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IMPLEMENTATION STATUS OF SPACE POLICIES AND PROGRAMS IN AFRICA COUNTRIES: A COMPARISON OF SOUTH AFRICA, EGYPT AND NIGERIA

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ABSTRACT

Space exploration is a development which began with the launching of the first artificial satellite, Sputnik in 1957. Since then, there have been remarkable progresses in the area of space science and technology. However, Space Policies and programs are important and very vital for the actualisation of any country to been seen as being space faring and also to be able to derive benefits that abound in the exploration of Outer Space. Over the years, many African countries are seen to be passive in respect to using space science and technology as a veritable tool in changing the socio-economic life of their citizens for the better. However, recently, there has been a shift from that state of being docile to being active in the exploration of Outer Space and use of Space Science and Technology. Countries in Africa like Nigeria, South- Africa, Egypt, Morocco and Algeria to mention a few have taken the giant stride by having a robust space policies and space programmes with space agencies as well. Nigeria and South-Africa have both launched and still operates satellite in Outer Space. This paper discusses the status of space programmes and policies in some African countries and it makes a comparison on the space policies and programmes of Egypt, South-Africa and Nigeria. This paper is not an attempt to discuss every facet of these countries space programme. It will rather look at the similarities in their space policies, their activities in terms of launching of satellites, space programmes and cooperation with other space faring countries in the world.

INTRODUCTION

At present, space science and technology is not surrounded by the limited reserve of developed States; many developing nations have become space faring and are using space science and technology to offer solutions to developmental challenges. Space should be seen as it ought to be seen – a means to an end and not an end in itself. The purpose of space technology would, however, differ, depending on the peculiar situation of each country.

Space exploration is a development which began with the launching of the first artificial satellite, Sputnik in 1957. Since then, there have been remarkable progresses in the area of space science and technology. A quick look at the number of launchings which have been registered with the United Nations will show the influence of space science and technology on human endeavours. For example, satellites can be used for navigation, weather forecasting, education, remote sensing of the resources of the Earth, disaster monitoring and communications.

An area previously dominated by just two nations in the world now involves more than sixty national space agencies, even as the list of nations setting their sights on space continues to increase. The advent of emerging space faring countries, differentiated from established space faring countries in terms of both time span and capability of their space activities, has changed the space environment dramatically, with far-reaching economic, political and social implications. Previous technological and economic barriers to entry are being brought down by factors such as the advent of small satellites and the spread of globalization. This has created opportunities for emerging space actors.

This paper discusses the status of space programmes and policies in some African countries and it makes a comparison on the space policies and programmes of Egypt, South-Africa and Nigeria. This paper is not an attempt to discuss every facet of these countries space programme. It will rather look at the similarities in their space policies, their activities in terms of launching of satellites, space programmes and cooperation with other space faring countries in the world. Africa countries are seen by most observers in space as not being associated with the high-tech sphere of space. However, in recent years, many countries on the Africa continent have woken up to the potential and usefulness of space technology. Hence, the formulation of Space Policies, that will harness the numerous potentials and usefulness of space technology in Africa.

Most Countries in Africa have not yet met its UN Millennium Development Goals so cannot be expected to engage themselves in outer space affairs. However, some countries in the continent are becoming active in space with space policies, space programmes and a few with space agencies. South Africa has a robust Space Policy and a Space Agency (SANSA) which frequently provides disaster monitoring and post-disaster assessment for South Africa and the Southern Africa Region. Ghana launched its Space Science and Technology Centre in 2012. Kenya Started its Space Programme in 2012. Angola plans on launching its first satellite, AngoSat-1, into orbit by 2016. It is being built by a Russian consortium. Algeria which established its Space Agency in the year 2002 launched five (5) disaster monitoring microsatellites in the early 2000 and an earth observation satellite in the year 2010. Egypt has its own military satellite. It launched its first satellite in the year 2007 for scientific research. The African Union Working Group on Space recently approved a draft African Space Policy and is currently developing a comprehensive Space Strategy. Algeria, Egypt, Tunisia, Nigeria, Morocco and South Africa all have a national Space Agency. Egypt, Nigeria and South Africa have all launched and operated satellites.

I. OVERVIEW OF SOUTH AFRICA SPACE POLICIES AND PROGRAMMES

South Africa is one of the leading countries with a robust space policies and programmes in the continent of Africa. South Africa has made considerable progress in an effort to put in order and make formal its space sector with the major focal point of enjoying the gains and spin-offs of space science and technology for socio-economic development and sustainable progress. An important mechanism in this respect is the National Space Policy, which make available a set of calculated goals and guiding standard in terms of how stakeholders, both state and non-state actors, should organise and conduct themselves within the framework of a national space programme.

South Africa possesses an inherited space capability for satellite and launch vehicle development and manufacturing from the previous apartheid era. The satellite and launch vehicle programme, at that time, revolved around the GreenSat programme, a reconnaissance military satellite, which was terminated due to mounting international pressure. The facilities used for the GreenSat programme are still intact and functional. The satellite assembly, integration and test facility, called Houwteq, has been used for the assembly, integration and testing of South Africa's micro-satellite, called Sumbandila-Sat. The launch facility, called Overberg Test Range, is currently being used for the testing of small-scale military missiles and this is provided as a service to

both local and international clients. Hence, the seed for a formal space programme exists, albeit in most instances with outdated technology, and therefore in need of upgrading and/or retrofitting with modern technology.

It is noteworthy to say that four (4) important Space related events took place in South Africa in the year 2009. The South Africa government released it National Space Policy in March 2009, the Country's first government built satellite, Sumbandila-SAT was launched. The National Space Agency was established in terms of the South African National Space Agency Act (Act 36 of 2008) and South Africa also celebrated its 180th anniversary of astronomy in the country. All these events and important progress shows South Africa's space ambitions.

It is important to know that the Space Policy of South Africa is tailored towards three major important areas of their country and they are namely: National Security, National Knowledge and Scientific Knowledge.

For national security, space provides a plethora of dual use technologies that can be used to bolster national defence systems; for example, space launch vehicles can double as missile delivery systems while National Prestige has been associated with national pride and Scientific Knowledge is the quest to explore other celestial bodies and the origin and evolution of the universe.

Similarly, the main policy directives within the framework of the South Africa national space policy are expressed through a set of policy objectives that suggest the direction that the national programme would be based. These policy objectives include; Improving coordination, Promoting Capacity Building, Supporting domestic and foreign policies, fostering research and development, creating a supportive regulatory environment, promoting a competitive space sector, Promoting space awareness and promoting the peaceful uses of outer space. South Africa also has a national space legislation that regulates and governs their space activities.

South Africa is boasting a 16-year-old national space agency, SANSA (South African National Space Agency), and strong involvement in SKA, which will be the world's largest radio telescope. The South African Square Kilometre Array (SKA) project is the Sudanese Observatory's contemporary successor. It provides quality scientific data that represents the key to unlocking secrets of the universe.

South Africa has also designed and constructed the MeerKAT telescope as a pathfinder to the SKA, which has resulted in more than 500 international astronomers, 58 from Africa, submitting proposals to conduct scientific work with MeerKAT once it is complete. Furthermore, the presence of these telescopes has increased the continent's previously nonexistent astronomical standing to ranking alongside facilities in Australia, Chile and the United States. South Africa has been using data obtained from remote sensing through satellites and other projects to provide assessment on flooding, fires, resource management and environmental Phenomena. It is also important to note that the South Africa National Space Agency Space Weather Centre is the only Space Weather Regional Warning Centre in Africa and also operates as part of International Space Environment Service (ISES). It also provides important services to the African continent and the world at large by monitoring the sun and its activities to be able to provide early warnings and forecasts on Space Weather conditions. The space weather products and services are required primarily for communication and navigation systems, in the defense, aeronautics, navigation and communication sectors.

II. OVERVIEW OF EGYPT SPACE POLICIES AND PROGRAMMES

Similarly, just like South Africa, Egypt also has robust space policies and space programmes and this has helped the country from benefiting from the exploration of Outer Space and uses of Space Science and Technology. Egypt space program vision is to gain indigenous capabilities in Space Science and Technology to serve local and regional needs for the sake of human welfare. These space programs include; optimization of domestic resources, building infrastructure for space science and technology, human resources and capacity building, domestic data and knowledge sharing, space awareness and international collaboration. The space program vision is for Egypt to join the Space age through gradual manufacturing of small research and remote sensing satellites, acquiring technological knowledge and capabilities, and building required infrastructure to achieve self-capability for Egypt to design and manufacture its own small satellite. It is also expected that all the visions mentioned above will aid and serve the national development plans. Egypt also established a scientific and research base for advanced industries.

It is also important to note that Egypt though with a robust space policy and space program does not have a space agency. A situation that many see has a form of drawback for the space activities in Egypt despite the fact that the country has launched so many satellites into space, a robust space policy and space program. The International Economic Cooperation Bureau of the Chinese Ministry of commerce signed the agreement with Egypt National Sensing and Space Sciences Authority for an Egyptian Assembly, Integration and Test Centre Project. This is an important infrastructure project needed for the country's space development. The Project is located in New Cairo and it would be the Egypt's first space cooperation project with China.

III. OVERVIEW OF NIGERIA'S SPACE POLICIES AND PROGRAMMES

Space exploration is a classic expression of the saying "different strokes for different folks." This is relevant to Nigeria as it does to every developing nation. The main objective of the Nigerian space programme, as stated in the space policy 2001, is the actualization of indigenous competence in development of space technology as a tool for the improvement of the quality of life of the Nigerian people. Since the advent of the policy, diverse steps have been engaged to accomplish the objective.

Nigeria is the most populous African nation and the largest economy on the continent. Since 1960, when the nation gained independence from Britain, respective governments have espoused ideas on how to ensure its development and lift and steer its course from economic servitude to the path of development. Space science and technology is unarguably a valuable tool in not only expanding the frontiers of development, but also strategic in ensuring national security. It is important to note that Nigeria has long been attached with space programme although not active before the space policy. In the year 1957, the United States of American established a portable radio station, outside Kano a northern part of Nigeria, which monitored Explorer1, Apollo and Gemini Satellites. Also, in the August I963, USNS Kingsport, the world's first satellite communication ship, relayed the initial live broadcast of a telephone conversation between Prime Minister Tafa Balewa in Nigeria and President John F Kennedy in Washington via Synacom.

The primary aim of the Space Policy 2001 is "*to make Nigeria build indigenous competence in developing, designing and building appropriate hardware and software in space technology as an essential tool for its socio-economic development and enhancement of the quality of life of its people*." It is divided into ten chapters cutting across issues of capacity building, poverty alleviation and food security, disaster warning and mitigation, defence, national security and law enforcement, understanding the earth from space for national development, space communication applications, education and training, commerce and training, promotion of international cooperation and policy implementation. These chapters articulate government's strategy and policy direction in its space programme and set the strategies for the accomplishment of these policy goals. The policy was adopted in 2001 while the national space roadmap, which sets specific time frame and targets for the fulfilment of the policy came into being in 2005. Although the national space roadmap

has not been made public, its specific contents have been pieced together from various presentations made by the leadership of NASRDA at different fora. The highlights of the roadmap is that Nigeria would launch the NigeriaSat-1 in 2003; train Nigerian engineers to build Earth Observation Satellites in 2006; launch NigeriaSat-2 and NigeriaSat-X in 2010; train and send Nigerian astronauts to space by 2015; develop and build made in Nigeria satellites by 2018; develop rocket propulsion systems by 2015; develop spin-off of allied industries by 2025 and ensure large scale commercialization of space technology and know-how by 2028. The roadmap is expected to drive the actualization of the space policy.

IV. INSTITUTIONAL FRAMEWORK FOR SPACE ACTIVITIES IN NIGERIA

The National Space Research and Development Agency (NASRDA) Act is the prime legislative document that governs space activities in Nigeria. It establishes NASRDA as the coordinating agency for space activities in Nigeria. The functions of the agency as provided in the Act includes the facilitation of space research and development,coordination of space application programmes, development of national strategies for space exploration, keeping all satellite data over Nigeria's territory, facilitation of international cooperation, supporting academic institutions in research, supervision of relevant space centresand reviewing the national space policy.

NASRDA has some centres around Nigeria and it is mandated to work with and through these centres in pursuing the Nigerian space policy. NCRS is responsible for the harmonization of research and development in space science and technology for Nigeria's socio-economic development, satellite acquisition and the development of application solutions.CSSTE is saddled with the responsibility for curriculum development in space science and technology, training of professionals in the application of remote sensing technology. CSTD is responsible for the training of engineers and scientists in the development of satellite technology. CSTP is to ensure the rapid advances in the propulsion system and rocketry. CGS handles issues pertaining to geodesy surveying and mapping while CBSS is to design and fabricate appropriate observatory equipment, alongside the provision education in space science, astronomy and astrophysics, rocketry and balloons, geomagnetism etc. NASRDA and its various centres are responsible for the day to day running of Nigeria's space policy. The decentralization of activities is expected to ensure efficiency in policy execution and administration. Garnaut argues that the location of these centres in various States of the federation is a reflection of Nigeria's diversity and would give different parts of the country a sense of participation in Nigeria's space program. She argues further that Nigeria has been influenced by an elite group of States who have a decentralised system of administration. While Nigeria is permitted to draw inspiration from other countries with successful space programs, it must design a system that reflects her financial state and aspirations.

V. LEGAL FRAMEWORK FOR SPACE ACTIVITIES IN NIGERIA

The regulation of space activities can be categorised into two layers. The first layer is the international legal framework, including bilateral agreements while the second layer is the national legal regime which governs States and their agencies in the conduct of space activities. Nigeria is a party to the prime multilateral treaties that govern the exploration and use of the outer space namely, the Outer Space Treaty, the Return and Rescue Agreement, the Liability Convention and the Registration Convention, but not the Moon Agreement. Nigeria is also a founding signatory to the Hague Code of Conduct against Ballistic Missile Proliferation and a member of the International Telecommunications Union (ITU). The implication of being a party to the relevant international space law treaties is that Nigeria is bound to ensure its government and entities do not contravene its international obligation under the treaties. Nigeria, however, has the discretion to instil the necessary mechanisms to ensure domestic compliance with its international obligations. The Nigerian Constitution provides that "*foreign policy objectives shall be…respect for international law and treaty obligations…*" Apart from the NASRDA Act discussed above, a number of domestic legislations also apply to space activities. With regard to remotely sensed data, the Copyrights Act and the National Geo information Policy both provide for the protection of intellectual property (IP) arising from remotely sensed data. The Copyrights Act was passed in 1988 and does not contemplate today's technological breakthroughs. Similarly, the IP rights over satellites developed by Nigerian scientists on various Know-How Training/Technology (KHTT) Transfer programmes also need to be spelt out by legislation. Collaboration with the private sector to enhance spinoff benefits of space exploration would also need to be guaranteed and ensured by the certainty of the intellectual property (1P) regime that would govern such transactions. The Fire Arms Act regulates the import and export of rocket weapons for peaceful purposes. Under the Communications Act, the Nigerian Communications Commission (NCC) has the exclusive authority to grant licenses and regulate the use of radio spectrum. The Wireless Telegraphy Act 1968 and the National Broadcasting Commission Act, are obsolete and not in tune with the realities of digital broadcasting and therefore need to be reviewed. The Insurance Act mandates that consent must be obtained before Nigerian insurance companies/foreign re-insurance companies can conduct transaction involving foreign placements. The applicability of some of these legislations to space activities has hardly been tested in practice partly because it is essentially a government affair. Policy dictates the direction of legislation and regulation as "legal perfectionism which ignores political reality would never come into force."

VI. IMPLEMENTATION OF NIGERIA'S SPACE PROGRAMME: SEARCH FOR PARTNERSHIP

The role of cooperation and partnership in the development of a country's space program is very essential. Nigeria has over the years keyed into the mechanism of cooperation and partnership in achieving this goal. To meet the challenges of Africa, some African countries namely: South Africa, Algeria, Morocco, Nigeria and Egypt formed the African Leadership Conference in Space Science and Technology. Based on this platform, the countries agreed to develop a constellation of high resolution earth observation satellites. It is noteworthy that Nigeria through the launch of NigeriaSat-2 satellite is the only country that has met this obligation and it has continued to image the African continent and shared such images with African countries.

Similarly, China Great Wall Industry Corporations signed an on-orbit delivery framework agreement of NigComSat-2/3 with NigComSat in Beijing on March 28,2016. Nigeria is the first country that owns and operates communication satellites in Sub-Saharan Africa. The first satellite of Nigeria has been operating on orbit for over 4 years, which was launched and delivered on orbit by China. NigComSat-2/3 will be the second and third communications satellites of Nigeria.

Nigeria is also in partnership with the United Nations. The United Nations General Assembly Resolutions 37/90 of 10th December 1982 – UNISPACE '82 stated '*That the United Nations Office for Outer Space Affairs (UNOOSA), through its Programme on Space Applications should focus its attention, interallia, on building of indigenous capacities for the development and utilization of Space Science and Technology, particularly at the local level*' and Resolution 45/72 of 11 December, 1990 – UN-COPUOS stated '*That the UN should lead, with the active support of its specialized agencies and other international organisations, an international effort to establish Centres for Space Science and Technology Education at the regional level in existing national/regional educational institutions in the developing countries*'. Based on these resolutions, Nigeria through NASRDA is hosting the Africa Regional Centre for Space Science Technology Education in English in partnership with the United Nations Office for Outer Space Affairs. It was established on 15th of September 1998.

The Goal of the centre is to develop skills and knowledge of university educators, research application scientists through

rigorous theory and research works, applications, field exercises, and Pilot-Projects with focus in Space Science and Technology, especially in five principal areas: Remote Sensing & GIS, Basic Space & Atmospheric Science (BSAS), Satellite Communications, Satellite Meteorology and Global Navigation Satellite System which Commenced in the year 2014.

VII. COMPARISON OF NIGERIA, SOUTH AFRICA AND EGYPT SPACE POLICIES AND PROGRAMMES

Developing economies including Nigeria, South- Africa and Egypt consist of the following components; Products from the earth surface and beneath it that is agriculture, mining engineering industries, utilities and construction; Service Industry transportation, healthcare, tourism, telecommunication, national security, national prestige, capacity building and entertainment . Space Technology is essential to maximize benefits and ensure sustainable socio-economic growth from all the above components .This is why some countries like Nigeria, South Africa and Egypt ventured into space technology for the socio-economic development of its citizens. It must be noted that space policies and programmes of these three (3) countries in Africa would be for socio-economic development, national security, national prestige and eradication of poverty in their countries. South Africa has a well defined National Space Legislation. Nigeria's National Space Research and Development Agency operates several multimillion dollar satellites, and recently the country announced it would send an astronaut into space by 2030. What's more, on January 31, it adopted the African Union's Space Policy and Strategy during the summit of AU heads of state in Addis Ababa. This document sets out the continent's objectives in driving an ambitious space programme that can help tackle its most pressing development priorities, while becoming a global space player.

CONCLUSION

Robust Space Policies and Program presents opportunities in the exploration of outer space that cannot be ignored. Investing in space science and technology can serve as a key enabler for inclusive and sustainable development in Africa through mapping the earth's surface with satellite surveillance that is of direct benefit to smallholder farmers. The current and emerging space science capacities in some African countries have highlighted the need for improved coordination of current and future activities in order to maximize the benefits of space technology. International cooperation and collaboration remains a viable option for nations in Africa to leap-frog into space faring nations.

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