guard Auxiliary, UK's RNLI, SSRS in Sweden, Danish Navy Homeguard and Germany voluntary organization⁶² have a position in their respective national SAR manual or plan. All of them are very well motivated and their performances are statistically good. Taking RNLI and SSRS as examples:

- The RNLI has an active fleet of 332 lifeboats which are deployed in its 233 lifeboat stations and are served largely by over 13,000 volunteers (branch officials, coxswains/helmsmen, crew, shore helpers and supporters). In 2004, RNLI launches reached as high as 7656 times, an average of more than 21 SAR cases a day and saved 433 lives, an average of more than one person a day⁶³.

⁶¹ See. http://www.ccg-gcc.gc.ca/mp-pm/docs/03-04/pr/sar_e.htm .

⁶² DGzRS has a team of about 800 volunteer rescue men/women and about 80 voluntary physicians.

⁶³ <http://www.rnli.org.uk/>, retrieved on 2nd July, 2006. Also see The RNLI Today, published by RNLI in 2005.

- The SSRS has 107 lifeboats deployed in about 50 rescue stations around the Swedish coast. In 2002, the SSRS was deployed and carried out approximately 70% of all rescue missions in Swedish waters.

3.3.4 Seeking for help from the international arena

Last but not least, international resources are also usually available if proper arrangements have been made such as entering into bilateral or international cooperation agreements or MOUs. This is always true when responding to big disasters like Tsunami, which a state's own resources are obviously insufficient to cope with such demand of mass rescue operations.

3.4 Summary

SRUs are an extremely important element for a SAR system and the lack of SRUs will surely influence a SAR system's performance. SRUs should be properly manned with competent crew as well as armed with suitable equipment to enable them to appropriately conduct SAR operations.

Different SRRs have different demand of SRUs in respect of the distressed people to be rescued. To choose suitable types of SRUs is a technical matter of which not only the SRR's unique transportation, climate, topography and physical characteristics but also the availability of SRUs in the region should be considered. The survey shows that primary SRUs are small water surface units mixed with other types of SRUs from various resources.

Four ways of acquiring SRUs are discussed in this chapter. The way of establishing SAR authority's own big fleet of SRUs is not only uneconomical but also hardly enough to cover every scenario, such as the case of Estonia. Designating SRUs controlled by other organizations and developing voluntary SAR systems are becoming common practice in pooling SRUs while seeking for help from international sources coincides with the initial ideas of the SAR convention. This is especially suitable for developing countries as well as littoral countries bordering the same water bodies, such as the Baltic States.

Chapter 4 SAR training

4.1 Introduction

The purpose of training is to meet the objectives of the SAR system by developing SAR specialists⁶⁴, i.e. by way of training to facilitate SAR service personnel to acquire the knowledge and skills that their works demand. The primary objective of SAR is the safe recovery of any person or persons in distress. SAR service personnel include all of those who provide, or may provide, a SAR service i.e. SAR coordinators, SMCs, OSCs, aircraft coordinators, SRUs commanders and their crew, and ships' masters and their crew since they may be involved as additional SAR facilities, or as OSCs when no more suitable unit is present.⁶⁵ All of them should be trained prior to assignment to SAR duties.

Training is very important for SAR personnel. "Training saves lives"⁶⁶. It will ensure one's ability to do the right thing, at the same time it can also reduce risks to its own valuable personnel and facilities. The knowledge and skills needed in SAR operations are so critical for these personnel that without sufficient training, they may be unable to properly perform their functions and even result in loss of lives of both SAR personnel and these distressed people to be rescued at sea.

However, regarding SAR knowledge and skills, unfortunately there are no unified standards at the international level, like STCW 78/95 for crews of merchant ships, to lay down the basic knowledge, understanding, experience and professional

⁶⁴ IAMSAR Manual Volume I PP.3-1

⁶⁵ MSC 81 \WP\6.doc

⁶⁶ World web site: <http://www.rnli.org.uk/home>, retrieved on 15th July, 2006.

competence, etc. This may be caused by the fact that the number of SAR service personnel needs to be trained is small as well as that SAR services are not so much internationalized and have nothing to do with commercial interests, thus it is not necessary to regulate unfair competitions, comparing with the training on merchant shipping crew. Nevertheless, to ensure the safety and the efficiency of SAR operations, states have made their own arrangements for training and some of them are quite inspiring.

4.2 STCW and SAR training

4.2.1 STCW 78/95 convention

The STCW 78/95 Convention does not prescribe any training requirement on SAR service personnel. At an international level, the Convention has established basic requirements on training, certification and watch-keeping for seafarers. These basic requirements are the minimum standards that contracting states are obliged to meet or exceed. In contents, the Convention has laid down 7 aspects of functional requirements including navigation, cargo handling and stowage, controlling the operation of ship and care for persons on board, marine engineering, electrical, electronic and control engineering, maintenance and repair, and radio-communications. Based on these requirements, special trainings are required towards those who may possibly serve on board of tankers, Ro-Ro passenger ships and passenger ships other than Ro-Ro ships. Comparing with STCW 78, the revised Convention has placed much more emphasis on the acquisition of skills by demonstration of an ability to perform (i.e. standards of competence). Furthermore, proposals of “.....developing provisions covering the training and certification of maritime pilots, vessel traffic services personnel and maritime personnel employed on mobile offshore units”⁶⁷ have been made but no international standards have been established yet.

⁶⁷ Resolution 10 of STCW Conference, 1995.

SRUs particularly the dedicated SRUs which are usually operated by government agencies are excluded from STCW 78/95 Convention. Article III Application of the Convention states:

“The Convention shall apply to seafarers serving on board seagoing ships entitled to fly the flag of a Party except to those serving on board:

(a) warships, naval auxiliaries or other ships owned or operated by a state and engaged only on governmental non-commercial service; however, each Party shall ensure, by the adoption of appropriate measures not impairing the operations or operational capabilities of such ships owned or operated by it, that the persons serving on board such ships meet the requirements of the Convention so far as is reasonable and practicable.....”

However, it could be argued that STCW can still be relevant to SAR training. Considering the nature of SAR operations, there are two groups of duties to be performed by SRUs i.e. navigation and on-scene SAR operations. Regarding navigation, the personnel on SRUs should have all the seven functions prescribed for common seafarers except for cargo handling and stowage but they still need to have a certain amount of knowledge in this area. Therefore, training on this part of knowledge and skills can follow the Convention. As per the on-scene SAR operations, although masters and chief officers under the Convention are also required to be trained on coordinating SAR operations⁶⁸, such training is the minimum requirements and can not be suitable for dedicated or specialized SRUs. So the training of coordinating and conducting SAR operations can not apply the Convention and special arrangements of this part training are left for states themselves.

4.2.2 Some unique features of SAR training

⁶⁸ STCW Code A, PP.44

It could be observed that SAR training has its unique features due to its nature of SAR functions. To start a SAR training program, these features should be considered.

(1) More safety concerns in SAR training

SAR operations sometimes are simple works such as picking up an overboard fisherman in good weather, but that is not always the case. Some of the SAR operations are so complex that SAR personnel are usually subject to extremely hazardous conditions, requiring unique safety and reliability standards to be maintained. On one side, training personnel in making sound assessments will help to ensure that trained professionals and valuable facilities remain available for future operations. On the other hand, SAR personnel have to make prompt response to the calls of SAR incidents as quickly as they can. The time used from being alerted to reaching the scene is usually a decisive factor in successful SAR operations. Without sufficient training, SAR personnel can be hardly available and reliable in responding to SAR incidents.

(2) SAR Training can be very costly, particularly for the specialized SRUs and dedicated SRUs

The expensive SAR training may be probably attributable to SAR posts' especially professional requirements as well as the low frequency of being involved in SAR operations averagely for every SRU. Normally, the specialized SRUs and dedicated SRUs are more likely to be tasked with challenging works that others SRUs are not competent to handle. Therefore, the training requirements for these specialized and dedicated SRUs are usually beyond the normal standard and the expectation of their performance is higher too. Actually, there is no way to retreat for these specialized and dedicated SRUs when they are confronted with severe SAR incidents. Fortunately, these severe SAR incidents are rare but this is unfortunately for these dedicated or specialized SRUs, as well as SMCs, and OSCs, because few participations of SAR incidents means few training opportunity therefore they can not gain enough direct experience in dealing with such rare emergencies. Furthermore, when MRCCs or MRSCs assigning a SAR task to the available SRUs, there is a common principle that other SRUs except for these dedicated or specialized SRUs

should be used more in order to train them and make them available in case of big disasters. Therefore, the need for specific training for these dedicated or specialized SRUs increase commensurately. For example, the pilots of SAR helicopter are expensive teams for the reasons of higher qualification requirements than that of commercial helicopter's pilots because they have to go out to save distressed people at sea even in bad weather while the commercial helicopter's pilots may be not. Further expense on SAR helicopter's pilots for maintaining their higher professional capabilities can be very costly, too.

On the opposite side, poor training can be even more expensive. Failures in SAR operations will not only cause loss of lives as well as valuable property, but also damage the image and trust of SAR community. Since providing SAR services is the dominant function of any public service (protecting and saving lives, maximizing public prosperity, and fair distribution of resources are the core reasons to establish political systems and saving lives is the most honorably task)⁶⁹, usually the government will be inquired and even be blamed if they fails to provide such service. This is exactly true in dealing with bigger disasters when the Media step in and exaggerate the effects. In this sense, SAR is political. How expensive the failures of SAR services can be for the politics is usually immeasurable and uncertain. Although sometimes the failures of providing SAR services may be caused by various factors, the poor training can be one of the decisive factors, which are usually reflected in the human factors in various ways. For example, after the catastrophe of Ro-Ro passenger ferry DASHUN, which capsized on November 24, 1999, at Bohai Bay China, resulting in tremendous loss of 282 human lives and properties, "Although the responsibility of catastrophe did not lie on CRS.....slow development of rescue and salvage system; serious insufficiency of investment; old and backward equipment; sole rescue means; low efficiency in lifesaving and so

⁶⁹ Capt. Udo Fox. Expert viewpoint.

on”⁷⁰ had been identified as the weak areas of CRS. Among these identified weak areas, it could be argued that training is one of the latent risk-taker behind these problems. Lack of investment and good equipment can be attributable to the low awareness training that may influence top leaders, who could possibly make better decisions if they are more instilled by severe problems mentioned above.

(3) SAR personnel usually have a big variety of entry levels

Officers and ratings under STCW 78/95 usually have similar training backgrounds and competence. In contrast, SAR personnel may be recruited from various sources and some of them such as some SAR volunteers may never be on sea before, while other SAR personnel such as SMCs usually have a profound marine experience. These different entry levels of SAR personnel cause different demand of training.

(4) SAR training is a much more functional or operational based program rather than knowledge based one

The functional requirements of an individual SAR personnel stem from the decomposed SAR system’s functions and if the functions can be realized by whatever way, it can meet the objectives of SAR operations, therefore training should be based on the requirements of these functions other than knowledge. For example, some SAR volunteers like fishermen can carry out good search operation in a certain sea area due to their long-time gained fishing experience. They may know nothing about nautical charts and electronic positioning system (GPS, Radar), but they can locate themselves in the sea by their own ways. In this case, training them how to read and use nautical charts does not make so much sense since they can realize the search function as assigned to them.

Taking the function of coordination as a further example, the SAR system has three levels of coordination associated with SCs, SMCs and OSCs. The general functions

⁷⁰ Capt. Jiahui, Song. Reform and Development of China Rescue and Salvage, presentation delivered at International Rescue and Salvage Forum 2004 and the annual general meeting of the Rescue and Salvage Committee of China Navigation Association, on 8th Sept, 2004.

assigned to these three posts are managing, mission planning and coordinating, and operational commanding and overseeing respectively. The training demands of these three categories of people are obviously different because of not only the different entry levels of a candidate who will possibly assume such posts but also different functional requirements. To tailor a suitable training program for an individual, the different levels of entry should be evaluated first and the gap between the required capability and the current competency should be analyzed. Based on these analyses, training needs and methods to establish the professionalism can be formulated.

Conclusively, although STCW 78/95 Convention is neither legally applicable to SAR personnel nor suitable for SAR training in terms of contents, it still can be one of the bases for training SAR personnel in respect of navigation knowledge and skills. The unique features of SAR training should be borne in mind when starting a SAR training program and particular focus should be concentrated on SAR services' functional requirements rather than knowledge although knowledge is also important for SAR personnel.

4.3 Functional requirements of SAR personnel

To meet functional requirements are the final objectives for SAR training programs. Usually when the functional requirements for a specific post are identified, then the training institutions could design suitable training curriculums to realize these functions, which should include what to be trained, indicators of assessment, refreshment arrangements, etc.

SAR system's functions are usually decomposed and assigned to individual SAR service personnel, among which SCs, SMCs, OSCs, aircraft coordinators and SRUs commanders are critical posts. According to the IAMSAR manual, their functional requirements are discussed as follows.

4.3.1 Basic functional requirement of SCs

The SCs are the top level SAR managers and usually take the overall responsibility of establishing, staffing, equipping, and managing the SAR system, providing appropriate legal and funding support, establishing RCCs and RSCs, providing or arranging for SAR facilities, coordinating SAR training for its subordinates, and developing SAR policies, etc. Obviously, it is a training of leadership for the SCs such as awareness training rather than technical issues.

4.3.2 Basic functional requirement of SMCs

The SMC is in charge of a SAR operation until a rescue has been effected or until it has become apparent that further efforts would be of no avail, or until responsibility is accepted by another RCC. The SMC is normally performed by the RCC chief or a designee. For complex cases or those of long duration, the SMC usually has an assisting team. The SMC's function exists only for the duration of a specific SAR incident.

The SMC should be able to use readily available facilities and to request additional ones during the operation. The SMC plans the search and co-ordinates the transit of SAR facilities to the scene. Therefore, the SMC should be well trained in all SAR processes and be thoroughly familiar with all applicable SAR operational plans. The SMC must competently gather information about distress situations, develop accurate and workable action plans, and dispatch and co-ordinate the resources which will carry out SAR missions. The plans of operation maintained by the RCC provide information to assist in these efforts.

4.3.3 Basic functional requirement of OSCs

When two or more SAR units are working together on the same mission, there is sometimes an advantage if one person is assigned to co-ordinate the activities of all participating units. The SMC designates the OSCs, who may be the person in charge of a SRU, ship or aircraft participating in a search, or someone at another

nearby facility in a position to handle the OSC duties. The person in charge of the first SAR facility to arrive at the scene will normally assume the function of OSC until the SMC directs that the person be relieved. Conceivably, the OSC may have to assume the SMC duties and actually plan the search if the OSC becomes aware of a distress situation directly and communications cannot be established with a RCC or a RSC. The OSC should be the most capable person available, taking into consideration of SAR training, communications capabilities, and the length of time that the unit where the OSC is aboard can stay in the search area. Frequent changes of the OSCs should be avoided.

4.3.4 Basic functional requirement of ACOs

The ACO's function is to maintain high flight safety and co-operate in the rescue action to make it more effective. The ACO function should be seen as a co-operating, supporting and advisory service. The ACO should normally be designated by the SMC, or if that is not practicable, by the OSC. The ACO function will normally be performed by the facility with the most suitable mix of communication means, combined with trained personnel to effectively co-ordinate the involvement of multiple aircraft in SAR operations while maintaining flight safety. Generally, the ACO is responsible to the SMC; however, the ACO on scene must be co-ordinated closely with the OSC, and if no SMC or OSC, as the case may be, the ACO would remain in overall charge of operations. Duties of the ACO can be carried out from a fixed-wing aircraft, helicopter, ship, a fixed structure such as an oil rig, or an appropriate land unit. The ACO's duties are usually depending on needs and its qualifications.

4.3.5 Basic functional requirement of SRUs' commanders

SRUs commanders are possibly to be assigned as OSCs therefore their functional requirements should be at the same level as that of OSCs. Except that, their primary tasks are to operate their units and carry out on-scene SAR operations. If SRUs personnel, on account of operational limitations, for example due to the small size

of the craft, lack of equipment carried, or weather limitations, are not qualified be an OSC, then their functional requirements should be reduced accordingly.

4.4 States' practices of training of SAR personnel

In the maritime field, there is limited research and literature addressing MET on SAR personnel even though some attempts have been done to probe into possible solutions such as the standards developed by ILF. Due to the absence of any binding international standard of training of SAR personnel, such training is left to states' authorities.

As reviewed in the first chapter, the USCG conducted research into states' practices of training in respect of length of training of SAR controllers. Its findings are mainly reflected in the following table.

Table 1 : States' practices on training of SAR controllers

Country	Length of SAR School	Length of On-the-Job Period
USA	3 weeks	6 weeks
Australia	2 months	2-3 months
Canada	1 month	6-7 months
Hong Kong	N/A ¹	2-3 weeks
Netherlands	3.5 months theory ²	3.5 months
Sweden	3.5 months theory ³	18 months
UK	10 days	Varies: 3 months-1 year ⁴

Notes:

1. Hong Kong does not have its own SAR school, but personnel attend schools in other nations.
2. The Netherlands does not have its own SAR school, but the Netherlands controllers who are graduates of the United States' and Canada's SAR schools train others after their 3.5 months of "SAR Theory."
3. Sweden has a SAR school for SRUs only. The situation for their controllers is the same as for the Netherlands.
4. Most of the UK SAR Coordinators have 10 to 20 years of merchant mariner experience.

(Source: USCG, 2004)

This table reveals that most of the countries spend quite a lot of time in training their SAR controllers, through resident and on-the-job training. However, this does not answer the course contents (the curricula of various SAR schools) and training

methodology, which can be more important than the length of the school training courses or on-the-job training.

The author has gone a further step in examining states' practices on how to train (formal or informal training and SAR exercise evaluation, etc) and what contents are to be trained on. In order to easily reflect states' practices, the author's survey was narrowed to SRUs crew training, and RCC or RSC staff training only. Based on the responses from the targeted states, their practices are presented in a qualitative manner and discussed as follows.

Table 2 : States' practices on SAR training arrangements

Questions		Canada	USA	UK	Sweden	Denmark	Germany	India	China
RCC or RSC staff training	1.following IAMSAR or not	yes	yes	yes	yes	yes	yes	partially	partially
	2.entry level required or not	yes	yes	yes	yes	N/A	N/A	N/A	negative
	3.formal training with certificates	only for SMCS	yes	yes	yes	yes	yes	negative	negative
	4.operational manual for all foreseeable SAR situations available or not	yes	yes	yes	yes	negative	yes	yes	yes
	5.cooperating and exercising with other RCCs or RSCs	yes but irregularly	yes but not often	yes	yes	yes	yes	yes	yes
SRUs' crew training & exercises	6. formal or informal	informal	formal	formal	informal	informal	formal	informal	informal
	7.SAR exercises evaluation	no formal evaluation process	yes	yes	negative	negative	yes	negative	negative

(Source: Chao Wang, WMU, 2006)

4.4.1 Following the training guidelines of the IAMSAR manual

The survey shows that the majority of states use IAMSAR manual as the training holy books for their RCCs and RSCs staff although two out of eight states only partially follow the IAMSAR manual. This result also coincides with the New Zealand survey findings. The New Zealand survey shows that eleven out of fourteen states have trained more than 90% of their watch-keeping staff in accordance with the IAMSAR manual. The reasons of this outcome could be:

- 1) The IAMSAR manual is very valuable and helpful although it is recommendatory.
- 2) SAR community becomes more and more internationalized and RCCs or RSCs are brought into international arena more frequently than before.
- 3) States have the commitments of providing SAR services, which also coincides with the fact that more and more states are becoming parties to SAR 79.

Two Asian states in the survey do not fully follow the training guidelines of the IAMSAR manual. The reason can be that the IAMSAR manual is still complex and unaffordable for them to follow. For example, all staff in DGzRS has formal and certified training at the Training Centre of the British Maritime and Coastguard Agency, obviously this may be uneconomical and unaffordable for these two developing states although they are parties to SAR 79 and have the commitments of providing SAR services too.

4.4.2 More formal training for RCCs and RSCs staff while less formal training for RSUs crew

The practices of states considered in the research reveal that most of them have formal and certified training arrangements for their RCCs and RSCs staff, particularly for the SMCs. These training arrangements are usually attached with some certain degree of entry requirements, for instance in Sweden, a master mariner certificate is required for an employment at MRCC. Canada has similar requirement that the candidates of a future SMC shall be a qualified ships' navigation officer before being provided necessary training.

The reason can be the idea of strengthening RCCs and RSCs' SAR coordination. Among SAR system's functions, SAR Coordination is a key element of SAR operations. It is the decision-making phase of SAR operations that determines the SAR strategy, availability of resources, and the coordination of specific activities of SAR players and technical considerations. For example, deciding whether to send a fast helicopter with a limited capacity of operation in harsh meteorological conditions, or a slower aircraft with efficient safety equipment; and determining whether to use a vessel of opportunity or task a dedicated patrol vessel. If failures happen in the process of SAR coordination, the outcome can be disastrous.

However, regarding SRUs crew training, most of states neither have implemented formal training system, nor have formal evaluation procedures in place to assess the informal SAR exercises. To establish a formal training system can be very difficult due to the different entry level of SAR crew as well as the different limitations of SRUs. But for SAR exercises, which are predominantly used by states to train their SRUs crew, it could be suggested that it should be possible and helpful to establish a formal assessment procedure. The author had a personal experience in participating in one of the Baltic Sea SAR exercise held from 24th to 28th April 2006 in Danish water⁷¹. After exercise debriefing, no further works like drafting a report and assessing the participants' performance were required for both the participating SRUs and the exercise organizer. In the later survey regarding the question of whether there is a formal planning and evaluation process for SAR exercises, Danish Navy's reply is that "the lessons learned in SAR exercise and evaluation is often a unit matter of discussion". The author holds the view that there should be some certain evaluation arrangements in place to assess the objectives of SAR exercises. Otherwise, exercise becomes exercising only and no improvement can be documented and expected.

4.4.3 Learning from others and self-learning in SAR training

⁷¹Chao, Wang & F. K. Akanga, SAREX Bornholm 2006--A Report by WMU Students, WMU.

To offset insufficient training, cooperating with other RCCs or RSCs such as having joint exercise and exchanging SAR personnel can be a good way. Another alternative commonly used in training is self-learning i.e. on-the-job training by examining operational procedures, observing and learning from senior and experienced staffs. The survey shows that these two ways are very popular in states' practices because they are cheaper but efficient ways of learning in terms of better outcome within a short time.

4.5 Summary

SAR training is important but no international standards are available currently. SAR training has its unique features which should be considered in establishing a SAR training program. Usually SAR authorities need to firstly define their staffs' functional requirements i.e. training demands first. States' practices show that training for RCCs and RSCs staffs is formally carried out while training of SRUs crew is informal. To compensate for insufficient training, some alternatives which are popularly used in SAR training have been illustrated.

Chapter 5 SAR System Management

The SAR system cannot be effective without management. The management task is defined as “consisting of organizing groups of individuals so that they work together towards common goals or, in other words, deciding what has to be done and getting other people to do it” and can be achieved “through the process of planning, making decisions, organizing, leading, motivating, communicating and controlling”.⁷² The functions of the SAR system are mainly realized through RCCs and/or RSCs by way of coordinating, controlling, and conducting maritime SAR operations within a SRR or SRRs, sometimes in addition to coordinating SRUs response for humanitarian incidents in accordance with its national policy. Therefore, the management task of SAR system is mainly a management issue of RCCs and/or RSCs.

5.1 RCCs and RSCs

5.1.1 Establishing RCCs and RSCs

Within a specific SRR, the questions of how many RCCs and/or RSCs are appropriate and where they should be located must be considered first when establishing a national SAR system. Development of a SAR system typically involves establishment of one or more SRRs, each associated with a RCC which is expected to handle the operational coordinations within its own SRR and with foreign RCCs responsible for other SRRs whenever appropriate. When settling these questions, as argued by Donaldson⁷³, “the most important balance to strike is that between working load and local knowledge. Staff in coordination centre need regularly to practice their skills by responding to distress calls and they must not

⁷² Rob Dixon. (2003). The Management Task 3rd ed. Heinemann pp.23

⁷³ Lord Donaldson of Lynton, Review of the Five Year Strategy for HM Coastguard. 1999

become bored. On the other hand, the size of district must not grow beyond the capacity of staff to hold the necessary level of local knowledge". Based on his argument, UK closed 3 MRCC and relocated another two.

Next to be considered is delimitating an AOP for which a RCC or RSC should be responsible, seamlessly but without overlapping, staffing RCCs and/or RSCs, assignments of SRUs, etc.

New Zealand survey shows that each RCC operates an average of 592 SAR cases annually and each watching staff coordinates an average of 44 SAR cases every year. These figures imply that to keep sufficient practices is an important factor of determining the number and the locations of RCCs and/or RSCs as well as staffing levels.

5.1.2 Staffing RCCs and RSCs

RCCs or RSCs staffing is to fill RCCs or RSCs roles in the SAR operations with qualified persons. Regarding on-duty officers in the RCCs or RSCs, the survey shows that in states' practices, there are normally 3 officers on duty per shift and the watching-duty officers are 7 per day for a RCC or RSC. In the peak time, the staffing level will be increased at least 1 person per day. This result coincides with the USCG's finding that there are usually 7 watchstanders plus 1 supervisor on duty posts.

Table 3 : RCCs' staffing levels in States' practices

Items	Shift Patterns				No. of staff on duty per centre			
Country	12 hr shifts	8 hr shifts	Day work only	Other :	winter (off-peak)		summer (peak)	
					Per Shift	Total	Per Shift	Total
Country A	x				2	4	2	4
Country B		x			3	9	3	9
Country C		x			4	12	4	12
Country D	x				3	6	4	8
Country E	x				4	8	5	10
Country F				x	5		5	
Country G	x				15	30	15	30
Country H	x				2	4	4	8
Country I	x				3	6	3	6
Country J		x			2	6	3	9
Country K		x			4	12	4	12
Country L		x			3	9	4	12
Country M				x				
Country N	x				2	4	2	4
Averages*					2.9	7.3	3.5	8.5

Note: Country M & F should be excluded due to incomplete data and country G is also to be excluded because of other responsibilities such as security are added to the RCCs or RSCs.

(Chao Wang, WMU 2006, Adapted from New Zealand Survey)

Table 4 : States' RCC staffing standards

Country	Staffing Standard (No. of Watchstanders+ No. of Supervisors)
USA*	5+1
Australia	7+1
Canada	5+1
Hong Kong	5+1
Netherlands	7+1
Sweden	7+1
UK	7+1

Note: changing to 7+1 after 2004.

(Source: USCG, 2004)

5.1.3 RCCs and RSCs library

In order to improve SAR capabilities and train SAR personnel, RCCs and RSCs should maintain an appropriate level of collection of relevant books, materials, data, etc. They should be systematically arranged and preferred to have an annotated bibliography for quick index.

For the IMO documents, the minimum and essential reference documents relevant to RCCs and RSCs are published in the COMSAR annual circular. The latest one is SAR.7/Circ.7/2006, which covers SAR and other tasks which MRCCs are often required to perform. The documents concerning the world-wide navigational warning system are only mentioned to the extent that access to the system is essential in the context of some SAR operations.

For other international, regional and national documents, there should be a comprehensive collection as well but it depends on the national SAR authority's consideration. If it is a highly-degree autonomous MRCC or MRSC, or its SRRs or Sub-SRRs relatively small, SAR authority may increase or reduce the store of such collections.

For the local knowledge, a collection of innumerable sources of oceanographic data including historical data and near real time data as well as estimates from numerical models is very helpful to aid the RCC Controllers in their SAR operations and should includes the following types of data:

- Sea surface temperature
- Wind climatology and resulting wind current
- Ocean wave prediction
- Sea state climatology
- Sea current (low frequency)
- Tides and tidal currents
- General oceanography texts
- Other types of relevant information

5.2. SAR Communications and dealing with false alerts

5.2.1 General requirement of SAR communications

Good communication is essential and critical for SAR services. RCCs or RSCs may locate far away from the sea but should have various means of communications to reach the scene within its associated SRR or SRS. Communications arrangement should promptly provide the RCC with alerting information permitting the RCC to dispatch SRUs and other resources to search areas without delay and to maintain two way contact with the persons in distress. The main functions of a SAR communications system are⁷⁴:

- receipt of alerts from equipment used by persons in distress;
- exchange of information with persons in distress, and among the SAR mission coordinator (SMC), OSC and SAR facilities for co-ordination of responses to SAR incidents; and
- direction finding (DF) and homing which allow SRUs to be dispatched to the vicinity of the distress and to home on signals from equipment used by survivors.

The basic communications requirements of the (M)RCC are⁷⁵:

- Timely delivery of alerts;
- Complete and easy to understand alerts;
- Minimum number of false alerts;
- Capability to contact units in distress;
- Common language.

The SAR organization is usually alerted to an actual or potential distress situation directly or by means of alerting posts. The information collected by alerting posts and other reporting sources should be forwarded immediately to the RCC or RSC, which decides on the type of response. The RCC or RSC may have the

⁷⁴ The IAMSAR manual Volume I chapter 4.

⁷⁵ COMSAR/Circ.37

communications capability itself or may rely upon other facilities to forward alerts and to carry out SAR response communications.

Communications between an alerting post and the RCC, RSC or local SAR unit should be fast and reliable. The channels should be checked regularly. These voice or data links could be via dedicated or public telephone, radiotelephone, radiotelegraph, or satellite. Preferably, communications to and from RCCs and RSCs should be as timely and reliable as possible, sufficient to handle the diversity and volume of communications for the worst potential scenarios such as a mass rescue operation, able to automatic retrieval of relevant associated emergency information from communication registration databases such as caller identification and recording for voice communications.

5.2.2 Dealing with false alerts

In the IAMSAR manual, false alerts are defined as any alert received by the SAR system indicating an actual or potential distress situation, when no such situation actually exists. The SAR false alert rate, which characterizes the impact of false alerts on SAR services, is the percentage of false alerts plus undetermined alerts over the total number of alerts transmitted to SAR Authorities. The 2004 SAR false alert rate was 97.7 % for 121.5 MHz beacons and 95.8 % for 406 MHz beacons⁷⁶. Statistics from (M)RCCs show that the SAR false alerts rates are continuously kept at approximate 95-100%, mainly caused by lack of knowledge of the relevant conventions, codes and regulations⁷⁷. Currently, false distress alerts have become a major problem to the efficient operation of SAR services and the severity of this problem is still increasing, thus causing potentially serious effects on both real distress situations and unnecessary work and cost of SAR operations, particularly when SAR operations are initiated as a result of such a false alert.

Concerted efforts are being made to cope with this situation, such as identifying the manufacturers, whose equipments have a high false alert rate, formalizing false alert

⁷⁶ COMSAR 10/6

⁷⁷ MSC/Circ.1078

reporting formats⁷⁸, better designing alerting equipments, fining as a deterrent to perpetrators, enhancing training for crews. From RCCs and RSCs' operational point of view, one of practical ways may be to establish a good cooperative relationship with SAR data providers and get quick access to relevant databases to identify who are calling then clarify whether or not it is a hoax.

5.3 Assessing SAR System Performance

SAR system should be periodically assessed for the purpose of identifying weaknesses and improving system performance. From the long-term considerations, although the Voluntary IMO Member State Audit Scheme currently does not include SAR 79⁷⁹, it does audit SOLAS convention. As discussed in Chapter Two, similar obligations of providing sufficient SAR services are imposed upon member states both in SOLAS and SAR 79. Further, in noting the importance of the ICAO audit scheme, the ICAO/IMO Joint Working Group on Harmonization of Aeronautical and Maritime Search and Rescue has submitted a report⁸⁰ which encourages IMO to establish, on a voluntary basis, a complementary SAR audit of maritime SAR services on the basis of the SOLAS and SAR 79. Therefore, assessing SAR system's performance not only satisfies its internal demands but also can be considered as making preparations for coming Voluntary IMO Member State Audit in the near future.

Among various ways of evaluating the effectiveness and efficiency of a SAR system, the analysis based on the SAR system performance data can be a good method, as recommended in the IAMSAR manual Volume I. However, the fact is not so satisfying. In practice, there may be some chaos in the SAR databases, particularly the SAR statistics.

SAR data analysis is an important means for documenting the need for a well-functioning and efficient SAR system as well as for providing sound justifications for SCs to compete for limited resources such as obtaining government funding and

⁷⁸ Ibid

⁷⁹ Resolution A.974(24)

⁸⁰ COMSAR 10/6

marketing in the community to motivate donations and support. It is also usually used to determine where to locate resources and how many if geographic distribution of SAR cases are referred to.

Statistics on the value of saved property is difficult to maintain. As discussed in the IAMSAR manual, the saving of property should possibly be accommodated in SAR services since it is often a natural extension of lifesaving effort, and may be a means of lifesaving, e.g., saving a vessel may be the best means of saving the lives aboard the vessel, and may help to justify SAR resources due to the value of property saved, and will take advantage of SAR facility capabilities when other means of saving property may be unavailable or too expensive⁸¹. Based on the data requirements recommended in the IAMSAR manual Volume I Chapter Five, the author initially designed a SAR statistics form in the survey to collect states' performance data and to examine how the SAR statistics are maintained in the states' practices. However, in the early evaluation process of the SAR questionnaire, some comments were given by interviewees that it might be very difficult to collect the set of data regarding property i.e. value of property lost, value of property saved/assisted, property loss prevented, etc, although they are the basic items that are suggested in the IAMSAR manual to be maintained in the SAR databases. One reason is the methodology of assessing the value of property and the other can be the cooperative difficulty from the rescuee side. Until now, there are no unified standards on how to evaluate the property involved in the circumstances of SAR operations. On the other side, usually rescuees themselves are unable or unwilling to provide the value of their property. Actually, it is not an easy work to estimate a maritime property's value even it is an approximate figure.

Despite of the difficulty of maintaining SAR statistics on properties, the pure data regarding life saving seems even more subjective even though there is a recommendation that guides to establish the SAR databases⁸². In the author's survey, states' practices show that all the states considered have maintained a

⁸¹ IAMSAR Manual Volume I PP.5-7

⁸² COMSAR/Circ.22

statistical database on SAR events particularly life-saving items, but the reasonability of such data may be questionable. The data collected is presented as follows:

Table 5 : Statistics of LS & LLA from year 2002 to 2004

Country	Yr2002			Yr2003			Yr2004		
	LS	LLA	EFF(L)	LS	LLA	EFF(L)	LS	LLA	EFF(L)
Canada	2650	8	99.70%	2790	3	99.89%	4510	0	100.00%
USA	3661	236	93.94%	5104	246	95.40%	5475	279	95.15%
UK	5851	319	94.83%	5689	234	96.05%	4947	268	94.86%
Germany	248	10	96.12%	272	10	96.45%	368	10	97.35%
India	139	2	98.58%	133	0	100.00%	1111	10	99.11%
China	12259	441	96,53%	15726	463	97,14%	16514	916	94,74%

(Source: Chao Wang, WMU 2006)

According to IAMSAR manual Volume I, the SAR system effectiveness can be statistically indicated by the denominator of SAR Programme Effectiveness for Preventing Loss of life i.e. $EFF(L) = LS/(LS+LLA)$, Where: LS = Lives Saved, LLA = Lives Lost After Notification. EFF (L) measures the proportion of lives actually saved versus the total available to be saved.

Based on the survey, these resultant ratios (EFF (L)) are pretty good but it can be debatable whether it is the real case or not. If it is manipulated SAR databases, then it definitely loses its sense of evaluating SAR system performances.

5.4 The policy of charging for SAR services

SAR operations are typically high tempo and require sophisticated communications and command infrastructure as well as costly SAR assets such as fixed wing aircraft, helicopters, cutters and a variety of boats. Usually the investments and the operational cost are provided by government budgets (except for DGzRS who totally rely on its own financing and it is the same as that of other voluntary organizations such as the RNLI). Whether or not charging for SAR services is a disturbing factor that should be eliminated but it is debatable too.

Logically, charging for SAR services would cause people to wait until they are in dire straits before notifying the SAR system of their situation. Charging in a certain sense creates incentive to delay calling for help until it is too late to save them. Often, if it is a real SAR incident, the delayed alerting results in added losses and SAR effort costs that can be much larger than potential funds received by charging. On the opposite side, a critical element in most successful SAR operations is the initiation of response before the persons are in extremes. This is really a dilemma of which the potential benefits of charging can be outweighed by its higher expense as well as the loss of lives and property although charging can also be used as a deterrent to reduce hoaxes.

In both legal and practical aspects, charging for SAR services does not make any sense either. Charging directly against those who need SAR services is not only contrary to international laws which define SAR services as a humanitarian assistance in nature such as in SOLAS and SAR 79 which regulate that SAR services must be provided without regard to nationality or circumstances, but also would impose enormous financial burdens on survivors. Typical SAR operations can easily cost so much that the persons who are rescued may be unable to pay it. And if it is an extensive search operation, the cost can be even higher. As indicated in the IAMSAR manual Volume I, it is normally impractical to charge those assisted, since they would be unable to afford the full cost in most cases. Deciding in each case whether to charge for a response can often be subjective too. SMCs cannot choose who to rescue based on the ability or willingness to pay, even if this could be quickly determined before rescue. Therefore, charging for SAR services is strongly discouraged.

Internationally, there are some SAR services that are customarily funded the services through charging, even if the assistance is provided at the request of another authority, e.g., an RCC of another state. Most states prefer that this should be preserved because an environment should be avoided that might dictate resolution of funding prior to providing assistance, and it is difficult to see where charging would end if it became an accepted practice. An exception to non-charging

would be when the services are provided by an organization under a contractual arrangement with the requesting organization, in which case this service provider is acting on behalf, and as a primary resource of, the responsible SAR authority.

In practices, some authorities have adopted a way of initiating advance fees charged to certain groups such as DGzRS requesting shipping companies to pay small amount of money for SAR services voluntarily when they begin to establish their business in Germany, or to participate in certain SAR related activities, to help offset the general costs of providing SAR services needed by those groups or for those activities.

5.4.1 Canadian policies on salvage of civilian property⁸³

Under Canadian National SAR Manual, SRUs may be utilized to salvage civilian property providing no commercial means is available and appropriate approval has been obtained by the requesting persons or agencies if such salvage operations will not jeopardize operations, disrupt training, or unduly hazard SAR personnel or equipment. However, SRUs shall comply with certain policies laid down in the “*Provision Of Towing Assistance by Vessels Engaged in Search and Rescue Operations*”⁸⁴, of which it is required that if in the judgment of the RCC / the RSC /the OSC or the commanding officer of the vessel on scene, the conditions for a distress or potential distress are not present, and if suitable commercial assistance is readily available, then the provision of tow by a SRU will be denied. At the same time, full details of the commitment shall be obtained. Based on these, the Superintendent, in consultation with the RCC/ MRSC, will decide whether to undertake the mission finally. In non-life threatening situations, and if requested, the RCC/MRSC will aid in arranging assistance from the private sector, which is stated in the above mentioned policies.

5.4.2 USA’s policies on charging for SAR services

⁸³ Canadian National SAR Manual, PP.10

⁸⁴ Annex 7A of Canadian National SAR Manual

U.S. policies on charging for SAR services, documented both in the National SAR Plan and USCG Addendum to the US National SAR Supplement to the IAMSAR manual, are as follows:

Domestically, each participant⁸⁵ will fund its own activities in relation to this Plan unless otherwise arranged by the participants in advance, and will not allow a matter of reimbursement of cost among themselves to delay response to any person in danger or distress. It is also agreed that SAR services provided to persons in danger or distress will be without subsequent cost-recovery from the person(s) assisted. Due to the possibility of conflict of interest, active duty Coast Guard personnel, reservists under active duty or inactive duty orders, and auxiliarists under orders are prohibited from engaging in commercial assistance activity of any sort. Likewise, reservists and auxiliary personnel are not to be used in any capacity that might give rise to the perception of a conflict of interest. Vessels and aircraft used for commercial assistance activities shall not be accepted as an auxiliary facility, and a designated auxiliary operational facility shall not be used as part of commercial assistance activities at any time.

Nevertheless, for non-distress situations, Coast Guard resources normally do not provide immediate assistance if alternative assistance is available. Determining whether or not it is a non-distress case is subject to the SMC's discretion but Coast Guard both supports efforts of private enterprise and encourages volunteerism in assisting mariners. Coast Guard resources will not unnecessarily interfere with private enterprise. A Coast Guard resource may assist in a non-distress situation when no higher priority missions exist and no other capable resource is reasonably available. All the services are free except two situations where the Coast Guard may seek to recover costs: (1) under limited circumstances to sell fuel and supplies to furnish services to public and commercial vessels and other watercraft; (2) to aggressively recover all costs the Coast Guard incurs as the result of an individual who knowingly and willfully communicates a false distress message to the Coast Guard, or causes the Coast Guard to attempt to save lives and property when no help is needed.

For the international assistant, in accordance with customary international law, when one nation requests help from another nation to assist a person(s) in danger or distress, if such help is provided, it will be done voluntarily, and the U.S. will neither request nor pay reimbursement of cost for such assistance.

5.5 Humanitarian issues in SAR operations and refuge law at sea

Humanitarian incidents are usually defined as SAR incidents (not aeronautical or maritime) which require a response by the SAR system to preserve human life or relieve suffering.

Humanitarian incidents sometimes are also classified as civil assistance. Under various international instruments, SAR services are required to be provided in case of humanitarian incidents, even in times of armed conflict. For example, under the 1949 Geneva Convention, SAR facilities are required to afford protection for their humanitarian missions so far as operational requirements permit. Such protection applies to coastal rescue craft, their personnel, and fixed coastal SAR installations.

Humanitarian incident can be a simple task such as the search for the body of a drown person, but also can be a very complex and challenging one such as the M/V Tampa case⁸⁵, which triggered a hot debate on how to treat refugees both from the rescuers side and coastal states side. The centre of the debate is a conflict—the sovereign right of nations to control and regulate entry into, and operations within, their territory; and the humanitarian need to quickly and effectively assist persons or property in danger or distress without regard to nationality or circumstances. In the M/V Tampa case, the Australian government was blamed by various scholars. Dr. Michael White commented in his paper that “the attitude of the Australian government towards the M/V Tampa appeared to be a breach of Australia’s international obligations” and “the retrospective dating of this legislation is not the

⁸⁵ Here “participants” refer to the federal agencies signatory to the National SAR plan.

⁸⁶ White, M. “M/V Tampa and Christmas Island incident, August 2001”. BIMCO Review 2002, PP.116-122.

conduct usually favored by civilized countries”⁸⁷. Richard Barnes argued that “states which refuse to allow vessels in distress refuge, and consequentially close their doors to asylum-seekers, may be acting contrary to their human rights obligations”⁸⁸.

In responding to the M/V Tampa case, a series of actions have been taken by IMO to cope with such situations. Resolution A.920(22) requests IMO bodies to take action as appropriate so that (1) survivors of distress incidents are given assistance regardless of nationality or status or of the circumstances in which they are found;(2)ships which have retrieved persons in distress at sea are able to deliver the survivors to a place of safety; and (3) survivors, regardless of nationality or status, including undocumented migrants, asylum seekers, refugees and stowaways, are treated while on board in the manner prescribed in the relevant IMO instruments and in accordance with relevant international agreements and long-standing humanitarian maritime traditions. At its 78th session, the MSC adopted pertinent amendments to Chapter V of SOLAS by Resolution MSC.153 (78) and to Chapters II, III and IV of the Annex to SAR 79 by Resolution MSC.155 (78), which entered into force on 1 July 2006. At the same session, the MSC adopted “Guidelines on the Treatment of Persons Rescued at Sea” by Resolution MSC.167 (78). The purpose of these amendments and the guidelines is to help to ensure that persons in distress are assisted, while minimizing the inconvenience to assisting ships and ensuring the continued integrity of SAR services.

Dealing with refugee issues sometimes may go beyond the scope of a national SAR authority’s capacity but the SAR authority does need proper preparations in case of such incidents since SAR services are usually involved initially and even play an important role in these situations. As required in SAR 79, “Parties shall, as far as practicable, follow relevant minimum standards and guideline developed by the Organization”, RCCs and SRUs should develop their own operational plan to handle

⁸⁷ Ibid. The Australian government passed a legislation that had retrospective effect to remove the rights of the persons who may have been unlawfully treated by the government from recourse to the courts to seek determination of any breaches and perhaps, redress for them.

⁸⁸ Richard, Barnes. “Refuge law at Sea”. The International and Comparative Law Quarterly; Jan 2004; 53, 1; Academic Research Library. PP.47-77

humanitarian incidents in accordance with the standards and procedures recommended in the guidelines.

5.6 Summary

In this chapter, some questions affecting SAR system performance are examined from the management point of view.

It is indicated that RCCs should be arranged in such a way that a balance between the workload and local knowledge should be maintained. This principle is conditional upon its staffing level as well as communications capabilities.

The SAR system should be continuously assessed for the purposes of improving the quality of SAR services; it could also be understood as preparing for the coming IMO Member State Audit. Among various performance-assessment methods, a general indicator i.e. EFF (L) has been used to evaluate SAR system's performance. It is found that the EFF(L)s, which are based on the SAR system performance statistics, are extremely good, while it can be the real case, or it is manipulated, although there is a general prescription on how to establish such a database in the IAMSAR manual.

Regarding the policy of charging for SAR services, it is argued that this should be discouraged with a few exceptions. The practices in USA and in Canada are examined to illustrate the way of how to handle such problems.

Lastly, the humanitarian issues in the context of SAR services are discussed and it is suggested that based on the recommended guidelines, some operational plans should be in place to cope with such a problem.

Chapter 6 Conclusions and recommendations

Maritime SAR services are an important part of the maritime safety system and have developed rapidly over the last few decades with the introduction of the GMDSS system. The global picture described under SAR 79 as amended requires states' parties to provide SAR services in a consistent and harmonized manner; however, the states' parties have shown a great variety of practices. The main objective of this research has been to analyze these good practices and identify the weak areas for the purpose of improving the quality of SAR services through the way of comparing states' practices.

6.1 Conclusions

To achieve this purpose, four areas of SAR services namely, legal framework, SRUs, SAR training and SAR management, have been examined and compared. The study and analyses indicate that:

- To provide SAR services is a long-time customarily-rigid obligation and states' national policies are critical in discharging such obligation particularly in respect of their SAR authorities' power and inter-agency/international cooperation arrangements. The multi-functional characteristics of SAR organization, or its parent management agency, usually facilitate the provision of SAR services.
- SRUs are primary SAR resources which deliver SAR services. Different states have different options and are composed of various SRUs but small water surface boats are the main ones. There are four ways to obtain SRUs among which designating SRUs and developing voluntary SAR organizations have been recognized as popular methods.

- SAR training is identified as a weak area in this research in terms of lacking unified standards, certificating arrangements and formal assessment of on-the-job training. Furthermore, public awareness of SAR, being one of the elements of SAR training, is also insufficient.
- Management is important for running a RCC or RSC. Problems which affect SAR performance should be identified and reduced, such as maintaining a comprehensive and objective SAR statistics database.

6.2 Recommendations

Based on the analyses and discussion in the previous chapters, the following principles can be concluded and recommended for states to follow in their practices of providing SAR services.

- 1) To promulgate high-level national legislation pertaining to maritime SAR is essential to run SAR services so that appropriate power could be given to RCCs in respect of acquiring SAR resources, defining SRUs legal nature as well as facilitating inter-agency coordination and cooperation. As the survey results have shown, a multi-agency approach of provision of SAR services is commonly used wherever it is possible in order to formally and actively involve potential SAR resource providers. At the same time, every individual agency's duty and responsibility should be clearly defined.
- 2) Dedicated SRUs are always needed in the SAR system but they can not be good enough in terms of response time and costly investment. Therefore, the fleet of dedicated SRUs should be kept at an appropriate level and the SAR authority should try its best to make use of other available SRUs by way of designating, developing voluntary SAR organizations and contracting, etc. It must be emphasized that voluntary SAR organizations are to be influential players in providing SAR services and should be encouraged, recognized and supported in states' practices.

- 3) Training should fit the purposes i.e. SAR training should be focused on the functional requirements of SAR system's various posts followed by a formal assessment mechanism. Public awareness should also be given a high priority for the purpose of more support and better understanding which can be bred and expected from the public.
- 4) Better management will bring higher efficiency. SAR management should be carried out throughout the whole system for the purpose of both reducing potential and/or existing problems and improving the services. "Urgent matters may not be important ones"⁸⁹. A philosophy of continuous improvement of the quality of SAR services should be borne in the minds of different levels of SAR managers and a workable management plan should be in place to guide SAR managers to consistently follow such a philosophy and approach to their goals.

6.3 Further areas of research

It is generally admitted that SAR techniques constitute a broad scope to be researched and developed, and this paper does not address so much. The innovation of SAR techniques can tremendously improve the performance of the SAR system. Therefore, SAR techniques should be given a higher profile and further researched into, at least including:

- 1) the computer-based decision supporting system, such as the integrated GIS search and rescue information system and large-scale disaster management system
- 2) search techniques such as night vision goggles, image detection techniques, drifting pattern calculation theories and appliances
- 3) applying AIS and LRIT techniques in SAR services
- 4) techniques to improve SART and EPIRB performance
- 5) purpose-based SRUs building high techniques

⁸⁹ Supra. See note 21 at pp.18.

Obviously, in the context of SAR, high level techniques cannot be listed comprehensively, but a clear understanding should be borne in mind that scientific innovations are surely the basic motors in pushing the SAR systems forward.

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Appendix Maritime search and rescue questionnaire

Your Name and Title:

Organization:

Address:

Part 1: Legal Framework

1. Which government agencies have authority and responsibility for co-ordination of maritime SAR? Where is this authority and responsibility described?
2. Are RCC(s) or RSC(s) assigned to perform other tasks which might detract them from their ability to handle SAR responsibilities? Please provide your RCC's organizational structure as well as its main functions.
3. Does your State have a national SAR Plan which describes the roles of all Government and non-government organizations which have resources that can support SAR?
4. Does your State have maritime SAR regions (SRRs) or SAR sub-regions (SRs) established?
5. Does your State have formal SAR agreements for inter-agency co-ordination and for co-operation with neighboring countries?
6. Can the RCC(s) or RSC(s) order the deployment of all primary SAR units? If not, does the co-ordination for use of SAR resources take place in a timely manner?

(Please provide a copy of legislations and documentations related to the above, if available)

Part 2: SAR Training

7. Is each RCC or RSC staff fully trained to do the following:
 - (a) Recognize the stages and phases of a SAR mission?
 - (b) Determine search datum, search areas, and probability of success?
 - (c) Account for ocean drift?
 - (d) Develop search action plans and rescue action plans?
 - (e) Allocate resources?
 - (f) Carry out international SAR obligations?

8. Have all of your RCC or RSC personnel attended formal SAR training? If so, have you established certificate system and how does it work?
9. Does each element in the SAR organization regularly evaluate its staff training status and take steps to correct all identified training needs?
10. Does each RCC- or RSC have a Plan of Operation manual which provides guidance in handling all foreseeable SAR situations?
11. Do crews of primary rescue units participate in regular SAR-related training or exercises? Is there a formal planning and evaluation process for these exercises?
12. Do your RCCs regularly work with other RCCs outside your region?
13. Do your RCCs or RSCs carry out exercises involving other RCCs and RSCs and rescue units on a regular basis?

Part 3: SAR Data

14. Does your State maintain a statistical database on SAR events?
15. Are SAR case records used to analyze and improve the SAR system? Do SAR case records satisfy legal requirements?
16. Please provide your past 3 years' SAR data according to the following form:

No.	Year	2002	2003	2004
1	Cases			
2	Responses			
3	Live Saved			
4	Live Lost Before Notification			
5	Live Lost After Notification			
6	Persons Otherwise Assisted			

17. Please provide 2-3 typical SAR cases.

Part 4: SAR Resources

18. Do all SAR units have mutually compatible communications?
19. Volunteer SAR resources include privately-owned aircraft and boats, fishing vessels, industry-owned helicopters and boats, professional organizations, etc. To what extent have these resources been organized?
20. Do the RCCs and RSCs Plans of Operation manuals include guidance on use of volunteer SAR resources?

21. What are your primary SAR resources which you rely on carrying out SAR operation? How frequently are they involved to carry out SAR operation?
22. Do you have special equipments or methods to respond to night search?
23. Are your SAR units covered by insurance against their own personnel injury, property damages as well as third parties damages?