Novel Approaches by Nigeria's Space Agency (NASRDA) in Geospatial Intelligence Training and Capacity Development of Institutions, Ministries Departments and Agencies for Sustainable Implementation of socio-economic Projects and Programmes in the Country.

By

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Presentation Outline

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NASRDA: Who we are ?

- National Space Research and Development Agency (NASRDA) is an Agency of the Federal Government of under the supervision of the Federal Ministry of Science and Technology.
- The main aim of the Agency is to steer and drive the implementation of the nation's Space policy and programmes.

Human Activity in Space

Government space programmes

- Governments conduct space with a number of goals in mind:
  - National security
  - National prestige
  - National development
  - Scientific and technological advancement

Nigeria's National Space Policy and Programme

Vision Statement:

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.

Policy Statement

Nigeria shall vigorously pursue 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.

Nigeria shall achieve this through research, rigorous education, engineering, development, design and manufacture of appropriate hardware and software in space technology, including transport and payloads, such as satellites, telescopes and antennas for scientific research and applications.

ii. Government shall foster Bi-lateral and international cooperation in all aspects of space science and technology in order to ensure that Nigerian Scientists and Engineers will benefit from global developments in this enterprise.

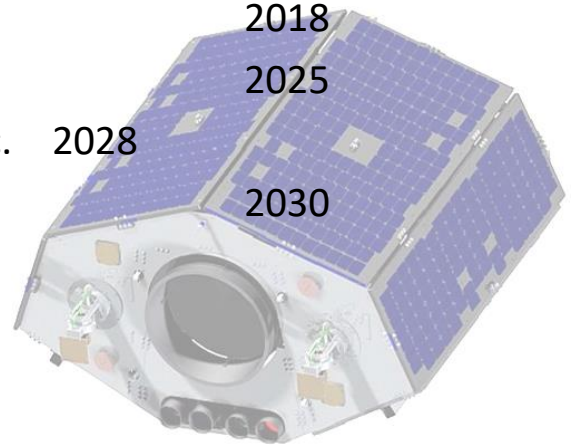
Road Map

- The Road Map was carefully articulated to outline the milestones/landmarks envisioned to be achieved in the implementation of the Space Policy and programme of the Agency from 2005 to 2030.

25 YEAR ROADMAP FOR THE NIGERIA SPACE PROGRAMME

- **Goal:** To develop, build and launch a Nigerian made Satellite from Nigerian Soil.

• Launch of NigeriaSat-1	2003
• Training of Nigeria Engineers to Build EO Satellite Abroad	2006
• Launch of NigeriaSat-2	2011
• Launch of NigeriaSat-X	2011
• Training of Nigeria Astronauts	2015
• Synthetic Aperture Radar	2015
• Development and Building of Made in Nigeria Satellites	2018
• Development of Rocketry/Propulsion Systems	2025
• Development of Spin-Off of Allied Industries – Electronics, Software etc.	2028
• Large-Scale Commercialization of Space Technology & Know-how	2030



Human Capacity Building

- The Agency has evolved a Multistage - Purposive Capacity Building Initiative (Programme). The aim of the programme is to first and foremost:

i. Develop a critical mass of indigenous manpower that will drive and steer the implementation of the nation's space programme. This is being done through Academic and Hands-on Training and Know-How Technology Transfer (KHTT) in collaboration with international institutions/organizations with proven competence in space technology, e.g. SSTL, China Great Wall Company Limited. Etc.

- **Nigcomsat-1 Communications satellite**
- 25 engineers and scientists were trained
- They are currently doing very well.
-

Human Capacity Building cont.

2. Agency is supporting in the development of capacity of institutions and universities in the establishment of Space Applications Laboratories, provision of hardware and software components and satellite images.
3. University lecturers and relevant stakeholders were involved in the validation exercise of NigeriaSat-1, NigeriaSat-2 and NigeriaSat-X for the purpose of developing capacity and expose the participants to satellite-based applications.

   This is done to encourage more manpower development and application of space technology in the country.

Human Capacity Building cont.

4. The capacity of Ministries, Departments and Agencies (MDA's) is also being developed through Geospatial Intelligence Training, provision of satellite images and joint projects implementation.
5. Students are encouraged and received on internships at the Agency's headquarters and Six Advanced Space Technology Applications Laboratories established across the country to sensitize and create awareness on the use and applications of RS/GIS.

- **Brief Profile of ASTAL, Uyo**
- **ASTAL's Programmes and Activities**
  - **Space Applications and Research**
  - **Space Education and Training**
  - **Collaborations and Linkages**
  - **Space Application Technologies for R&D**
- **Tackling Environmental Challenges in the ND Region**
- **Generation of Geospatial Information for Sustainable Devt.**

FACILITIES AND EQUIPMENT

ASTAL's Digital Image Processing laboratory is equipped with modern hardware and soft w
facilities that aid in carrying out research, activities in Space Science & Technology.

A0 Scanner

Multi media Projection

A0 Plotter

Team of scientists & Engineers

Fig. 3: showing ASTAL's facilities

FACILITIES AND EQUIPMENT

ASTAL Digital Image Processing Laboratory, Uyo

Photocopier

Four Wheel Drive Field Vehicle

Office equipment

Fig. 4: ASTAL's facilities

Activities of the Advanced Space Technology Applications Laboratory, Bayero University, Kano

Dr Ibrahim Yakubu Tudunwada – Coordinator

2017 Annual Conference/Exhibition of CSTD, NASRDA

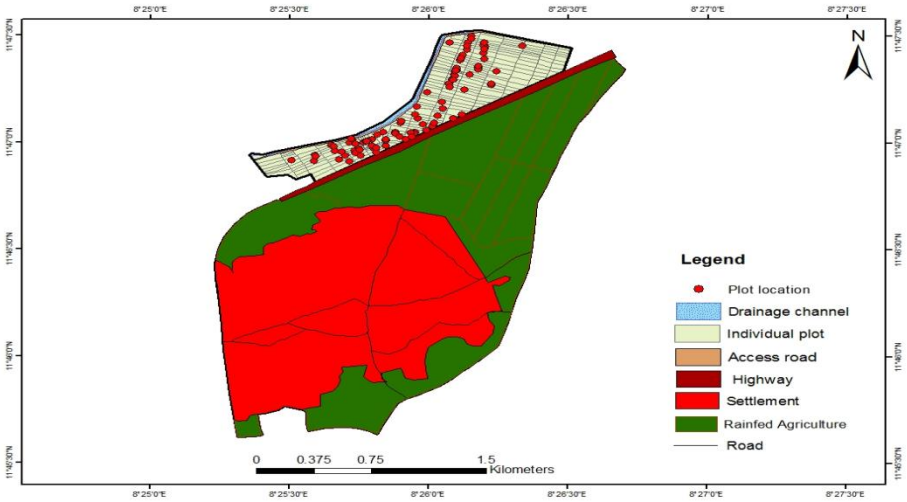
22nd – 23rd August, 2017

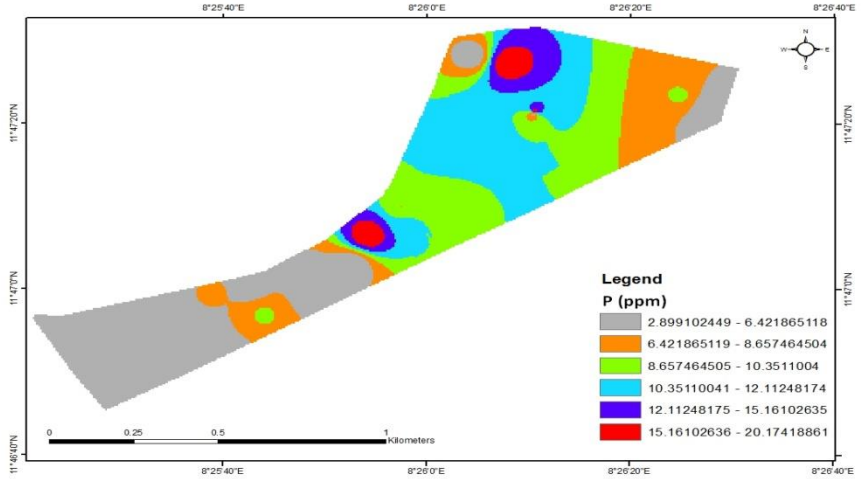
Achievements Since 2012

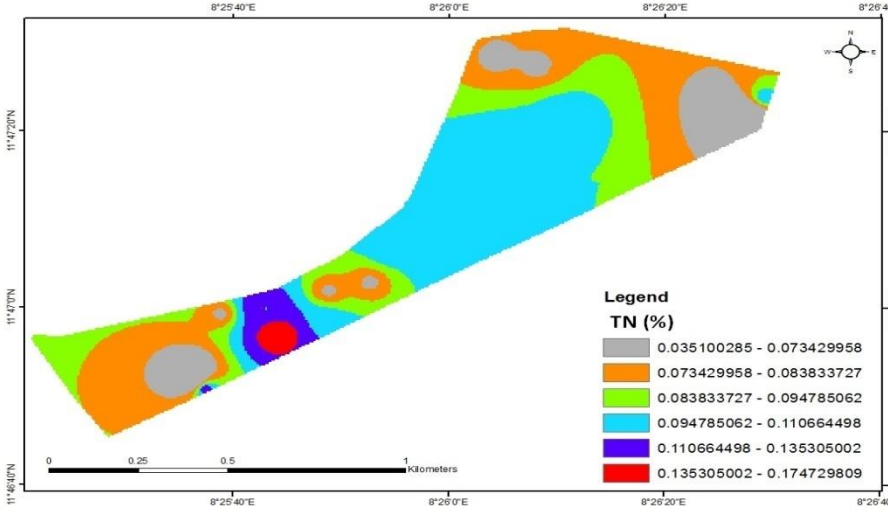
- Partnering with the following institutions: KUST Wudil; BUK; IAR, ABU Zaria; FUT Minna; HJRBDA, ICRISAT And FRINN Ibadan
- Partnering with the following ministries in Kano State: Agriculture & Natural Resources; Water Resources; Science & Technology; Commerce, Industry & Cooperatives; Environment and Ministry for Local Government
- With Jigawa State Government (Invest Jigawa)
- With Lee Group Kano, Dangote and GEMS - 3
- And internationally with FEWSNET, ICRISAT, IITA and World View Satellite Providers

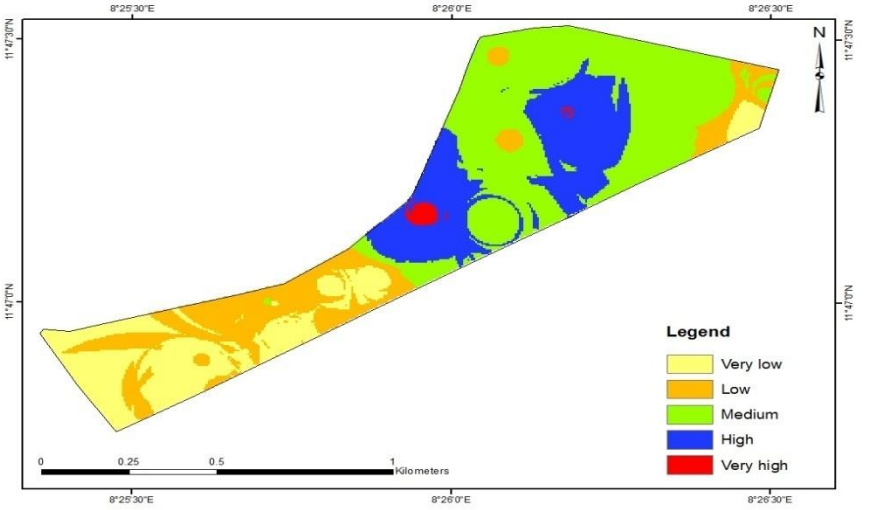
Team of gems – 3 Staff on a Visit to ASTAL Kano

Excerpts From KRIP Study

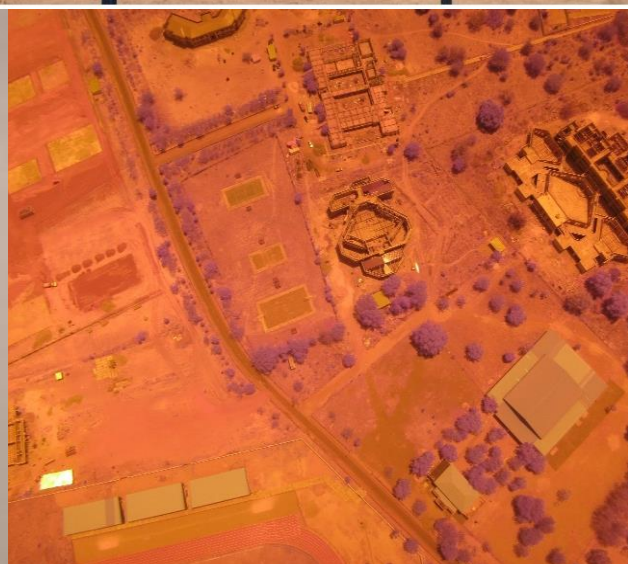








More from stars



NASRDA'Space Technology Assets

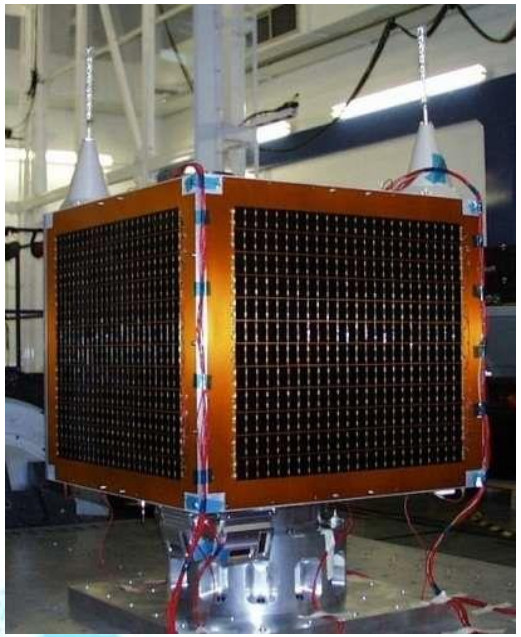
- It is necessary to establish centres of excellence and an institutional framework to develop the relevant fields and coordinate various programmes for the attainment of the national space capability.

- **Centre for Satellite Technology Development (Abuja, FCT**
- **Centre for Basic Space Science (Nsukka, Anambra state)**
- **2. Centre for Remote Sensing (Jos, Plateau state)**
- **4. Centre for Geodesy and Geodynamics (Toro, Bauchi State)**
- **5. Centre for Space Transport & Propulsion (Epe, Lagos state)**
- **6. Centre for Space Science and Technology Education, Ile-Ife,**
- **Osun state)**
- **7.Centre for Atmospheric Research Ayigba Kogi State**

Mission

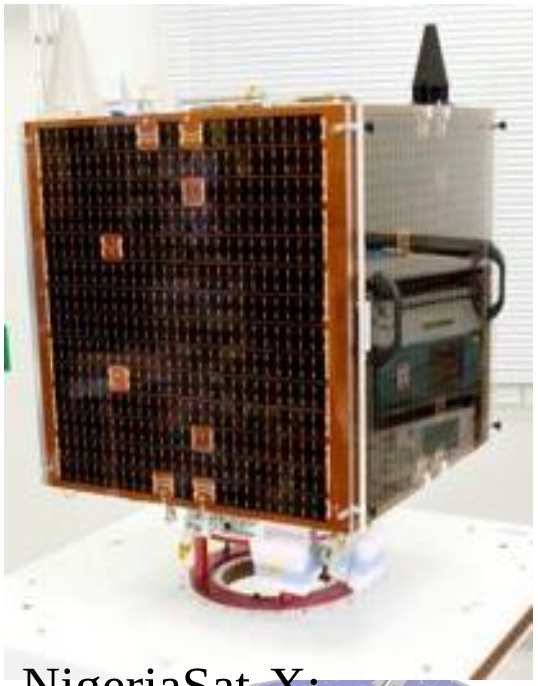
- Centre for Satellite Technology Development (CSTD).
- The Centre shall achieve satellite technology competence so as to indigenously design, build, fabricate and test satellites.

NASRDA Space Assets



NigeriaSat-1: 32m Multi-Spectral Imager (MSI)
Launch: 27th Sep 2003
Part of DMC
De-Orbited 2012

NigeriaSat-2:
2.5m Pan
5m & 32m MSI
Launch: 17th August 2011

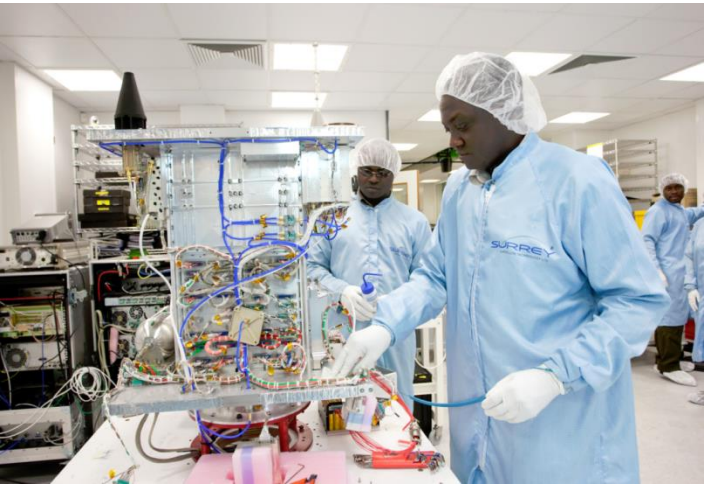


NigeriaSat-X:
22m MSI
Launch: 17th August 2011
Built by Nigerian KHTTs

SELECTED ACHIEVEMENTS AT NASRDA

NigeriaSat-2 and NigeriaSat-X

Launched 17th of August 2011



Major Application Areas

- Save Nigeria funds spent on high resolution satellite imagery annually.
- Support Nigerian Peace Missions All over the World.
- Enhance Precision Agriculture.
- Urban Mapping at 1:25,000.
- National Security Applications.
- Disaster Monitoring and Management.
- Data Revolution in Africa.

Centre for Basic Space Science (Nsukka, Anambra state) : Current efforts

1. Environmental, Pollution and Soil Monitoring (EPSm) System

2. NASRDA – CBSS Space Rover (Robotics)

3. NASRDA Geiger Muller Counter

4. Radio Astronomy Dish fabrication for L-Band Applications

High Precision GPS Device

Env. Mon. & Gas Pollution Detector

Range Finder

IR non – contact Thermometer

Intrusion Detection & Alert System

tation

Remote timing / trigger System

Multi – level Temperature meter

Soil Moisture Reflectometer

NASRDA – CBSS Space Rover

433MHz

Centre for Atmospheric Research

CENTRE FOR ATMOSPHERIC RESEARCH
National Space Research and Development Agency

Mandates

- A world class research and development center of NASRDA committed to research and capacity building in the atmospheric and related sciences

- Dedicated to understanding the atmosphere the air around us and the interconnected processes that mak up the Earth system, from

  the ocean floor through the ionosphere to the Sun's core

- Provides research facilities and services for the atmospheric and Earth sciences community

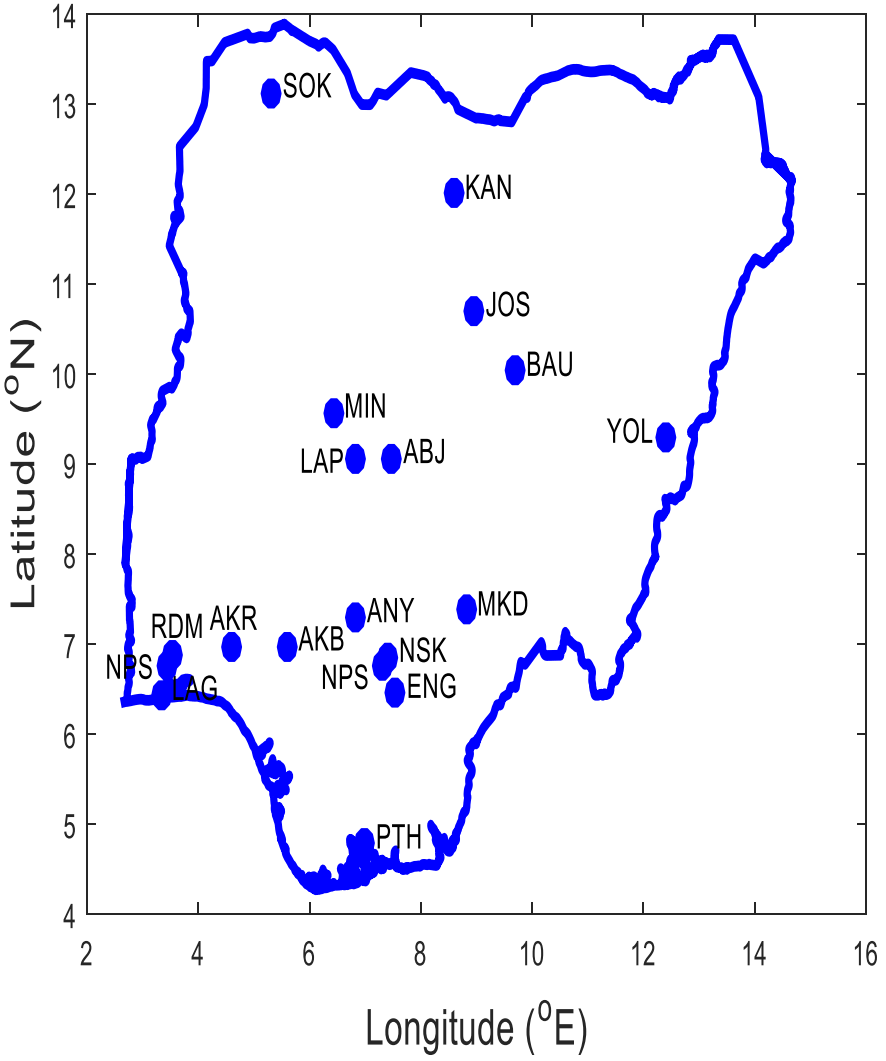
Research Projects of CAR

- Space Weather Observation Network over Nigeria- SWONON
  - Space Weather Observation Network over Africa- SWONOA
- Tropospheric Data Acquisition Network – TRODAN
- Atmospheric Chemistry and Environment Research – ACER
- Microgravity and Human Space Technology - MHST
- Atmospheric Research Software and Instrumentation Development - ARSID

Stations Installation Dates and & Codes

1.	UNN ... July 2007	NSK
2.	UNIABUJA ...July2007	ABJ
3.	UNILAG ...October 2007	LAG
4.	UNIAGRIC MAKURDI ...October 2008 (2015)	MAK
5.	UNIJOS ...March 2008	JOS
6.	FUT, MINNA ...February 2008	MIN
7.	RSUST, PH ... February 2008	PHT
8.	AAU, AKUNGBA... July 2008	AKB
9.	CBSS PERM SITE ...July 2008	NPS
10.	UTHMAN DAN FODIYO UNIV, SOKOTO ...May 2008	SOK
11.	FUT, YOLA ...November 2009	YOL
12.	FUT, AKURE ...May 2010 AKR	
13.	IBB UNIV, LAPAI ... May 2010 LAP	
14.	CAR AYINGBA ... July 2010 AYB	
15.	Redeemer's Univ. 2010 RDM	
16.	ESUT. 2012 ENU	
17.	LAUTECH 2012 OGM	
18.	ATBU, BAUCHI April 2013 BAU	
19.	BUK, Kano May 2017 KAN	

Geographical location of the stations on Nigeria



Microgravity &Human Space Technology – MHST

- Acquisition of facilities for Microgravity
- Experiments in the Laboratory
- Training/Workshops

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CENTRE FOR ATMOSPHERIC RESEARCH
National Space Research and Development Agency

Space Weather Observation Network over Nigeria- SWONON

- Monitoring space environment including satellite altitudes
- Maintenance of existing stations
- Networking of existing stations
- 1 Station per state
- Data generation
- Secondary products

Equipment

Magnetometer
GPS SW monitor
Digisonde
FPI
All Sky Optical Imag

CENTRE FOR ATMOSPHERIC RESEARCH
National Space Research and Development Agency

SELECTED ACHIEVEMENTS AT NASRDA

International Collaborations

- African Union (AU) and ECOWAS - Satellite Projects
- African Resource Management (ARM) Constellation Satellites.
- Member Disaster Monitoring Constellation (DMC)
- Regional Support Office for United Nations Platform for Space-Based Information for Disaster Management and Emergency Response.
- Collaboration with NASA for GPS Ground Control Network in Toro.
- International Astronautic Federation.
- University of Missouri-Kansas City for Environmental Assessment in Niger Delta and Lake Chad Basin.

STEM

- Through the Various centres of excellence the Agency is encouraging school pupils, students and university graduates and under graduates to participate in Science Technology , Engineering and Mathematics. The Agency has many programmes to this effect.
- Recently, 2016 the Director General (NASRDA) instituted a Space Science Ambassadors Scheme take involved about 30 selected secondary schools in the country, and 20 primary schools in the Federal Capital Territory administration.
- It is hoped that more schools will participate this year.
- the idea is to stimulate participation in sciences and catch them young.

Women In Space (WIS)

- This is an organization and initiative of the staff of the Agency through which fellow women are encouraged to participate is space science activities.

Science and Technology Exhibition

- The ministry as introduce Science and technology education to encourage individuals, young scientists and Agencies to participate in both individual and collective innovative projects. The Agency encourages her staff to take part effectively.

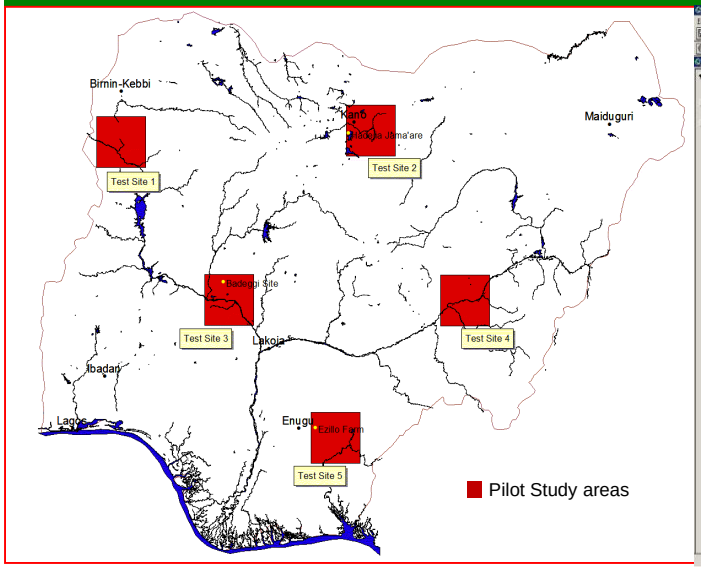
Applications to SDGs

- Data availability, access and utilization is key to well-informed decision making process
- With out accurate, current and reliable data decision making will be faulty and misleading
- Satellite-based approaches help to avail the decision maker sufficient information on which reliable decisions are made.
- Satellite-based data are applied in all aspects of human-endeavour. With well trained personnel in the space technology using accurate dataset will help address most challenges relating to climate change, poverty, environmental degradation, health challenges and access to education by all.

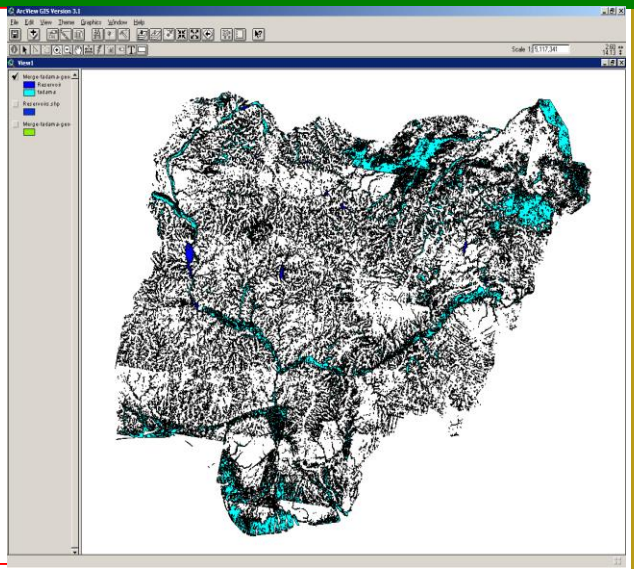
Projects and Impacts

- Agriculture and Food Security
- Telemedicine
- Urban and Regional
- Crime Hot spot mapping
- Ecotourism
- Disaster Risk Reduction Maps

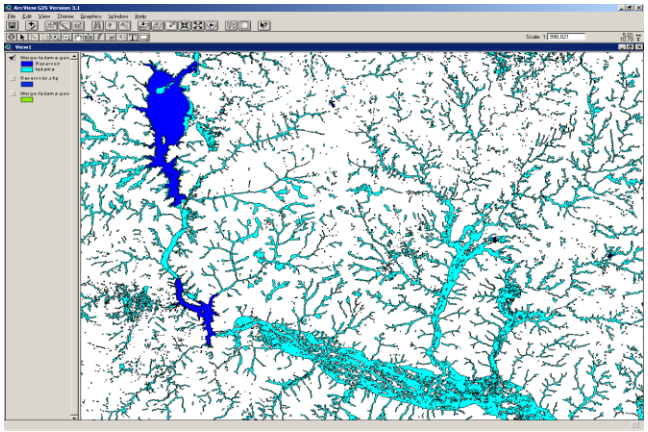
DEVELOPMENT OF FADAMA LAND INFORMATION MANAGEMENT SYSTEM (FLIN



Study area and location of test sites for rice cultivation.

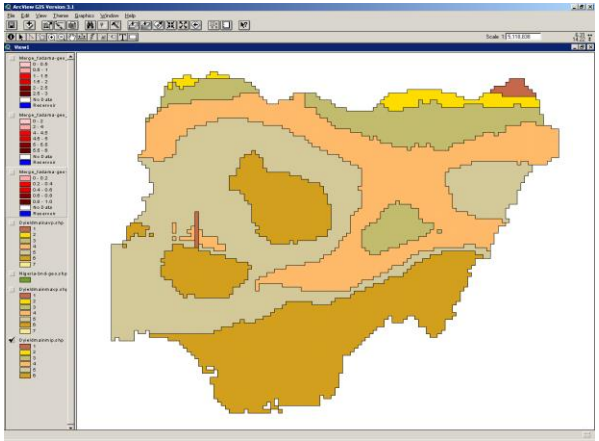


National extent of Fadama (wetland) in Nigeria



Fadama or wetland areas in a close-up view.

Kainji Lake



Min potential yield for Fadama rice

Development Goals

- **Food Security**
- **Poverty Reduction**

Project has established the use of satellite and climatic data (rainfall and temperature) to:

i. Map national extent of Fadama land (wetland) available in Nigeria.

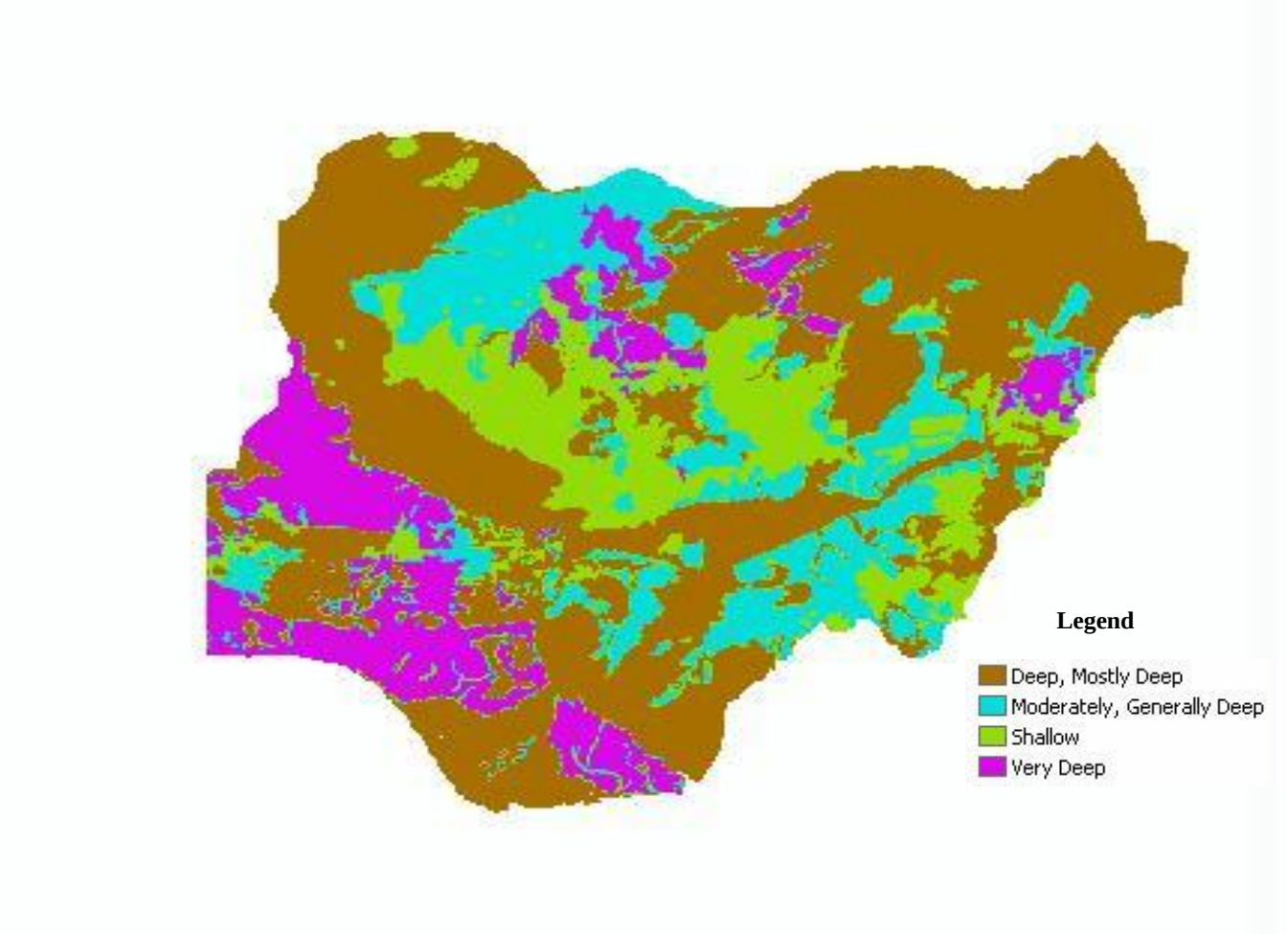
ii. To identify suitable areas for up-land and Fadama rice production in Nigeria.

iii. Determine minimum, moderate and maximum potential yield of Fadama and upland rice for strategic national planning.

iv. Presently approximately 2M ha of Fadama Land is being cultivated for wetland rice.

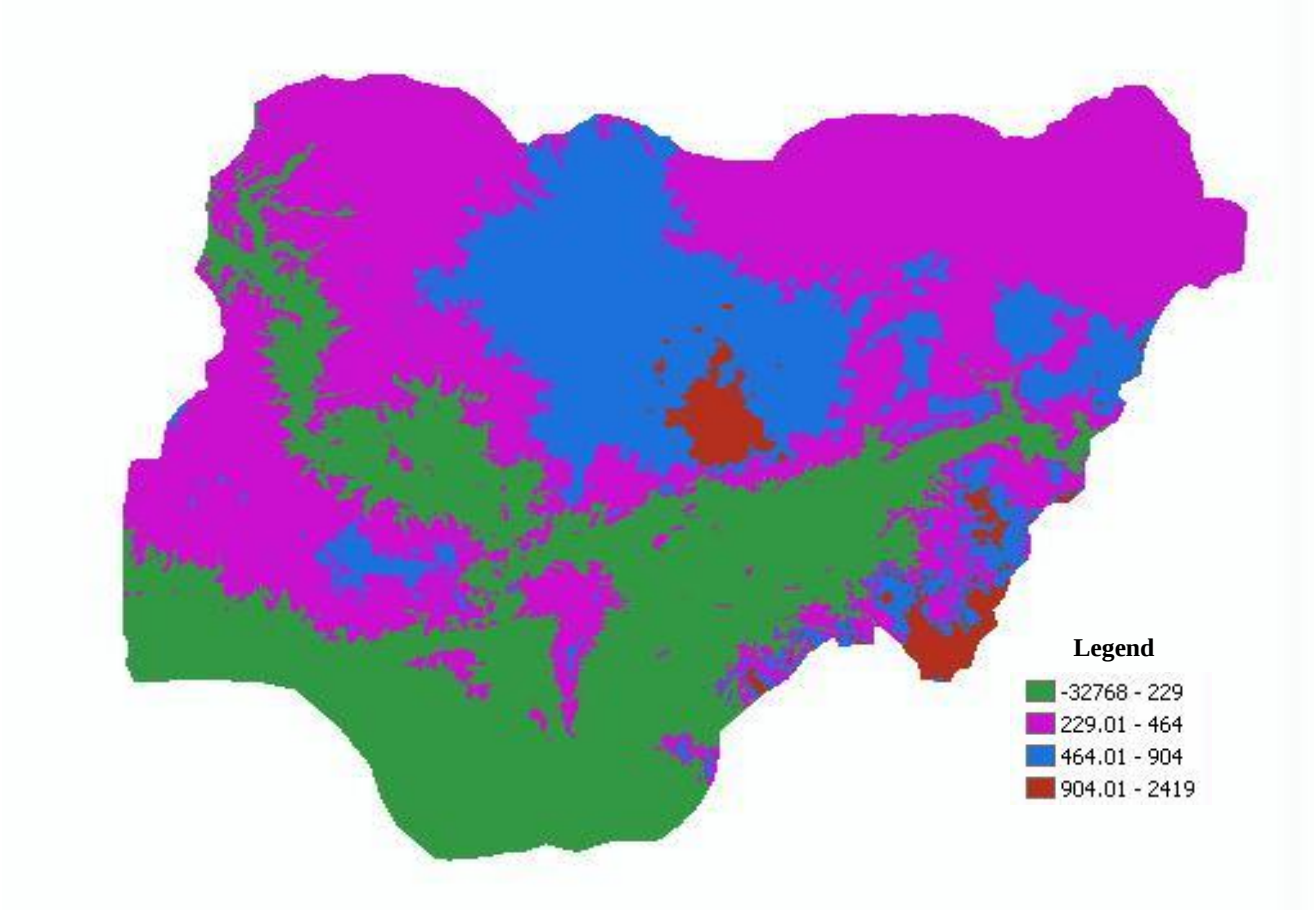
v. Over 3.5m ha of inland valley or Fadama land is available for strategic planning/cultivation to increase production.

GIS Based Agro-ecological Zoning for Nigeria cont.



Soil Depth Classes of Nigeria

GIS Based Agro-ecological Zoning for Nigeria cont.



Height Classes of Nigeria

SELECTED ACHIEVEMENTS AT NASRDA

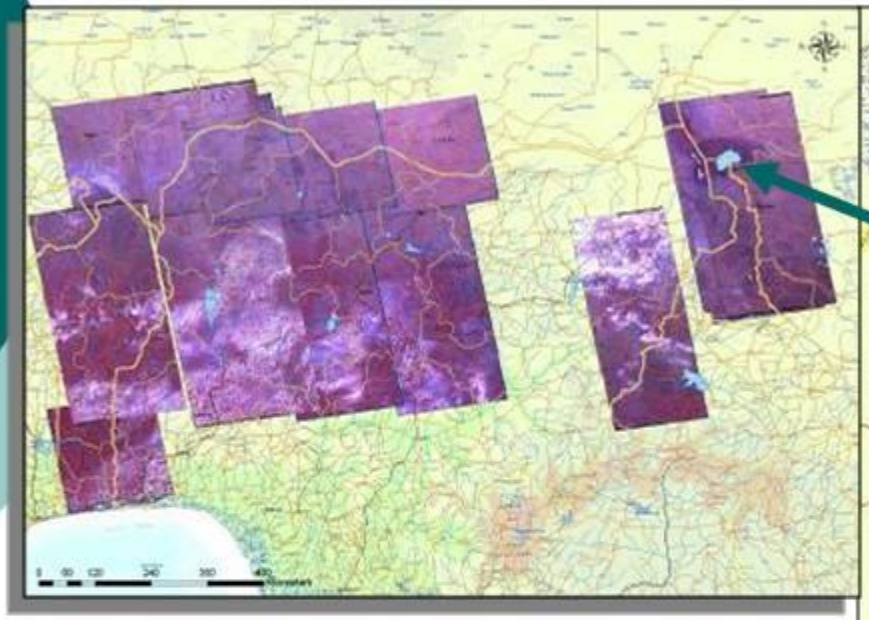
PILOT TELEMEDICINE PROJECT

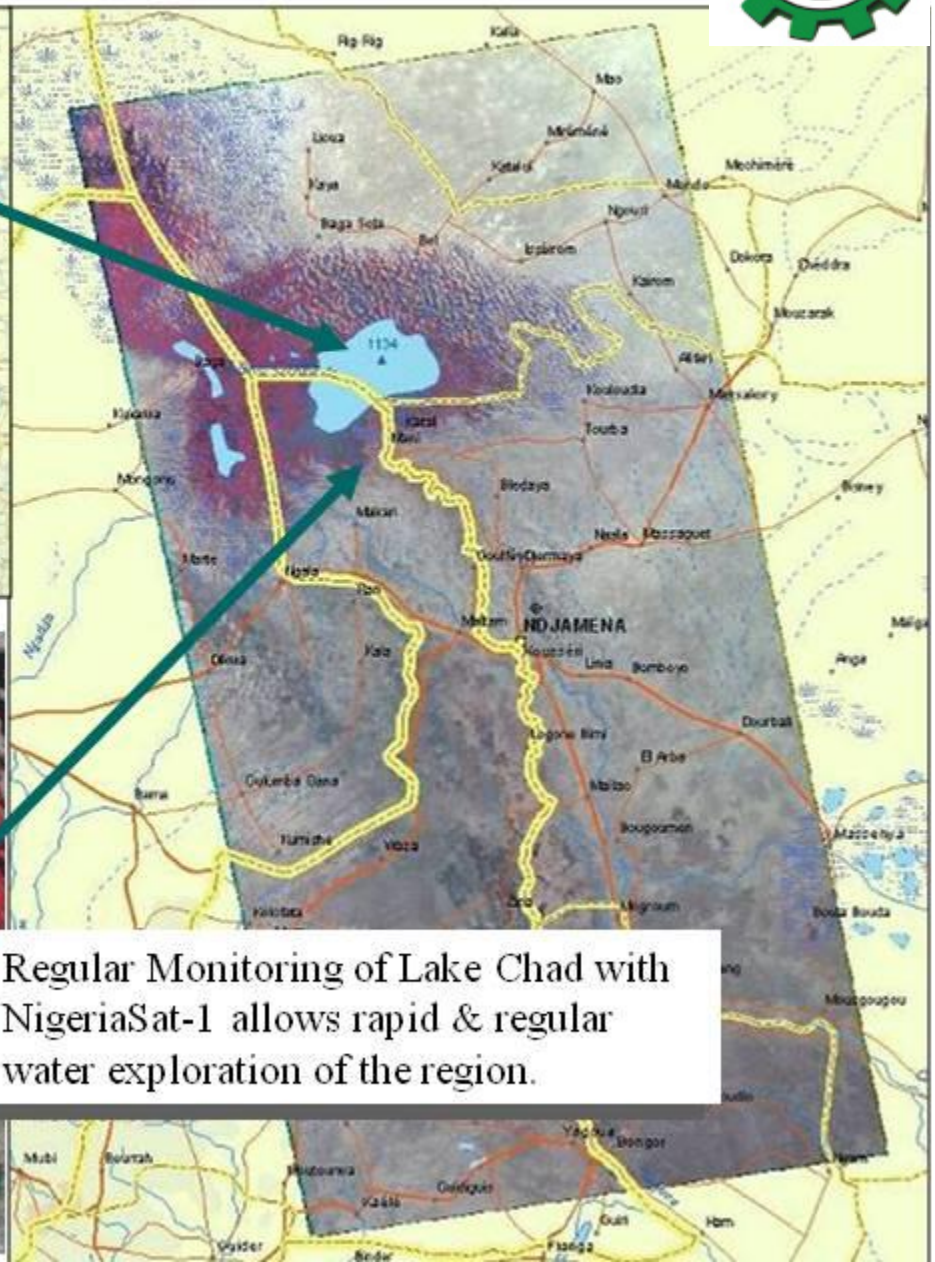
Deployment of National Telemedicine Programme with a mobile terminal node in each of the 6 Geopolitical Zones for healthcare delivery to rural areas in collaboration with Federal Ministry of Health.

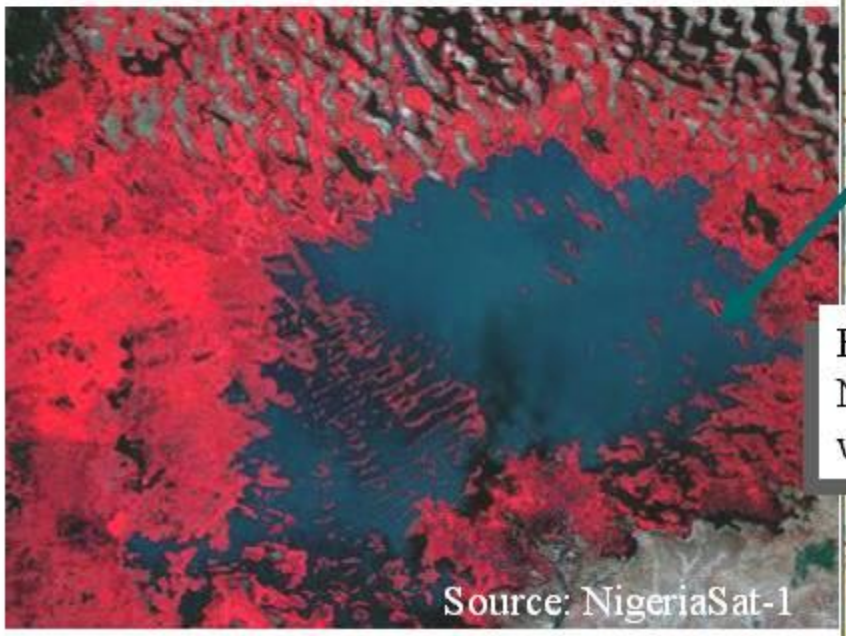
Mobile Telemedicine Bus

Mobile Telemedicine Boat for Niger Delta

Trans-Boundary Hydrological Mapping: Lake Chad Water Courses





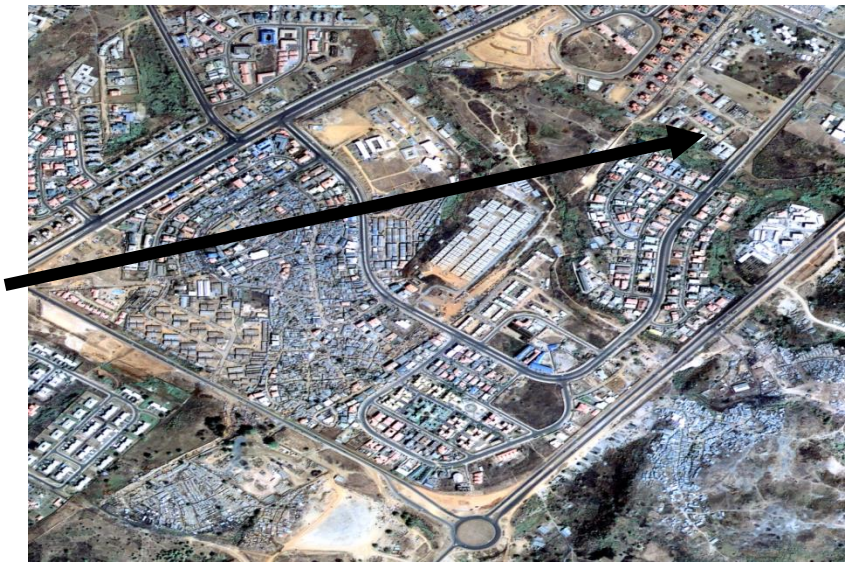


Regular Monitoring of Lake Chad with NigeriaSat-1 allows rapid & regular water exploration of the region.

Urban Renewal (Slum Clearance)

- Urban and Regional Planning,
- Urban Renewal and Change Studies
- Feasibility Study, Landuse Mapping,
- Land Administration,
- Location of Industries.

Gudu Village, Abuja, 2012



CHALLENGES IN HARNESSING SPACE TECHNOLOG DEVELOPMENT IN AFRICA

The major problems associated with harnessing space technology in Nigeria and Africa as a whole include:

- Acceptability
- Lack of initial investment capital
- Inadequate man-power
- Poor funding
- Lack of relevant laboratoryy facilities
- Lack of sufficient awareness of its invaluable spin-off and benefits
- More awareness of its potential as alternative economic asset .
- Need for private sector participation
- Establishment of allied industries
- Need for a continuous investment in communication infrastructure
- Inadequacies in government policies
- Recognition of and overcoming the risk involved in space exploration
- Need for transparency in international cooperation

conclusion

- Space Science , innovation and ICT has changed and made positive impacts on the development of nations especially in the areas of telecommunications and geospatial information for planning and decision support .

- Early acceptance and use of space technology has been slow for many reasons which include:
- very little awareness of its invaluable benefits (which may not be immediately quantifiable in monetary terms),
- lack of man-power to use and transfer the knowledge

- However, space technology is critical to the development of various sectors of the economy and would enhance the achievement of good governance, regional integration and international cooperation.

- Space Technology is vital to the establishment of Spatial Data Infrastructure (SDI) which serves as basis for geospatial data standardization, management and sharing. The implication of the SDI in achieving Sustainable Development Goals (SDGs) cannot be over-emphasized.

- It is therefore imperative for UNOOSA to encourage developing countries both space- faring and non-space faring nations to work together towards a unified standard datasets to drive development in their various sub-regions.

Thank You
For Your Attention.