

# OUTREACH SESSION REPORT



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## Space for Developing Regions

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## 1 INTRODUCTION: SPACE FOR EARTH

"Space gives you a chance to dare to dream. It gives you expanded horizons, satisfies curiosity about the way the world – the universe – works. That's the kind of spirit that we need to spark in scientists, engineers and entrepreneurs. We need that culture to be pervasive in society. That's the catalyst that space can be!" [1] In the words of Sias Mostert, a space pioneer in South Africa, space has always represented a source of inspiration. The fact that "every culture has a link to the stars" has been noted by Dr. Kevin Govender, another South African representative and Director of the Global Office of Astronomy for Development (OAD). For Dr. Govender, astronomy represents a tool for creating a better society and a better life. It helps people understand how little and fragile Earth is. It educates children and young generations to better value our planet.

Studying outer space helps us become better citizens of the world by expanding our horizons. Space gives us inspiration and answers life's most important questions – Why are we here? Where do we come from? Where are we going? Today space technology allows us to watch our planet from above and directly benefit from the knowledge we gain.

Today space applications have become an indispensable part of our everyday life. Satellite enabled telecommunications, remote sensing, and navigation allow us to live a better life by helping us address many of the challenges we face today. Space is considered among the best tools to spur scientific and technological progress in knowledge-based societies. If this is true for developed countries, where science and technology represent key factors of economic progress, it is true even more so for developing countries. In these nations, a high percentage of the population is still located in rural areas and the lack of terrestrial infrastructure sometimes makes satellite technology the only available option. Therefore, investing in space applications should be among the top priorities of developing countries.

Unfortunately, developing countries often view space programs as unnecessary, prestige-based, and only suitable or adequate for large, developed countries. This perspective is misleading. This report demonstrates that outer space is not only the domain of wealthy and technologically advanced nations. Space-based technology is in fact, currently one of the best tools to bridge the gap between developed and developing countries.

## 2 BENEFITS OF SPACE PROGRAMS TO DEVELOPING COUNTRIES

Communications, medical care, disease prevention, urban planning, agriculture, natural resource management, environmental pollution control, education, disaster prediction, disaster relief and meteorology are some of the important areas where space benefits society [3].

Communication satellites transcend traditional geographic barriers and limitations. They can provide data broadband services, enable tele-education, and allow doctors to provide medical information on demand to anywhere on the globe.[4] Remote sensing satellites can observe and monitor large areas. Other satellites can focus on specific territories. Radar technology can be used during the night and amidst heavy overcast. Radar is also used for prospecting water, oil and minerals. Remote sensing data can be used to predict outbreaks

of many diseases and to identify conditions conducive to disasters. Remote sensing satellites are often the only available technological tools after a disaster occurs. Developing countries can also benefit from the use of navigation satellites, which can improve transportation systems, logistics, and security.

Space activities have shown a plethora of spin-offs that have improved our lives dramatically. Some of the latest spin-offs include water generation, which is based on recycling water technology developed for the ISS, as well as food management technology, which is based on the food processing and storage technology developed for the ISS. It is important that food storage and retrieval mechanisms be in place when natural calamities are about to strike.

## 2.1 Space Programs in Developing Countries

The best way for a developing country to benefit from space technology and space applications is to establish and implement a national space program. A national space program should stipulate short-, medium- and long-term goals of the country for the utilisation of space. The program should also state how the country wants to make investments – whether directly (creating and investing in a home grown space industry) or indirectly (focusing on space applications and services). Policymakers should select priorities and allocate resources based on the needs of their country. For the short and medium-term periods, focusing on basic space applications is a good starting point. This will enable the development of local space expertise. However, in order to obtain long-term benefits from space, focusing on a home grown space industry should be the most appropriate path to follow. Scientific and technological independence for developing countries means there is a possibility for those countries to tailor scientific research to their own needs. Presently, Algeria, Egypt, Morocco, Nigeria and South Africa already have space programmes. Nigeria and South Africa have national space policies, while only South Africa has a national space law.

A centralised strategy allows a government to implement long-term projects, which is critical for the creation of a space education curriculum and the establishment of infrastructure management (i.e., capacity building). It necessitates creation of jobs and helps address the problem of “brain drain”. Since many of the challenges that effect developing countries are common, a national space programme can foster international cooperation at the very least among them.

Many consider space technology too expensive and not a priority worth investing financial resources. However, as India has demonstrated when they started their space programme, satellites can provide developing countries with the opportunity to “catch up to more developed countries in communications and natural resource management without going through an initial stage of expensive infrastructure development” [5]. In the words of M. Mahmoud Ibrahim, Executive Manager of the EduSat Program the Egyptian National Authority for Remote Sensing and Space Sciences, “space applications are fundamental to solving many of the challenges that developing countries have to cope with space technology that really opens new dimensions for a country.”[6] A homegrown space industry means more control over and accessibility to space assets. In addition, it helps to provide something that developing countries are really in need of – self-reliance.

### 3 REGIONAL AND INTERNATIONAL COOPERATION FOR THE SPACE INDUSTRY

Given the challenges that a developing country faces when establishing a national space programme (lack of capabilities, expertise, basic infrastructure, capital, etc.), international cooperation is fundamental to provide expertise where needed. However, for better sustainability of space programmes, regional cooperation may be more important, necessary and meaningful. The incentives for regional cooperation include the following:

(i) *Common natural resources and disasters*

Countries in the same geographical vicinity share similar natural resources and are prone to similar natural disasters. It is, therefore, a good idea for them to come together and identify solutions that countries can cooperatively work on. Each country's benefits will be the sum of the contributions. A case to highlight here as an example is Lake Chad in Western Africa, which Chad, Niger and Nigeria border upon. Satellite images are being used to monitor the gradual drying of the lake as a result of desertification [7].

(ii) *Establishment of a regional structure for the larger international community*

Regional cooperation creates a strong basis for international cooperation [8]. It is culturally and logistically easier and therefore, more efficient. Regional cooperation should be encouraged before moving on to pursue larger collaborations.

(iii) *Improvement of indigenous capabilities*

Regional cooperation brings nations together and makes them self-reliant. It improves their indigenous industries, provides in-house jobs and makes for a more stable economy [10].

(iv) *Sharing of costs and benefits of new programmes*

Space is a new industry for most African nations. Embarking on the uncharted path together helps distribute the risks and costs, leading to more benefits. Building a larger project together also triggers the economies of scale so countries can gather more benefits for smaller shared costs.

(v) *Utilisation of existing infrastructure and expertise*

Some countries in Africa have underutilised space facilities, while others have a large skilled workforce. For example, South Africa and Kenya have launch pads which were used during early space missions, while Nigeria produces thousands of skilled professionals. Regional cooperation will enable the sharing of knowledge and facilities. This will ensure the retention of human capital within Africa. Furthermore, cooperating with nations that have already developed technologies allows emerging space nations to harness existing technology rather than to start its development from scratch.

(vi) *Financial security of a programme's sustainability*

Space programs are capital intensive. In several instances governments stop supporting space projects when there are more pressing national needs. However, sharing the cost of such projects will likely ensure that such projects continue.

(vii) *Unification of Regions – promotes communication and reduces conflict in other areas*

Collaboration in the space industry initiates communication and goodwill in other fields between the collaborating countries. It provides incentives for politicians to maintain good relations with each other. Citizens hold foreign citizens in good opinion and could even serve to avoid conflicts in other areas.

There are some apprehensions associated with international or regional cooperation. These includes misuse of information and shared resources; potential loss of power and influence of the stronger providers; and delays in implementation due to cooperation/communication requirements (logistics and coordination can be difficult). Despite these risks, the benefits from regional cooperation are more significant.

### **3.1 Example: The African Region**

Currently, some collaborative space programs exist in Africa. Some of the examples include the African Resource Management Satellite Constellation (ARMC) Project, the African Leadership Conference on Space Science and Technology for Sustainable Development (ALC) and the Square Kilometre Array (SKA) [9].

ARMC is meant to be a constellation of Earth Observation satellites. Current participating countries include Algeria, Kenya, Nigeria and South Africa. Those countries contribute with a satellite to the constellation. These countries will have free access to data from any of the satellites. Presently, only Nigeria has contributed a satellite to the project. It is expected that more African countries will join the project.

ALC is a platform for space experts and professionals to come together to share knowledge, experience and to advise policy makers in Africa, so that they may make decisions based on satellite-derived data. The group holds a biennial conference. Past conferences were held in Algeria (2005), South Africa (2007), Nigeria (2009) and Kenya (2011). Efforts are being made to integrate the ALC into the African Union.

SKA is a project to set up the world's largest ground-based telescope. The bid for hosting the project is between Australia and South Africa. Eight African countries are supporting the bid of South Africa. If South Africa wins the bid to host the facility, the different participating countries will benefit in the utilization of the facility and sharing of data. Currently, young scientists from the cooperating countries are benefitting from a capacity development programme in South Africa.

## **4 BUILDING SUPPORT**

As already mentioned, space programmes are often considered by developing countries as unnecessary, prestige-based, and only for large, developed countries. Thus, building support for space programmes and projects is as necessary as the identification of the different stakeholders. Potential stakeholders include taxpayers (who are also the people at risk), policy makers and governments, NGOs and other such volunteering organisations,

students and the next generation of African nations, public (inclusive of children and unemployed citizens who are not likely to pay taxes), industrial sector, other countries (government and public), scientists and financial institutions.

Steps have to be taken to address the needs and different opinions of the different stakeholders. Below are some recommendations for gaining broader support for space programs in developing countries:

- i. Inform, with the help of the media, all stakeholders about the benefits that come from space-based technology (use of brochures, conferences, debates, television, radio programs, children school books, etc.).
- ii. Space science should be integrated into school curriculums. It is important to link the researcher with the actual educators in the field.
- iii. National agencies should collaborate with other government departments and institutions. An office or point of contact should be set up to stimulate interaction with government institutions.
- iv. Establishment of non-profit organisations, which liaise with the government and other organisations related to space applications. Examples of such non-profit organisations are the African Space Institute, the South African Space Association, and the South African Space Foundation.
- v. Lobby the drafting and endorsement of a UN resolution that urges countries to focus on implementing space related products on education. For example, declare the year 2015 as the International Year of Space Science.
- vi. Approach intergovernmental organisations to get the support from government and therefore, propagate the message of space applications and benefits.
- vii. Create smaller, pilot programmes in schools and universities. Use the results from groundwork to show what results can come in the future. Apart from education, policy steps currently underway allow countries to gain greater benefits from space applications and national space programmes.
- viii. Companies should create policies to encourage knowledge transfer.
- ix. All policies should encourage local human capital development.
- x. Create policy for productivity where researchers, operators and agencies have to showcase the outcome of programmes by publishing papers. Researchers need to make their knowledge and research results understandable by the general public.

#### **4.1 Financing space projects**

One of the benefits of building support is that space programmes and projects will receive more financing. Space programmes can be financed either through conventional or unconventional means. Conventional methods include giving tax breaks to new space-based companies and providing necessary infrastructure such as steady power supply, good roads and other utilities. Governments could also provide additional funds through grants and fund matching campaigns. Unconventional methods include government lotteries, crowd financing, donations from social media and websites, tapping from the budget of existing agencies, inter-agency collaboration and allocation of funds from private individuals or foundations [11, 12].

## 4.2 Involving students and young professionals

Students and young professionals are essential to the progress of the world and the general support is incomplete without their contribution. It is important to engage them in outreach activities so that they gain familiarity. On their part, they can increase the interests of various stakeholders to invest in space. The key is to work together rather than individually. The different ways in which students and young professionals can contribute are:

- i. Direct involvement in teaching in schools.
- ii. Organisation of workshops, games and competitions (e.g. SPHERES Zero Robotics and The Space Game).
- iii. Form clubs/societies and organise events (e.g. Space Generation Advisory Council, SGC and Yuri's Night).
- iv. Use social media or mobile phones to reach out to thousands or even millions of users.
- v. Entrepreneurial start-ups for grassroots/field teaching, technology development and space advocacy think-tanks.
- vi. Get involved in making policy.
- vii. Space professionals can get their youngest employees involved in initiating and participating in scholarships and internships.

## 5 CONCLUSIONS

Space benefits Earth in many ways. Space-based technology has become indispensable to most countries today. Since space activities are not only the domain of the wealthy and technologically advanced nations, developing countries can directly benefit from space and actively procure those benefits for themselves. It has been observed that in countries where there is a lack of infrastructure or where a high percentage of the population is located in rural areas, spending on space technology applications is more beneficial than spending on terrestrial applications. Moreover, space science and space technology are among the best tools to spur development and help bridge the developed-developing country gap. This report identified the key stakeholders in the process of developing the space industry in developing countries. It goes on to assert that regional and international cooperation is the best way to initiate the process and foster growth in the industry. Investing in space applications, space technology and national space programmes should be among the top priorities of the governments of developing countries; in fact, several methods for building support have been identified among all age-groups and classes of stakeholders.

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