



THE XXIV FIG INTERNATIONAL CONGRESS 2010



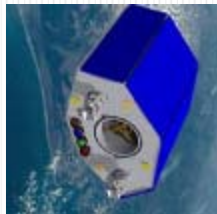
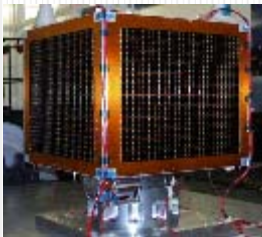
"Facing the Challenges – Building the Capacity"

## Nigeria in Space – an Impetus for Rapid Mapping of the Country for Sustainable Development Planning

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11 – 16 April 2010 Sydney Convention & Exhibition Centre, Sydney, Australia

## Presentation Outline

- Introduction
  - Sustainable Development & Mapping
  - Developed, less Developed, & Developing Countries– What is missing?
- Nigeria Space Programme as catalyst
  - Nigerian Satellites
    - NigeriaSat-1
    - NigcomSat-1
    - NigeriaSat-2
    - NigeriaSat-X
  - National Geospatial Data Infrastructure (NGDI)
- Nigeria Satellite Data Mapping Utilisation
- Nigeria Land Reform Agenda
- Conclusion

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## The Outer Space

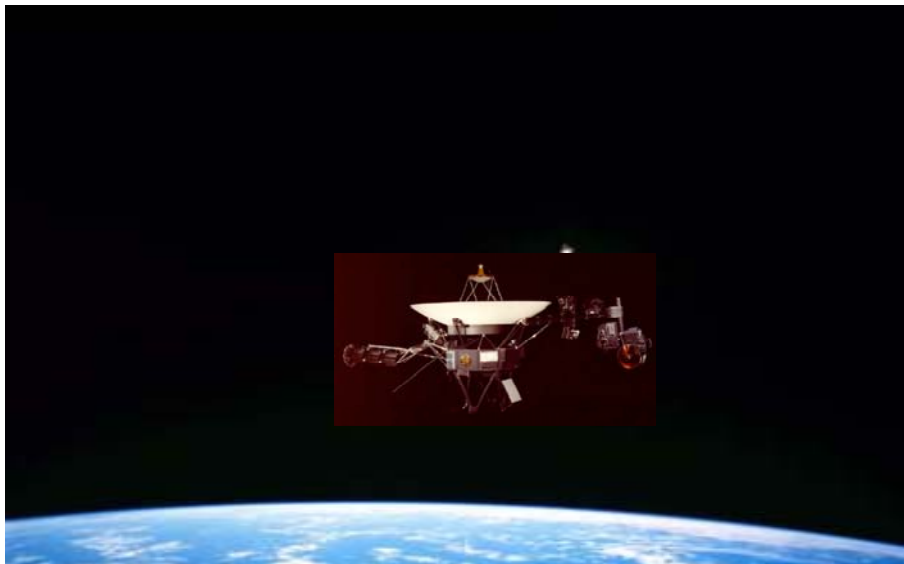
*"Man must rise above the Earth – to the top of the atmosphere and beyond – for only then will he fully understand the world in which he lives"*  
Socrates ca. 450 B.C.



- A stimulus for increased technological advancement and economic innovation
- Offers a unique challenge and platform for exploration and exploitation of our natural resources and environment.

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Space technologies have become integrated into everyday life, so deeply that modern and traditional societies can not function without

– Source: *International Academy of Astronautics.*

Communications via satellite Earth observation



Martinez, 2009

Urban Management



Disaster Management - Floods



SUSTAINABLE DEVELOPMENT

“The development that meets the needs of the present without compromising the ability of future generation to meet their own needs” (WCED, 1987)

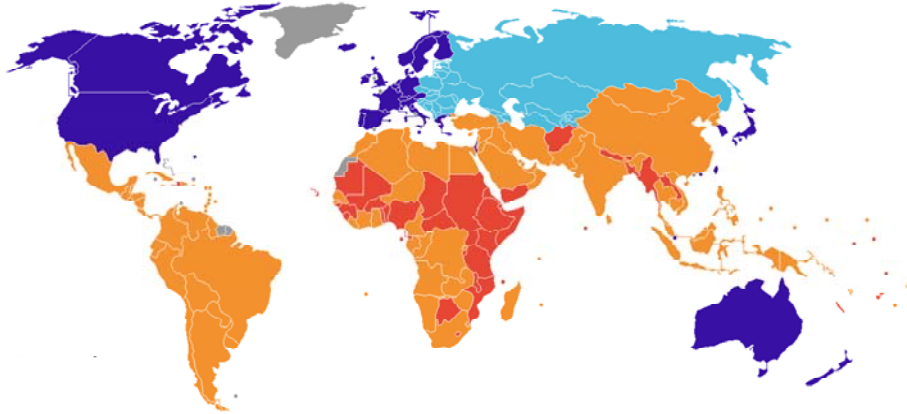
Achieving Rapid Sustainable Socio-Economic Development

- Development of Natural Resources
- Understanding of Our Environment (Protection)
- Maintenance of National Security
- Social Development (WSSD, 2002)

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**DEVELOPED, LESS DEVELOPED, DEVELOPING COUNTRIES – WHAT'S MISSING?**

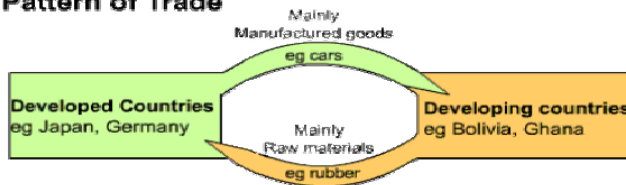


Wikimedia (2010)

- Advanced economies
- In transition
- Less developed
- Least developed

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**Pattern of Trade**



[www.scalloway.org.uk](http://www.scalloway.org.uk)



← Developing Country

© Mayank Bhambhani  
www.graphicreflections.org



→ Developed Country

[www.graphicreflections.org](http://www.graphicreflections.org)

### FOOD FOR THOUGHTS

“Most countries with large (production) of natural resources do more poorly than those without, which is an irony.”

(**Joseph Stiglitz**, the 2001 Nobel Prize - Economic Sciences)

People are dying while sitting in a land full of riches – Why?

“I hope they do not find any more diamonds, otherwise we will start killing each other again.” – The Film Blood Diamond

“Future opportunity will only be available to nations that invest in technological innovations, human capital skills development, and investment in information and communication technology infrastructure”

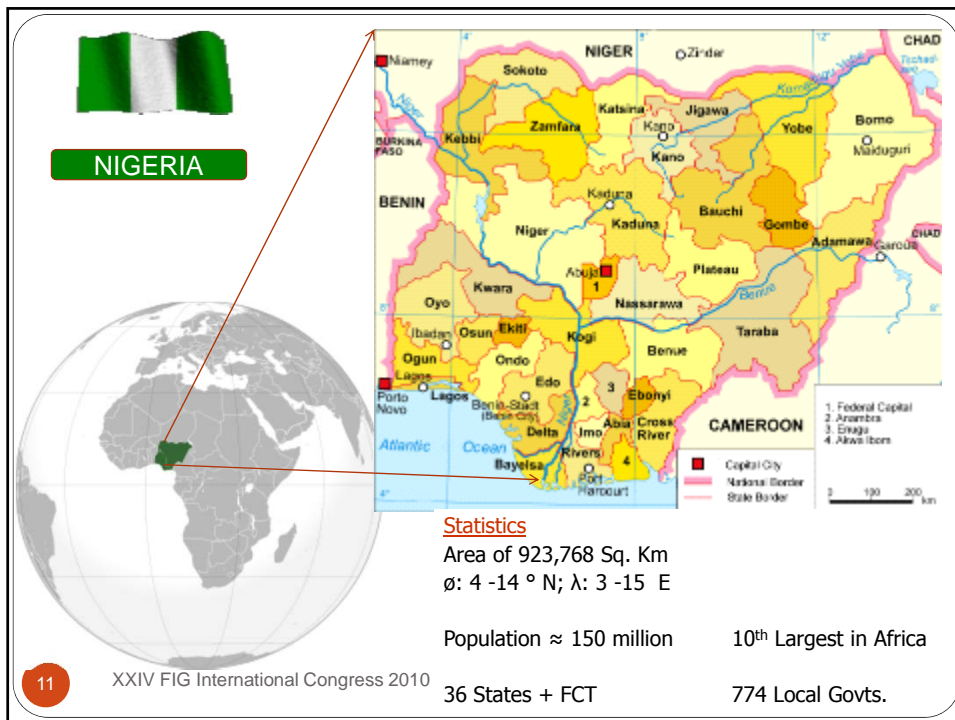
**Sir Arthur Clark [1918 – 2008]**

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### SUSTAINABLE DEVELOPMENT CONTD.

- Sustainable Development of any nation depends on access to reliable and adequate geospatial information (GI).
- **Root Causes of Underdevelopment -**
  - Poor Quality of Data Collection and Management Practices
  - Lack of adequate data infrastructure and;
  - Lack of skilled human capacity in natural resources and environmental management
- **Consequences -**
  - Food Insecurity
  - Air & Water Pollution
  - Environmental Degradation etc.
  - Poverty etc.



## SUSTAINABLE DEVELOPMENT CHALLENGES IN NIGERIA



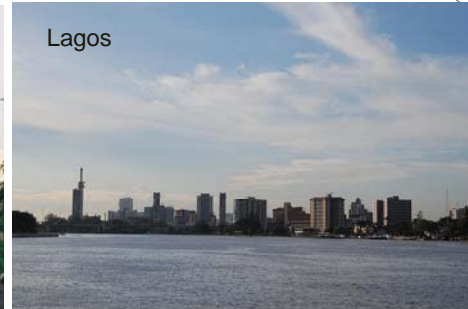
SUSTAINABLE DEVELOPMENT CHALLENGES IN NIGERIA CONTD



Abuja



Lagos



Lagos Beach

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### GEO-SPATIAL DATA CHALLENGES IN AFRICA

- ❖ Lack of up-to-date maps
- ❖ Most maps are still in analogue format
- ❖ Inadequate capacity for the utilization of RS data
- ❖ Inadequate R&D in RS applications
- ❖ Lack of well developed and harmonized Geo-information curricula at tertiary institutions
- ❖ Low bandwidth
- ❖ High cost of high resolution satellite data, software, hardware, etc
- ❖ Poor linkages and coordination among Geo-information institutions

(Ottichilo, 2008)

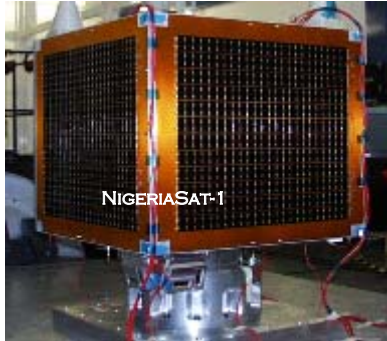
### Nigerian Space Programme

NASRDA

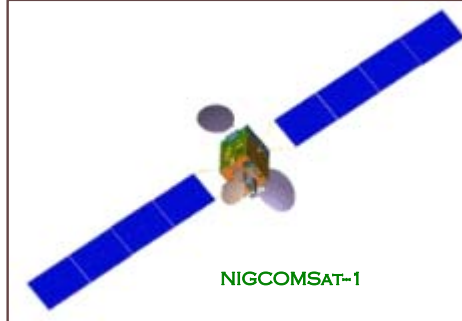




## NIGERIAN SATELLITES

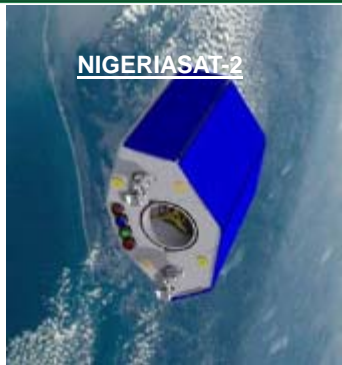


- Launched on the 27th of Sept, 2003
- Microsatellite for earth observations
- Design lifespan - 5 years
- Mass – 100kg
- Imaging payload – 32m GSD in three bands (red, green, NIR)
- Swath width - 600km x 600km
- Revisit period -3-5 days



- A Geostationary Satellite
- Over 5 Tons Wet Mass
- Carrying 40 Hybrid transponders (28 active) in Ku, Ka, C and L-bands
- Coverage: Africa, Middle East, and Europe (Parts of)
- Life Span – 15 years - launched on the 14th May 2007

## NIGERIAN SATELLITES



- NigeriaSat-2 is an Earth-Observation Satellite
- 2.5m panchromatic (very high resolution)
- 5m Multi spectral (High resolution)
- NIR, RED, GREEN & BLUE.
- 32m Multi spectral (medium resolution)
- NIR, RED, GREEN & BLUE
- 7.2m Dish
- Design life span 7 years
- To be launched in 2010

- NigeriaSat-2 Training Model – built to Flight Specification
- Built by Nigerian Engineers
- 22m multi-spectral (RGB, NIR) imagery
- Max swath 600km @ 8bits



**NIGERIASAT-X**

## THE GROUND STATION



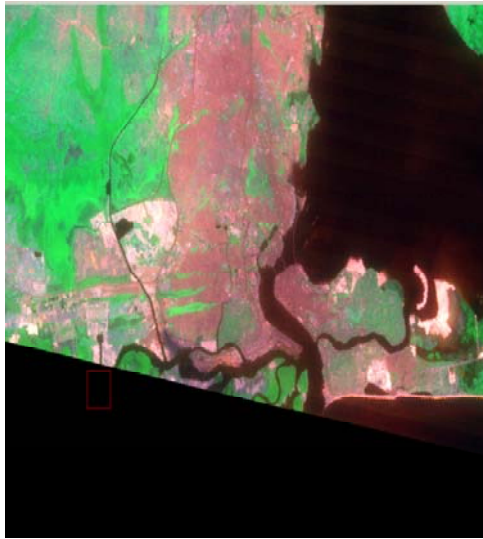
## NASRDA'S SATELLITE IMAGERIES



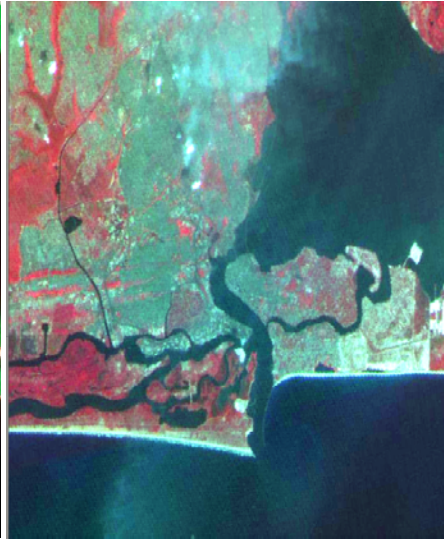
### NIGERIASAT-1



### LANDSAT TM & NIGERIASAT-1 IMAGERIES OF LAGOS, NIGERIA



Lagos 1994 (Landsat TM)



Lagos 2003 (NigeriaSat-1)

### NigeriaSat-1 Data Utilisation



**New Orleans from NigeriaSat-1 showing the effect of Hurricane Katrina**



Mississippi Delta and New Orleans as well as coastal regions eastwards to Gulfport, Biloxi and beyond. USA

## NigeriaSat-2 Spacecraft

MISSION AND SYSTEM	
Architecture	1 Satellite, 1 fixed ground station, store and forward and near-real-time imaging
Orbit and Launch	700km SSO, 22:30 PM LTAN – DNEPR,
Lifetime,	7yrs
DATA PRODUCTS	
Imaging modes	Single and strip scenes (ON & OFF Nadir), Area scenes, Stereo images, Near-Real-Time (NRT)
Quality	5-10% radiometric calibration, 30-45m geolocation accuracy
Capacity	Over 150 raw images per day or 450 compressed ones, storage for 70 images


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<b>EO PAYLOAD</b>	
GSD and swath	2.5m PAN & 5m MS at 20km x 20km for VHRI 32m MS at 300km x300km for the MRI
<b>SPACE SEGMENT</b>	
Mass	Approx. 300kg
Communication, Command and control	S-band TTC link at 28/28 Mbps up/downlink X-band data rate at 2x105 Mbps downlink, Back door commanding, automated operations
<b>GROUND SEGMENT</b>	
Mission planning	Web based automated MP system
Mission and spacecraft control	Full compatibility with NigSat-1 GS, full networking of MCC and all equipments, 7.3m dish ground station

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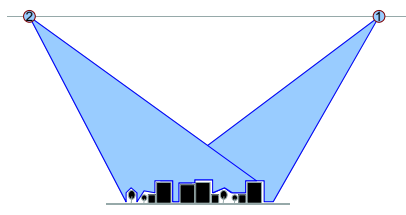
## Typical Collection Missions




**Single Scene Imaging**



**Strip Imaging**



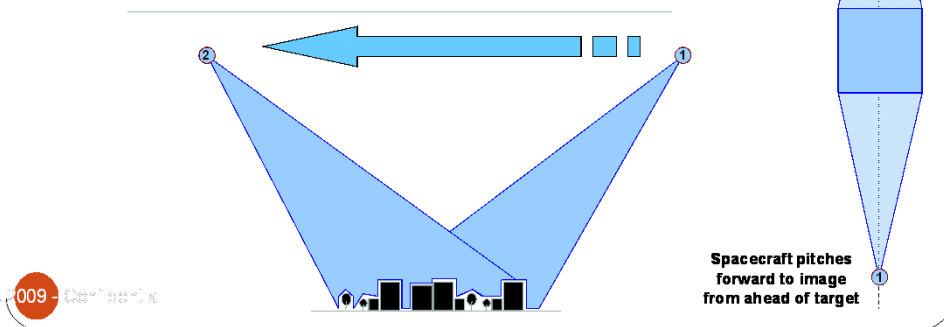
**Stereo Mode Imaging**



**Area Mode Imaging**

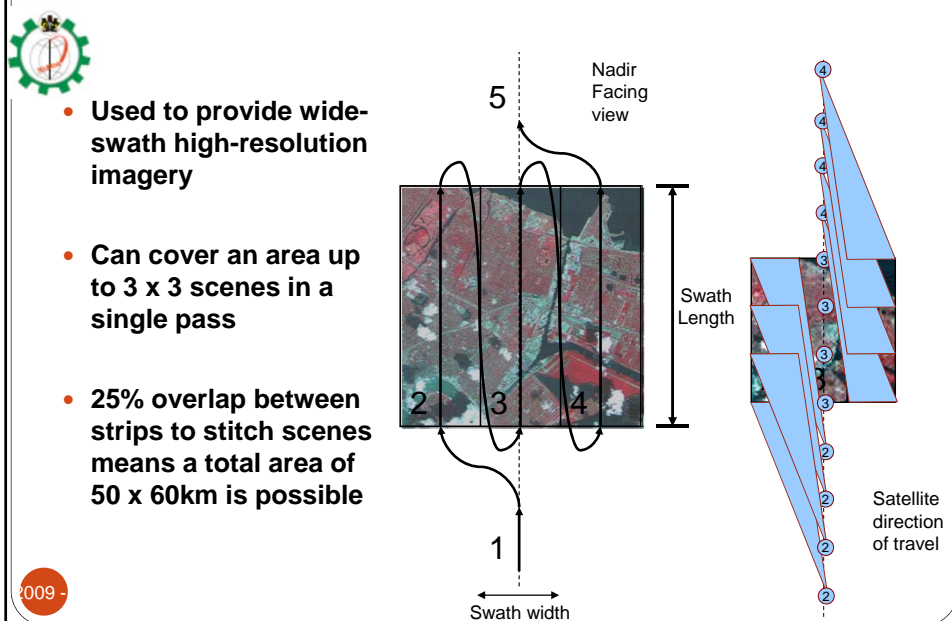
## Stereo Mode Imaging

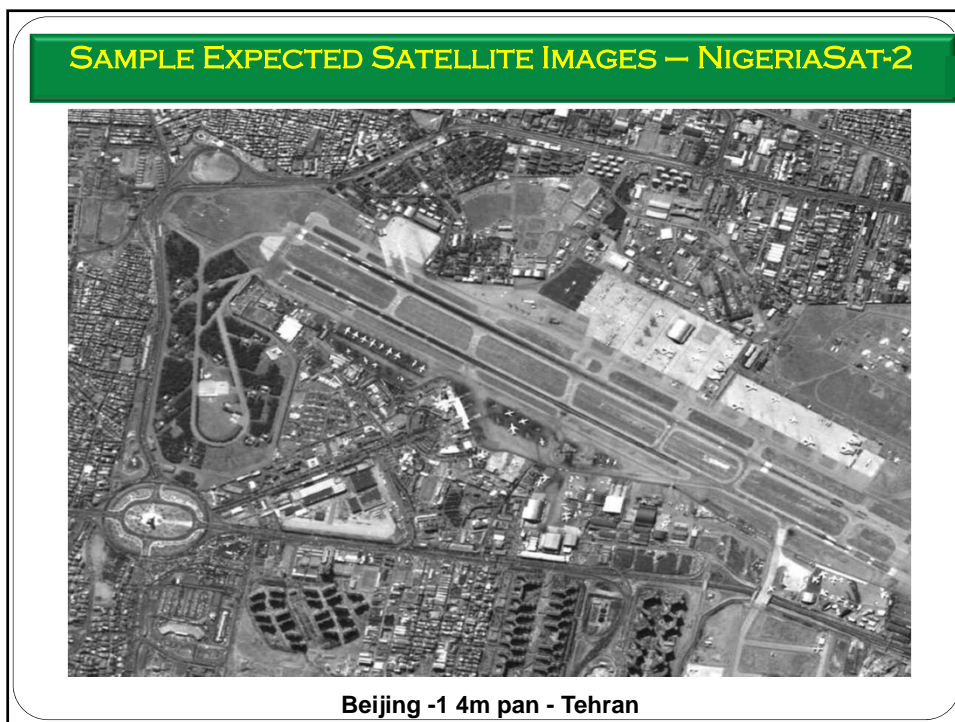
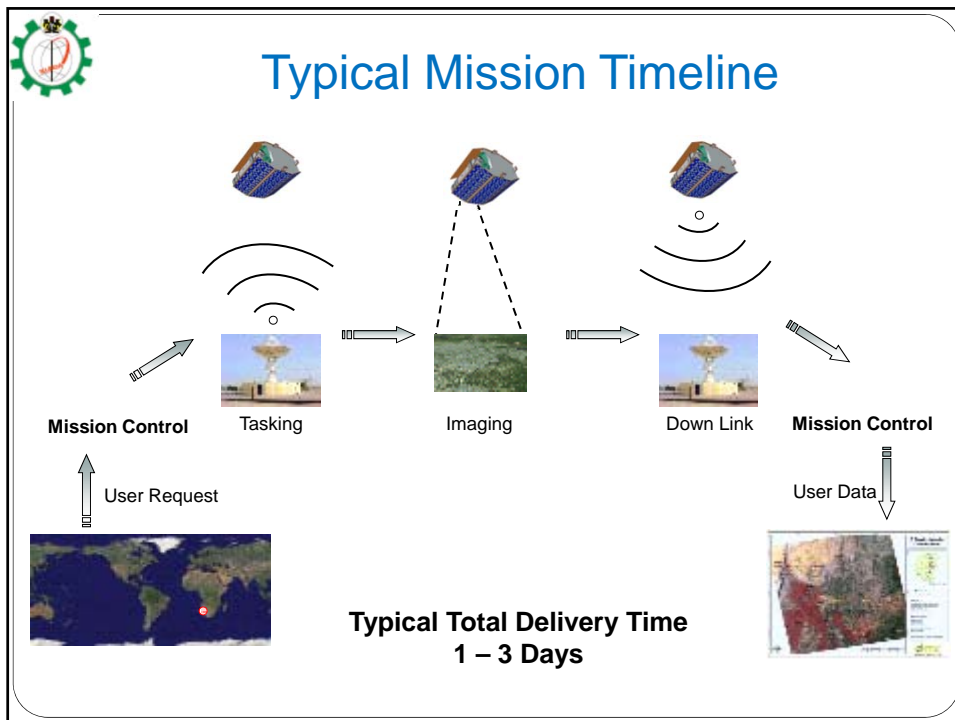
- Combination of two images
- Pitch angles of 10-45° possible
- Used to provide height information on targets



## Area Mode Imaging

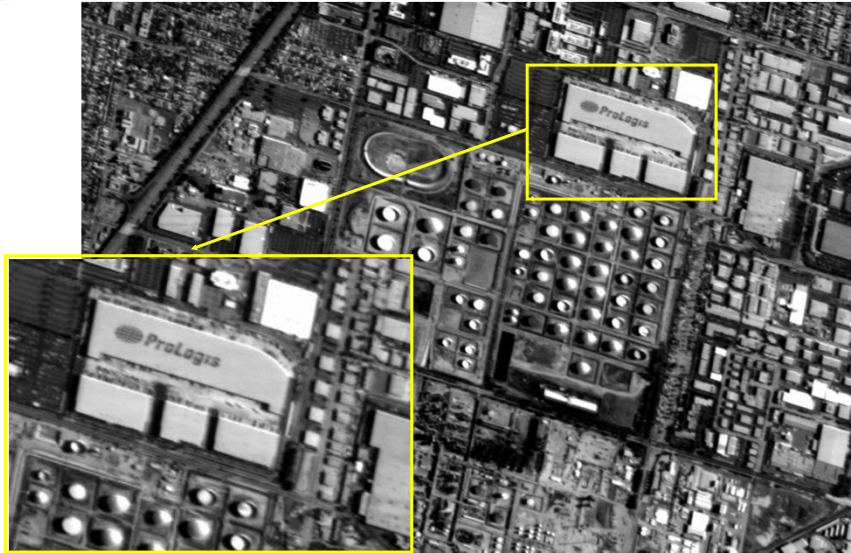
- Used to provide wide-swath high-resolution imagery
- Can cover an area up to 3 x 3 scenes in a single pass
- 25% overlap between strips to stitch scenes means a total area of 50 x 60km is possible







## UK-TOPSAT (2.5m –Pan)



009 -

TopSat image of Los Angeles, USA



## TopSat -MS



009 -



## NSat-2 Application Areas

- Large Scale Mapping
- Water resources management
- Precision Agriculture
- Population Estimation & Urban development
- Health hazard monitoring
- Disaster Mitigation and Management etc.
- Tourism
- Geological Mapping
- Security etc.

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## NIGERIA LAND REFORM

- Key to Poverty alleviation
- Open New Economic Opportunities
- Overhaul Land Use Act (1978) which gives gives possessory right to land in the Governor of a State.
- to adequately empower individuals and groups to use land for the upliftment of their standards of living
- Presidential Technical Committee on Land Reform Inaugurated on the 2nd April 2009

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## NIGERIA LAND REFORM - FOCUS

- Provide technical assistance to government at all levels to undertake land cadastral nationwide;
- Determine individuals' 'possessory' rights using best practices and most appropriate technology to determine the process of identification of locations and registration of title holdings;
- Ensure that Land cadastral boundaries and title holdings are demarcated in such a way that community, hamlet, village, town, etc are recognizable.

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## NIGERIAN LAND REFORM CONTD.

- Achieving the Land Reform objectives therefore rest squarely on the input from the professional surveyors into the process.
- Nigerialsat-2 imagery will definitely serve as a major input into the planned process especially in the rapid generation of large scale maps to aid the cadastral process and features updating

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## CONCLUSION

□ Mapping of the whole country is germane to achieving a sustainable national development planning to support the current effort in alleviating poverty and achieving the Millennium Development Goals (MDGs). Availability and easy access to satellite imagery at relevant spatial resolution serves as catalyst in this respect.

□ Nigerian Space Programme serves as major input for the successful implementation of Rural Development, MDGs, and SDI in the country.

□ Realisation of Rural development objectives depends on availability and speedy access to real-time data and availability of relevant infrastructures for data acquisition, processing, standardisation and data sharing.

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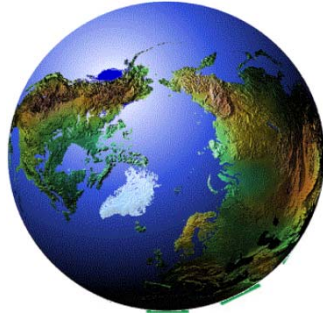
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## CONCLUSION

- Space technology has convincingly served and will continue to serve as a major tool for the management of the natural resources endowment of any nation and for providing a better understanding of the environment, as well as the interactions between the environment and society. It will also enhance the nations defence and security.
- The unique roles of space technology in the achievement of developmental agenda, which includes economic reforms, poverty reduction and economic stability cannot be over-emphasized.

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