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Space Technology: A Panacea for National Security and Economic Development in Nigeria

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Abstract- ***Space technology has emerged as a vital component of national security and economic development strategies worldwide. This paper explores the multifaceted role of space technology in addressing Nigeria's national security challenges and driving economic growth. Space technology offers a wide range of applications, including satellite communication, navigation, remote sensing, and space-based surveillance, which can significantly enhance national security capabilities. Additionally, space technology can contribute to economic development by facilitating resource management, environmental monitoring, and disaster response. This paper highlights the current state of space technology in Nigeria, its potential applications, and the benefits of investing in space technology for national security and economic development. We also discuss the challenges and opportunities for Nigeria to leverage space technology and propose recommendations for policymakers and stakeholders.***

Keywords: Space Technology, National Security, Economic Development, Satellite Communication, Remote Sensing, Nigeria.

I. INTRODUCTION

Space technology (ST) involves that technology for developing and deploying spacecraft, satellites and space stations into orbits and ST also includes the development and use of the ground support infrastructure, equipment and procedures [1]. Space exploration used to be a luxurious show of technological night between the United States of America and the defunct Soviet Union, until developed nations realized the potentials of space technology in addressing real-life challenges and improving the conditions of living on Earth. Developing nations followed suit, committing their limited resources at a smaller but significant scale to exploit outer space programmes for socio-economic gains as well as national pride among the committee of nations [2].

As many Nigerians are aware, Nigeria is signatory to the United Nations Sustainable Development Goals (SDGs) but not many are aware that the country cannot achieve the SDGs without an effective and efficient space agency.

Space Technology is central to the success or otherwise of Nigeria's sustainable development goals and the agency is doing quite a lot in this regard even as it is expected to do but more needs to be done. A few examples would suffice of what the agency has been doing and what it is expected to do to ensure the sustainable development of Nigeria.

Sustainable development is defined as development that satisfies the needs of the present without compromising the ability of future generations to satisfy theirs. In order to be sustainable, development must combine three main elements: fairness, protection of the environment, and economic efficiency [3].

Space technology innovation for sustainable development involves three key approaches; addressing basic needs through innovation and capacity building including poverty reduction, agriculture, urban planning resource management and disaster risk reduction; promoting innovation and innovative approaches which will lead to sustainable economic growth and job creation; and promoting global and regional cooperation for better management of global challenges together by finding global pictures and information[4]. We cannot hope

for sustainable development without peace, stability, human rights and effective governance based on the rule of law. Yet our own world is increasingly divided. Some region enjoys peace, security and prosperity, while others fall into seemingly endless cycles of conflict and violence. This is not inevitable and must be addressed [5].

Armed violence and insecurity have a destructive impact on a country's development affecting economic growth and often resulting in grievances that last for generations.

China has embraced its space program as a driver of economic growth and technological advancement that can help change its economy from a low-cost manufacturer to a high-tech competitor. According to Chinese analysts, investments in space technologies can produce a ten-fold return. The demand created by space projects can spur advances in high technologies that not only can be applied to other uses but also can create new markets. The creation of high technology space products is also intended to support the development of other industries through the introduction of spin-off technologies-technologies originally developed for the space industry that have found a civilian application.

Progress in space technologies can create new markets, such as satellite communications, radio and television, remote sensing data, and satellite navigation products as well as those related to new materials and information technology.

Chinese writings on space and counter space indicate that China sees that it has widespread economic and military interests in space and that these interests must be protected. Underlying this analysis is the belief that "whoever controls space controls the Earth." This belief is based on the premise that space is the new high ground on which battles on the terrestrial battlefield is based. Indeed, space is so important to battlefield success that conducting modern war is not possible without its effective use. In November 2009, then People's Liberation Army Air Force Commander and now Vice Chairman of the Central Military Commission General Xu Qiliang stated that space had become a "new commanding height for international strategic competition" and that having control of the air and space "means having control of the ground, oceans, and the electromagnetic space, which also means having the strategic initiative in one's hands [6]. Space can be used for a variety of national security applications, including reconnaissance, meteorology, missile early warning. communication, and navigation. These technologies can provide critical capabilities to monitor the activities of potential adversaries, facilitate communication between far-flung forces, and provide navigation data to naval and air forces. Weapons can also be placed in space. These include ballistic missile defenses to intercept incoming nuclear-armed missiles, anti-satellite weapons to destroy orbiting satellites, and orbital bombardment systems that can conduct strikes against terrestrial targets.

This paper intends to look at space technology as a panacea for national security and economic development in Nigeria.

II. NIGERIA'S SPACE AMBITION

Nigeria is one first countries in Africa to join the ranks of spacefaring nations, and currently maintains one of the biggest space programmes on the continent. Nigeria, during a joint session of the UN Economic Commission for Africa and the Organization of African Unity in 1976, first expressed its ambition to join the elite League of Nations with outer space programmes. Preparatory policies followed between 1976 to 1980, leading to the establishment of a 10-million-naira National Remote Sensing Centre which started operations in 1996. A blueprint of what later became known as the National Space Agency was contained in the National Space Science and Technology Policy drafted by a nine-man committee in 1998.

On 5th May 1999, the government established the National Space Research and Development Agency (NASRDA), under the Federal Ministry of Science and Technology, and adopted the National Space Policy in 2001 NASRDA led the implementation of the national space programme with an initial operational budget of USD 93 million and unwavering government support

In 2003, NASRDA's collaboration with UK-based Surrey Satellite Technology led to the launch of NigeriaSat-1, an earth observation satellite with a 32m resolution camera and an optical sensor. The following year, the Nigerian government contracted the China Great Wall Industry Corporation for the manufacture and in-orbit delivery of a communications satellite known as NigComSat-1 NigComSat-1 was launched on 13th May 2007, but failed in orbit in November the following year as a result of non-deployment of the satellite's solar panels. Nigeria and China agreed a replacement deal, resulting to the launch of a second communications satellite NigComSat-IR which was launched in 2011 as a replacement for the failed NigComSat-1.

On 17th August 2011, Nigeria launched two more earth observation satellites, NigeriaSat-2 and NigeriaSat-X, for disaster and environmental monitoring missions. UK-based Surrey Space Technology Limited built NigeriaSat-2 and provided technical training for Nigerian engineers to build NigeriaSat-X, (X meaning experiment), as part of the contract. Currently, Nigeria has three functional satellites that are orbiting the Earth, delivering important data and driving social economic development across various sectors of Nigeria's economy [7].

III. BENEFITS OF SPACE TECHNOLOGY ON THE SOCIO-ECONOMIC SECTOR IN NIGERIA

The investments in space programmes are often justified by the scientific, technological, industrial and security capabilities they bring. The wish to develop a specialization may allow a country to participate later on in large space programmes because of its expertise. Space investments can also provide socio-economic returns such as increased industrial activity, and bring cost efficiencies and productivity gains in other fields (e.g. weather forecasting, tele-medicine. environmental monitoring and agriculture previsions). Several space applications have reached technical maturity and have become the sources of new commercial downstream activities, sometimes far removed from the initial space research and development. For example, the growth of positioning, navigation and timing applications, which rely on satellite signals, has spurred new commercial markets (eg. GPS chipsets in smartphones). But as Einstein wrote
-Not everything that counts, can be counted This is also true for the diversity of socioeconomic impacts derived from space activities. As shown in Figure 6, impacts can be categorized in different segments: new commercial products and services (including indirect industrial effects from space industry contracts, meaning new exports or new activities outside the space sector). productivity/efficiency gains in diverse economic sectors (e.g. fisheries, airlines), economic growth regionally and nationally, and cost avoidances (c.g flood) [8].

A defining feature of many space-related goods and services is that their cost is tiny compared to the convenience, efficiency, information, and other benefits they yield. For example, most people would list direct-to-home television and satellite radio as space related industries, and indeed, these services provide access to television and radio to many new subscribers. Much more sweeping. however, is the use of space by broadcast and cable television. Broadcast and cable television providers rely on satellites to distribute nearly all content to cable head ends and broadcast affiliates and to transmit new feeds from location to studio. Satellites also enable truly global internet service. Satellites are not the primary mode of Internet communications, but they extend Internet content and access in ways that current terrestrial networks simply cannot accommodate. Satellites provide intercontinental capacity to augment fiber optic cable networks that under serve certain pathways. Satellite connections have also allowed many Internet users to receive broadband service without waiting the years that it is taking in some areas to build high-speed landline connections. Long-distance telephone service via satellite was the earliest widespread space application and delivered instant telephone access among many countries. Today, many long-distance calls travel on fiber optic cables, but many nations that are not connected to cable networks due to expense or geography still depend on satellites (see Table I for examples of goods and services using space infrastructure). Satellite navigation is another excellent example of the disproportionate benefits delivered by space goods and services. Global

Positioning System (GPS) constellation of satellites signals allows users on land, on the sea, and in the air with inexpensive GPS devices to determine their position and, aided by computer maps (most of which were developed in part using other satellite capabilities such as remote sensing). plot a course to their destination [9].

IV. SPACE TECHNOLOGY AND NATIONAL SECURITY

On other continents space programming encompass security and defense or planetary exploration, in most cases African nations for the moment at least are following a more practical and essential objective: communications. Nigeria serves as a fine example. Nigeria founded its National Space Research and Development Agency (NASRDA) with the intent of developing space technology that would translate into socioeconomic benefits for its citizens. Since the launch of its first satellite in 2003, the country has come a long way in satellite technology [10]. It has established NigComSat, an independent company which manages the commercial operations of communications satellites. The company launched NigComSat-IR in December 2011; a hybrid satellite with a 15-year lifespan that has provided improved and cost-effective wireless coverage for Nigerians [10]. The satellite system is also a boon for national monitoring. It can map the wetlands, aid farmers in crop production, monitor desertification, find the optimum location to construct dams, assess the environmental impact of oil drilling and locate oil spills, and track border movements. To date, Nigeria has managed to sell about 1,000 of its satellite images and hopes that similar sales will cover the costs of manufacture and operation over the course of each satellite's lifetime. Nigeria has used its satellites to monitor the oil-rich Niger Delta. Its satellites have also been used in election monitoring, providing crucial information about voters who may otherwise have been overlooked by poll workers. Satellites have also proved useful in the fight against extremist groups such as Boko Haram. In 2014, Nigeria used its SatX and Sat 2 to monitor the group's movements and to help find the 273 girls it had abducted. However, there are limits to how useful satellites can be in these situations. Finding those kidnapped proved difficult because the satellites only have a 2.5 metre resolution. This means that it cannot trace individuals 'movement it can only get maps of some locations at some particular times. Also, because satellites move from one location to another, it means that it can take up to four days for one to get into position to take a particular photograph. Nonetheless, Amnesty International has pioneered the use of satellite images for human rights research and advocacy over the past six years using imagery from GeoEye and Digital Globe. It has also used satellite imagery to collect information about Boko Haram's activities.

NigComSat is one of the government agencies. with a satellite in orbit. The potentials and possibilities of this satellite are endless; from customs and excise payments, to national database creation and management, to e-passports but these services are not fully utilized [11]

V. CHALLENGES FACING SPACE TECHNOLOGY IN NIGERIA

a. Inadequate funding remains a major challenge for the implementation of space programme in Nigeria. The country is yet to develop domestic facilities and industries for indigenous satellite manufacturing and launch. Given the current status of the Nigerian space program, as well as its limited budget, it appears that Nigeria must continue its strategy of using international partnerships to fulfil its space policy, at least in the near term.

b. The poor acceptance of space technology in Nigeria has been blamed on low awareness. While the effort to boost Nigeria's space technology is laudable, many have argued that there are other aspects of the economy the government can channel its efforts into. Some say that Nigeria should focus on developing the satellite technology on ground first rather than make plans of going into space.

c. Another major challenge confronting Nigerian space programme now is the lack of Assembly Integration and Testing (AIT) centers, which is at the heart of the space programme. This center is a spacecraft production and testing facility which will help in the indigenous realization of satellite

assembly, as well as for qualification and acceptance testing from design to launch phase

d. The most critical challenges facing Nigeria's Science and Technology System today are the non-commercial of successful research results, non-demand driven R&D activities, lack of linkages between the research institutes and private sector.

e. Lack of collaboration among relevant agencies in Nigeria

f. Poor Maintenance culture

VI. CONCLUSION

Nigeria can accelerate her security development and growth using space for actualizing more than the SDGs. Space technology (ST) is an economic development tool as evident in economics of active space-faring nations. To make Nigeria one of the top 20 economies, government should put more efforts to boost the economy through space technology. Economic growth is driven by technological innovation, and space exploration fuels this innovation.

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