

Nigeria Space Programs

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Abstract: This paper gives a brief description of the space policy and activities of the Federal Republic of Nigeria implemented through National Space Research and Development Agency (NASRDA). The NASRDA is one of the research institutions under the aegis of the Nigeria Federal Ministry of Science and Technology with a mission to pursue the research and development of space science and technology. The NASRDA policy aims at ensuring that Nigeria vigorously pursues the attainment of Space Capabilities as an essential tool for its socio-economic development and the enhancement of the quality of life of its people.

Keywords: NASRDA, observation and communication satellites, guidance and navigation systems

1. INTRODUCTION

1.1 National Space Policy and Visions

Since the Russians launched SPUTNIK into the orbit in 1957, space exploration and the exploitation of space resources have become dominant factors in communication, national security, natural resources management, prediction, navigation and management of natural disasters.

The spin-offs of space exploration are generating new products, new ideas and solutions in medicine, manufacturing industry, agriculture, microwave engineering, food technology and material science. Thus space technology can impact on the socio – economic development of any Nation when integrated into the development strategy.

In view of the above, Nigerian government decided to evolve a space policy to address the space needs of the nation. Following the Nigeria space policy, National Space Research and Development Agency (NASRDA) was established to administer the space programme in Nigeria.

1.2 Vision and Mission Statement of Nigeria Space Policy

The following vision and mission statements were derived from the Nigeria space policy:

- **Vision Statement.** Nigeria shall attain continental leadership in science and technology through the development of competence and capabilities in selected areas of science and technology as a tool for national growth and integrity and contribute to the development of space science and technology for human benefit.
- **Mission Statement.** Nigeria shall achieve technological competence in the manufacturing and launching of satellites.

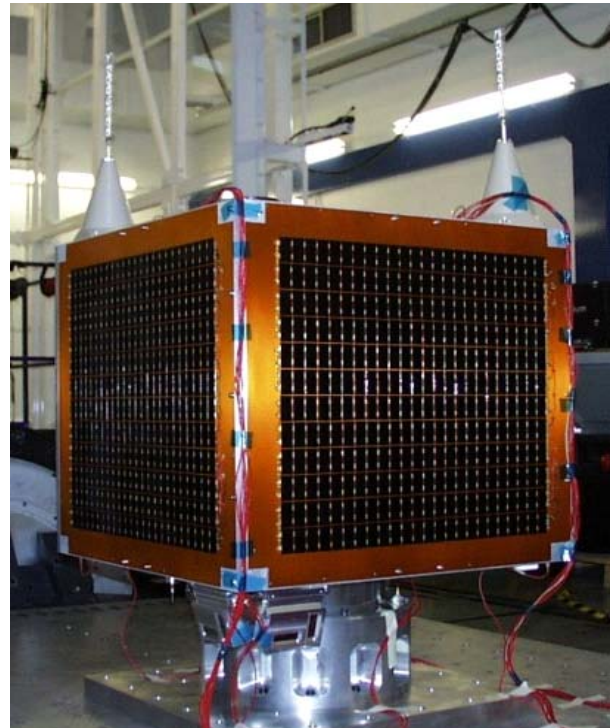


Fig. 1. The observation satellite *Nigeriasat -1*

1.3 Objectives of Nigeria Space Policy.

The objective of the Nigeria National space policy programme is to make space research and development activities part of the overall strategies for sustainable national development. To achieve this objective, The National space programmes have their main thrust as follows:

- To develop strategies and space application in the areas of: National resources management, communication and information management, study of earth and its

environment, education and training, to promote international cooperation, promote private sector participation in the space industry and provide support for universities and other academic institutions in space related research and development projects etc.

- Development of human resources and capacity building in various areas of space science and technology.
- To develop and build competence in space technologies of direct relevance to national development and to enhance the quality of life of its people through various space applications programs.

1.4 The NASRDA Centres and Their Mandate

The implementations of the above key objectives was decentralized through the establishments of six activities centers located in different parts of the country each saddled with unique responsibilities so as to attain the objectives with supervision of NASRDA.

The establishment of NASRDA marked the beginning of active space research in Nigeria. The Agency has six activities Centres whose mandates are directly relevant to the objectives of the mission statement. The centres are listed thus:

- Centre for Satellite Technology Development (CSTD), Abuja; with the mandate to undertake satellite manufacture and space missions.
- Centre for Space Transport and Propulsion (CSTP), Epe, Lagos State with the mandate to manufacture rockets and develop launch facilities
- Centre for Basic Space Science and Astronomy (CBSSA), Nsukka, Enugu with the mandate to carry out research and development in space environment
- Centre for Space Science Technology Education (CSSTE), Ile-Ife, Osun state with the mandate to undertake capacity building in all areas of Space science and Technology.
- National Centre for Remote Sensing, Jos, with mandate to carry out research and development in applications areas of Earth Observation and Remote Sensing.
- Centre for Geodesy and Geodynamics, Toro, with the mandate to carry out research and development in areas of crustal movement.

2. THE SPACE ASSETS

Since its establishment, NASRDA has successfully embarked on two satellites projects through international collaboration.

In September 2003, the observation satellite *NigeriaSat-1* was launched on a sun-synchronous orbit from Russia. The satellite was designed to serve the remote sensing need of Nigeria and is also part of the world disaster monitoring constellations (DMC).

Also, in May 2007, NASRDA made another landmark achievement by launching a geostationary satellite, *Nigcomsat-1* into orbit also through an international corporation. This satellite is designed to serve, not only the communication need of Nigeria, but the entire Africa.

In addition, there is an ongoing project on *Nigeriasat-2* at Surrey, UK. Apart from the above space assets, NASRDA also engage in the following space activities:

- The training of fifteen young Nigerian scientists and engineers on the design and building of all sub-systems of the *Nigeriasat-1* spacecraft.
- Orbit maintenance and housekeeping of *Nigeriasat-1* satellite by Nigeria engineers at *Nigeriasat-1* ground control station located in Abuja.
- Know how technology transfers (KHTT) training of 50 Nigerian engineers and scientists on communication satellite design.
- Global monitoring of Disaster using the Disaster Monitoring constellation satellite with *Nigeriasat-1* spacecraft as a member.
- Space application support for sustainable national development using image and data from *Nigeriasat-1*.
- Preparation of Image map using satellite technology for economic planning of Nigeria
- Participation and Involvement in Local and International Workshops.
- Telemedicine, e-government and e-conference application services projects etc.

2.1 Focus Areas of the Nigerian Space Program

- Basic Space Science and Technology that can provide the understanding space environments and its effects especially on how it impacts the world. This will enable Nigeria to integrate space technology as part of economic planning so as to derive maximum benefits from the nation's participation in the space enterprise;
- Remote sensing that will help scientists and government, understand and manage environment and natural resources using space-acquired information. This technology will enable government understand land, air and water resources and their associated problems;
- Satellite Meteorology including study of atmospheric and weather sciences using satellite data so as to facilitate the effective management of Nigeria environment;
- Communication and Information Technology that will provide efficient and reliable telecommunications services for Nigeria in order to enhance the growth of the industrial, commercial and administrative sectors of the economy;
- Career Development through Education, Training and know how technology transfer. The agency prepares its identified manpower so as to address the unique responsibilities and challenges of space programme. The career development will be achieved through a combination of formal and informal training and various development methodologies which include:
- Know how technology transfer programmes (KHTT).
- Sponsor of agency's engineers and scientists on Postgraduate qualifications (MSc. & PhD) in highly reputable international institutions in relevant fields of space technology.

- Participation of professional Science and Engineering Societies, Engineers/Scientists in local and international Technical Conferences, Seminars and Workshops in Space related fields so as to enrich their knowledge and enhance their competence.
- Professional certification courses, Membership of Space societies and Subscription to Space journals.

3. HIGHLIGHT OF THE NASDRA ACTIVITIES

Irrespective of the fact that Nigeria is a developing country and lack competence manpower in space research and development, a few modest achievements have been recorded by the agency through international collaborations with space technology developed countries and companies all over the world.

3.1 Some of the achievements include:

- (1) Medium resolution earth observation satellite Project (Nigeriasat-1).
- (2) A communication satellite (NigComSat-1) which has now domesticated the hosting of communication/internet bands in the country. The satellite is also expected to improve the provision of GSM services in Nigeria.
- (3) The Space Agency is presently working on NigerianSat-2 (Fig. 2) which is expected to be launched by 2010.

3.2 The Earth Observation satellite (Nigeriasat-1, 2003)

Nigeriasat-1 project was conceived with underlisted mission statements:

- Nigeria to contribute to disaster monitoring constellation of satellites globally.
- Nigeria to build a capacity in satellite technology through know how technology and transfer training.
- Build and launch a low earth orbit microsatellite.
- Establish and control a ground control station for the satellite in Nigeria.
- Control and maintain the satellite in the ground control station by Nigeria engineers and scientists.

3.3 Description of the Nigeriasat-1 satellite

The Earth observation microsatellite is situated on 686 km sun-synchronous circular orbit,

- Approximately 100kg microsatellite with 5 years lifetime.
- Imaging payload of 32m GSD.
- 600km swath width at Green, Red and near infra Red.
- On board data storage of 2X0.5Gbyte SSDR to support daily imaging activities.
- Main download at 8Mbps at S-band using QPSK modulation scheme.

The lifespan of Nigeriasat-1 has expired and the satellite would be replaced in 2009 by a more accurate and better stand alone *Nigeriasat-2* which is also being built in Surrey, England.

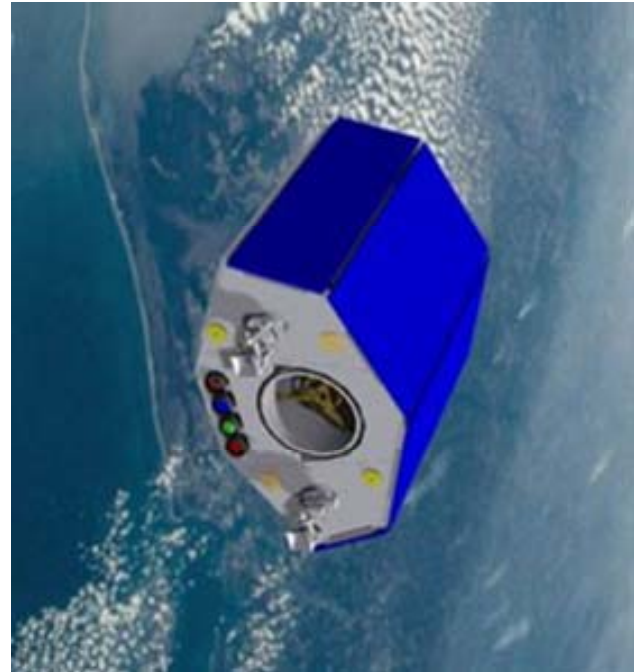


Fig. 2. The observation satellite *Nigeriasat-2*

3.4 The Consortium of DMC.

Algeria, China, Nigeria, Brazil and UK

3.5 The Constellation

- ALSAT- 1
- Beijing- 1
- NigeriaSat- 1
- Bilsat
- UK- DMC

Status of Nigeriasat-1: Though the five years mission life has expired but the satellite is still in operation in orbit and is expected to be replaced with *Nigeriasat-2* in 2010.

3.6 Nigeriasat-2

Nigeriasat-2 though stand alone, will replace *Nigeriasat-1* in orbit after the ends of its design Life of five years. The buildings of *Nigeriasat-2* will also further the Development of skills in the design and development of satellites by the Agency. It will be built on high resolution 2.5m panchromatic and 5m multispectral cameras with design life span of seven years.

3.7 Nigcomsat-1

The First Nigeria communication satellite was built with the following requirements:

- Provide Ku-band, C-band, Ka-band and Navigation payloads capability.
- The Ku-band payload will have 14 operational channels, 2 fixed beams over Western and Eastern Africa. The C-band payload will have 4 channels with coverage of Western Africa.



Fig 3. The communication satellite *Nigcomsat-1*

The Ka-band payload will have 8 channels providing communications using 3 fixed spot beams over Europe, South Africa and Nigeria.

The Navigation payload shall receive 2 uplink signals at C-band covering Nigeria and Europe, and transmit 2 downlink signals at L-band, L1 and L5, using a global coverage. The TC&R system shall be provided at C-band. The TT&C facilities will be located at Abuja, Nigeria.

Nigcomsat-1 will provide different kinds of communication services which include intra national telephone relays, direct-to-home television services, direct radio services, broadband data communication services and navigation services for GPS signal integrity and augmentation etc. and has a mission life of 15 years.

This project also include know how technology transfer and training (KHTT) for 50 Nigeria engineers on communications satellite design and its operations.

The satellite was launched on 13th may 2007 after intensive design, assembly, integration, verification and test with experts advice and supervision from Telesat, Canada.

3.8 Applications of *Nigcomsat-1*

The payload of NigComSat-1 Satellite includes Ku, C, L, Ka four bands and will provide fixed communication service, broadcast communication service and Navigation payload service.

The *Nigcomsat-1* is situated onto Geostationary Orbit.

Status of Nigcomsat-1: The satellite experiences some problems after eighteen months in orbit and is expected to be replaced with *NigComSat-R* so as to meet the communication need of Nigeria.

4. HUMAN CAPACITY BUILDING

In the area of human capacity building, NASRDA always includes know how and technology transfer training (KHTT) for her scientists and engineers on Spacecrafts subsystems conceptual designs and modeling during any of her major satellite projects. The Agency has trained over seventy engineers and scientists during the building of past satellites projects and is still training some on the on going satellite project.

The above-listed objectives are not an easy task to achieve within 25 years, but NASRDA consider it to be a challenge that can be overcome. To achieve these objectives, NASRDA is collaborating with major players in the space industry for technological assistance.

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