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**ONE HUNDRED YEARS OF INTERNATIONAL COOPERATION IN
HYDROGRAPHY: A LOOK AT INTERAGENCY COOPERATION
IN HYDROGRAPHIC SURVEY IN NIGERIA**

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INTRODUCTION

1. The link between humans and oceans has been fundamental to the development of civilization. Throughout history, the seas and oceans of the world have been essential for the exchange of goods, people, ideas and religion¹. This is evident today as about 80 per cent of global trade by volume is presently being carried by seas and oceans which cover 75 per cent of the earth's surface.² Global maritime trade has effectively permitted an enormous variety of resources to be more widely accessible and has enabled the widespread distribution of our planet's common wealth and to the increase and acceleration of the development of many States³. This dependence of trade on marine transportation therefore makes having accurate and up-to-date information about the seas crucial. A critical understanding of these waterways towards ensuring their safe and effective utilization by nations and other entities necessitated the development of applied sciences such as hydrography. Hydrography is that branch of applied sciences which deals with the measurement and description of the features of the seas and coastal areas for the primary purpose of navigation and all other marine purposes and activities,

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including offshore activities, research and protection of the environment⁴. Hydrography provides such vital information as water depth, hazards, tides and currents among others which enables mariners navigate safely across seas and oceans

2. There are no barriers, boundaries, or borders in the ocean, and although we often list the oceans separately, they are all interconnected to each other, forming one global ocean⁵. This means that coastal nations all over the world are affected by the connectedness of the ocean thus underscoring the international relevance of hydrography. Hydrographic information has typically been published in the form of nautical charts. These charts connected the global oceans across continents and proved critical for providing mariners the world over with the information they needed to navigate ships safely and efficiently. It therefore meant that international cooperation between chart making nations was crucial to ensure standardization of these nautical publications in order to eliminate ambiguity and ensure conformance to universally accepted practices. Additionally, mariners always needed to know the water routes to countries and ports with which they traded. This required the use of charts which had to be interpreted from foreign languages. Hence, there existed a pressing need to achieve international standardization in nautical charts and associated publications in the interest of peaceful trade and the development of better global communications.

3. The need to promote international cooperation and conformity to standards led to the first tangible steps being taken to establish an international organization that would promote the objectives of conformance to standards through coordinated international action. This was achieved through a meeting of hydrographers at a conference held in Washington in 1889 and a second one held

in Saint Petersburg in 1912. Furthermore in 1919, a hydrographic conference was held in London and had 24 countries in attendance⁶. It was here that a unanimous decision was taken to establish a permanent coordinating organization to standardize charts and nautical products in aid to safety of navigation within world's seas, oceans and lakes. This move gave birth to the International hydrographic Bureau (IHB). The Bureau commenced its activity in 1921 with headquarters in the Principality of Monaco⁷. On 31 May 1976, Nigeria joined the IHB in order to demonstrate her commitment to providing accurate hydrographic services for international and local shipping and thus promote international cooperation. In a bid to achieve the aforementioned objectives, the federal government instituted several agencies with connected interests in hydrography in relation to coastal waters and inland waterways. These agencies include the Nigerian Navy (NN), Nigerian Port Authority (NPA), Nigerian Maritime Administration and Safety Agency (NIMASA) and National Inland Waterways Authority (NIWA). Over the past decades, these agencies have collaborated in various aspects of hydrography in a bid to provide mariners with up-to-date nautical information in the most standard form in order to aid safe navigation within Nigeria's waters. Notwithstanding this inter-agency cooperation, hydrography in Nigeria still remains fledgling stage.

4. It is against this backdrop that this paper seeks to highlight 100 years of international cooperation in hydrography with emphasis on interagency cooperation in Nigeria. The paper will cover historical development of hydrography, 100 years of international cooperation in hydrography as well as overview of hydrography in Nigeria. The paper will further consider interagency cooperation in hydrography in Nigeria, challenges of interagency cooperation among hydrographic stakeholders in Nigeria and finally a path forward: priority

areas for interagency collaboration between maritime stakeholders in Nigeria. It is assumed that the effective synergy between hydrographic stakeholders in Nigeria will aid in the improvement of international hydrographic cooperation. The paper shall be limited to the last 100 years of international hydrography which is the period of coordinated efforts in the practice of hydrographic survey.

AIM

5. The aim of this paper is to highlight 100 years of international cooperation in hydrography, while laying emphasis on inter-agency collaboration between hydrographic stakeholders in Nigeria with a view to making recommendations.

HISTORICAL DEVELOPMENT OF HYDROGRAPHY

6. One of the oldest stories of the sea titled ‘The Odyssey’ was written by the Greek poet Homer, circa 900 B.C. It tells the story of the mythical sea voyage made by the legendary Greek king Odysseus and mentions a part in it where Odysseus says to his crew ‘My friends, east and west mean nothing to us here’ referring to when they were lost in the vast seas during the course of their voyage. The first Western civilization known to have developed the art of navigation at sea was the Phoenicians, circa 2000 B.C. During these ancient times, sea voyages were undertaken using sailing directions which were based on the experience and estimates of seafarers. These sailing directions contained important information that was needed to safely sail from one port to the other. In more recent times, nations of the world began to develop the art of hydrography and nautical chart making as a means of facilitating safety of navigation at sea. Early hydrographic surveys consisted of depths measured by sounding pole and hand lead line, with positions determined by three-point sextant fixes to mapped reference points⁸.

Lead lines were ropes, or lines, with depth markings and lead weights attached with the lines lowered and read manually to obtain depth values.

7. The nation of Denmark was one of the earliest countries to conduct hydrographic survey and nautical charting on a national scale. The Danish Admiralty first organized and conducted charting of Danish waters in the late 1600s. This included mapping the country's 500 islands and 7000-km long coastline⁹. In 1784, the country had collected relevant navigational details for both Danish and international waters. Thus, reliable and accurate charts were developed for both Danish Navy and Merchant Marine. The USA traces its nautical charting efforts back to 1807 when President Thomas Jefferson founded the agency known as Survey of the Coast to provide nautical charts that would ensure safe shipping, national defense, and maritime boundaries. The agency conducted hydrographic and oceanographic surveys, producing its first set of 6 charts from 1843 to 1845¹⁰. The agency was renamed Office of Coast Survey and became a department under the National Oceanographic and Atmospheric Administration (NOAA) which was designated as the national hydrographic office of the USA. Other countries such as United Kingdom, Australia and New Zealand also began nautical charting of their waters in the 18th and 19th century thus giving birth to the global use of nautical charts for navigation at sea and improved maritime safety. The Australian Hydrographic Service formerly known as the Royal Navy Hydrographic Service was established by the British Admiralty Hydrographic Office in 1897 to boost hydrographic survey in Australian waters. In 1913, the hydrographic depot was taken over by the Australian government and was renamed the RAN Hydrographic Department. Captain John Robins, RAN was appointed first Hydrographer in 1920 when the RAN Hydrographic Department was established at Navy Office in Melbourne on 01 October 1920. Subsequently, survey activities were performed by

Royal Navy vessels until World War I¹¹. Surveying operations did not resume in the region until World War II, when it became evident that Age of Sail-era charts of the South West Pacific desperately needed updating with the RAN designated as the charting authority responsible for supporting Allied operations in the South West Pacific Area.

8. After the First World War, hydrographic efforts of various coastal nations of the world brought about tremendous improvements in the frontiers of the science of hydrography. As technology evolved so also did hydrographic methods as well as techniques, which brought about varying degrees of standards being adopted by different countries. However, the global nature of hydrography and nautical charts making meant that there was an urgent need to harmonize the efforts of these hydrographic and chart producing nations. New Hydrographic Offices were established and those already existing were developed. The Directors of the Hydrographic Offices of France and United Kingdom considered the possibility of holding an International Conference and the French director suggested that London would be the most adequate place to stage such a meeting. In June 1919, at the invitation of the British Admiralty, a hydrographic conference was convened in London, in which 24 nations participated¹². This marked the beginning of international cooperation in hydrography.

100 YEARS OF INTERNATIONAL COOPERATION IN HYDROGRAPHY

9. International cooperation in hydrography truly began with the coordinated efforts of France and United Kingdom at organizing the first international conference in hydrography where various stakeholders from all over the world could come together to discuss hydrography related issues as well as develop a roadmap towards achieving seamlessness in hydrographic operations.. Upon the

restoration of peace after the First World War, the French and British Hydrographers came together, and in April 1919 the British Hydrographer submitted his official proposal to hold the world's first International Hydrographic Conference in London to the Lords Commissioners of the Admiralty. One of the most notable resolutions passed during the meeting was for the establishment of a permanent international bureau. It was agreed at the Conference in London that some form of IHB should be established, and that a longer period of work was necessary to develop this project. To examine this question, a special committee, called the International Hydrographic Conference Committee, was appointed¹³. This committee prepared the first draft Statutes and a set of provisional directions. Its work culminated in 1921, with the adoption of Statutes by the founding States Members, and the election of the first Directing Committee. This body was formed by Vice Admiral Parry from the United Kingdom, Rear Admiral Phaff of the Netherlands and Captain Müller from Norway. Commander Spicer-Simpson from the UK, who had been the Official Interpreter at the London Conference, was appointed as Secretary General. Thus, on 21 June 1921, the IHB was formally established and began its activities with 18 Member States¹⁴. The Principality of Monaco was selected as the seat of the Bureau, partly for its central location, but largely because of the generous offer of Prince Albert I of Monaco to provide accommodation for this new Organization. This action was the result of the interest of Prince Albert I in the fields of hydrography and oceanography, being himself an eminent marine scientist and explorer. On 22 September 1970, an intergovernmental convention was enforced that officially recognized the Organization as the International Hydrographic Organization and its secretariat became known as the IHB¹⁵.

10. The designation of the IHO as an intergovernmental consultative and technical organization has played a vital role in ensuring international cooperation in hydrography. This has been achieved through the support of safe and eco-friendly marine navigation by providing accurate and timely hydrographic information to the general public. As at 29 January 2021, the total number of IHO member states was 94¹⁶. The IHO council which is made up of representatives from member states including Nigeria has also effectively supported IHO objectives. In coordinating global hydrographic survey operations, IHO is saddled with the responsibility of ensuring that all the world's oceans, seas and navigable waters are properly surveyed and charted, through the coordinated endeavors of national Hydrographic Offices that also contribute to the promulgation of Maritime Safety Information (MSI). This is with the vision to 'be the authoritative worldwide hydrographic body which actively engages all coastal and interested states to advance maritime safety and efficiency and which supports the protection and sustainable use of the maritime environment'¹⁷. The mission of the IHO is to 'create a global environment in which States provide adequate and timely hydrographic data, products and services and ensure their widest possible use and to finally protect by the United Nations Convention on the Law of the Sea as a competent international organization in the field of Hydrography'¹⁸. For effective and efficient coordination of national hydrographic offices of member states, IHO set specific objectives which are found under Article II of Convention on the IHO. Thus, the IHO continues to influence national practices which countries have sacrificed in the interest of achieving an international goal which would permit mariners of all nationalities the maximum use of nautical publications published in any part of the world.

11. Hydrographic technology has also advanced over the course of 100 years and this has been largely due to cooperation among member states and also the IHO. IHO has been a key driver in these technological advancements through development of standards, guidance, products and services. The IHO develops and adopts standards and guidance that ensure that hydrographic information is available and can be delivered to users through appropriate harmonized and interoperable products and services. The current maintenance of existing standards and the development of new ones are driven by the need to continue to satisfy the SOLAS requirements of enhancing safety of navigational, and more recently, supporting the implementation of “e-navigation”, which is being led by the UN’s International Maritime Organization (IMO)¹⁹. Both elements require easy access to standardized high quality digital geospatial information that can support marine spatial management. . Accordingly, the IHO continued to work on its Standards framework such as S-100, to support the creation and maintenance of interoperable maritime data product specifications compliant with that of the ISO-19100 series of geographic information standards.

12. As result of the work done by IHO, many Member States including Nigeria are making significant efforts to tailor technological advancements and methods in line with IHO as well as utilizing such datasets for national and international coverage. Through its active technical and capacity building programmes conducted in close liaison with other international organizations, notably the International Maritime Organization and the Intergovernmental Oceanographic Commission of UNESCO, the IHO supports the development and improvement of hydrographic and nautical charting standards, products and services, especially in digital formats. These capabilities contribute directly to safe navigation, informed marine spatial planning and coastal management and the prevention of natural

disasters. Therefore, the collaborative efforts fostered by the IHO among member states have thus ensured that most of the world's established shipping routes are relatively safe for navigation.

13. In a bid to keep shipping routes within Nigeria's maritime space safe, hydrographic practice and nautical charting in Nigeria have been greatly influenced by the standards and guidelines set out by the IHO. This has largely informed Nigeria's decisions in the development of methods and technologies utilized during hydrographic data acquisition and the production of Nigeria's indigenous paper charts and electronic navigational charts (ENCs).

OVERVIEW OF HYDROGRAPHY IN NIGERIA

14. Hydrography in Nigeria dates back to the early eighteenth Century, when the Hydrographic Office of the Admiralty now present day United Kingdom Hydrographic Office (UKHO), surveyed and published charts used for navigation in Nigerian waters. On 18 August 1827, the first chart produced by the Hydrographic Office of the Admiralty covering Nigerian waters was published. That chart was titled Chart 594 - Chart of the West Coast of Africa and it was based on surveys carried out by HM Ships *Leven* and *Barracouta* under the direction of Captain W.F.W. Owen. By 1846, most of Nigeria's coastline had been surveyed at a scale of 1:72,000 through the use of leadline method and on 7 February 1861, the first chart of Lagos titled Chart 2812 – Lagos River, was published. The UKHO also conducted hydrographic surveys within Old Calabar River and Akwayafe River using HM Ships *Peacock* and *Beacon*. These surveys resulted in the production of fairsheets for the rivers²⁰.

15. In 1914, the Nigerian Marine Department was established. The Department was controlled by the Director of Marine and was responsible for all maritime matters including hydrographic surveys in the Colony and Protectorate of Nigeria. By October 1928, the first hydrographic survey was carried out by the Department²¹. The areas surveyed included Lagos Harbour, Apapa Crossing and Channel Approaches to Customs to Wharf. The data obtained during the surveys were forwarded to the UKHO for the production and update of their charts. The early 1950s saw extensive modernization of port facilities in Nigeria which had to be properly managed to ensure productivity. This led to the enactment of the Ports Authority Ordinance of 1954 which created the Nigerian Ports Authority (NPA)²². Amongst the numerous roles of the NPA, was to provide hydrographic survey within the port limits of Lagos Harbour and the rivers of Forcados, Warri and Bonny. In November 1954, the first hydrographic survey by NPA was conducted at the Escravos River entrance.

16. The colonial government of Nigeria identified the need for a naval force for maritime security of Nigeria's territorial waters and on 1 June 1956, the Nigerian Naval Service was established and had amongst its obligations, to undertake hydrographic surveys outside port limits as directed by the Federal Government. This Service would later evolve into the Nigerian Navy (NN) through an Act of Parliament passed after Nigeria's independence. The Act of Parliament of 1964 further charged the NN with the responsibility of producing nautical charts and superintend over national hydrographic matters. Accordingly, the NN established the NNHD in 1970 to carry out this responsibility on its behalf. The NNHD was further sub-divided into the Nigerian Navy Hydrographic Office (NNHO), Nigerian Navy Hydrographic School (NNHS) and the NN Hydrographic Ship for ease of operation and administration. These efforts were aimed at building

hydrographic capacity for the NN towards meeting its responsibilities to aid in facilitating maritime activities by improving safety of navigation and reliability of our shipping routes. Another objective for the establishment of the NNHD was to foster both local and international cooperation with various stakeholder agencies and organizations in the hydrographic sector.

17. The federal government established other hydrographic related agencies such as Nigerian Inland Waterway Authority (NIWA), Nigerian Maritime Administration and Safety Agency (NIMASA) and the Nigerian Institute of Oceanography and Marine Research (NIOMR). NIMASA was established to promote safety of Nigeria's waterways. NIMASA undertook hydrographic surveys which was necessary for removal of wrecks and underwater obstructions to facilitate safety of navigation in Nigerian waters²³. In the area of ocean research studies, NIOMR was established to conduct hydrographic and oceanographic survey activities for research into the resources and characteristics of Nigeria's territorial waters²⁴.

18. Private oil and survey companies also contributed to hydrographic survey operations in Nigeria. With the discovery of crude oil in mainly offshore locations such as Oloibiri, Afam and Bomu in the 1950s, several foreign oil companies including Shell/Darcy Petroleum Development Company and Mobil Exploration Company of Nigeria, began prospecting for oil and gas²⁵. In order to conduct these prospecting activities, hydrographic survey was utilized in obtaining critical information about the marine areas that the oil fields were located. Apart from oil exploration related survey operations, hydrographic survey work was also done by some oil companies with respect to environmentally related activities. In 1957, Shell/Darcy Petroleum Development Company in conjunction with local survey

authorities, conducted hydrographic surveys in Bonny and Calabar River. The survey was carried out along with oceanographic and meteorological observations to determine the occurrences of bar at the entrance to the Bonny River during heavy rains and the weather that can be expected in Bonny vicinity under the worst conditions which occur during the rains²⁶.

19. The establishment of the above agencies by the federal government was as a result of the growing understanding of hydrography and hydrographic related activities and how they affected maritime activities both locally and globally. The need for proper coordination of hydrographic efforts in Nigeria also saw several inter-agency cooperative efforts that would further institutionalize hydrography in Nigeria.

INTER-AGENCY COOPERATION IN HYDROGRAPHY IN NIGERIA

20. The advancement of hydrography in Nigeria has been due in no small measure to the cooperative efforts of the various hydrographic stakeholders and their contributions towards the improvement of hydrographic knowledge and best practices. Since independence, Nigeria has continued to strive to fulfill her hydrographic obligations under the various international conventions she acceded to. In carrying out these responsibilities, various government agencies charged with hydrographic functions in Nigeria like the NN, NPA, NIMASA, NIWA and NIOMR interface with each other in what is called interagency cooperation, to advance hydrographic practice and nautical charting in order to facilitate safety of navigation within our waters.

21. Accordingly, interagency cooperation in Hydrography in Nigeria dates back to the 1950s and 1960s when the NN was carved out from NPA following an act of

parliament. This led to the ceding of some vessels to the NN. Among the ships ceded to the NN by the NPA was a survey vessel named Pathfinder, which was used by the NN, in collaboration with the NPA, for hydrographic survey duties in the 50s. Between 1956 and 1958, NN and NPA conducted the survey of Lagos harbour, Opobo River (Imo River entrance), approaches to Lagos, Escravos River, Forcados River, Nun River, Bimbria River, Burutu and Benin River²⁷. These early collaborative efforts in hydrographic surveys between NN and NPA during their formative years was thus very instrumental in obtaining important hydrographic data that were used during the production and update of nautical charts by the British Admiralty for part of Nigeria's territorial waters.

22. Following the establishment of the Nigerian Navy Hydrographic Office (NNHO) in 1973 to carry out the responsibilities of charting and coordination of all national hydrographic surveys, more collaborative efforts were made with NPA and other relevant stakeholders to ensure that hydrographic practices in Nigeria are in accordance with international standards laid down by the IHO. During this period, the hydrographic offices of the NN and NPA interacted through exchange of ideas during conferences both at local and IHO levels. The interaction also led to the conduct of joint trainings and surveys and above all exchange of hydrographic data and Maritime Safety Information (MSI). These collaborations have facilitated the sustainment of MSI dissemination to mariners all over the world via Nigeria's MSI portal domiciled at the NNHO. It also facilitated the production of Nigeria's national navigational charts covering Lagos harbor and part of Badagry Creek. As at today, NPA shares its quarterly survey data with the NNHO for update of existing navigational charts.

23. Nigeria's maritime boundary delimitation efforts also provided another opportunity for cooperation between hydrographic stakeholder agencies specifically the NN and NIOMR. The federal government identified the western part of the Gulf of Guinea (GoG) as a region over which it could extend its national jurisdiction over the continental shelf beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured. This process required the submission of supporting scientific and technical data on the outer limits of the continental shelf to the Commission on the Limits of the Continental Shelf (CLCS) through the Secretary-General of the United Nations (UN). These key technical data were obtained through hydrographic and seismic survey activities involving a multiagency survey operation by the NN, National Boundary Commission (NBC) and NIOMR. These agencies conducted joint survey operations in 2009 and 2016 around the identified western region within the GoG. The data collected from these collaborative survey activities have been submitted to the UN CLCS for consideration and possible approval for additional 150nm continental shelf for Nigeria. Nigeria. This joint effort between the NN, NBC and NIOMR in conducting survey operations for the purpose of national interest was largely applauded in all quarters of government. It is hoped that the CLCS would give a positive feedback and subsequently ratify the extension of Nigeria's outer territorial limits to 350nm.

24. There also exist a cooperation arrangement between the NN and NIMASA through executed MOU in area of hydrography. As at today, NN Hydrographic Officer heads the Hydrographic Survey Services Unit (HSSU) of NIMASA. This Unit, which operates under the direct supervision of the Executive Director of Maritime Safety and Shipping Development, was established to provide hydrographic services in areas pertaining to national maritime safety

administration. This collaborative effort between the NN and NIMASA has also helped in sustaining MSI dissemination to mariners within Nigerian waters. It has also helped in identification of wrecks dangerous to navigation along Tin-can Ijegan channel, which has cut the attention of Nigerian Government and subsequently led to approval for their removal. It is believed that NIMASA will commence action for the removal of these wrecks in the next few months. It is, therefore, safe to say that the cooperative agreement between the NN and NIMASA has been effective towards ensuring hydrographic surveys for wreck removals and identification of dangers to navigation towards enhancing safety of navigation with Nigeria's waterways.

25. In addition to collaboration among government agencies, there is also some form of collaboration that exist between private hydrographic practitioners and government agencies in the field of hydrography, primarily for the purpose of ensuring safety of navigation. For instance, the NPA is in a joint venture partnership with Lagos Channel Management and Bonny Channel Company for maintenance of Lagos and Bonny channels respectively. This has ensured safety of ships calling at the ports, with inherent advantage of improved revenue generation for the Government. The NN on the hand, through its Hydrographic Office monitors the activities of private survey companies engaged in any form of hydrographic and seismic surveys, as well as other marine scientific research activities within our waters. This is in accordance with the United Nation Convention on Law of the Sea (UNCLOS), as well as Nigeria's petroleum regulation L.N. 69 of 1969. Through this, companies are meant to conduct their survey and other survey-related activities within the approved limits and also acquire only data for which approval is given. At the end of the survey activities, these companies are meant to submit acquired bathymetric data to the NNHO for

archival, as part of the National marine geo-spatial data infrastructure for Nigeria. These data always form the basis for update of existing charts and also provide basic information to surveyors and marine scientists wishing to carry out further studies within same area in future. This is in line with the concept of crowd-sourced bathymetry of the IHO, which is intended to obtain bathymetric data from other sources for various applications, particularly in chart updates. Thus, the cooperation between the NN and private practitioners in hydrographic and other related activities in Nigeria has helped in preventing clandestine survey of our waters for intentions inimical to Nigeria's national security and has also facilitated the development of marine geospatial data for national and other uses.

26. Nigeria has made modest gains in the development of hydrographic capability and standards through interagency cooperation among hydrographic stakeholders. These cooperative efforts have also translated to increased productivity from the individual agencies. Through collaborative efforts with the NN and private stakeholders, NPA has consistently and regularly conducted dredging and hydrographic surveys of all ports and harbour facilities. This has greatly aided shipping activities by ensuring free flow of vessels in and out of the ports and through the channels. NIMASA has also benefitted from interagency collaboration as they have also carried out surveys including bottom profiling surveys which were done to better assess the existence of guyots and other forms of navigational hazards around the Lagos Harbour entrances. Interaction between government agencies and private hydrographic firms also contributed to crowd-sourced bathymetric data that are crucial datasets for international initiative related to hydrography and nautical charting. Notwithstanding the successes achieved through interagency cooperation in Hydrography in Nigeria, there is still room for more improved collaboration among stakeholders in order to fully develop

hydrographic practices in Nigeria. It is hoped that the recent induction of a 60-meter hydrographic survey vessel into the NN fleet will stem the tide in this regard.

CHALLENGES OF INTERAGENCY COOPERATION AMONG HYDROGRAPHIC STAKEHOLDERS IN NIGERIA

27. Establishing a cooperative attitude and close working relationship among industries, and federal as well as state government hydrographic agencies is the best way of ensuring effective hydrographic and charting efforts in Nigeria. However, several challenges exist which have hampered such collaborative efforts. These challenges include lack of proper legislation, lack of joint participation/organization of interagency hydrographic forums as well as inadequate information and knowledge sharing. These challenges shall be discussed subsequently.

LACK OF PROPER LEGISLATION

28. The legal frameworks establishing several maritime stakeholders in Nigeria such as NIMASA, NPA and NIWA, could sometimes be a bit unclear with respect to the conduct of hydrographic operations which these agencies undertake regularly. Thus, there exists the potential to duplicate efforts, which leads to wastage of both human and financial resources. A major challenge for these agencies is determining where best to apply their efforts, both in terms of the relative importance of interconnected hydrographic issues and the potential effectiveness of processes and practices that can strengthen interagency coordination. Another challenge that potentially arises is unhealthy rivalry among maritime stakeholders which is due to overlapping and intersecting functions which breeds unnecessary competition. The inability to address these issues in a

linked way among these agencies and with the private sector has resulted in significant unintended consequences, duplicative effort (as earlier mentioned), and high economic, environmental, and social costs.

29. The NN and by extension the NNHO is also affected by these interagency overlapping roles and responsibilities. The NNHO derives its functions from the Nigerian Constitution of 1999 and Armed Forces Act Cap A20 Laws of the Federation of the Nation, which vested the responsibility of charting and coordination of all national hydrographic survey in Nigeria to the NN. In spite of this, there still exist several bureaucratic bottlenecks which hamper effective cooperation between the NNHO and other agencies, especially as it relates to the coordination of national hydrographic surveys. . This is largely attributed to deficient legislation, which, although allows the NN to coordinate national survey activities, but did not explicitly mandate other agencies to partner with the NN during the conduct of any of their routine national hydrographic activities. This makes it difficult for the NN to effectively perform this coordinating function, as most agencies assume that they are not obliged to do so, more so when they have constitutional mandate to decide what to do with data they acquire within their maritime area of jurisdiction. This has and will continue to slow down indigenous hydrographic and nautical chart coverage of Nigeria's waters. There is therefore the need for more improved data sharing among government agencies with hydrographic-related functions in Nigeria.

LACK OF JOINT PARTICIPATION/ORGANIZATION OF HYDROGRAPHIC FORUMS

30. Public hydrographic forums, including workshops, seminars and capacity building trainings, provide a very useful opportunity for promoting synergy

between stakeholders in the hydrographic sector. Most hydrographic related matters that arise are often times interconnected to each other and the various agencies and indeed private sector players experience these issues albeit at varying degrees. Joint conduct and participation in forums and seminars by the stakeholders provide a crucial platform for learning and sharing of experiences that could be valuable in solving these interrelated problems. However, this has been lacking as most hydrographic agencies conduct trainings and organizes seminars and workshops on parallel lines. This often times prevents the sharing of information, technology and methodologies between agencies which could assist in addressing problems and improving standard.

31. The NNHO organizes sensitization workshops and seminars on diverse range of hydrography related matters including MSI and hydrographic best practices regularly but the attendance by other stakeholders is often times poor. It is imperative to note that leveraging on various private and government agencies' hydrographic initiative through joint workshops and symposiums can effectively address the myriad of problems that occur in the industry. The various agencies could bring their considerable knowledge, assets and experiences to bear by engaging in constant dialogues over their agency goals, actions and objectives. This could result in significant multiplication of both government and private sector hydrographic stakeholders' actions and also help in building healthy interpersonal networks that could facilitate interagency relationships.

INADEQUATE INFORMATION AND KNOWLEDGE SHARING

32. Inter-organizational collaboration among hydrographic stakeholders provides some important outcomes for the partnered organizations. One of such collaborative efforts is critical hydrographic information sharing and knowledge

transfer. Collaboration between these hydrographic agencies not only transfers current knowledge among them but also paves the way for the creation of new knowledge bases and produces synergistic solutions. Each of these stakeholders possesses vast sea experiences and work force that is specialized in different aspects of hydrography. For instance, NNHO possesses practical experiences as the national authority for hydrographic survey and charting activities in Nigeria, while NPA which is in charge of the nation's ports and harbours, conducts frequent surveys of these areas. Effective information and sharing between them in recent time facilitated the production of Nigeria's first indigenous navigational charts, which placed Nigeria on the map of chart producing nations of the world.

33. There is therefore an urgent need for other agencies like NIWA, NIMASA, NIOMR among others to volunteer navigational information within their area of jurisdiction to the NNHO for improved nautical chart coverage of Nigeria's waters. Accordingly, effective collaboration could be encouraged between the aforementioned agencies which would pave the way to share resources, transfer knowledge and produce the synergy that is required for the development of hydrography in Nigeria. In achieving the desired outcome, these organizations need to be well embedded and actively involved in the process of collaboration by understanding the national imperatives of indigenously charting our entire maritime space.

A PATH FORWARD: PRIORITY AREAS FOR INTERAGENCY COLLABORATION BETWEEN MARITIME STAKEHOLDERS IN NIGERIA

34. Several priority areas have been identified as ways of bolstering collaboration and cooperation between hydrographic agencies in both the public

and private sectors. These strategies are targeted at mitigating the problems associated with synergizing hydrographic survey capabilities and operations between these relevant stakeholders including the NN. These measures include enactment of a National Hydrographic Law (NHL), and conduct of joint hydrographic trainings/exercises. . These will be discussed accordingly.

ENACTMENT OF A NATIONAL HYDROGRAPHIC LAW

35. Enactment of a NHL would overcome the challenge of lack of legislation for coordination of national hydrographic activities. The NHL would provide the legal backing for the establishment of a National Hydrographic Office (NHO) to facilitate the coordination of all the stakeholders responsible for hydrography in Nigeria. The NHO could be headed by a serving professional hydrographer, designated as the Hydrographer of the Nation (HoN), from the NN, while representatives from MOD, Ministry of Transport, Ministry of Finance, the NPA, NIWA and NIMASA could form the Board of the NHO.

36. The NHO could encompass liaison desks of other public and private sector hydrographic agencies. These liaison desks could act as interfaces between the various agencies thereby ensuring coordination by building mutual trust and understanding between relevant bodies. This coordination centre could create opportunities for joint trainings, seminars as well as other capacity building and technology transfer efforts. This will ensure that uniform hydrographic procedure that meets IHO standards is maintained in all agencies, thereby facilitating the production of national hydrographic charts and publications to support maritime trade towards enhancing national development in Nigeria. Therefore, there is the need to enact a NHL.

CONDUCT OF JOINT TRAINING/EXERCISES

37. Opportunities to better identify and address collaborative efforts between hydrographic agencies and organizations are extensive. One of such opportunities is through the conduct of regular multi-agency training exercises, seminars and forums. As you are all aware, most hydrographic issues are interconnected and impact both public and private sector stakeholders. In order to effectively address these issues, the conduct of joint trainings and technical workshops is necessary as this involves all relevant stakeholders working together. This ensures that they all leverage each other's considerable knowledge, assets and experience. It also ensures that they engage each other in dialogues over goals and actions, which could result in significant multiplication of governmental actions to the benefit of the nation.

38. There is therefore the need to organize and conduct periodic exercises and capacity building trainings where the various stakeholders in the hydrographic sector can interface. These efforts would potentially result in more effective and efficient outcomes with positive return on investment. For issues that border on hydrographic matters, applying this framework can significantly reduce duplication of effort and therefore potentially result in cost savings, considering the high cost of conducting hydrographic operations. Furthermore, these joint trainings/exercises could reduce unintended consequences in which actions taken to address one stakeholder's domain without consideration other closely connected stakeholders can result in negative outcomes in these connected domains. Applying this criterion can help focus attention on those issues in which many agencies have overlapping jurisdictions and in which the potential for unintended consequences is high.

CONCLUSION

39. The conclusion of the First World War in 1918 brought about significant progress in hydrography due to the effort of various coastal nations including the USA, Denmark, UK and France. The individual hydrographic efforts by these countries meant variances in standards and methods employed. However, the global nature of hydrography and nautical chart production necessitated the harmonization of efforts of the various national hydrographic offices. The IHO was established following an international conference of hydrography held in June 1919 in London, with a mandate of promoting international cooperation between hydrographic offices for safety of navigation and other maritime related activities. The designation of the IHO as an intergovernmental consultative and technical organization was instrumental towards ensuring the adherence to standards and best practices by member states including Nigeria. This ultimately streamlined the hydrographic efforts of all member states and the creation of nautical products and related datasets that had both national and international coverage.

40. The early Eighteenth century and prior to Nigeria's independence saw a total reliance on the UKHO by Nigeria for hydrographic surveys and publication of nautical charts covering Nigerian waters. However, after Nigeria's independence in 1960 and establishment of government agencies including NN, NPA, NIWA, NIMASA and NIOMR, the total dependence on the UKHO reduced. This was as a result of hydrographic related operations being conducted by the aforementioned agencies as mandated by the Federal Government. Although, the UKHO still produced Nigeria's charts, the various government agencies began to develop hydrographic capacities. Nigeria formally joined the IHO in May 1976 with the NN designated as the national hydrographic agency as a result of her constitutional

mandate. This move by Nigeria in joining the IHO, meant a development of a framework to guide the practice of hydrography in the country. As a result, the various government hydrographic stakeholders commenced the setting up of hydrographic departments that would ultimately contribute to the coordination of national hydrographic related operations for improved maritime activities.

39. Interagency cooperation among the various hydrographic stakeholders in Nigeria has contributed to the development of capacity, standards and industry best practices in Nigeria. The collaboration between the NN and other relevant hydrographic agencies has given rise to productivity in their operational outputs. These outputs range from the regular maintenance dredging and conduct of hydrographic surveys of harbours and port facilities by the NPA to the timely clearance of wrecks and other dangers to navigation by NIMASA. The NN through the NNHD has taken the lead role by conducting hydrographic surveys and subsequent production of IHO approved paper and electronic nautical charts that are now being used for navigation by mariners. The NNHD has also taken the initiative towards contributing to crowd-sourced bathymetric data to IHO projects, through cooperative efforts with private oil/survey companies. All these have been instrumental in placing Nigeria among the on the international hydrography map.

40. As with various other endeavours, several challenges still exist which have impeded the collaborative efforts among maritime stakeholders and thus limited the growth of hydrography in Nigeria. Some of the challenges identified include lack of legislation, lack of joint participation/organization of hydrographic forums and inadequate information and knowledge sharing. These challenges were recognized as impediments to national hydrographic growth. There was thus an urgent need to address these challenges through strategies including the enactment

of a national hydrographic law, greater multi-agency coordination and conduct of joint trainings/exercises. It is believed that the adoption of these strategies would positively affect inter-agency cooperation among hydrographic agencies on a national scale as well as promote international cooperation among coastal nations of the world.

REFERENCES

1. L.Paine 2013. *The Sea: Civilization. A maritime history of the world.* Published by Vintage, October 2015
2. Review of Maritime Transport. UN Conference on Trade and Development, 2018, p. 23.
3. Factsheet: People and Oceans. The Ocean Conference. UN, New York, 2017.
4. International Hydrographic Bureau. *Manual on Hydrography.* Publication C-13. 1st Edition, May 2005.
5. Science without borders. Connected Ocean: No barriers, No boundaries, No borders. 2019.
6. Commodore D.C Kapoor. *International Cooperation In Hydrography.* Paper presented at the 15th Annual Canadian Hydrographic Conference, Ottawa, April 1976.
7. FJ Bermejo. *The History of the International Hydrographic Bureau.* International Hydrographic Review, Monaco, LXXIV(1). March 1997.
8. National Oceanic and atmospheric administration. History and evolution of hydrography. <https://nauticalcharts.noaa.gov/learn/history-of-hydrographic-surveying.html>, Accessed 23 May 2021.
9. Danish Geodata Agency. *History of Nautical Charting.* Article at, <https://eng.gst.dk/danish-hydrographic-office/history-of-nautical-charting> . Accessed 25 May 2021.
10. Office of Coast Survey. *The Nations's Nautical Chartmaker.* <https://nauticalcharts.noaa.gov/about/about.html> . Accessed 25 May 2021
11. Australian Hydrographic Office. *Our story.* Article at <https://www.hydro.gov.au/AHO2020/AHO-Storyboard-01-October-2020.pdf> . Accessed 28 May 2021.

12. FJ Bermejo. *The History of the International Hydrographic Bureau*. International Hydrographic Review, Monaco, LXXIV(1). March 1997.
13. Id
14. Id
15. Hydro International Journal. *International Hydrographic Bureau*. Article at <https://www.hydro-international.com/content/article/international-hydrographic-bureau-2> , Accessed 29 May 2021.
16. International Hydrographic Organization. *Lebanon joins the IHO*. Article at <https://iho.int/en/lebanon-joins-the-iho> . Accessed 29 May 2021.
17. IHO Strategic Plan 2021-2026. *International Hydrographic Organization (IHO) Strategic Plan for 2021-2026*. Published by the International Hydrographic Organization, November 2020, Pg 1.
18. Id.
19. International Hydrographic Organization. *Input to the Report of the UN Secretary General on Oceans and Law of the Sea*. Article at https://www.un.org/Depts/los/general_assembly/contributions_2014_2/IHO.pdf . Accessed 29 May 2021.
20. United Kingdom Hydrographic Office. The UKHO Archive. Accessed 15 June 2021.
21. Id.
22. Duyile WA. *Historicizing the Development and Intensification of the Nigerian Navy between 1956-1958*. International Journal of History and Cultural Studies (IJHCS) Volume 5, Issue 3, 2019, Pg 2.
23. About NIMASA. Electronic Article at www.nimasa.org/about_us, Accessed 20 May 2021.
24. History of NIOMR, Electronic Article at www.niomr.gov.ng. Accessed 30 May 21.

25. P Steyn. Oil Exploration in Colonial Nigeria, C.1903-1958. University of Stirling.

26. Duyile WA. *Historicizing the Development and Intensification of the Nigerian Navy between 1956-1958*. International Journal of History and Cultural Studies (IJHCS) Volume 5, Issue 3, 2019, Pg 5.

27. Id.