

Nigeria



# Maximizing the Benefits of a UN Regional Centre for Space Science and Technology Education for SDGs



United Nations/Austria Symposium 2017 "Access to Space: Holistic Capacity Building for the 21<sup>st</sup> Century" Graz, Austria, 3 – 7 September 2017



- Introduction Sustainable Development & Capacity Building
- UN-OOSA Regional Centres Establishment of
- ♦ ARCSSTE-E ► Establishment of; ► Goals & Objectives
- ✤ ARCSSTE-E Core Activities PGD, MTech., SEOP, etc.
- Opportunities Accruing from Establishment of ARCSSTEE
- Catch them young Approach' to stimulate the interest of precollegiate youths in STEM
- International Collaborations
- ✤ Challenges
- Recommendations for UNISPACE+50 Thematic Priority 7
- Conclusions



Gain Control over Environment 
Increased realization of the values of the Society:

- Socio-economic advancement
- Security, and
- Improved wellbeing of the people
- Sustainable Development

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

Capacity Building in Space Science and Technology as well as <u>enhancement and retention of existing capacity</u>, are <u>critical</u> for developing competencies to efficiently respond to societal challenges and addressing Sustainable Development.



## Capacity Building/Development:

"are <u>dynamic and ongoing processes</u> which are happening against the background of growing global inequity and limited progress on alleviation of poverty. Capacity development is <u>about change and transformation through</u> <u>designing and facilitating culturally appropriate local solutions to</u> <u>development issues</u> at a large enough scale to make a real difference for human development"

#### Jenny Pearson (2011)

### Capacity Building

- Individual (competencies, skills, attitudes, values and culture, etc.)
- Organisational (establishment of efficient structures, processes and procedures)
- Institutional (Policies, enabling environment, etc.)

 $\succ$  Capacity creation  $\rightarrow$  Capacity utilization  $\rightarrow$  Capacity retention



## **Introduction - 3**

The 2002 World Summit on Sustainable Development (WSSD) recognized the urgent need for coordinated observations of the state of the Earth in other 'to create a world where decisions and actions are informed by coordinated, comprehensive and sustained Earth observations'.

## ➤ SDGs2030

2 ZERO HUNGER 3 GOOD HEALTH 5 GENDER EQUALITY 6 CLEAN WATER AND SANITATION NO POVERTY \_\_\_\_\_ ۵ 8 DECENT WORK AND **9** INDUSTRY, INNOVATION AND INFRASTRUCTURE 10 REDUCED 13 CLIMATE 14 LIFE BELOW 15 LIFE ON LAND 16 PEACE, JUSTICE AND STRONG INSTITUTIONS 17 PARTNERSHIPS FOR THE GOALS THE GLOBAL GOALS For Social Address The Device of the Social data and the Social data

### ≻ The UN General As

indigenous capacities in Space Science and Technology about 35 years ago especially in the developing countries in an effort to haul the World's poorest people out of misery and restore/nurture the damaged environmental web that sustains life.



#### United Nations General Assembly Resolutions

#### • 37/90 of 10<sup>th</sup> December 1982 – UNISPACE '82

'That the United Nations Office for Outer Space Affairs (UNOOSA), through its Programme on Space Applications should focus its attention, interallia, on <u>building of indigenous</u> <u>capacities for the development and utilization of Space Science and Technology, particularly</u> <u>at the local level'</u>

#### • 45/72 of 11 December, 1990 – UN-COPUOS

'That the UN should lead, with the active support of its specialized agencies and other international organisations, an international effort to <u>establish Centres for Space Science</u> <u>and Technology Education at the regional level in existing national/regional educational</u> institutions in the developing countries'

#### African Centres: ARCSSTE-E (Anglophone - NIGERIA) ; CRASTE-LF – (Francophone – MOROCCO)

- India (inaugurated in 1995)
- Morocco (inaugurated in 1998)
- Nigeria (inaugurated in 1998)
- Mexico and Brazil (inaugurated in 2003)
- Jordan (inaugurated on 29 May 2012)
- China (inaugurated 2014)





#### ARCSSTE-E - Established 15 September 1998





## **ARCSSTE-E Core Activities**

## Post Graduate Diploma Programme

- Duration: 9-month Postgraduate Diploma
   Programme in five key areas of Space Science and
   Technology (SST) Education
- International Participants are offered full scholarship covering: - Tuition Fee, Accommodation, Medical Services, Travel Ticket, etc.



#### \* 17 of the 24 Countries have participated in the PGD Programme to date



Botswana	2
Cameroon	33
Congo DRC	1
Ethiopia	4
Gambia	1
Ghana	9
Kenya	15
Liberia	12
Malawi	7
Nigeria	334
Sierra Leone	1
Sudan	15
South Africa	1
Tanzania	5
Uganda	11
Zambia	3
Zimbabwe	7
Total	473



## Post Graduate Diploma Programme - 2

## Distribution of PGD Participants by Course Options [2001-2016]









## Post Graduate Diploma Programme - 3

#### Design and construction of a prototyped cubesat



- A 10x10x10 prototype Cubesat (EregbuSAT) was developed by a student in Satellite Communication option of the PGD program.
- EregbuSAT is designed to simulate communication (send and receive data) between a satellite and its Ground Station (GS)
- ➤ The development of EregbuSAT was also reported in the website (<u>http://www.uk.amsat.org/?p=12387</u>) of AMSAT-UK, a voluntary organization that supports the design and building of equipment for Amateur Radio Satellite.



## MTech. (Space Science & Technology)



- **Duration**: 18-month MTech. (SSTA) in five key areas of Space Science and Technology (SST) Education
- Collaborating University: Federal University of Technology, Akure (FUTA)







## **Space Education Outreach Programmes**

## "Catching them Young"



## Workshops for Students -1



The Founder/CEO of SLOOH addressing the participants during the 'Twinkle Twinkle Little Star' Workshop - 2015



**Zero-Gravity Instrument Project** [ZGIP] promotes space education and research in microgravity.

http://www.unoosa.org/oosa/en/sapidx.html

The United Nations Office for Outer Space Affairs launched the ZGIP on 1 February 2013, and distributed the microgravity simulation instruments to qualified schools, universities, research centres and institutes



CLINOSTAT: A one-axis clinostat was selected for distribution because of the ease of use and potential scientific benefits.

ARCSSTE-E received, on a competitive basis, one of the 20 Clinostats distributed in 2013

**ARCSSTE-E** has developed **Curricula for** space science education in primary and secondary schools in Nigeria

#### During this project, the student learn:

- How to collect scientific data a laboratory environment
- Analyze the data with specialized software
- Obtain results
- of their study in a standard format to the scientific community





## Workshops for Students-2











This project involves the development of a small model rocket from totally local materials. The rocket fuselage, tail, rocket cones, fins etc. were fashioned out of polyvinylchloride (PVC) pipes.

The rocket propellant was a cocktail designed, blended and tested in-house.









### From Zeronaut to Astronaut



Stella Felix ARCSSTE-E's 1st Zeronaut 2006





Adeolu Akano ARCSSTE-E's 2nd Zeronaut 2007

Omolola Ibrahim ARCSSTE-E's 3rd Zeronaut 2008

The Zeronaut Programme was established to inspire the young ones. It takes place annually at the Kennedy Space Center, Florida, USA in collaboration with Space Week International Association (SIA). Three Nigerian secondary school students selected by **ARCSSTE-E** have been privileged to participate in the Zero-G flight, and experience the floating conditions associated with space flights.



## CanSat programme (1)





- Simulation of an actual satellite
  - Because it contains many major real-life satellite subsystems: communication, power, payload etc.



#### ARCSSTE-E and OAU collaboration

- ARCSSTE-E iLab OAU Robotic Education Programme
- Aimed at inspiring interest of young people in STEM and robotics
- Students receive training on <u>robot building and programming using</u> <u>Lego Mindstorm<sup>®</sup> kits</u>
- ARCSSTE-E supported students to participate in the 2011 World Robot Olympiad, held in Abu Dhabi, from 18-20 November, 2011





#### 2017 Space Education Outreach Programme



- Participants students and teachers drawn from 32 public and private Secondary Schools in Kwara State.
- ➢ 6 students and 2 teachers from
- ARCSSTE-E technical staff carried out presentations in various field of space science and technology.





#### 2017 Space Education Outreach Programme

#### 2017 Space Generation Advisory Council (SGAC)/Centre for Atmospheric Research/ARCSSTE-E Outreach Programme:

**'WHY SPACE?'** - Space Exploration: A Step into the New Frontier

University of Benin, Nigeria; Date:16th of May, 2017





### Space Clubs (1)

ARCSSTE-E Space Club Officially Inaugurated On May **18**, **2007** by Air Vice Marshal Dan Baba representing the Chief of Air Staff









## Space Clubs (2)

### **Primary School Activities**





## **Space Research & Development**



### **ARCSSTE-E Core Activities IV – Space Research & Development**

#### Desertification Monitoring System over Sahelian Region of Nigeria

### February 2017



The establishment of a system of information is vital in order to accurately assess the processes that lead to desertification and droughts, and to build a framework for environmental accounting.

#### **OBJECTIVES**

- i. Continuously measure parameters (Pressure, temperature, humidity, wind velocity and rain rate);
- ii. Analyse data obtained and ascertain if desertification is occurring or not;
- iii. Model possible rate, volume and direction of future encroachments; and generate a hazard map for affected regions.









#### Grant Proposals

- ARCSSTEE as Regional Activity Centre (RAC) for the ECOWAS region (REC) to implement the <u>Pan-Africa/European Union program – GMES for</u> <u>Africa</u>. Proposal meetings on-going in line with '2006 Maputo Declaration'. <u>Grant Estimate €17M</u>
- ARCSSTEE on Strategic Partnerships for Higher Education Innovation and Reform (SPHIER) Partnership funding for <u>E- Learning for Space Science</u> <u>and Technology Education in Nigeria</u>. Grant Estimate: £2.6M
- ARCSSTEE Horizon 2020 Call: H2020-SFS-2016-2017 (Sustainable Food Security - Resilient and resource-efficient value chains). *Enabling Bio-organic Farming and Verification Across African Countries*. Acronym: BIO-SenSys. Grant Estimate: €2.2M



#### Alumni Conferences & International Workshops



International Training Workshop on GNSS in collaboration with RCSSTEAP and Beihang University, Beijing, China (August, 2016)



Bi-Annual Alumni Conference – an avenue to foster Regional Collaboration







## GEONetCast Installation - 2017



On-going EUMetcast C-Band installation at ARCSSTE-E Space Museum, OAU, Ile-Ife.



**GEONetCast** is a global network of Satellite-based data dissemination systems providing environmental data to a world-wide user community

**Data:** MeteoSat, GOES East & West image data; EUMETSAT & NOAA-NESDIS metrological data; Sea surface temperature and Vegetation Data; etc.

**Licence** granted & Installation (95% completed)

**On Completion** of the Earth Station the Centre will be poised to provide real-time world class data to support the Postgraduate programmes and collaborative research.



#### 7<sup>th</sup> Governing Board Meeting

#### 26<sup>th</sup> April 2017



#### **Member States in Attendance**

- i. Ghana
- ii. South Africa
- iii. South Sudan
- iv. Ethiopia
- v. Egypt

- vi. Liberia
- vii. Uganda
- viii. Cameroon
- ix. Nigeria



## **Infrastructure Deficit**





#### Yellow House Obafemi Awolowo University Ile Ife, Osun State, Nigeria.





#### ARCSSTE-E's Permanent site





#### NIGERIA's EO Space Infrastructure Supporting ARCSSTEE Activities





## **International Collaborations**

1. GEO, Geneva, Switzerland



International Committee on

Global Navigation Satellite Systems

- Participating Organisation (PO) status
- 2. International Committee on GNSS, UN-OOSA, Vienna
- 3. RCSSTEAP, China

- 4. EUMETSAT on GEONetCast
  - establishment of



5. Samara State Aerospace University, Russia

### **Planned Collaborations**

- China-Brazil Earth Resources Satellite (CBERS) - Ground Receiving Station (educational)
- **ESRI Educational licensed products** e.g. ArcGIS
- ESA; Others welcome!











## Challenges

- Funding: Inactive Member States- contribution Nil since inception
- Dearth of Infrastructural Facilities: ICT, Ground Receiving Station facilities for teaching and research
- Regular Annual Governing Board meeting:
  - Member Countries' Institution Point of Contact'
  - Mobilisation Visits to Member Countries
- Selection of PGD participants from Member countries through Foreign Affairs and Equivalent Ministry handling Science and Technology Affairs.



## Recommendations – for UNISPACE+50 (Thematic Priority 7) SDG 4



## **Recommendations - 1**

- Strengthen the Capability and Status of the UNOOSA Regional Centres for Space Science and Technology Education as a major hub for Regional Capacity Building.
- Involvement of Regional Bodies/Organisations e.g. AUC, ECOWAS, IGAD,
   AARSE, UNECA, etc. for effective utilisation of the Centre's potentials.
- UNOOSA Reps in attendance during GB meetings, Graduation, etc.
- Staff Internship and Secondment/Exchange in collaboration with other Regional Centres/International Institutions [including Member countries] and Network with UN University
- Financial commitment of Member States to the Regional Centres must be rekindled; Permanent Reps in Vienna, & Ambassadors engaged.



## **Recommendations** -2

- Regional Centre's Directors meetings (Regional Centres Alliance), on the edges of COPOUS meeting or in rotation at Regional Centre's locations.
- Collaboration in research and support for teaching facilities from Space
   Fairing nations
- Incubation of best practice from industries and other major players through UNOOSA in the Centres
- Access to data for teaching and research purposes and other relevant educational materials through OOSA



## **Recommendations - 3**

- Access to data for teaching and research purposes and other relevant educational materials through OOSA
- Establishment of E-learning facilities in collaboration with other Regional Centres and International Institutions in Member countries;
- Certificates designed to be similar and appropriately signed by UNOOSA
   Director/Rep
- Build institutional capacity of the Regional Centres, enabling them to keep pace with the fast changing and dynamic technological advancement in training and research, especially in space science and technology applications and other relevant areas.



## Conclusions

➤ The applications of SS&T to socio-economic development within the African region are gaining wide acceptance with the emergence of more countries pursuing the development of one form of SS&T programme or the other, depending on the individual country's level of investments.

➢ There is a clear evidence of the impact of the UN-assisted capacity building programme which has already produced appreciable number of trained personnels as revealed in ARCSSTE-E's programme implementation and its achievements since its establishment in November, 1998.

➢ New strategies for capacity building at the formal and informal levels of education to train a sizeable number of experts to ensure meeting up the SDGs 2030 are evolving in line with advances in technologies. The Regional Centres should be made to keep abreast of them.

Indigenous Skill Acquisition in Space Science & Technology especially is key to the Socio-Economic Sustainable Development of any nation.



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