PATHS TO PROGRESS

Space and the Southern Hemisphere

Executive Summary

INTERNATIONAL SPACE UNIVERSITY®

Southern Hemisphere Summer Space Program 2011

University of South Australia

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References

Christensen, I, Hay, JW and Peura, AD. 2007. *National Development through Space: India as a Model*, Space Policy Institute: George Washington University CIA World Factbook:

Global Security.org 2009 "*Nigerian Space Programs*", online <http://www.globalsecurity.org/space/world/nigeria/index.html> last viewed 30 Jan 2011

Gunters Space Page "*NX (NigeriaSat X)*" online <http://www.skyrocket.de/space/doc_sdat/nx.htm> last viewed 30 Jan 2011

Hans Herren, 2010. Available from: <http://www.laveudafrica.com/africa/Detarts.asp?id=440&t=%22Internet+es+clave+para+acabar+con+el+hambre%22> [Accessed 17 January 2011]

P.N. Okeke "*Past, Present and Future Space Program: Nigerian Experience*" First African Leadership Conference on Space Science and Technology for Sustainable Development Nov 2005

R.A. Boroffice "*The Nigerian Space Programme: An Update*" African Skies/Cieux Africains, No. 12, October 2008

S. Mostert , "*The African Resource Management (ARM) Satellite Constellation*" African Skies/Cieux Africains, No. 12, October 2008

Introduction

Mission Statement:

"To propose space-related policies and strategies to serve current and future social and economic needs of Southern Hemisphere States."

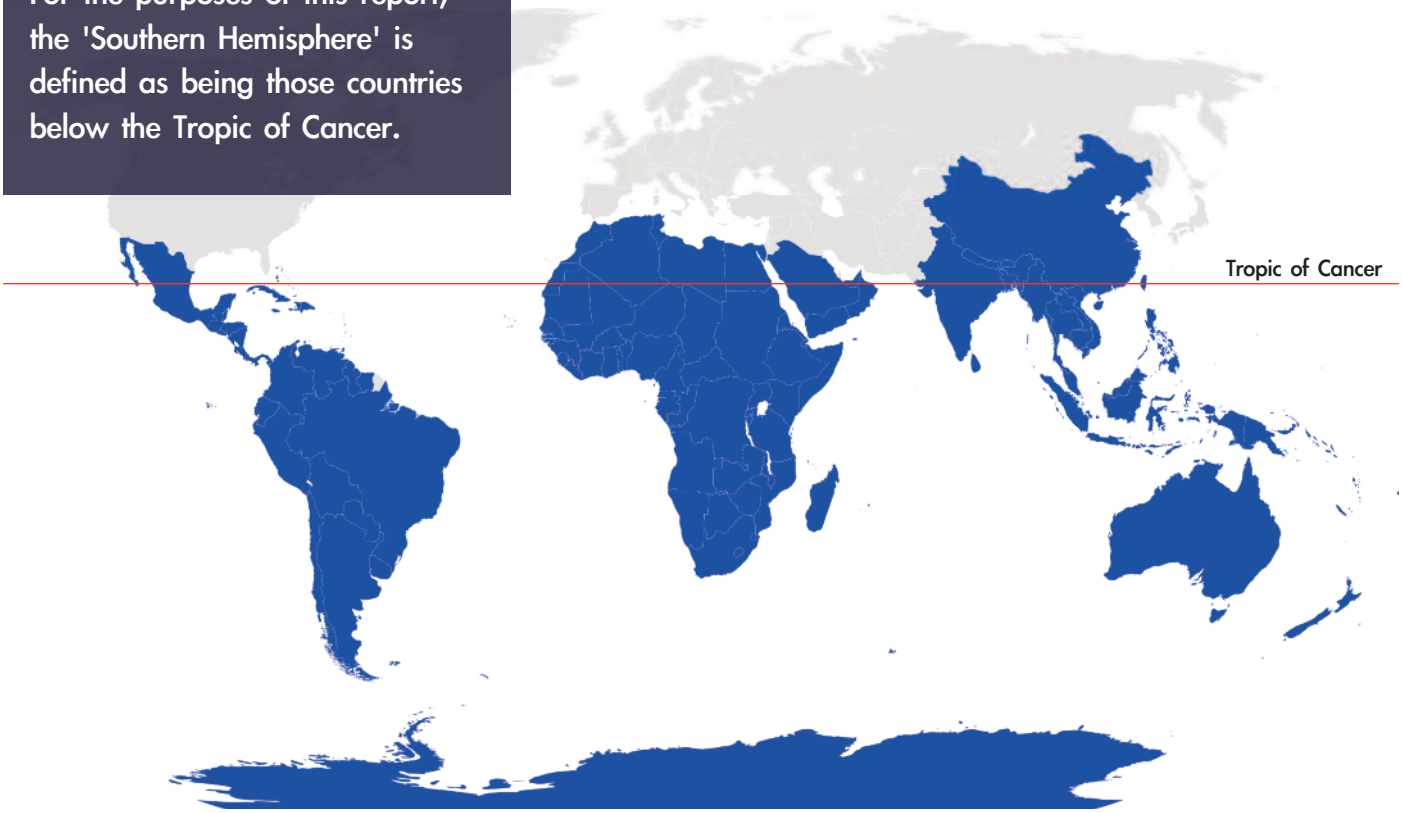
The inaugural Southern Hemisphere Summer Space Program (SHS-SP) 2011 consisted of 43 individuals from nine countries who were tasked with writing a White Paper on the topic of "defining the role of space for the Southern Hemisphere States: a plan for the future."

Southern Hemisphere States possess unique attributes that can contribute to international space capability. 'Paths to Progress' discusses how States can identify and develop these opportunities, and address their social and economic needs through collaborative space activities.

Figure 1: Logos of the UN Millennium Development Goals (Image: Leung, 2007)

Southern Space

For the purposes of this report, the 'Southern Hemisphere' is defined as being those countries below the Tropic of Cancer.



Needs

The progress of each of the United Nations Millennium Development Goals (MDG) can be assisted by the application of space technology. Telecommunication and Earth Observation (EO) are effective tools in supporting the UN MDG goals. The Southern Hemisphere States that could benefit most from space-derived earth observation data in addressing their social and economic needs do not receive timely access to it.

Food and water security

Information derived from earth observation data can be used to help farmers decide when and where to plant crops, and can detect agricultural diseases at an early stage. EO sensors can detect and map sub-surface water distributions, assisting in the effective placement of community wells.

Health

Vector-borne diseases can be tracked by EO satellites. Health services can be delivered remotely using communication infrastructure (tele-health). Improved access to pre- and post-natal health care via tele-health will facilitate progress in attaining infant and maternal health targets.

Natural disaster relief

EO data is used to accurately map topography, water courses, deforested and high fire risk areas. Regions of increased vulnerability and susceptibility to natural disasters can be identified, and mitigation measures implemented. Loss of life and property can be minimized by the accurate weather forecasting made possible using meteorological satellite data. Near real-time EO data is invaluable in delivering aid to people affected by natural disasters.

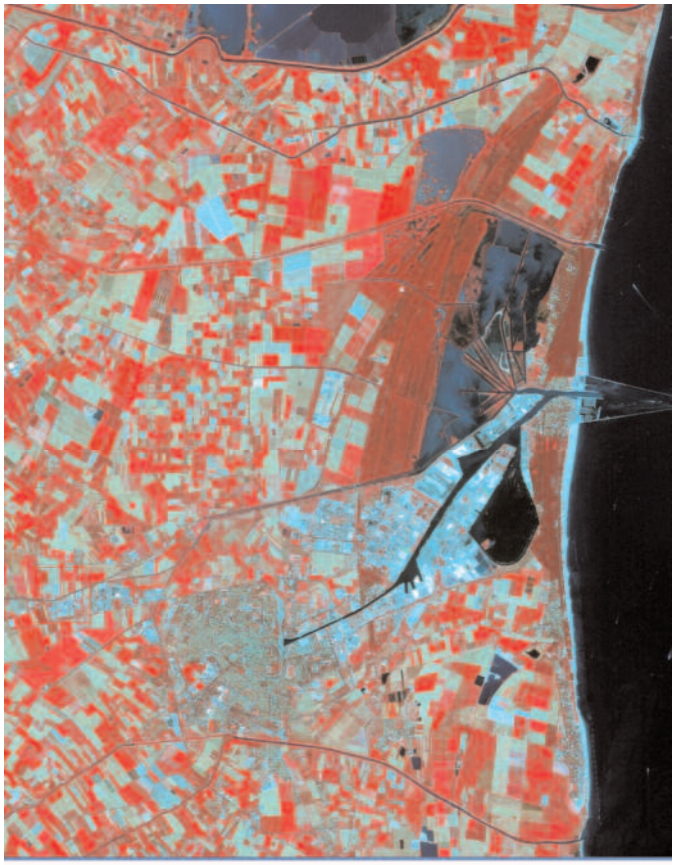


Figure 2: EO Information is used to monitor crop health (Image: SSTL, 2010)

Goal:

To reduce the impact of natural challenges through enhanced access to space based Earth Observation (EO) capabilities.

Education
Access to education can be expanded through tele-education services. The goal of gender equality can benefit from tele-education's broader geographic reach than conventional schooling.

Communications
Satellite communication systems can overcome many of the difficulties of constructing terrestrial links in Southern Hemisphere States, chiefly the need to install wires over vast distances and rough terrain. Terrestrial "last-mile" solutions distribute data from a central satellite-capable hub to multiple locations within a community. Access to communication is an enabler for health, education, global and partnership targets.

Goal:

Use space telecommunication capabilities to support the UN Millennium Development Goals, with an emphasis on health and education.

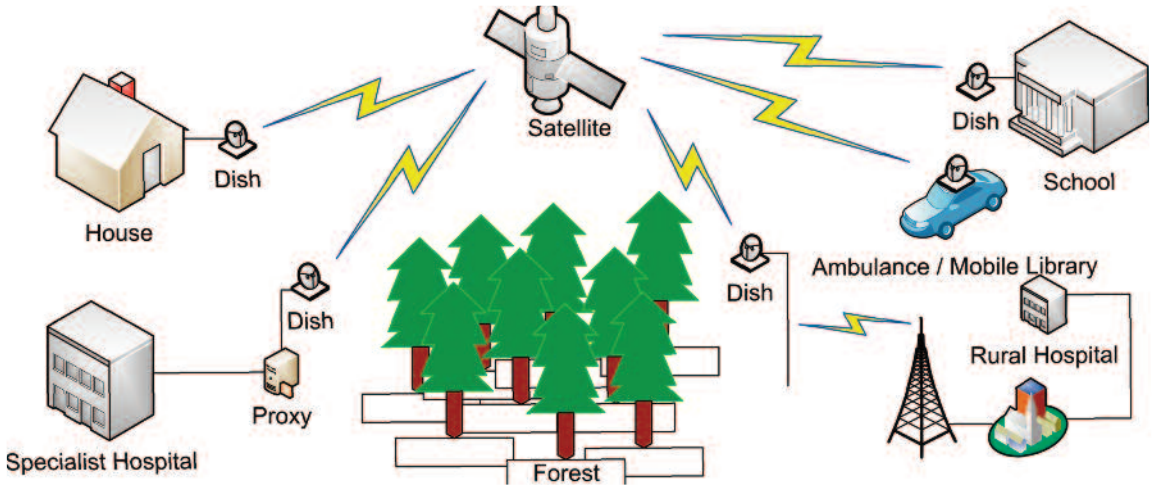


Figure 3: Tele-health / Tele-education Infrastructure

Challenges to data access
Prohibitive cost and an absence of supporting policy present barriers to Southern Hemisphere States' access to space-derived data.

> "…giving [Africa] free access to internet is worth more than all development projects of the World Bank, the Foundations or the large Non-Governmental Organizations." (Herren, 2010)

The value of EO data is only realized when processed into information and delivered in a timely fashion to those in a position to make decisions with it. Application of information derived from EO sensors requires trained personnel, an effective distribution system, and an understanding of its capabilities by decision makers.

Opportunities

Southern Hemisphere States possess favorable attributes that can contribute to our collective space capability and yield commercial opportunities. States need to be able to recognize these assets and market them to the space industry.

Goal:
To realize the space-related capabilities and competitive advantages that the Southern Hemisphere can provide to the international community.

Geography

Equatorial coastal regions are favorable as launch sites for space systems, particularly communication satellites; e.g., Kourou, French Guiana, was developed to support ESA launches. Telemetry, tracking and control of satellites require the location of ground stations in both hemispheres. The process of tracking orbital spacecraft and debris, known as Space Situational Awareness, can be enhanced by the addition of Southern Hemisphere sites.

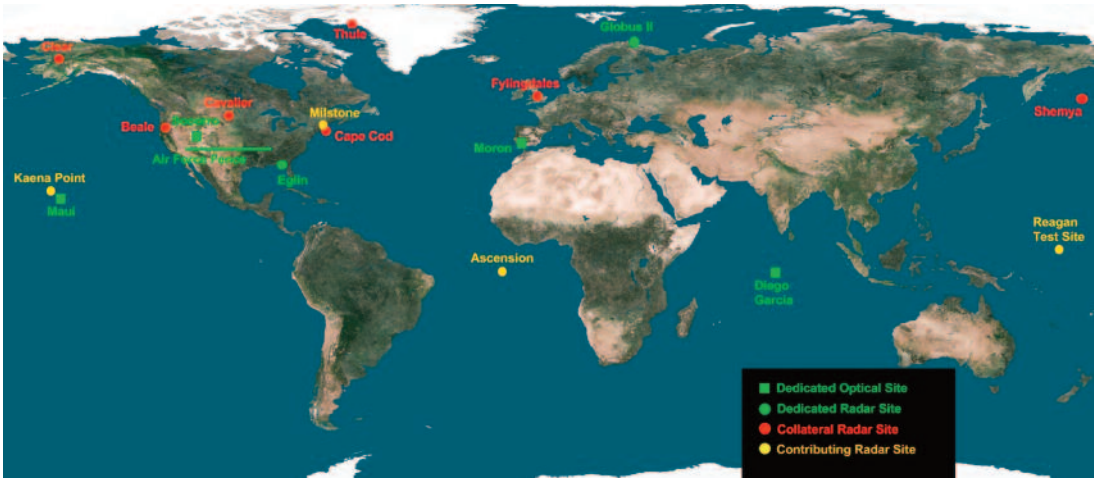


Figure 4: The U.S. Space Surveillance Network (Image: SWF, 2010)

Population density

Launch and re-entry sites require large, clear safety zones in case of equipment malfunction. Many Southern Hemisphere States have large, sparsely populated regions that would be suitable for this application. Regions of low population density have associated low levels of light pollution and night time activity, favorable characteristics for the conduct of optical astronomy. Low levels of radio 'noise' minimize interference effects on radio astronomy; e.g., the Square Kilometer Array project bids in Australia and South Africa.

Topography

A number of regions in the Southern Hemisphere are sufficiently dry and barren to be treated as analogues to as yet unexplored extraterrestrial bodies. Analogous land allows scientists to conduct the experiments designed for missions to other planets; e.g., Antarctica is used as an analogue to human space exploration of the Moon and Mars.

Benefits

Southern Hemisphere States can negotiate access to earth observation data in return for the provision of services and infrastructure that support the needs of the international space industry. International collaboration is fundamental to the development of space capability for Southern Hemisphere States, facilitating the division of responsibilities, cost sharing and transfer of knowledge and technology.

Case Study: Nigeria

Nigeria's space endeavors started with the Council of Science and Technology in 1970 and evolved through the Ministry of Science and Technology in 1980. Obafemi Awolowo University became host to a UN initiative to develop indigenous space capability, and lead to the concept of amalgamating Nigeria's six centres of space expertise under a single coordinating agency.

In 1998 the Government of Nigeria approved the Nigerian Space Policy (Global Security 2009 online). This marked the beginning of Nigeria's increase in space capability. The Nigeria space program focuses on Development of Human Resources, Capacity Building and Education, Natural Resource Management, Defence and National Security, Study of Earth and Nigerian Environment, Space Communication and Study of Distant Space (Okeke, 2005).

- NigeriaSat-1 is a remote sensing platform built by Surrey Satellite Technologies (UK). It was launched in 2003 to provide Earth Observations as part of the Disaster Monitoring Constellation (DMC) in conjunction with several other space nations.

- The Chinese-developed telecommunications satellite NIGCOMSAT-1R is due to launch in 2011.

Figure 5: A Nigerian engineer works on NigeriaSat-X (Image: SSTL, 2010)

- A team of 15 Nigerian specialists are building NigeriaSat X in conjunction with Surrey Satellite Technologies, a training platform that will develop satellite capabilities for Nigeria. (Gunters Space Page 2010 online).

- Since 2009 Nigeria has been working in collaboration with South Africa, Kenya and Algeria on the African Resource Management (ARM) constellation of remote sensing satellites to meet African requirements. (Mostert, 2008)

The Nigerian Space Program is characterized by the aggressive manner in which it has acquired space capabilities and return on investment from space activities relating to EO and telecommunications. Nigeria is rapidly developing indigenous capabilities through collaboration with other space faring nations and technology transfer.

Conclusion & Recommendations

Many Southern Hemisphere States have neither a space agency nor space policy. The goals proposed by 'Paths to Progress' are collaborative in nature, requiring States to achieve a measure of space capability through the development of favorable attributes into space-related opportunities. The following recommendations form the basis for the policies and strategies that will define the future role of Southern Hemisphere States in space.

Recommendation 1: Exploit the natural and geographic advantages of the Southern Hemisphere.

Southern Hemisphere governments and organizations can use their unique geographical and environmental characteristics to gain access to space capabilities, data and information.

Recommendation 2: Establish a Regional Space Industry Association.

A non-profit Regional Space Industry Association would be responsible for representing the space capabilities of regional Members in the global space domain, increasing commercial opportunity and awareness of niche markets.

Recommendation 3: Collaborate on Earth Observation systems.

The high costs of acquiring EO capabilities should lead States to collaborate and develop structures to enable data sharing for mutual benefit.

Recommendation 4: Cooperate on EO data and product dissemination.

The distribution of data between collectors, processors and end users is critical in achieving the full potential benefit of EO data and processed information products.

Recommendation 5: Develop expertise and infrastructure to ensure optimal use of available EO and GIS solutions.

Investment in processing infrastructure and institutional knowledge to produce final information products enables a State to make full use of EO capabilities and increases self-reliance.

Recommendation 6: Invest in Tele-health and Tele-education.

Tele-health and Tele-education have proved to be effective methods for providing health and education services to both high and low population density in rural and urban areas (Christensen, Hay & Peura, 2007).