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ENHANCEMENT OF SEARCH AND RESCUE MISSIONS IN THE WEST COAST OF AFRICA

EXAMINING THE POSSIBILITIES OF USE OF DRONES

IN CABO VERDE SEARCH AND RESCUE

ARTEMISA CRISTINA GOMES NEVES MOTA

A dissertation submitted to the World Maritime University in partial fulfilment
of the requirements for the award of the degree of Master of Science in Maritime
Affairs

2023

Declaration

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

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

(Signature): 

(Date): **26 Sep 2023**

Supervised by: **Dr. Dimitrios Dalaklis- Professor Safety and Security**

Supervisor's affiliation: **MSEA, World Maritime University**

Dedication

*This dissertation is dedicated to my late grandfather.
A man of few words but with a great meaning in life.
But above all else a man of the sea.*

Acknowledgement

My first thanks go to my beloved husband Nivaldo Monteiro Mota for the unconditional support and love that allows me to stand and continue. It has always played a pivotal role in boosting my morale for continuity. To my parents, brothers and my big sister for all the support and continued caring for me. I most respectfully pay tribute to my late grandfather who was from the sea and taught me the passion for it. Pei thank you; I will always love you and remember you.

I am pleased to extend my sincere gratitude to my organization, Cabo Verde Armed Force, especially my unit Cabo Verde Coast Guard for the opportunity of allowing me to leave to attend the WMU's master's degree program in Maritime Affairs. Furthermore, a special thanks to my colleagues in the JRCC in Mindelo for their tireless efforts in sharing the information required for the dissertation.

I take this forum to express my gratitude to the International Maritime Organization for granting me the sponsorship at this amazing University WMU, which showed me much more about the maritime sector than I knew. I would like to extend my sincerest thanks to the faculty of my specialization MSEA, for all the knowledge and experience they have shared with me during my stay at the university.

I earnestly extend my humble gratitude to my supervisor Prof. Dimitrios Dalaklis for his professional guidance and support throughout my writing. He was always there for course correction whenever it was required and motivate me to perform better every time. Without his insights and knowledge this dissertation would not have been in the present form it is.

I convey my deepest appreciation to all the Coast Guard personnel that responded to my survey and to my interviewees. Without their participation, the dissertation would not have been possible.

Last but not least this dissertation was not possible without the support of my WMU colleagues from class of 2023. My special thanks to Eslam Badry and Commandant Rahul Lodhi for their technical support.

Abstract

Title of Dissertation **Enhancement of Search and Rescue Missions in the west Coast of Africa - Examining the Possibilities of Use of Drones in Cabo Verde Search and Rescue**

Degree: **Master of Science**

The study was aimed at holistic review of Search and Rescue operations in Cabo Verde SRS and explore the feasibility of employment of drones in SAR. Being a small island developing state, livelihood of which depends on tourism and fishing, also being scarce in resources and located close of sea lines of communication, Cabo Verde is expected to provide SAR coverage in the entire region. With little research undertaken in the area this study was expected to identify the gaps in the existing system and make it more effective to ensure continued high quality SAR coverage in the area.

The study employed an exploratory mixed method design which employed extensive literature and legal review in consonance with collection of primary data using survey and semi-structured interviews. To ensure consistency of the research benchmarking of Cabo Verde SAR system was also undertaken against Swedish Maritime Administration based on interview with high-ranking personnel in the organisation. The qualitative exploratory part consisted of 4 interviews with senior maritime experts that are part of the CNCSAR in the country. Collected data was organized and detailed analysis resulted in identification of gaps in the SAR and also feasibility of introduction of drones in maritime SAR was brought out.

The study showed that there is a need to improve the national search and rescue system in the country. Furthermore, there is a need to improve communication systems at JRCC and ensure efficient coverage as well as training and certification of operators and SMC. There was a unanimous agreement for introduction of drones in the maritime SAR of Cabo Verde. The study ends with recommendations based on the findings for improvement in the system and conduct of a detailed feasibility study covering all aspects for the introduction of drones.

KEYWORDS: Search and Rescue, Cabo Verde, National SAR System, Drones, Drone and SAR.

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List of Abbreviations

| | | |
|-----------|---|---|
| AI | - | Artificial Intelligence |
| AIS | - | Automatic Identification System |
| CNCSAR | - | National Search and Rescue Commission |
| CVCG | - | Cabo Verde Coast Guard |
| EEZ | - | Economic Exclusive Zone |
| EPIRB | - | Emergency Position Indicating Radio Beacon |
| GISIS | - | Global Integrated Shipping Information System |
| GMDSS | - | Global Maritime Distress and Safety System |
| HF | - | High Frequency |
| IAMSAR | - | International Aeronautical and Maritime Search and Rescue |
| ICAO | - | International Civil Aviation Organization |
| IMO | - | International Maritime Organization |
| IMRF | - | International Maritime Rescue Federation |
| INTERCO | - | International Code of Signals |
| JRCC | - | Joint Rescue Coordination Center |
| MASS | - | Maritime Autonomous Surface Ship |
| MF | - | Medium Frequency |
| MR | - | Maritime Reconnaissance |
| MSAR | - | Maritime Search and Rescue |
| MSC | - | Maritime Safety Committee |
| MSW | - | Maritime Single Window |
| NWASARREG | - | North West Africa SAR Region |
| REC | - | Research Ethic Committee |
| RQs | - | Research Questions |

| | | |
|----------------|---|---|
| SAR | - | Search and Rescue |
| SAR Convention | - | International Convention on Maritime Search and Rescue |
| SART | - | Search and Rescue Transponder |
| SIDS | - | Small Island Developing State |
| SMA | - | Swedish Maritime Administration |
| SMC | - | SAR Mission Coordinator |
| SOLAS 74/78 | - | International Convention for the Safety of Life at Sea |
| SRR | - | Search and Rescue Region |
| SRS | - | Search and Rescue Sub-region |
| SRU | - | Search and Rescue Unit |
| TRS | - | Tropical Revolving Storms |
| UNCLOS | - | United Nations Convention on the Law of the Sea |
| USCG | - | United State Coast Guard |
| VHF | - | Very High Frequency |
| VMS | - | Vessel Monitoring System |

CHAPTER I: INTRODUCTION

1.1 Background

The seas and oceans of our planet have been and will continue to be a dangerous place. Safety of life at sea has always been a priority for us ever since the tragedy of RMS Titanic in 1912. An extensive Search and Rescue (SAR) system has been developed in the past century by the International Maritime Organisation (IMO) to ensure that accidents such as MV Prestige, Herald of Free Enterprise and recently Costa Concordia do not happen in the future (Chybowska et al., 2023). This research was an attempt to examine and suggest possible measures for improvement of SAR system in the Cabo Verde Search and Rescue Sub-region (SRS) via introduction of new technology, especially drones.

The Cabo Verde archipelago consists of ten volcanic islands that are divided into two groups: Barlavento (Santo Antão, São Vicente, Santa Luzia, São Nicolau, Sal, and Boa Vista) and Sotavento (Maio, Santiago, Fogo, and Brava) (Lopes, 2010). It is located in the North Atlantic, 355 nautical miles west of the African continent. A land area of 4033 km², coastal line of 1020 km, an Exclusive Economic Zone (EEZ) of 734 265 km², and SAR area of 645,000 km² are some of the key highlights of the country. Being a Small Island Developing State (SIDS), the ocean is one of the primary sources of income for the country, with fishing and tourism being the two main industries having a significant influence on the nation's economic growth. Figure 1 below shows the geographical

location of Cabo Verde .

Figure 1

Geographical Location of Cabo Verde



Note. From “Phylogeography of *Brachidontes puniceus* (Gmelin, 1791) in the Cape Verde archipelago (In Portuguese),” E. Lopes, 2010. (https://www.researchgate.net/publication/261648019_Filogeografia_de_Brachidontes_puniceus_Gmelin_1791_no_arquipelago_de_Cabo_Verde). Copyright 2008-2023 by ResearchGate.

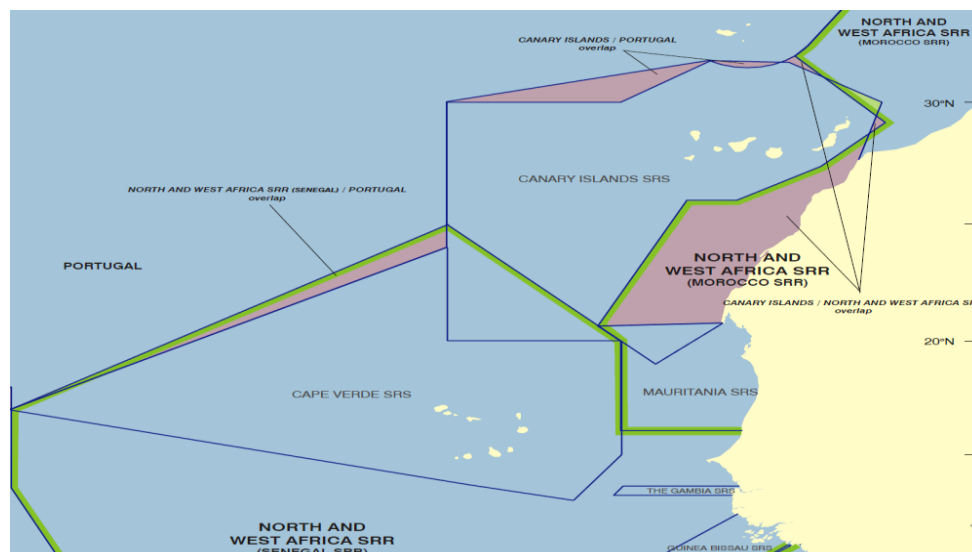
There has also been a naval obligation between the mariners at sea to help each other when in distress and this is where SAR draws its roots. The rescue of sailors and passengers in distress or survivors of ditched aircraft at sea is called Maritime Search and Rescue (MSAR) (Cho et al., 2021). SAR organizations date back to the year 1850 when the government of Prussia at the time together with other countries in the Black Sea formed one of the oldest organizations, composed of no more than 20 boats on the basis of cooperation (Fox, 2007). Often in most countries these SAR missions are carried out by the Coast Guard or Navy depending on how their Maritime Administration is organized. The United Nations Convention on the Law of the Sea (UNCLOS), which is beyond a doubt, considered as the constitution of the sea and unified over a hundred years of fragmented law which are agreed and accepted by all. The Convention establishes that:

all the Member States shall guarantee the maintenance of an adequate and effective SAR service regarding safety on and over the sea and, where circumstances so require, by way of mutual regional arrangements cooperate with neighboring states for this purpose. (UNCLOS, 1982, Art. 98 (2))

This broad understanding of SAR given in UNCLOS was further codified by the Maritime Safety Committee (MSC) which has separated the oceans into 23 Search and Rescue Regions (SRR). Of these 23 SRRs established by MSC which gives responsibility for SAR effort in the region of designated countries, this research will focus on the **Cabo Verde SRS** which falls under the NORTH AND WEST AFRICA SRR designated to Senegal. International regulations such as the International Aeronautical and Maritime SAR Manual (IAMSAR), UNCLOS and International Convention on Maritime Search and Rescue (SAR Convention) are fundamental guidelines to be followed for the improvement of SAR worldwide (IMO, 2022). Figure 2 below shows the division of areas in the Atlantic Ocean region with Cabo Verde SRS playing a central role as it connects Senegal and Morocco's SRR.

Figure 2

IMO Maritime SAR Regions



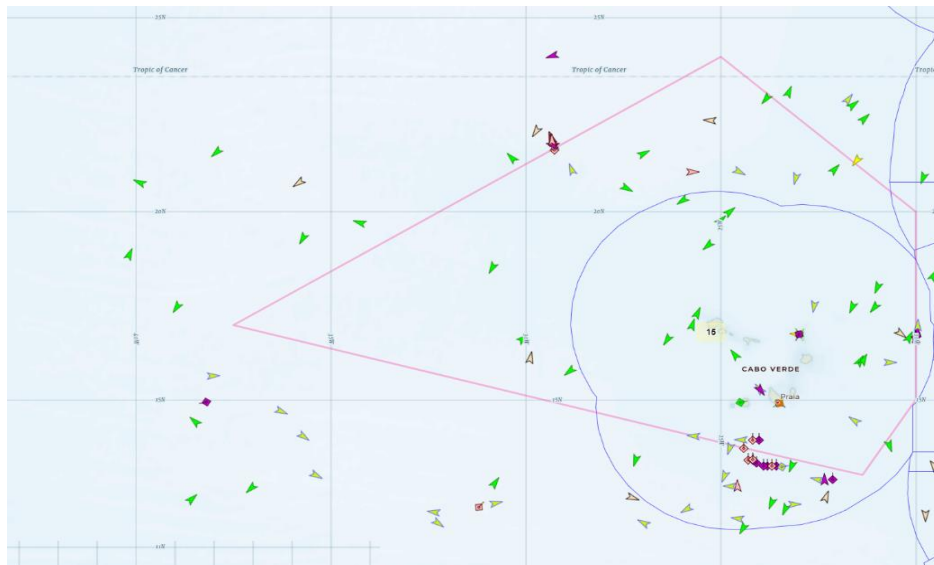
Note. From “World Index. CDR” by IMO, n.d. (<https://www.dco.uscg.mil/Portals/9/CG-5R/nsarc/IMO%20Maritime%20SAR%20Regions.pdf>).

We have seen exceptional strides in the field of technological advancements from robotics to Artificial Intelligence (AI) in the past couple of decades (Syam & Sharma, 2018), the maritime sector is no different. With a wide range of technological advancements from Maritime Single Window (MSW) to Maritime Autonomous Surface Ships (MASS) the maritime sector has also seen leaps and bounds of improvement in technology (Deling et al., 2020) which assists us in performing the tasks more efficiently and effectively. MSAR must also follow this new reality by adopting and introducing the latest technology to mitigate the emerging threat of increased traffic at sea. Regulation, management and technological development in the maritime area has proved to be crucial for the development and the guarantee of safety in the sector.

As a SIDS Cabo Verde possesses limited resources in terms of assets and infrastructure for covering the ever-increasing traffic density in the region. Since Cabo Verde lies in the tropical belt it faces tropical seasons and is prone to formation of Tropical Revolving Storms (TRS) which gives rise to high sea conditions making SAR efforts more difficult. That being stated, the idea of using technology for improving SAR response in the region will be evaluated as a beneficiary of the technological advancements and how they can be implemented in a planned manner. Figure 3 highlights the density of traffic passing through the country. Where each green triangle represents a vessel.

Figure 3

Maritime Traffic Density in Cabo Verde



Note. From “SARMASTER system in JRCC, Cabo Verde,” JRCC, 2023, August 24.

1.2 Search and Rescue - Regulatory Overview

The fundamental international instruments which regulate maritime SAR around the globe are SOLAS and the 1979 SAR Convention, which covers around 98.91% of the world's fleet (IMO, n.d.). Since seas are also being utilized by the aviation industry for passage, IMO¹ and International Civil Aviation Organization (ICAO)² were responsible for developing and implementing SAR rules and regulations that are used today. The IAMSAR manual is recognized as the international standard for aviation and maritime SAR organization, procedures, instruments and terminology.

1.2.1 IMO and ICAO Interconnections

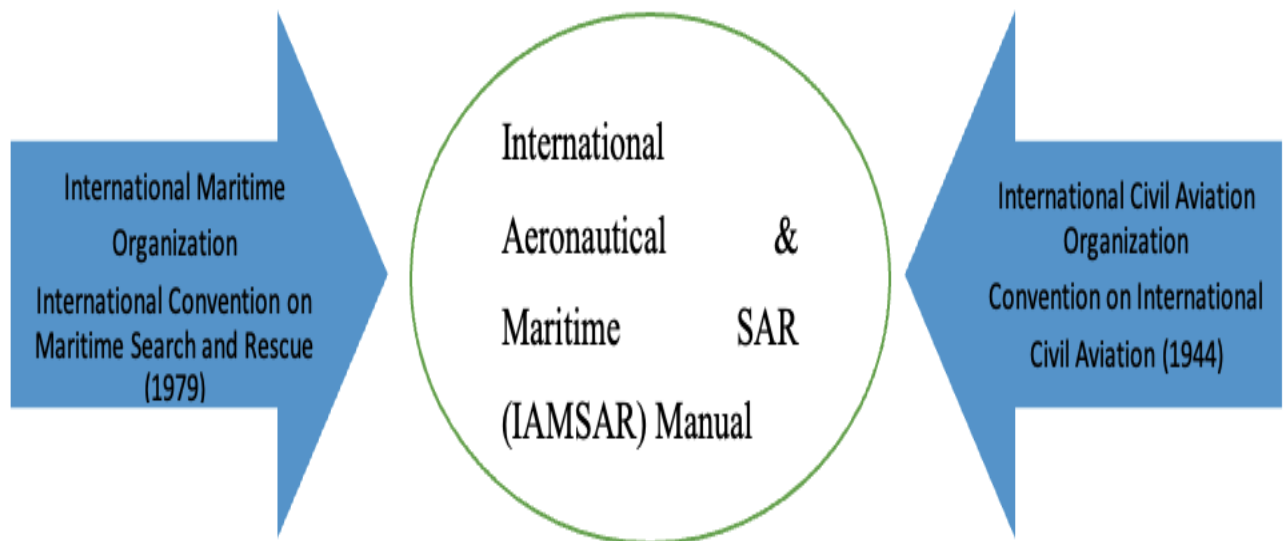
IMO and ICAO have jointly defined a SAR region as being: *“An area of defined dimensions associated with a rescue coordination center within which search and rescue services are provided”* (International Civil Aviation Organisation [ICAO], 2007). However, both organizations have their own definition in their separate regulations. ICAO in its Annex 12, Section 2.2, says that *“The delineation of search and rescue regions is determined on the basis of technical and operational considerations and is not related to the delineation of boundaries between States.”* On the other hand, IMO through the 1979 SAR Convention, in its paragraph 2.1.7 defines: *“The delimitation of search and rescue regions is not related to and shall not prejudice the delimitation of any boundary between States”*. Figure 4 below summarizes the creation of the IAMSAR manual, the result of joint efforts by IMO and ICAO to harmonize MSAR internationally.

¹ IMO- The international maritime organization in charge of creating and enforcing all laws pertaining to the shipping industry.

² ICAO- International agency in charge of creating norms, procedures, and guidelines for international flights

Figure 4

IMO/ICAO Interconnection



Note. Created by the Author.

Unquestionably in order to promote cooperation across institutions, IMO/ICAO adopted unified SAR regulations in 1998 in the form of a handbook the IAMSAR manual, replacing Merchant Ship Search and Rescue (MERSAR)³ and IMOSAR⁴ manuals with an emphasis on SAR and its necessity for being uniform across the world. The IAMSAR Manual's major aims to support nations in achieving their own SAR demands and commitments. It is divided into three volumes which include Mission Coordination, Mobile Facility Management and

³ **MERSAR**- Considered the basis of the SAR 79 Convention, focusing on the importance of the ship's master in providing assistance in case of emergencies, and entered into force in 1993.

⁴ **IMOSAR** - The IMOSAR Manual, which was established in 1978 and entered into force in 1993, was created to assist governments in implementing the SAR Convention by guaranteeing uniformity of practices and collaboration between states.

Organization. The IAMSAR Manual covers the entire scope of SAR at sea covering both ships and aircrafts.

1.3 SAR Legal Framework

In the following section, the UNCLOS, SOLAS Convention, SAR Convention, INMARSAT and the GMDSS will be discussed. These regulations are considered to be the legal bases for harmonizing SAR. IMO standardized global SAR in an effort to ensure that fundamental requirements for SAR operations are met at the international level, each instrument/code or regulation discussed below have the elements which act as the building blocks for overall the SAR mechanism.

1.3.1 UNCLOS

UNCLOS, is the result of the third United Nations Conference on the Law of the Sea signed on 10 Dec 1982 in Jamaica. The Convention was the result of extensive negotiations for nearly a decade. For this reason, UNCLOS is often called the constitution of the Ocean. Out of many aspects governing the oceans which were codified in UNCLOS, responsibilities of Flag, Coastal and Port States are of particular significance to this work. Art. 98(1) of UNCLOS entitled “Duty to Render Assistance”, gives responsibility to the flag States towards SAR and Art. 98 (2) acts as the bedrock for all SAR facility development of coastal states and the existing regional cooperation (UNCLOS, 1982). The article states that

Every coastal State shall promote the establishment, operation 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 neighboring states

for this purpose. (UNCLOS, 1982)

Being the constitution of the ocean UNCLOS Art. 98 gives validity to Member States actions towards ensuring safe seas for maritime transport to flourish.

1.3.2 SOLAS

The International Convention of the Safety of Life at Sea (SOLAS) developed on the principles enshrined in UNCLOS is the base Convention which establishes clear regulations on construction, equipment and operation of vessels, guaranteeing safety of navigation and consequently the safeguarding human life at sea (SOLAS 74). Immediately after the unforgettable and most unfortunate sinking of the RMS Titanic, the predecessor of the existing SOLAS Convention was developed in 1914. The Convention over the past century has seen many changes and modifications to its present form, which ensure above all safety of the passengers and crew onboard a ship via regulating the mechanism for safe and effective search and rescue or evacuation.

Table 1 below shows some of the main existing regulations in the SOLAS 74 Convention. Chapters III, IV and V of the Convention are those that have more detail on the equipment to be present on the ship to guarantee the safety of human life at sea and the responsibilities of Member States in ensuring compliance with SAR requirements.

Table 1*SOLAS Convention and SAR*

| SOLAS 74 Convention | |
|---|--|
| Chapter III Regulation 6 Parag. 2.2 | This regulation explains the need to possess a minimum of two Search and Rescue locating tools on the ship's lifeboats, allowing the ship to be located more quickly. |
| SOLAS Chapter IV Regulation 2,4, 7, 8,9,10,11,12 | Most of the safety equipment that must be present on the ship, such as GMDSS, EPIRB, DSC, INMARSAT and NAVTEX are in this chapter. Through this equipment, ships must be able to respond quickly and effectively to communications between ships or between the ship and the stations on land. |
| SOLAS Chapter V Regulation 7,8, 10, 12, 21, 33 | In addition to having the necessary procedures regarding the ship's safety of navigation, which at the level of the manual INMARSAT or the VTS system that should help maintain this safety, this chapter also shows the need for cooperation between states. |

Note. Created by the Author.

1.3.3 SAR Convention 1979

Adopted at Hamburg in April 1979 and entered into force on 22 July 1985, the SAR 79 Convention is a detailed roadmap for the Member States to follow uniform regulation and implementation of SAR services across the globe (SAR Convention, 79). 1979 SAR Convention lays the groundwork for the cooperation of all Member States towards conjoined efforts for providing SAR services to anyone in distress at sea, irrespective of the location. As we have seen in section 1.1, it has been an age-old tradition and responsibility of the ships at sea to provide assistance

to anyone in distress and the same has been emphasized in the SOLAS Convention. It was not until the promulgation of SAR Convention that the law and regulations governing such a crucial aspect of ships operations at sea were codified into an internationally binding treaty.

Traffic at sea has been increasing gradually over the past century. Trade across the globe has seen tremendous growth due to bigger and more capable ships (ICS, n.d.). Increased traffic and marine accidents go hand in hand. Effective SAR mechanisms in many regions of the world prior to the SAR Convention, for example in Great Britain, France and Germany during World War II, were established with the aim of providing SAR service to pilots of downed aircraft (Nagy, 2012). It is not possible for any one nation to provide 100% SAR coverage for its vessels as shipping is international in nature. Therefore, we should rely on each other's assistance for providing effective SAR coverage so the trade through sea can continue to flourish. This cooperation amongst various littoral states was achieved via SAR 79 Convention.

At present there are 23 SRR in the world, with each SRR being the responsibility of one Member State with further subdivision in smaller SRS. These SRR are managed by the respective MRCCs, who coordinate SAR efforts in the area of responsibility with available resources in the area. This is made possible due to the cooperation between neighboring Member States which allows for the use of available assets as per the pre-existing conditions between the nations. Finally, with the conception of the IAMSAR manual IMO has been able to harmonize SAR effort at sea for both vessels and aircraft in coordination with ICAO. Promulgation of this manual in 2004 allowed Member States to develop respective national SAR plans which included reporting and monitoring of vessels in SRR via ship a reporting procedure. The 4 key concepts which can be considered as the takeaway from SAR

Conventions are listed in Table 2 below.

Table 2

Key Concepts in the SAR Convention

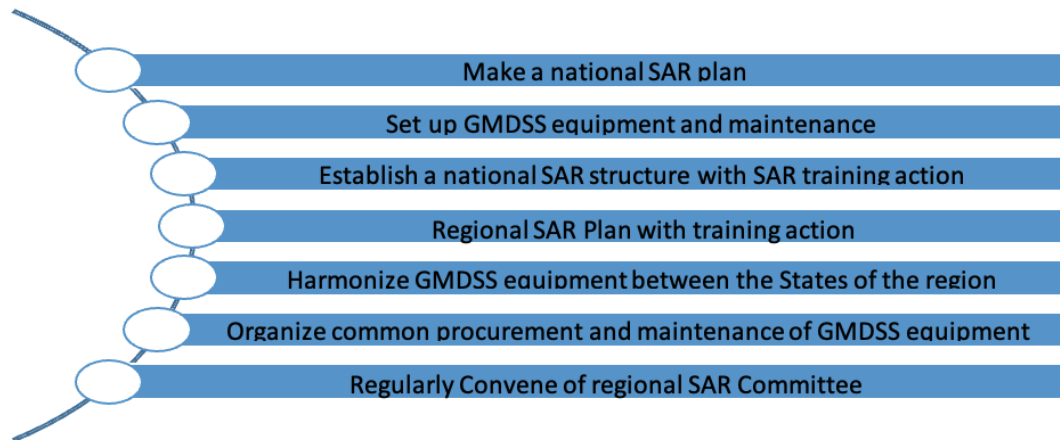
| Regulations | Overview |
|-------------------------------|---|
| Chapter 1 | The Chapter talks about the responsibility given to each coastal states with regards to SAR operations in a well defined area known as Search and Rescue Region (SRR) or at times subdivision in Search And Rescue Sub-Region (SRS) |
| Chapter 2 Regulation 2.4.2 | This regulations explains about the establishment of SAR coordination centers and its composition |
| Chapter 3 Regulation 3.1.1 | This section deals with the cooperation among different coastal states to ensure smooth and effective SAR coordination anywhere on the oceans |
| Chapter 4 Regulation 4.4 | The regulation speaks about non-discriminatory approach of SAR and anyone in need of assistance at sea shall be provided assistance irrespective of any affiliation of that individual. |

Note. Created by the Author.

Adoption of international Conventions has no meaning until and unless they are ratified, domesticated and implemented at the national level. SAR Convention provides the required procedures to maintain the standards required for effective implementation. SAR Convention has made it possible for homogeneous application of set rules across the globe as the Convention has been ratified by 114 Member States comprising 80.44% of world's fleet (IMO, n.d.). Figure 5 below highlights the key points for domestication and implementation of SAR Convention by each Member State.

Figure 5

Implementation of SAR Convention



Note. Created by the Author.

1.3.4 GMDSS and INMARSAT

The Global Maritime Distress and Safety System (GMDSS), adopted in 1988 and made mandatory for all merchant ships in 1999, has been revised and modernized to adapt to modern communication systems. It is estimated that with the introduction of GMDSS safety of life at sea has improved by more than 85% (Tenese, 2019). The IMO Subcommittee on Navigation, Communications and Search and Rescue (NCSR), Sub-Committee on Ship Design and Construction (SCD) and Sub-Committee on Ship Systems and Equipment (SSE) are some of the sub-committees there are responsible for drafting amendments to the SOLAS Convention. GMDSS was overhauled by NCSR via a correspondence group in order to update the GMDSS system, which culminated in approval of amendments by MSC 104 in 2021, and adoption by MSC 105 in 2022 (MSC 105,2022).

GMDSS and SOLAS regulation IV/5 mandates all Member States to provide information about and regularly update their GMDSS master plan (national plan) which contains vital information about the existing shore-based ship-to-shore and vice versa communication equipment and GMDSS systems available to them. The information contained in these plans are easily accessible to MRCCs, communications hubs, ships, and training facilities. As per the Master Plan available in the IMO Global Integrated Shipping Information System (GISIS), Digital Selective Calling (DSC) installations, VHF, MF, and HF are among the services listed in each State's Master Plan.

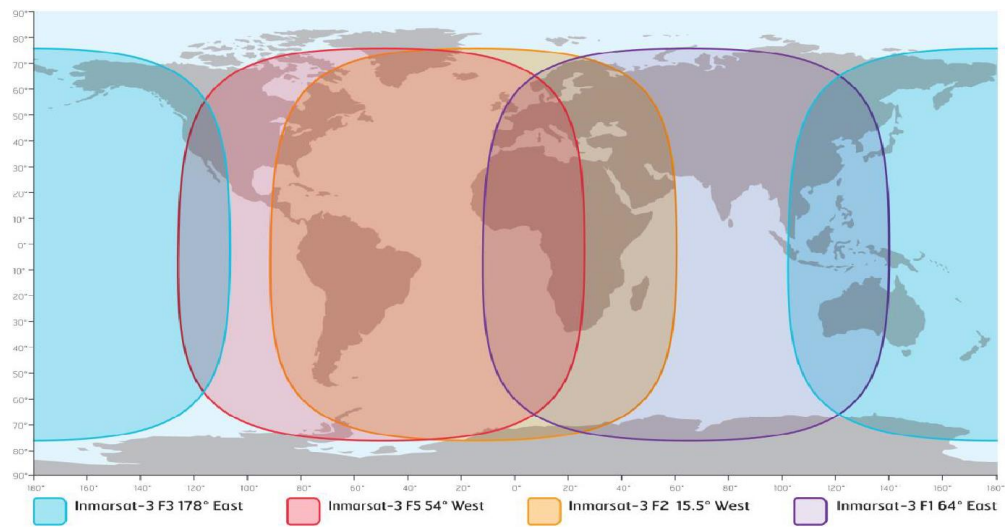
GMDSS doesn't operate in isolation. Its relationship with INMARSAT strengthens SAR services globally. The movement of INMARSAT satellites in 2018 resulted in new regulations that complimented the GMDSS but had no effect on the reception of the Maritime Safety Information (MSI). INMARSAT offers the vast majority of the services deemed necessary for SAR operations. INMARSAT is the owner and operator of 15 satellites that operate in the L-band, Ka-band, and S-band and are in geostationary orbit 35,786 kilometers above the Earth (Hoyhtya et al., 2017). Services like Fleet Safety, SafetyNet II, and/or Rescue NET, as well as Inmarsat C are part of the system. Being the Rescue NET service, which is primarily used for receiving Distress Alerts, warnings from vessel & MRCCs and/or Distress Chat Each month, 30,000 SAR and maritime safety awareness messages are transmitted via Safety NET (The European Space Agency, n.d.).

Three new modes of communication—satellite-to-satellite, satellite-to-ground, and satellite-to-mobile have been added to the current ones with the addition of the Iridium satellite system, which has an overall coverage area on the surface of the Earth with a diameter of around 4,500 km (Valčić et al 2019). According to Valčić et al 2019, the Iridium satellite is being considered as the second GMDSS

satellite services provider to enhance maritime safety and commercial communications. Figure 6 highlights the coverage of INMARSAT satellites worldwide, with each color representing one satellite.

Figure 6

Areas Covered by INMARSAT Satellite



Note. From “Inmarsat C service guide, Version 3. 0,” INMARSAT, 2018.

(https://www.iz1cqn.it/INM_C_I3_I4_migration_guide_V3.0.pdf). Copyright 2018 by

IMNARSAT Global Limited.

1.4 Problem Statement

On average in the past seven years 88.7 persons have been reported missing at sea in Cabo Verde SRS. The majority of whom can be attributed to local fishermen and recreational activities. According to the reports of JRCC the success rate of SAR mission

in the region is 91%, which means that Cabo Verde loses eight persons at sea per annum (Joint Rescue Coordination Center [JRCC], 2022, slide 4). Although the numbers look small, when compared to a country like India (in terms of population comparison) with a similar access to sea the total loss of life at sea per annum corresponds to 23,200 persons. The loss of such precious lives can be attributed to many factors, including lack of awareness among the local populace, ill prepared artisanal fishing boats and increased traffic density in the region. However, the major cause can be considered the limited capability of Cabo Verde Coast Guard (CVCG) under National Search and Rescue Commission (CNCSAR) to provide SAR cover. Whatever the case may be, as a coastal State, it is the responsibility of a nation to provide SAR coverage in the area of responsibility under UNCLOS⁵. Better cohesive efforts between all regional stakeholders, synchronized efforts by the responsible national agencies and use of the latest technology can provide the required boost for CVCG to improve SAR success rate.

Due to its status as a SIDS, Cabo Verde lacks sufficient academic and research resources for maritime safety, security professionals and mainstream academia is not concerned with a nation with only 10 islands in the middle of North Atlantic. Hence, not much research has been done in analyzing the regional cooperation and what technologies can be used in Cabo Verde SRS for improving SAR efficacy, ensuring safety of life at sea. There is a need to examine the strength of existing SAR mechanisms in Cabo Verde SRS along with regional cooperation, to consider the introduction of new technology like drones for enhancing the SAR capabilities of the nation.

⁵ UNCLOS Art 98. parag.2 which lays down the responsibility of coastal states for providing SAR coverage in their area of responsibility through cooperation and agreement between the neighboring states.

1.5 Aims and Objectives of the Study

Mankind have been able to achieve great results with cooperation, the efforts in reducing the impact of climate change is a prime example (Orliange, 2020). Also, technology has improved each aspect of our lives and is continuing to grow at a phenomenal rate (Benhabib & Spiegel, 2005). The aim of this research was to analyze the present status of SAR operations in Cabo Verde via examination of how SAR operations are organized internally in Cabo Verde and the regional mechanisms established. This was intended to evaluate the introduction of new technologies, such as the use of drones in SAR operations. This was achieved by the following three objectives: -

- To analyze how SAR operations are carried out in Cabo Verde SRS.
- To assess the existing regional cooperation amongst neighboring littoral states.
- To evaluate the introduction of new technologies in the SAR process, with main emphasis on utilization of drones.

1.6 Research Questions and /or Hypotheses

The Research Questions (RQs) were developed based on the objectives set out in the previous section. The three questions were based on an assessment of the current situation and what will be the consequences of introducing new technologies in SAR missions. The RQs are as follows:

- What is the current state of SAR in the region?
- Is there a need for improvement of the SAR missions in the area? If yes, how can it be improved?

- How can the use of new technologies improve the SAR operations in this area?

1.7 Methodology Research Design and Methods

This section discusses research methodology and the approach taken to answer RQs. The section outlines the research methodology in detail and the data collection method used which includes the criteria used for the selection of participants. A discussion on expected outcomes and research limitations was presented next and finally the outline structure of the dissertation was presented.

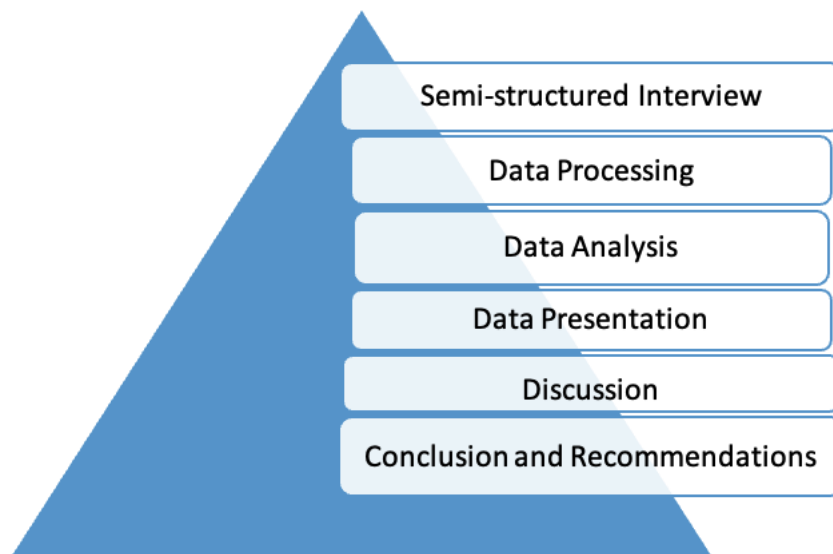
1.7.1 Data Collection and Analysis

To fulfill the three main research objectives, the study employed qualitative research using a semi-structured interview approach. Semi-structured interviews can be characterized as an open-ended question and the use of an interview guide (or topic guide/list), in which broad areas of interest, occasionally containing sub-questions, are defined in a determined conversation (Hijmans, E., & Kuyper, M. (2007) as cited by Busetto et al. (2020)). An online survey in Google Survey Forms was also developed and distributed to key participants in SAR operations in Cabo Verde. In an online survey, participants are given open-ended questions in textual form through email or other modes like WhatsApp, messages, etc., frequently in conjunction with quantitative RQs on the same subject (Alisha, 2022). Documents and data related to SAR operations in Cabo Verde as per the researcher's understanding were requested from appropriate authorities to demonstrate the performance and current status of operations.

For semi-structured interviews the researcher used a free version of an online website known as ATLAS.ti 23 for coding. This tool was preferred over manual coding because it saves time and keeps the data and coding organized, allowing more time for producing results that are of higher quality. Figure 7 below shows the data analysis process adopted by the researcher.

Figure 7

Data Analysis Process



Note. Created by the Author.

1.7.2 Selection of the Participants

Taking into account the organization of Cabo Verde's SAR, the target participants of the research was taken from the components of CNCSAR Cabo Verde, namely the CVCG and the National Maritime Police. Four interviews were

conducted with senior officials from CVCG, Cabo Verde Maritime Police, JRCC and CNCSAR to corroborate the results.

1.8 Expected Results

The research was expected to bring out the deficiencies in the existing SAR mechanism of Cabo Verde which includes internal and external cooperation. Also, to bring out the measures which can be implemented to improve the existing system. The following outcomes were aspired:

1. How to manage the SAR operation more effectively;
2. Introduction of new technologies to improve the operations – The use of drones
3. Positive relationship between the countries involved in SAR in North Africa.

1.9 Key Assumptions and Potential Limitations of the Study

In this study, the main assumption was that the adoption or introduction of new technologies or the use of drones in SAR operations is important to facilitate, streamline and provide a better and greater response to SAR operations in Cabo Verde SRS. Based on the study's chosen methodology, some potential limitations include:

- Investigation of the topic was based on the viewpoint of the personnel working in JRCC of Cabo Verde;
- The time needed to collect current and relevant data for the research;
- Obtaining timely answers to the questions asked in this research and the contact to be established between the research and the interviewees

1.10 Ethical Considerations

The application for ethical clearance was submitted to the Research Ethics Committee (REC) of the World Maritime University (WMU) containing the research proposal, WMU protocol form, a sample consent form and an interview and a questionnaire. The process of data collection was approved by the WMU REC. First the request and consent for the questionnaire were sent to the participants by email and the participants for the interview were all contacted by email and WhatsApp to organize the time and day. Secondly, the researcher informed all the participants that the data would be used just for the purpose of the dissertation and will be erased and not shared without any approval after the research is completed. The participants are also protected by maintaining confidentiality. All other ethical considerations were followed during the course of the research.

1.11 Concluding Remarks and Structure of the Dissertation

Chapter one introduces the concept of SAR at an international level and the role of Cabo Verde in the designated SAR area. The chapter then discusses the regulatory overview of SAR and the instruments which obliges Member States to provide SAR in their area. Conventions and regulations such as UNCLOS, SOLAS, SAR, GMDSS and INMARSAT are analyzed to bring out the larger picture of SAR as a whole. Problem statement, research's aim, questions and methodology designed for answering RQs followed by the key assumptions and limitations of the research. Finally, the author deliberates on the ethical considerations for the research.

The research is organized in five chapters. Chapter two provides a detailed literature review of the research, discussing the use of new technologies such as drones in the field of SAR. A brief discussion regarding the regulation established by IAMSAR

covering what the aeronautical regulations entail. This chapter also contains a benchmarking analysis between Cabo Verde and Swedish SAR agencies to better understand the points that need to be improved in Cabo Verde SAR organizations. Chapter three discusses the national SAR system in Cabo Verde. The national legislation and the stakeholders that are part of the SAR system in the country are analyzed. Also, international and regional cooperation with countries such as Spain, Portugal, Senegal and France are analyzed and finally the statistics of the SAR operations in Cabo Verde are discussed. The fourth Chapter contains the analysis of the collected data through interviews and questionnaires. The results of the analysis will be presented in the form of discussions and in a graphical format for ease of understanding. In the last chapter the results are formulated in the form of a conclusion, a pathway for improvement is recommended along with scope of future research.

Chapter II: Cabo Verde SAR System

2.1 Introductory Remarks

The majority of SAR efforts in Cabo Verde are concentrated on helping distressed fishermen. There are 1,265 fishermen spread across Cabo Verde's islands engage in semi-industrial and industrial fishing (DGRM, 2019). With the growing number of fishing fleets and tourism activities including recreational use of the sea, the chances of a maritime incident are also increasing. CVCG under CNCSAR is in charge of Maritime SAR organizations throughout the nation. The composition of the SAR mechanism in Cabo Verde is discussed in detail in this chapter.

A number of actors, all of whom fall under CNCSAR's purview, are part of the SAR system. The CNCSAR has taken all necessary steps to ensure that the nation is covered by international laws, and this chapter also lists the legislation that has been passed to date and their relevance to SAR system. The roles and impact of the major participants, including the CVCG, JRCC, COSMAR, and Maritime Police, in the national SAR system are briefly discussed. Due to SAR's global nature, Cabo Verde has entered into many regional SAR agreements throughout the area. These agreements are briefly discussed to highlight the mechanism of regional cooperation for SAR activities, at the end SAR data as per the latest report of JRCC is analyzed to bring out the fact that despite limited resources, missions have been largely successful. The discussions in this chapter present the existing status of SAR in the country, which answers the first RQ of the

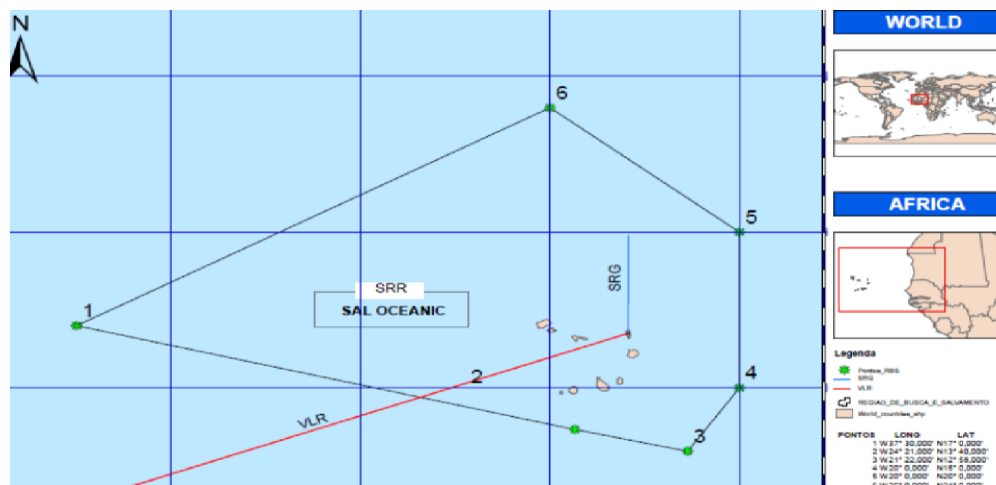
research.

2.2 National SAR System (NSAR)

The NSAR system was established through the domestication of international regulations. Cabo Verde has a vast assigned area of responsibility with a total of 110k km² of SRS. With the available resource effective coverage of the entire SRS is a big challenge for the nation. SRS designated to Cabo Verde is managed in accordance with regulations and guidelines established by the IAMSAR manual. Figure 8 below represents the SRS area assigned to Cabo Verde through the separation of areas established by the SAR Convention 79.

Figure 8

Cabo Verde SRS



Note. From "Virtual Workshop on the Establishment of an Effective SAR Organization" (https://www.icao.int/WACAF/Documents/Meetings/2020/SAR%20Workshop/11.1_SAR%20Organisation%20in%20Cabo%20Verde%20%282%29.pdf).

2.3 National Legislations

The Cabo Verdean State is accountable for ensuring the protection of human life through SAR service because it ratified SOLAS 74/78, SAR 79 and ICAO 74. The ratification of the UNCLOS and Chicago Convention 1944 in Cabo Verde are considered as the umbrella Convention for the implementation of other international Conventions that regulate SAR. Cabo Verde has been working since ratification of the Conventions towards transforming them into national legislation. National SAR legislation is regulated by OPR SAR GC (DL 31/2018); AAC (DL 28/2004); RES 39/2009 and 84/2015 – CNCSAR; Po 81/2015- SRR CV; DL 31/2018- CV SAR; IMP DL 38/2019 and of course the establishment of a national SAR plan. Cabo Verde is also Party to several international agreements regarding SAR operations.

2.4 The Main Framework of Cabo Verde MSAR (CNCSAR)

The NSAR system is a network of several agencies with different functions, each of which work in harmony with another. The responsibilities and coordination of SAR services are regulated by a legislation, latest being Decree-Law No. 31/2018, of May 31st. CNCSAR, which is the nodal agency for SAR, was established by Resolution No. 31/2009, of September 21. The inter-agency coordination is the main responsibility of CNCSAR. CNCSAR is composed of one member from each agency, with the authority to make decisions on their behalf. However, JRCC supported by COSMAR is responsible for providing SAR coverage in SRS. With the establishment of CNCSAR the coordinated efforts towards SAR in the nation have improved, better utilization of available resources and a common national SAR plan are some of the key highlights. Organizations working in SAR in Cabo Verde under CNCSAR are shown below in Figure 9.

Figure 9

CNCSAR Cabo Verde



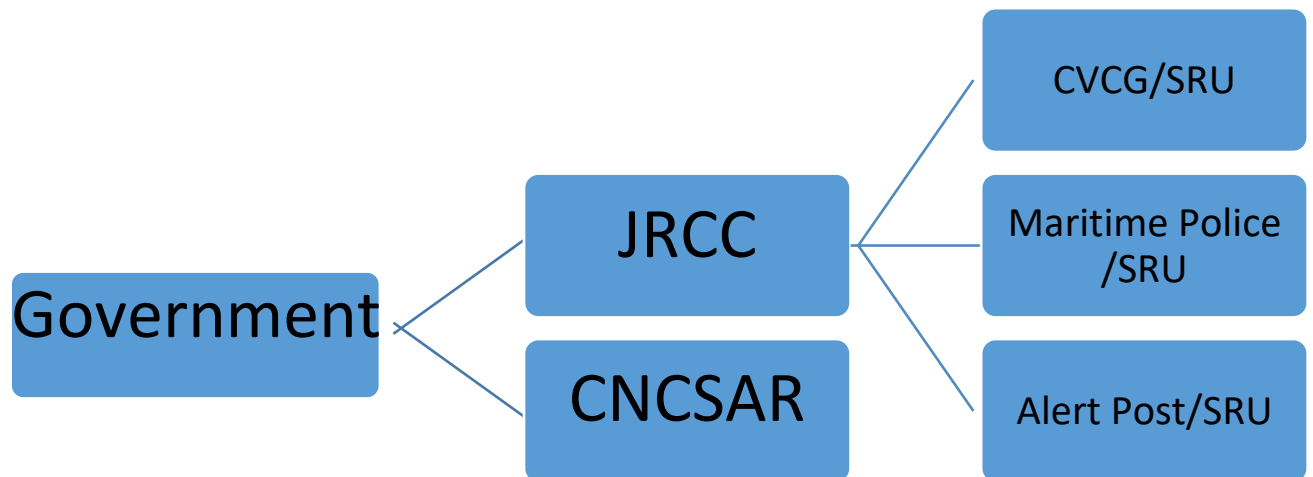
Note. Created by Author.

2.4.1 SAR Organization in Cabo Verde

Looking at the topology of the SAR system in Cabo Verde, the government sits at the highest level with all the regulatory power, at the next level lies CNCSAR and JRCC which can be considered as the strategic level of command which also work as operational centers the last level is the operational level which is largely looked after by the CVCG. Figure 10 below represents how SAR is organized in Cabo Verde.

Figure 10

Cabo Verde National SAR Organization



Note. Created by the Author.

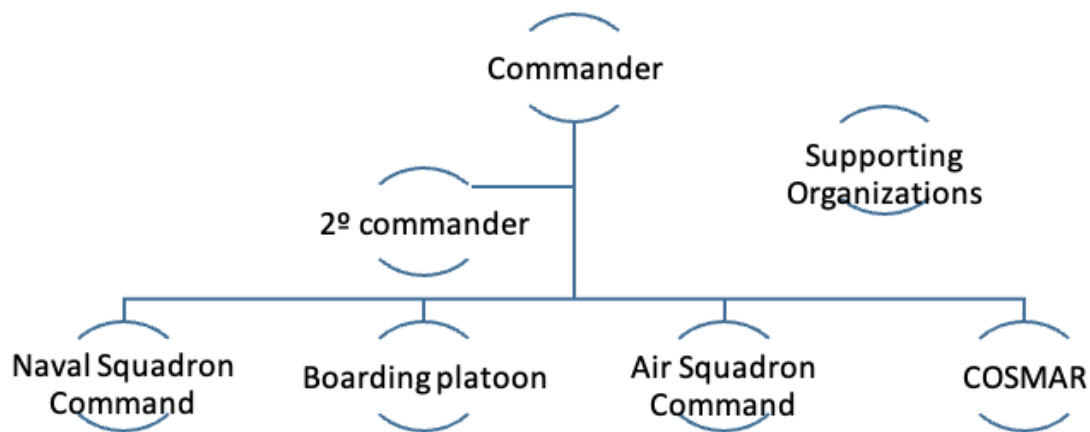
2.4.2 Cabo Verde Coast Guard

Coordination of aviation and maritime SAR operations in designated SRS is one of the GCCV's missions and responsibilities. According to Regulatory Decree No. 5/2009, January 26, the CVCG is the part of the Armed Forces of Cabo Verde (FACV) responsible for air and naval support in land and amphibious operations, as well as the defense and protection of the nation's economic interests at sea under national jurisdiction. However, it is the duty of CVCG to protect life at sea and carry out commitments made as a result of the State of Cabo Verde ratifying international treaties. The CVCG is now organized to meet its demands and to be in line with the missions given to it within the FACV. Its structure

includes: Naval Squadron; Air Squadron; Boarding Platoon and COSMAR. Figure 11 below shows the structure of the CVCG.

Figure 11

Organization of the Cabo Verde Coast Guard



Note. Created by Author.

The following competencies and duties related to the delivery of the SAR service in the nation are delegated to CVCG by the national SAR strategy:

- Ensure the Safeguarding of human life at sea, guide and carry out SAR operations through the JRCC and COSMAR, without prejudice to the obligations attributed to other institutions;
- Manage communication channels of the Armed Forces and land, air and

naval means;

- Instruct all air, sea and land units to take over as an Alert Post;
- Contribute with personnel and equipment for SAR, naval, air and land resources in SAR operations;

2.4.3 COSMAR

COSMAR was established in 2010 with US assistance, and thanks to its radio communications (HF and VHF), telephone, and fax capabilities, as well as its Automatic Identification System (AIS) for ships (Sea vision and TV32), fishing Vessel Monitoring System (VMS), and decision support system for patrol activities (SADAP6), it is one of the main support centers for Maritime Security operations. To assure the planning and execution of operations in the area of marine safety in the waters under national jurisdiction and in the EEZ, COSMAR is an inter-agency which coordinate with the CVCG for SAR operations (Rodrigues, 2017).

Information on marine safety is gathered, analyzed, and disseminated by COSMAR. The exchange of data obtained from satellite and radar images is examined and shared with centers of neighboring States, such as the Maritime Operations Center of Portugal and the Operations Center and Maritime Action Surveillance of Spain, made possible by cooperation with national maritime safety agencies and other international agencies (Rodrigues, 2017).

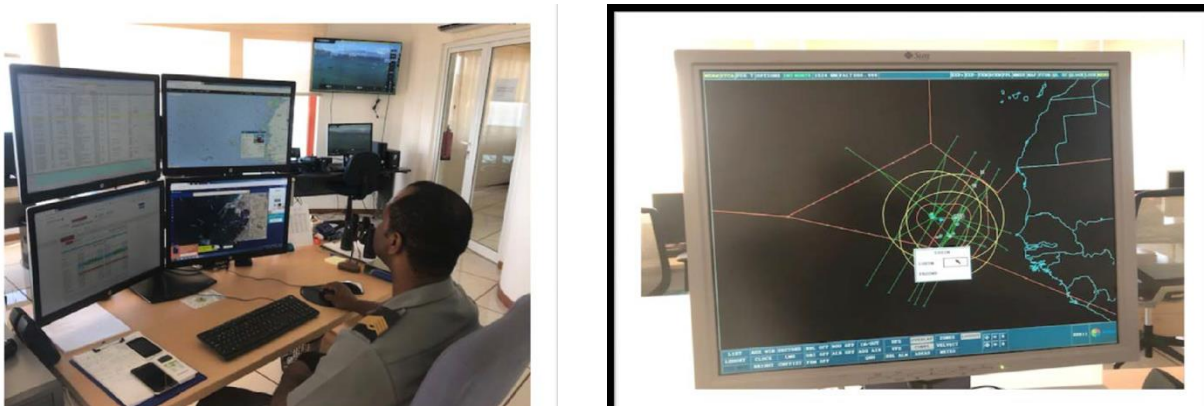
2.4.4 JRCC Cabo Verde (Joint Rescue Coordination Center)

The creation of the JRCC in the country was due to the need to have an agency that coordinates both the aeronautical and maritime SAR services. JRCC can be considered as the brains of the operation when it comes to SAR and is entirely staffed by members of CVCG. With limited manpower SMC and SAR operators are deputed from CVCG who are qualified to carry out such duties. The service is available around-the-clock, a SMC and operator are always on call with a 30-minute response time. All aviation and maritime SAR activities in the SRS of the archipelago are coordinated by the Vessel Traffic Management System (VTMS) center which is situated in Barlavento Islands in Mindelo. When necessary, the center can also participate in operations outside of SRS at times.

The JRCC is equipped with VHF and HF transmitters, a landline phone, an air traffic control monitor that can only be used by ASA air traffic controllers and SAR Master software. The JRCC uses SAR Master, an innovative software that is used in all SAR related activities. It provides helpful SAR planning tools that can be used to coordinate SAR activities in addition to data collection. It is equipped to receive warnings from COSPAS-SARSAT system beacons, calculate search areas and plans, create SAR Briefing Reports, record activities, determine the survival rate of those onboard, and assign search and rescue units (SRUs) based on the information fed by the operator. Even though the program is outdated, the majority of procedures can still be undertaken. It is crucial to stress that, despite being under CVCG supervision, the JRCC is not a component of the organization. Figure 12 below shows JRCC working.

Figure 12

JRCC Cabo Verde and SAR Master



Note. From "Virtual Workshop on the Establishment of an Effective SAR Organization" (https://www.icao.int/WACAF/Documents/Meetings/2020/SAR%20Workshop/11.1_SAR%20Organisation%20in%20Cabo%20Verde%20%282%29.pdf). Copyright 2017 by JRCC, Cabo Verde

2.4.5 Maritime Police

Within the scope of the national maritime system, the Maritime Police have, among other competences and responsibilities:

- Act as an alert post;
- Provide and participate with appropriate personnel and equipment during a SAR operation;
- Ensure the security of all parts and the aerial and coastal SAR stations used;
- Take care of deceased persons and/or personal belongings of the victims, in coordination with the Mission Coordinator;

Maritime Police play an integral role in SAR organization with almost 20

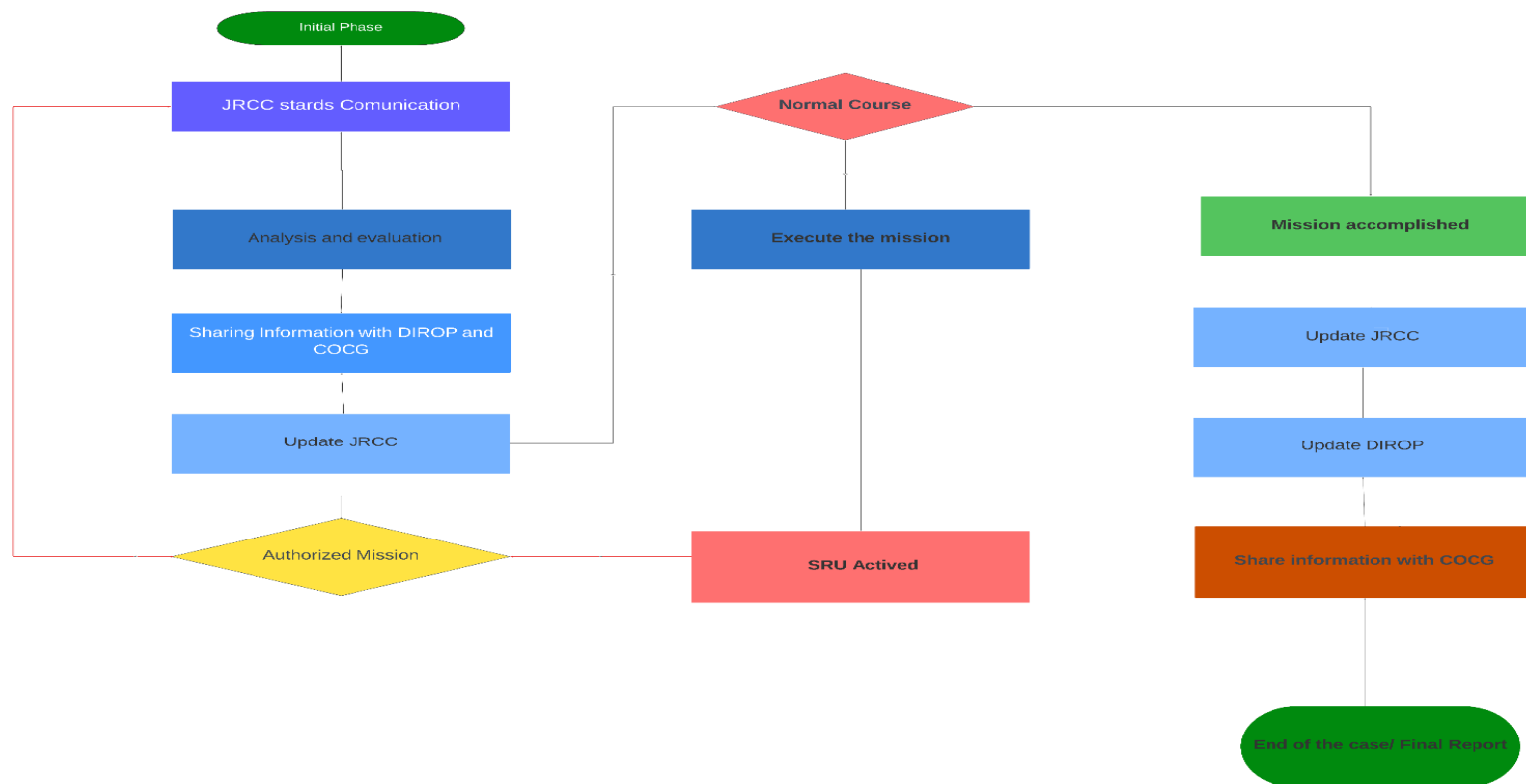
patrol boats spread across 9 islands with a fast response time. However, due to lack of sea going experience and proper training the efforts are not always coordinated and disruption in the flow of real-time information causes difficulties in the operations of JRCC.

2.5 Activation of SRU in Case of SAR in Cabo Verde

Four phases, including the initial phase, analysis and decision, mission execution, and final phase, are involved in the information flow for activating units to perform SAR missions. Within Cabo Verde's SAR process, decision-making involves a number of participants. The principal actors are the Coast Guard Commander, the Director of Operations at JRCC, the JRCC as represented by the service operator, the SMC, and the message transmitted to the unit. Figure 13 represents a flowchart as a summary of the decision-making process and activation of the SRU, within the scope of a SAR mission.

Figure 13

Chain of command for the Use of SRU in Cabo Verde



Note. Created by the Author.

2.6 Multilateral and Bilateral SAR Agreements in Cabo Verde

Cabo Verde has entered into many multi/bi-lateral agreements with other littoral neighbors. These agreements are part of the SAR system and assist the nation with resources which are not available to it. An entire discussion on the agreement is beyond the scope of this research, however, a summary of the agreement is placed in Appendix 1. Also, the three agreements are placed as example at Appendix 2, 3 and 4.

2.7 Statistics of SAR Operations in Cabo Verde

The JRCC is responsible for SAR operations in the country and is responsible for coordination with CVCG, Civilian, ships of opportunity and especially with partner MRCC and ARCC's. From SAR and MEDEVAC missions to training and joint-exercises at the JRCC, the success rate is considered positive. JRCC was established in 2016 and the data repository was also started in 2016. An evaluation of JRCC data from 2016 to 2021 shows the effectiveness and efficiency of the institution in the country. Figures 14,15 and 16 below represents the data from the annual report submitted by JRCC to CNCSAR in 2022. The report is placed as Appendix 5.

Figure 14

Density of SAR Occurrence 2016-2021, Cabo Verde

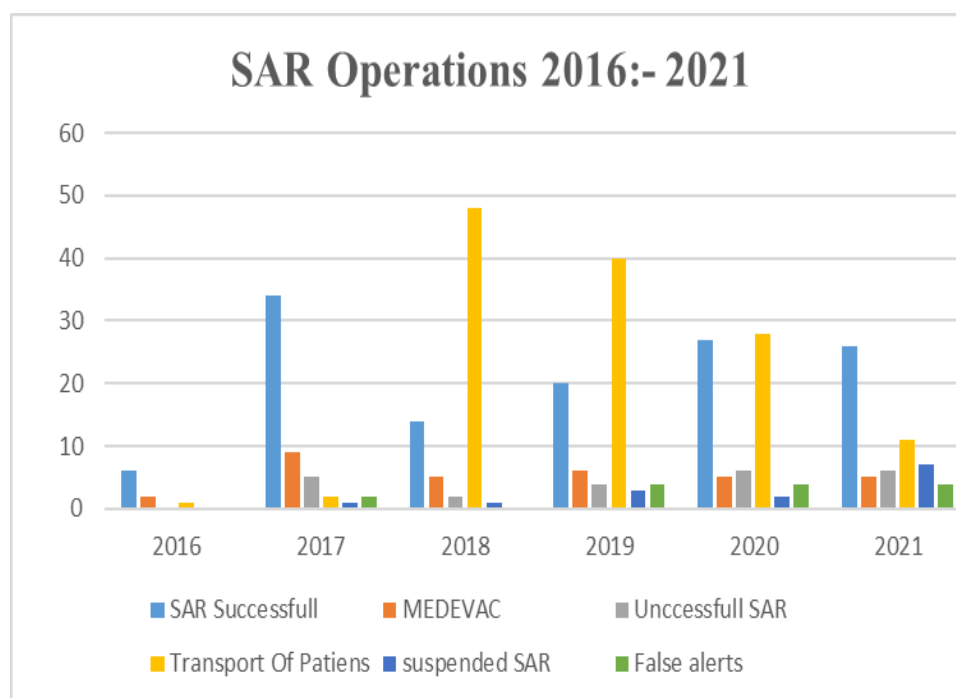


Note. Adapted from Annual Report 2016-2021 from JRCC.

Each SAR occurrence is presented as a green dot, the color changes to yellow and then to red depending upon the density of incidents occurring in any one region. A closer look at the data highlights two major facts, firstly, more than 90% of the SAR incidents occur within 25 nautical miles of the coast line and secondly, the density of incidents is higher in the area which is a hub for fishing communities.

Figure 15

SAR Operation in Cabo Verde from 2016 to 2021

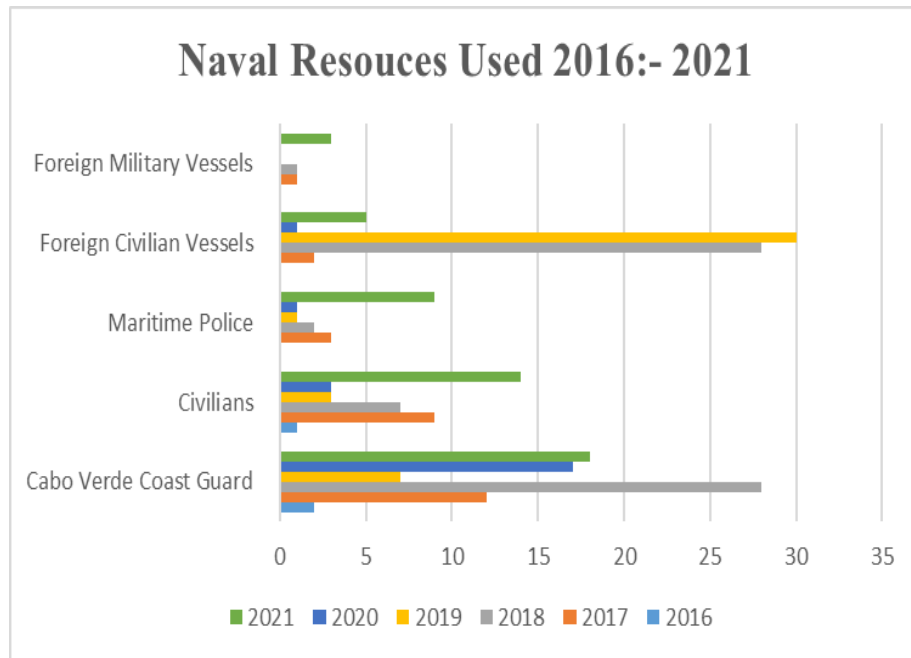


Note. Created by the Author.

The statistics presented in the above graph highlight a rise in the number of MEDEVAC operations undertaken from 2017 to 2021. The data shows that the number of unsuccessful SAR operations are negligible in comparison to successful operations, which is indicative of the fact that even with limited resources JRCC has been able to provide effective SAR coverage in the designated SRS.

Figure 16

Naval Resources Used in SAR operation between 2016 to 2021



Note. Created by the Author.

The data represented in the above graph is indicative of the fact that the dependence of foreign assets is slowly reducing which can be attributed to the induction of newer vessels with CVCG and Maritime Police. This is a clear indication that, with the right resources CVCG in coordination with Maritime Police is more than capable of providing effective SAR coverage in Cabo Verde SRS.

2.8 Concluding Remarks

In this chapter a holistic view of the SAR system in Cabo Verde is presented, which discusses the national legislation and the agency (CNCSAR) which are responsible for the functioning of the SAR system. Each important element of SAR organization is

then discussed in detail which includes CVCG, JRCC, COSMAR and Maritime Police. The discussion is then held in relation to the regional SAR agreement which Cabo Verde has with other nations and finally some statistics were provided from the annual report of JRCC which highlights the fact that with limited resources Cabo Verde has been able to provide effective SAR coverage in the designated SRS. The discussion in this chapter directly answers the first RQ.

Chapter III: Literature Review

3.1 Introductory Remarks

This chapter discusses existing literature on the deployment and use of drones in various fields. A review of advantages and disadvantages of using technologies in SAR especially drones along with financial implications are also discussed. In order to ascertain whether the use of drones in maritime SAR missions in Cabo Verde SRS is viable and offers answers for enhancing operations in terms of efficacy, efficiency, and operational level, this chapter evaluates earlier studies. Twenty-five (25) articles from 2014 to 2023 were identified after filtering the entire search which was conducted by using keywords such as ‘Use of Drones’, ‘Drones in SAR’, ‘Technology and maritime SAR’, etc., showing an accelerated growth of research on the use of drones in all industries, more precisely in maritime SAR. The literature review is divided into four sections: a) a brief discussion of the fields where drones are being used in a successful way b) a literature review on the use of drones in SAR, c) a benchmark of the current Swedish practice related to SAR and d) the findings of the literature review.

Setting the Scene

The ability to quickly locate a survivor or a ship in danger at sea is one of the biggest challenges in a SAR event. The second challenge is determining what resources are required to carry out the rescue in those same situations. However, time is the most

important consideration in SAR operations since the life of the person in distress is in danger. With the passage of time the probability of locating and rescuing a person in distress reduces drastically (Breivik et al., 2012). The SAR operation therefore must be improved and should be able to adapt to present situation and technological advancements in order to provide the greatest chances of survival at sea. The risk of maritime incidents has increased many fold due to increased traffic at sea and especially in Cabo Verde SRS due to the growing presence of fishermen who do to abide by safety regulations. Lack of proper communication systems and GMDSS equipment further complicate the situation. The use of technologies in the maritime area has evolved a lot over time. The Global Positioning System (GPS) which revolutionized maritime navigation by providing extremely accurate and reliable position information, enables ships to determine their exact location in real time and has undoubtedly had one of the most significant effects on the maritime industry. However, currently the evolutions beyond E-navigation⁶ to unmanned ships, green technology and energy management.

Technology advancements in a number of fields have shown that SAR operations can also be improved. Drones or AI have long been considered potential search aids, but at present they are primarily used for land-based operations. There are certain cases in which technology has been used to improve survival rate at sea which includes the Search and the Rescue Transponder (SART) and the Emergency Position Indicating Radio Beacon (EPIRB). Thus, the use of drones has huge potential in improving the odds of survival at sea, lowering the possibility that people or goods will be lost. Drones when launched from a SRU can cover more area and quickly search for the survivors, playing a role similar to that of helicopters (Xiong et al., 2020). The main goal is to use drones to

⁶ E-Navigation: Its primary purpose is to digitally transform manual navigational duties to simplify ship operations and enable flawless communication between ships and land-based authorities. So that they can plan routes more effectively and safely, marine experts are now able to receive real-time information regarding traffic conditions and potential hazards.

locate the distressed person as soon as possible and, if it's possible, to provide them with some basic survival gear. Drones are dependable and efficient, using them can decrease costs and cut down on time required for searching. There are advantages and disadvantages in every industry, but using drones for SAR has more benefits than liabilities.

3.2 Fields in Which Drones are Being Used Successfully

The drone industry is a booming. Possible applications of drones are limitless and given the variation in dimensions in which they can be built, drones are being utilized in every sphere of our lives, for recreational purposes for surveying and for specific military applications. Karaca et al., (2018), define drones as small aircraft that are flown by an operator on the ground instead of a pilot. The benefits of using drones by governments, military and law enforcement authorities as a way of maintaining order in many cases is testament to the versatility of drones. Greenwood et al., (2019), states that based on their configuration, drones can be split into three general categories: single-rotor (or helicopter) & multirotor rotorcraft, fixed-wing hybrid vertical take-off & landing (VTOL) and fixed-wing which are also known as UAVs. With the availability of drones to the common public and reduction in price drones are now being used by sectors which were initially labor intensive such as: agriculture, inspection and maintenance of infrastructures, education, mapping and surveillance, monitoring endangered environments and protection and conservation of species and of course in land SAR.

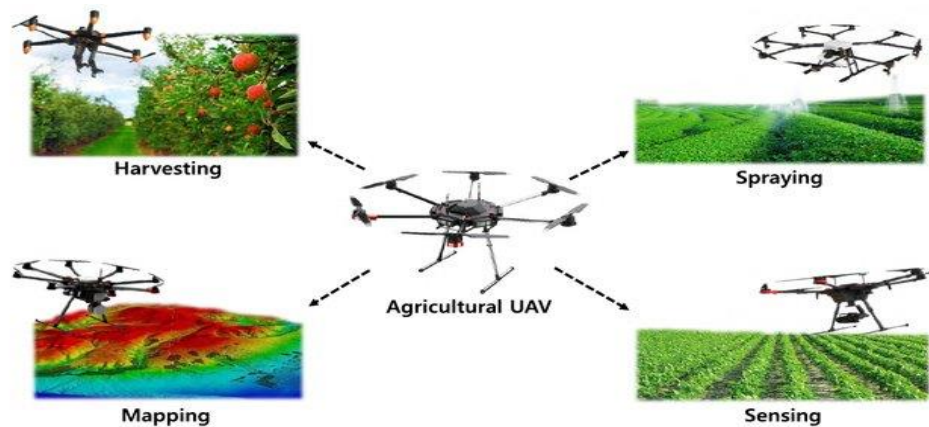
3.2.1 Drones in Agriculture

The application of drones in agriculture is a much-researched field internationally, taking into account the importance of this activity; agriculture contributes as the main source of food security in the world which is directly in

line with Sustainable Development Goals 2 (SDG 2) (zero hunger) (Friha et al., 2021). Drones are being utilized in collecting and analyzing data on soil conditions, irrigation, and plant health, allowing farmers to properly analyze soils and make informed decisions for a better yield (Rejeb et al., 2022). A study carried out by Kulbacki et al., 2018, shows that the use of drones in agriculture has several advantages, namely analyzing the nature of the soil in terms of nutrients and possible diseases, giving farmers the advantage of knowing the soil before planting. Figure 17 represents use of drones in agriculture.

Figure 17

Use of Drones in Agriculture



Note. From “A Review of Applications and Communication Technologies for Internet of Things (IoT) and Unmanned Aerial Vehicle (UAV) Based Sustainable Smart Farming,” N. Islam, M. Rashid, F. Pasandideh, B. Ray 2021. (https://www.researchgate.net/publication/349158479_A_Review_of_Applications_and_Communication_Technologies_for_Internet_of_Things_IoT_and_Unmanned_Aerial_Vehicle_UAV_Based_Sustainable_Smart_Farming/figures?lo=1).

3.2.2 Drones in Mapping and Survey

Knowing the characteristics of a certain place has always been something that man sought. Determining whether land contains a type of mineral or if it is suitable for cultivation has become faster and more effective with the use of drones. Information now has the advantage of being collected faster and more cost-effectively by drones (Skylogic Research, LLC, 2016). The mapping of some endangered species can be done with drones in order to guarantee their conservation. Regarding illegal hunting in protected areas or other illegal activities, the use of drones has proven to be a decisive factor for protection and conservation of wildlife (Wich & Koh, 2018).

3.2.3 Drones in Land SAR

The use of drones in land SAR, is already part of most SAR organizations. In their study, Casper and Murphy (2003) examined the significance of deployment of drones and land-based robots in helping SAR personnel locate victims in the wake of the 9/11 terrorist attacks in New York. The use of drones in ground operations in the context of accidents such as hurricanes, earthquakes and forest fires has helped rescue teams to be more efficient, rather than a single manned aircraft, since SAR teams are usually equipped only with some tools like sniffer dogs and heat-sensing cameras (Grogan, et al., n.d).

Research carried out by Karaca et al., (2018), involving the use of drones and a mountain rescue team in March 2017, showed the difference between locating a victim on the mountain by humans and by drones. The first team composed of five rescuers duly certified by the Turkish Ministry of Health and a second team of three personnel and drones. The tests were carried out on a mountain with snow in a thickness that varied between 40 to 100 cm and concluded that locating and reaching the victim was accomplished much more quickly using

a Drones Team (DT) compared to teams composed just by the rescuers (CLT) SAR operations. The study concludes that, between the two different SAR methods evaluated, the DT allow for the search of a larger area in a shorter period of time, locating the victim more quickly and allowing rescuers transported on snowmobiles to reach the victim more quickly as compared to CLT (Karaca et al., 2018).

3.3 Use of New Technologies/Drones in Maritime SAR

The bibliographical search was conducted using the following keywords: drones and unmanned aerial vehicles, maritime industry safety, drones and naval safety. The majority of the results discussed the use of drones for land SAR operations. Drones have proved to be a vital component when it comes to SAR operations on land, be it flood relief operations, earthquake disaster relief or man-made disasters (Bogue, 2019) as discussed above. One of the prominent examples of drones being used for rescue operations to great effect was after a landslide that happened in Xinmo, Sichuan Province, on June 24, 2017 (Luo et al., 2020). For all intent and purposes drones can be utilized at sea with the same effectiveness as they have been used during land operations, providing a large amount of information in real time in a predefined area (Queralta et al., 2020).

The historical background of drone use can be traced back to World War I when the military started using drones in operations (Imperial War Museums [IWM], n.d.). We have seen tremendous development in technology in the past 40 years and today's drones are far more sophisticated and advanced in nature. Companies like M/s Elbit, Israel, M/s SZ DJI, China, M/s 3D Robotics, US are but some examples of forerunners of the industry. Elbit systems UVA are being used by military forces all around the world with the Israel Defense force as their primary user. The technology used in these drones is advanced and sophisticated that are sought after by countries in all five continents (Elbit Systems, n.d.).

The drone industry has seen gradual rise in interest from the maritime sector especially SAR agencies like the Danish Emergency Management Agency (DEMA), the United States Coast Guard (USCG), the Swedish Maritime Administration (SMA) and others which is indicative of the fact that use of drones is not only viable at sea but is presently being utilized. The utility of helicopters in SAR cannot be disputed as they can quickly locate and rescue distress persons at sea. On the other hand, helicopters and aircrafts have also proved very useful in the search for lost persons because of their higher endurance and higher quality radar systems fitted onboard (Xiong et al., 2020).

High capital investment, non-availability of proper infrastructure and lack of trained manpower are few of the drawbacks which SIDS like Cabo Verde face in the employment of aircrafts in SAR operations. This is where drones can fill the gap and provide the required agility without much extra cost and infrastructure attached to it. It is inevitable that technology will be used and developed on a global scale. Its use in SAR operations will make human missions unnecessary, considerably reducing collateral damage and saving lives of the casualties at sea (Khan et al., 2022). According to Khan et al., (2022), drones are most suited for SAR missions in part because they can operate with non-stop vigilance and reliability. Drones can have far reaching effects on how we think about SAR operations and are expected to stretch the realm of possibilities which can be achieved. Utilizing unmanned assets may make more sense economically as well. In fact, the normal SAR operations on land or at sea involve the use of patrol boats and/or manned rescue helicopters, both of which operate for thousands of dollars per hour. This operational cost can be significantly reduced by unmanned assets, freeing up manned assets for higher priority activities (Cubber et al., 2017).

Like any other technology, the use of drones has its advantages and disadvantages. According to a study conducted by Llasag et al., (2019), live video streams may experience disruption due to buffering. As a result, a synchronization mechanism based

on the presentation stamp is included in the transmitter and receiver modules of the Unmanned Aerial Vehicles (UAV)-App and Mixed reality system (MR-App)⁷. Another disadvantage of employing drones and AI for SAR missions includes the need for several drones to be operated by SAR team members to cover large search regions or the underappreciation of the security risks SAR systems, as was highlighted by Nguyen et al (2023). However, Lin and Goodrich (2009, as cited in Cho et al., 2021) prefer to highlight the benefits of using drones because it is crucial to immediately locate the precise place of the incident/accident. Agility, portability, and accessibility in the air are added benefits of UAVs as brought out in the study. Another study carried out by Naidoo et al., (2011), on the Development of an UAV for Search & Rescue Applications, showed that the use of a UAV can be very advantageous in the case of SAR, namely Land SAR. The advantage of the development of drones is the ability to hover, allowing for localized inspection and a thorough reconnaissance of a disaster site.

Pham and Han (2022) emphasized these benefits by stating that drones are lighter, more maneuverable, and significantly more affordable than other means available like MR aircrafts and robots for land-based SAR. According to the study, drone size, which range from as large as an adult to no larger than the palm of a human hand, make it simple for them to navigate obstacles and search as per the desired direction. The researcher does, however, believe that one of the benefits mentioned by Pham and Han (2022), which is more significant and up-to-date, is the fact that employing drones is simply safer than risking human life for the same task, while also being economical and environmentally more viable against deployment of SRU for search operations which are both costly and significantly more polluting in nature. Other advantages such as flexibility, timeliness, low cost, low consumption, low risk, strong monitor capability, widespread coverage

⁷ The study conducted on SAR operations feature streaming video to display real-time footage. The use of mixed reality is interface-based to provide location awareness and video streaming. Human recognition was tested using the transfer of learning process.

outlined by Duan & Zhang, (2014) show that the UAV is well suited for the services in maritime safety supervision, such as marine patrol, law enforcement, investigation, evidence gathering, emergency response, maritime SAR, detection of oil spill and pollution from ship discharge, the patrol and examination of buoys and surveys of the channel (Duan & Zhang, 2014).

DEMA, Denmark is an example of one of the agencies that regularly uses drones in its SAR missions. Drone use does not, however, come without difficulties. The crew may not find the missing individual because of terrain factors that can obscure the view from above, which is a common problem when employing UAVs in SAR (Hoang et. al 2023). Hoang et al. (2023) in their study of the DEMA discovered that the use of helicopters in SAR situations is frequently slower, more expensive, and necessitates coordination between multiple organizations. They also discovered that drones are increasingly being used in conjunction with AI and computer vision technologies to provide automated support for emergency response.

The fact that maritime SAR has different characteristics and requirements can be met by the drone industry in this fast-developing technological field which can provide maritime SAR with the tools to reduce risk and increase efficiency in SAR operations. Drone applications should be further investigated, with a focus on drone support to humans, notably in casualty identification, according to a report by Mohd Daud et al., (2022) on the applications of drones in disaster management. However, the study showed that using drones for mapping, SAR, transportation, and training is not only effective but it is economical as well. In a study carried out by Cho et al., (2021) with the aim of increasing the efficiency and integrity of search operations in maritime SAR systems in South Korea, a search area divided into hexagonal grid cells was used, assuming that each UAV moves through the center of the grid. The study concluded that the proposed model can be operated comprehensively, even with changes such as the shape or size of the

search area and the diversity or number of UAVs. Drones have already proved their worth in the land-based SAR operation and can be utilized in Maritime SAR as well on a global scale.

3.4 Benchmarking for Cabo Verde SAR Organization Against Swedish Maritime Administration (SMA).

To answer RQ 2, *‘if there is a need for improving the SAR system of Cabo Verde’*, SAR organisation of Cabo Verde was benchmarked against SMA, Sweden. The benchmarking brought out some of the similarities and differences/deficiencies in the existing system. Well-established legislative and regulatory framework, good cooperation and collaboration with littoral neighbors and well-defined areas of responsibilities are some of the positive points w.r.t. Cabo Verde SAR system had, which were drawn from the benchmarking. On the other hand, lack of SAR assets, especially aerial assets, outdated communication systems, lack of trained manpower and no capabilities for in-house training were some of the identified. The transcript of the interview conducted with personnel from SMA is placed at Appendix 6. The detailed benchmarking is placed at Appendix 7.

3.5 Findings and Concluding Remarks

Many authors have highlighted the advantages/disadvantages of using drones in different situations. The advantages considered include, quick deployment time, real-time information sharing, effective responses and more economical when compared to helicopters. Some of the fields where drones are being utilized successfully were explored in the literature review. Extensive utilization of drones for land-based SAR was also explored. The perspective from an aerial asset is wider than that of a ship, allowing it to scan larger areas and, as a result, find people or ships in distress much more rapidly. The

first part of the chapter drives home the point that drones could act as the eyes and ears for SAR agencies. The coverage factor, operating and maintenance cost, a greater number of assets and low turnaround time can be considered as the main differences when compared to more traditional air assets. To answer RQ 2, Cabo Verde SAR system was benchmarked against SMA, to identify the areas which can be improved to provide effective SAR coverage. Condensed results were presented in the chapter.

Due to Cabo Verde's economic situation, as well as the potential for simplicity of operation and cheaper training of the necessary skills required, the recommendation of utilizing drones in its maritime SAR is very attractive. Having a method to enhance communication and remote rescue is helpful given that rescue vessels must keep a safe distance from the ship or the person in danger. A drone can get around this problem as it is remotely piloted and can be used to provide first-aid relief to people in distress. The idea of using drones in maritime SAR was one of the key elements which was analysed during the survey and interviews in the next chapter.

Chapter IV: Analysis and Findings

4.1 Introductory Remarks

The data collection was designed so as to provide a wide spectrum of responses from the individuals working in SAR organizations. CVCG personnel from JRCC and ships who carry out SAR operations were selected for the survey; the same questionnaire was sent to maritime police officers but no response was obtained. A total of 16 responses were obtained from the questionnaire, from a total of 20 personnel who work at JRCC. A total of four interviews were also conducted to corroborate the results obtained from the survey and for a deeper analysis. The interviews were conducted with the heads of agencies which are part of the SAR system in the country. The analysis of these results is carried out with the aim of answering the third RQ, which focuses on the use of new technologies in the form of drones that can be used in SAR operations in Cabo Verde.

4.2 Questionnaire Analyzes

The questionnaire was developed keeping all ethical considerations in mind and was submitted for REC approval. Upon approval, the questionnaire was distributed amongst JRCC and Maritime Police personnel. The questionnaire is divided into 3 parts: Section I targeted socio-demographic and work-related data of the respondents; Section II was aimed at respondents' understanding of SAR operations in the country and Section III was for respondents' views on the use of drones to enhance SAR missions. For the responses,

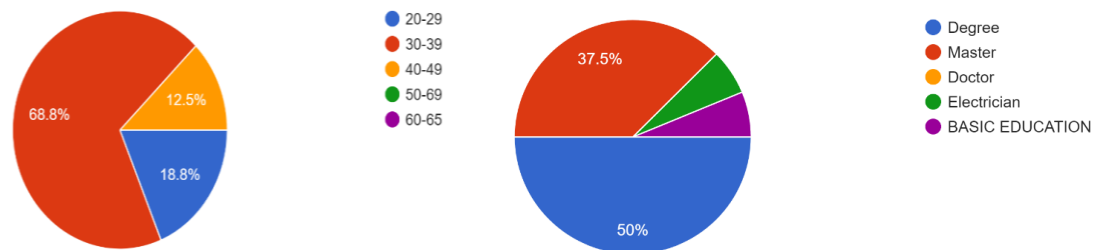
a code was developed to designate a specific code which corresponds to each individual with a number prefixed with *M*. For example: M1 represents the responses from the first individual and M16 for those of the sixteenth individual. The questionnaire is placed at Appendix 10 to this research.

Section I – Socio-Demography of the Participants

All respondents were service personnel most of whom were male, mostly aged between 30 and 39 years. 87.5% of the respondents hold a degree or higher, which indicates a better understanding of the issues being discussed. These respondents are functioning as SAR Operators, SMCs and masters of GCCV ships, who are directly linked to SAR operations in the country. Figure 18 below represents pie graph for age and educational backgrounds.

Figure 18

Age and Educational Background of the Respondents



Note: Created by the Author based on the responses from the survey.

Section II Assessment of SAR Knowledge of the Participants

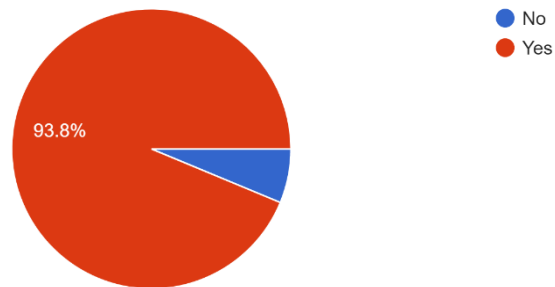
In this section, participants were asked to evaluate their training and qualification regarding SAR operations and how they classify the effectiveness of SAR operations in Cabo Verde.

Training and Certification

Figures 19 and 20 below represent the responses given in relation to two questions based on SAR training and the quality of the training obtained. For figure 19 the rating system from 0 to 5 was chosen where 0 indicates *Poor* and 5 indicates *Excellent*. The responses to the question regarding whether or not any SAR training was imparted to the participants were very positive, with 93.8% indicating in affirmation of obtaining training on SAR operations. However, when the same participants were asked to evaluate their training, the responses were quite different. 46.7% rate their training as *Good*, 26.7% rate it as *Sufficient* and the same percentage as *Very Good*. Of the 93.8% having obtained SAR training only one fourth consider it to be *Very Good*. The data is indicative of the fact that JRCC is presently manned by personnel who are not fully confident in the SAR training they have received and consider that scope exists for improvement in system.

Figure 19

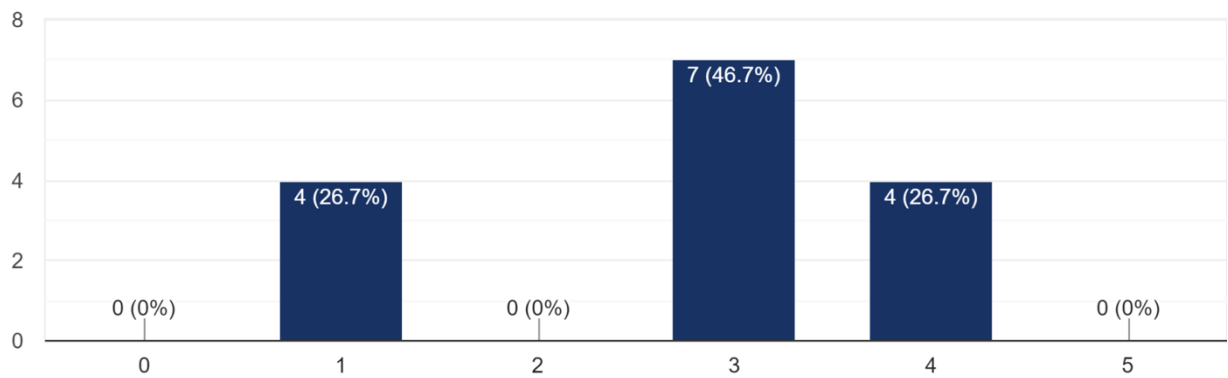
Response to SAR Training Obtained



Note. Created by the Author, based on the Responses to the Survey.

Figure 20

Response to the Quality of Training



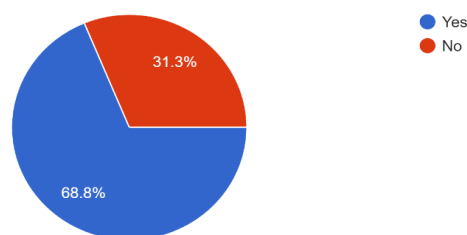
Note. Created by the Author, based on the Response to the Survey.

Success Rate of SAR Operations

The question related to the success of SAR operations in the country was divided into three parts, for the first part 68.8% of the participants said *Yes* it had been successful and 31.3% had a negative answer, which can be seen from figure 21 below.

Figure 21

Response to Success of SAR Missions



Note. Created by the Author, based on the responses to the Survey

The second part of the question was subjective in nature which required respondents to explain their choice. Most respondents had the same opinion that despite the difficulties in training, personnel and ships for the missions, and with limited resources SAR agencies have been able to provide effective SAR coverage. A few of the responses are listed below to elaborate:

M3 : Personnel with good SAR training and the center is equipped with good systems.

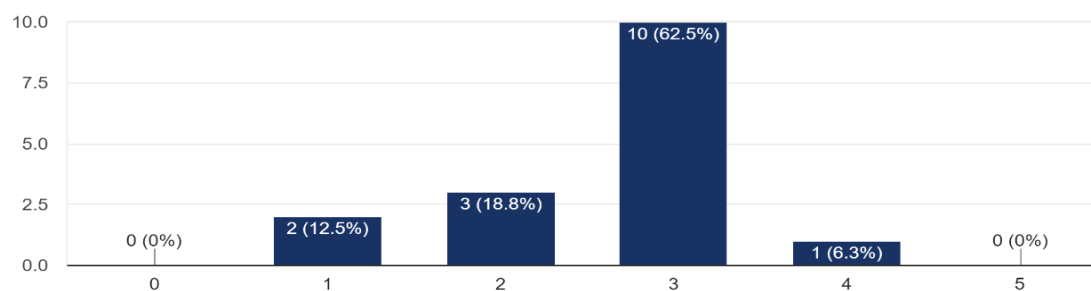
M6: In my opinion even though we don't have all the resources that we would like to have, we still are able to respond to SAR cases that appear in our SRS, trying to find a better way to find help for those who need it.

M7: Crew not well trained but still we can do something.

For the third part of the question a rating system similar to the question above was used where 0 indicated *Poor* and 5 indicated *Excellent*. With 62.5 % of the responses classifying SAR success rate as *Good* and 31.3% rating it *Satisfactory* and below, this is depicted in the figure 22 below.

Figure 22

Classification of Success Rate of SAR Mission



Note. Created by the Author, based on the responses to the Survey.

The response can be corroborated with the success rate of 91% reported by the JRCC in the 2016-2021 report (See Appendix 5). Also, as mentioned above, most of the respondents brought out that more resources are required in order to performing the duties entrusted to SAR agencies. It was opined that this is the most plausible reason for the reported success rate, yet this cannot be kept up if new resources are not added to the existing system, by providing the required layup time to the SRUs.

Section III- Assessing SAR Operations in Cabo Verde and The Use of Drones

Section III of the survey was specifically designed to understand SAR operation situations in Cabo Verde and whether the use of drones in the Cabo Verde SRS is feasible or not. The section consisted of three objective questions and two subjective questions.

The first question of the section aimed to analyze participants' knowledge of the term SAR. The majority of participants responded objectively and in accordance with the internationally applied definition. The participants were invited to evaluate the SAR operations situation of Cabo Verde and to give their opinions. Most of the participants are of the opinion that, despite the positive rate shown in the recent years for the success of SAR missions, there is a lack of resources especially in terms of human, material and communication. Two of the responses are enumerated below to bring out the same:

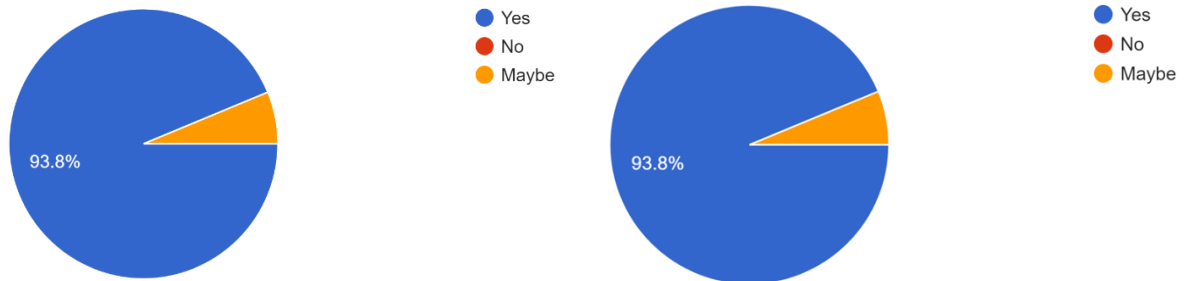
M1: It (SAR Operations Situation) is too low due to lack of air and sea resources

M16: The search and rescue operations in Cabo Verde, despite responding to the demands, lack updated equipment for communications and software used at the SAR level, such as SAR master and better coordination between the institutions that are part of the National SAR system.

When asked if Drones can be used in SAR operations in Cabo Verde and added value to the existing system, 93.8% of the respondents agreed to both the questions and no single respondent replied against the idea. Figure 23 below represents the responses to both the questions respectively.

Figure 23

Response to Feasibility and Utility of Drones in SAR Operations



Note. Created by the Author, based on the responses to the Survey.

The respondents were also asked to provide the reasoning for their selection. Some of the reasons are listed below:

M4: It is only useful the organization providing the SAR service has other means such as helicopters and ships with rescue capabilities after the victims are located by the drones.

*M9: It increases the quality of searches, **reduces the response time**, it also allows you to see and evaluate real conditions in the search zone*

*M10: **Faster and maybe more economical***

*M15: Because we **don't have aircraft**, and **Drone can better scan the marine space than ships**, and can help ships*

4.2.1 Concluding Remarks on the Analysis of Response to the Questionnaire

Through the questionnaire, it can be said that the NSAR system has a vote of confidence from its stakeholders. Although it is clear that the resources are not sufficient to meet the ever-increasing demand for the operations. The results of the analysis of the survey are indicative of the fact that there exists a need for improvement in the existing SAR system of Cabo Verde, especially in the field of resources and communication. This will be further corroborated and examined during the analysis of the interviews.

4.3 Analysis of the Interview

The participants interviewed were representatives of the Cabo Verde institutions that make up the national CNCSAR, with the objective of the interviews being to see how the SAR governance system works in the country from the point of view of its leaders. Four participants interviewed were representatives of the National Maritime Police, JRCC, CNCSAR and CVCG. The participants are mostly trained in maritime SAR and aviation and possess extensive knowledge of SAR operations in the country, taking into account the functions they perform, which is why they were chosen for the interview.

The interviews were coded using the online version of Atlasti.23 application. Figure 24 below highlights the most frequent words in the interview, one color was designated to each person and the common words which appeared in the shaded area representing the common concerns shown by each individual. Depending upon the common concerns shown by all participants the analysis is grouped in four categories which are discussed in the succeeding paragraphs. For representing the data from the interview, a similar code was used as in the case with survey. All personnel were designated specific numbers which are S1, S2, S3 and S4.

Figure 24

Code of the Data of the Interviews



Note. Created by the Author.

Training and certification are presented in most of the answers, leading to the conclusion that there is a need to improve the training and certification of operators and SMC in the country. International cooperation and collaboration that is seen through SAR agreements between neighboring countries culminates in the carrying out of periodic exercises that mostly contribute to the improvement of SAR services. Innovation in the international SAR has proven to be an asset for SAR operations, since the scarcity of resources can make operations more difficult in some situations which started the discussions on training and certification.

A. Training and Certification

During the interviews the most common concern shared by all interviewees was that of training and certification of personnel. Some of the excerpts are presented below: -

S2: One of the challenges, this direction that I chair, took and put in the activity plan, which was to get the certification. Because this is part... Because we, for example, were audited, right? Recently. And then it is part of some non-conformities that were found. And so, we were working in that direction because this certification and this qualification has to be done at an international level or standard, shall we say.

S3: ... As far as certification is concerned, we don't have a certifying structure for the elements that work in the JRCC, the officers, the operators. This is something that we know is a, I would say, a non-compliance, using standard terms, it would be a non-compliance that we need to resolve.

What can be concluded is that although the staff belonging to the JRCC are competent, taking into account the percentage of cases resolved in the JRCC was quite positive. However, Cabo Verde does not have a certification and training system for its operators and SMCs, similar issues were highlighted during the Member State Audit conducted for Cabo Verde by IMO in 2017 (IMO, 2018). The outcome of the report was lack of resources for effective implementation of IMO instruments.

B. Exercises, Cooperation and International Collaboration

International cooperation at the SAR level is mostly done through exercises between agencies that strengthen communication and the use of SAR resources. Through the interviews carried out, it can be seen that Cabo Verde has a strong connection with neighboring countries and that periodic exercises have been the basis of successful SAR operations.

S1: We had several trainings with the Brazilian Air Force, with the Canary ARCC, with the US Navy. We had several training opportunities, "on job" training, right? Some of the elements were receiving certificates of participation in training, of completion of these training. As far as certification is concerned, we don't have a certifying structure for the elements that work in the JRCC, the officers, the operators.

S3: The training is always positive; however, it is necessary to take the lessons learned and in the next series of training try to insert these lessons learned in the previous exercises and evolve with these changes that must be made. Training for commanders and masters, implementation of lessons learned in subsequent exercises and then I think we will have greater benefit from these practices.

C. Resources

When it comes to SAR resources in Cabo Verde, both the Maritime Police and the Coast Guard have limited means and resources that are distributed throughout the archipelago in order to cover the largest possible area of the national territory. The concerns were also shared by the interviewees which is reflected in the statements below:

S1: It has some limitations and needs to improve the capabilities of both the ships and the center in terms of improving communications. The JRCC currently does not have an HF. GMDSS. But despite the limitations, I consider that the response to the SAR cases is positive.

S2: The Maritime Police has a considerable number of resources divided into almost all the islands of the country. Covering about 100 percent of the area in Cabo Verde. Maritime Police currently has a total of 19 vessels supplied by the US, Spain and the UK. Distributed as follows: Santiago 7, São Vicente 4, Santo Antão 1, São Nicolau 1, Sal 2, Boavista 1, Maio 1, Fogo 1, Brava 1.

S3: Our reality is exactly that, the archipelagic reality, where we don't have units on all the islands, we necessarily do, and the size of our SRS. As we mentioned initially, the distribution of naval assets across the islands, in almost all SAR operations at national level, we have the intervention of volunteers, be it overturning vessels, sport fishing vessels, semi-industrial vessels, etc.

S4: ... this project to create maritime zones, if I understood correctly, each maritime zone would be complemented with naval units. Two, three, two, three means that will give this area the ability to respond to events at a local level. And obviously, the ocean-capable unit is responsible for covering the rest of our Benefits? Greater presence, greater capacity to respond in good time and obviously the operational availability of means will determine this capacity.

D. Innovation, Improvement and Efficiency

Regarding the use of new technologies, namely the use of drones in SAR operations in the country, the response was unanimous. All participants said that the use of drones in SAR operations in the country will be of added value and that it will greatly improve the quality of response in the country.

*S2: Therefore, drones have a limited range of action. So, **the drone, for example, could be very good to, for example, have a job for coastal searches close to the coast.** Also, to be used on ships. For example, ships that are in the search area can use drones to sweep the area. Because the radius of action is short. And the radius of action of drone's limits some of them, the best ones, to 25 miles.*

*S3: And Cabo Verde, our status as an archipelago, our geography, definitely the implementation of the use of drones for search and rescue operations, **I am absolutely certain that it could bring benefits.** The speed with which the drone is able to arrive on the scene, particularly in coastal situations, could make a lot of difference in terms of minimizing the time to locate the people or vessel in distress and making the naval unit, the search and rescue unit rescue that is oriented.*

*S4: So far, it makes perfect sense. Given that many nations are adopting this technology for their operations, and Cabo Verde must do the same, we must confront the challenges of deploying drones. **Drones have a lot of benefits.** They should be made available to the maritime authorities in order to enhance SAR efforts across the nation.*

4.4 Discussion

This section covers the discussion and findings of the collected data which was analyzed in the above two sections. The first two RQs examined the current state of SAR in the region and assessed whether there is a need for improvement of SAR missions in the area. The categories acquired through the coding of the interviews cover these two questions. Training and certification show the state of the personnel, and the collaborations and cooperation in the form of exercises show how SAR is carried out. The third RQ regarding the use of new technologies to improve SAR operations in the area was also answered in the interviews and in the questionnaire. The discussion is again divided into four categories which were created for the analysis of interviews.

A. Training and Certification

Respondents reported non-compliance regarding training and certification of the personnel who work in the JRCC, according to regulations prescribed by IMO. They explained that the majority of the staff who work in the JRCC are not certified, however, on-job training assists them to carry out SAR missions, resulting in a very positive number of operations. Despite this apparent non-compliance, all respondents highlighted that Cabo Verde has a fully functioning national SAR system and has always pursued its objective, which is to safeguard human life at sea. The results obtained here are also corroborated by the answers received relating to questions about training and certification in the survey, which highlighted that only 26.7% of the personnel only consider training to be *Very Good*. Some of the answered received which further strengthen this fact are as follows:

SI: And that at the moment, I mean, Cabo Verde still doesn't have, let's say, an

organized structure capable of issuing this type of certification, but that doesn't mean that our people, in practical terms, don't have that capacity or aren't trained to.

B. Exercises, Cooperation and International Collaboration

Cooperation is at the heart of opting for a positive SAR operation. Cabo Verde has been very dependent on international SAR agreements to guarantee its SRS coverage. The responses from both surveys and the questionnaire also indicate the same. The exercises carried out periodically between the JRCC and countries such as Spain, Portugal and France, show that the knowledge and qualification of the personnel has improved a lot and the operations have shown improvement. A higher-than-average response rate to the effectiveness of SAR operations in the country despite the lack of resource given in section II of the questionnaire (68.8% of the respondents agreeing that SAR success rate is *Good* or *Very Good*). During the course of the interview a similar theme was identified as can be seen from some the responses below:

*S2: Because the certificate is good, because you know we are complying, it is evidence, it is proof, but the exercises, because the exercises have a plan, the exercises have a briefing, the exercises have a debriefing, they even have what they call a hot wash, that is, everything is discussed in detail afterwards. Then there are those **lessons learned** that you take away from the exercises. So, this is fundamental for our growth, for the growth of the JRCC itself, and also of COSMAR itself as a subset in search and rescue operations.*

*S4: The country has what I consider **important support** from the FALCON 50 plane, which is a military plane from the **French Navy deployed in***

*Senegal that plays an important role in many SAR operations in the region.
Main partner, regarding the use of aircraft.*

C. Resources

With a vast area comprising its SRS, Cabo Verde is not able to provide the necessary coverage to guarantee patrolling and SAR operations on its own, naturally. CVCG currently has a limited number of resources too. As far as communication is concerned, the JRCC is currently experiencing a need to update its systems. The responses to survey questions, interviews and the IMO Member State Audit conducted in 2017 all point to the fact that there is a serious shortage of resources especially in manpower and assets.

SI: It has some limitations and needs to improve the capabilities of both the ships and the center in terms of improving communications. The JRCC currently does not have an HF. GMDSS. But despite the limitations, I consider that the response to the SAR cases is positive.

D. Innovation, Improvement and Efficiency

With the lack of resources, the only way to improve efficiency is by using innovation and technology to undertake the work which can normally be done by a person or an asset. Innovation is currently seen as a good way to improve CVCG's responsiveness with regard to SAR operations. Regardless of effectiveness and efficiency, it has a very positive number representing 91%, when evaluating the data between the years 2016 to 2021, and also according to the answers obtained by the questionnaire carried out. However, the idea of having drones in SAR operations is received as a way to maximize resources and decrease

response time so that the CVCG is not as dependent on ships of opportunity as is currently the case. At the same time, the opinion that drones will not solve the problem is raised by one of the interviewees who draws our attention to the range of drones and their use.

S2: So, by that I mean, yes, we can have drones, but we will continue to need air resources, other air resources, the ability to go to the limit of our exclusive economic zone, which will, and we even intend to increase it to 200 miles. If we are going to go up to 200 miles, we have to be able to go up to 200 miles and we know that drones only go up to 25 miles.

In general, the analysis of the collected data indicates that the existing SAR system in Cabo Verde is performing well but to achieve this the resources available have been stretched to limit. The analysis of the interviews further affirms the initial findings that there exists a need for the improvement of the SAR system in the country, which directly answers RQ 2. Also, both the survey and interview agree that the country may currently consider the introduction of drones in SAR activities, due to their benefits. The reduction in human resources, costs, the reduction in ship maintenance and operation costs, are the main advantages highlighted. However, it is important to consider indicating that drones may have some initial costs in their implementation, but in the long term the return is greater. This answers RQ 3 which explores the feasibility of introduction of Drones in the SAR system of Cabo Verde. The RQ 1 has been answered in chapter II where the existing SAR system of Cabo Verde was analyzed in detail.

Chapter V: Conclusions and Recommendations

This chapter brings the discussion in the analysis and findings sections to a conclusion and discusses the possible measures to improve the SAR system as a whole in Cabo Verde with special emphasis on the introduction of new technology in the form of drones. Finally, recommendations for further studies are suggested. The analysis of the collected data and interview can be summarized into five major categories which are enumerated in the following sections.

Certification for SAR Operators. Both in the survey and interviews the issue of training and certification of SAR operators was emphasized during the responses. The lack of certified personnel for manning SAR facilities and non-availability of in-house expertise for training personnel in SAR operations are the two major concerns which were brought out. Although, all responders maintain that on job training of personnel has been effective and the high success rate of SAR operations is testimony to it.

Lack of SAR Resources. As per the survey, 13 out of 16 responders brought out that Cabo Verde lacks SAR resources such as aviation assets and ships to provide effective coverage. One of the participants clearly replied that the resources are limited with a lack of aeronautical and maritime assets (M4). Similar concerns were shared by all the personnel who were interviewed. The participants said in general that the country needs naval and air units with greater operational availability for SAR operations.

However, 62.5% of the responders and all four personnel which were interviewed agreed that Cabo Verde is able to maintain an effective SAR response for the SRS despite limited resources. The same is further corroborated by the data presented in Chapter I, which shows SAR success rate to be 91%.

Need for Updating of Existing SAR Communication System. A sound communication system forms the backbone of a robust SAR system as the flow of information is essential for a quick and effective response to any incident at sea. Two out of Five personnel emphasized the fact that most of the communication systems are outdated and either need replacement or upgrade. This fact is further corroborated by the 2021 report submitted by the JRCC to CNCSAR. The report is placed as appendix 4 and brings out many deficiencies and defects in the existing system. This point is an unexpected outcome of the interview conducted with senior person from the SAR organization.

Cooperation and International Collaboration. There was unanimous agreement in the survey and the interviews that inter-agency cooperation and collaboration with neighboring States is well established and it has been performing well. The same outcome was also brought out during the benchmarking process. The collaboration includes training of personnel, exercises, joint operations and real-time exchanges of information for SAR coordination. The extensive SAR cooperation agreement which Cabo Verde has been elaborated in Chapter III, all SAR agreements have also been placed as appendices.

Feasibility of the Use of Drones in Maritime SAR Operations. Another topic in which all respondents showed unanimous agreement was the use of drones in maritime SAR operations. Figure 14 in section 3.6 indicates that almost 90-95% of SAR incidents happened within 25 Nm from the coastline. Drones deployed from the land-based operation center could improve the response time quite significantly. When utilized in coordination with small patrol boats of CVCG and Maritime Police, drones can prove to be an effective tool.

Recommendations. This section brings out the recommendations for mitigating

the lacunas brought out in the conclusion and also proposes the scope for further studies in the area for practical deployment of drones in the Cabo Verde SAR system.

Improving the Rate of Certification of SAR Operators. A two-pronged approach to improve the situation is considered most suitable, which includes increasing the training of personnel with partner nations for having a larger pool of trained manpower to work in JRCC. US and Spain being the largest supporters of the nations, can be impressed upon to increase training slots in order to improve the existing situation.

Developing In-House Capabilities for Certification on Basic SAR Training. While looking at the long-term outlook, the most suitable approach is to train personnel with other nations from the existing pool of certified individuals being the trainers and develop in-house training facilities in two stages. First stage, establishes infrastructure and facilities for providing basic SAR training to personnel by the trainers trained in the programme. When the system is well-established then as the next phase of the implementation, a similar approach can be adopted for the introduction of in-house advanced SAR training.

Introduction of Long-Range Vessels for SAR Operations. Lack of resources, especially ships and aviation units are a cause of concern for the Cabo Verde SAR system. At present only one medium to long range vessel *MP Guardiao* is available with CVCG to respond to emergency situations. The induction of at least two more such vessels will ensure better coverage of the entire SRS, taking into consideration time required for repairs and ship maintenance.

Aviation Resources (Fixed Wings and Helicopters). Cabo Verde is in the process of acquiring one fixed wing aircraft which is expected to be operational from 2025, this will be a major boost to SAR organization as the search capability will be

improved many fold. However, fixed wing assets cannot be utilized for rescue operations. A serious thought towards induction of helicopters dedicated for rescue operations is required. Keeping the political climate of the country and its international relations with US, Spain and Portugal in mind, two helicopters can be on lease from these nations for the time being, until the country has enough resources to allow the procurement of helicopters owned and operated by CVCG.

Urgent Need for Updating of SAR Communication System. The IAMSAR manual lays down the required communication system which each SAR coordination center is supposed to maintain. The author agrees with the recommendation for upgrading existing communication systems in JRCC to support better coordination and flow of information during SAR mission.

Feasibility of the Use of Drones in Maritime SAR Operations. The data collected during the survey and interviews with senior personnel and the literature review is indicative of the fact that, drones have already proven to be a viable tool in land based SAR operations and in the absence of required aviation assets they present an economical option for enhancing SAR capability via use of latest technology in the field. However, a detailed feasibility study for consideration of all variables involved such as the cost of procurement, training of operators and maintainers, the meteorological conditions in which drones are expected to operate, infrastructure requirements and manpower, etc., need to be undertaken before a policy decision for the introduction of drones into the maritime SAR of Cabo Verde can be considered.

Concluding Remarks. The chapter summarized the results obtained from the analysis and the findings which brought to light the five most important issues which need to be addressed to improve the SAR system of Cabo Verde. Specific recommendations

are also given for each topic. The chapter ends with the conclusion that the use of new technology in the form of the introduction of drones can be used to improve the existing SAR system, answering the final RQ. However, a detailed feasibility study needs to be undertaken before drones can become a reality in the maritime SAR of Cabo Verde.

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Appendix 1 - Summary of the SAR Agreements

1. Fundamental framework regarding the Governance system of SAR is enshrined in various mandatory international instruments, which establish the rights and obligations of each state. While some countries just needed to adapt their national services to comply with international laws, other countries had to make significant efforts to create agencies that could meet even the bare minimum standard, this is where regional cooperation with littoral neighbors comes into play. Establishing an effective SAR service requires overcoming many challenges such as financial burden related to personnel and material and operational resources and regional agreements helps dissipate such expenses amongst partners to ensure better implementation of the SAR organization as mandated by international standards. Article 98.2 of UNCLOS encourages coastal states to promote mutual cooperation for better implementation of SAR facilities in the region. Due to its small size and limited resources, over a period of 4 decades Cabo Verde has established a number of regional agreements with its neighbors to strengthen its ability to provide SAR services in the designated SRS.

One of the main multilateral SAR agreements that Cabo Verde participates in is the regional North and West African Maritime SAR (NWAR region), with Morocco as the hub for African states regarding SAR training. The regional center covers the SRR/SRS of countries such as Morocco, Mauritania, Senegal, Gambia, Cabo Verde and Guinea-Bissau.

2. **SAR Agreements: France, Spain and Portugal**

2.1 **France.** Signed in February 1980, bi-lateral relation with France was the very first agreement signed by the nation. Under the agreement France has offered to have a specialized SAR fixed wing aircraft (ATLANTIQUE, FALCON 200 GARDIAN or a FALCON 50) with a team from the French Naval personnel,

stationed permanently at the DAKAR-YOFF Aerodrome, Senegal to participate in the SAR operations carried out by Cabo Verde. It is up to the government of Cabo Verde, according to the agreement, to bear the operational costs of the aircraft. Currently, a FALCON 50 aircraft is in the DAKAR, which Cabo Verde often uses for its SAR operations.

2.2 **Spain.** The SAR agreement between Cabo Verde and Spain was signed in February 2000. The main objective described in the technical agreement is the cooperation and support of the SAR services regarding the use of means available in the respective RCC's. Communication and collaboration are the basis of the agreement in which both countries are available to provide mutual support both in terms of human and material means. The agreement stipulates the need for periodic meetings between the states to evaluate the operations and exercises that have been conducted. It also calls for the development of a manual of procedures between Cabo Verde and Spain to make it easier for the RCC, which is in charge of leading the mission, to use the available tools.

2.3 **Portugal.** The SAR agreement between Cabo Verde and Portugal has similar characteristics to that with France. The use of aerodromes and aircraft of the countries are the basis of the agreement. The two countries mutually agreed to allow aircraft to enter their airspace quickly and efficiently with all facilities provided. The agreement is aimed at mutual support between Cabo Verde and Portugal in the regions RCC Sal, Cabo Verde, and RCC Lajes, Portugal. Signed in December 2012, the agreement establishes that aircraft operating costs must be the responsibility of the state requesting the aircraft. The two countries also undertake to carry out a SAR Exercise and periodic meetings to exchange information as a way to improve cooperation between the states, as well as the creation of a joint coordination manual between RCC Sal and RCC Lajes.

Appendix 2 - SAR Agreements Between Cabo Verde and France

**CONVENTION TECHNIQUE ANNEXEE AU PROTOCOLE
D'ACCORD ENTRE LES GOUVERNEMENTS CAP-VERDIEN
ET FRANÇAIS SUR
LA MISE A LA DISPOSITION DU DE LA REPUBLIQUE DU
CAP-VERT D'UN AERONEF SPECIALISE DANS LA
RECHERCHE ET LE SAUVETAGE (S.A.R.)**

*** * ***

CONVENTION TECHNIQUE S.A.R.

I - INTRODUCTION

Conformément :

- au protocole d'accord entre le gouvernement cap-verdien et le gouvernement français du 20 février 1980;

Un avion spécialisé SAR avec un équipage de la Marine Nationale française est stationné sur l'aérodrome de DAKAR-YOFF, pour participer aux opérations SAR dont la responsabilité incombe à la République du Cap-Vert.

La présente convention technique a pour objet de préciser les conditions et les modalités pratiques de mise en place et d'emploi de cet avion.

Elle annule et remplace la convention technique du 21 février 1980 annexée au protocole d'accord visé ci-dessus.

II - CONDITIONS OPERATIONNELLES

Les conditions opérationnelles de détachement de l'avion SAR à DAKAR-YOFF sont les suivantes:

A - Présence permanente à Dakar-Yoff :

- d'un ATLANTIQUE ou d'un FALCON 200 GARDIAN, ou d'un FALCON 50 SURMAR,
- d'un équipage de 14 hommes pour l'ATLANTIQUE, de 6 pour le GARDIAN et de 5 pour le FALCON 50 SURMAR,
- de 5 techniciens de maintenance (au maximum) ;

B - Relève de détachement :

- avion, équipage et 4 mécaniciens de maintenance : en principe toutes les trois semaines, à la diligence des autorités françaises,
- le technicien de maintenance chargé du matériel de servitude et de rechanges reste en permanence à DAKAR,

C - Posture d'alerte

Nuit et jour : 3 heures (ATLANTIQUE avec 10 tonnes de carburant, F200 et F50 pleins complets).

Pour l'ATLANTIQUE dans le cas où la mission prévue doit dépasser sept à huit heures de vol, un rechargement des pleins est nécessaire et entraîne un délai supplémentaire ; il reste bien entendu que dans ce cas la priorité est donnée pour le ravitaillement, à l'aéronef SAR sur tous les autres aéronefs.

Cette posture d'alerte pourra être modifiée en fonction des phases critiques connues par les autorités responsables de la mise en œuvre des services de recherches et de sauvetage des deux Etats.

En cas d'indisponibilité de l'appareil mis en place à Dakar, l'alerte sera assurée par un autre ATLANTIQUE basé en métropole pendant la durée du dépannage.

D - Missions d'entraînement

En dehors des vols prioritaires (missions SAR ou surveillance des pêches), la Marine française se réserve le droit d'utiliser l'avion pour effectuer des vols d'entraînement dans la zone; dans ce cas l'avion est disponible pour alerte en vol dans les mêmes conditions qu'au paragraphe (C).

E - Mise en œuvre de l'avion pour une opération SAR

La demande de mise en œuvre de l'avion pour une opération de recherches et de sauvetage est adressée par le Centre de Coordination SAR (RCC) de SAL au centre de coordination SAR (RCC) de Dakar qui la prend en charge suivant les procédures habituelles.

F - Attribution à l'avion SAR d'une zone d'action définie comme suit

En priorité :

- La région de recherches et de sauvetage (SRR) de SAL océanique
- Les deux régions de recherches et de sauvetage (SRR de Dakar terrestre et de Dakar océanique

par extension, sur demande des Centres de Coordination SAR intéressés, les régions de recherches et de sauvetage couvrant les Etats africains liés à la France par un accord de coopération et contiguës aux SRR de Dakar, à savoir SRR Abidjan et SRR Niamey. (1)

Le RCC Dakar est juge de l'opportunité de donner satisfaction à de telles demandes;

(1) Conformément aux recommandations de l'OACI (art. 25 de la convention de Chicago et Annexe 12 OACI), les Etats (Centre de Coordination SAR) des autres SRR contiguës aux SRR Dakar peuvent également faire appel au concours des moyens du RCC Dakar pour une opération coordonnée mais dans ce cas, l'accord éventuel du RCC Dakar sera subordonné à celui de COMFOR Dakar.

Toute opération de recherches et de sauvetage déjà en cours au profit d'une autre SRR, plaçant l'aéronef spécialisé à plus de 12 heures de Dakar, entraînera la mise en état d'alerte en France d'un deuxième aéronef, de la même façon qu'en cas d'indisponibilité technique (cf. paragraphe C)

Le centre de coordination SAR (RCC) de Dakar en exprimera la demande par l'intermédiaire des autorités militaires dont relève l'aéronef spécialisé.

III - CONDITIONS LOGISTIQUES

A - Sur le plan technique :

La maintenance est à la charge des autorités françaises :

- mise en place à SAL, en cas de nécessité, d'un lot de rechanges et de matériel de servitude, ainsi que des équipements SATER/SAMAR fournis par la Direction Générale de l'Aviation Civile (D.G.A.C),
- ravitaillement de l'avion en carburant et huile pour tous les vols effectués au départ de SAL,
- l'entretien journalier et le dépannage lors des atterrissages à SAL, au cas où les dépannages dépasseraient les possibilités locales, du matériel et du personnel seraient fournis par la Marine française et acheminés par transport aérien,
- les opérations dépassant le cadre de l'entretien journalier et des dépannages, sont assurées en France;

B - Sur le plan général

Est à la charge des autorités cap-verdiennes respectivement compétentes, la fourniture des facilités suivantes à l'avion spécialisé dans la recherche et le sauvetage (SAR)

- franchise des redevances d'atterrissage, d'usage des dispositifs d'éclairage et de route,
- détaxe des carburants, lubrifiants,
- autorisation permanente d'atterrissage et de survol des îles du Cap-Vert afin de permettre à l'aéronef spécialisé d'exécuter les missions de recherches et de sauvetage et, conformément aux recommandations de l'OCAI, une fois par mois, les missions d'entraînement,
- aire de stationnement délimitée (accès et aire convenablement bitumés, exempts de gravillons), avec téléphone dans les locaux réservés aux équipages, et moyens d'amarrage de l'avion,
- entrepôt du matériel de servitude (abri),

- véhicule pour le transport des personnels,
- dans la mesure du possible la mise à disposition d'un hangar pouvant recevoir un aéronef spécialisé dans la recherche et le sauvetage (SAR) pour les dépannages éventuels,
- hébergement et nourriture du personnel volant et non volant.

IV - CONDITIONS FINANCIERES

Le gouvernement français demandera au gouvernement cap-verdien le remboursement :

- d'une partie des dépenses afférentes aux heures de vol effectuées pour l'exécution des opérations de recherches et de sauvetage et des entraînements réguliers (en moyenne deux heures mensuelles) (1),
- des dépenses afférentes aux indemnités de frais de déplacement du personnel.

V - RESPONSABILITE CIVILE ET CONTENTIEUX

A l'exception du cas de perte de l'avion par force majeure faisant l'objet de l'article 1.9 du Protocole d'Accord, tous les litiges de responsabilité civile concernant les accidents et les dégâts causés aux tiers seront justiciables de la souveraineté de l'Etat d'immatriculation de l'aéronef considéré ; c'est-à-dire la République Française.

(1) La facturation des dépenses afférentes aux heures de vol se fait de la manière suivante :

- à 100% pour les opérations réelles
- à 50% pour les missions d'entraînement.

VI - DUREE DE LA CONVENTION

La présente est résiliable sous réserve d'un préavis de six mois par l'un ou l'autre des deux gouvernements.

Fait à Dakar, le

Pour le gouvernement de la
République Française :

Pour le gouvernement de la
République du Cap-Vert:

L'Ambassadeur de France
au Sénégal



André LEWIN
Ambassadeur de France
au Sénégal

L'Ambassadeur de la
République du Cap-Vert

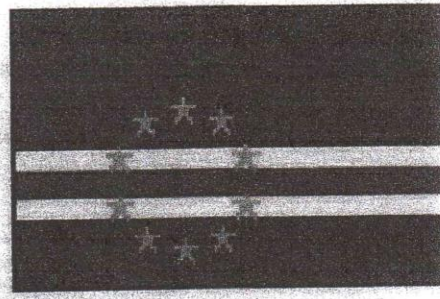
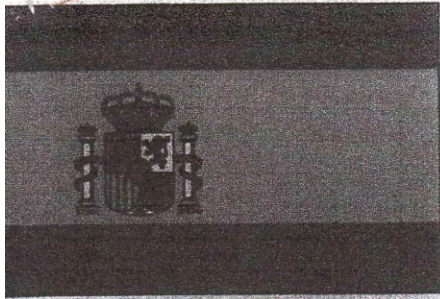


Signé:

MÁRIO GOMES FERNANDES
Embaixador

TOTAL P.08

Appendix 3: SAR Agreement Cabo Verde and Spain



ACUERDO TÉCNICO

SOBRE

COOPERACIÓN Y APOYO MUTUO

ENTRE

LOS SERVICIOS DE BÚSQUEDA Y

SALVAMENTO AÉREO

DEL REINO DE ESPAÑA

Y

DE LA REPÚBLICA DE CABO VERDE

**ACUERDO TÉCNICO SOBRE COOPERACIÓN Y APOYO MUTUO ENTRE LOS
SERVICIOS DE BÚSQUEDA Y SALVAMENTO AÉREO DEL REINO DE ESPAÑA Y DE
LA REPÚBLICA DE CABO VERDE.**

0. PREÁMBULO

Los servicios de Búsqueda y Salvamento (SAR) de España y de la República de Cabo Verde, considerando necesario el establecimiento de unas normas de cooperación para la actuación conjunta en caso de accidentes, teniendo por base las normas y recomendaciones de la Organización Internacional de Aviación Civil (OACI), concluyen el presente Acuerdo Técnico en los siguientes términos:

1. OBJETO DEL ACUERDO

El presente Acuerdo Técnico tiene por objetivo la cooperación y apoyo mutuo entre los Servicios de Búsqueda y Salvamento de los dos Países, en los referente al empleo de medios asignados a los respectivos RCC's.

2. ÁMBITO DEL ACUERDO

- 2.1. Los servicios SAR de España y Cabo Verde acuerdan en prestarse apoyo mutuo, poniendo a disposición del RCC (Centro Coordinador de Búsqueda y Salvamento) Director, sus medios de Búsqueda y Salvamento para la ejecución de acciones SAR en las respectivas SRR (Región de Búsqueda y Salvamento) de su responsabilidad.
- 2.2. Este acuerdo se aplica a los medios españoles y de Cabo Verde específicamente atribuidos a los respectivos servicios SAR, así como a cualquier otro medio que se encuentre empleado en la ejecución de una operación de Búsqueda y Salvamento, bajo el control del RCC designado como Director.

BASES DE COOPERACIÓN

- 3.1. Constituyen bases de cooperación las Normas y Recomendaciones de la OACI, de la que ambos países son miembros.

4. PROCEDIMIENTOS OPERATIVOS

- 4.1. Las autoridades SAR de ambas partes facilitarán la información necesaria relacionada con las instalaciones y medios SAR respectivos, con vistas a obtener la mayor eficiencia posible en la cooperación mutua.
- 4.2. Los RCC's de cualquiera de los dos Estados deberán alertar inmediatamente a los RCC's vecinos siempre que ocurra un incidente dentro de su SRR y se prevea la necesidad de una eventual utilización de las instalaciones y medios SAR del otro RCC.

ACORDO TÉCNICO DE COOPERAÇÃO E DE APOIO MUTUO ENTRE OS SERVIÇOS DE BUSCA E SALVAMENTO DO REINO DE ESPANHA E DA REPÚBLICA DE CABO VERDE.

0. PREÂMBULO.

Os Serviços de Busca e Salvamento (SAR) de Espanha e da República de Cabo Verde, considerando necessário o estabelecimento de normas de cooperação para a actuação conjunta em caso de acidentes, tendo por base as normas e recomendações da Organização da Aviação Civil Internacional (OACI) assinam o presente acordo nos seguintes termos:

1. OBJETO DO ACORDO

O presente Acordo Técnico tem por objecto a cooperação e o apoio dos Serviços de Busca e Salvamento dos dois Países, no referente ao emprego de meios disponíveis nos respectivos RCC's.

2. ÂMBITO DO ACORDO

- 2.1. Os serviços SAR de Espanha e de Cabo Verde acordam em prestar apoio mútuo, pondo à disposição do RCC (Centro de Coordenação de Busca e Salvamento) Director, os seus meios de Busca e Salvamento para a execução de acções SAR nas respectivas SRR (Região de Busca e Salvamento) da sua responsabilidade.
- 2.2. Este acordo aplica-se aos meios espanhóis e cabo-verdianos especificamente atribuídos aos respectivos SAR, assim como a qualquer outro meio que esteja a ser utilizado na execução de uma operação de Busca e Salvamento, debaixo do controlo do RCC designado como Director.

3. BASES DE COOPERAÇÃO

- 3.1. Constituem bases de cooperação as Normas e Recomendações da OACI, de que ambos os países são membros.

4. PROCEDIMENTOS OPERATIVOS

- 4.1. As autoridades SAR de ambas as partes facilitarão a informação necessária relacionada com as instalações e meios SAR respectivos, com vista a obter a maior eficiência possível em caso de cooperação mútua.
- 4.2. Os RCC's de qualquer um dos Países deverão alertar imediatamente os RCC's vizinhos sempre que ocorra um incidente dentro de sua SRR e que se prevê a necessidade de uma eventual utilização das instalações e meios SAR do outro RCC.



4.3. Entre ambos RCC's se decidirá de común acuerdo, cual de ellos será el RCC Director y cual el Asociado. Siendo el RCC Director el más adecuado, según las circunstancias, para llevar a cabo con eficacia, la dirección de la operación, sólo o con ayuda del otro RCC.

4.4. El RCC solicitante facilitará al otro RCC toda la información necesaria sobre la cooperación pretendida, especificando:

- a) Tipo de accidente, coordenadas y características del lugar donde se van a desarrollar las actividades SAR.
- b) Medios de apoyo SAR necesarios.
- c) Indicativos del órgano de coordinación y de los aeródromos o Bases Aéreas de apoyo.

4.5. El RCC que recibe la solicitud informará al RCC solicitante sobre qué medios SAR serán destacados para la misión, de acuerdo con las disponibilidades existentes.

4.6. Durante el vuelo las aeronaves establecerán contacto, lo antes posible, con el RCC Director, indicando su condición de aeronave SAR y solicitando instrucciones.

4.7. Los medios SAR destacados permanecerán bajo el Mando Operativo del organismo al que pertenezcan, pasando bajo control Operativo del RCC Director.

4.8. El RCC que cedió los medios SAR podrá, por causas justificadas y previa coordinación entre los dos RCC's, ordenar el regreso de los medios SAR destacados.

4.9. El RCC Director mantendrá permanentemente informado al RCC Asociado del desarrollo y resultados de las acciones SAR.

5. FACILIDADES

5.1. El RCC solicitante llevará a cabo, respecto a los medios del otro país, todas las acciones que sirvan para facilitar la actuación de los medios SAR destacados, en lo que concierne a los trámites legales relativos a los Servicios de Inmigración y a los Servicios de Aduanas, etc., facilitando a estas entidades los siguientes datos:

- a) Area de intervención de los medios aéreos SAR
- b) Matrícula e identificación de las aeronaves y respectivas tripulaciones.
- c) Bases y aeródromos de apoyo donde los referidos medios podrán operar y/o estacionar.
- d) Materiales y equipos que transportan.

5.2. En caso de que una aeronave de un país aterrice en territorio del otro, como consecuencia de la misión SAR que está realizando en apoyo del RCC solicitante, le será prestado todo el apoyo necesario por las autoridades SAR solicitantes y concedida la exención de tasas aeroportuarias y de apoyo a la navegación aérea y otras formalidades aduaneras previstas en la legislación nacional de cada una de las partes, en lo referente a equipos y material que transporten indispensables para llevar a cabo las misiones de Búsqueda y Salvamento.

5.3. Corresponde a las autoridades SAR del RCC solicitante facilitar la prestación de los siguientes servicios:

- a) Utilización de los aeródromos designados y de sus instalaciones.
- b) Abastecimiento de combustible y demás servicios de apoyo a las aeronaves.
- c) Transporte de las tripulaciones.
- d) Reserva de alojamiento de las tripulaciones.

5.4. El Jefe del RCC solicitante y el Comandante de la aeronave dispondrán la recuperación de todos los materiales SAR y equipos de supervivencia que estén en condiciones de volver a ser utilizados.

6. SOBREVUELOS Y ATERRIZAJES

6.1. El RCC solicitante llevará a cabo los trámites necesarios para facilitar la entrada en espacio aéreo propio a las aeronaves SAR del RCC cooperante, notificando a las autoridades competentes sobre su condición de aeronaves SAR y facilitándoles los siguientes datos:

- a) Punto de entrada de las aeronaves.
- b) Identificación, ruta y nivel de vuelo.
- c) Áreas a sobrevolar y de operaciones.
- d) Aeródromos de apoyo previstos.

6.2. Dado el carácter humanitario de las misiones de búsqueda y salvamento, y la urgencia y capacidad de respuesta que deben presidir las actuaciones de los medios SAR, les deberán ser concedidas las siguientes facilidades:

- a) Prioridad en el tráfico aéreo.
- b) Prioridad en el abastecimiento de combustible.
- c) Autorización para despegar sin plan de vuelo, el cual será transmitido por radio.

7. RELACIONES ENTRE LAS AUTORIDADES SAR

7.1. Las autoridades responsables de los servicios centrales SAR de España y Cabo Verde podrán establecer contactos directos para tratar todas las cuestiones y actividades comunes de ámbito SAR, en los términos establecidos en el presente Acuerdo Técnico.

7.2. De común acuerdo, se tomarán las medidas necesarias para la organización de ejercicios cuya finalidad sea mejorar la coordinación entre los servicios SAR. La realización de ejercicios conjuntos será precedida de una reunión preparatoria entre los delegados de los RCC's participantes, teniendo como finalidad el intercambio de conocimientos y de información técnico-operativa de interés para ambas partes.



5.3. Caberá às autoridades SAR do RCC solicitante, facilitar a prestação dos seguintes serviços:

- a) Utilização dos aeródromos designados e das suas instalações Abastecimento de combustível e demais serviços de apoio e das aeronaves.
- b) Transporte das tripulações.
- c) As reservas de alojamento das tripulações.

5.4. O Chefe do RCC solicitante e o Comandante da aeronave providenciarão de todos os materiais SAR e equipamentos de sobrevivência que estejam em condições de voltar a ser utilizados.

6. SOVREVOOS E ATERRANGES.

6.1. O RCC solicitante tomará as devidas diligências para facilitar a entrada no espaço aéreo próprio, às aeronaves SAR do RCC cooperante, notificando às autoridades competentes sobre a sua condição de aeronave SAR e facilitando-lhes os seguintes dados:

- a) Ponto de entrada das aeronaves.
- b) Identificação, rota e nível de voo.
- c) Áreas a sobrevoar e de operações.
- d) Aeródromos de apoio previstos.

6.2. Dado o carácter humanitário das missões de busca e salvamento e a urgência e capacidade de resposta que devem presidir as actuações dos meios SAR de Busca e Salvamento, dever-se-ão ser concedidas as seguintes facilidades:

- a) Prioridade no tráfego aéreo.
- b) Prioridade no abastecimento de combustível.
- c) Autorização para descolar sem plano de voo, o qual será transmitido por rádio.

7. RELAÇÕES ENTRE AS AUTORIDADES.

7.1. As autoridades responsáveis dos serviços centrais SAR de Espanha e de Cabo Verde poderão estabelecer contactos directos para tratar todas as questões e actividades comuns de âmbito SAR, nos termos estabelecidos no presente Acordo Técnico.

7.2. De comum acordo, tomar-se-ão medidas necessárias para a organização de exercícios cuja a finalidade seja melhorar a coordenação entre os serviços SAR. A realização de exercícios conjuntos será precedida de uma reunião preparatória entre os delegados dos RCC's participantes, tendo como finalidade o intercâmbio de conhecimentos e de informações técnico-operativas de interesse para ambas as partes.



- 7.3. Será elaborado conjuntamente o Manual de Procedimentos de Cooperação SAR entre Espanha e Cabo Verde, destinado a facilitar a operação de meios aéreos SAR destacados em apoio do RCC solicitante.
- 7.4. As autoridades SAR ou os seus representantes, deverão reunir-se periodicamente, em Espanha e Cabo Verde alternadamente, para examinar as operações realizadas, os exercícios levados a cabo e, estudar as directrizes gerais ou medidas particulares a introduzir nas normas conjuntas de actuação.
- 7.5. Os RCC's solicitantes enviarão aos RCC's que prestaram o apoio, cópias dos relatórios de cada operação SAR em que tenham participado aeronaves de outro País.

8. APLICAÇÃO E VIGÊNCIA.

Este Acordo Técnico entrará em vigor na data da sua assinatura.

Este Acordo Técnico poderá ser denunciado por qualquer de uma das partes deixando estar em vigor a partir do trigésimo primeiro dia depois da comunicação da denúncia por meio dos canais adequados.

Assinado em Madrid e na Praia em dois exemplares na língua portuguesa e dois exemplares em língua espanhola, tendo ambos os textos o mesmo valor.

Praia, 18. Fev de 2000

PELO MINISTÉRIO DE DEFESA DA
REPÚBLICA DE CABO VERDE

Comandante de Guardia Costeira

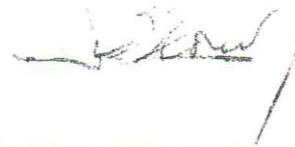


ANTONIO LIMA FORTES

Madrid, 18.12. de 2000

PELO MINISTÉRIO DE DEFESA
DO REINO DE ESPANHA.

El Jefe del Estado Mayor
del Ejército del Aire Español



GENERAL DEL AIRE
JUAN A. LOMBO LÓPEZ

Appendix 4- SAR Agreement Cabo Verde and Portugal

Protocolo de Cooperação
entre
o Governo da República de Cabo Verde
e
o Governo da República Portuguesa
relativo às
Operações de Busca e Salvamento Aéreo

O Governo da República de Cabo Verde e o Governo da República Portuguesa, a partir de agora denominados "Signatários";

Reconhecendo a importância de fortalecer a longa tradição de relações de amizade e de cooperação na área da defesa entre os dois países;

Considerando o disposto no Tratado de Amizade e Cooperação entre a República de Cabo Verde e a República Portuguesa, assinado em Lisboa, em 9 de junho de 2010;

Conscientes da importância da cooperação na busca e salvamento (SAR) para a prestação dos serviços SAR de forma expedita e eficiente;

Querendo estabelecer assistência mútua no âmbito da busca e salvamento aéreo de acordo com os princípios e as disposições da Convenção sobre Aviação Civil Internacional assinada em Chicago em 7 de dezembro de 1944;

Decidem o seguinte:

Cláusula 1

Definições e acrónimos

Nos termos do presente Protocolo as expressões abaixo mencionadas têm o seguinte significado:

- **Aeronave em emergência:** uma aeronave está em emergência quando existe uma razoável certeza de que a mesma e os seus ocupantes correm perigo grave e/ou iminente e que necessitam de auxílio imediato;

- **Busca e salvamento (SAR):** responsabilidades, atividades ou meios utilizados nas operações de busca e salvamento aéreo;
- **Centro de coordenação de busca e salvamento (RCC):** órgão responsável por promover a organização eficiente dos serviços de busca e salvamento e por coordenar a realização das operações inerentes no interior de uma região de busca e salvamento;
- **Região de busca e salvamento (SRR):** área de dimensões definidas, associada a um centro de coordenação de busca e salvamento, no interior da qual são prestados serviços de busca e salvamento;
- **Unidade de busca e salvamento:** recurso móvel composto por pessoal treinado e dotado de equipamentos adequados para a realização rápida das operações de busca e salvamento.

Cláusula 2

Objeto

O presente Protocolo visa estabelecer os princípios para a cooperação e apoio mútuo entre os órgãos de busca e salvamento aéreo dos Estados e a coordenação dos respetivos meios aéreos SAR, nos termos do Direito aplicável.

Cláusula 3

Âmbito

As disposições do presente Protocolo aplicam-se às Regiões de Busca e Salvamento de Sal e de Santa Maria, sob a responsabilidade dos Signatários, conforme estabelecido pela Organização da Aviação Civil Internacional (OACI).

Cláusula 4

Solicitação da assistência

1. Os centros de coordenação de busca e salvamento aéreo da República de Cabo Verde (RCC Sal) ou da República Portuguesa (RCC Lajes), responsáveis pela

condução das operações SAR, podem solicitar a assistência do outro centro, em qualquer momento.

2. Ao efetuar um pedido de ajuda, o RCC Sal ou o RCC Lajes, fornece ao centro que providencia a assistência toda a informação relevante para a condução das operações SAR, nomeadamente:
 - a. Área(s) de Busca;
 - b. Período estimado para a estadia da aeronave, pessoal e equipamento no território;
 - c. Características e identificação de cada aeronave envolvida nas operações de Busca e Salvamento;
3. O RCC solicitado, em função da sua disponibilidade, afeta meios SAR para a operação e o RCC solicitante assume o controlo operacional dos mesmos.
4. Quando os meios SAR de um Signatário participam em operações de busca e salvamento no interior ou sobre o território do Estado do outro Signatário, o RCC solicitante avisa imediatamente as autoridades responsáveis pela vigilância do território.
5. O RCC solicitante efetua os procedimentos necessários para autorizar, tão rápido quanto possível, a entrada ou o sobrevoo da aeronave estrangeira no seu território.

Cláusula 5

Modalidades de emprego

1. Os meios SAR destacados comunicam ao RCC solicitante as suas capacidades e disponibilidade para a missão assim permanecendo até ao fim das operações. Contudo, em caso de necessidade, o RCC solicitado pode a qualquer momento retomar o controlo dos seus meios.
2. A organização responsável pelo SAR do Estado solicitante toma a seu cargo o custo dos seguintes serviços associados à utilização dos meios aéreos:

- a. Utilização dos aeródromos designados e dos respetivos equipamentos;
 - b. Serviços de assistência à aeronave;
 - c. Reabastecimento de combustível;
 - d. Alojamento, alimentação e transporte da tripulação destacada.
3. Os restantes custos da operação ficam a cargo do Estado solicitado.
 4. No final da operação o RCC solicitante comunica ao RCC solicitado o respetivo relatório e eventuais comentários técnicos.
 5. Compete, igualmente, ao RCC solicitante a recuperação dos equipamentos de sobrevivência reutilizáveis.

Cláusula 6

Responsabilidade

O Estado do RCC solicitado permanece responsável pelos seus meios enquanto disponibilizados ao RCC solicitante.

Cláusula 7

Exercícios SAR

Poderão ser programados, de comum acordo, exercícios combinados com a finalidade de melhorar a coordenação entre os serviços SAR dos dois Estados.

Cláusula 8

Relações entre as autoridades SAR

1. As autoridades responsáveis pelos serviços SAR em cada um dos Signatários, ou os representantes designados, no âmbito do presente Protocolo, estão autorizados a estabelecer contactos diretos para tratar de qualquer matéria relevante para a condução das operações de busca e salvamento aéreo.

2. A operação dos meios aéreos postos à disposição do RCC solicitante, decorre em conformidade com o disposto no *Manual de Coordenação SAR entre o RCC Sal e o RCC Lajes*.
3. As autoridades SAR cooperam, nomeadamente, através das seguintes atividades:
 - a. Troca de informação SAR pertinente;
 - b. Realização de reuniões de coordenação regulares, nomeadamente, através de áudio ou vídeo-conferência;
 - c. Elaboração e atualização do *Manual de Coordenação SAR*.

Cláusula 9

Disposições finais

1. O presente Protocolo produz efeitos a partir da data da sua assinatura por ambos os Signatários.
2. O presente Protocolo pode ser alterado em qualquer momento por comum acordo entre os Signatários e cessa os seus efeitos através de notificação escrita com pré-aviso de, pelo menos, 3 meses.

Assinado na Cidade do Mindelo, Cabo Verde, aos dois dias do mês de dezembro de 2012.

Pelo

Governo da República de Cabo Verde

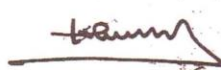


Jorge Homero Tolentino Araújo

Ministro do Conselho de Ministros
e da Defesa Nacional

Pelo

Governo da República Portuguesa



José Pedro Aguiar Branco

Ministro da Defesa Nacional

Appendix 5- JRCC Reports From 2016-221



1



2

RELATÓRIO JRCC – 2016 - 2021

OPERAÇÕES SAR

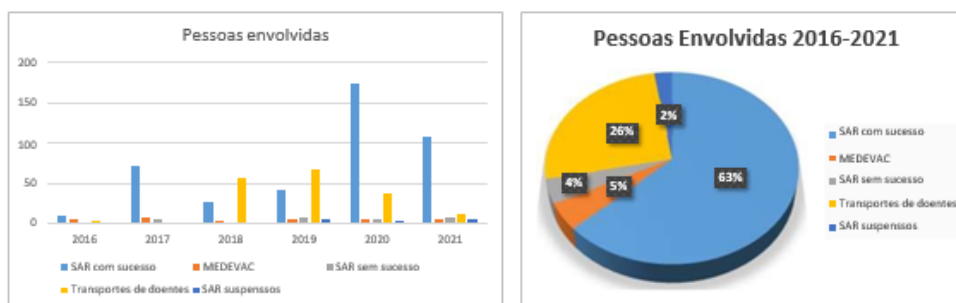


| Operações SAR | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|------------------------|------|------|------|------|------|------|-------|
| SAR com sucesso | 6 | 34 | 14 | 20 | 27 | 26 | 127 |
| MEDEVAC | 2 | 9 | 5 | 6 | 5 | 5 | 32 |
| SAR sem sucesso | 0 | 5 | 2 | 4 | 6 | 6 | 23 |
| Transportes de doentes | 1 | 2 | 48 | 40 | 28 | 11 | 130 |
| SAR suspensos | 0 | 1 | 1 | 3 | 2 | 7 | 14 |
| Falso alertas | 0 | 2 | 0 | 4 | 4 | 4 | 14 |
| Treinos | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

3

RELATÓRIO JRCC – 2016 - 2021

Pessoas envolvidas em ocorrências



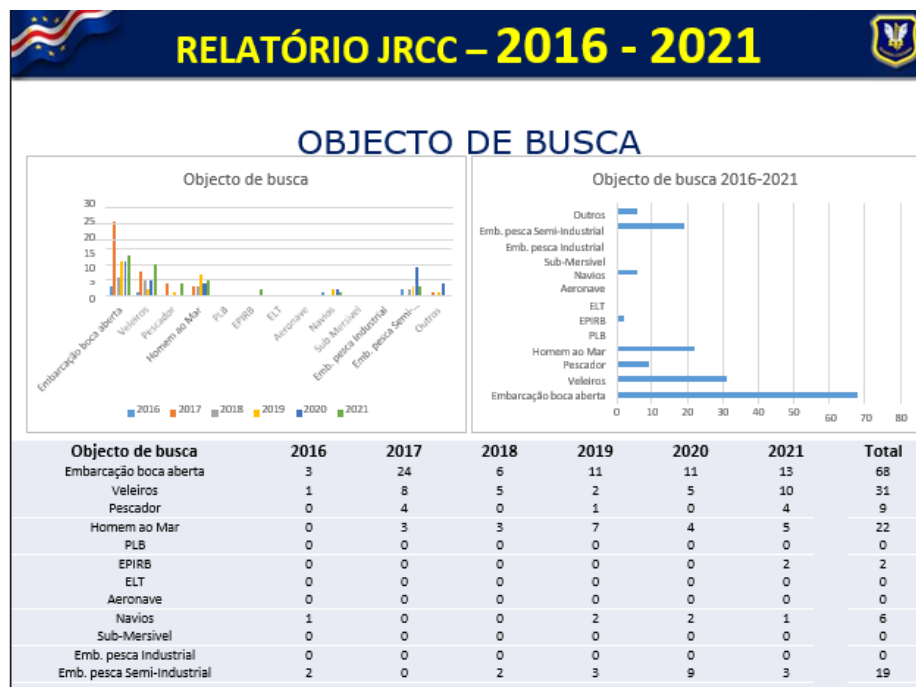
OBS: o JRCC durante o período de 2016 a 2021 prestou assistência a um total de **689** pessoas.

| Pessoas envolvidas | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|------------------------|------|------|------|------|------|------|-------|
| SAR com sucesso | 9 | 72 | 28 | 42 | 175 | 108 | 434 |
| MEDEVAC | 6 | 7 | 3 | 6 | 5 | 5 | 32 |
| SAR sem sucesso | 0 | 5 | 2 | 7 | 6 | 8 | 28 |
| Transportes de doentes | 4 | 2 | 56 | 67 | 37 | 12 | 178 |
| SAR suspensos | 0 | 2 | 1 | 5 | 4 | 5 | 17 |

4



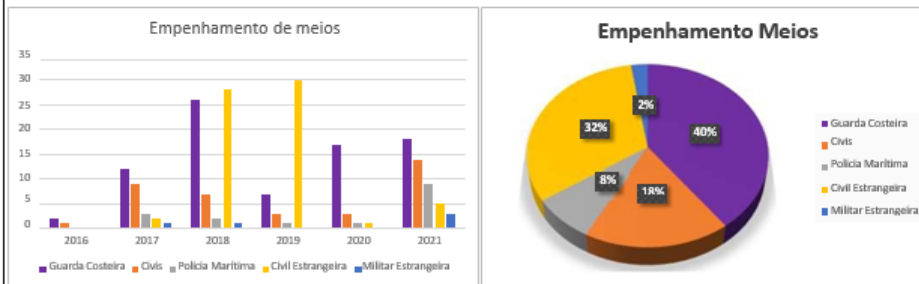
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6

RELATÓRIO JRCC – 2016 - 2021

EMPENHAMENTO DE MEIOS



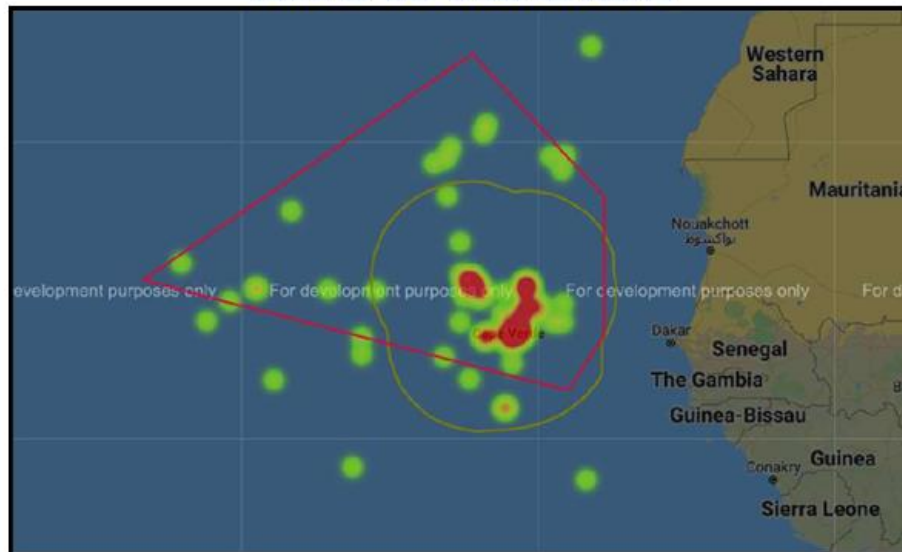
OBS: o empenhamento de meios civis estrangeiras na maior parte trata-se da aeronave Jetstream 32 alugada pelo o estado de cabo verde, que foi empenhada e inúmeras missões de transporte de doentes interilhas.

| Empenhamento de meios | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|-----------------------|------|------|------|------|------|------|-------|
| Guarda Costeira | 2 | 12 | 26 | 7 | 17 | 18 | 82 |
| Civis | 1 | 9 | 7 | 3 | 3 | 14 | 37 |
| Polícia Marítima | 0 | 3 | 2 | 1 | 1 | 9 | 16 |
| Civil Estrangeira | 0 | 2 | 28 | 30 | 1 | 5 | 66 |
| Militar Estrangeira | 0 | 1 | 1 | 0 | 0 | 3 | 5 |

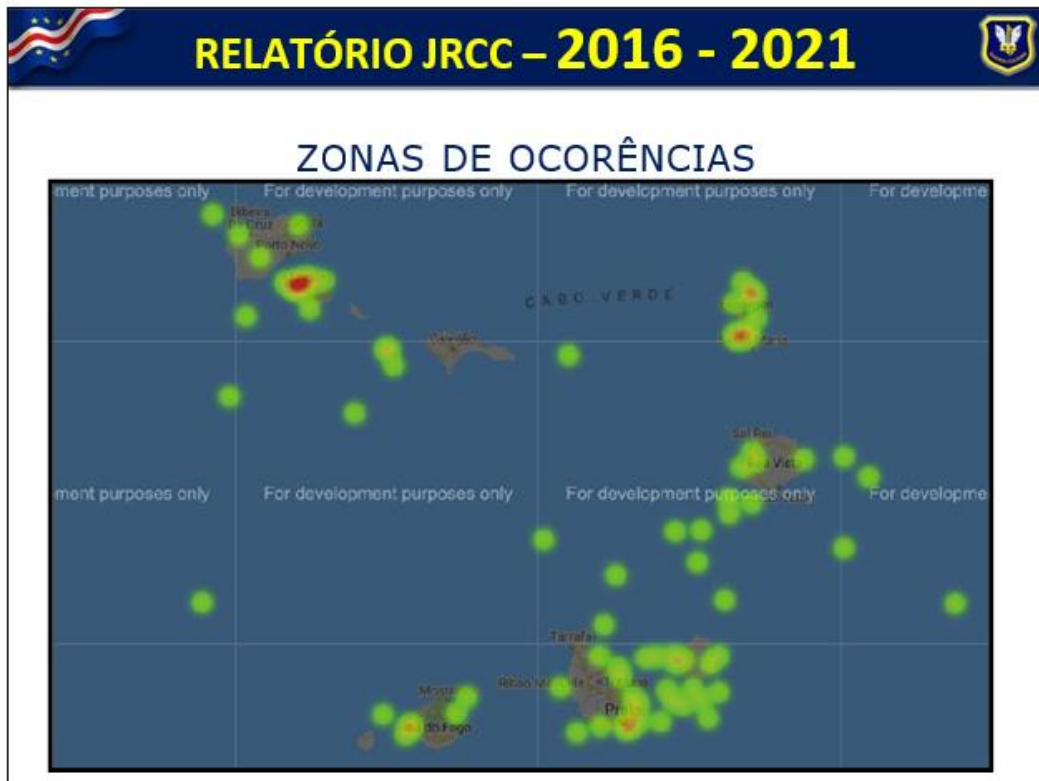
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RELATÓRIO JRCC – 2016 - 2021

ZONAS DE OCORRÊNCIAS



8



Appendix 6- Interview with SMA

Interview With the Swedish Maritime Administration on July 27 2023

The heads and commanders of the institutions and units in charge of conducting national search and rescue operations are the target audience for this interview, and private entities with experience in the matter.

I can begin with the presentation and I'm A, I'm the SAR coordinator of Sweden and working with both the maritime and the SAR authority is Swedish maritime administration. So, we handle both the aeronautical and the maritime search and rescue.

My name is B and colleague to you on, and I'm a regional coordinator on the West Coast, the Gothenburg area. And I do that as part time and I also marine pilots at the at the West Coast of Sweden.

Section 1: Legal Framework

Q: Which government agencies have authority and responsibility for coordination of maritime SAR?

A: Swedish Maritime Administration.

Q: 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?

A: Yeah. We have an overall Swedish search and rescue program. Then we have SAR plans according to the SOLAS regulations. We have done for fulfilling passenger ship in Swedish waters. Then we have interagency agreements with the national actors. For example, the Swedish Sea Rescue Society, we have a paper and a document there who regulate the regulation between the authority and the organization they are called the Lifeboat organization. We do even have interagency agreements with other parts as the Coast Guard, the Police Authority, and the healthcare. For example, we have with the municipal rescue service for maritime incident response group. We have several interagency agreements in Sweden. Then if we go one level up, we will be the closest neighboring states.

Q: Does your State have formal SAR agreements for inter-agency co-ordination and for co-operation with neighboring countries?

A: Yeah. We have nine neighboring coastal states. Between this state and the Swedish governmental office, the Ministry of Foreign Affairs, we have an inter-governmental agreement. Inter-governmental agreement is a documented handshake between two countries that we agreed that we should help people when they're coming to a distress situation in Swedish water, in the neighboring states water, or in the airspace over that. That is according to the United Nations Convention for Law of the Sea Article 98, that we should help each other in a regional basis in over borders between countries. To do this a little bit more practical, we have even signed operational agreement with all the nine neighboring states. That is more practical for the rescue coordination center that they should have a framework to working when they have a distressed situation. We have two documents with each of the nine neighboring states.

Q: Can the RCC(s) or JRCC(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?

A: Since 2009, we have Joint Rescue Coordination Center, and that is located in Gothenburg. The time before 2009, we had one maritime rescue coordination center and one aeronautical rescue coordination center who was located in the same building. We have fulfilled the IMO recommendation of harmonization of the maritime and aeronautical rescue coordination center service.

a. This center is the one responsible for deploying all the primary SAR resources?

A: Yeah.

Section 2: SAR Training

Q: Have all of your RCC or JRCC personnel attended formal SAR training? If so, do you have you an established certificate system and how does it work?

A: All the personnel in the JRCC, they have attended four months of training.

For the staff in the joint rescue coordination center, when we have recruit them, we take people from example, ATS service, air traffic service, pilot, airline pilots, maritime pilots, for example, ship officers, BTS personnel to recruit people to the Joint Rescue Coordination Center. Then we have an internal education for them. That education is mixed between theory, INMSAR, SAR convention, the ECO, SAR plans, for example, the national legislation framework, and so on. Then we mix that with practical officer on watch duty as a third part. They've been on watch in the rescue center under the time they do the theoretical studies. From they get employed until they are signed a certificate that they have the mandate to work in an ordinary position. It's 12 to 18 months.

a. **As I understand, your personal is not military. You are civilian personnel in the JRCC?**

A: Yeah. Some of them we recruit from the Air Force center, but not so much anymore because the military forces need their own personal today.

Q: 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?

B: Yeah. Well, for our sake in the area, we have one point of contact within the JRCC. And together with him, as regional SAR coordinators, we establish the training and how it's supposed to be done and the evaluation of it and what we would like to train. We have, let's say, a discussion all the way with our JRCC contact and everything concerning the training and so on. That's quite well functioning system, I think.

Q: Do your RCCs or JRCC carry out exercises involving other RCCs and JRCCs and rescue units on a regular basis?

B: No, not the other GRCCs. The only GRCCs, but all the other participants in the SAR community. So, let's say for the Coast Guard and the Voluntary Sea Rescue Service and yeah, all other who is involved with the SAR operations, we train together. But the only one we have. Inside Sweden, not with the countries outside? A: Yes, just inside Sweden.

A: But we have an initiative just now and B colleague in Stockholm area. He is leader of the new initiative we call Tabletop Exercise Always ready. We should train the MRCC in Finland together with JRCC talent in Estonia and JRCC in Gothenburg, Sweden. I think that is a new possibility we get now. We get video technique.

Get better possibilities to train rescue coordination center with the neighboring states. Now we will have the first test in the autumn this year. Per Erickson, our colleague, he had done four scenarios in the area of the SAR region borders between these three countries. They should have four exercises run with a maximum time of 59 minutes in each scenario. After 59 minutes, they should get online with each other and have a solution what each one should do in this exercise. It's short scenarios, but often, you can train all the staff who is on watch in the rescue coordination center. This is a little bit new for us now.

Section 4: SAR Resources

Q: 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?

A: The volunteer organization, the lifeboat organization, the Swedish Sea Rescue Society, doing the main part of the social rescue missions in Swedish SAR region, up to 75 % I would say. Much of this is connected to the leisure boat life. But we have even the Coast Guard Fleet with ships, boats, fixed wing aircrafts, drones, for example. We have the police authority in Sweden who is the biggest operator with national coverage of unknown aerial vehicles in different levels. They have other sensors and resources. They have helicopters, they have boats in the ~~archipelago~~ areas, and of course, they have police patrol who coming to the area of the incident and to take care of people and do their work. It's not only the lifeboat organization, it's a broad cooperation between civil organizations.

Q: Do the RCCs and RSCs Plans of Operation manuals include guidance on use of volunteer SAR resources?

A: There we can start with B. He had a regional cooperation meeting each year

B: Yeah. Let's say it's two times per year. We have two meetings per year and two trainings, two exercises per year. The meetings are more on manager levels. Let's we outline how the cooperation should work and we make sure that it's available and we make contacts for everybody to have it on a daily basis. It will be a smoother operation when it comes because we say that on manager levels, you don't get to see each other as often since in operation, well, crew under the boat crews, they get together more since there's quite a lot of heavy traffic and there's quite a lot of operations going on. Therefore, on manager levels, we get some more focus on it to make sure that everybody's up to speed with everything. Also, if there is anything, any changes in the organizations, they will let us know that. Everybody has the same picture of the area and what is going on and the difficulties and possibilities all the participants have. Let's say it's a meeting for everybody to be up to speed and how the SAR service is doing. For instance, we can say that in the Gothenburg area, it's a very pleasant area to be in because there is a lot of units. It's more that when we have an operation, it's quite often that we are, I shouldn't say too much units on the way, but it's quite a lot of units coming. It's a delicate situation that sometimes we have to say that, Oh, no, you can stand by for this one. But that's very good for the population, I think.

Q. What are your primary SAR resources which you rely to carry out SAR operations? How frequently are they involved in carrying out SAR operations?

A: For start with the frequency. In this time of year, on the whole area, it can be, let's say, five per day or so. But because it can be quite a lot because it's a lot of leisure boats in the area for this at least eight weeks through the summertime. It's quite crowded. All together, we use boats and the helicopter, the SAR Helicopter together. And they are quite well trained because when we do training, we train together. So, we do winching operations together, so we should have a mutual understanding and we should know the pros and cons of the helicopter service and you should know the hazards as a boat crew. It has shown on the operations real life that it's been working well. So, the training has given result. It's been quite good to see in real action as well that is working. When the helicopter is with their perspective, the boats can do their thing. But when the helicopter comes, for sure, there are not so many, but they are quite fast and do an excellent job in the service, I think.

Q: Do you have special equipment or methods to respond to night search?

B: No, no special equipment for the sail. The helicopter, I think, have goggles and so on. Some ships have a fleet, but despite from that, we only have lights.

Use of Drones in SAR:

Q: In your opinion can drones be used in SAR missions? In your opinion, the drones can be used in the SAR with better quality than the helicopter or other aeronautical means?

B: In my opinion, we're absolutely not there yet that the drones can do can be more useful than a helicopter. That's very much also because the helicopter can find the object and they can recover the object. So, in that sense, I think they are very... We are not there with drones yet, but I think it can be a good complement, especially if you have no helicopters in the area. Then I think absolutely a drone who can get another vision of it is very good. But short answer to the question, if it's more suitable than the helicopter, I would say no. Not since we have winching possibilities on our helicopter as well.

If I ask you, so how can we use them in the South? You should say that we use used with the helicopter or with the ships itself?

B: I would say with the ships itself. Because if you should have an operation and drone should work together with a helicopter, it takes this severe training for the helicopter and the drone pilot to work together. We are not there yet, but I think maybe it will come if the drones will be more. If we have more drones and it will be shown that they are quite good, then for sure we will need to work together but as it is now, I would say if you have a drone, I don't think you will have the helicopter there. So, if no helicopter, drone, very good.

A: Think also, I think f we talk about unmanned air vehicle, we have to divide it in different levels. Because. If you're talking about a drone, you can buy that on app store. It's a small one. It's sensitive for weather and wind. It's more like a toy, maybe. But if we're talking about to solve the S in SAR, we have to divide unmanned aerial vehicles in at least three levels. The small one who may come with a police car or police patrol on the shore side, you have larger fixed wing drones who have electro optical sensors for night vision search. You have real big fixed wing drones who can be in the air for a day or more. That is military grade equipment. But even military grade equipment in

Sweden, we have access via the legislation to get sensor data because in the Swedish legislation, we can go to the to do the Air Force and say, we want the picture of this area and we know that you have a resource there with electro optical sensor.

Hey then they send over this if we spot somebody who is in emergency situation at sea. Maybe we should divide this and not only call it the drones, fixed wing helicopter drones in different levels. It's a little bit of different. The police authority in Sweden, they have four levels of unmanned aerial vehicles. The smallest one they used for a patrol police patrol. The second one, they have an employed pilot. The third one, they have the special police air unit pilots. The fourth level, it's a secret one. That is because that is an anti-drone. They have to fight and take down drones in the dangerous situation.

Q: If yes. In with Institution, it will be better implemented? And how will be responsible for the training?

A: For example, in the Swedish maritime administration, we have our own air squadron, a division in the Search and Rescue Department who is responsible for the rescue helicopter operation. We're owning our own rescue helicopters and we have our organization around this and follow the flight rules and everything around that. We have a flight organization in the Swedish maritime administration. The Swedish Coast Guard, they have three fixed wing aircrafts, dash eight for surveillance. They have also organization to organize their air crews and airplanes. The police, they have our own flight organization. Everybody is civil authorities. Then the military and the Air Force, they also have an organization to fulfill the regulation around air operations. We have different authority with different tasks with aircrafts, and you can implement unmanned vehicles in that flight organization. But you should not underestimate the cultural barriers because a helicopter pilot, he doesn't like drone to come in close, it interferes with the manned and unmanned system. You have to separate them very well. The manned system, they should feel safe when they are in the air because if they collide with the unmanned drone, they may be going to crash. Here we have a cultural barrier to overcome before we could implement and operate in the same airspace.

Q: In your opinion does the use in SAR operations adds any value, to the quality of the operations in the Country?

A: The helicopter they're doing both the S and the R in SAR, both the search and rescue. But it's a very expensive system for only searching. Therefore, maybe we should combine to have the unmanned system to search in large areas and sending the helicopter for rescue.

We spot something. Or you have the unmanned system searching in the northern area of the search area and the helicopter in the southern area, and then they can change. They are not exactly in the same airspace, for example. With the aircraft, the fixed wing aircraft from the Coast Guard, they are always on top, maybe on 4,000 feet. Then the helicopter is on 1,000 feet when they're searching. The fixed wing has very small move and nice cameras, electro optical cameras they can see from this flight level down to the surface. The helicopter may be search visually or with night vision goggles. You separate them in height instead, different flight levels

B: Final Statement

Would say to start with, I can't see right now that it will take away so many jobs because as Johan said, we are supposed to be doing both the S and the R, and I don't see for distant future how a drone could do the R. Therefore, I think that in that level, I think it will be accepted quite well for the most cases. I think that for sure it could be useful for the search. Since in this area, we have winter time, except for eight weeks of summertime, it's quite cold up here. Here, I think the first one is if we have casualties, we need to have good search so we can find them quite fast because the time lapse will be the hazardous one to start with. If we combine, since we have the archipelago is quite challenging sometimes. I think that with the surface units and the drones could work. If you put away the helicopter for a while and just use the surface units and the drones, I think they can be combined in a good way to do the search because I think you can extend the surface units quite well.

Let's say if you have a drone on the surface unit and you have an area to cover, the where well may be that if you're going to search around an island, maybe you can do half the search with the boat and maybe it's too shallow on the other side. In that case, if you would have a drone, then you could easily search the whole island, the whole area, even where you're not able to search with only the boat. As Johan said, it's several levels. If you don't take the helicopter in consideration, for sure, it could be good for searching. And combined with the surface units, I think it could be quite good. If you ~~eah~~. Short answer to the question, I think it will be well accepted with the surface units and also with the helicopter pilots if it could be coordinated in a good way.

Because as we said, the police now is the number one in the drones and the helicopters together because they have the same organization and they have been working together and doing trainings together. And then I think it can be used in a good way for the citizens.
But then it's going to be quite some training, I think.

Other Clarification

1. Which Act/Law has established the SMA? In what year?

- The Swedish Maritime Administration been A own authority, Government offices of Sweden since 1 July 1969, and has since sorted under civil departments and the Ministry of Transport (Swedish name today; *The Ministry of Rural Affairs and Infrastructure*). Maritime Search and Rescue included. Aeronautical Search and Rescue been added to SMA responsibility in 2009 and the Joint Rescue Coordination Centre been established. The Civil Aviation Authority do not have any rescue service responsibility anymore.

2. When was the SAR 79 domesticated by Sweden and by which law?

- Law and regulation for Rescue service¹ incl. SAR in Swedish SRR been established in 12 December 1986. The convention entry in to force in 1985 since the sign of 27 April 1979 International Maritime Search and Rescue Convention at the diplomatic conference in Hamburg Germany.

瑞典
FOR SWEDEN:
POUR LA SUEDE:
DA SUEDE:
FOR SUECIA:

Gösta Lind of Hungary
Bo. Bellqvist
Elin Bengt

¹ *Lagen (2003:778) om skydd mot olyckor and Förfordningen (2003:789) om skydd mot olyckor*

3. When was SMA given responsibility SAR in Swedish SRR and who was responsible for it before?

- Under the time of SAR 79 have SMA always been the authority for Maritime SAR in Sweden. Different provider of mobile facilities support the Swedish SAR system via the legalization.

4. Who the SAR communication system and plans are organized in Sweden?

- SMA own and operate the coastal radio system for shipping. A coastal radio station is a integrated part of the Joint Rescue Coordination Centre, call sign *Sweden Rescue*. Other digital Tetra radio system is owned by other authorities and SMA only operate this technic in SAR. Swedish SRR belongs to the GMDSS A1 radio area. SMA is SPOC, SAR Point of Contact, in Sweden and receive emergency and distress alert to RCC, according to the SAR-79

5. Warning and Danger Broadcasting Facilities with SMA. Brief discussion (1 Paragraph max).

- Broadcasting of Nav-warning/Met-warning etc. is provided by another SMA function call sign *Sweden Traffic*. Maritime Safety Information MSI, Enhanced Group Call EGC, is broadcasted via EIK in UK to shipping enroute to Swedish water

6. What is the area of responsibility of the SMA in kilometers?

- Sweden via SMA and have responsibility for the Search and Rescue around the Swedish coast and the three largest inland lakes ~~Vänern, Vättern and Mälaren~~. The Swedish SRR extends a maximum of 60 nautical miles from the Swedish coast. Approx. area 175k km² (Cape Verde 110k km²)

Sweden has bilateral SAR agreements with all nine neighboring countries.

[illegible][illegible]

Appendix 7- Benchmarking for Cabo Verde SAR Organization Against Swedish Maritime Administration (SMA).

1. International Maritime Rescue Federation (IMRF) data show that there are currently more than 130 governmental and non-governmental organizations registered with IMFR which provide SAR services worldwide (International Maritime Rescue Federation [IMRF], 2023). Each agency has its own internal organization; however, all agencies are modelled on the principles of the IAMSAR manual. More often than not SAR operations fall under the mandate of Navies and the Coast Guards of the nations. However, a comparison of Cabo Verde Coast Guard as a SAR agency with Coast Guards of Japan, USA and India is not a practical approach, due to their size in terms of the number of personnel, available assets and areas of responsibility.

On the other hand, Nordic countries such as Denmark, Finland, Norway and Sweden, which mostly have a smaller SRR compared to the countries mentioned above, are more suitable for comparison. Sweden stands out amongst the Nordic countries as its SRR is approximately 175k km² which can be considered suitable in nature. Also, with almost 270,000 islands and a total area of 1.2 million hectares which corresponds to 3 percent of Swedish territory, extending a maximum of 60 nautical miles serves as a basis for benchmarking in relation to Cabo Verde (Swedish Sea Rescue Society [SSRS], 2023). The Swedish Maritime Administration (SMA) is the authority responsible for all sea-related SAR operations in the country. The organizations follow the guidelines promulgated via various instruments, regulations and code by IMO about SAR-Management, Mission Coordination and Mobile Facilities (Christodoulou et al., 2022).

Being considered as one of the most effective SAR service providers with limited resources and innovative measures, SMA can be considered most apt for comparison and

improvement in Cabo Verde SAR services. Sweden has agreements with neighbouring States and internal agreements to strengthen its operations. Use of volunteer-based services gives SMA an edge over the other agencies with similar mandates in other nations. One of the most prevalent volunteer organizations designed to assist in maritime SAR efforts is the Swedish Sea Rescue Society (SSRS) that is involved in 90% of all SAR operations in Sweden (SSRS, 2023), the Lifeboat Service being one the most prominent.

As it has been established in the previous section, for benchmarking the infrastructure, organization and process of SAR operation of Cabo Verde, SMA will be used. The process is expected to bring out the deficiencies in the existing SAR system of Cabo Verde and how they can be improved upon given the current situation of the country. The benchmarking will be divided into 03 main parts which are regulatory framework, cooperation and infrastructure & available manpower.

(a) Regulatory Framework.

Having established that certain aspects of SAR under SMA are similar to the SAR system in Cabo Verde. The first aspect which will be compared is the regulatory framework of both the agencies. Any discussion on regulatory framework has to start with the adoption of base IMO convention which in this case is SAR 79. Starting comparative benchmarking with SMA: -

Sweden became a member of IMO in 1959 and joined SAR 79 convention in 1982 and it came into force in 1985 with the rest of the world. SAR 79 was domesticated on 12 December 1986 via *Lagen (2003:778) om skydd mot olyckor* och *Förordningen (2003:789) om skydd mot olyckor*.(SMA, personal communication, July 27, 2023) which is indicative of a robust domestic mechanism which is in place. Also, SMA was given the responsibility of SAR in the Swedish SRR from 1 July 1969, and Aeronautical SAR was added to SMA responsibility in

2009 and the JRCC was established (SMA, personal communication, July 27, 2023). The overall system of regulatory framework for SMA in an overview looks holistic and complete in nature.

On the other hand, Cabo Verde became a member of IMO in 1976 after gaining independence from Portugal in 1975. The SAR 79 convention was accessioned in 2003, it entered into force after a period of one month in the same year. SAR 79 was domesticated by the government in 2004 which is indicative of the fact that preparative work for the domestication was undertaken simultaneously with the ratification process. However, a delay of more than 18 years in ratification of one of the most important conventions is indicative of an unstable system and policy which could result in adverse impact on the SAR mechanism. CVCG has been designated as the nodal agency for SAR efforts in the Cabo Verde SRS via Decree No. 5/2009, dated January 26.

Findings of the Comparison.

- Following are the findings of the comparison of the regulatory framework of both the agencies.
- Both Sweden and Cabo Verde are members of IMO.
- Both countries have ratified and domesticated the SAR 79 convention. Although, it took Cabo Verde more than 18 years before ratification of SAR 79.
- Both countries have a nodal agency for SAR operations in their respective SRR/SRS.
- The difference lies in the type of organization which is responsible for SAR in both nations. In the case of Sweden, the responsibility is given to the Maritime Administration which is also the case with countries like Georgia

and Slovenia (European Maritime Safety Agency [EMSA], 2007). However, Cabo Verde follows a more traditional approach of giving responsibility to an operational organization like Coast Guard which is the case with most nations including the US and India.

(b) Cooperation.

The maritime sector and oceans do not know any boundaries and requirements of SAR can come up anywhere (SOS Mediterranee, 2022). It is an ancient mariner's code to help each and every one who is in peril at sea. For this reason, cooperation amongst nations as well as internal cooperation amongst various agencies is the key for a successful SAR organization.

SMA along with the government of Sweden has entered into many bi- and multilateral agreements with all nine littoral neighbors for maritime SAR efforts (SMA, personal communication, July 27, 2023). SMA also engages with various govt. and non-governmental agencies via bi-lateral agreement. Agencies like Helicopter Preparedness, Municipal Rescue Groups, the Lifeboat Society and many others have proved instrumental in defining SAR efforts and resources for the nation (SMA, personal communication, July 27, 2023). As per the personnel interview conducted on 27 July 2023 with a senior official from SMA, almost 75% of the of the rescue missions are undertaken by the volunteer organizations which are mentioned above. The use of volunteers for the SAR operation not only is effective and provides a large workforce at short notice, it also gives the flexibility to SMA for organizing its efforts towards SAR operation.

Cabo Verde also has a strong regional presence in the Atlantic Region near

the African coast. With regional agreement for cooperation in SAR activities with Spain, Portugal, France and Senegal (See appendices 2, 3 and 4). Also, Cabo Verde is a member of IMRF which is an NGO working towards capacity building and harmonization of SAR efforts worldwide (IMRF, 2023). CVCG works in collaboration with 15 other national agencies under the auspices of CNCSAR towards safeguarding Cabo Verde SRS.

Findings of the Comparison.

- Both countries have a strong regional cooperation with neighboring nations towards SAR. However, unlike Sweden, Cabo Verde does not have any agreement with any African nation on the west coast of Africa other than Senegal. To have an effective SAR mechanism in its SRS, agreement with neighboring African nations would help Cabo Verde.
- Both nations differ in their approach when it comes to internal cooperation. Sweden mainly depends on the SSRS which is a volunteer organization for the manpower and coordination of SAR efforts. On the other hand, Cabo Verde does not involve volunteers for SAR efforts. Cabo Verde depends on CNCSAR and its 15 governmental agencies for SAR efforts in its SRS. Swedish approach towards the SAR gives them a distinct advantage towards additional manpower when required without expenditure and ensures a higher success rate for SAR operation even without the presence of Coast Guard or Police assets.

(c) Infrastructure and Manpower.

Even with the most robust regulatory framework and cooperation mechanism in place, without right infrastructure and well-trained manpower they are of little use (International Labor Organisation [ILO], 2003). It is a well-known fact that the man behind the machine is the most important element in any system. A well-established infrastructure gives the right tools to the manpower to perform effective SAR operations.

Sweden has a well-established infrastructure for effective coordination of any SAR effort in their SRR. The entire region is divided into fifteen SAR areas with the JRCC at Gothenburg (Swedish Maritime Administration [SMA], n.d). JRCC harmonizes the maritime and aeronautical SAR operations in accordance with IMO MSC.1/Circ.1594 (IMO,2018). All fifteen SAR areas are under the direct control of the Traffic Area Director who is responsible for SAR efforts in their area. All SAR coordination centers are equipped with required MF/HF communication equipment and satellite services. Major assets provided for SAR operations such as vessels, helicopters, fixed wing aircrafts and drones are primarily assigned to the Swedish Coast Guard and the Swedish Police. With over 100 boats and 3 aircraft Swedish Coast Guard is capable of providing SAR coverage for the entire SRR under Sweden (Swedish Coast Guard [SCG], n.d.). Also, the volunteer organizations as mentioned above also contribute SAR assets to SMA.

The manpower is recruited from various walks of life, personnel having experience in maritime and aviation fields are selected to undergo training before then can be put to work. SMA has a well-structured training program for all its personnel which is in tune of 15-18 months for complete certification of personnel

(SMA, personal communication, July 27, 2023). SMA also coordinates with other agencies such as Swedish Coast Guard and volunteer organization for joint-training and exercises for smooth and effective SAR operations (SMA, personal communication, July 27, 2023).

On the other hand, Cabo Verde being a SIDS has one JRCC at São Vicente Island as the coordinator of SAR. COSMAR situated at Santiago Island assists JRCC in SAR operations at sea. Although Cabo Verde SRS is divided into two main regions of the Barlavento Islands (Northern Island) and the Sotavento Islands (Southern Islands) all SAR efforts are coordinated from the JRCC manned by CVCG. Both JRCC and COSMAR are well-equipped with all required communication equipment, however, most of the equipment are outdated and need replacement. With about 30 (10+20) ships and no aircraft for SAR services, CVCG relies heavily upon the merchant traffic in the area for rescue at sea. During an interview with one of the senior personnel of CVCG it was brought out that the assets available for SAR are not sufficient to cover the entire SRS (CVCG, Personal communication, August 15, 2023). Unlike Sweden, Cabo Verde does not have a programme for volunteer organization participation in the SAR services.

CVCG is a much smaller organization with only 174 personnel on active duty for managing the SAR system and manning of JRCC. The recruitment for personnel is through regular army recruitment and also CVCG personnel manning JRCC are mostly trained on the job and Cabo Verde does not have in-house expertise to train personnel on SAR system. CVCG has few certified personnel who undergo training with various countries as per the bi-lateral cooperation agreements they have.

Findings of the Comparison.

- Both Sweden and Cabo Verde have the required infrastructure for SAR organization, however, Cabo Verde is in a need for updation or replacement of communication equipment in the JRCC
- Sweden is well equipped with assets which are required for effective SAR coverage including 3 air assets which is in deep contrast with Cabo Verde existing situation.
- Cabo Verde has a much smaller workforce which is dedicated towards SAR operations and does not use volunteers for the same.
- Sweden has a well-established training mechanism for personnel working in SAR organizations as compared to Cabo Verde which primarily depends on friendly states for training.

Appendix 8- Consent Form for the Participants



Dear Participant,

Thank you for agreeing to participate in this research survey, which is carried out in connection with a Dissertation which will be written by the interviewer, in partial fulfilment of the requirements for the degree of Master of Science in Maritime Affairs at the World Maritime University in Malmo, Sweden.

The topic of the Dissertation is: *Enhancement of Search and Rescue Missions in the West Coast of Africa: Examining the Possibility of the Use of Drones in SAR in Cabo Verde*

The information provided by you in this interview will be used for research purposes and the results will form part of a dissertation, which will later be published online in WMU's digital repository (maritime commons) subject to final approval of the University and made available to the public. Your personal information will not be published. You may withdraw from the research at any time, and your personal data will be immediately deleted.

Anonymized research data will be archived on a secure virtual drive linked to a World Maritime University email address. All the data will be deleted as soon as the degree is awarded.

Your participation in the interview is highly appreciated.

| | |
|----------------|--|
| Student's name | Artemisa Cristina Gomes Neves Mota |
| Specialization | MSEA: Maritime Safety and Environmental Administration |
| Email address | W1012993@wmu.se |

* * *

I consent to my personal data, as outlined above, being used for this study. I understand that all personal data relating to participants is held and processed in the strictest confidence, and will be deleted at the end of the researcher's enrolment.

Name:

Signature:

Date:

Appendix 9- WMU REC Protocol



WMU Research Ethics Committee Protocol

| | |
|--|---|
| Name of principal researcher: | Artemisa Cristina Gomes Neves Mota |
| Name(s) of any co-researcher(s): | Not required |
| If applicable, for which degree is each researcher registered? | MSc in Maritime Affairs (MSEA specialization): WMU |
| Name of supervisor, if any: | Dr. Dimitrios Dalaklis |
| Title of project: | Enhancement of Search and Rescue Missions in the West Coast of Africa : Examining the Possibility of use of Drones in SAR in Cabo Verde |
| Is the research funded externally? | No |
| If so, by which agency? | ---- |
| Where will the research be carried out? | By phone (In Cabo Verde with the maritime administration responsible for the search and rescue in the country) |
| How will the participants be recruited? | The Participants will be officers and activists of the Coast Guard and the maritime policy in the country. |
| How many participants will take part? | Around 50 participants |
| Will they be paid? | No |
| If so, please supply details: | ----- |
| How will the research data be collected (by interview, by questionnaires, etc.)? | The Data will be collected by questionnaire and by interview |
| How will the research data be stored? | Research data will be stored in my personal laptop and hard disc with strong password |
| How and when will the research data be disposed of? | The data will be deleted from my laptop upon completion of my MSc studies, degree scheduled to be awarded 28 October 2023 |
| Is a risk assessment necessary? If so, please attach | No. |

Signature(s) of Researcher(s):

Artemisa Mota

Date: 03/05/2023

Signature of Supervisor:

[Signature]

Date: 03/05/2023

Appendix 10 – Survey

Section 1 of 4

Examining the Possibility of Use of Drones in SAR Missions in Cabo Verde

You are invited to participate in the survey "*Enhancement of Search and Rescue Missions in the West Coast of Africa: Examining the Possibility of use of Drones in SAR in Cabo Verde*" conducted by Artemisa Cristina Gomes Neves Mota, as part of the research project in fulfilment of the requirements for the award of the degree of Master of Science in Maritime Affairs

At World Maritime University (WMU). It will take no more than 15 minutes to complete the questionnaire.

This questionnaire consists of three sections:

- Section I collects sociodemographic and work-related characteristics of the respondents.
- Section II collects the respondents' understanding of SAR missions in the country.
- Section III collects the respondents' views on the use of drones to enhance SAR missions in the country.

The survey has been reviewed according to the WMU Research Ethics Committee procedures. Your participation is voluntary and you can withdraw from the survey at any point. Your survey responses will be strictly anonymous. Your details will not be identified in any report resulting from this survey. If you have questions at any time about the survey or the procedures or want to be in touch concerning the project, you may contact, the researcher Artemisa Mota, at +238 9766546 or by email at the email address specified below.

Thank you very much for your time and input. Please start with the survey now by clicking on the Next button below to start.

The researcher Artemisa Mota

Research W1012993@wmu.se

World Maritime University (Sweden)

Section 2 of 4

Sociodemographic and work-related characteristics



Description (optional)

What is Your age? *

- ☐ 20-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-69
- ☐ 60-65



What is Your Educational Background ? *

- ☐ Degree
- ☐ Master
- ☐ Doctor
- ☐ Other...

What is your gender *



- ☐ Female
- ☐ Male
- ☐ Prefer not to say

Where is your place of work ? *

- ☐ JRCC
- ☐ COSMAR
- ☐ Coast Guard Comand
- ☐ Maritime Police
- ☐ Other

What is your Current position at your place of work? (Please provide a short answer) *

Short answer text

.....

Section 3 of 4

Assessment of your knowledge of SAR



The questions in this section are designed to assess your understanding of SAR operations and, if your organization conducts SAR missions, how successful they are.

Do you have any training in Search and Rescue Operations? *

- ☐ No
- ☐ Yes

If yes how do you classified it?

...

| | | | | | | | |
|------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------|
| | 0 | 1 | 2 | 3 | 4 | 5 | |
| Poor | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Excellent |

Do you consider your organization/SAR unit as being successful regarding SAR services? *

- ☐ Yes
- ☐ No

Please explain your selection ? *

Long answer text

How do you classified it ? *

| | 0 | 1 | 2 | 3 | 4 | 5 | |
|-------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------|
| Never | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Always |

After section 3 Continue to next section



Section 4 of 4

Objective Questions



In this section the respondent is invited to answer the questions within a limit of up to 500 words.

What is your understanding of Maritime search and rescue ? *

Long answer text

How many search and rescue operations do you conduct / participate on average per year? How successful are those operations?

Long answer text

What is your understanding of the current search and rescue operations situation in Cabo Verde ?

Long answer text

Classified ? *

| | | | | | | | |
|------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------|
| | 0 | 1 | 2 | 3 | 4 | 5 | |
| Poor | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Excellent |

Do you now what is a drone?

Short answer text

In your opinion drones can be used in SAR mission in Cabo Verde

- ☐ Yes
- ☐ No
- ☐ Maybe

In your opinion using drones in SAR operations adds any value ?

- ☐ Yes
- ☐ No
- ☐ Maybe

Explain why?

Long answer text
