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WORLD MARITIME UNIVERSITY
Malmö, Sweden

EXAMINING RESILIENCE

**Assessing and measuring resilience in the context of
Maritime Administrations**

By

LAREZ PINDER
The Bahamas

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

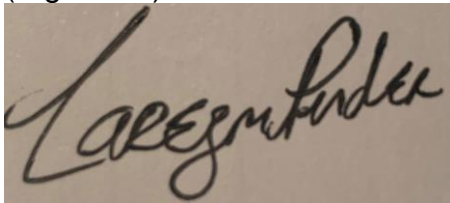
(MARITIME SAFETY AND ENVIRONMENTAL ADMINISTRATION)

2021

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):

A photograph of a handwritten signature in black ink on a light-colored background. The signature is written in a cursive style and appears to read 'L. Anish Hebbar'.

(Date): **21 September 2021**

Supervised by:

Dr. Anish Hebbar

Supervisor's affiliation:

World Maritime University

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I am grateful to the Bahamas Maritime Authority for my sponsorship and thus allowing my attendance at the World Maritime University.

Members within the BMA, and former members of the RBDF have my thanks for participating in this research. There were a lot of ideas and concepts exchanged despite the few whom I had access to. This gives me optimism in the true potential of the framework if participation and willingness within an administration becomes zealous.

Appreciate my supervisor who helped sow the concept within my mind and challenged me to be dynamic with my thinking and methods.

While Examining Resilience within Maritime Administrations is not yet a popular thought, I hope that no matter how small, this work can help contribute knowledge to a line of studying which is only inevitable for the safety of our industry.

Abstract

Title of Dissertation: **EXAMINING RESILIENCE: Assessing and measuring resilience within the context of Maritime Administrations**

Degree: **Master of Science in Maritime Affairs**

This research aims to provide insight towards resilience. It explores the context of resilience studies, potentials, and why it is relevant in organizations and complex systems. The measurement methods conducted previously in other domains are discussed, and a framework to assess resilience potentials within maritime administrations is proposed.

Utilizing the Resilience Analysis Grid (RAG) method, in conjunction with an adapted Resilience Matrix (RM), two critical organizations within the system of Maritime Administrations are assessed in resilience based on responses from interviewees, and publicly available documents.

What is discovered is that administrations can have their resilience measured, but to do so thoroughly requires an extensive amount of willing participants, and understanding of the entire domain to create appropriate assessment metrics.

KEYWORDS: Resilience, resilience potentials, learn, monitor, anticipate, respond, complex systems.

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Chapter 1 Resilience Thinking

1.1 Background

Resilience finds mention across various areas of study, with differing definitions dependent upon the domain. The National Academy of Sciences (NAS) defines resilience as the ability to plan and prepare for, absorb, recover from, and adapt to adverse events (NAS, 2012). Whether social, psychological, medicinal, engineering, climate, disaster, economical, ecological, or organizational; the general expectation is the system encapsulating abilities towards prevention, or adaptation of adverse conditions, (Woods, D. 2018) while being able to control system properties (Leveson, et al. 2017). These “abilities” refers to a system exhibiting resilience potentials, defining what it can do amongst altered states and disturbances (Hollnagel, E. 2015). Which, once incorporated, has the potential to lead to a safer and efficient system.

Within the maritime industry, safety has traditionally been addressed through strategies of a find and fix, reactive approach (Psaraftis, H. 2002). This approach was sufficient perhaps in earlier eras of shipping. Now vessels, the people who operate, manage and administrate their functions are more multifaceted, along with the challenges encountered. Shipping, being a socio-technical system, should not have its safety components be treated as a static design, but a dynamic process that is continually adapting to achieve its ends in order to react to itself and the environment. It is important that operations continue safely as changes and adaptations occur over time (Leveson, et al., 2017).

These changes and adaptation should begin with a mentality shift, increasing our knowledge and understanding of how systems, and components within them, interact in their environment. Rather than finding comfort in international regulators,

enforcing safety and compliance, the system should evolve into safety becoming an emergent property. In this respect, the author seeks to discuss why Maritime Administrations (MARADs), and the organizations which they encompass, should strive to exhibit resilience potentials.

1.2 Problem Statement

Application of Resiliency within Maritime Administrations should engender adoption of a more proactive, rather than reactive approach, in carrying out functions. The shipping sector is caught in a compliance, rather than a safety culture. Instead of focusing only on accidents, and failed scenarios, why not shift attention towards the ability of a system and its members to act correctly, and strengthen its capabilities? If applying a resilience potential approach and utilizing Safety I prescriptions or Safety II theories, we find the maritime industry, inclusive of its administrations, widely embracing a “work as imagined perspective” (Schröder-Hinrichs et al., 2016). Examining and measuring resilience of maritime administrations can help combat the managerial challenges in transforming organizational resilience from a set of redundant preventive actions, involving resource management, into a proactive strategy funded on a set of practices capable of fostering daily effectiveness of operations and processes (Annarelli, A., & Nonino, F., 2016).

In practice, assessing the resilience potentials of a Maritime Administration will prove challenging. Using The Bahamas MARAD as an example, a diagrammatic expression of how complex the system is illustrated in Figure 1.

Figure 1: System which emphasizes organizations and factors requiring a Maritime Administration to exhibit resilience

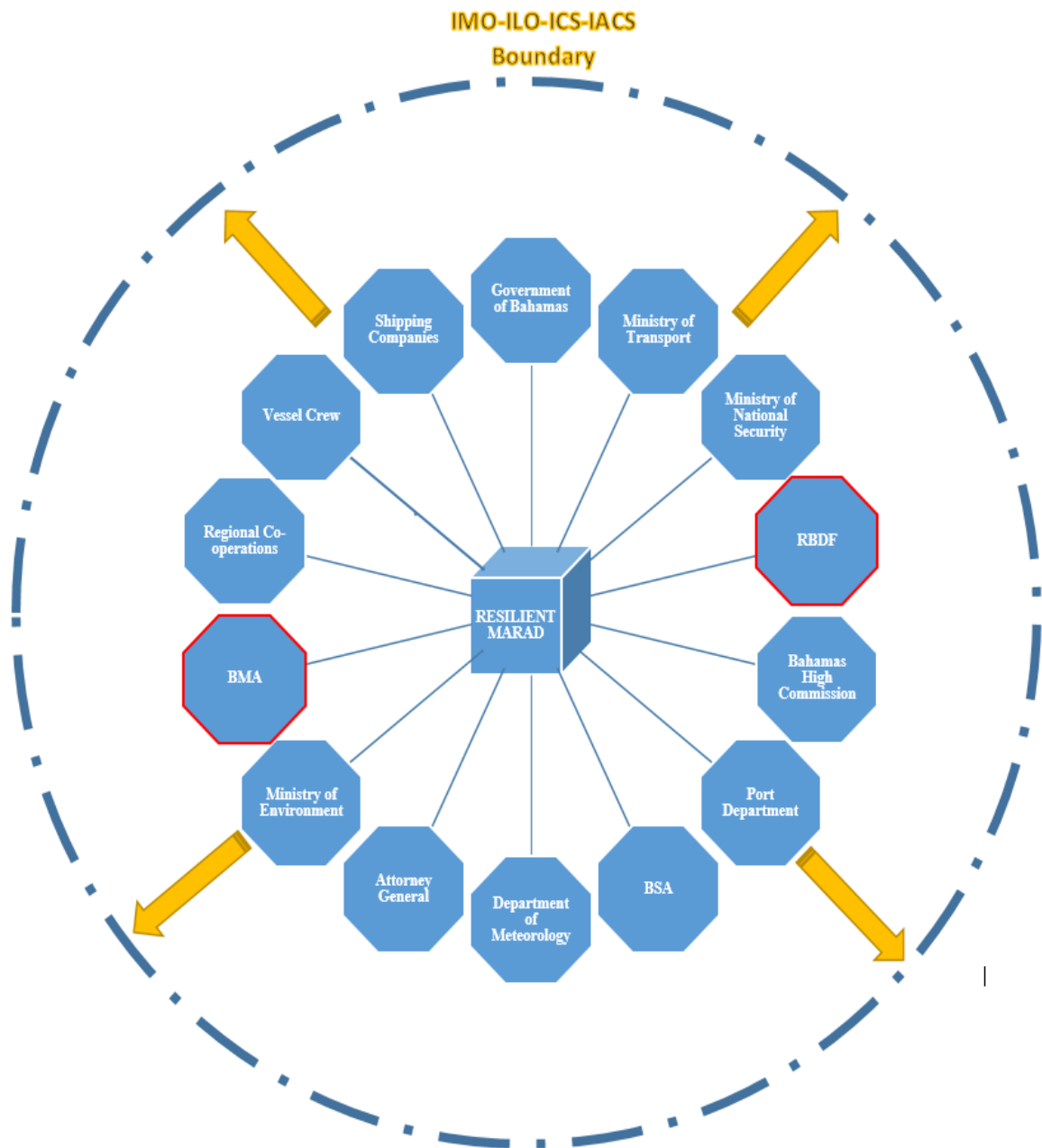


Image created by author.

Figure 1 depicts a representation of the many organizations whose operations determine the resilience potentials within the Bahamas MARAD. The International Maritime Organization (IMO) is a specialized agency of the United Nations that is responsible for setting safety and security standards of international shipping (IMO, 2021). Along with other international standard establishers, they are placed *outside* of the MARAD system. The reason is to depict that regulations, standards and guidelines issued by these bodies, serve as the overall standards for what the system aims to achieve. The broken boundary layer illustrates that while some organizations are suited for national legislation, those subjected to international laws, have the ability to grow towards, or even beyond, established safety and security standards. This growth is illustrated by the golden arrows. Finally, we have the organizations, and contributing factors, which create the Maritime Administration of The Bahamas. It's very evident to observe in order to assess the resilience of an entire MARAD, is well beyond the scope of this thesis. However, the two organizations outlined in red within the system will have their resilience potentials assessed and discussed.

1.3 Research Aim and Objectives

The aim of this paper is to examine resilience characteristics that can be applied to assessing and potentially enhancing the resilience of Maritime Administrations. In order to achieve this, resilience concepts that have been applied to other fields, institutions, and areas of studies will be reviewed and discussed in context. Discussions of how resilience has been measured for organizations will also be reviewed. A framework will then be proposed as a measurement tool, based on adaptations of previous assessors for organizational resilience, and applied to organizations within the Maritime Administrations. The aim will be achieved via the following objectives:

1. Understanding the context of resilience studies.
2. Discussion of how resilience has been understood and integrated across domains and measured for organizations.
3. Identify and apply a method of assessment for complex organizations such those within the system of a Maritime Administration.

1.4 Research Questions

This research aims to answer the following questions:

1. Can we evaluate the degree of resilience in an organization?
2. Can Maritime Administrations be assessed in their resilience potentials?
3. Do organizations operating in a complex system, such as Maritime Administrations persevere from exhibiting resilience?

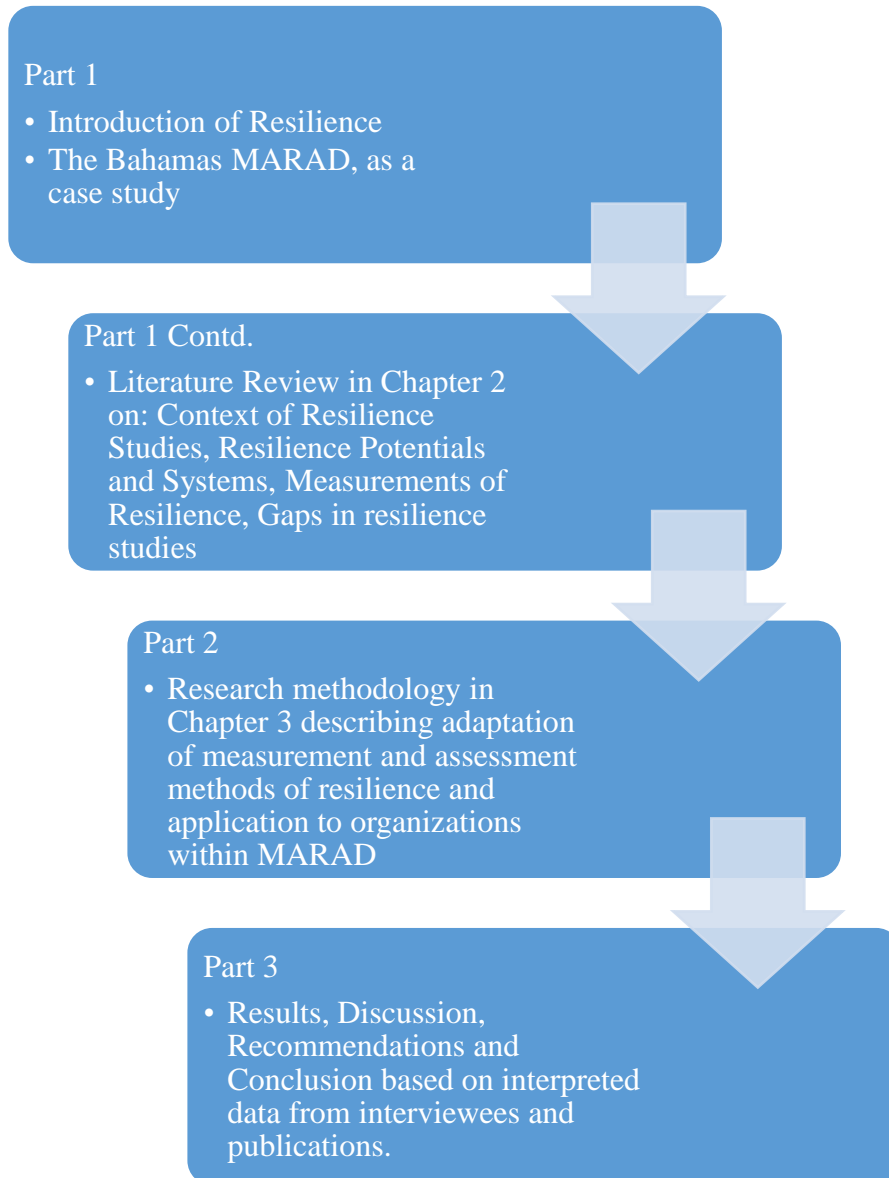
1.5 Research Limitation

Resilience within organizations as a field of study, is fairly recent. The organizations are usually geared towards those involved in business, disaster response, health care, and some transportation services. Despite being mentioned in railroad, nuclear, and aviation industries, resilience has yet to find its way widely considered into the Maritime Industry. Several mentions of safety towards the International Maritime Organization (IMO) exist, but this is only the facilitator for the industry standards. The research aims to bring elements of other resilience studies into the Maritime domain towards Member States and their Maritime Administrations.

1.6 Overview of the Research

The research consists of three (3) parts across six (6) chapters which are outlined within Figure 2.

Figure 2: Overview of research

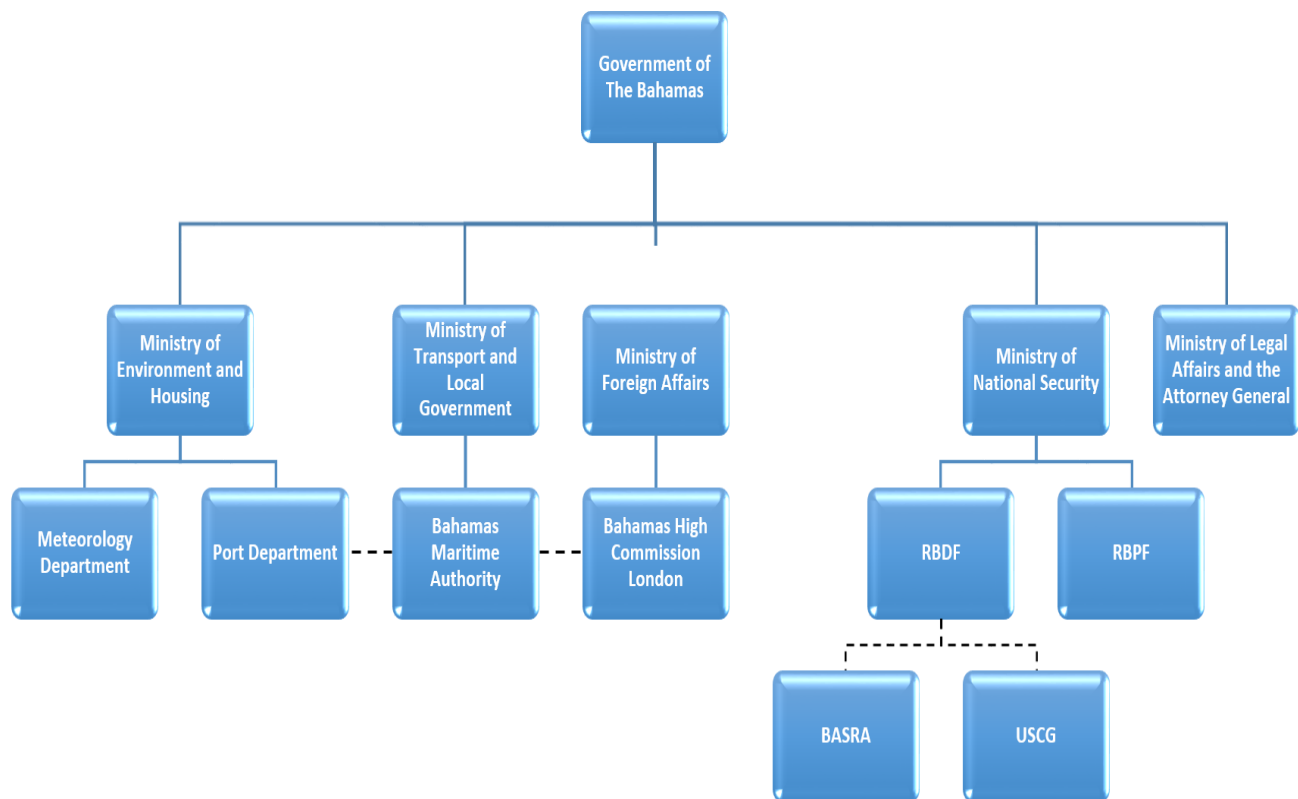


1.7 The Bahamas Maritime Administration as a Case Study

Despite the complexity of Figure 1 illustrated within section [1.2](#), the core focus of the organizations which will be assessed in the MARAD must be outlined.

The *standard* Maritime Administration of The Bahamas consists of multiple entities, as illustrated in the organizational chart of Figure 3. Assessing resilience within the entire Maritime Administration is well beyond the scope of this thesis, as it would require considerable amount of interviews, follow-ups and transparency from all organizations involved. Also, not all of the organizations at the time of writing will have necessary documents available publicly which can be used as further guidance for establishing existence of resilience potentials or characteristics.

Figure 3: Organizational chart of Bahamas Maritime Administration



Source: Created by author

Despite this not being a study on IMO Member State Obligations, an understanding of these commitments, especially towards flag, coastal, and port state duties, as a MARAD, must be made. It is in fulfilment of these obligations where the Maritime Administration strives to exhibit resilience, and how effectively the responsible organizations serve these duties, is deterministic upon resilience potentials.

The IMO Instruments Implementation Code (III Code); Contracting Governments must adhere to international instruments pertaining to:

- safety of life at sea;
- prevention of pollution from ships;
- standards of training, certification and watch keeping for seafarers;

- load lines;
- tonnage measurement of ships; and
- regulations preventing collisions at sea.

With respect to the aforementioned obligations, the Maritime Administration should therefore establish policies, legislation, administrative procedures for implementation and enforcement based on The Bahamas’:

- jurisdiction;
- organization and authority;
- legislation, rules and regulations;
- promulgation of applicable international mandatory instruments, rules and regulations;
- enforcement arrangements
- control, survey, inspection, audit, verification, approval and certification functions;
- selection, recognition authorization, empowerment and monitoring of recognized organizations as appropriate, and of nominated surveyors;
- investigations required to be reported to the Organization (IMO); and
- reporting to the Organization and other Administrations.

The Bahamas Maritime Authority (BMA) and the Royal Bahamas Defence Force (RBDF), in conjunction with other stakeholders, are tasked primarily with the **Flag, and Coastal State obligations** of The Bahamas. Hence, these two organizations will be used as a model to assess resilience potentials within Maritime Administrations

1.7.1 Flag State

The Bahamas Maritime Authority (BMA) is the flag state administration of The Bahamas. Working under the Ministry of Transport and alongside the Bahamas High Commission London, the BMA is responsible for registering, enforcing, monitoring

and improving vessels safety and standards carrying the Bahamian Flag (BMA, 2021). The BMA has five (5) main departments, alongside the management team that are relevant in carrying out its functions, as shown in Table 1:

Table 1: Description of various subcomponents within the Bahamas Maritime Authority.

Subcomponent	Mission Statement	Citation
Management	Offers a wide range of specialism from the international shipping sphere	Bahamas Maritime Authority. (2021). Management team. https://www.bahamasmaritime.com/the-bma/management-team/
Maritime Affairs	Represent BMA on external bodies, primarily the IMO. Using depth and breadth of knowledge, experience of the whole administration is used to represent the voice of The Bahamas.	Bahamas Maritime Authority. (2021). Maritime Affairs. https://www.bahamasmaritime.com/services/maritime-affairs/
Accident & Investigation	"Eliminate marine casualties". Carry out investigations, publish reports, increase awareness, determine where possible changes in regulations may be desirable, improving national and international co-operation in marine safety investigations. Success rests on cooperation and information provided by all parties involved. Shares information amongst Bahamas' Fleet to improve safety.	Bahamas Maritime Authority. (2021). Accident & Investigation. https://www.bahamasmaritime.com/services/investigations/
Seafarers & Manning	Ensures that all seafarers employed on board Bahamas vessels are trained and certified in accordance with the requirements of STCW. Approves training providers, issues Certificate of Competency (CoCs) and Certificate of Proficiency (CoP) in accordance with IMO standards.	Bahamas Maritime Authority. (2021). Seafarers & Manning. https://www.bahamasmaritime.com/services/seafarers-manning/
Inspection & Surveys	Ensuring registered ships are in compliance with national legislation and all statutory requirements set out in international Conventions and Codes to which The Bahamas is a party. RO's carry out certification but department overviews certification. Reviews ships for registration.	Bahamas Maritime Authority. (2021). Inspections & Surveys. https://www.bahamasmaritime.com/services/inspections-surveys/
Registration	Register vessels that meet relevant legal and safety standards. Technical suitability and age of vessel are taken into consideration before it is accepted to fly the Bahamas Flag.	Bahamas Maritime Authority. (2021). Registration. https://www.bahamasmaritime.com/services/vessel-registration/

The functions of the Flag State as per the III Code details: implementation, delegation of authority, enforcement, flag state surveyors, flag state investigations, followed by evaluation and review. How effectively these duties are carried out will contribute to assessing resilience potentials.

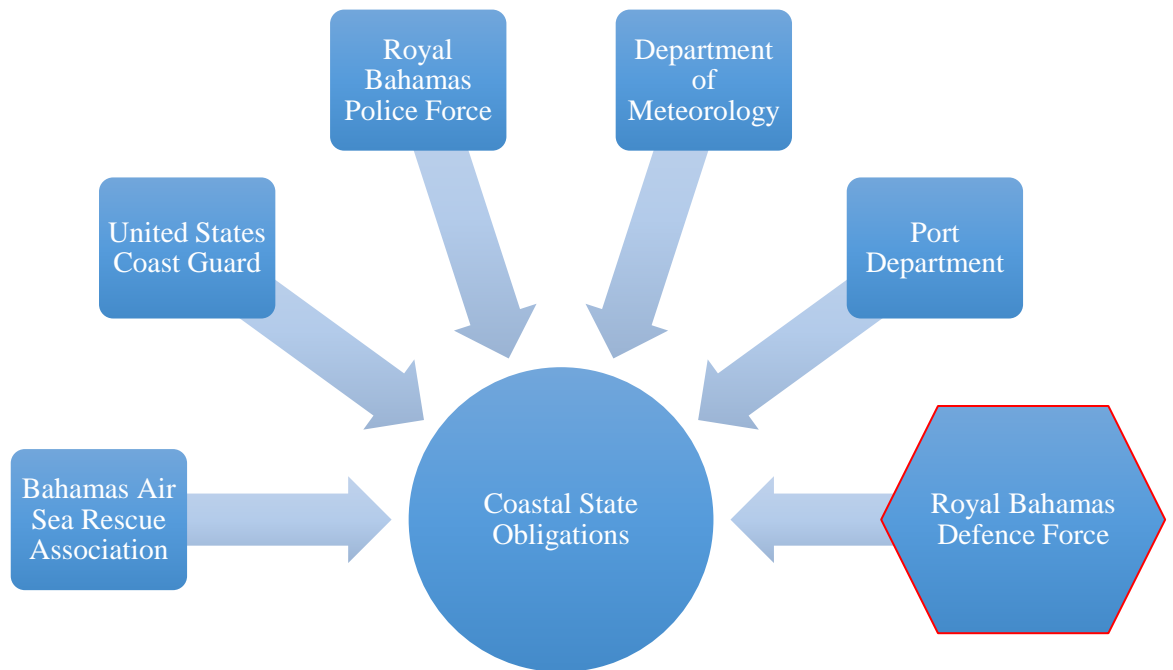
1.7.2 Coastal State

The Royal Bahamas Defence Force (RBDF) is primarily an armed service whose roles also encompass some aspects of a coast guard as well as a disaster relief agency. These roles require Defence Force personnel, with respect to Maritime functions, is to assume the duties of: Naval and infantry personnel, fisheries inspectors, and emergency rescue personnel (RBDF, 2021).

Coastal State Obligations as per the III Code are to ensure the legislation, guidance and procedures are consistent with international instruments with respect to: radio communication services; meteorological services and warnings; search and rescue services; hydrographic services; ships' routing; ship reporting systems; vessel traffic services; and aids to navigation. The contribution of these duties fulfilment by the RBDF will be used in assessing resilience potentials.

The RBDF is the primary respondent for all Search and Rescue operations within Bahamian territorial waters. RBDF is also responsible for upkeep and reporting on status of Aids to Navigation. The Bahamas Air Sea Rescue Association (BASRA), and the US Coast Guard (USCG), contribute essential resources to the Coastal State Obligations of The Bahamas MARAD. Figure 4 illustrates the organizations which all contribute directly to the Coastal State duties required.

Figure 4: Illustration of entities responsible for Coastal State Obligations in Bahamas MARAD.



Source: Created by author

1.7.3 Other Entities

The intent of this section is merely to introduce the duties and responsibilities, in contrast to international obligations, of the BMA and RBDF. Other organizations within the MARAD system are of equal importance for other purposes and cannot be overlooked. However, their resilience will not be assessed within this paper.

Chapter 2 – Welcoming Resilience

The purpose of this literature review is to assist enhancing the purview of resilience for the reader. Contexts of resilience studies will be discussed, briefly highlighting varying definitions and applications across different fields of studies. Why it is relevant and what it means for domains will be addressed, leading into organizational resilience and the potentials, which are used in determining the resilience characteristics of an organization. The review will then address some methods of assessing and measuring resilience within organizations, concluding with a discussion with the gap in context of Maritime Administrations.

2.1 Context of Resilience Studies

Authors have aimed to inquire into the definition, characteristics, and measurements of resilience across disciplines. What is apparent is the lack of an accepted definition universally, despite an abundance of applications, tailored specifically for the demands of a system. Resilience, or the display of its characteristics, finds mention in ecology (Holling, C. 1973), psychology (Boin, et al. 2010, Wiig & Fahlbruch. 2019), engineering (Yodo, N., & Wang, P., 2016), environmental (Bruneau et al., 2003), organizational (Stephenson et al., 2010), and other domains. The emphasis of their potentials may differ, yet the overarching contribution of resilience into the system remains very similar. What prevails is the ability of an entity, individuals, community, or system to return to normal condition, or functioning, subsequent to an event that disturbs its initial state. Not to be confused with robustness, flexibility, survivability, fault tolerance and agility (Wiig & Fahlbruch 2019, Hosseini, et al., 2016). Table 2 displays resilience across seven (7) different domains, their definitions and emphasis on key characteristics that help define its contribution to their respective system.

Table 2: Adapted Table from Quinlan, et al., 2016 illustrating resilience definitions in different domains.

Resilience	Definition	Emphasis	Key References
Engineering Resilience	System that survives and recovers from the likelihood of damage due to disruptive events	Recovery, efficiency, repel, resist, absorb, adapt.	Yodo, N., & Wang, P. (2016).
Organizational Resilience	Ability of an organization to survive, and potentially thrive in an environment of change and uncertainty	Situation awareness, management of vulnerabilities, adaptive capacity	Stephenson et al., (2010)
Ecological Resilience	Ability of system to withstand shock and maintain critical relationships and functions	Buffer capacity, withstand shock, persistence	Holling, C. (1996)
Social-ecological resilience	Magnitude of change or disturbance that a system can experience without shifting into an alternate state.	Reflexivity, persistence, shock absorption.	Quinlan et al., (2016)
Social Resilience	Ability of individuals, groups communities, to cope with external stresses and disturbances as a result of social, political, environmental changes	Coping capabilities, adaptive capacity, transformative capacity	Keck, M., & Sakdapolrak, P. (2013).
Community Resilience	A process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance	Adaptive capacity, disturbance, social	Norris et al. (2008)
Psychological Resilience	Process that occurs due to adjustment of particular circumstances. Here, resilience was defined as a dynamic process encompassing positive adaptation within the context of significant adversity.	Coping, adaptation, process, positive outlook	Boin, et al. (2010)

Source: *Quinlan, et al., 2016 with adaptations from author.*

From an **Ecological** perspective, it is understood that complex systems are never linear. Environments are filled with uncertainties and resilience is an appropriate

coping mechanism. The measurement of which defines the persistence of the ecological system to absorb changes, while maintaining relationships between the variables and parameters which allow the system to thrive (Holling, C. 1973, Boin et al., 2010).

The **Psychological** experience with resilience is based on studies involving children born into adverse circumstances; whether it be parental, political, environmental and etc. What was uncovered in these studies demonstrated resilience as a process, rather than individual trait based on adjustment to circumstances. (Boin et al., 2010). Positive adaptation amidst significant adversity proved children can undergo the dynamic process of developing resilience traits, despite being in high-risk for failure environments (Tugade, et al., 2004).

Evolving the ecological and psychological domains further, we arrive at **social resilience**; involving people, groups, and communities within their environment, especially with respect to disasters. This domain addresses potentials such as mitigation, prevention, preparedness, response, consequence management, recovery and aftermath politics. Threats can alter state while changing systems, resulting in potentially much more devastating catastrophes (Boin, et al., 2010, Cutter et al., 2013). While disaster, climate and crisis resilience tends to neglect the potentials of what resilience characteristics are (Bruneau et al., 2003), the work still produces a clear result of challenges faced due to absent resilience traits. In this regard, supply chains for food and water become scarce, communication systems fail, people panic, transport systems are disrupted, and the reliance of critical functions and supplies are tested (Lundberg J., & Johansson, B. J. 2015, Bruneau, et al., 2003). All of these can have some degree of mitigation, preparedness, response and recovery, if resilience thinking was previously adopted.

Resilience Engineering (RE) originated within the science of properties of materials, focusing on bending a beam due to the application of force, leading to an

induced stress and a resulting strain in the material. The material then may return to its original shape, or undergo deformation. Certain instances may even cause failure. These resulting characteristics lead to terminologies such as resistance, elasticity and stability (Bodin and Wiman, 2004), yet a material can only be considered resilient if it can return to its normal state quickly after experiencing external shocks, forces or disturbances (Martin-Breen & Anderies, 2011). Resilience Engineering thus introduces the thinking, or lack thereof, towards realizing failures can not only propagate, but multiply across materials, organizations and systems (Partk et al., 2013). RE paves the way for organizational safety management to begin developing tools necessary for building the resilience potentials of learning, monitoring, anticipating and responding. These potentials become necessary to narrow the gap between work as intended, and work as performed (Pillay, M., & Morel, G. 2020). Not just within the organization, but also external, yet contained within the system of operation (Woods & Hollnagel 2006). People and resources within organizations are exhaustible, therefore a diverse thinking towards safety in systems, which is independent of traditional risk management methodologies, is required. RE studies enlighten domains of the fact that; accidents and events within a system are not a failure of normal system functions, but a disruption in the ability to adapt to the complex nature of what the operational system requires (Dekker et al., 2008).

Organizational Resilience (OR) encompasses elements from ecological, psychological and engineering resilience studies (Boin et al., 2010), while recognizing that they must face not only the nature of their own threats, but those of the system they are within. OR is defined as an organizations ability to maintain, or recover to a stable state, in order to maintain operations during a significant event or amidst continuous stress (Wreathall, J.2006). It is within organizational resilience that the mentality of concentration on weaknesses begin to fade, in favour of examining strengths. This is due to resilience in OR context not being a single characteristic, rather a collectivism of traits working in cohesion (Westrum, R. 2006). The world is more interconnected than ever, and organizations must begin to

demonstrate resilience potentials due to the nature of threats internal and external within a rapidly changing environment (Wiig & Fahlbruch, 2019). Safety can no longer be considered something the organizations have, but rather something they do (Dekker, et al., 2008, Bharna, et al., 2011).

It is evident that all previous branches of resilience discussed; psychological, ecological, social and engineering, lead towards and have an impact on organizational resilience. This is especially true as the study continues into socio-technical systems. A depiction of domains of resilience influencing organizational resilience is illustrated below in Figure 5:

Figure 5: Diagrammatic expression of alternative Resilience domains influencing Organizational Resilience.



Source: Created by Author

2.2 Resilience Characteristics and within Systems

Systems and the organizations within them, have to develop the capability to preconceive threats, while being able to anticipate necessary actions in preventing catastrophic failure (Woods & Hollnagel 2006). Risk management approaches tend to overlook low probability, high- consequence events, hence resilience driven strategies are necessary, in order to provide protection against undesirable consequences of dramatic and unwanted events (Park et al., 2013). It is paramount that regulators, administrators, and operators alike, are aware that resilience thinking can be synergistic with already established traditional risk analysis approaches (Linkov, et al., 2016).

Complex socio-technical systems find themselves being drawn into critical states they once were unable to observe. Extreme events are becoming more challenging and difficult to predict, making the systems susceptible to many sudden shocks (Boin et al., 2010). Prior and post-event strategies to prepare for future events must begin to be incorporated within complex systems. However, this does not mean erasing risk assessments, but perhaps making it a preliminary phase leading to a resilience analysis which requires rethinking, re-assessing and reconfiguring (Linkov et al., 2016, Heinimann, H. 2016) of approaches. Resilience is an emergent property within complex systems and the greater the complexity, the greater the difficulty in failure predictions for elimination (Park et al., 2013, Ham, D. 2020). To help prevent a destabilization, an overhaul of the perception of safety is required.

In this overhauled perception of safety, two tiers are produced; Safety-I and Safety-II. Within **Safety-I** thinking, limitations arise for complex systems due to a growing misunderstanding of the systems functions (Patriarca, et al., 2018). Accidents can't be regulated out of a system, this is a myopic way of thinking. In the picture of safety, successful work outcomes have the same sources as failures. Accidents are

abnormal results from work processes that are usually successful, yet fail under specific conditions. As workers, regulators, administrators, etc. the thought continues that an abnormality of a process means the entire system is flawed. It is easier to accept human errors as being root causes of failed outcomes, as opposed to symptoms from a poor system design (Ham, D. 2020). Failures and successes within work stem from the same causes, therefore the higher tier of Safety-II thinking should be adopted. This allows continued improvement based on what goes right, instead of simply reacting and implementing measures when something goes wrong (Ham, D. 2020).

Safety II thinking is an improvement of Safety-I, it should aim to supplement areas where Safety-I thinking can fall short. Work situations with continued success should be a focus, rather than constant efforts on minimizing failed situations (Ham, D. 2020). If something that goes wrong has a cause, then something which goes well must also have a cause (Hollnagel, E. 2017). The work as imagined using Safety-I thinking will not mirror the work as it is actually done, which is why this adaptation is required for the functioning of complex systems (Patriarca, et al., 2018).

Having pre-packaged preparedness is one element, but preparation of a potentially system-wide failure event is another level of thinking. If the inevitable cannot be prevented, then the organization with its resources must be prepared (Boin, et al., 2010) to exhibit **resilience potentials** to keep the system thriving. These potentials vary across domains, yet are still able to find use for organizations within the context of socio-technical systems. Mitigation, prevention, preparedness is established from a crisis perspective. Buffering capacity, flexibility, margin, tolerance from systems (Dekker et al., 2008). Anticipating, monitoring, responding, recovering, learning and self-monitoring (Lundberg, J., & Johansson, B. 2015), sensing and adaptation (Park et al., 2013) for social and engineering resilience.

There is no inherent law stating a fixed amount of resilience potentials a system should have. Yet, to assess and measure organizational resilience, the four key

potentials designed to encompass sufficient coverage within the system for this study are: Learning, Monitoring, Anticipating and Responding as proposed by RE (Hollnagel, E. 2015).

Organizations should **learn** from all possible events, whether operating correctly or inducing failures, and ensure they are learning correctly (Hollnagel, E. 2015). The essence of this learning is to enhance the organizations ability to monitor, respond, anticipate, and then further improve its learning to not be limited from failures (Hollnagel, E. 2017). Issues relating to the potential to learn from an organization are displayed in Table 3 below:

Table 3: Examples of detailed issues relating to the potential to learn

Event	Detailed issue
Selection criteria	Does the organisation have a clear plan for which events to learn from (frequency, severity, value, etc.?)
Learning basis	Does the organisation try to learn from things that go well or does it only learn from failures?
Learning style	Is learning event driven (reactive) or continuous (scheduled)?
Categorisation	Are there any formal procedures for data collection, classification and analysis?
Responsibility	Is it clear who is responsible for learning? (Is it a common responsibility or assigned to specialists?)
Delay	Does learning function smoothly, or are there significant delays in the learning process?
Resources	Does the organisation provide adequate support for effective learning?
Implementation	How are 'lessons learned' implemented? (Regulations procedures, training, instructions, redesign, reorganisation, etc.)

Source: Hollnagel, E. 2017

Unanticipated disturbances, which will challenge the normalcy of a system, along with boundaries of expected uncertainties should be **monitored** within organizations

(Woods, D. 2017). Whether constructive or adverse, the monitoring should cover the organizations performance, along with the environment it is placed within. The ability to monitor, and knowing what to monitor, is instrumental for the systems performance (Hollnagel, E.2015). An organization that does observe activities within the operating environment will always be surprised at disturbances. On the contrary, an organization constantly responding to disruptions will likely exhaust its resource and capabilities. This is where systems learn about efficiency thoroughness trade off. To be efficient, an organization must work well with fewer resources, yet to be thorough, tasks must be carried out with sufficient resources. (Hollnagel, E. 2017, Ham, D. 2020). Table 4 below illustrates ways an organization may face issues with their potential to monitor.

Table 4: Examples of detailed issues relating to the potential to monitor

Event	Detailed issue
Indicator list	Does the organization have a list of regularly used performance indicators?
Relevance	Is the list verified and/or revised on a regular basis?
Validity	Has the validity of indicators been established?
Delay	Is the delay in sampling indicators acceptable?
Sensitivity	Are the indicators sufficiently sensitive? Can they detect changes and developments early enough?
Frequency	Are the indicators measured or sampled with sufficient frequency? (Continuously, regularly, every now and then?)
Interpretability	Are the indicators/measurements directly meaningful or do they require some kind of analysis?
Organisational Support	Is there a regular inspection scheme or schedule? Is it properly resourced? Are the results communicated to the right people and put into use?

Source: Hollnagel, E. 2017

Exhibiting foresight is difficult, yet to be prepared for looming threats a system must have the ability to **anticipate** developments forthcoming, whether disruptions, demands or changes in conditions (Hollnagel, E. 2015). The older Safety-I approach of having a pre-set of responses to known threats is not an effective way of testing resilience as later, unknown threats may come to expose the system to vulnerability (Lundberg, J., & Johansson, B. 2015). The knowledge gained from anticipating is useful once incorporated and turned into future strategies for potential disruptions (Park et al.,2013). Thinking about what may happen in the future is arguable one of the least most appreciated potentials (Hollnagel, E. 2017), yet still very important for resilience performance. Table 5 illustrates challenges faced with organizations in the ability to anticipate.

Table 5: Examples of detailed issues relating to the potential to anticipate

Event	Detailed issue
Corporate culture	Does the corporate culture encourage thinking about the future?
Acceptability of uncertainty	Is there a policy for when risks/opportunities are considered acceptable or unacceptable?
Time horizon	Is the time horizon of the organisation appropriate for the kind of activity it does?
Frequency	How often are future threats and opportunities assessed?
Model	Does the organisation have a recognisable and articulated model of the future?
Strategy	Does the organisation have a clear strategic vision? Is it shared?
Expertise	What kind of expertise is used to look into the future (in-house, outsourced)?
Communication	Are the expectations about the future known throughout the organisation?

Source: Hollnagel, E. 2017

Systems, industries and regulations typically specify the appropriate standards of a **response**, yet they must still be adequate, appropriate, well timed and effective (Hollnagel, E. 2017). Being able to respond to irregular changes, disturbances and opportunities by established actions or extemporaneous adjustment is a valued characteristic of resilience (Hollnagel, E. 2015). Table 6 demonstrates issues relating to the potential of conducting an appropriate response.

Table 6: Examples of detailed issues relating to the potential to respond

Event	Detailed issue
Event list	Is there a prepared list of possible and potential events or conditions (internal or external) for which the organisation should be ready to respond?
Relevance of event list	Has the list been verified and/or is it revised on a regular basis?
Response set	Have responses been planned and prepared for every event on the list? Do people know what to do when one of these events occur?
Relevance of response set	Does the organisation check that the responses are adequate? How, and how often, is this done?
Response start and stop	Are the triggering criteria or threshold well defined? Are they relative or absolute? Are there clear criteria for ending the response and returning to a 'normal' state
Activation and duration	Can an effective response be activated fast enough? Can it be sustained as long as needed?
Response Capability	Are there sufficient support and resources to ensure response readiness (people, equipment, materials?)
Verification	Is the readiness to respond (response capability) adequately maintained? Is the readiness to respond verified regularly?

Source: Hollnagel, E. 2017

2.3 Measuring & Assessing Resilience

Resilience is an inherent property and it is vital to avoid making important what is measured, as opposed to measuring what is important (Patriarca, et al., 2018).

These measurements should be used to present an organisations position with reference to a standard, regulatory norm, industry average or etc. (Hollnagel, E. 2017) hence the establishment of Flag (1.7.1) and Coastal State (1.7.2) duties. What exactly are we aiming to measure and assess? Across various domains the definitions of resilience differ, therefore, having a universal method for measurement isn't practical. However, what is consistent, is that each domain must tailor resilience thinking based on their unique context, allowing for a measurement of what resilience potentials should look like. Though, it is not a quantitative property outside of engineering, assessing resilience can bring difficulties due to it being easier to recognize the absence of resilience, as oppose it existence (Boin, et al., 2010).

2.3.1 Resilience Analysis Grid

The premise behind the Resilience Analysis Grid (RAG) is to establish a measurement of resilient performance in order to manage them, rather than making a comparison (Hollnagel, E. 2017). The true potential of RAG is demonstrated when an organization uses its initial assessment as its own reference point, thus enhancing an intrinsic ability to monitor (Hollnagel, E. 2015). A specific set of questions should be developed in order to determine how well a system performs on the four main potentials of learning, monitoring, anticipating, and responding (2.2). The questions should be specific to the function of the organization and the system it operates in. An example being creating RAG for the RBDF based off Coastal State Obligations (1.7.2). The RAG building process consists of four phases: defining the boundary, structure and resources of the system; selection of relevant questions for corresponding relevant items of the studied system; rating the questions for each cornerstone, or potential in this context; and finally combination of the ratings (Hollnagel, E. 2009). The results of this combination can be plotted a graph to illustrate the degree of potentials based on questions and responses.

2.3.2 Resilience Matrix

Globally accepted thresholds to characterize resilience have yet to be established, however, regulatory community is not constrained by early support of resilience potentials assessment efforts (Linkov et al., 2018). In an effort to assess resilience within large organizations, the Resilience Matrix (RM) has been proposed. This methodology aims to evaluate the total resilience within a system or organization by deconstructing resilience across subcomponents, branches, and hierarchical levels, so that a cohesive understanding of resilience-related strengths and weaknesses can emerge (Wood et al., 2019). Taking into consideration the functions, or duties of the subcomponents, resilience initiatives throughout a large organization can be further understood. The method builds upon construction of a matrix, mapping the potentials and domains, using information gathered either from interviews, literature or publicly available documents, and placing the relevant departments in appropriate grids based on their performance. A similarity analysis takes it to another level, as this helps much larger organizations recognize where departments overlap. This is useful because it can highlight where resources, or attention should be shifted towards, especially in larger contexts like the Department of Army Study (Wood, et al., 2019).

2.3.3 Alternative Methods

The AR⁶A resilience framework borrows attributes from the earthquake, engineering and biological systems, promoting an eight function concept to measure systems performance. The key properties of a system based on this method are: Robustness, Resistance, Re-stabilize, Rebuild, Reconfiguration, Adaptation, Attentiveness and Remembering. The ability of the system falling during an event and recovering post event would be graphically represented in order to determine its resilience. Logic behind this methodology is considering that stakeholders in organizations or systems are more likely to understand the importance of eight specific functions, rather than comprehending a specified definition of resilience (Heinimann, H.R. 2016).

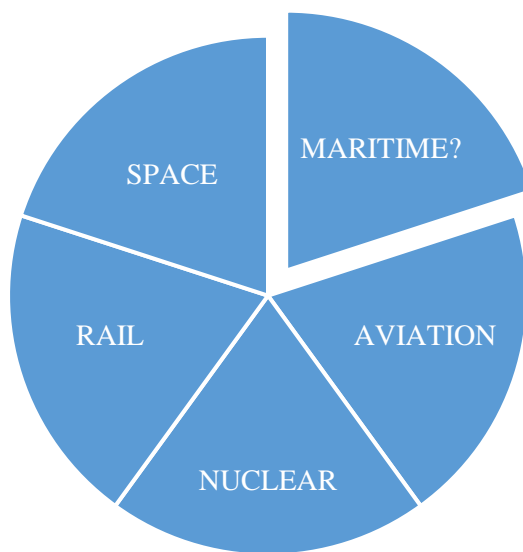
A trust indicator versus resilience profile was proposed, following the concepts of actively bouncing forward as opposed to bouncing back. This methodology is based off inputs of people within the organization and the capacity of the organization when faced with circumstances considered the “unknown unknown”. Using a semiotic image wall, the trust indicator method has members of the organization choose pictures which display their perception about the present and future state of their organization, followed by a description of why those particular images are chosen. The resulting sentences have relevance which exceeds that of the image selected and are analysed using a text mining tool as a quick application framework. This seems appropriate for organizations who presently lack ability to invest into resilience analysis (Imola, L. 2016). The resilience profile consists of four main dimensions of: operations, structure, planning and resources. These are further subdivided to help describe organizations sources of resilience and highlights any potential vulnerabilities. Despite not being suited for safety critical organizations, the means of measuring resilience potentials accurately will become more complicated as generic systems evolve (Imola, L. 2016). Therefore, it may even be in line with resilience thinking to adopt simpler resilience assessments before a system becomes too complex to examine.

2.4 Identifying the gaps

We find resilience assessment applications across some safety critical industries. Whether aviation (Ljungberg, D. & Lundh, V. 2013), rail (Pagani, et a., 2019), space (Woods, D. 2017), and nuclear (Dekker, S. 2017), yet the measuring of resilience

potentials for the maritime industry, or towards maritime administrations appear lacking as illustrated in Figure 6.

Figure 6: Where's maritime in the safety critical pie?



Source: Created by author

Though, even with an increased awareness of what organizations in complex adaptive systems encounter, there is still a lack in safety science applications of resilience overall. Additionally, resilience strategies for organizations is insufficient for theory building (Wiig & Farhlbruch, 2019). There must be a framework developed for high-risk settings and sectors, whether it be healthcare, transport, petroleum, disaster, or now, maritime.

2.4.1 Internal System of Maritime Industry

The Maritime Industry has a trend of a reactionary approaches in its response to disasters. This may have been appropriate in previous eras, but with increased complexity of the system, improving one particular aspect legislation, crew

competency, automation, ship design and etc., does not mean the system improves as a whole. The maritime industry has risk analysis and management tools integrated within frameworks such as the Formal Safety Assessment (FSA). However, high-consequence, low-probability events are often disregarded from decision-makers' agendas (Linkov et al., 2016). This style of thinking is beginning to grow redundant. Maritime Administrations should remain prepared regardless of the likelihood or risks of events and resilience analysis helps a system rebound to complete functionality as quickly, and efficiently as possible for a reduction in harm (Linkov, et al., 2016).

Examples of these events, as it pertains to the Bahamas MARAD, would be Hurricane Dorian, SARS, Swine- Flu, Ebola, all events which have caused disruptions, and reactions, within the functioning of Maritime Administrations. While those events could not have necessarily been prevented by any organizational factors, there could have been a “what-if” thinking applied, allowing the MARAD to anticipate measures required to effectively operate under current pandemic conditions, or future natural disasters.

Analysis of resilience potentials begin with identifying critical functions of the system and stakeholder values, with a subsequent assessment of system improvement alternatives. While universal thresholds of resilience characterisation is presently non-existent (Linkov et al., 2016), regulatory bodies can begin implementing measures of support which help enhance, or exhibit resilience potentials of organizations and maritime administrations.

2.4.2 External System of Maritime Industry

The International Maritime Organization (IMO) develops and provides regulatory framework in order for safe, secure and efficient shipping internationally

(IMO,2021). However, nations and their respective Maritime administrations must implement as far as practicably possible these measures into their legislation, ensuring compliance. In a sense, this can be considered to limit the potential of the maritime administrations, or even the system overall, as partially demonstrated in Figure 1 (1.2). Perhaps maritime administrations can enhance their capacity beyond international requirements, where feasible and without infringing upon sovereign freedom. If Safety-I thinking embodies the IMO as perceived, then with the potential of anticipation, maritime administrations can ‘bounce forward’ in enforcing compliance. Delays in organizational learning stems from regulators, executive planning and management of work assuming that compliance, procedures, and guidelines are sufficient to guarantee safety (Hollnagel & Macleod, 2019). Leading indicators generated by the resilience potential of monitoring and anticipating, provide feedback on performance before accidents or incidents occur. Reactive responses will focus on the specific incident, whereas a proactive mentality being adopted, would focus on capabilities of the organization presently, in order for these specific incidents to have a lower likelihood of occurring (Hopkins, A. 2009)

Chapter 3 – How we can Assess Resilience Potentials

3.1 Basis

While resiliency cannot simply be measured as a unit or quantity within organizations ([3.1](#)), various methods exist in order to obtain a sense of how well the organization can exhibit resilient potentials or characteristics. The available framework, regulations and guidelines established by the IMO gives us a testament as to what specific roles flag, port and coastal states play in maintaining maritime safety. The way administrations meet these standards, or even exceed them, depends upon their respective capacity and ability to enforce within national legislation. This creates a basis of what is to be expected from organizations and their subcomponents, not necessarily how it is accomplished, nor how well their duties are fulfilled. Considering this, an attempt to assess the resilience potentials of maritime organizations can be created utilizing previously applied assessment techniques. A mixture of methods will be incorporated along with diversified questions that are both generic and maritime specific.

The primary organizations of focus are the Bahamas Maritime Authority (BMA) and Royal Bahamas Defence Force (RBDF). These two organizations, with their various subcomponents, have the sole responsibility under the Ministry of Transport and Ministry of National Security, for a wide range of international and domestic compliance of standards within The Bahamas Maritime Administration.

The questions prepared for the BMA have been altered to be more specific towards the maritime domain and flag state duties, and will be assessed using the Resilience Matrix (RM) approach ([2.3.2](#)). The reason for this choice is because the BMA is an organization which is more management based in conducting Flag State duties. The performance of the Flag State does not necessarily reflect poorly on the organization as a whole, and it seemed the more appropriate organization for the RM. Questions for the RBDF are tailored in the same fashion with relevance to Coastal State duties

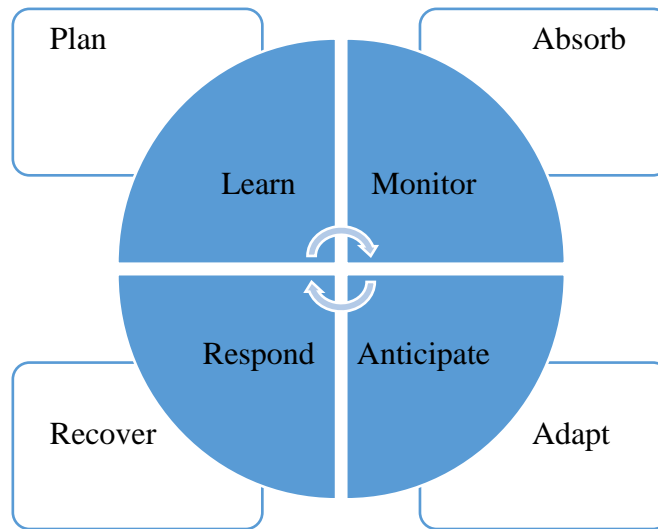
and will be assessed using Resilience Analysis Grid (RAG) method ([2.3.1](#)). The author wanted to demonstrate two separate resilience assessment methodologies, for two separate functioning organizations, yet within the same system. The RBDF is much more hands-on in their fulfilment of Coastal State Duties and would most likely benefit most from reassessments using RAG.

3.2 Method

The first methodology is based off an alteration of the Resilience Matrix (RM) approach. Resilience Matrix has been proposed as a means to evaluate resilience of sociotechnical systems, either relative to an established baseline performance, or to compare complex systems to each other. Use of the RM is to demonstrate an approach of measuring resilience initiatives across a large organization by considering the missions of its subcomponents, deconstructing and measuring organizational resilience through the RM. Thus, a cohesive understanding of an organizations resilience-related strengths and weaknesses emerge. The RM decomposes any potential threat event cycle into Preparation, Absorption, Recovery, Cognitive and Social domains. Placement of each subcomponent on the RM will be quantitatively compared to the placement of the others in order to determine how the subcomponents' resilience approaches diverged and overlapped. By painting the picture using qualitative and quantitative methods, improvements to how the organization overall can improve resilience characteristics will be observed. (Wood, et al., 2019)

Maintaining the 4x4 RM format, the four event cycle phases have been changed from ecological to organizational purposes as shown in Figure 7:

Figure 7: Illustration of adaptation from Ecological to Organizational Phases



Source: Wood, et al., 2019

The four domains for the alternative axis of the matrix will retain their same definitions and functions as described in Table 7:

Table 7: Defining domains for Resilience Matrix

<i>Domain</i>	<i>Definition</i>
<i>Physical</i>	Resources and the capabilities and the design of those resources
<i>Information</i>	Information and information development about the physical domain
<i>Cognitive</i>	Use of the information and physical domains to make decisions
<i>Social</i>	Organization structure and communication for making cognitive decisions

Interviews will be conducted virtually amongst senior members of each relevant BMA department. The questions will be open-ended and aimed to understand the

ability of each subcomponent to exhibit resilient potentials. Interviews will be recorded, transcribed and qualitatively assessed. The mission statements from the BMA website, completed Pre-Audit Questionnaire (PAQ), and accident investigation reports, will also serve as supplementary data to help develop the RM. Each cell within the RM helps consider the organization's resilience at a specific phase and domain which gives a detailed overview of the administration's ability to exhibit resilient potentials. The responses from the interviews after being transcribed, coded and rated to create a resilience metrics which will then be rated and applied to the matrix. The questions created for the BMA are shown in [Appendix 1](#).

Resilience Analysis Grid method will be applied to the RBDF based on interview responses from retired members of the organization, in conjunction with publicly available documentation, illustrating policies, strategies and vision. It can be applied to various subcomponents to address different domains for an overall snapshot of the organization. However, the purpose is to specifically focus on the **Coastal State** elements, highlighting special focus on the Operations Department which consists of Patrol Squadron, Commando Squadron, and Air Wing.

The RAG can be used to assess how the resilience profile of an organization changes over time and should be used repeatedly to assess resilience profiles for different groups of respondents. The answer to the questions will be rated using a Likert-type scale as proposed by Hollnagel shown in Table 8:

Table 8: Ratings for RAG using Likert-type scale

Value	Rating	Description
5	Excellent	The system meets and exceeds the criteria for the required ability
4	Satisfactory	The system fully meets all reasonable criteria for the required ability
3	Acceptable	The system meets the nominal criteria for the required ability
2	Unacceptable	The system does not meet the nominal criteria for the required ability
1	Deficient	There is insufficient ability to provide the required ability
0	Missing	There is no ability to provide the required ability.

Source: Hollnagel, E. 2015

Each rating will be given a corresponding value which will then be used to plot onto the radar chart in order to determine how well the organization performs functions that relate to resilience potentials. The questions created for the RBDF are shown in [Appendix 2](#).

3.3 Questions origin and use

The questions to be used in the interviews are aimed to assess the Resilience Potentials of the studied organizations. Hollnagel suggests these questions be tailored to target the particular domain or application (2.3.1). Researching different fields of study show that “generic” resilience potential assessment questions can be applied to an extent to maritime related organizations. Some terminology will be interchanged for the sake of specific functions. The overall ability in order to consider having resilient performance is shown in Table 9.

Table 9: Abilities necessary for Resilient Performance

Potential	Satisfactory Ability
Learn	Knowing what has happened, or being able to learn from experience, in particular to learn the right lessons from the right experience.
Monitor	Knowing what to look for, or being able to monitor that which is or could seriously affect the system’s performance in the near term- positively or negatively. The monitoring must cover the system’s own performance as well as what happens in the environment.
Anticipate	Knowing what to expect, or being able to anticipate developments further into the future, such as potential disruptions, novel demands or constraints, new opportunities, or changing operating conditions.
Respond	Knowing what to do, or being able to respond to regular and irregular changes, disturbances, and opportunities by activating prepared actions or by adjusting current mode of functioning.

Source: Hollnagel, E. 2015

Ideally, for the RAG measurement, the process would be more frequent and diversified into subcomponents. However, the aim is to see that a sense of resilience performance can be achieved, so that the organization(s) know where improvement is necessary.

3.4 How the questions are used

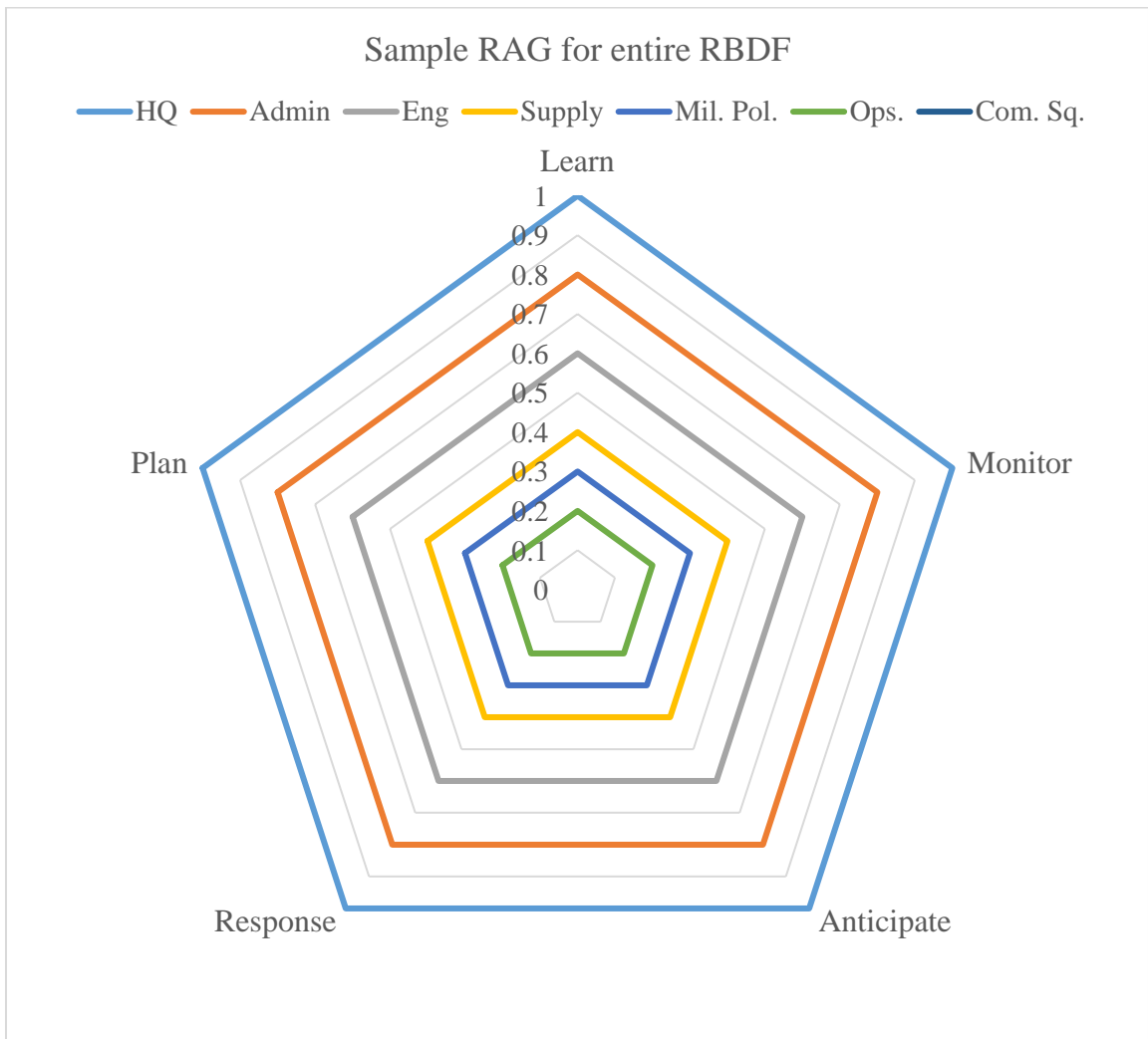
An adapted Resilience Matrix has been created by the author as displayed in Figure 8. Aiming to assess the BMA based upon interview information, and organizational documents. The phase cycles are changed, yet the threat event cycle remains the same.

Figure 8: Adapted Qualitative data analysis: RM for BMA Subcomponent Analysis.

	Learn	Monitor	Anticipate	Respond	Subcomponent Count
Physical					
Information	Maritime Affairs		Inspection & Survey	Accident & Investigation	
Cognitive				Registration	
Social		Management			
Subcomponent Count					

A sample of what the RAG graphical output would look like if all branches of the RBDF were assessed in Figure 9:

Figure 9: RAG Sample for entire Royal Bahamas Defence Force



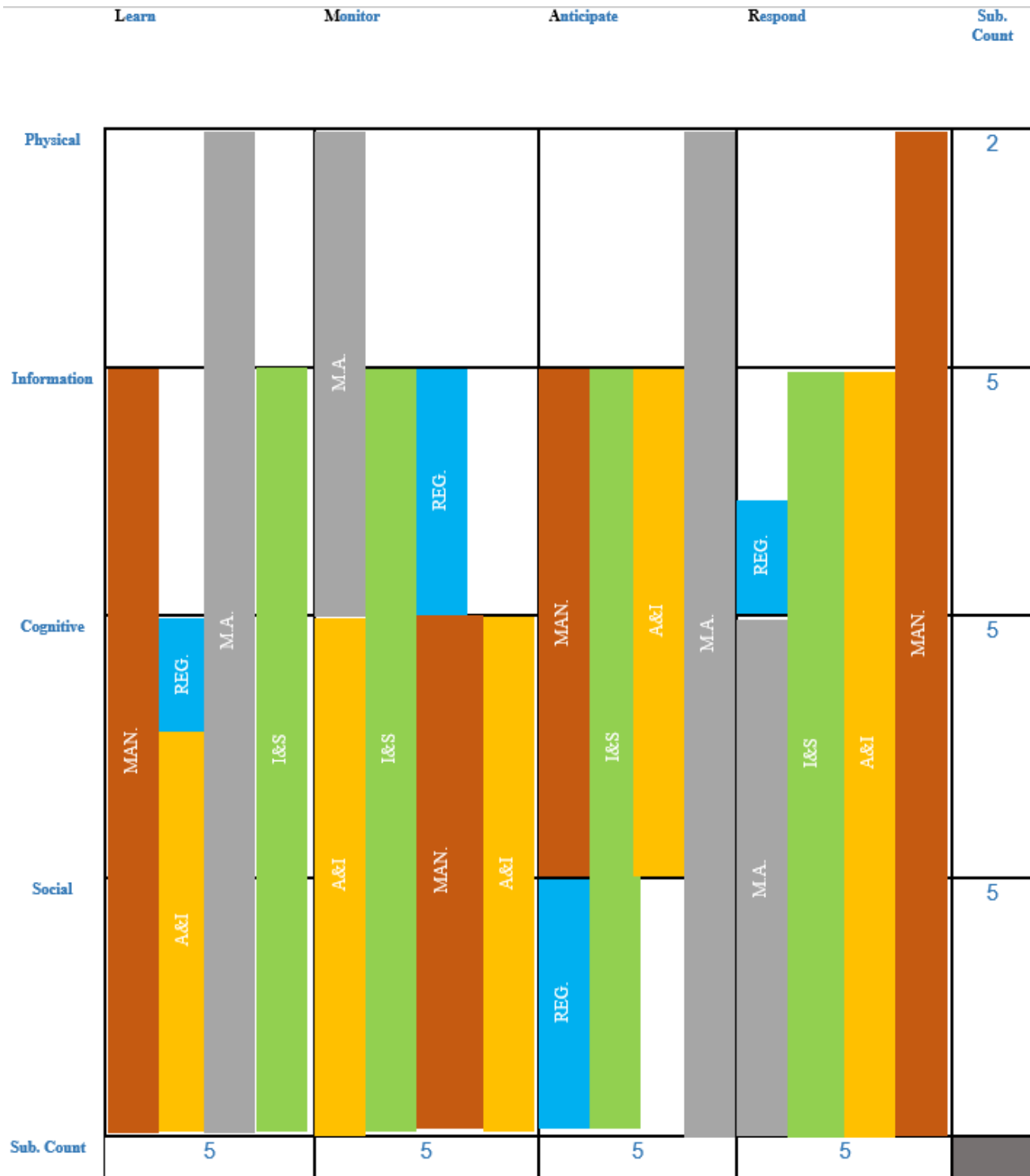
Source: Created by author

Chapter 4 – Resilience Results

4.1 Bahamas Maritime Authority

The resulting Resilience Matrix for the BMA is shown in Figure 10. Overall, the Bahamas Maritime Authority departments displays resilience potentials throughout the organization, With the exception of the physical domain threat cycle, multiple departments contribute towards resilience potentials discussed in section [2.2](#). The physical threat cycle exhibits a low subcomponent count primarily due to lack of physical staff. An interviewee placed the approximate amount of the entire BMA within their office at fifty-five.

Figure 10: RM Analysis for BMA based on interview and publications

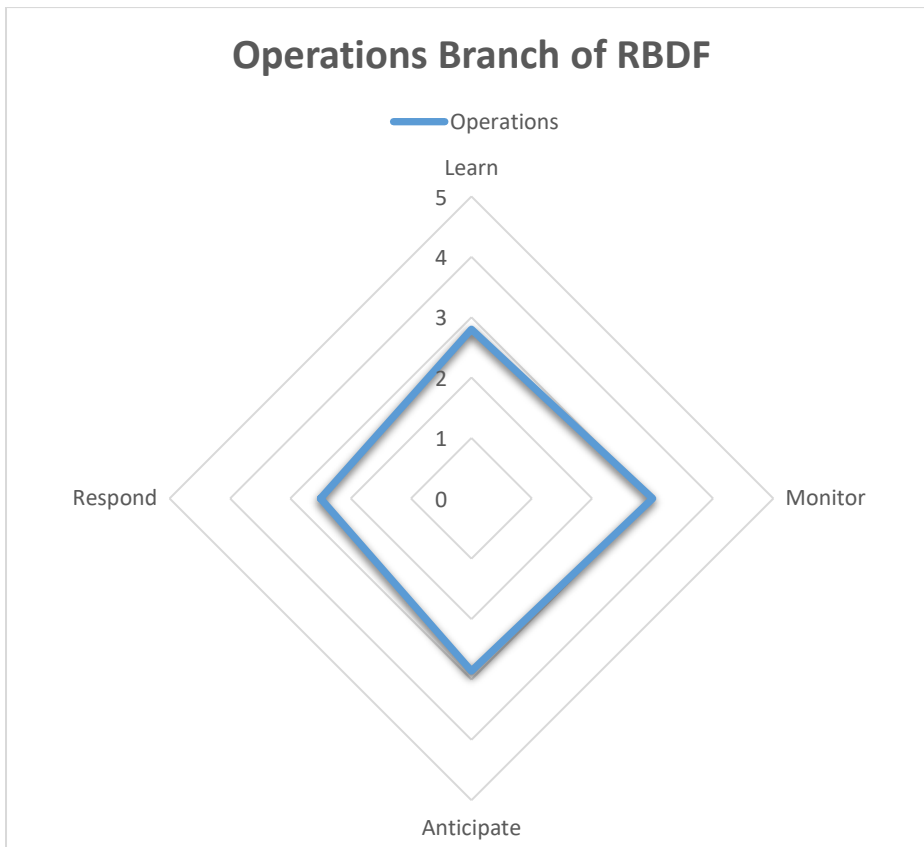


4.2 RBDF

The Operations department contains Patrol Squadron, Commando Squadron and Air Wing, which are primarily responsible for Coastal State Duties within the RBDF.

The results based on interviewees response are shown in Figure 11:

Figure 11: RBDF Operations Branch RAG Results



The RAG in this context would have yielded a more enhanced understanding had active members within the RBDF been willing participants to the research. However, the discussion with former personnel whom had experience within the Operations department yielded insight into the culture of the organization. It's observed in Figure 11 that no potential exhibits a rating exceeding 3, which is an acceptable rating based on Table 8. Though the RAG is not intended to be used as a rating in

this sense, but more of a pictorial representation and reference point for further RAG analysis as discussed previously ([3.2](#)).

Chapter 5 – Do we have Resilience Performance?

The significance of this chapter is to discuss the findings further and analyse resilience potentials within both organizations assessed. Some of the subcomponents within the BMA will be used as discussion points based on interview responses, thus demonstrating resilience thinking resulting in resilience potentials being exhibited within the organization. The questions were as reasonably possible relevant to Flag State obligations, and the respective departments' duties. A sample of how some topics were mapped to address resilience potentials is available in [Appendix 3](#).

Interviews amongst the retired RBDF personnel yielded some optimism in resilience assessment. The conversations were essentially on phone surveys asking the few participants to give their opinion on the rating of questions shown in [Appendix 2](#). Key publications of the RBDF issued were used in addition to discuss resilience performance of the organization.

5.1 Flag State – BMA

In order to achieve their objectives, the BMA has various other organizations which it must work with in performing as a quality Flag State illustrated within Figure 12.

Figure 12: BMA and relationship with other relevant stakeholders



Source: Created by author based on BMA's website.

The details of the subcomponents within the BMA were mentioned in [1.7.1](#). Though the Seafarers & Manning and Registration department both participated within interviews, the author has chosen to focus on the primarily resilience contributors within the BMA. The Seafarers & Manning department operate widely with STCW related matters for vessels within the flagged fleet. However, there is nothing binding the administration from using seafarers exclusive to the Bahamas MARAD. The

departments resilience potentials therefore do not have a significant impact on how the systems resilience is viewed. The Registration department follows a slightly similar fashion. While that subcomponent ensures international safety standards are met from vessels before earning the Bahamian Flag, the learning and monitoring elements which lead to responses are mostly triggered from inter-organization. Meaning its resilience potential is essentially a net effect of other subcomponents contributing to the organization. It was still mapped within the RM due to this aspect, but does not warrant enhanced discussion. The departments which are dominant in exhibiting resilience potentials are the Maritime Affairs, Accident & Investigation, and Inspection & Surveys, which will be discussed further.

All interview participants were heads of their specific departments, therefore part of the managerial team and allowing dual input from a department and management perspective. A concern noted in [2.4.1](#) mentioned decision makers not necessarily wanting to take action towards low-probability, high consequence events. However, the management team within the BMA encourages development of resilience potentials where practically possible and barriers are not a hindrance.

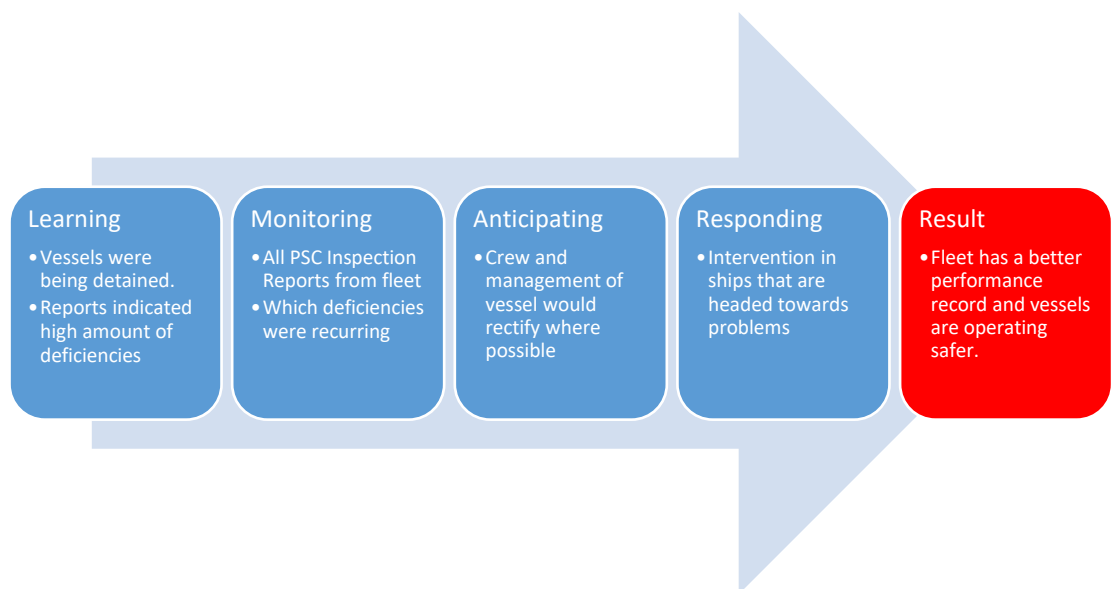
5.1.1 Inspection & Surveys

The Inspection & Surveys department within the BMA exhibits resilience potentials in ensuring vessels within the Flag comply with national and international legislations, conventions and codes to which The Bahamas is a party. The relationship with the Recognized Organization, based on the RO Code, is of extreme importance. The BMA has a relationship with 156 inspectors over 78 different countries, which are companies carrying out the statutory surveys and certification, though the department still overviews all issuances of certificates.

When questioned about the Class NK 2021 Port State Control Annual inspection report, shown in [Appendix 1](#), the author inquired about a growing trend of

deficiencies over a three-year period, in an attempt to observe any of the four potentials. However, it was noted that while the organization is aware of these statistics, RO performance reports are not necessarily a metrics the Inspection & Survey department deems important. This is due to the administration being able to **monitor** trends, knowing that often times, repeat offenders, or vessels under the same company, can interfere with performance metrics. What is important however are Memorandum of Understandings (MoU) reports. In this regard, the interviewee was asked about the Black Sea MOU report for 2020 showing a mere 1% increase in detentions. Again what the organization noted was that a large amount of detentions came from specific ports, for an even more specific type of vessel. Not wanting to get into the political sensitivity of details, it was evident that this department does manage to monitor activities of vessels, so that intervention can be possible through **anticipating** oncoming detentions if flags are constantly raised. Figure 13 illustrates a strategy implemented by this department that resulted in a vast reduction of detentions in a 10-year period, as a resulting of **learning** and **responding**.

Figure 13: Inspection & Survey department demonstrating resilience potentials in a response to reducing deficiencies



Respondent also offered views of how the International Safety Management Code (ISM Code) underpins much of the safety matters the administration is being plagued with. An argument was made that crew, and companies lack the ability to narrow down the simple document and begin to create more complex scenarios for themselves. A recommendation of perhaps Safety Management System (SMS) manuals being balanced between comprehensive and detailed without having crews feel overwhelmed.

5.1.2 Accident & Investigation

The Accident & Investigation department strives to minimize and reduce marine casualties within the Bahamian territorial waters, along with flagged fleet internationally.

Accident investigations are excellent tools of learning because they serve as reminders that through working, there are consequences, allowing routine jobs to be carried out with care and attention. They can be used as a catalyst for changing regulatory framework or laws (Hollnagel & Macleod, 2019). Accident reporting is a great demonstration of how an organization and fleet can improve. For the BMA, these reports consist of lessons to be learned, actions taken, and recommendations. These categories are what were primarily used for the basis of resilience assessment of the Accident & Investigation department. Fifty (50) accident reports were sampled and analysed with no particular preference on incident or ship type, only that the incidents were not older than ten (10) years.

For the purpose of discussion, the Fri Dolphin incident will be used as an example of illustrating resilience potentials and the benefit to the MARAD and shipping industry as a system. Additionally, the information in the reports can also help identify gaps, which when closed, can enhance the overall resiliency of the system.

Fri Dolphin on 13 February 2020:

The Fri Dolphin is a general cargo vessel that experienced a fumigant poisoning incident resulting in a fatality on 13 February 2020. The vessel was loaded with aluminium phosphide fumigant which decomposes into PH₃ as it contacts moisture in the air. Due to heavy weather, compartments experienced the failure of air and watertight seals, resulting in the fumigant entering accommodation space. Unfortunately, one of the crew members died and several others hospitalized. Information listed in IMDG Code, MSC.1/ Circ. 1264 recommended practices and guidance for fumigation, company's management system could have all been adhered to without changing the outcome.

The only actual **response** from the Flag State was issuing Safety Alert #20-01 throughout the fleet detailing hazards of fumigations and guidance in reducing risks. As per the report: "The Bahamas does not have any regulations identifying occupational exposure limit values for phosphine" and through **learning** from the incident, five different recommendations were proposed for the Flag State, which can potentially lead to further response.

The follow through of these recommendations are not entirely up to the BMA, as the Bahamas Ship-owners Association (BSA) must also be in agreement, to ensure their interests are met before an official proposal is given. An interviewee discusses this particular case mentioning that "permissible limits of fumigation that lead to this causality varies from country to country and the IMO also strives for unified interpretation". Here, the conversation begins to illustrate the barriers that inhibit resilience potentials within the MARAD, as a resulting of the "boundary" of being within the IMO as depicted in [1.2](#). The topic at hand is fumigant gases which have industry based limits, whether shore side, factory or commercial use. Yet these limits are not maritime based, nor are they uniform universally. The BMAs solution would be to adhere to the strictest limit from an industry perspective. However, this opinion

alone causes a divide amongst stakeholders as to why the strictest? Why not the second or third tier strictness? Why invest more in continuous monitoring? Issues that can be overcome and assist the MARADs effectiveness, if the IMO would establish a permissible limit, or mandate continuous monitoring.

That scenario forms a systems perspective limiting resilience potentials of a Flag State. While they learn from accidents that can protect other vessels within their fleet and the industry, more convincing is required before an effective response can be carried out within and without the MARAD system.

A gap within the BMA reporting was also addressed with the respondent discussing the language of: “should consider” proposals, revisions, implementations being used five (5) times within the recommendations for this case. While we previously addressed the reasons for the limitations, it was agreed that perhaps a follow-up system should be implemented subsequent to reporting. What happens after these proposals are made? What are the results of the meetings of industry stakeholders? What more has to be researched or suggested to convince the industry?

Demonstrating immediately that the organization is **learning** from the accident. A resilience thinking model is illustrated in Figure 14 with respect to the Fri Dolphin incident:

Figure 14: Fri Dolphin Incident resulting in resilience potentials within Accident & Investigations department

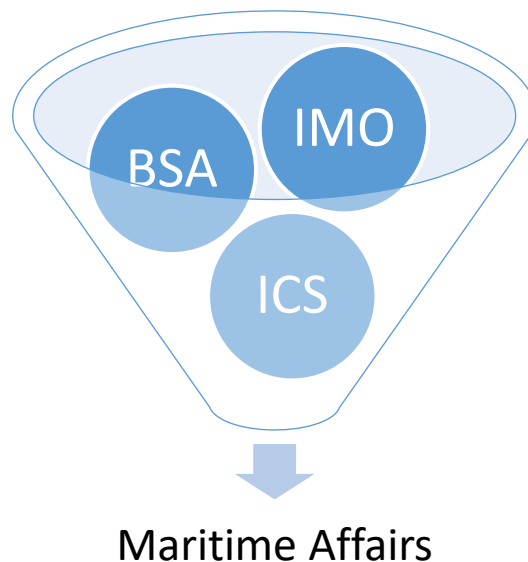


5.1.3 Maritime Affairs

The Maritime Affairs department claims a “proactive leading role” at the IMO and other international bodies. This department is an essential part of the Bahamas Flag State on the international platform, though the official delegations consists of other entities from within the MARAD such as legal attorney general’s office in The Bahamas and other delegates from the High Commission of London whom may have interest in discussion topics.

The department in conjunction with management is overtly responsible for learning from the international forums, given the direct link and attendance at IMO and subcommittee meetings. Maritime Affairs is also responsible for disseminating relevant information within the organization to departments as deemed necessary. Figure 15 depicts how relevant international bodies feed information into the Maritime Affairs department contributing directly to its **learning**.

Figure 15: Maritime Affairs Department actively learning from international stakeholders.

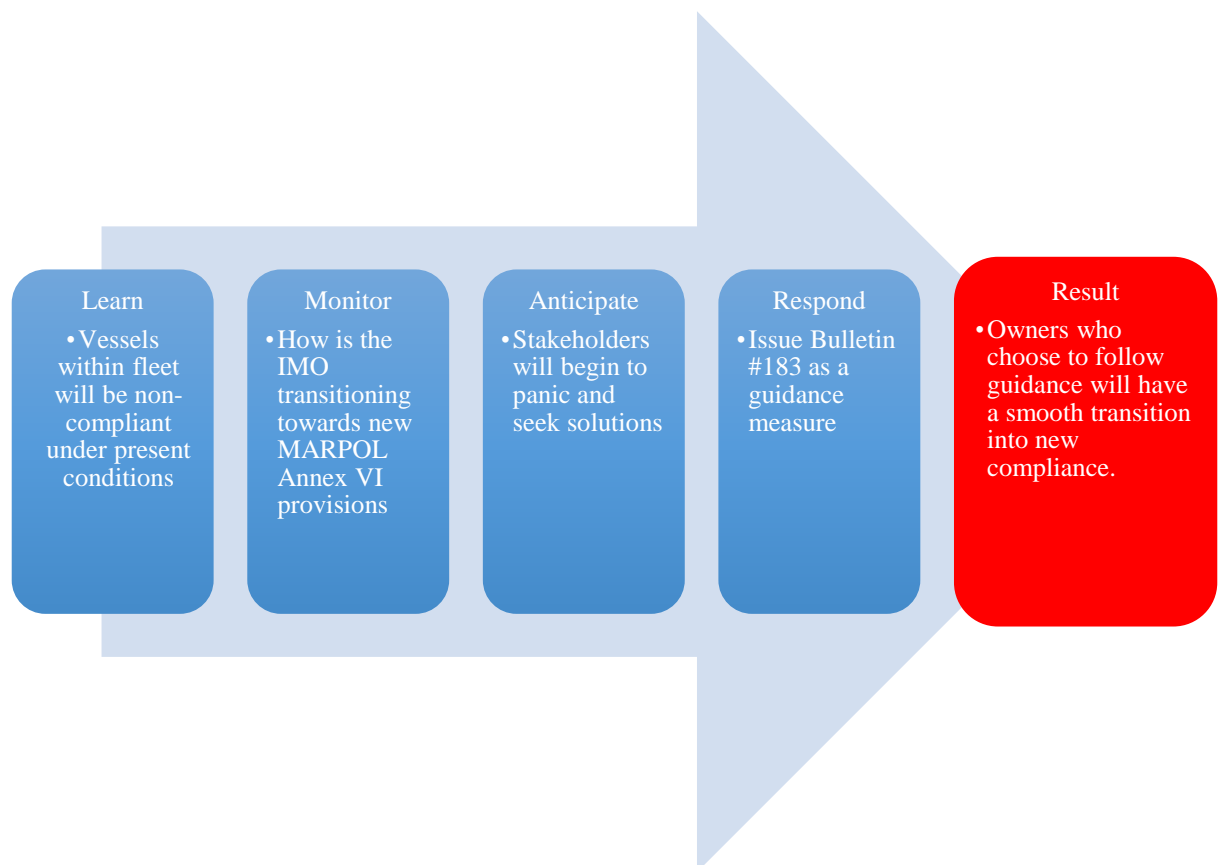


Source: Created by author.

A discussion with regards to the sulphur emission cap for January 2020 was carried out in an attempt to address measures implemented by the BMA, which have been heralded amongst the flag fleet. The maritime affairs department explained the challenges that arise when International Chamber of Shipping (ICS), engages in topics of interest with Bahamas Ship-owners Association (BSA), who then bring these matters to the Maritime Affairs department within the BMA, who concurrently is engaging in talks with the IMO. All organizations discussing the same issue, with different methods of a solution and no results.

In **anticipating** that the sulphur cap was going to be enforced, and in order to help prepare shipowners and Companies within the Flag Fleet for a smooth transition, the BMA issued Information Bulletin 183 as a proactive **response**. This provided guidance for relevant stakeholders into the entry into force of the MARPOL Annex VI provisions. Figure 16 illustrates resilience thinking exhibiting resilience performance within the Maritime Affairs Department.

Figure 16: Resilience performance by Maritime Affairs with respect to Sulphur Cap Emissions 2020.



5.1.4 Further Information

Overall, using just a few examples, despite the vast discussions, it is evident that the Bahamas Maritime Authority exhibits resilience potentials in its present operations. The Management team of the BMA has also been praised for being in the forefront with declaration of seafarers as essential workers within the international shipping community, a key **response** measure in alleviating issues plagued by the Covid-19 pandemic in the maritime industry.

Outside of the information gathered through staff members of the BMA, additional resources for assessment of resilience potentials can be gathered through analysis of their publications:

- Bulletins
- Safety Alerts
- Technical Alerts
- Marine Notices
- Information Notices

All of which, contribute to an element of Learning, Monitoring, Anticipating and Responding

5.2 Challenges

Based upon the findings of author and further discussion with staff members, there are some barriers that can be addressed to help enhancing resilience characteristics of the Flag State.

An internal barrier prohibiting the BMA from learning and responding more effectively, is the he Maritime Affairs department lacking a system whereas after

every IMO meeting, there's an official report specifying what resolutions were adopted, and what can or should be transposed into guidance or regulations for the BMA. In this sense, departments and management are admittedly reactive. However, this is a result of deficient resources, as opposed to an overlook of management or departments. Bridging this communication gap, perhaps by hiring additional personnel can be considered, thus being able to enhance resilience within the physical domain as per [4.1](#).

An external barrier to the BMA, yet inclusive within the MARAD of The Bahamas, is one which hinders the ability to respond effectively. Respondents noted that the Bahamas National Requirement which serves as guidance is a living document, whereas the Bahamas Merchant Shipping Act has not seen an update within the last two decades. Therefore, a recommendation could be put forward to the Ministry of Transport and Attorney-Generals office within The Bahamas to grant the Bahamas Maritime Authority ability to self-regulate, a privilege already extended to the banking sector in The Bahamas in response to the same issues (duration of time) raised by the BMA.

5.2 RBDF

Though the lack of willingness to participate as a result of unforeseen circumstances is rather disappointing, the assessment method proved to be a learning experience. The RAG analysis was used for the RBDF because it aims to look at operational details of the four potentials, the concrete functions that are necessary for an organization to be able to learn, monitor, anticipate and respond ([2.2](#)). The Coastal State duties ([1.7.2](#)) are based more upon concrete actions and responses.

Observed from results in [4.2](#), the operations branch, which is the main department for Coastal State duties within the RBDF, operates at just about an "acceptable" level

for all resilience potentials. Though this only serves as a baseline for the future, not necessarily an accurate representation of the present.

The Royal Bahamas Defence Force (RBDF) has published a few documents which, when combined with interviewee feedback and external reports, highlight the resilience potentials. Key publications are the Hurricane Avoidance Policy, Maritime Security Plan, and Operational Risk Management 2021. In addition, the Sandy Bottom Project commenced by the Government of The Bahamas is instrumental in enhancing resilience performance in the MARAD, through enhancing the resilience potentials of the RBDF.

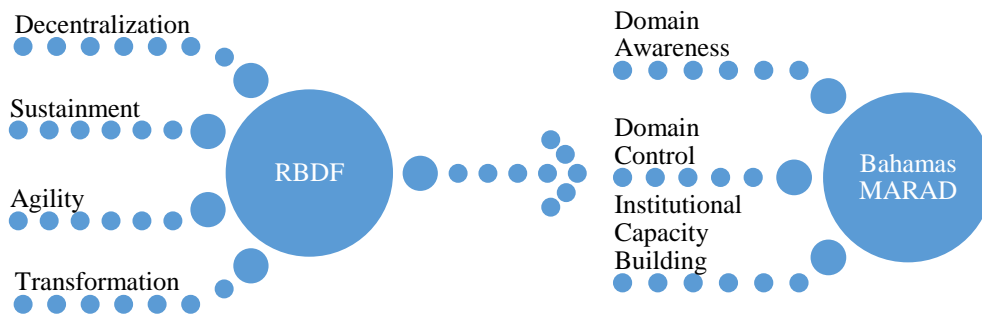
The Sandy Bottom Project is historic in nature for the Government of The Bahamas, providing measures to assist in the RBDF programs that focus on decentralization, agility, transformation and sustainment (RBDF, 2021), all of which promote Coastal State resilience. The RBDF's website states that this project will "enhance overall efficiency in conducting search and rescue and disaster relief operations, in addition to maintaining marine navigational aids for the safety of lives at sea and ashore." An important statement that will serve fruitful in future RAG assessments, as personnel, active or otherwise, should have more encouraging answers towards the resilience potentials within the organization. With this in mind, the RBDF is on the correct path to exhibit more resilience potentials by implementing the programs and processes that display resilience thinking.

Search and Rescue services within Bahamian territorial waters lies primarily with the RBDF. Yet all interviewees whom are retired RBDF personnel unanimously agreed that excessive dependence is placed primarily upon the United States Coast Guard (USCG) and Bahamas Air Sea Rescue Association (BASRA). A point of interest highlighted by a former member of the commando squadron was the sustainability of search and rescue operations. i.e how long were they willing to carry out these activities until it became too expensive to continue. The respondent discussed the

vessels being primarily for patrols, particularly for poachers or immigration. Highlighting that during their era, mitigating threats of Maritime Security was more of a focus as opposed to safety and environmental responses. The respondent continued to analyse from a frequency point of view. Owning planes meant their maintenance, which also meant pilot training, and to spend money on events which were infrequent, was not within the organizations interest. Any time a RBDF vessel went out to sea, whether its smuggling or search and rescue, considers must be made towards fuel, food, water and other provisions requiring supply. Therefore, monetary constraints based on the national security budget of the MARAD is an evident limitation. Though this is external to the organization, yet internal to the MARAD, so does not reflect resilience potentials of the RBDF.

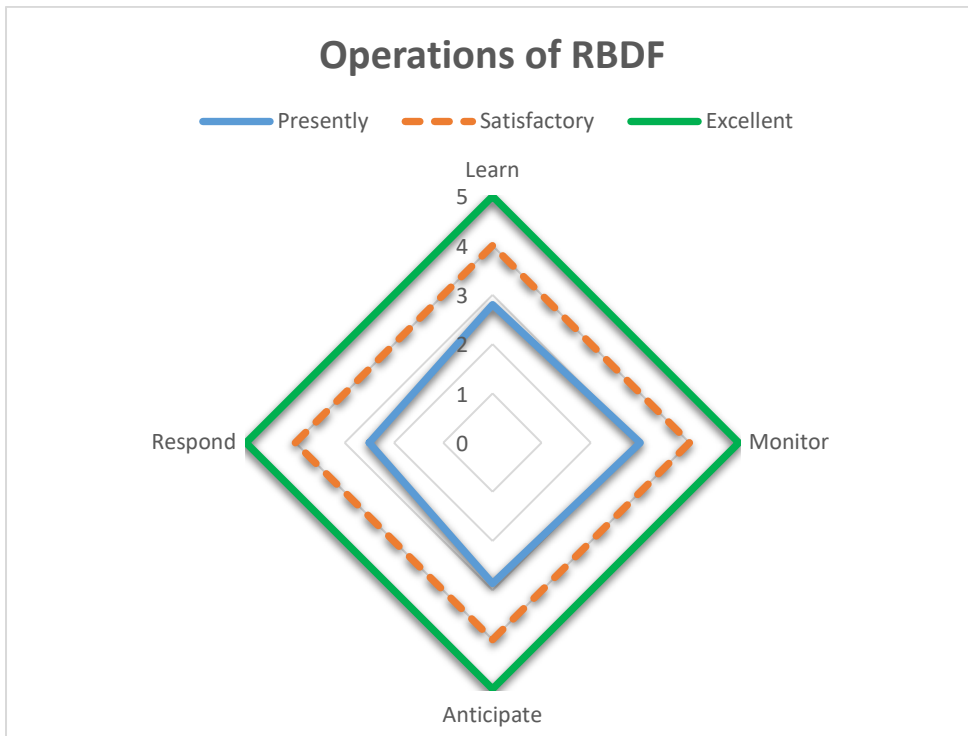
What does address resilience of the RBDF is as per Maritime Security Plan 2021, there have been thirty-nine (39) responses to Search & Rescue Cases. Yet, there's no information publicly available as to the status, or results of these cases from the RBDFs perspective. How this information being used to help improve the organization, if at all, remains a gap that may remain open due to the lack of transparency of the organization. Sometimes, knowing what the absence of resilience performance looks like, helps to understand what resilience characteristics may be present. The maritime security plan also demonstrates the four key strategies which will directly improve resilience potentials of the maritime administration, if implemented correctly, as depicted by Figure 17.

Figure 17: RBDF Organizational campaigns directly contributing to Bahamas MARAD .



If the information in publications, strategies, and other policies prove fruitful, then a potential model could be created for what the organization aims to have their RAG assessment look like in the next measurement cycle. Intermittent analysis can also be carried out in the interim, much like an internal audit, to determine whether improvements have been made in potentials. An example would follow Figure 18:

Figure 18: RAG Model for RBDF to show potential targets in next assessment.



This would also be dependent upon the nature of the questions, amount of personnel participating in surveys and other organizational factors such as expanding roles throughout more of the entire organization, changes in national priority over time, resource liabilities, etc.

6.0 Recommendations and Conclusion

In closing, recommendations towards each of the organizations addressed will be provided along with a recommendation for the entire Bahamas MARAD.

6.1 BMA: Lessons Learned, and then what?

In the published Accident Investigation Reports; lessons to be learned are learning opportunities. However, there are no clear indication as to how they are used. Companies, fleet, manufacturers and other stakeholders may read the reports, create circulars, implement training, but if they are not actually learning in order to anticipate or prevent another scenario of the same elements, then the system may struggle to improve towards safety.

An example of resilience thinking would be seen in the incident on board the cruise ship *Genting Dream*, involving a child fatality from drowning in a swimming pool due to poor and incorrectly placed sign indicating the depth. Based on the time of the report, there were “no specific international regulations for the safe operation of swimming pools on ships.” (BMA,2019). The report acknowledges that regulations ashore exist and can be tailored towards the shipping industry. A recommendation for the BMA mentioned within the report stated that regulations should be implemented requiring passenger ships with swimming pools to have lifeguards on duty to ensure safety (BMA, 2019). Two years post event and still no international guidelines, yet alone a known proposal from any member states at the IMO. This can be viewed in a negative light towards both the organizations resilience potentials, which are a direct cause of some inherent barriers. Lack of physical resources cannot be a continued excuse, especially if the incident repeats itself. Sub-Departments within the BMA can be assessed based on their contribution to the publications, or rather their follow-up. As described in the previous section, the Accident &

Investigations team can be assessed based on what takes place subsequent to completion and publication of reports. The language of “should be” shows a degree of learning in order to anticipate a potential repeat. Following up based on actual proposals or tools at the administrations disposal such as notices and guidelines, is another factor. The same thinking can be applied towards Inspections & Surveys department, who based upon type and degree of deficiencies, can be measured by any improvements and requirements within the inspection process, including the inspectors themselves.

6.2 RBDF: Cannot Measure the Unperceivable

Transparency is an evident barrier in the ability to assess resilience potentials in organizations. If members within the organization are unwilling to participate or contribute to measurement methods, and reports or necessary documentations are not available, then measurement of resiliency becomes difficult.

Therefore, organizations can be assessed more thoroughly using the methods of RAG and Resilience Matrix method, if members are willing to participate in discussions and interviews. However, there can be a more in depth analysis for the specific functions and outputs of an organization, especially in a Maritime Administration. The Resilience Matrix approach based on [3.3](#) was very information in the Department of Army (DOA) context, primarily because the DOA seeks to learn from outside systems just as much as within. The nature of a militaristic discretion can be detrimental when it involves services directly involved with the safety of externalities.

6.3 Government of Bahamas MARAD

Based upon the National maritime policy of 2017, the Bahamas MARAD has strategies and concerns that if focused upon can help enhance the resilience of the system. These focuses are shown in Figure 19.

Figure 19: Top concerns of Bahamas MARAD based on National maritime policy



Source: Bahamas National Maritime Policy 2015.

Focus on implementing resilience thinking in education and training now, so that the system will begin to exhibit potentials in the future. It might be wise to view a system made from resilient thinking individuals will endure longer than a system consistently being adapted to increase resilience potentials. Contemporary cases such as MV Wakashio off of Mauritius, X-Press pearl in Sri Lanka, and the obvious Covid-19 pandemic, should demonstrate to MARADs everywhere, reactiveness is a

mentality for yesterday. Systems as complex as those within the maritime industry must evolve into learning, monitoring, anticipating and responding based on scenarios as they are today, to prevent the disruptions of tomorrow.

The Bahamas national maritime plan states: “the impacts from international shipping and The Bahamas currently has no overarching strategic framework for managing the maritime sector”, this needs to be addressed as a nation, rather than as separate organizations.

As tedious as it may seem, the IMO’s resilient potentials can also be assessed the same way as any organization, breaking down the subcomponents to gain an understanding of the entire structure. Departments, sub-committees, member states, guidelines, regulations, actions taken post-event can all be analysed to a degree in order to gain an understanding of the system’s resilience. This can also lead to Maritime Administrations performing resiliently if they choose to perform outside the bubble of the IMO. Examples of such performance can be viewed with some EU Member States.

Hindrance in developing resilience potentials in the entire system is that each organization will have it’s own sub-set categories to focus on. Observation in the structure of the diagrams and stakeholders they interact with is required. Just because an organization is within a Maritime Administration, does not mean it’s entire function revolves around serving the purposes of the administration. Therefore, when assessing resilience of organizations instrumental in complex systems, it is important to differentiate the resilience potentials as an organization tasked with multiple system commitments, should not have potentials relevant to one system, mistaken for relevance in another. Unless the organization is being assessed independently, and not with respect to domains of a system. An example would be assessing the Ministry of Environment, which functions in the MARAD only with respect to pollution and oil spill prevention, every other element is outside the domain of maritime.

For Future Resilience Studies: Measurements based on organizational outcomes and recovery are presently less popular (Ruiz-Martin et al., 2018). This may appear normal for a standard organization, but should not be overlooked for those in socio-technical system such as the BMA and RBDF.

6.4 Yes, we can assess

We learn that organizations within Maritime Administration system can be assessed for their resilience potentials, and benefit from improved performance and safety with respect to international obligations, if these potentials are further enhanced and developed. In the case of the RBDF, an initial rag analyses can be used based on personnel responses to questions in addition to documents, websites and publications. It is easy to create publications that show a sense of enhancing the organizations ability to learn, monitor, anticipate and response, yet the implementation process may not be effective. However, these should reflect in the overall RAG analyses of personnel within the organization since particular cases should improve.

Having retired or personnel no longer present in the organization can also serve useful, as their perspectives during their tenure can be reflected in comparison to those presently within the organization to observe what has changed or remained the same.

Following these resilience assessments, the next phase may be consideration as to what comparisons must be made, whether to internal organizations in the MARAD,

or externally. Another thought would be analysing the degree, or strength of the resilience potential. For the study on the BMA subcomponents we can see that each department exhibits some resilience potential. This is effective for illustrating what is lacking, and where, not necessarily how well it does, or how well it can perform, in learning, monitoring, anticipating and responding.

“The monitoring of performance through operational safety audits, error counting, process data collection, and incident tabulations has become institutionalized and in many cases required by legislation or regulation. As long as an industry can assure that components (parts, people, companies, countries) can comply with pre-specified and auditable criteria, it affords the belief that it has a safe system”

(Dekker, et al., 2008)

In presenting this concept, the author hopes that one day, a full and complete resilience assessment can be created of an entire maritime administration as depicted in Figure 20. This is simply a concept, the true work is implementing resilience thinking in our actions as seafarers, administrators and regulators.

Figure 20: Future proofing: A Comprehensive RM of The Bahamas MARAD.

	LEARN	MONITOR	ANTICIPATE	RESPOND	SUB. COUNT
PHYSICAL	High Commission	Government of The Bahamas		Port Department	
INFORMATION	Regional Co-operation	ICS	MARAD ENCOMPASSING RESILIENCE POTENTIALS	Meteorology Department	
COGNITIVE	BSA	Recognized Organizations		Ministry of Foreign Affairs	
SOCIAL	Attorney- General	BMCC		RBPF	Ministry of Environment
		BMA		RBDF	Ministry of National Security
SUB. COUNT					

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Appendices

Appendix 1 Semi-Structured Interview Questions for BMA

Accidents & Investigation:

Information based on discussion about accident reports selected by author: Fri Dolphin, Genty Dream, MV Bulk Jupiter, MV Sherice M, MOL Comfort.

Vessel	Incident	BMA recommendations
Fri Dolphin	Fatality from fumigant poisoning	<i>SHOULD CONSIDER proposal to IMO Continuous Gas monitoring affixed within the accommodation and engine spaces of vessels carrying fumigated cargoes. SHOULD CONSIDER proposal to IMO on international standard of occupational exposure limit values for safe use of pesticides on vessels requiring fumigation. SHOULD CONSIDER implementing occupational exposure limit values for applicable vessels as an interim. SOULD CONSIDER revision of Load Line Survey effectiveness carried out by RO's to ensure gastight and watertight integrity. SHOULD CONSIDER revision of ISM audits by ROs towards adequacy of risk assessments for safe carriage of fumigated cargoes.</i>
Genting Dream	Passenger Fatality	Consider implementing regulation requiring passenger ships with pools to have qualified lifeguards on duty to ensure safety of occupants during operating hours
MV Sherice M	Fire	<i>Proposal to integrate Caribbean Safety Codes into national legislation within Merchant Shipping act 1976, chapter 268 as amended. Draft proposal for a regulatory framework for ministry of transport to ensure all home-trade vessels meet min. regional standards. Conduct review of existing procedures for annual inspections for domestic fleet. Include this case in IMO GISIS for sharing lessons with other states (4).</i>
MV Bulk Jupiter	Fatality	Propose to IMO review of IMSBC Appendix 1 schedule for bauxite and its associated Group C rating and composition.
MOL Comfort	Sinking	Further investigate issue of ventilation of totally enclosed lifeboats with a view to improving thermal loading of occupants in emergency situations

Inspections & Survey:

1. Admittedly from your department's website: "*Many of today's new build ships have advanced features that are not yet addressed by existing legislation*", which leaves the department being subjected to for advice and consultations. Could you discuss the process and challenges involved with sourcing and outsourcing information?
2. Problems faced within the flag state, Bahamian ship-owners and the wider shipping industry are all concerns for the BMA. How does the BMA use lessons or issues discussed by the shipping community to improve their organization and fleet?
3. As per the ICS 2020/2021 Flag State Performance table, The Bahamas as a flag has positive performance indicators across all categories such as PSC, Ratification Conventions, RO's, fleet age, reports, and IMO contributions. From this perspective, what more can be done by your department to further enhance the fleet? What can other flag states learn from this department or the BMA in this context?
4. The Bahamas national requirements is considered a "live" document to be updated as required. Can you elaborate on what factors your department, and the BMA considers entering and updating the document? Can you discuss the process leading to this?
5. With respect to Recognized Organizations:
 - a. Could you elaborate on the relationship between your department, the BMA, and the RO's
 - b. As per ClassNK 2021 Port State Control Annual Inspection report:

Country	2018			2019			2020		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Panama	131	2,519	5.2%	135	2,548	5.3%	94	2,490	3.8%
Singapore	11	549	2.0%	8	590	1.4%	11	608	1.8%
Marshall Islands	21	494	4.3%	28	564	5.0%	22	595	3.7%
Hong Kong	14	393	3.6%	13	382	3.4%	18	374	4.8%
Liberia	24	400	6.0%	27	434	6.2%	15	471	3.2%
Japan	3	302	1.0%	4	320	1.3%	2	309	0.6%
Malta	13	163	8.0%	8	151	5.3%	2	152	1.3%
Bahamas	2	110	1.8%	4	116	3.4%	5	114	4.4%
Turkey	0	65	0.0%	1	57	1.8%	1	50	2.0%
Thailand	3	78	3.8%	3	75	4.0%	1	68	1.5%
Cyprus	10	66	15.2%	5	61	8.2%	0	61	0.0%
Malaysia	0	50	0.0%	0	54	0.0%	0	54	0.0%
Other Flag	27	328	8.2%	17	333	5.1%	10	428	2.3%
Total	259	5,517	4.7%	253	5,685	4.5%	181	5,774	3.1%

Note: (I): No. of Detentions, (II): No. of NK SMC Ships, (III): Detention Ratio = (I) / (II) %

There appears to be a growth in detention ratio over the past 3 years with this particular RO. Though, there may be no blame to cast given the circumstances of each detention. Could you describe how this information would be used within your department and if any changes would result? Are reports published by other ROs utilized within the BMA outside of Inspection & Surveys? If so, how?

6. The inspection & surveys department participates in working groups at the IMO, while also advising on technical aspects for maritime safety investigations. What benefits does this bring to the organization and fleet? What exactly are the results of participating in these working groups as it relates to the administration?
7. What is the department's position on offering remote services and e-certification for inspection and surveys?
8. The Bahamas Maritime Authority has 156 inspectors available over 78 different countries. Can you explain how the relationship works between the BMA and these inspectors? What have been some issues encountered and how has the administration chosen to respond? Under what criteria are the inspectors considered?
9. With reference to the BMA's, PSC report of 2019:

Period 2017-219	Inspection	Detention	Period detention	Period	Rank among largest flags	MoU Rank	Note
Abuja MOU	268	0	0.00%	2017-2019	1	-	N/A
Black Sea MOU	519	6	2.46%	2017-2019	5	-	N/A
Caribbean MOU	112	0	1.65%	2017-2018	1	-	2017-2018. Year 2019 report not published yet.
Indian Ocean MOU	547	9	1.65%	2017-2019	1	-	N/A
Mediterranean MOU	128	1	0.78%	2017	2	-	2017. Year 2018 and 2019 reports not published.
Paris MOU	2,124	27	1.27%	2017-2019	1	3	white list
Riyadh MOU	217	0	0.00%	2017-2018	1	-	2017-2018. Year 2019 report not published yet.
Tokyo MOU	2,233	37	1.66%	2017-2019	2	7	white list
USCG	1626	8	0.49%	2017-2019	1	-	Q21 Qualified for 2020
Vina del Mar MOU	807	1	0.12%	2018-2019	1	-	2018-2019. Year 2017 report not published.

With the exception of the Black Sea MoU, the BMA fleet has maintained a detention rate of less than 2% through 2017-2019. A vast improvement of the inspection to detention ratio from 2009. Can you discuss the processes, ideas, or any contributing factors that would have led to this 10 year turn around?

10. The table below is Inspection Data by Flag taken from the Black Sea MoU report for 2020:

FLAG	NUMBER OF INSPECTIONS	INSPECTIONS WITH DEFICIENCIES	NUMBER OF DEFICIENCIES	NUMBER OF INSPECTIONS WITH DETENTIONS	NUMBER OF INDIVIDUAL SHIPS INSPECTED	DETENTION PERCENTAGE	% OF INSPECTIONS WITH DEFICIENCIES
Antigua and Barbuda	79	45	258	4	69	5.06	56.96
Azerbaijan	14	8	37	3	10	21.43	57.14
Bahamas	113	39	185	4	94	3.54	34.51

Statistics such as these do not necessarily reflect poorly on the Flag State given what is considered exceptional performance in other MoU's. Would you mind elaborating on how the Inspections & Survey department would use this information?

Maritime Affairs:

1. Directly from the Maritime Affairs website it states there is a “*proactive leading role at the International Maritime Organization (IMO), EU and Quality Shipping Committees.*” Can you discuss how Maritime Affairs, in conjunction with other departments in the BMA, carries out proactive leading?
2. Problems faced within the flag state, Bahamian shipowners and the wider shipping industry are all concerns for the BMA. How does the BMA use lessons or issues discussed by the shipping community to improve their organization and fleet?
3. Based upon my compilation in the excel sheet: Published Accident & Investigation reports have three (3) elements I’m interested in. These are: Lessons to be Learned, Actions Taken, and Recommendations. With this in mind;
 - a. How are lessons to be learned utilized within the BMA?
 - b. In the sample size of investigations, there were seven (7) types of incidents, twenty-five (25) actions taken of which only two (2) applied to the BMA (8%). Can you explain why this might be?
 - c. Using the same sources, there were a total of thirty-three (33) recommendations of which only seven (7) applied to the BMA (21%). The **Fri Dolphin** in particular (see excel sheet and attached report) resulted from fatality due to fumigant poisoning where the phrase “should consider” was used for all proposals, implementations and revisions in five recommendations. What does the process of “consideration” mean to the BMA? How do considerations turn into actions? Are they feasible to recommend in the first place?
4. Technical Alerts were introduced in 2013 by the BMA and Safety Alerts followed in 2017, neither of which are mandatory, but advisory. While the intent of both is clear per IN-12, where and why did the concept come about?
5. What procedures are in place to ensure that notices and alerts are adequate and relevant ?

6. Information Bulletins such as #183 aimed for “*preparation for a coordinated and orderly transition*” into what was then upcoming sulphur limit changes in 1 Jan 2020. What systems does the organization use to look into the future for potential safety and security related weaknesses and threats? How are these communicated to relevant people, departments or processes?
7. What methods are in place to ensure the information communicated through notices, bulletins, guidelines, etc. lead to meaningful, useful or necessary actions being taken within the organization and fleet?
 - a. How do you determine whether these methods are properly resourced?
8. What systems are in place to determine the criteria for responding to an event?
 - a. What is the threshold when a response will be activated via direct interventions?
 - b. What is the threshold to return to a normal state?
9. How is the relationship between the Bahamas High Commission, Ministry of Transport and BMA structured? How do these parties work towards accomplishing their goals?
10. How would you describe the BMA’s relationship with their RO’s? Do you feel there is an oversight?

Supplementary:

11. Domestic Ferry Legislation implementation strategy?
12. General feeling about the process of published reports, especially those not in public domain
13. How the BMA addressed matters of Remote services, Covid-19, seafarers contracts, e-certification for inspections and surveys.

STCW [from a managerial perspective]:

1. Could you discuss your role within the Seafarers & Manning department, and how it contributes to the BMA as an organization?
2. Covid-19 has called for creativity in many aspects of the maritime industry, seafarers documentation being amongst the list. Whether it be renewals, extensions, expirations, what were some of the challenges faced or tools implemented to address this matter?
 - a. With PSCO's of different regions?
 - b. Working conjunction with any others within the BMA to resolve these issues?
3. Your website addressed there's a growing number of requests sent to the BMA for revision and issuing of statement letters for internal non-STCW training.
 - a. How do you feel the nature of seafaring training approval will change?
 - b. Is there a growing shift towards on vessel training for larger ships/ companies?
4. Can you discuss any challenges faced in establishing Safe Manning Documents in conjunction with Work Rest Hours Regulations?
 - a. Thoughts about moving forward or how to address some of the issues? (Strictly manager's/owners responsibility? How is it revised?)
5. Certificate of Competency discrepancies

Registration:

1. Could you describe what typical day-to-day operations would look like for the registration department? Has the routine improved over time?
2. The BORIS system has been praised for increasing business efficiency and time costs for the registration process:
 - a. How has your department viewed transitioning towards e-certification, digital registry or any other electronic formats relevant for registration?

- b. Outside of potential resource issues, what factors (if any other) lead to adaptation of BORIS?
3. In what ways does the registration department assist other departments within the Bahamas Maritime Authority? Additionally;
 - a. Could these contributions be improved?
 - b. How do other departments within the BMA help or improve registration practices?
4. As per the ICS 2020/2021 Flag State Performance table, The Bahamas as a flag has positive performance indicators across all categories such as PSC, Ratification Conventions, RO's, fleet age, reports, and IMO contributions. From this perspective, how does the registration department view these metrics from incoming flag transfers, or companies wishing to bring in their new builds?
5. Can you discuss any other challenges and solutions presently being monitored or anticipated by the registration department?

Regional Director(Asia):

1. Could you discuss your role and duties as Regional Director for the Asia region? How does your domain contribute to the Bahamas Maritime Authority performance as an organization?
2. Problems faced within the flag state, Bahamian ship-owners and the wider shipping industry are all concerns for the BMA. How does the BMA use lessons or issues discussed by the shipping community within your region to improve their organization and fleet?
3. The Bahamas Maritime Authority has 156 inspectors available over 78 different countries. Can you explain how the relationship works between the BMA and these inspectors? What have been some issues encountered within your region, and how has the administration chosen to respond?
 - a. How has the remote services and e-certification processes contributed to the fleet within your region?

4. The following snapshots are taken from the Tokyo MoU on Inspections and Detentions from flags for the year 2016 and 2020:

Flag	Number of inspections				Number of detentions				3-year rolling average detention %
	2014	2015	2016	Total	2014	2015	2016	Total	
Antigua and Barbuda	502	473	423	1,398	27	25	17	69	4.94
Australia	3	4	12	19	0	0	0	0	0
Bahamas	661	733	764	2,158	16	20	14	50	2.32

Flag	Number of inspections				Number of detentions				3-year rolling average detention %
	2018	2019	2020	Total	2018	2019	2020	Total	
Algeria	0	3	2	5	0	2	0	2	40.00
Antigua and Barbuda	280	247	143	670	10	11	4	25	3.73
Argentina	1	0	1	2	0	0	0	0	0
Australia	2	9	1	12	0	0	0	0	0
Bahamas	749	727	417	1,893	9	11	11	31	1.64

Can you discuss the challenges, changes, thought process and decision making involved with respect to reduction of amount of detentions from the flagged fleet, despite having increasing inspections?

5. The Bahamas Flag prides itself on being whitelisted under the Tokyo MOU. Can you discuss what measures will be taken to ensure the fleet maintains this status or improve their ranking?
6. As per the ICS 2020/2021 Flag State Performance table, The Bahamas as a flag has positive performance indicators across all categories such as PSC, Ratification Conventions, RO's, fleet age, reports, and IMO contributions.

From this perspective how does the Asian region of our fleet contribute towards these indicators? What can other flag states learn from this region or the BMA in this context?

7. Discussion of MV Bulk Jupiter.

Appendix 2 Semi-Structured Interview Questions for RBDF

Learn	Monitor	Anticipate	Respond
The personnel training across departments are up to standard for the organization to fulfil required duties?	The RBDF has the ability to monitor potential events, whether internally or externally with respect to coastal state obligations?	Is there a culture within the RBDF that encourages thinking about the future?	The RBDF ability to carry out SAR operation without dependency upon external organizations (BASRA,USCG,CaribbeanMoU, etc.) is acceptable?
The RBDF seeks to learn from things that go well as opposed to only failures/disruptions?	The RBDF has a list of performance indicators to identify how well functions are carried out?	Future threats and opportunities are assessed based on current or potential capabilities?	Are there sufficient drills or exercises being carried out for realistic scenarios?
Procedures, regulations, trainings, instructions, alterations and etc. are conducted from “lessons learned”?	Do the indicators of the RBDF contribute to the continuous learning (if at all)	The RBDF is prepared and equipped to aid vessels in distress within territorial waters?	The RBDF’s response to an oil spill (<Tier II) would be sufficient ?
Resources for learning are adequate across the RBDF and utilized for enhancement?	The RBDF conducts inspections and audits within itself to identify its resources are up to standard, in order to be prepared?	The RBDF is prepared to perform in low-likelihood, high consequence events? (hurricanes)	The RBDF’s has organizational support and resources to maintain a sustainable response as the scenario requires?
There are systems in place to ensure learning results in changes which further promotes safety and security?	Aids to navigation are being maintained and operated based on international regulations and guidelines?	Does the RBDF have sufficient contingency plans for routes, areas, resources, critical for responses?	The RBDF is able to enhance response efforts on sight?

Ratings from Respondents

Learn	R1	R2	R3	AVG
The personnel training across departments are up to standard for the organization to fulfil required duties?	4	4	4	4
The RBDF seeks to learn from things that go well as opposed to only failures/disruptions?	2	3	1	2
Procedures, regulations, trainings, instructions, alterations and etc. are conducted from “lessons learned”?	3	3	3	3

Resources for learning are adequate across the RBDF and utilized for enhancement?	4	3	4	3.66
There are systems in place to ensure learning results in changes which further promotes safety and security?	2	1	1	1.33
	Weighted Average: 2.8			

Monitor	R1	R2	R3	AVG
The RBDF has the ability to monitor potential events, whether internally or externally with respect to coastal state obligations?	3	3	3	3
The RBDF has a list of performance indicators to identify how well functions are carried out?	3	3	3	3
Do the indicators of the RBDF contribute to the continuous learning (if at all)	4	4	3	3.66
The RBDF conducts inspections and audits within itself to identify its resources are up to standard, in order to be prepared?	4	4	4	4
Aids to navigation are being maintained and operated based on international regulations and guidelines?	2	2	3	2.33
	Weighted Average: 3.0			

Respond	R1	R2	R3	AVG
The RBDF ability to carry out SAR operation without dependency upon external organizations (BASRA,USCG,CaribbeanMoU, etc.) is acceptable?	3	2	2	2.33
Are there sufficient drills or exercises being carried out for realistic scenarios?	4	4	4	4
The RBDF's response to an oil spill (<Tier II) would be sufficient ?	3	3	3	3
The RBDF's has organizational support and resources to maintain a sustainable response as the scenario requires?	2	1	2	1.33
The RBDF is able to enhance response efforts on sight?	2	2	2	2
	Weighted Average: 2.5			

Anticipate	R1	R2	R3	AVG
Is there a culture within the RBDF that encourages thinking about the future?	3	3	3	3
Future threats and opportunities are assessed based on current or potential capabilities?	4	3	3	3.33

The RBDF is prepared and equipped to aid vessels in distress within territorial waters?	3	3	3	3
The RBDF is prepared to perform in low-likelihood, high consequence events? (hurricanes)	3	3	3	3
Does the RBDF have sufficient contingency plans for routes, areas, resources, critical for responses?	2	2	2	2
	Weighted Average: 2.86			

Appendix 3 Examples of resilience potentials being displayed for BMA

Subject	Learning	Monitoring	Anticipating	Responding
Cruise and passenger ships coming with larger fairgrounds on board.	As ships get bigger, their facilities will become more accommodating.	Size of ships, construction regulations per SOLAS and shore side.	International regulations at the time lacking. BMA decided to follow shore based regulation.	Implementing fairground regulations using German shore side rules as a guideline
Fuel System changes	Research more about the fuels that may become market ready ahead of any international guidelines.	IGF Code framework and any potential specifics for lower flash point fuels	Expecting methanol, ammonia, hydrogen based substitutes for fuel use on ships.	Consultation with experts and professional bodies. Conducting own in house research
Scenarios where regulations are not yet existing.	Future discussions with ship owners, builders and interested parties that will contribute to drafting regulations	NGO's and other major registries approaches		Regulations implemented through shipping act (Reference to GENTY Dream Case)
Bulk Jupiter	Bauxite not as safe as suspected. Thorough work carried out with China & Australia to discover dynamic separation phenomenon.			Proposal to IMO revision of IMSBC Appendix.
Self-Discharging Bulk Carrier	Vessels should test their sprinkler heads opening more frequently and that sufficient pressure for opening and sustaining is observed. Acceptance of reactive responses, yet proactive measures for future incidents of similar nature.	Observing inspection reports to determine failure rate of nozzles opening	Vessels can suffer catastrophic damages in the event of fire and the sprinkler nozzles fail	Raising awareness at IMO for revision of FSS code with nozzle testing. Specific fire and safety risk assessment provision within ISMBC code. Notices to fleet with recommendations of testing intervals.
ISM Code	ISM Code underpins a lot of elements that lead to issues faced			
Recognized Organizations*	Classing becomes a barrier due to monetary concerns of <500GT vessel owners and yacht operators.	Whether or not being an IACS Member is sustainable for maintaining a safe fleet domestically.	With a growing international and domestic fleet, we have to build up surveying	Annual meetings with ROs to discuss areas of interest. Considering easing restrictions for

			capacity within the country.	non-IACS society to survey vessels <500 GT.
Class Inspection reports	If a particular class is encountering issues, investigation is carried out to see if the problem is a ship or company.	RO's are not observed in isolation, rather the fleet is observed for performance as a whole. Overall, annual detention has decreased significantly.	RO's to address abnormal circumstances internally before flag considers matters a concern.	Vessels, companies who consistently produce dreadful PSC despite guidance will be asked to leave flag.
Memorandum of Understanding statistics	Ships age is generally a factor within Black Sea MoU. Cannot target or specifically attack any particular port or region. These are used as Metrics unlike RO reports	Black Sea MoU noticeably higher detentions than other MoU's. Analysed further into Ship, Company, and specific Ports for trends.	As the company with older fleet begins upgrading ships or removing old vessels, discrepancies with PSCO's should decrease.	With respect to black Sea MoU, new inspector appointed.
Overall detention rate decreasing		PSC Reports for detained vessels		Requested older reports
MARPOL Annex IV	Port reception facilities not a priority within government plan, hence hesitation in signing. Public misconception about sewage from passenger ships and educating on effluent composition required for stakeholders creating issues.	Perception of being a non-signatory of annex amongst industry stakeholders.	Other flag registries would use non-signatory status as a tool to dissuade owners from flagging with Bahamas	Convinced government of The Bahamas to sign, despite reservations of port reception facilities.
Covid-19	Limitations placed on Government, specifically AG office due to emergency orders.			
Bahamas National Policy(Requirements), Merchant Shipping Act.	Bulletin system becoming overwhelming and following a more established format like that of the MCA.	How updated information is distributed amongst fleet, especially with national document not being updated within last two decades. Regulation creation takes too long to create due affiliation with government agency.	Outdated referencing of information amongst fleet becoming	New Shipping Act under development. New formatting of notices: What you have to do vs. what you can do. Turned BNR into a living document.
Legislation not being up to date	Maritime Affairs department could work better with other departments to know what's going to be adopted for the BMA to begin transposing regulations and other guidance.			Resource issue and will probably begin bringing in people to begin this process

