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Application of Geo-Information Technology to National Security, Conflict Resolution and Transborder Cooperation: A Case Study of Nigeria-São Tomé and Principe

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ABSTRACT
This paper examines the evolution of boundaries in Africa with emphasis on Nigeria and São Tomé. It also appraises the existing bilateral relationship (treaty) between Nigeria and São Tomé with particular interest on the need for trans-border cooperation and peaceful co-existence as a panacea for conflict resolution. It further relates the importance of monitoring and managing the border and the territorial maritime space between the two countries using geoinformation science and technology (Satellite imaging/Remote Sensing, GIS and GNSS). Using documents appraisal and geo-spatial methodologies, Nigeria's mile stone in space programmes was identified as a veritable area of joint partnership that can bridge the gap of conflicts arising from territorial spatial coverage, technical know-how, socio-cultural and political ventures. It was further highlighted that Strict adherence to the law of the sea and the already signed treaty would prevent possible conflicts considering the provisions inherent in it. This combined with an up-to-date digital map and satellite monitoring of the Joint Development Zone (JDZ) will ensure peaceful co-existence and respect for contiguous sovereign nation's territorial right over the bordering waterways. The paper concluded that the fact that conflict exists, however, is not necessarily a bad thing: as long as it is resolved effectively, it can lead to national and international growth and development and this can be achieved chiefly through geoinformation science and technology.
Keyword: Border, Geoinformation, Joint Development Zone (JDZ), Treaty, Satellite.

1. INTRODUCTION

There is general agreement among historians that ethnic conflicts have been the core cause of bloodshed in Europe and the Mediterranean world (Anyu, 2007). The deep scars that these conflicts leave on people and nations are often obscured by historical accounts that, more often than not, glorify conquest and ignore aggression. Though ethnic conflicts have defined European history for centuries, Africa was spared this problem until the Europeans decided to treat the continent as free-for-all real estate. One major aspect of land boundary studies deserving for more attention as far as security, mapping and conflict management is concerned is their effect on everyday life (Blake, 1989) because, today more than 103 ethnic conflicts are on-going on the African continent (Anyu, 2007).

The inevitable conflicts and the subsequent destruction of lives, properties and the environment calls for a holistic approach through effective boundary demarcation/delineation, trans-border cooperation, conflict management and resolution to achieve a peaceful and stable world with guaranteed territorial security. Recourse to two known *territorial security* concepts has not yielded the expected result. For instance, The first and more traditional focuses on curbing threats to national security by limiting the flow of illegal commodities, human and arms trafficking, illegal migration and transnational crime (i.e. hermetically sealed one). The second more contemporary approach is a form of 'relative security' and focuses on making a prosperous and efficient border foster a secure border (Ackleson, 2005). Neither strategy addresses each threat in its entirety; it is for this reason that the National Security Strategies of both Canada and the United States have attempted to fuse the two concepts into a more comprehensive security strategy called National Strategy of the United States 2006, Canada's National Security Policy 2004 (Kalacska, 2008). Initially, for several years people living in the same geographic area had lived without demarcation of boundaries and they were satisfied. But with the advent of colonialism, especially in Africa, land demarcation now brings about disorderliness in the existing land identification format. This format most of the time was due to the extent of some abstract factors like the social relationships, cultural relationships, extent of spread of language and commercial interaction (Sodeinde, 2001).

Besides the land borders (De Blij and Muller, 1997), of particular interest is the maritime territorial integrity of a nation (Magstadt, 1994). In the maritime geospace, fishing and other deep sea activities are carried out based on some identifiable natural landmarks for territorial ownership without due regard for appropriate record or mapping (analog or digital). With the geospatial laceration of Africa Continent by the colonial masters during the Berlin conference of 1884, the issue of boundary demarcation and conflict resolution became apparent owing to claims and counter-claims by neighbouring countries. While internal sovereign conflicts led to several tribal or local wars, that of international arena has resulted to international litigations and some pocket of killings by locals residing around the borders due to conflict of interest. One of such conflict is the current dispute between Nigeria and Cameroon over the Bakassi Peninsula (Anyu, 2007).

Although many nations have taken bold steps to settle their border disputes through various bilateral or multilateral agreements (treaties), there still exist several unresolved issues bordering on border cooperation and peaceful coexistence on one hand and accurate mapping of contiguous borders using geospatial science and technology such as satellite Remote Sensing (RS), Geographic information Systems (GIS) and Global Navigational Satellite Systems (GNSS) on the other hand.

In this paper, we trace the evolution of Nigeria boundaries, Nigeria's maritime boundary with Sao Tome and Principe, existing bilateral relationships and agreements, possible source of conflict and methods of resolution using geospatial technology and compliance with laid down rules/treaties and the possible areas of collaborations in the areas of space science and technology (with reference to Nigeria space programme), culture and politics. The above is with a view to fostering a trans-border cooperation and peaceful co-existence between both countries thus improving the atmosphere of doing business.

2. LITERATURE ON EVOLUTION OF BOUNDARIES: THE AFRICAN PERSPECTIVE

According to Asonson (1999), for a long time outsiders viewed Africa with curiosity, awe, and greed. Foreign invasions were prevented for a long time due to Africa's geography, but because of its size, surface features, climate, resources, and strategic importance, it became a prime candidate for conquest by ambitious European empire. Although Africa is physically remote from the power centres of Europe, North America, and Asia, it is surrounded by water and can therefore be reached easily from the other continents (see De Blij and Muller, 1997). This meant that the Europeans needed to establish rules for dealing with one another if they were to avoid constant bloodshed and competition for African resources. The Berlin Conference established those ground rules (see Boahen, 1985).

The exploration of Africa by Europeans started with the Portuguese sailing along Africa's coast in 1450. The success the Portuguese had on these voyages encouraged other European naval powers to explore Africa. By the mid-nineteenth century, Europeans had established colonies all along the African coast and competed for control. The push for overseas territories was made even more intense by the Industrial Revolution and the need for cheap labor, raw material, and new markets. The competition between the Europeans often leads to violent conflict.

This violent conflict was terribly wasteful, so Portugal suggested the idea of an international conference that could settle the territorial disputes that arose from European activities in the Congo region. From available records, the Berlin Conference was held in Berlin between November 15, 1884 and November 26, 1885, under the leadership of German Chancellor Otto von Bismarck (Aronson, 1999). Although controlling the slave trade and promoting humanitarian idealism were promoted as the focus of the conference, the conference only passed empty resolutions about the ending of slave trade and providing for the welfare of Africa. In truth, the result of the Conference was a method of dividing the continent of Africa between the European powers (See Anyu, 2007; Aronson, 1999).

To Rosenberg, fourteen countries were represented by a plethora of ambassadors when the conference opened in Berlin on November 15, 1884. The countries represented at the time included Austria-Hungary, Belgium, Denmark, France, Germany, Great Britain, Italy, the Netherlands, Portugal, Russia, Spain, Sweden-Norway (unified from 1814-1905), Turkey, and the United States of America. Of these fourteen nations, France, Germany, Great Britain, and Portugal were the major players in the conference, controlling most of colonial Africa at the time.

Article 34 of the Berlin Act states that "any European nation that took possession of an African coast, or named themselves as *protectorate* of one, had to inform the signatory powers of the Berlin Act of this action" If this was not done then their claim would not be recognized. This article introduced the "spheres of influence" doctrine, the control of a coast also meant that they would control the hinterland to an almost unlimited distance. Article 35 determined that in order to occupy a coastal possession, the nation also had to prove that they controlled sufficient authority there to protect existing rights such as freedom of trade and transit. This was called the doctrine of "effective occupation" and it made the conquest of Africa a less bloody process (Aronson, 1999)

The Berlin Act was an important change in international affairs. It created the rules for "effective occupation" of conquered lands, ensuring that the division of Africa would take place without war among the European powers. Through the Berlin Act, the European powers justified dividing a continent among them without considering the desires of the indigenous peoples. While this appears extremely arrogant to us now, it seemed to them to be the obvious extension of their imperialism. The Berlin Conference is one of the clearest examples of the assumptions and preconceptions of this era, and its effects on Africa can still be seen today. The arbitrary boundaries the Europeans imposed often divided an ethnic group and also brought enemies under the same government causing strife that still exists today.

Figure 1: Map of Africa Showing Territorial boundaries as Influenced by Berlin Conference.

From figure 1 above, the major colonial holdings included according to Rosenberg are:

- Great Britain desired a Cape-to-Cairo collection of colonies and almost succeeded though their control of Egypt, Sudan (Anglo-Egyptian Sudan), Uganda, Kenya (British East Africa), South Africa, and Zambia, Zimbabwe (Rhodesia), and Botswana. The British also controlled Nigeria and Ghana (Gold Coast).

- France took much of western Africa, from Mauritania to Chad (French West Africa) and Gabon and the Republic of Congo (French Equatorial Africa).

- Belgium and King Leopold II controlled the Democratic Republic of Congo (Belgian Congo).

- Portugal took Mozambique in the east and Angola in the west.

- Italy's holdings were Somalia (Italian Somaliland) and a portion of Ethiopia.

- Germany took Namibia (German Southwest Africa) and Tanzania (German East Africa).

- Spain claimed the smallest territory - Equatorial Guinea (Rio Muni).

3. RESEARCH METHOD AND MATERIALS

In this study, we rely mostly on secondary sources of data such as official documents of governments (National Boundary Commission of Nigeria inclusive), web documents, published materials and advisory consultations. Using Geographic Information System (GIS) and Remote Sensing technology (hard and software), the satellite image covering Nigeria was digitized and clipped out to show the territorial extent of the country. Maps of the JDZs were adapted from relevant authorities (JDZ, 2004). Status appraisal and geospatial methodologies were adopted.

4. DISCUSSION OF FINDINGS

4.1 Nigeria's Boundaries

From the record of the Nigeria Boundary Commission (NBC), Nigeria shares Land boundaries with the Republics of Benin, Niger, Chad and Cameroon and Maritime boundaries with the Republics of Benin, Cameroon, Equatorial Guinea, Sao Tome and Principe and Ghana. The Nigerian Federation of 36 States and the Federal Capital Territory has 774 Local Government Areas as the third tier of Government. In each of the 774 Local Government Areas are several other polities – districts, village areas, autonomous Communities, emirates and chiefdoms which like the States and Local Government Areas, operate within more or less jurisdictional areas (NBC, http://www.nbcnigeria.org/evolution.html).

While European imperialism gave Nigeria and other African and third world countries their international boundaries, British colonialism on the other hand gave Nigeria its first set of internal boundaries. The division of Nigeria into protectorates, provinces, divisions, districts, native authorities, federated communities, etc., was done for British administrative convenience. Successive post-independence Nigerian constitutions from 1960 to date clearly allowed the creation of more administrative units. This partly explains the phenomenon of the bourgeoning of Regions, States and Local Government Areas, etc., (NBC).

In 1963, the Mid Western Region was created out of the defunct Western Region of Nigeria. Four years later (1967), a more drastic restructuring of the nation was undertaken by the Military Administration of General Yakubu Gowon, which broke the country into 12 States structure. This was further followed by another exercise in States creation in 1976 when General Murtala Mohammed gave the nation the 19 States structure. In 1987 and 1991 two and nine additional States respectively were created by the General Ibrahim Babangida Administration. The Military regime of Sani Abacha on its part created another 6 new States in 1996 bringing to 36 the number of States in the country excluding the Federal Capital territory (FCT) of Abuja. All the State creation exercises except that of 1963 were either followed by or done side by side with the creation of more Local Government Areas. The States on their part embarked upon the creation of additional Districts, village Areas, Chiefdoms, Emirates and Autonomous Communities (NBC).

In 2008, former President Yar' Adua of Nigeria directed the National Boundary Commission (NBC) (*who is charged with the mandate of facilitating the resolution of boundary disputes which may arise between Nigeria and any of her neighbours, or among and between the states, Local Government Areas and the various communities in the country*) to ensure the extension of Nigeria's continental shelf beyond the 200 nautical miles (The Punch, 2008). The commission is expected to come up with dynamic proactive initiatives for the prompt and dynamic determination of all boundary-related matters with a view to effectively boosting peaceful co-existence, engendering inclusiveness, enhancing the welfare of the people. Achieving the above directive lies squarely on the application of geospatial science and technology because of its capability to digitally integrate, store, manage, retrieve, analyze and digitally display georeferenced results automatically.

4.2 Nigeria – DR of Sao Tome And Principe (DRSTP) Maritime Boundary

Boundary conflicts in most part of the world develop most of the time to endless war that only time could solve. The case of boundary conflict between Eritrea and Ethiopia still looms (see Abbink, 2003) and several lives have been lost. A case could also be sited of the boundary conflict between Nigeria and Cameroon (see Anyu, 2007). However, with the successful conclusion of the Maritime boundary negotiations with Equatorial Guinea and the eventual unitization of Zafiro/Ekanga oil fields, which straddled the maritime boundary between Nigeria and Equatorial Guinea in 2000, the Nigerian Government's attention shifted to the maritime boundary between her and Democratic Republic of Sao Tome and Principe (DRSTP). Coincidentally, DRSTP had already deposited with the United Nations in 1998, which undoubtedly overlapped Nigeria's claim (see Figure. 2).

Fig. 2: Map of Nigeria Gulf of Guinea and the Coastal Countries near Sao Tome and Principe

The existence of such considerable overlap between the maritime claims of Nigeria and DRSTP eventually led to the initial meeting between the heads of States of both countries in November, 1999 in Abuja. The result of the bilateral meeting was a mandate authorizing the Boundary Commissions of two countries to immediately commence maritime boundary negotiations in an effort to resolve the overlapping claims.

The inaugural meeting of the JTC came up a month later i.e. December, 1999 in Sao Tome, followed by two other subsequent meetings, but because of the perceived presence of hydrocarbon in the area in contention, each of the sides gave no much ground, except Nigeria's slight movement away from its full weight effect claim based on the proportionality of its coast vis-à-vis that of DRSTP to a one third-weight effect claim. DRSTP did not however, reciprocate, as it did not move from its median line claim.

With their near deadlock situation in the negotiation process, the two Presidents, in the spirit of African brotherhood, met yet in Sao Tome on 28th August, 2000, and reached a historic agreement to establish a Joint Development Zone (JDZ) in the area of overlapping maritime claims. This is in line with the provisions of Article 74(3) of the United Nations Convention on the Law of the Sea (UNCLOS III of December, 1982), which clearly requires:

> *"States with opposite coasts, in a spirit of understanding and cooperation, to make every effort, pending agreement on delimitation, to enter into provisional arrangements of a practical nature, which do not jeopardize or hamper the reaching of final agreement on the delimitation of their Exclusive Economic Zone-EEZ"*

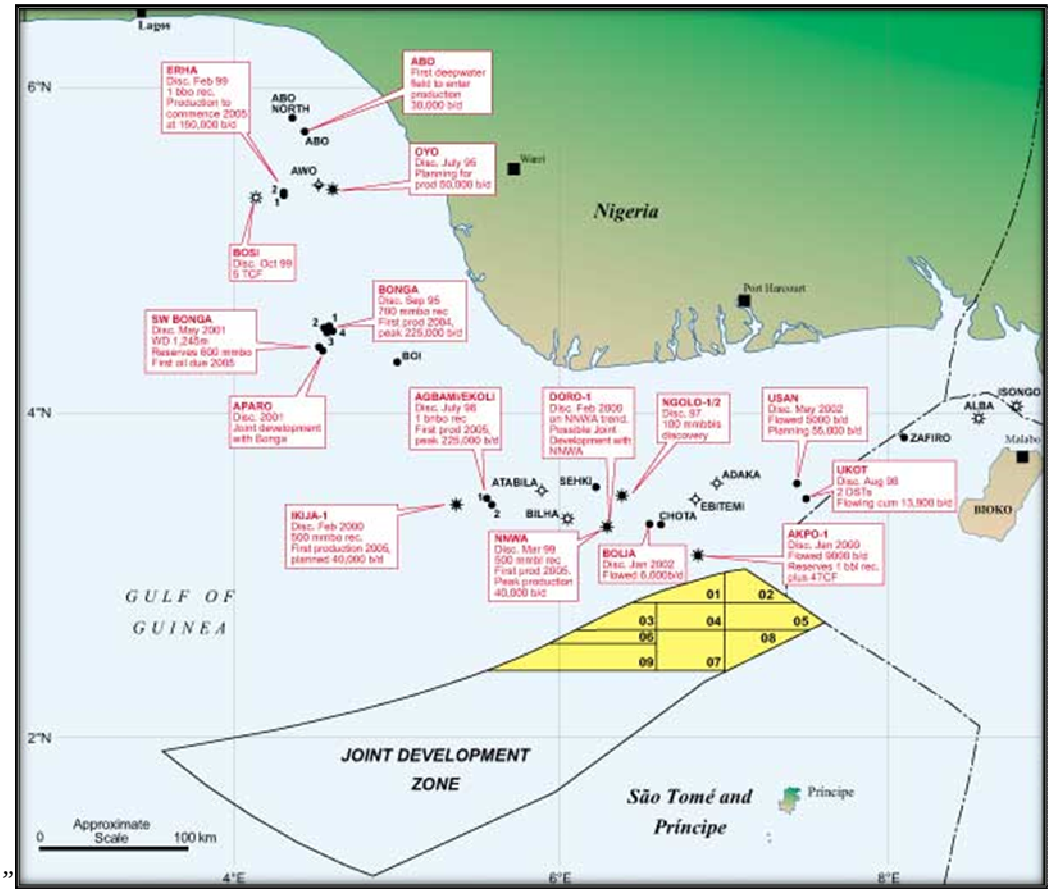

Figure 3: Joint Development Zone Demarcation (JDZ, 2004)

According to NBC, the timely and wise decision by the two countries, to enter into provisional arrangement to establish the JDZ, notwithstanding the previously held rigid positions on the overlapping maritime boundary claims (DRSTP's median line and Nigeria's third weight effect) was welcomed within both countries and in the International community as a model. Already, a Joint Development Authority (JDA) was established to manage the activities on the Zone. So far the JDA has succeeded in the following:

i. Putting in place the necessary fiscal regimes that guides oil and gas exploration in the Zone; such as Petroleum Regulations 2003; Tax Regulations 2003; Guidelines for Investors in the JDZ Licensing Round 2004; and Production Sharing Contract (PSC) formula;

ii. The signing of the first PSC for JDZ Block 1 in Sao Tome on 1st February 2005. This is seen as one of the most important Milestones of the JDA. Put in context, it provided a model PSC, which was used as the basis for additional PSCs (Blocks 2-5) awarded in February 2005 – 3 of which (Blocks 3,4 and 2) have been executed on 14th and 15th March 2006;

iii. It is clear that the stage is now set for the potential producers of hydrocarbon in this Zone to commence production as the drilling of JDZ Block 1 has commenced in mid-January 2006 and is progressing satisfactorily;

iv. Both Nigeria and DRSTP have started enjoying the benefits of this shared venture as demonstrated by the receipt and sharing of the Signature Bonus for JDZ Block 1 by both Governments in June 2005 and blocks 2, 3, and 4 in June 2006;

v. But perhaps another greatest achievement of the JDA was its firm stand and weathering the storm against undue criticisms of the two licensing rounds it has so far conducted. The report of an investigation carried out late in 2005 on behalf of the Office of the Attorney General, DRSTP (though not accepted by the Government) seemed to cast some aspersions of impropriety against the 2004 Licensing Round. However, the lop-sidedness of the report, the united stance of the Governments of the two countries in rejecting it and particularly the staunch defence put up by the JMC finally sealed the report as just bickering from disgruntled elements and, therefore, a storm in a tea cup.

The fact that JDA has been able to sign 3 PSCs and preparations are at advanced stages to conclude and sign the remaining two PSCs, all point to the stability and success story that the JDA is well accepted.

4.3 Existing Bilateral Relationships/Agreements,

In 2001, São Tomé and Nigeria reached an agreement on joint exploration for petroleum in waters claimed by the two countries of the Niger Delta geologic province. After a lengthy series of negotiations, in April 2003 the JDZ was opened for bids by international oil firms (JDZ, 2004). The JDZ was divided into 9 blocks; the winning bids for block one, ChevronTexaco, ExxonMobil, and the Norwegian firm, Equity Energy, were announced in April 2004, with São Tomé to take in 40% of the $123 million bid, and Nigeria the other 60%. Bids on other blocks were still under consideration in October 2004. São Tomé stands to gain significant revenue both from the bidding process and from follow-on production, should reserves in the area match expectations.

4.4 Trans-border Cooperation, Security and Conflict Resolution

Most of the time, boundary conflicts have been solved by identifying some natural features as a means of landmark, in some other cases however, large beacons which are of geodetic accuracy are set out for boundary demarcation which have so far not solved all the boundary conflict problems. In spite of the presence of visible landmarks, conflicts still arise as to who owns a part of a landmass or maritime zone. This kind of problems is usually noticed between large geographical settlement e.g. cities, countries, state etc. Recently, Nigeria has experienced a lot problem on boundary conflicts even in some cases where there are visible landmarks. For example a case of Bakassi peninsula which is a boundary conflict between Nigeria and Cameroon (Anyu, 2007). In this case, in spite of the presence of visible landmark, there is a conflict to who owns the peninsula (Sodeinde, 2001). The application of satellite based mapping could have solved these problems if it was resulted to on time.

To enhance security, avoid conflict and promote trans-border cooperation and peaceful co-existence, there is need for tools/techniques that enable rapid planning and enable taking rational and informed planning decisions that ultimately lead to plans that are better and implementable especially with regards to trans-border cooperation. Satellite imagery and use of Geographical Information System (GIS) are examples of such tools that facilitate preparation of rapid, comprehensive, rational and implementable plans for peaceful co-existence.

4.4.1 Mapping, Space Science and Technology

The Use of Satellite Imagery and GIS in Trans-border Management has been advocated as a result of the veritable results it produces as observed in most developed countries like UK, USA and the rest of Europe. A geographically accurate base map can be generated either by undertaking a detailed topographical survey or by using satellite imagery along with other sources of information (Shirley and Bindu, 2002).

a. Satellite Image Monitoring

The main goals of remote detection for border security is to identify the most likely surreptitious crossing points across the Nigeria-Sao Tome border and provide accurate and timely information to the enforcement teams (see for example, Figure 4 for Satellite Image Coverage of Nigeria).

The true strength of this data can be seen when combined with other forms of spatial data. Suitable satellite data for coastal and marine mapping are Light Detection and Ranging (LiDAR), SeaWiFS, MODIS, IKONOS etc (see Figures 5a and 5b).

The LiDAR uses a specific wavelength of light to obtain very detailed topographic information, both of the ground, and of the vegetation canopy effectively allowing one to observe details of the ground below the forest canopy. Used in conjunction with the hyper spectral imagery and the panchromatic satellite imagery, trails may be detected despite potential forest canopy cover allowing one to see where people might cross the border.

Figure 4: Satellite Image Covering Nigeria

Information derived from these data sources when combined with known logging trails, water bodies, roads, forested areas etc., a sophisticated model can be built in a GIS environment to identify vulnerable routes for trafficking operations or potential smugglers access between Nigeria and DRSTP. These routes would otherwise remain undetected despite aerial or ground surveillance (i.e. through visual observation). Identification of boats, ships or vessels at the Gulf of Guinea through sensors such as NigeriaSat-2, Quickbird, IKONOS and many more can be used to map potential routes. In addition, unmanned aerial vehicle (UAV) equipped with very high resolution sensors can be used as surveillance to monitor activities at border areas as well as the JDZ.

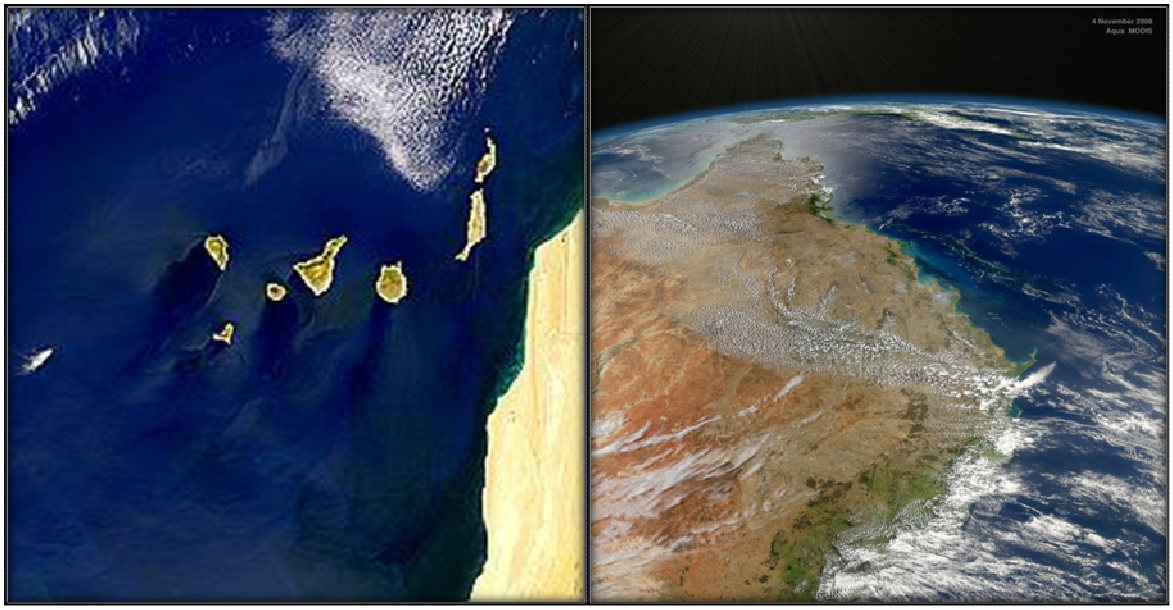

Figure 5a: Coastal Images acquired by MODIS Aqua on 4th November, 2008

Figure 5b: Canary Island Wakes acquired by MODIS Aqua on April 24, 1999.

Space technology has unveiled itself as a very useful tool in early detection of oil spills and management over the years. The proper handling and archiving of data originating from combination of space assets like Earth Observation satellites, and other space related technologies such as GIS and objects positioning obtained with the aid of GNSS has made space technology a dependable tool in the reduction of hazard to the aquatic environment. Oil spill pollution, a severe environmental problem, which persists in marine environment or in inland water across the world, has grown to an alarming magnitude with increased levels of oil production and transport. A successful combating operation to a marine oil spill depends on the rapid response from the time the oil spill is detected. In fact, the concept of oil spill contingency planning refers to several activities for developing an immediate response program and undeniably the most important one is oil spill detection (Qingling and Ying, 2007).

The recent research and progress of monitoring marine oil-spill using microwave remote sensing technology has proved to be of great success at the offshore oil fields. The used of this readily available technology will be of great assistance to the 'Joint Venture' in terms of keeping the 'Best Practice' and meeting the international standard in the area of obligations of the oil producing State and the company involved in the oil exploitation. This became paramount because petroleum is very toxic and when it spills in an aquatic environment it is very difficult to manage and also deadly to marine flora and fauna. Hence, an early detection and clean-up is very important to the survival of millions of marine plants and animal.

b. Topographical Surveying and Mapping based on Satellite Image

A comprehensive physical survey of the planning area can be carried out using total station survey equipment. Several details can be surveyed ranging from all built features, roads, natural elements, levels etc. This process ensures considerable accuracy, however, stringent controls have to be ensured while setting the traverse and taking measurements. Such a survey will not only serve the planning objective adequately but also can be later used for detailed planning of infrastructure where the need arises. Detailed surveys are required while planning and implementing infrastructure works such as roads, drainage, and water supply works etc., which need not be repeated. Subsequently the survey information can be used to generate other applications such as assessment of property taxes, mapping of other infrastructure networks for the purpose of maintenance, management, planning, etc. However this requires considerable amount of resources/investments upfront and in most cases wherein the planning agencies do not have adequate resources, a topographical survey is rarely undertaken.

4.5 Resolving Conflicts through the "Law of the Sea" Treaty

The Law of the Sea Treaty ("Treaty") was conceived in 1982 by the United Nations (U.N.) as a method for governing activities on, over, and beneath the ocean's surface (see Marjorie, 2004 and Roger, 1982)**.** It focuses primarily on navigational and transit issues. The Treaty also contains provisions on the regulation of deep-sea mining and the redistribution of wealth to underdeveloped countries as well as sections regarding marine trade, pollution, research, and dispute resolution (John**,** 1994)**.** Under the Treaty, a 12-mile territorial sea limit and a 200-mile exclusive economic zone (EEZ) are established (see Figure 6). This sets a definitive limit on the oceanic area over which a country may claim jurisdiction (see Carrie, 2004)

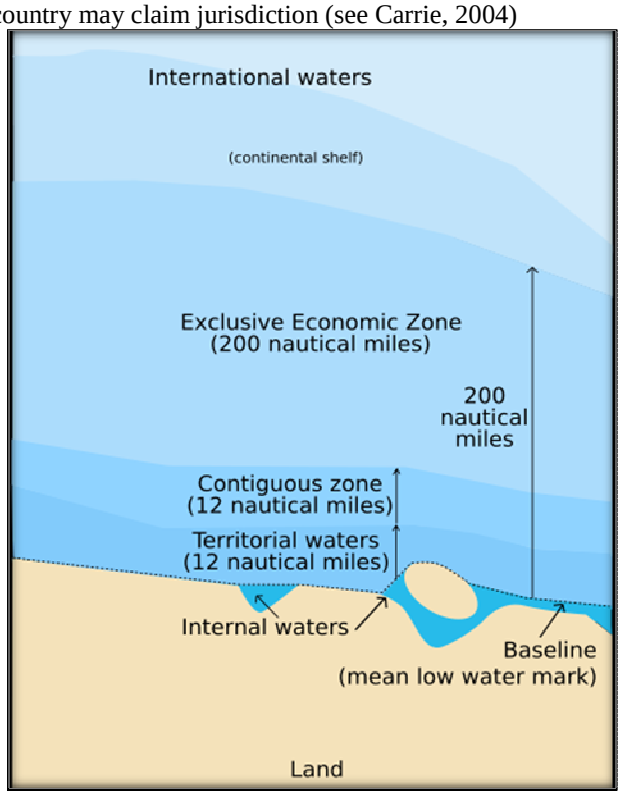

Figure 6: Contiguous Maritime Space, EEZ and Waterways

However, innocent passage, including non-wartime activities of military ships are protected (Carrie, 2004). Even without the Treaty, these boundaries, and the precedent of safe passage, are protected under multiple independent treaties, as well as traditional international maritime law (see for example**,** Guy 1981)**.**

Based on the above law, the Federal Republic of Nigeria and the Democratic Republic of São Tomé and Príncipe (DRSTP) signed the treaty on the Joint Development of Petroleum and other Resources, in respect of Areas of the Exclusive Economic Zone of the two states (Figure 6). Below are the main premises:

- Taking Into Account the United Nations Convention on the Law of the Sea done at Montego Bay on 10 December 1982 and, in particular, Article 74(3) which requires States with opposite coasts, in a spirit of understanding and co-operation, to make every effort, pending agreement on delimitation, to enter into provisional arrangements of a practical nature which do not jeopardize or hamper the reaching of final agreement on the delimitation of their exclusive economic zones;
- Fully Committed to maintaining, renewing and further strengthening the mutual respect, friendship and co-operation between their two countries, as well as promoting constructive neighbourly co-operation;
- Acknowledging The Existence of an area of overlapping maritime claims as to the exclusive economic zones lying between their respective territories (“the Area”);
- Determined to pursue their common economic and strategic interests;
- Noting the possibility that petroleum and other resources may exist in the Area;
- Desiring to enable the exploration for and exploitation of those resources without delay and in an orderly fashion;

- Mindful of the interests which their countries share as immediate neighbours, and in a spirit of co-operation, friendship and goodwill;
- Convinced that this Treaty will contribute to the strengthening of the relations between their two countries; and
- Believing that the establishment of joint arrangements to permit the exploration for and exploitation of petroleum and other resources in the Area will further augment the range of contact and co-operation between the Governments of the two countries and benefit the development of contacts between their peoples;
- Having Decided Accordingly To Constitute by the present Treaty a Joint Development Zone for the Area, without prejudice to the eventual delimitation of their respective maritime zones by agreement in accordance with international law;
- Reaffirming that the rules of international law will continue to govern questions not regulated by the provisions of this Treat, among others.

As observed above, strict adherence to the Law of the Sea Treaty could also prevent possible conflicts considering the provisions inherent in it. This combined with an up-to-date digital map and satellite monitoring will no doubt ensure peaceful co-existence and respect for contiguous sovereign nation's right over the bordering sea.

4.6 Possible Collaboration Between Nigeria and Sao Tome

4.6.1 Space Science and Technology

Identification and response to national security threats can be swiftly handled with dedicated high spatial and temporal resolution satellite images. There are sensors and cameras appropriate to the terrain and weather; new platforms such as Unmanned Aerial Vehicles (UAVs), lighter-than-air ships or satellites to improve detection effectiveness, and signal intercept devices (U.S. Border Patrol, 2004). Nigeria has imbibed the use of space science and technology as an essential tool for its socio-economic development thus, tasking the National Space Research and Development Agency (NASRDA), with the implementation of the Space Policy and Programme. NASRDA in 2000 signed the contract for the building and launch of her first earth observation satellite. Nigeriasat-1 which was launched in 2003 has since provided Nigeria with valuable remote sensing data, used by several institutions inside and outside Nigeria. Following the success of the Nigerisat-1 project and the need to ensure data continuity at the end of life of the satellite which is designed for 5 years, NASRDA signed a contract with Surrey Satellite Technology Ltd (SSTL) in November 2006, for the supply of a highly advanced Earth Observation satellite (Nigeriasat-2) and associated ground segment and image processing system. The project also includes the training of 25 Nigerian engineers as part of a Know-How and Technology Training (KHTT) programme. The Nigerisat-2 was successfully launched in 2011, and is been controlled from a new state-of-art facility in Abuja. The spacecraft was designed to provide advanced capabilities for land and resource management, the mission boasts a 2.5m GSD panchromatic imaging capability together with 5m GSD 4-band capability and a wide swath 32m GSD 4-band imager. This capability is supported on the ground with a full system for processing, archiving and cataloguing of images, allowing a fast and efficient distribution of the data to the users, from the Abuja facility.

Sequel to the above mile stone in Space programme by the Nigerian government, it is recommended that a future joint collaboration in space science and technology especially in the area of providing satellite data for effective monitoring and management of common boundary interest will further boost the socio-economic and political understanding of both countries. Similarly, the socio-cultural and technological know-how of both countries can be harnessed to enhance peaceful co-existence devoid of rancour or conflict of any kind be it boundary dispute, natural resources (crude oil) location and exploitation or otherwise.

4.6.2 Manpower Development and Security Patrol

The use of technological resources (space) has moved the border security into the 21st century of law enforcement. These devices enable immigration and custom officers to more effectively apprehend and accurately track the crossing patterns of illegal immigrants and smugglers. The Nigeria-DRSTP border presents unique challenges to enforcement agencies due to its nature, challenging geography and cultural diversity. To be

more effective, the enforcement agencies require improved specially designed detection and response capabilities. These agencies require remote detection technologies because it is practically impossible to monitor the vast offshore boundary between Nigeria and Sao Tome. Presently, the Custom and Immigration Services of both countries do not have enough man power and resources to adequately tackle the offshore border related problems that is anticipated to follow the exploitation of petroleum in this region. Since Satellite technologies can provide constellation and monitoring data, collaboration with NASRDA for geospatial training in satellite Remote Sensing and GIS to manage and provide geo-spatial intelligence is advocated. Training can also include the creation and maintenance of up-to-date digital database of installations, boundary of interest, common water front, resources (natural and man-made features) and other possible conflicting phenomenon.

5. SUMMARY AND CONCLUSION

Given the resource constraints, availability of satellite imagery has made the task of correcting and updating the existing national maps much easier and faster. A reasonably accurate base map can be prepared using satellite imagery (PAN and IKONOS, Nigeria-sat-1, NigeriaSat-2 and X, among others, depending on the required resolution) as a base and integrating information from various sources such as aerial photographs, revenue maps, sheets, maps from various government departments etc. Appropriate corrections are required to ensure geographical accuracy such as geo-referencing and registration of satellite imagery with topographical sheets. Accuracy can be ensured depending on the resolution of the satellite imagery used. It has been shown that there is a wide range of applications for satellite imaging products using the appropriate tools such as GIS and Remote Sensing Software. Furthermore, on-going space-based research and development is continually expanding the current range of applications. One of the most important characteristics of using space science and technology such as satellite remote sensing and GIS is its ability to spatially integrate georeferenced data of different time period, retrieve, manipulate and classify them, manage and present the result in digital readable format that can be queried for various purposes. One of the areas of international application is border mapping and monitoring because it helps to eliminate the problem of inaccessibility of remote areas or dangerous terrain or water body such as the territorial maritime space shared by Nigeria and Sao Tome. Based on the above analogies we, therefore, conclude that the fact that conflict exists, however, is not necessarily a bad thing: as long as it is resolved effectively, it can lead to national and international growth and development and this can be achieved chiefly through geoinformation science and technology. It is, therefore, recommended that both countries adhere to the already signed treaty and foster cooperation in satellite border mapping, patrol and knowledge exchange. This will further enhance national security, peaceful cooperation and coexistence anchored on bright business and political atmosphere.

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