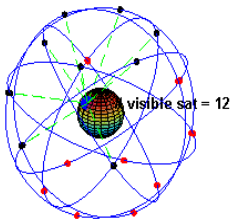
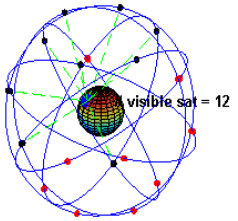


Current Status of Space Science Development in Africa

Babatunde Rabiu,

Centre for Atmospheric Research,
National Space Research & Development Agency,
NASRDA, Anyigba, Nigeria

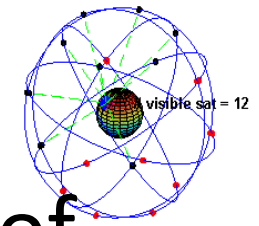
Email: tunderabiu2@gmail.com



Outline

GNSS Challenges in Africa

- Space Science Technology
- Space Science Technology
- Why Space Science
- Facilities
- Space Studies in Africa
- Conclusion.



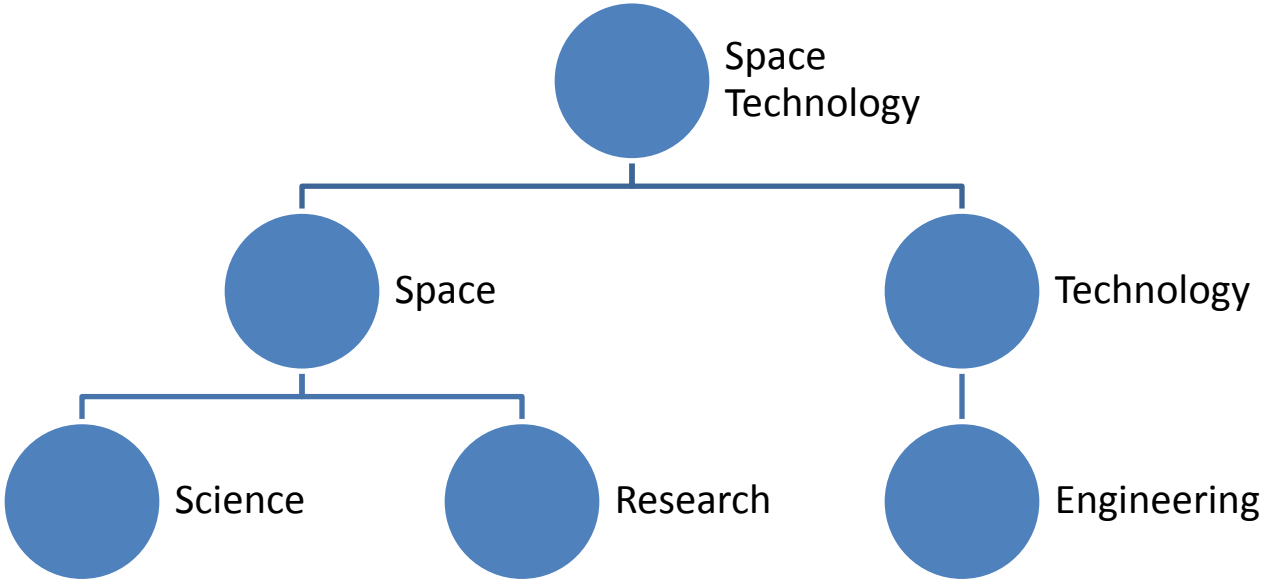
Today's world is not driven by wealth of nations in terms of natural resources, but by technological advancement which has

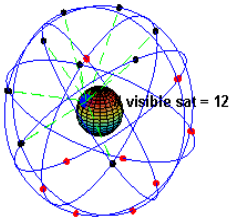
space technology

as one of its drivers.

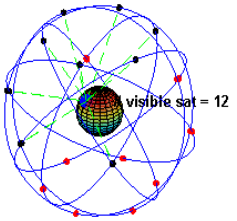
Rabiu (African Skies 2006)

Space technology





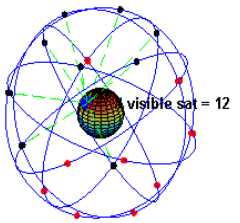
Space



Geospace before 2004

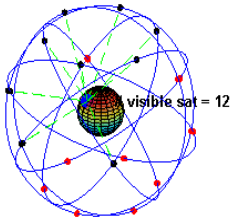
- Before 2004, space refers collectively to the relatively empty parts of the universe. Any area outside the atmospheres of any celestial body can be considered 'space'.
- Although space is certainly spacious, it is not always empty, but can be filled with matter — say a tenuous plasma. In particular, the boundary between space and Earth's atmosphere is conventionally set at the Karman line.
- 'Outer space' begins about 200 km above the Earth, where the shell of air around our planet disappears. With no air to scatter sunlight and produce a blue sky, space appears as a black blanket dotted with stars.

“Heliophysical”



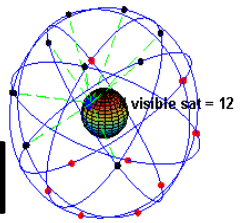
- “Heliophysical” is an extension of the word “Geophysical,” extending the connection from the Earth to the Sun & interplanetary space.
- It was universally agreed during pre-IHY years that the new word, "heliophysical," in order not to be confused with the more limited "heliospherical" (meaning primarily "solar wind"), should embrace not only atmospheric and solar-terrestrial physics but include studies of other planets, the outer reaches of the heliosphere, and its interaction with the interstellar medium (Crooker, 2004)
- Heliophysical studies thus foster interdisciplinary ties with astronomy, astrophysics and traditional geophysics.

Scope of Space Science (after Crooker 2004)



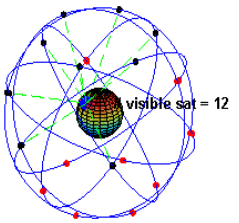
Space Space now embraces

- atmospheric physics
- solar-terrestrial physics
- Planetary studies
- Outer reaches of the heliosphere
- Interaction of the heliosphere with the interstellar medium
- Space studies thus foster interdisciplinary ties with astronomy, astrophysics and traditional geophysics.



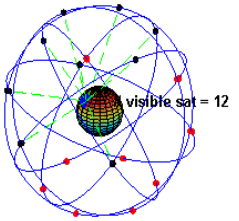
Scope of Space Science Explained

- Sun – Earth Connections (Heliophysics geophysics,
- atmospheric physics,
- Astronomy (planetary geology, geophysics, atmospheric-/geo- chemistry, geo-/astro-/space- biology)
- science history etc.



Technology

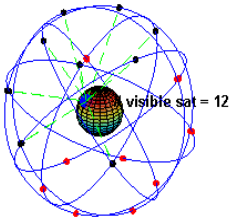
- Coined in early 17th century from Greek '*teckhnologia*' 'systematic treatment', from 'tekhne' *art,craft* + 'logia'
- Technology – the application of scientific knowledge for practical purposes, especially in industry ('advances in computer technology')
- Machinery and devices developed from scientific knowledge
- Branch of knowledge dealing with engineering and sciences



Space Technology

- Any technology that takes advantage of knowledge of unique properties/conditions of space environment to set up machines/tools in space in order to deploy deliverables for benefit of man on earth or other planets

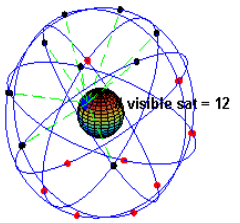
- Prefer the word – space based technology



Space-Based Technologies

- Satellite technology
- Navigation technology
- Information technology ,
- communication technology
- Power systems

Space technology

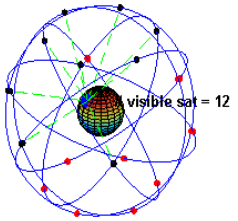


A major Driver of sustainable development in

- Agriculture – precision farming etc
- financial transactions
- Education
- Tourism
- Health
- land administration
- Military
- Social security /public safety
- navigational systems – autonomous navigations, UAV etc
- communication

Its not gainsaying that space technology has tremendous derivable socio-economic benefits

Social-Economic Applications

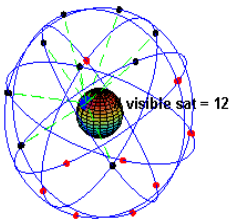


on increasing level

- positioning services,
- surveying & mapping,
- Boundary mapping
- food security,
- disaster management,
- air, land & sea navigation,
- Land administration
- emergency response
- Wild life management
- communication

Communication technology

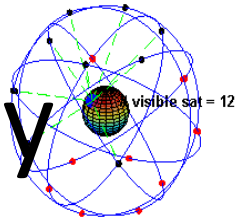
- Voice
- Data / Imageries
- Earth-sat communication
- Signals passes through space environment

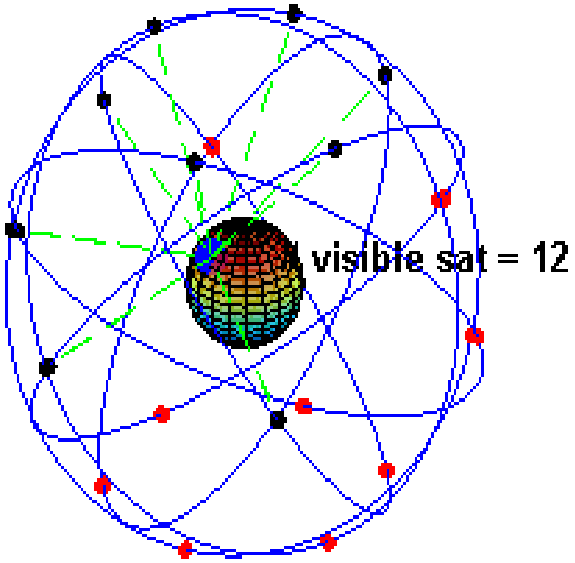


Defense/Military

- Signal transmission
- Robotics
- Space commands
- Navigation
- Drones

Applications of GNSS Technology





1: Surveying

2: Road transport

3: Aviation

4: Maritime transport

5: Environment and agriculture

Wild life conservation

6: Civil protection and surveillance

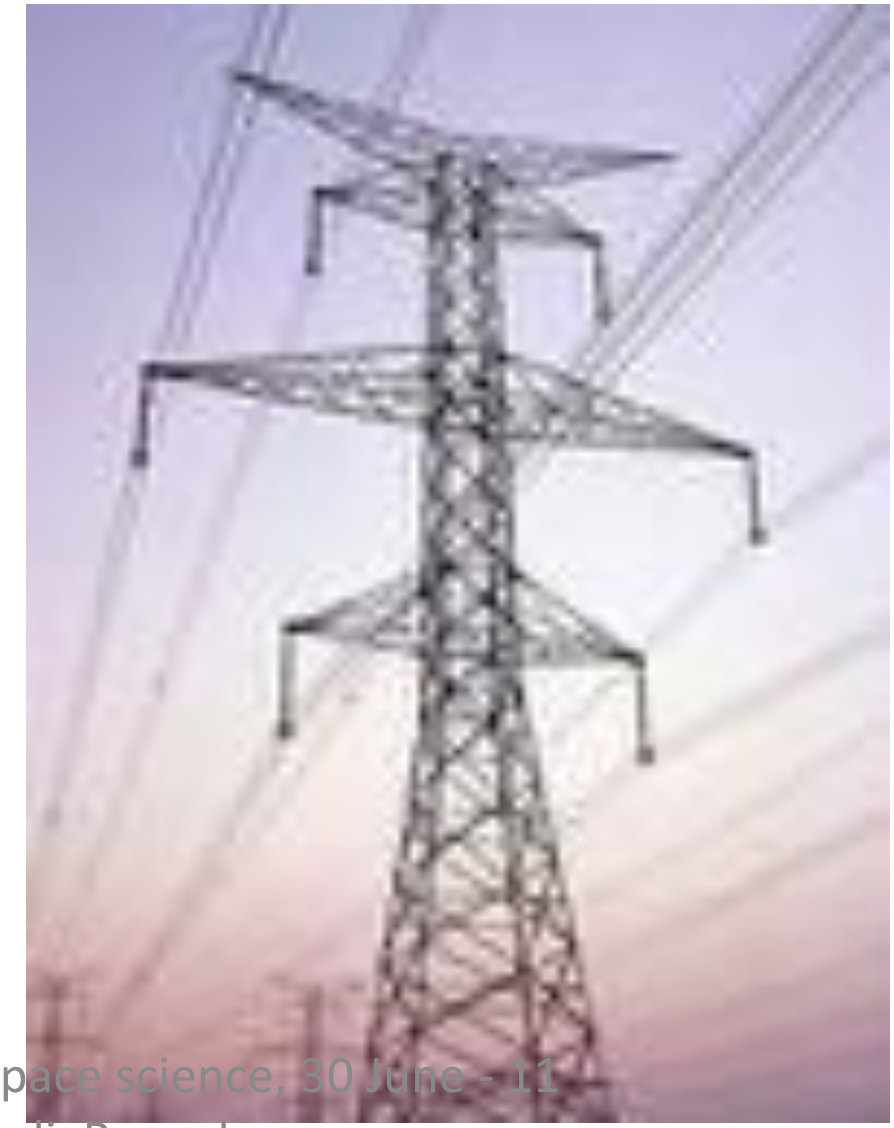
Financial transactions

- Largely dependent on space-based technology
- E-banking gaining prominence
- Volume of e-transaction outgrowing cash-at-hand
- Cashless economy….
- increasingly becoming space-dependent
- SPACE - ultimate platform

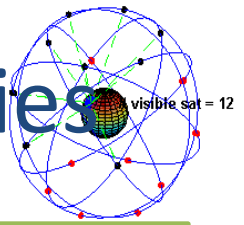
Ground systems Impacted by Instability in Space

GIC affects:

- National Power Grids
- Power outages
- Pipelines
- Telecommunication overhead cables



Products of Space-Based Technologies

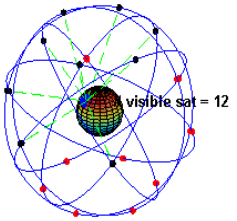


- ✓ **Tropospheric weather report,**
- ✓ **GSM telephony,**
- ✓ **Transaction of business with credit/ATM cards**
- ✓ **Online/mobile banking**
- ✓ **Navigation by GNSS – personal, air, sea, land**
- ✓ **Surfing the Internet.**
- ✓ **Watching Cable Television**
- ✓ **Air travels**
- ✓ **Modern Military Warfare**

Instability in space can lead to unavailability of all of these services

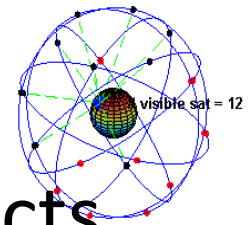
Loss of lives and properties defined as disasters

Application in Journalism: News Gathering



GSM & GPS

- GSM telecommunication systems are synchronized with GPS systems
- GSM users are now track-able – position and time
- Location identification
- Crime control and public safety
- School children in Japan wears GPS chips under their collars
- Shoes with GPS chips



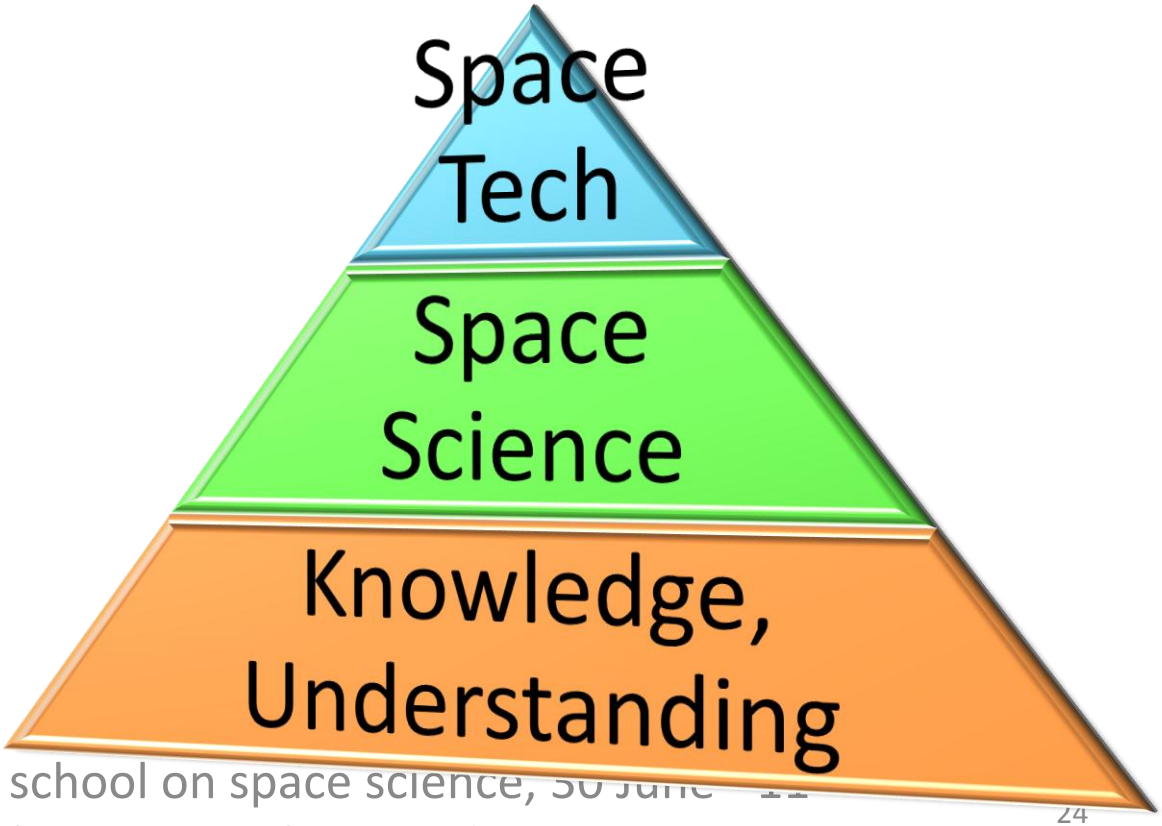
Capabilities of Space Technology products

Mega-solution to mega-problems

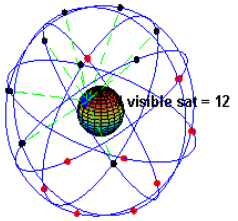
- producing good governance
- inhibits corruption
- create job opportunities
- advance wealth creation
- promote quality of living
- Secured society/public safety
- Control emigration, engaging active minds
- provide platform for sustainable manpower and economic development

Harnessing Potentials of Space Technology

- Development of Space Science/Research
- Understanding Space environment



Why Space Environment?



Poor performance of satellites

Interruptions of space-based Services

Signal loss/fade-out/scintillation/Signal degradation

instability in space environment

Satellite drag

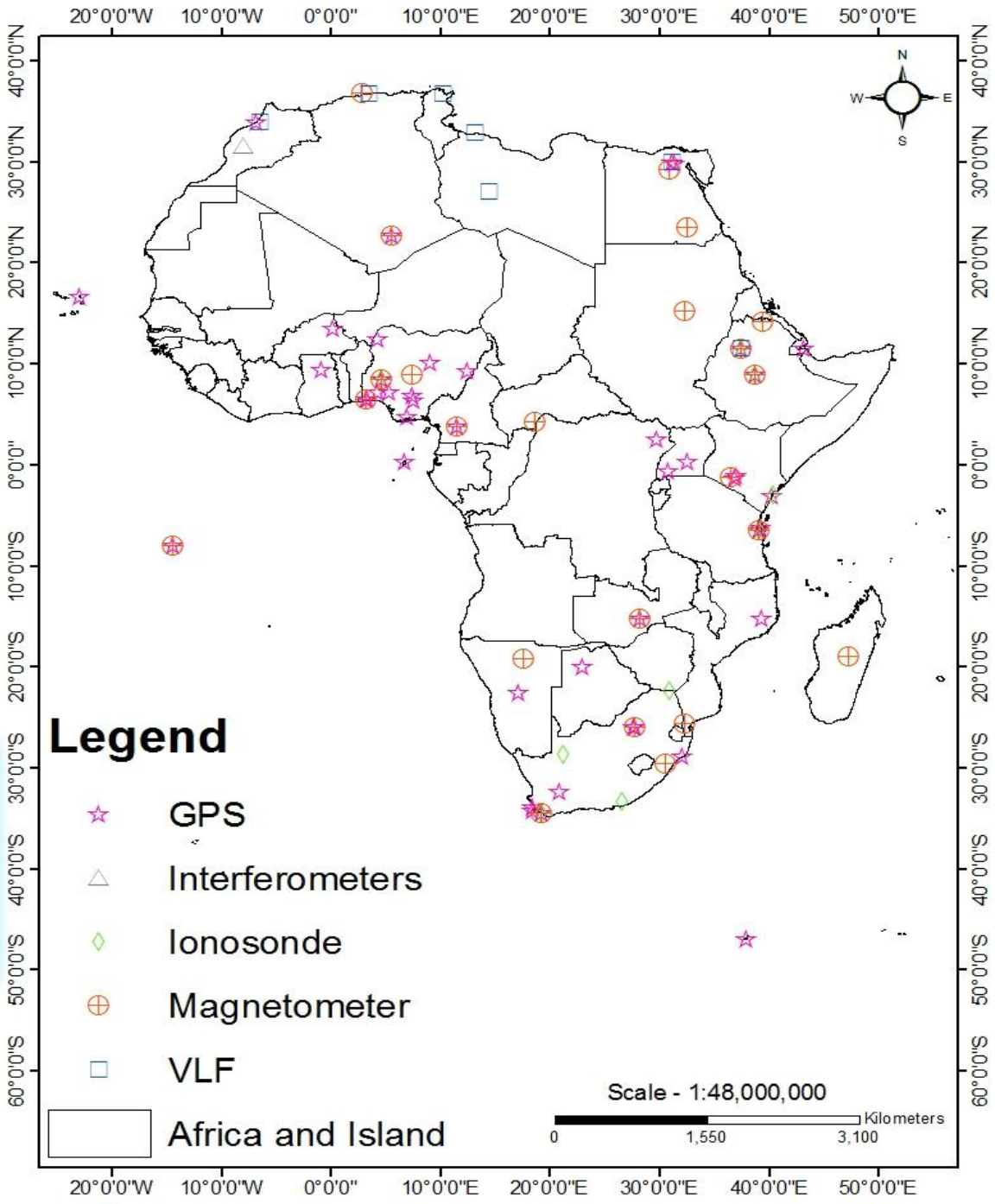
Navigational errors

Satellite loss

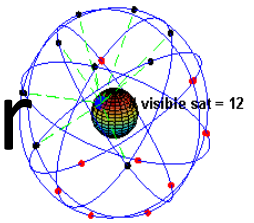
GICs

Status of Space Research facilities

- Mostly foreign intervention
- National Participation



Studies in Space Science in Higher Institutions

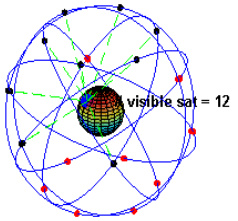


- **Nigeria**
- **South Africa**
- **Egypt**
- **Cote D'Ivore**
- **Ethiopia**

- Kenya
- Zambia
- Uganda
- Burkina Faso
- DR Congo
- Algeria
- Morocco

- **Ghana**
- **Tanzania**
- **Cameroon**
- **Niger**

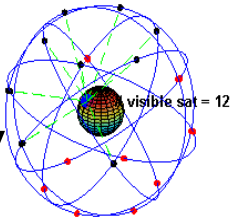
African Regional Centres for Space Science & Tech Education ARCSSTE

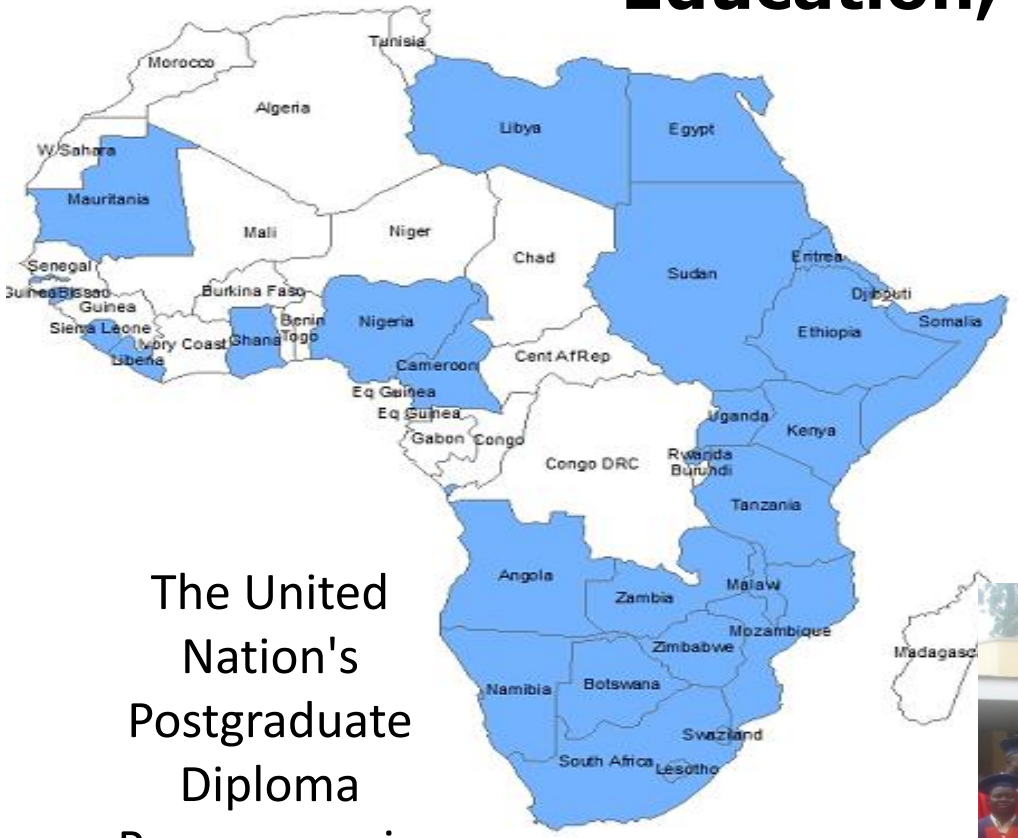


- Affiliated to the UN
- Francophone – Morocco
- Anglophone- Ile-Ife, Nigeria.
- Develop curriculum, capacity building & awareness

- Satellite Remote Sensing, Atmospheric sciences, Meteorology & Communication, and Geographic Information System (GIS)
- PG diploma in Atmospheric sciences, RS & GIS, & Sat Meteorology
- > 200 participants trained at Ile-Ife ARCSSTE-E

Centre for Space Science and Technology Education, Ile-Ife





Anglophone Countries of Africa

The United Nation's Postgraduate Diploma Programme in Space Science and Technology Application

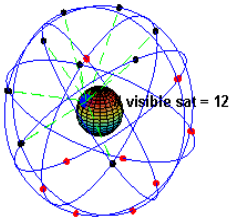
Ionospheric research in Africa

- The ALCANTARA Survey provided very interesting results about ionospheric research by African scientists working in the continent.
- Data about the growing number of papers published in peer-review journals by these scientists ar encouraging.

Country	Total n° of papers	1st author from the country	2008	2009	2010	2011	2012
UGANDA	2	1	0	0	0	0	2
SOUTH AFRICA	63	41	9	20	13	8	13
NIGERIA	56	45	9	8	12	9	18
KENYA	4	3	0	0	0	0	4
ETHIOPIA	6	4	0	0	2	1	3
EGYPT	16	14	1	2	4	4	5
COTE D'IVOIRE	9	6	1	2	1	2	3
BOTSWANA	1	0	0	1	0	0	0
ALGERIA	9	8	0	2	5	0	2
BURKINA-FASO	8	8	0	2	0	2	4
TOTAL	*174*	*130*	*20*	*37*	*37*	*26*	*54*

Table 14 Ionospheric research papers published by African scientists working in Africa

Radicella, et al 2014



Space Agencies

National Entities coordinating Space S & T activities

- Nigeria – NASRDA (since 1999)
- South Africa – SANSA
- Algeria
- Ghana
- Kenya

AGS
African Geophysical Society

– *Nov 2012, Addis Ababa*

www.afgps.org

African Geophysical Society

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AGS is a dynamic, innovative, and interdisciplinary scientific association committed to the pursuit of understanding of Earth and Space for the benefits of mankind.

African Geophysical Society AGS
International Secretariat,
National Space Research and Development Agency (NASRDA),
Km 17 Umar Musa Y'Aradua Expressway
(old Airport Road), ABUJA, Nigeria

Email: secretariat@afgps.org; membership@afgps.org
Telephone: +234 803 0705787

CENTRE FOR ATMOSPHERIC RESEARCH, ANYIGBA

OF THE

NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY, ABUJA

Presents

1st Annual Conference of the African Geophysical Society (AGS)

Theme:

THE ROLES OF EARTH & SPACE SCIENCES IN THE DEVELOPMENT OF AFRICA

Date: Mon. 2nd - Fri. 6th June, 2014

Venue:

National Space Research and Development Agency (NASRDA)
Km 17, Umaru Musa Yar'adua Expressway, Abuja, Nigeria.

2014 AGS Conference fall out

- ✓ 121 applicants invited from 11 African Countries, UK, Japan, & India
- ✓ 97 papers
- ✓ 43 orals presentation
- ✓ 46 posters
- ✓ 8 plenary papers
- ✓ ***6 fellows***
- ✓ ***Constitution was adopted***

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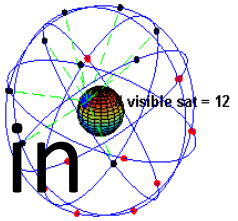
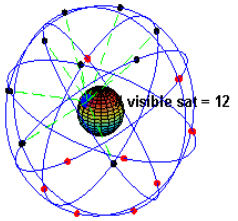
CENTRE FOR ATMOSPHERIC RESEARCH, ANYIGBA
NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY, ABUJA


AGS
African Geophysical Society
1st Annual Conference
of AGS 2 - 4 June 2014



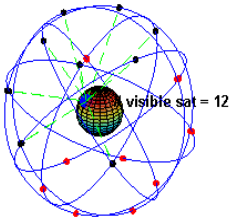
Improving Space Science Programs in Africa

- Promotion of National programs
- Intra-continental interactions
- Critical mass of scientists available in the continent
- Sharing continental resources
- Support from National Governments
- Overhauling of most national education curriculum to include space science



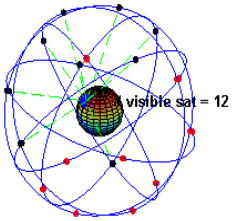
Recommendations/Summary

- African scientists must work with their government to promote space science in the region
- Development of Pre-requisite physical infrastructures for space research
- Densification of ground based facilities for monitoring SW



Acknowledgements

- ICTP
- BC
- UNOOSA
- CST-UR
- NASRDA



THANK YOU