MARITIME RESCUE CO-ORDINATION CENTRE OF HONG KONG SAR

Dr. Stephen Y K Li
Marine Department, Hong Kong China

Abstract

The South China Sea encompasses a portion of the Pacific Ocean stretching from Singapore to the Strait of Taiwan in the northeast. It is rich in natural resources such as oil and natural gas. Due to the high economic growth in China, shipping in the South China Sea is vital to world trade today. However, due to adverse weather, human error and other causes, marine accidents occur from time to time. Seamen and passengers sustained injuries or lost their lives in marine accidents. The Hong Kong Maritime Rescue Coordination Centre (HK MRCC) is dedicated to minimizing the extent of danger to human lives and damage to properties when a marine accident is occurred.

The prime responsibility of the HK MRCC is to render assistance to all marine craft which found themselves in difficulties at sea. The geographic limit within the HK MRCC's responsibility is bordered to the south by 10° north latitude and to the east by 120° east longitude.

The search and rescue system of Hong Kong SAR comprises of a number of government departments. HK MRCC has installed modern GMDSS equipment to listen and monitor any assistance/distress call from vessels. The HK MRCC acts as a coordinator of search and rescue operation by deploying aircraft and vessels of the relevant departments into action. The Digital Selective Calling and the Cospas-Sarsat systems maintain watch on distress channels whilst the Navigational Telex system (Navtex) promulgates vital information to the mariners.

The HK MRCC is manned with professional officers. Their primary responsibility is to ensure that rescue planning and operations are implemented in an effective and efficient manner when a marine emergency arises. HK MRCC also maintains close co-operation with the neighbouring maritime authorities to ensure that search and rescue operations are conducted smoothly in the region.

1. Introduction

Ladies and gentlemen, it is a privilege for me to attend this symposium. Before I introduce the topic of this paper, I have to thank the National Institute for the South China Sea Studies for arranging this opportunity for every one of us to meet and exchange ideas as regards the maritime safety in this region.

This paper introduces the work of Hong Kong Maritime Rescue Coordination Centre (HKMRCC), its communication equipment and the search and rescue operation to vessels in distress in South China Sea.

The South China Sea encompasses a portion of the Pacific Ocean stretching from Singapore to the Strait of Taiwan in the northeast. The area includes more than 200 small islands, rocks, and reefs, with the majority located in the Paracel and Spratly Island chains. Many of these islands are partially submerged islets, rocks, and reefs that are little more than shipping hazards and are therefore not suitable for habitation.

The South China Sea is rich in natural resources such as oil and natural gas. These resources have generated attention throughout the Asia-Pacific region. China's economic growth rates have been among the highest in the world. Such growth rates have in turned resulted in an increasing demand for energy. Between now and 2025, oil consumption in developing Asian countries is expected to rise by 3.0% annually on average, with more than one-third of this increase coming from China alone. If this growth rate is maintained, oil demand for these nations will increase from about 14.5 million barrels per day in 2000 to nearly 29.8 million barrels per day by 2025.

To transport oil or mineral ore in bulk from continent to continent, ship provides the safest, quickest, cheapest and most reliable way. Due to the high economic growth in China, shipping in the South China Sea is vital to world trade today. More than half of the world's annual merchant fleet tonnage passes through the Straits of Malacca, Sunda, and Lombok, with the majority continuing into the South China Sea.

However, due to adverse weather, human error and other causes, marine accidents occur from time to time. Seamen and passengers were injured or lost their lives in marine accidents whilst ships, cargo and properties were also lost. Although every incident might take its toll despite the great deal of effort that had been put into preventing them from happening, the Hong Kong Maritime Rescue Coordination Centre (HK MRCC) and its staff have devoted their full strength with professionalism to minimize the extent of damage to human lives and properties, often in adverse weather after a marine accident had occurred.

2. The Air and Maritime Rescue Centres of Hong Kong

Hong Kong is a Special Administrative Region of China and has maintained its own Search and Rescue (SAR) system in conducting SAR operation across the seas within its responsibility. Under the existing arrangement, there are two rescue coordination centres in

Hong Kong, namely the Hong Kong Maritime Rescue Coordination Centre (HK MRCC) and the Hong Kong Aeronautical Rescue Coordination Centre (HK ARCC). They were established pursuant to the requirements of the International Convention on Maritime Search and Rescue, 1979 and the Convention on International Civil Aviation respectively. This paper concentrates mainly on the operation of the HK MRCC.

In 1989, on the establishment of the Hong Kong Vessel Traffic Services in the Macau Ferry Terminal, a dedicated Maritime Rescue Coordination Centre in the former Port Control Centre was set up. The HK MRCC is under the direct supervision of the Director of Marine of Hong Kong Marine Department. In term of Search and Rescue jargon he is also called the Search Director. The Director of Marine in turn delegates his authority to a Senior Marine Officer or the (please use “the” if there is only one Search Coordinator but if there are more than one, then please use “a”) Search Coordinator who is responsible for looking after the running of HK MRCC.

The responsibility of the HK MRCC is to render assistance to all marine craft which found themselves in difficulties at sea that may require assistance, including all kinds of distress or emergency. The HK MRCC is responsible for the area within the inner boundaries of Hong Kong – which has been assigned to the local marine police. Apart from local waters, this area also includes an outer region – bordered to the south by 10° north latitude and to the east by 120° longitude.

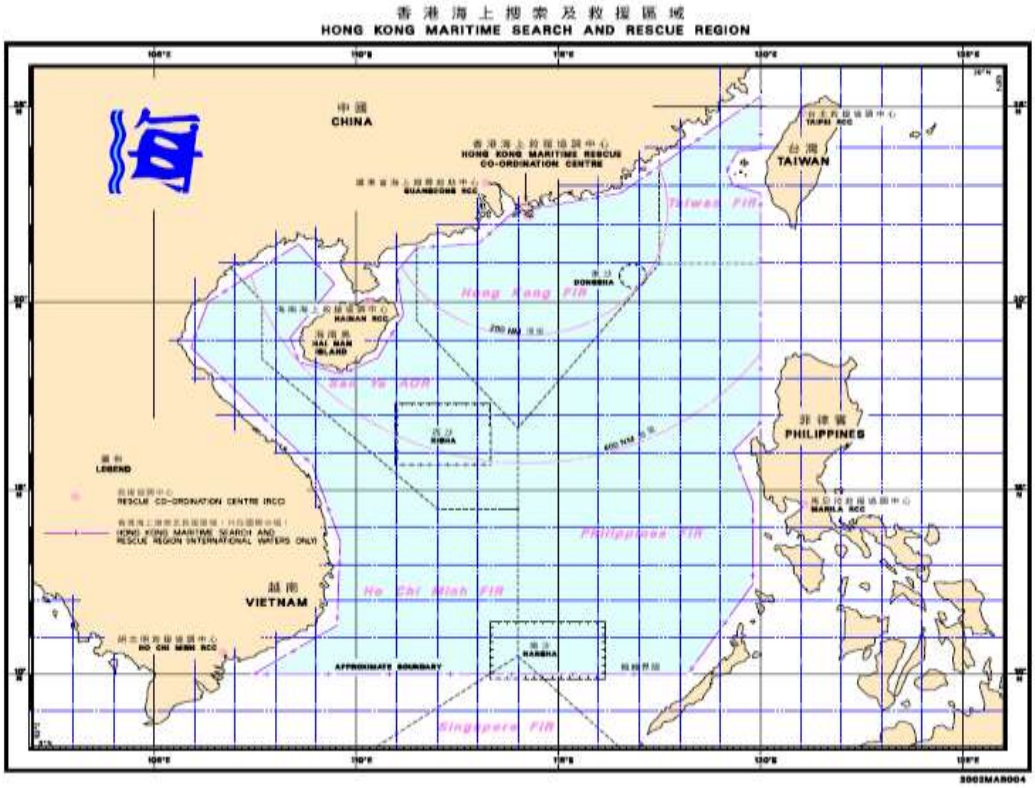

Fig. 1 Search and Rescue boundary of HK MRCC

3. Search and Rescue Units (SRU)

One of the roles of HKMRCC is to effect marine rescue operation by co-ordinating with the other departments and then deploying the SRU, including aircraft and marine vessels, if necessary.

3.1 Government Flying Service

- 2 British Aerospace Jetstream 41 (J-41) fixed-wing aircraft (with maximum speed up to 295 knots, 6 hours endurance, 500 nautical miles action radius);

Fig. 2 British Aerospace Jetstream 41

- 3 Eurocopter AS332 L2 (Super Puma L2) helicopters (with maximum speed up to 170 knots, 4.5 hours endurance, 200 nautical miles action radius) and

Fig. 3 Eurocopter AS332 L2

- 4 Eurocopter EC155 B1 (EC155) helicopters (with maximum speed of 175 knots, 3 hours endurance, 140 nautical miles action radius).

Fig. 4 Eurocopter EC155 B1

3.2 Other Government Departments

Marine Police/Fire Services and other government departments with marine assets – various small launches for local operation

Fig. 5 A Marine Police Launch

Fig. 6 Fire Boat 6

3.3 Merchant Ship Search and Rescue

When a marine emergency in South China Sea occurs outside the aircraft coverage, search and rescue operation often relies on the assistance of cargo ships or fishing vessels that might be in the vicinity of an incident. In many SAR operations, cargo ships and fishing vessels could arrive on the scene much earlier and assist with an effective surface search.

The obligation of ships to respond to distress from other ships is one of the oldest traditions of the sea and is also enshrined in various international conventions. The obligation to provide assistance to persons in distress at sea has been embodied in the International Convention for the Safety of Life at Sea 1974 and the United Nations Convention on the Law of the Sea 1982.

Concurrently with the revision of the search and rescue Convention, the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) jointly developed the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual to provide guidelines for ship masters in organizing a common aviation and maritime approach to providing search and rescue (SAR) services. These guidelines are published in three volumes covering Organization and Management; Mission Co-ordination; and Mobile Facilities. The IAMSAR Manual replaces the IMO Merchant Ship Search and Rescue Manual (MERSAR).

4. Structure of HK MRCC

HK MRCC operates 24 hours night and day and also acts as a Search and Rescue point of contact for information of ships registered in Hong Kong. The database in HK MRCC records the registered particulars of all Hong Kong registered ships including a ship's

name, call sign, Maritime Mobile Service Identity (MMSI), Emergency Positioning Indicating Radio Beacon (EPIRB) serial protocol number, Selective Calling number and information of ship owner, management companies and local agents with particulars for contact at any anytime in 24 hours on any day.

The manning of watch arrangement in the HK MRCC comprises of 1 marine officer acting as Search Mission Coordinator, 1 marine inspector and 1 radio officer. The marine officers are professional mariners and are well trained to handle different types of marine emergencies. When a marine emergency occurs, the marine officer will plan and coordinate the SAR missions, prosecuting each operation with resources available. They must use good judgment to effect the rescue operation by adapting the search plan with the changing circumstances in each unique marine emergency. SAR's liaison group meetings, chaired by the senior marine officer, are held at regular intervals to review operations and to ensure efficient inter-departments co-operation is maintained.

5. Communication Facilities – GMDSS System

During the 1990's, the International Maritime Organization (IMO) implemented the Global Maritime Distress and Safety System (GMDSS) system to enhance marine communications to mariners at sea. The GMDSS consists of several systems, some of which are new, but many of them have been in operation for many years. The system is able to reliably perform the following functions: alerting (including position determination of the unit in distress), search and rescue coordination, locating (homing), maritime safety information broadcasts, general communications, and bridge-to-bridge communications. Specific radio carriage requirements depend upon a ship's area of operation, rather than its tonnage. The system also provides redundant (redundant is often used to describe something which is unnecessary. If the author is trying to explain that the system provide a "back up" means, it is recommended that a positive word is adopted to replace this negative word) means of distress alerting, and emergency sources of power.

The GMDSS applies to commercial vessels of 300 gross registered tons and above engaged on international voyages and became mandatory for such vessels internationally since 1 February 1999. The GMDSS utilizes both satellite and terrestrial (conventional) radio systems. The major difference between the GMDSS and its predecessor is that the radio communications equipment to be fitted to a GMDSS ship is determined by a ship's area of operation, rather than by its size.

1. Area A1 lies within range of shore-based Very High Frequency (VHF) coast stations in which continuous digital selective calling (DSC) alerting is available (20 to 30 nautical miles);

2. Area A2 lies within range of shore based Medium Frequency (MF) coast stations in which continuous digital selective calling (DSC) alerting is available (excluding A1 areas) (approximately 100 - 150 nautical miles);
3. Area A3 lies within the coverage area of Inmarsat communications satellites (excluding A1 and A2 areas - approximately latitude 70 degrees north to latitude 70 degrees south); and
4. Area A4 comprises the remaining sea areas outside areas A1, A2 and A3 (the polar regions).

The GMDSS takes into account technology of satellite communications and advanced digital data processing. It provides full global coverage to encompass all shipping lanes.

As all international commercial ships are required to comply with the requirements of GMDSS, the HK MRCC has equipped with the GMDSS communication equipment so that it can disseminate navigational safety message, monitor distress alerts in a swift manner in marine accidents and to effect search and rescue operation without delay. This is called a shore-base GMDSS system. It consists of many separate systems which are being implemented in a coordinated manner. Some of these systems are further discussed below.

5.1 Digital Selective Calling (DSC) System

The DSC System is capable of receiving a distress alert from a vessel in trouble. This equipment can also relay the distress alert on appropriate frequency band to alert other vessels in the area. Subsequent communications can be established on other voice or by telex over radio. DSC is, basically, a paging system that is used to automate distress alerts sent over by (?) terrestrial marine radio systems. The DSC system's digital processing techniques, combined with the relatively narrow receiver bandwidths used, provide a DSC signal with resistance to noise and fading over the radio path.

DSC can be considered as a replacement for the radiotelephone and radiotelegraph (Morse) alarm signals. Rather than just indicating that the sending station is in distress, the DSC system allows a great deal more information to be transmitted, including:

- the priority of the call - DISTRESS, URGENCY, SAFETY or ROUTINE;
- the address – all ships or a single ship/station;
- the identification of the ship in distress;
- The position of the ship in distress; and the nature of the distress.

The International Telecommunication Union has allocated a DSC distress and safety channel in the MF, each of the HFs (The author is requested to clarify as to whether it should be “each HF” or “each of the HFs”) and the VHF marine radio bands. These are MF/HF DSC

distress and safety channels on 2187.5 4207.5 6312.0 8414.5 12577.0 16804.5 (kHz) and VHF DSC distress and safety channels on VHF marine channel 70.

Urgency, safety and routine calls can be addressed to all stations, an individual station, or a group of stations. All DSC sets are required to be equipped with a distress button, which allows the transmission of a distress call with minimum delay. The button is required to be protected by a cover, and also can only be activated after 2 separate and independent actions.

Fig. 7 A shipboard DSC set

5.2 Navigational Telex (Navtex)

The Navtex system is used for the automatic broadcast of localised Maritime Safety Information using Radio Telex (also known as Narrow Band Direct Printing, or NBDP). The system mainly operates in the Medium Frequency radio band at 518 KHz. System range is generally approximately 400 nautical miles from the transmitter. Broadcast within the marine region of NAVREA XI Area by different coastal stations including China, Hong Kong and Japan. Messages on weather, navigational warning and traffic information are broadcast at 4 hours interval. The Navtex messages are prefixed with a priority code to give the nature of a message. All urgent or distress messages can be broadcast at any time and will trigger an alarm in all receiver sets for alerting purposes.

The Navtex system is designed to be used in GMDSS Sea Area ranging from 100 – 150 nautical miles. All broadcasts from stations within the same allocated sea area (NAVAREA) must be coordinated on a time sharing basis to eliminate interference. In addition, power outputs from each station are adjusted to control the range of each broadcast. This is particularly important during night-time hours, as Medium Frequencies always travel further after dark.

Fig. 8 A Navtex receiver front panel

A Navtex receiver is normally a compact unit, with an integrated printer, display and keyboard. Once programmed with appropriate station codes and subject indicator characters, the unit is left unattended - messages are received automatically and printed on the integrated printer.

5.3 Cospas-Sarsat System

Under the GMDSS system, ships in distress could alert the shore base station via satellite beacon via Emergency Position Indicating Radio Beacon (406MHz EPIRB). This EPIRB will send the accurate location as well as the identification information to rescue authorities immediately upon activation through both geostationary and polar orbiting satellites. The satellites will relay the received distress signal to a ground receiving station for subsequent distribution to the MRCC. Its signal allows a satellite local user terminal to accurately locate the EPIRB at an accuracy of 2 to 5 km. Proper registration of 406 MHz EPIRB by ship owners is necessary. Registration of a shipboard EPIRB is a mandatory requirement to all Hong Kong registered ships. It is intended to save life and property at sea in a marine emergency.

This satellite system for receiving and distributing alerts is the Cospas-Sarsat system. Cospas-Sarsat is an international satellite-based search and rescue system established by the U.S., Russia, Canada and France to locate emergency radio beacons transmitting on the frequencies 121.5, 243 and 406 MHz. The Cospas-Sarsat system provides global coverage from sea areas A1 to A4. In Hong Kong a local user terminal is located at the hill top site of Hong Kong Island to receive, locate and identify the position of transmitting EPIRB and to provide accurate location data of a vessel in distress. Once the information of the EPIRB is retrieved, it can be verified against the database in the HK MRCC to find out a ship's identity, owner, type of the ship and other relevant information. This information will assist the SAR in planning the rescue operation in case of a genuine distress.

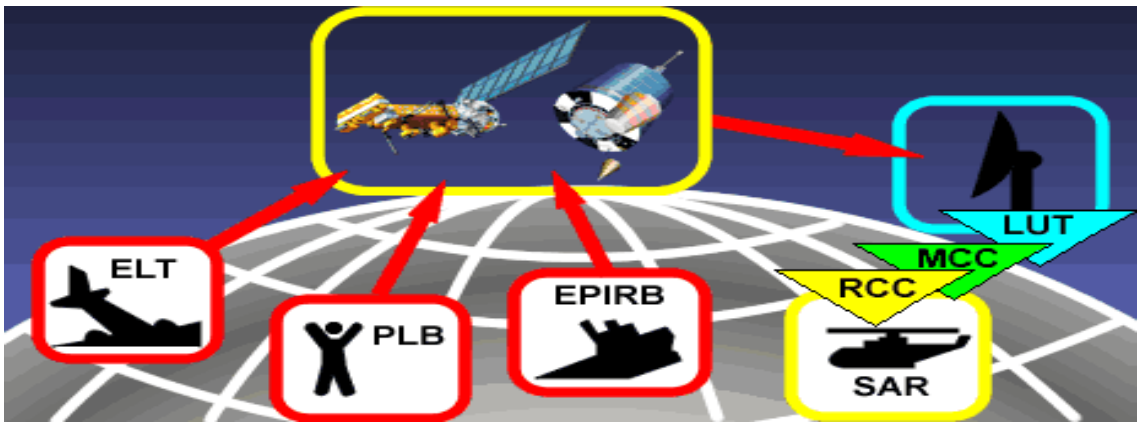

Fig. 9 The Cospas-Sarsat System

6. Search and Rescue Operation in the HK MRCC

When an emergency alert has been received in the HK MRCC, the operation procedure will be started without delay. Generally there are 5 stages in the Search and Rescue operations. They are Awareness; Initial Action; Planning; Operation and Mission Conclusion. It is important to get as much relevant information from the informant as possible at the initial stage. It then needs to establish further means of communication for maintaining the contact and also for updating the situation. In the case of a large scale operation, a check list may also be required to ensure that all necessary actions have been properly carried out.

Efficient and effective rescue planning and operations are critical to saving lives. Planning involves evaluating survivors' location and condition, selecting an appropriate rescue mode, and deciding a delivery point and means of transport. The Search and Rescue Units (SRU) will be briefed with all available information for them to carry out the rescue plan. The SRU determines the actual rescue method used, based on the conditions on scene and SRU capabilities. Although an initial alert notification is sent to alert relevant government departments of the incident, the deployment of SRU may not be made until a rescue plan is made up. This includes assessing of situation to determine the nature of the incident, scale of operation, choice of SRU, weather on scene, daylight availability and degree of urgency.

An on scene coordinator (OSC) is usually appointed in an SAR operation. Normally it will be a fixed wing aircraft due to its longer endurance capability. The OSC will take charge of the on scene operation in coordinating the activities of the SRU and report to the HK MRCC through an agreed communication link. Under all circumstances, safety of the search and rescue units and the survivors is the primary concern throughout the whole operation.

7. Co-operation with Neighbouring Maritime Authorities

Hong Kong is a Special Administrative Region of China. After reunification with China in 1997 and under the "one country, two systems" policy, there has not been any change in the HK MRCC and the SAR operations to the shipping community in the South China Sea.

Geographically Hong Kong is situated at the southern end of the Pearl River Delta. There are also a number of mainland ports in the Guangdong province which are important trading partners to Hong Kong. Each day a large number of passengers are carried by high speed craft (HSC) between the river ports to and from Hong Kong. In 2004, the total number

of passengers having been carried by HSC was well over 20 million.

While the HSC travels at a speed of between 30 and 40 knots, each vessel is capable of carrying more than 200 passengers onboard. Should an accident occur to one of the passengers on aboard a HSC, the consequence could be catastrophic. Therefore, apart from stringent safety regulations to maintain operational safety to these HSC, the Hong Kong Marine Department and the neighbouring maritime authorities have to ensure that in case of a marine emergency, the search and rescue operation must be fast and effective so as to minimize the damage to human lives and property.

Hong Kong MRCC and Guangdong RCC have established a mutual understanding for many years. Agreements have been reached between the two places that the SAR units from Hong Kong can be deployed across the boundary to conduct search and rescue operation without the need to obtain prior clearance. Subsequent notification to counterpart RCC is however required for any necessary follow up actions. This mutual understanding has facilitated quick responses to marine emergencies and has proved to be effective in saving lives at sea in the past.

Apart from reaching agreements, HK MRCC and Guangdong RCC also conduct joint search and rescue exercises in the Pearl River Estuary at regular intervals. These exercises have enhanced and will continuously foster effective cooperation between the two maritime authorities from the joined operation of their SAR facilities. It is believed that the crew have benefited from the search and rescue units by familiarising themselves with their ship borne emergency equipment and the SAR plans.

Besides co-operating with the Guangdong RCC, the HK MRCC has also held joined SAR exercise with the Hainan RCC for simulated marine emergency in South China Sea in 2004. Moreover, the HK MRCC has established procedures with the China Airport Administration for refuelling SAR aircraft in Hainan. In addition, the HK MRCC has established agreements with the offshore oilrigs operators in the South China Sea so that SAR helicopters from Hong Kong can be refuelled at their platforms. This refuelling arrangement has significantly increased (will significantly increase – the author is requested to clarify whether the impact has taken place) the flying range or on scene endurance of the SAR helicopter.

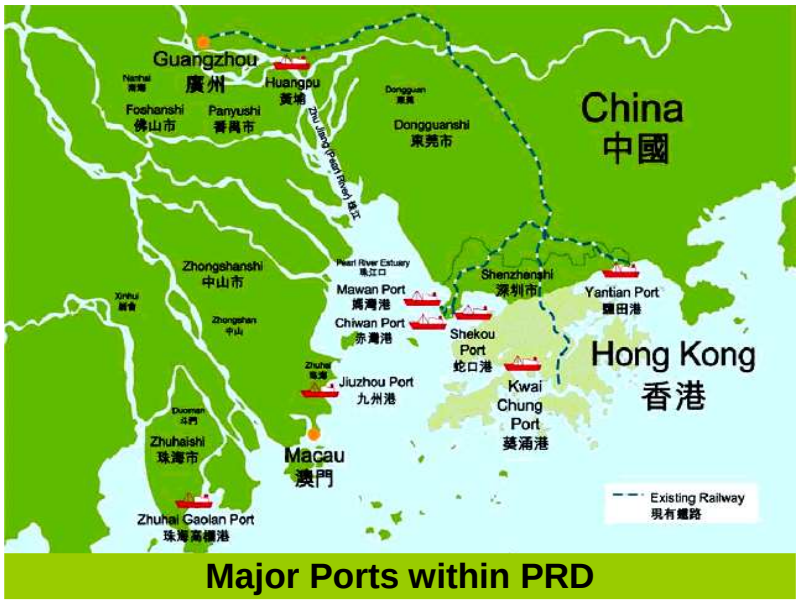

Fig. 9 Ports within Pearl River Delta

8. Statistical Summary for SAR cases in HKMRCC

Finally I would like to summarise the contribution of the operations performed by the HKMRCC for the past two years as follows:

	2003	2004	2005 Jan-Jun
No. of SAR case	74	66	30
No. of people saved	127	152	193

Types of vessel involved

Cargo vessel	21	23	16
Passenger vessel	4	4	2
Fishing vessel	24	18	5
Pleasure vessel	4	4	0
Others	22	17	7

Their range from Hong Kong

Within 50 nm	46	43	25
50-500 nm	23	22	5
Beyond 500 nm	4	1	0

References:

1. Operation Guidelines of HK MRCC
2. GMDSS Hand book
3. Web Sites of Government Flying Service, Marine Police and Fire Services Departments
4. The International Convention on Maritime Search and Rescue, 1979
5. International Convention for the Safety of Life at Sea 1974
6. United Nations Convention on the Law of the Sea 1982