Towards efficient coastal Search and Rescue operations

Capt. Sameh K. Rashed
Lecturer
Nautical Dept
College of Maritime Transport
Arab Academy for Science and Technology
Ant Maritime Transport - AASTMT
redmahi@hotmail.com

Abstract:

A search and rescue operation is initiated generally as a result of receiving a distress signal, either directly from a distressed vessel or aircraft, or via a third party. Saving human life is the primary responsibility of all participants in Maritime search and rescue operations. Although vessels, for the most part merchant vessels, on high seas or coastal waters are not designated as maritime search and rescue facilities, they are obliged by various international maritime conventions to provide assistance to persons in distress at sea.

In order to face extraordinary circumstances, the efficient and well-prepared plans and urgent procurements for maritime search and rescue operations should exist, and all participants must acquaint the maritime search and rescue regulations and conventions. Moreover, the required ideal and effectual monitoring for search and rescue processes in the event of a major and prolonged, very complex, maritime search and rescue operations can be achieved by the front-line search and rescue organizations, that are responsible for ensuring the most effective arrangements to save lives and properties, in addition to mitigate the threat of vessels catastrophe.

To accomplish such appropriate manners, nations and/or authorities involved in responding to vessels emergency and casualty, should take on suitable great efforts in the developing the efficiency of human elements, that operates maritime search and rescue of coastal regions control centers, supply the rescue coordinating centers- RCCs, by electronic

aids for controlling, planning and monitoring the SAR operations, and activate and encourage the role of the volunteers in maritime SAR systems.

The paper reveals a vision illustrates the importance of maritime SAR human element in SAR operations, and demonstrates the experience of Saudi Border Guards in training and preparing such members, as a case study. Also the consequences of usage of electronic instruments as aids to control and monitoring on scene maritime SAR operations, and finally the role of volunteers in increasing the efficiency of maritime SAR systems, explain the Canadian volunteers system as an example.

Key Words: SAR – Volunteers – Human element - SARMAP- SARIS – CCGA - Border Guard – Frontier Guard

1-Introduction:

Saving lives and reduce the loss of lives at sea are the primary responsibility of all nations participants in search and rescue operations through supporting the framework of the maritime search and rescue services. Search and Rescue is an essential service provided by States and Militaries to search for, locate and rescue survivors of accidents and incidents. Moreover, civil Search and Rescue utilizes a system of well-trained professional's persons or volunteers, an effective Search and Rescue organization, supported by industry and other providers of infrastructure and possessions indeed, all forms of Search and Rescue rely on capable, specialized assets for efficiency Infectivity.

Maritime search and rescue professional skilled person is one of the most important and fundamental aspects in the attaining of efficient Search and rescue operation because human element constantly scanning the environment for clues related to the presence or passage of the search subject, indeed the process of recognizing potential clues as relevant is very complex, maritime SAR human element remains the found organized maritime search and rescue efforts.

On the other hand, the latest generation of information technology and marine environmental software systems for maritime Search and Rescue are very essential to obtain the efficiency required in the maritime SAR operations, as it is an integrated maritime SAR planning tool incorporating both Search Area Determination and Search Area Coverage. Also it is used internationally, by Coastguards, Navies and SAR Authorities. Electronic aid to

maritime SAR operations that establishes the primary planning requirement during a maritime Search and Rescue (SAR operation) is knowledge of the likely search area in which targets may be found. The determination of search areas is not straightforward in an environment where the prevailing meteorology complicates target trajectory.

Moreover, Volunteers that assist in the maritime search and rescue operations become the Auxiliary enhances nation's search and rescue (SAR) capability. They have very Important and impressive role in accomplishment of maritime SAR operation efficiency, Through SAR response, prevention and safety related activities, the Auxiliary and SAR authorities work together to achieve their common objective of preventing the loss of life and injury. Canadian Coast Guard, SAR authority, conceder the volunteers as an important element of marine safety net and assists the in promoting safety on their water areas, the most important reason for a voluntary service is efficiency. The three supposed phases are considered as the fundamentals of increasing the maritime SAR systems and operations efficiency fig 1.

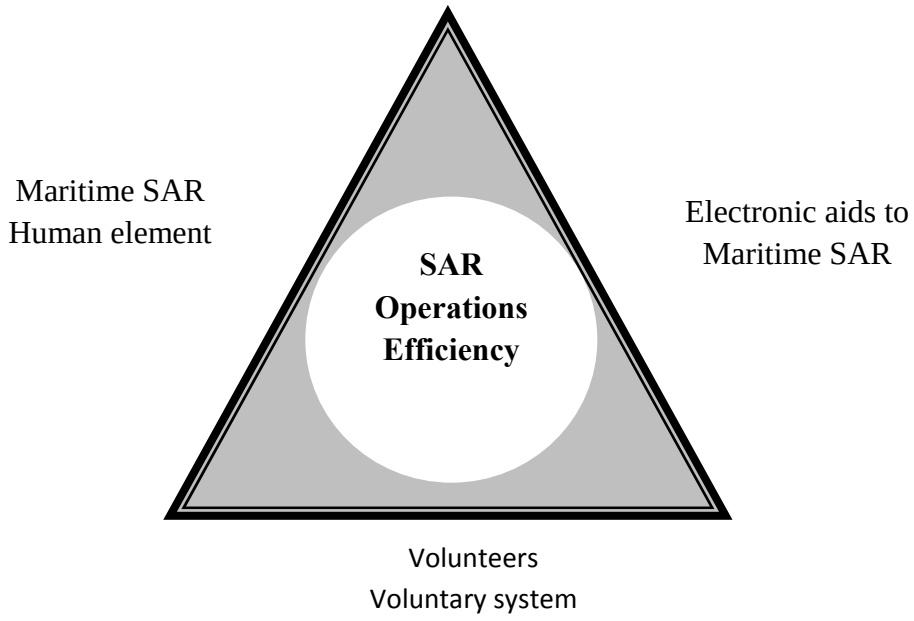

Fig 1: phases to increase maritime SAR system efficiency

2-The concept of maritime search and rescue systems

The Maritime SAR systems for any regional level established to provide help and support to people in distress without delay, and to ensure that persons in distress will be assisted without regard to their locations, nationalities, or circumstances.

The Maritime Search and Rescue Act defines maritime SAR services as the search and rescue of persons in distress at sea, provision of emergency medical services for them and conduct of radio communications related to an emergency phase fig 2. The Act also lays down provisions regarding the authorities responsible for maritime safety radio communications, the provision of telemedical assistance services for vessels, maritime assistance services, the use of certain emergency signaling devices being subject to license, and preparedness requirements set for maritime SAR services.

Fig 2: the SAR system components

SAR system, like any other systems has individual components that must work together to provide the effective results. The core of the maritime SAR system are of recognition response and reporting, it can be viewed as the corners of the triangle fig 3, SAR system can

be established on a national or regional levels or both, so it is require studies and research by specialized members to develop, and integrate the provision of the nations system components with the global SAR system. (IAMSAR)

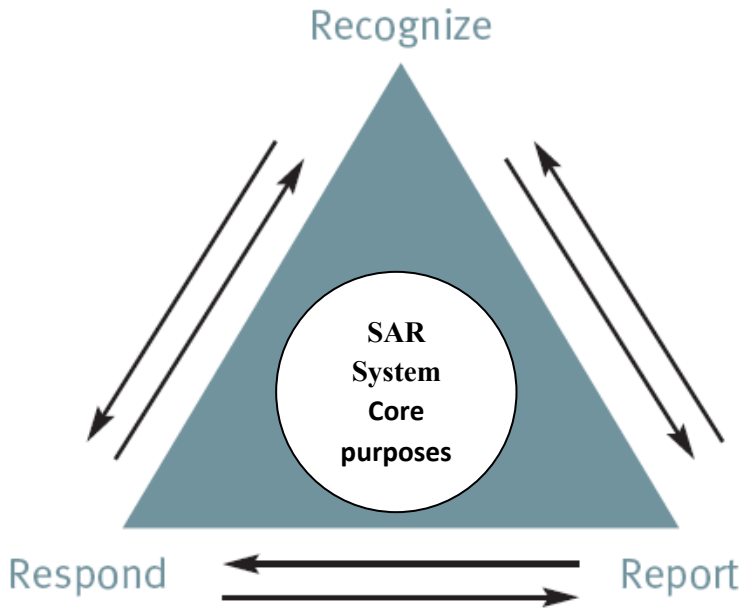

Fig 3: the core purpose of SAR system

3- International agreements

The International Convention on Maritime Search and Rescue (Hamburg, 27 April 1979) as amended in 1998 and 2004, hereafter the Hamburg Convention, is the key international agreement on maritime SAR services. The operational provisions on the arrangement of SAR services can be found in the technical Annex of the Hamburg Convention. The Convention and its Annex create the international foundation and specify the performance requirements for the maritime SAR systems of the world's coastal states.

Parties to the Convention are encouraged to enter into SAR agreements with neighboring states that involve the establishment of SAR regions and the arrangement of cooperation in maritime SAR operations. The Convention states that the parties should undertake to adopt all legislative and other appropriate measures necessary to give full effect to the convention and

it's Annex, which is an integral part of the Convention. Among other things, this means that the parties must ensure that necessary arrangements are made for the provision of adequate SAR services for persons in distress at sea around their coasts.

The Hamburg Convention also contains provisions regarding issues such as the coordination of SAR operations, classification of emergency phases on the basis of their seriousness, the measures required in response to emergency phases, and SAR plans and systems employed. Information about the key agreements affecting maritime SAR arrangements can be found in Annex 4.

The International Convention for the Safety of Life at Sea (1974) and amendments hereafter the SOLAS Convention also contains the general obligation to provide maritime SAR services. State parties to the SOLAS Convention undertake to take all necessary arrangements for coastal surveillance and for the rescue of persons in distress at sea around their coasts. These arrangements must include the establishment; operation and maintenance of such search and rescue facilities as deemed practicable and necessary, having regard to the density of the seagoing traffic and the navigational dangers.

On the Law at Sea (1982) also lays down the general obligation for coastal states to arrange a search and rescue service. Passenger ships within the scope of application of Chapter I of the SOLAS Convention must have on board a plan for cooperation in the event of an emergency developed in cooperation. (Finland Border guard, 2010)

4- Phase1: Human element is essential to attain efficient SAR operations

4-1 The human element:

There is no accepted international definition of the human element. In the maritime context, it can be taken to embrace anything that influences the interaction between a human and any other human, system or machine on board ship. The human element is a critical feature of all aspects of ship and system design and operation. Moreover, the human element is increasingly accepted as the greatest source of risk to safe and effective. (Lloyd's, 2008)

4-2 The human element and the maritime Search & Rescue:

The core of operational facility responsible for promoting efficient operation of maritime search and rescue and co-coordinating the conduct of SAR operations is Rescue Co-coordinating center RCC. To establish an effective, impressive, and 24 hours availability readiness RCC, it needs well skilled human element that operate not only RCC but all SAR system components, to obtain the improved capabilities of SAR system required, and locate where it can effectively perform its functions, persons is the key word.

SAR proper response is the aim of SAR organization, so human element (stuff) that operates the maritime SAR organization (RCCs, SAR facilities and units) should be qualified, certified, and well trained to ensure sufficient experience, maturity, and judgment to undertake the unexpected circumstances. The training for maritime SAR human element or stuff members of all component of maritime SAR system or organization should meet the STCW SAR requirements, and include the following:

1) Study of application of maritime SAR procedures, techniques, and equipment according to the mission.
2) Assisting in or observing actual operations.
3) Exercises in which personnel are trained to co-ordinate individual techniques and procedures in simulated operation. (IAMSAR)

4-3 Case study: Saudi Border (Frontier) guards hold a stake in Maritime SAR human element qualifications

One of the primary missions of the Saudi Arabia Frontier Guards is maritime search & rescue operations. Therefore, they constructed very intensive maritime SAR training courses and programs according to STCW for SAR members, Border Guard members, on all rank levels and missions, through *the Border Guards Nautical Institute*. In addition to the on scene training practice with different situations and circumstances.

Saudi Arabia Border (Frontier) Guard institute is one of leading maritime search and rescue training institutes in the area, as it was supplied with high experienced professional

lecturers and instructors in such field (Navigation, and search & rescue) to ensure the intensifying of the maritime SAR training programs for members belongs to maritime SAR missions of all levels. Moreover, it was supplied with up to date electronic aids, training units, facilities, equipments, and computer software and Saudi Frontier Guard General Directorate gives a Great internists to SAR field.

The Saudi Frontier Guard as a skilled maritime SAR human element, participate in maritime SAR when an emergency phase, and the successful conduct of SAR duties calls, not only for the efficient utilization but also close cooperation with the vessel in distress as well as the efficient and appropriate employment of other vessels near the scene. The participation of Saudi Frontier Guard members and facilities, with high performance stander, participation in maritime SAR operations of the disaster of passenger ship El SALAM 98 in the year 2006 considered an obvious substantiation of their proficiency and efficiency in training programs for their maritime SAR human element.

5- Phase2: Usage of electronic technology in Rescue co-ordination centers-RCCs

5-1 Maritime Search and Rescue electronic Planning System - SARMAP

The SARMAP Search and Rescue model (SARMAP) or Search and Rescue Information System (SARIS) is based on the search planning methodology. It is intended for use in marine incidents maritime SAR operations. The model determines the most probable location and the area around the search object. The position of the search object changes due to winds and currents acting on the object. Over time the search area increases and is related to the drift of the object. In the SARMAP user interface the search object selected from a list of approximately fifty possible objects. Each search object has default values for the drift resulting from winds blowing against the exposed (above water) surfaces of the search object and the angles at which search objects may be transported to the left or right of downwind.

The SARMAP is largely concerned with the common GIS notion as to "where things are" and contains a wide range of elements pertaining to situational awareness, spatial analysis and drift simulation. (Rashed, 2007)

5-1-1 Applications for SARMAP include:

- Determine search area for missing vessels, persons or Containers.
- Identify probable location of an accident site or lost object.
- Store home base locations of all available Search & Rescue Units (SRUs).
- Drills and education.

5-1-2 SARMAP Features

- Contains a database of drift behavior for a variety of objects based on the latest US Coast Guard data
- Includes ASA's own GIS or can be used in other GIS software such as ArcView ®
- Easily interpreted visual displays of search area over time
- Performs a series of postulated accident sites to develop envelopes of likely search Links floating debris to find a lost object
- Real-time data links
- Rapid Response Module (RRM) or SARMAP Wizard to very quickly lead them through the steps required to calculate a search area. (Commercial Joint Mapping, 2008)

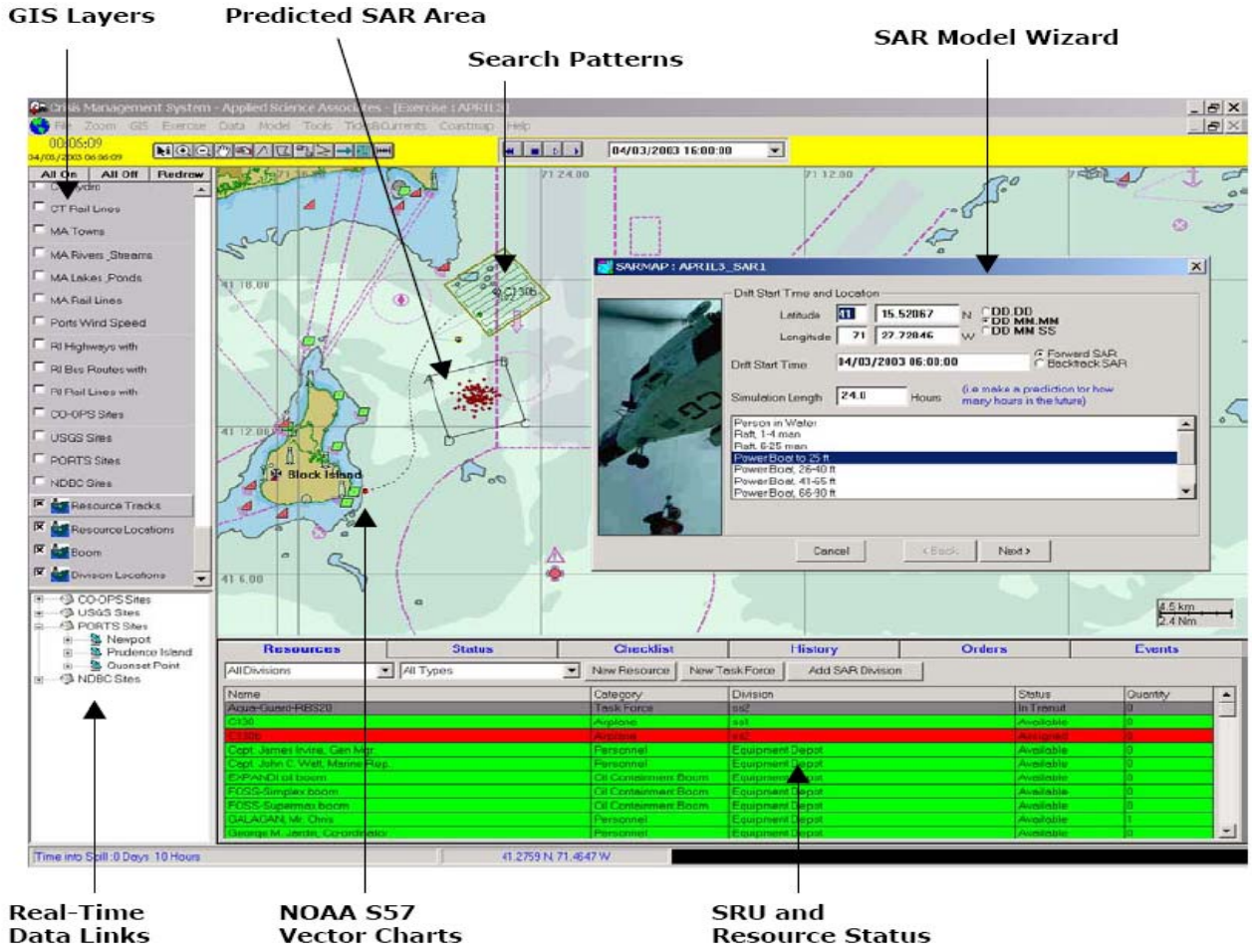

Fig 4: SARMAP feature

5-1-3 Supports commercial nautical charts:

- BSB NOAA Charts
- MapTech Charts
- NDI Charts
- British Admiralty (ARCS) Charts
- NOS Charts

5-2 Case study: The Search and Rescue Optimal Planning System- SAROPS

The Search and Rescue Optimal Planning System SAROPS is an information system being designed to support Situation Awareness, Drift Modeling and Optimal Allocation of Resources. SAROPS is built upon the Commercial Joint Mapping Tool Kit (C/JMTK), a government initiative to provide enhanced ArcGIS 9 functionality to support Command and Control system development. The open SAROPS architecture can accommodate a wide range of third party extensions to support non-SAR missions SAROPS itself contains an environmental data subsystem built upon ArcSDE technology; a Monte-Carlo particle simulation engine implemented in Java and an extended ArcMap user interface. When deployed, SAROPS will allow the USCG to be even more successful in the timely rescue of lives and property in coastal waters and on the high seas. (USCG, 2008)

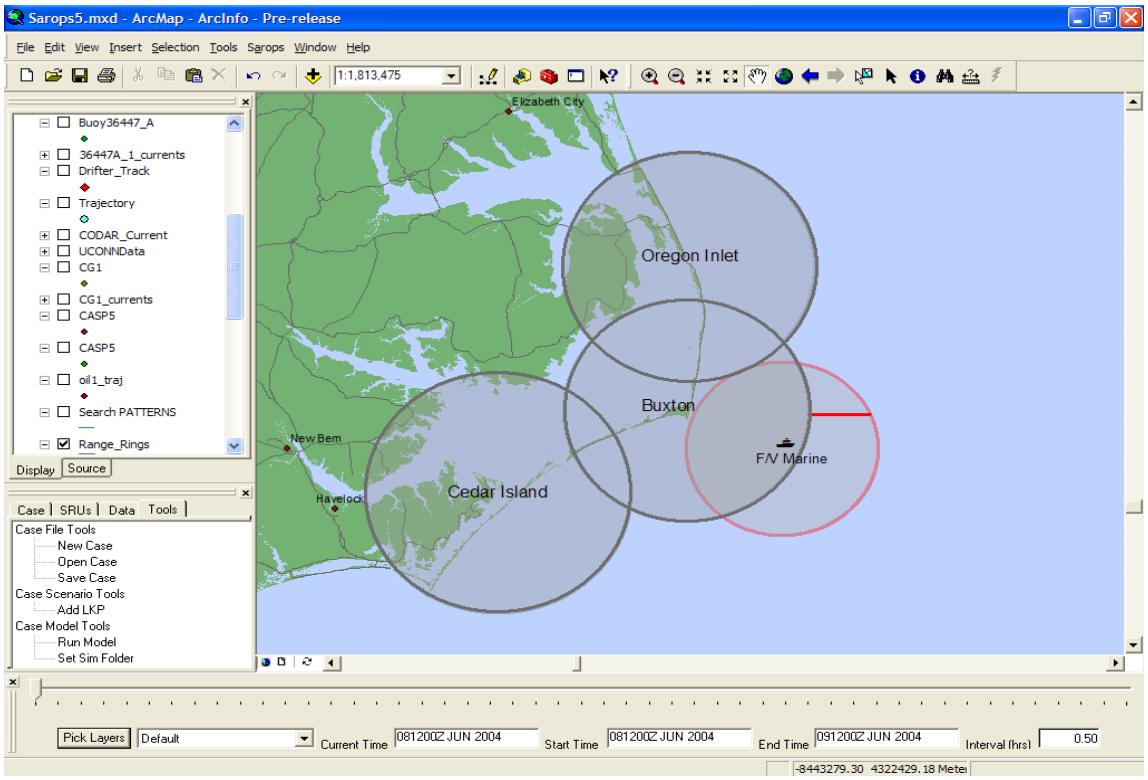

Fig 5: SAROPS diagram

The US Coast Guard has Command Centers in Puerto Rico, Guam, Hawaii, Alaska, in addition to those all along the coast of the mainland United States. These units are central to a wide range of operations ranging from Homeland Security to Marine Environmental Protection and serve as Rescue Coordination Centers (RCC) in support of maritime Search and Rescue (SAR) operations. Although SARMAP passed on Geographic Information System (GIS) technology plays a key decision support role in all these functions.

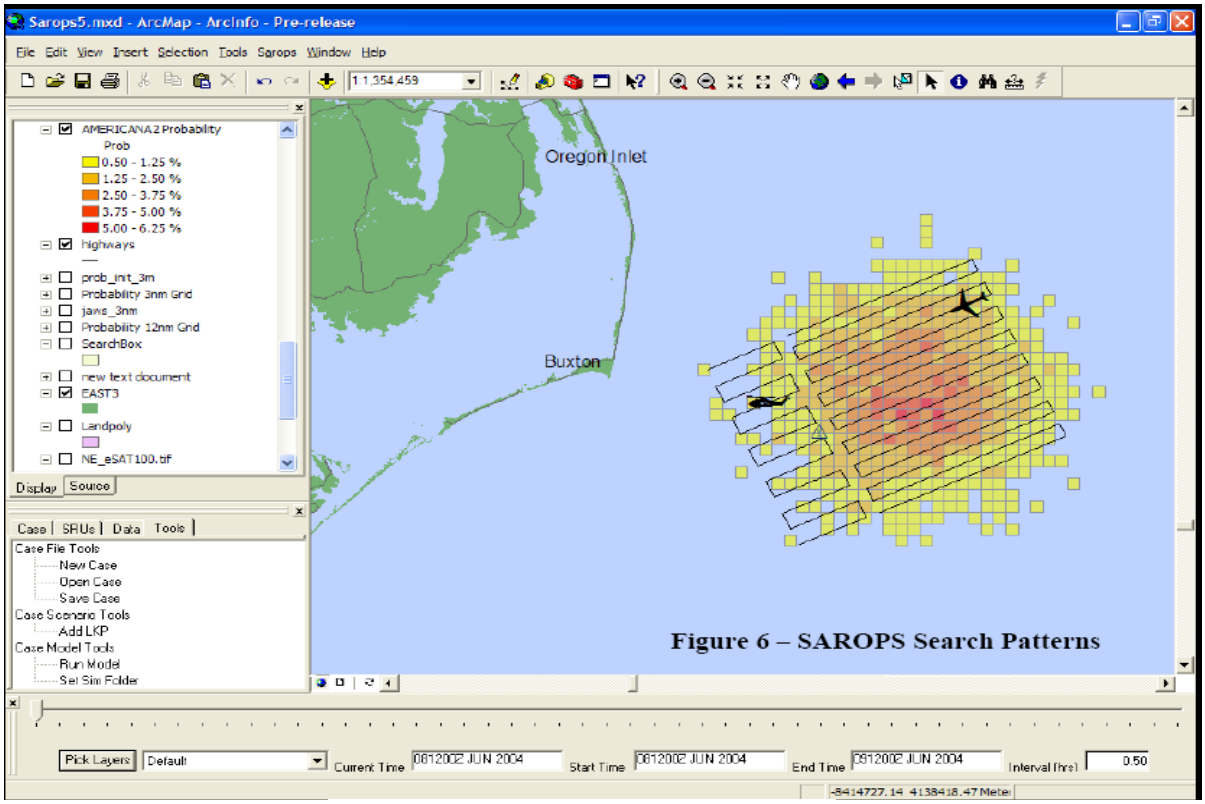

Fig 6: SAROPS Search Patterns

USCG established the Search and Rescue Optimal Planning System (SAROPS) to maximize the overall effective search plan. An open ocean case with a long drift interval (the time between a search object's Last Known Position (LKP) and the searcher's on scene time) can easily require the expenditure of hundreds of search hours and hundreds of thousands even millions, of dollars. Determining how and where to place the available search assets to maximize the overall effective maritime search operations is the subject matter of Search Planning. The most effective search plan is the one that continuously maximizes the probability of finding the search object as each hour passes.

6- Phase3: The consequence of activating Volunteers role in maritime SAR systems

6-1 "Volunteer"

Maritime search and rescue auxiliary, means an individual, including a supervisor registered by the Provincial Emergency Program for preparing and responding to a disaster or an emergency, it is also considered a unpaid assistant for the purposes of this policy. A "**convergent volunteer**" means an individual that offers their service and/or expertise during the activity, and assigned in to the task. Through SAR response, prevention and safety related activities, the Auxiliary (volunteers) and SAR authorities work together to achieve their common objective of preventing the loss of life and injury. (Canada CG, 2010)

6-1-1 The role of Volunteers

Volunteer assistance is a key element in maximizing the efficiency of SAR operations prevention and safety-related activities. Volunteers as individuals or groups gives their time talent, and abilities to a cause they believe in, without pay. Participation of volunteers in maritime SAR operations increases the ability of immediate response to emergencies.

Since the most important reason for a voluntary service is efficiency, Each SAR authority attracts a number of the most able and active members of the community. Their time expertise and local knowledge cannot be bought. Their intimate knowledge of their own waters and coastline is often vital to a successful rescue.

6-1-2 Responsibilities of SAR volunteers

- Follow safe work practices and procedures when training, exercising and responding.
- Advise their supervisor if they believe that their assigned activities cannot be safely performed.
- Immediately report all incidents of unsafe situations, hazards, accidents and injury to a designated supervisor.
- Participate in training and orientation activities required to safely undertake assigned roles and responsibilities.
- Provide records of completed training and certification to their SAR supervisor.
- Cooperate with SAR supervisors and fellow volunteers on matters related to safety. (SAR Safety Program Guide, 2009)

6-2 Case study: The Canadian Coast Guard Auxiliary- CCGA

The Canadian Coast Guard Auxiliary is an organization established by the Canadian Coast Guard in 1978. Made up of dedicated volunteers who assist the Coast Guard, Canadian SAR authority, in marine search and rescue operations and prevention, the Auxiliary enhances Canada's search and rescue (SAR) capability. The Auxiliary is made up of 5,000 dedicated volunteers and 1,600 vessels with a combined asset value of over 215 million dollars. Vessels are either privately owned, community owned or on loan from the Canadian Coast Guard. CCGA volunteers also conducted 3,000 courtesy checks of vessels on behalf of the Canadian Coast Guard.

In seaside villages, marinas and ports across Canada, auxiliarists are organized into units that handle missions in their vicinity. Each unit is led by an elected unit leader. A group of units combines to make up a zone led by a director who sits as a board member of the regional association. The Auxiliary is incorporated into six non-profit regional associations:

- CCGA Newfoundland Inc.
- CCGA Maritimes Inc.
- CCGA Quebec Inc.
- CCGA Central & Arctic Inc.
- CCGA Pacific Inc.; and, CCGA National Inc. responsible for directing the activities of the Canadian Coast Guard Auxiliaries.

The territory covered by the CCGA is vast. Canada's area of responsibility stretches over 5.3 million square kilometers, bordering some of the most rugged coastline in the world. In addition, the CCGA is also present on many of Canada's major inland waterways. Its units are especially concentrated within those high-risk areas where the requirements are greatest.
The Auxiliary, volunteers, is an important element of Canada's marine safety net and also assists the Coast Guard in promoting safety on Canadian waters. CCGA activities include marine safety equipment demonstrations, safe boating lectures, and exhibits and boat show displays. CCGA members also conduct courtesy checks for pleasure crafts and small fishing vessels.

6-2-1 Who are the CCGA members?

Members are primarily pleasure boats operators and commercial fishermen who use their own vessels for Auxiliary-related activities. All CCGA members are dedicated to saving and protecting lives in distress. It is expected that, in order to work within the umbrella of the Canadian SAR system as a CCGA member, a person must have the skills, knowledge and certification to perform duties on board a vessel accepted in the Auxiliary.

CCGA vessels conduct over 1,800 rescue missions each year. They contribute to more than 25% of all marine call-outs in Canada and save an average of 200 lives each year. Moreover, the Auxiliary has shown an enduring and valuable commitment to maritime SAR Each year, the CCGA contributes to saving 94% of those, whose lives are at risk in marine incidents in Canada. Since the CCGA was founded in 1978, its members have been credited with participation to 36,000 missions and saving 4,000 lives.

Another 5,000 people are helped each year in non-distress marine incidents and millions of dollars of property are saved. Finally, the CCGA also promotes its unique identity and mandate to the Canadian public through the media and at public events across the country.
The statistics illustrates the importance of include the volunteers in the maritime SAR systems of nations that their coasts overlooking the sea. (Canada CG, 2010)

In conclusion:

This enquiry has identified the fact that maritime search and rescue system is an imperative matter and nations must offer sufficient interests to it Because SAR services are sometimes made an integral part of any local, and national emergency management systems. In addition to providing safer and more secure coasts, as well as reduces the possibility of accidents or disasters, that mainly affects maritime industry and transportations. Moreover, the enquiry construct a supposed triangle consists of three elements that are essential to increase the efficiency, and response preparedness of maritime SAR systems, resulted in efficient coastal Search and Rescue operations.

Recommendations:

1- Supply RCCs with electronic maritime SAR planning system such as SARMAP or the Search and Rescue Optimal Planning System- SAROPS or similar electronic SAR planning systems particularly in the central traffic regions of great economical importance such as Arabian Gulf, and Red Sea to effectively performing their functions within areas that are under their command and control.

2- Activate the role of volunteers in maritime SAR systems, to increase the maritime SAR systems readiness and efficiency, as well as, establish a regional organizations and association to regulate the activities of the volunteers and voluntary system in the goal of maritime SAR.

References:

- Canadian Coast Guard, (2010). "**Canadian Coast Guard Auxiliary National Guidelines**", Maritime Services Directorate- Fisheries and Oceans Canada Ottawa, Ontario K1A-0E6
- Commercial Joint Mapping Tool Kit, (2008). **"Search and Rescue Optimal Planning System (SAROPS)"** USCG
- Finland Boarder guard, **(2010). "MARITIME SEARCH AND RESCUE MANUAL", Ministry of the interior**
- IAMSAR. International Aeronautical and Maritime Search and Rescue Manual, Volume (1), chapter (1).
- Rashed. S, (2007)." **دور حرس الحدود فى تطوير مستوى إدارة عمليات البحث والإنقاذ البحرى** " 2nd symposium on maritime disaster management
- SAR Safety Program Operational guide, (2009). "**SEARCH AND RESCUE (SAR) SAFETY PROGRAM GUIDELINES**", Ministry of Public Safety and Solicitor General, Emergency Management BC – Victoria
- The Lloyd's Register Group,(2008). "**The human element**" http://www.lr.org, cited on 1st April, 2010

Web sites

- Canadian coast guard auxiliary
www.ccga.gcac.org

- Search & Rescue Organizations- UNITED STATES
www.cgaux.org , http://cgaux7.org
http://a07013.uscgaux.info/ and www.cgauxpr.org

- Search & Rescue Organizations- British Virgin Islands
www.visar.org

- Search & Rescue Organizations- Puerto Rico
USCG Sector San Juan at www.uscg.mil/sectorsanjuan
www.cgauxpr.org

- Ministry of Public Safety and Solicitor General
www.pep.bc.ca