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Realizing a Regional African Space Program

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ABSTRACT

The African Union (AU) Heads of State and Government during their Twenty-Sixth Ordinary Session on 31 January 2016 in Addis Ababa adopted the African Space Policy and Strategy as the first of the concrete steps to realize an African Outer Space Program, as one of the flagship programs of the AU Agenda 2063. The adoption of the policy although significant has no meaning in itself unless steps are taken to implement it. The AU, therefore, request the development of an implementation architecture for the African Space Policy and Strategy, taking into account requirements of different sectors and end-user groups; as well as a Governance Framework that covers the relevant legal requirements and protocols for an operational African Outer-Space Program. Egypt, and potentially Sudan have indicated interest in hosting an African Space Agency to coordinate the regional response to the space policy. Following an introduction, Part II of this paper provides some examples of proposed and actual cooperative activities involving Africa in the science and technology realm that if implemented would have had a substantial impact on the African region. It questions the opacity of African space cooperative activities in spite of the increased attention paid to the development paths of individual African space nations. Part III and IV introduce the African Space Agency and objectives of the newly adopted African Space Policy and its evolution, with an emphasis on analysis of the agenda, actor group, internal and external capacity and implementation experience of Africa towards the goal of space development in the region. Part V questions whether the development of regionally concentrated applications eventually leads to regulation on a regional level instead of at the universal level and whether such a development be desirable. The article ends with some thoughts as to what emerging space actors need to be prepared to consider if they intend to invest in developing space capabilities.

I. INTRODUCTION

Space exploration contributes to the goal of international cooperation, knowledge generation, and inspiration - instrumental outputs for “common benefit.” In line with Article 1 of the Outer Space Treaty,¹ common benefit calls for the exploration and use of space for the benefit and in the interests of all countries. Aganaba-Jeanty argues this should be understood as a concept that enables an outcome.² But, with no clear defined conception of common benefit, the debate around benefit, in reality, is exploited to protect individual benefits as opposed to determining what the effort to use space collectively can generate for the common good,

by actively enabling others to succeed and participate in space exploration and use. In fact, the common benefit has been constructed as a property claim (give me my part) instead of a distributive justice claim (access to fair share derived from a common pool resource). Aspirant space actors are therefore unfairly disadvantaged because there has been a disproportionate accrual of benefits and those capable of meeting the common benefit obligation appear to view it as a soft norm and express sentiments of good intention.

In assessing cooperative initiatives ranging from those of established space-faring nations such as the U.S. to new entrants such as Ghana, it appears

¹ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, 610 UNTS 205, 18 UST 2410, TIAS No

6347, 6 ILM 386 (entered into force on 10 October 1967) [Outer Space Treaty/OST].

² Timiebi Aganaba-Jeanty (2016) “Space Sustainability and the Freedom of Outer Space” 14:1 *Astropolitics* 1.

that cooperation between entities of varied technical capability may not be as widespread as the increasing number of space capable/aspirant countries would lead us to believe. For example, in 2011, 50% of NASA's cooperation was with only eight partners,³ with many of the other established space nations only cooperating with traditional partners.

Perhaps importantly, the difficult question is "what would proportionality look like?" The goal of distributive justice should be focused on common outcomes, while acknowledging that some actors and users would need more assistance on the way to achieving those common outcomes, paying close attention to the relics of domination that exist. In the African context, regional cooperation could be an avenue to be pursued because actors are more closely aligned, and it provides for cost sharing and pooling of resources as well as increase influence and prestige on a global stage. This action could pave the way for an evolution in the general principles, allowing all actors to think more coherently and systematically about cooperation in Outer Space at a time when impacts are asymmetrically felt most by the emerging States. Such an evolution may be opportune as well at a time when cooperation is needed to produce greater capacity to share and manage collective goods.

Part II of this paper provides some examples of proposed and actual cooperative activities involving Africa in the science and technology realm that if implemented would have had a substantial impact on the African region. It questions the opacity of regional cooperative activities in spite of the increased attention paid to the development paths of individual African space nations. Part III and IV introduce the African Space Agency and objectives of the newly adopted African Space Policy with an emphasis on analysis of the agenda, actor group, internal and external capacity and

implementation experience of Africa towards the goal of cooperative space development in the region. Part V questions whether the development of regionally concentrated applications eventually leads to regulation on a regional level instead of at the universal level and whether such a development would be desirable. The article ends with some thoughts as to what emerging space actors need to be prepared to consider if they intend to invest in developing space capabilities.

II. COLLABORATIVE REGIONAL ACTIVITIES

Over the decade, African investment in space science and technology has grown, driven by earth observation development programs in Algeria, Egypt, Nigeria, Gabon and South Africa, and investment in satellite telecommunications in countries such as Angola and Congo. Encouraged in part by the successful South African bid to host the Square Kilometer Array global astronomy project, new entrants have emerged in the African space arena. In 2013, investment in space science was driven by the developments in the field of radio telescopes and astronomy as African countries, including Ghana and Ethiopia, sought to accomplish two primary objectives: to develop and upgrade existing infrastructure and to invest in new scientific tools to boost science capacity in the region. These activities are driven primarily by African agendas linked to (sustainable) development goals, and with a few exceptions, national space programs are largely financed through national budgets and not foreign aid as popularly believed.

With the emergence of an increasing number of developing countries engaging in space activities, greater awareness exists as to the development paths that African national programs follow.⁴ However, little is shared about the development of African space projects at the regional level. Abiodun highlighted in his address⁵, several

³ Michael O Brien, International Cooperation at NASA, Presentation at the Asia Pacific Regional Space Agency Forum, December 8, 2011.

⁴ Megan Ansdell et al. (2011) "Analyzing the Development Paths of Emerging Space Nations: Opportunities or Threats for Space Sustainability"

Online:<
https://swfound.org/media/46125/emergingspaceactors_report-august2011.pdf>

⁵ Notes taken during the address at the 5th African Leadership Conference on Space Science and

initiatives with substantial proposed/actual African participation but failed for various reasons including:

- The African Remote Sensing Council and Program created in 1975 to establish an earth-based regional center for receiving and processing data remitted by remote sensing satellites. According to Abiodun, the program failed because the concept was dominated by other interests. It did rebirth as the African Organization of Cartography and Remote Sensing in 1988 following a merger with the African Association of Cartography. The official reason for the merger was that both were performing similar functions with little success because of the lack of political and financial support from the Member States⁶;
- The 1979 joint African-Indian proposal for the establishment of an International Institute for Space Sciences and Electronics (INISSE) and the construction, in Kenya, of a Giant Equatorial Radio Telescope (GERT). This was the most comprehensive regional proposal for fundamental basic science and technology research in Africa with an estimated cost of \$15 million which failed due to lack of funding;
- The ongoing Guinea Current Large Marine Ecosystem (GCLME) Project with 16 African countries designed to Combat Living Resources Depletion and Coastal Area Degradation in the GCLME through Ecosystem-based Regional Actions. This is through creation of an ecosystem-wide assessment and

management framework for sustainable use of living and non-living resources in the GCLME. While extensive capacity building has occurred, the project is arguably ineffective as little is done on a national/local basis. Despite a substantial top-down framework, strong political support for the project and creation of a governing Commission, a 2013 evaluation has identified “country drivenness and ownership as a weakness in the project, associated with lack of empowerment of national structures, and low visibility of the project in countries without a demonstration project or Regional Activity Centre”⁷;

- The Regional African Satellite Communications Organization (RASCOCOM) project has been riddled with challenges and has not provided the full range of expected benefits.

The lack of opacity around African regional space cooperation may be explained by several historical factors. Firstly, the majority of space-related projects at the regional level do not ab initio appear to be African-driven and are primarily donor-dependent. As highlighted by Adedeji,⁸ in reference to the African Remote Sensing Council, the application of remote sensing to resource development was undertaken at the national level mostly by foreigners working on grant-aided projects, thus the foundation laid through the implementation of such projects was often not built upon because of the lack of manpower to continue the practice after those projects were terminated. Funding sources are a fundamental consideration because historically projects were funded because of their immediate application potentials with no tangible concern

Technology for Sustainable Development held in Ghana 2013, on file with author.

⁶ United Nations. Economic and Social Council, United Nations Economic Commission for Africa (1988-03), Report on the Establishment of the African Organization for Cartography and Remote Sensing. UN. ECA Conference of Ministers Meeting (14th: 1988, Apr. 14-18: Niamey, Niger); UN. ECA (23rd session: 1988, Apr. 14-18: Niamey, Niger), Addis Ababa.

⁷ UNEP (2012) Terminal Evaluation of the UNDP-UNEP GEF Project: Combating Living Resources Depletion and Coastal Area Degradation in the GCLME through Ecosystem-based Regional Actions (GCLME),
Online:<https://www.unido.org/fileadmin/user_media_upgrade/Resources/Evaluation/UNEP_REGIONAL_IW_FSP_GCLME.pdf>

⁸ Adebayo Adedeji, *Towards a Dynamic Economy: Selected Speeches and Lectures 1975-1986*, (Routledge: 1989).

for basic research to address fundamental problems facing the continent in the long term. The reality, however, is that turn-key projects undertaken in Africa do not lead to the development of full systems because they do not serve as stimuli for intellectual development.⁹ This is linked to the lack of visibility and ownership of regional programs and expresses the apparent lack of political will to fully engage in the process as well as a lack of capacity to adequately address issues. Where space projects are African-led, there has been a mixed outcome. No tangible outcome from the African Resource Management Satellite Constellation project¹⁰ between Nigeria, Algeria, Kenya and South Africa appears to have materialized. Abiodun argues that instead of each country developing individual satellites to form the constellation, a more collaborative endeavor where each country develops a *different component of each* satellite would bring increased benefit.¹¹

Secondly, projects have suffered from the lack of coordination at the African Union level as well as with national space programs making it unclear from a governance perspective how the space projects would be managed so as to benefit from synergies. Of course, the general skepticism around the effectiveness of the AU does not help, though efforts are being made to strengthen and make the institution more effective.

III. A PROPOSAL FOR AN AFRICAN SPACE AGENCY

It has been posited that one such avenue through which African regional cooperation can be encouraged is through the establishment of an African-led regional space program managed by an African Space Agency. In August 2010, the African Union (AU) Ministers of

Communication and Information Technology called for the AU Commission to conduct a feasibility study for the establishment of such an agency, called AfriSpace. Through funding from the European Union, a European consortium undertook the feasibility study, highlighting the current situation of the use of space applications in Africa and made recommendations and created a roadmap for the establishment of the Agency.¹² The apparent reasoning behind recent calls for an African Space Agency according to Gottschalk¹³ is, to some extent, the fact that the continent already has some space related regional activities/institutions.

Following earlier discussions within the AU on a proposed African Space Agency, the AU's 2009-2012 strategy affirmed Gottschalk's view that "through the launch of [an] African Union Space Agency, Africa will be able to negotiate better offers for satellite construction, space launches and technology transfer; and share data, scarce facilities and infrastructure much more than individual small countries can do on their own."¹⁴ The initial AU's draft third strategic plan for 2014-2017 built on this by further proposing the development of an African Space Policy and development of a constitutive convention by 2015 to establish an African Space Agency. However, further drafts stated that the 2015 goal was instead to develop "space ...policy, programmes and strategic pan-African institutions and networks". The following challenges have been identified with an African Space Agency - lack of political support, dependency on external support, insufficient coordination, awareness and talents capacity and regulatory restrictions.¹⁵ This, however, has not deterred Egypt, who has indicated its interest in hosting an African Space Agency, as well as

⁹ Abiodun Adigun Ade (1983) "Basic Space Sciences in Africa" 3:7 *Advances in Space Research* 79-84.

¹⁰ Sais Mostert (2008) "The African Resource Management (ARM) Satellite Constellation" 12 *African Skies* 53.

¹¹ *Supra* note 5.

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¹³ Keith Gottschalk (2008) "The Roles of Africa's Institutions in Ensuring Africa's Active Participation in the Space Enterprise: The Case for an African Space Agency (ASA)" 12 *African Skies* 26-28.

¹⁴ African Union Commission, Strategic Plan 2009-2012, (May 19, 2009), Online: <http://www.au.int/en/sites/default/files/Strategic_Plan2009-2012.pdf>.

¹⁵ Islam Abou El-Magd, 7th Space Working Group Meeting, Presentation delivered at ALC-2015 Sharm El-Shikh, Egypt 1-4 December 2015, Online: <<http://www.alc.narss.sci.eg/webroot/attachments/alc2015/Day%201/Session%201/IAM-PPT-Policy-Strategy-ALC.pdf>>.

taken the concrete action to allocate \$USD10 Million to implement the project.¹⁶

IV. ASSESSING THE POTENTIAL OF THE AFRICAN SPACE POLICY

In Khartoum, Sudan in September 2012, the Ministers of Science and Technology recommended, in the Khartoum Declaration, that the AU Commission develop a space policy for the Continent in collaboration with relevant stakeholders; taking into account remote sensing applications and satellite imagery processing. Following the Declaration, the AU Commission endorsed the establishment of a Working Group on Space Science tasked to develop a draft African space policy and strategy. Comprised of members of the African Leadership Conference and national space agencies, an initial draft policy was completed in October 2013 and presented for consideration and the final adopted at the AU Summit in January 2016.

Using the MacArthur Foundation's Regional Governance Framework,¹⁷ the factors of regional governance to be addressed in assessing the potential of the African Space Policy and Strategy include the agenda, actor group, internal and external capacity and implementation experience. In analyzing the agenda, the fundamental question of what serious challenge the policy seeks to address must be asked. Based on easily accessible drafts of the policy,¹⁸ the high-level policy drivers for an African Space program have evolved. Initially the focus was:

- To use space science and technology to derive optimal socio-economic benefits that both improves the quality of life and creates wealth for Africans and in addition contribute to the international

body of knowledge and the knowledge economy;

- To develop and maintain indigenous infrastructure, human capital and capabilities that service an African market and that cater for the geospatial and space information needs of the African continent.

Later drafts¹⁹ show the shift towards the overarching goal to:

- Create a well-coordinated and integrated African Space Programme that is globally competitive, but yet responsive to the needs of the continent.
- Create a regulatory environment that promotes and supports an African agenda, but yet ensures that Africa is a responsible user of outer space

The policy principles are focused the following factors:

1. Addressing user needs – harnessing the potential of space science and technology in addressing Africa's socio-economic opportunities and challenges;
2. Accessing space services – strengthening space mission technology on the continent in order to ensure optimal access to space-derived data, information services, and products;
3. Developing the regional and international market – developing a sustainable and vibrant indigenous space industry that promotes and responds to the needs of the African continent
4. Adopting good governance and management – adopting good corporate governance and best practices for the

¹⁶ African Union, Decisions, Declarations and Resolution, Assembly/AU/Dec.588-604 (XXVI), Online:

<http://www.au.int/en/sites/default/files/decisions/29514-assembly_au_dec_588_-_604_xxvi_e.pdf>.

¹⁷ William Barnes & Kathryn Foster (2012), Toward a More Useful Way of Understanding Regional Governance, Online:<[http://br.berkeley.edu/wp-content/uploads/2012/10/Barnes-Foster-Toward-a-](http://br.berkeley.edu/wp-content/uploads/2012/10/Barnes-Foster-Toward-a-more-useful-way-of-understanding-regional-governance.pdf)

[more-useful-way-of-understanding-regional-governance.pdf](http://br.berkeley.edu/wp-content/uploads/2012/10/Barnes-Foster-Toward-a-more-useful-way-of-understanding-regional-governance.pdf)>

¹⁸ See African Space Policy (Draft Version 7) Online:<https://www.wmo.int/amcomet/sites/default/files/field/doc/events/african_space_policy-v7.pdf>

Note: This is not the final version.

¹⁹ African Space Policy (Draft 10) Online:<https://www.wmo.int/amcomet/sites/default/files/field/doc/events/doc._7.1_african_space_policy_v10a.pdf>

- coordinated management of continental space activities;
5. Coordinating the African space arena – maximizing the benefit of current and planned space activities, and avoiding or minimizing duplication of resources and efforts;
 6. Promoting regional and international cooperation – promoting an African-led space agenda through mutually beneficial partnerships.

If the idea is to increase the take up of space applications in Africa while creating capacity and an indigenous market, then the areas of focus need careful consideration as evidenced by the challenges faced even in established markets such as the EU. The strategic approach in implementing the African Space Program is to adopt a needs pull philosophy in response to relevant user requirements. The strategy focuses on priorities that underpin the key priority areas of political, economic and social affairs, namely around disasters, health, ecosystems, biodiversity, climate. However, Earth observation will form the primary focus of the African space program as it is viewed that this application has the most potential to address the socio-economic challenges of the continent.

Market development challenges for the creation of a European Earth Observation services industry serve as instructive and include: 1) raising awareness as to how Earth observations can be applied to problems of customers/users; 2) to medium companies lack the resources to develop new opportunities and find it difficult to export and 3) the need to work in partnership between public and private suppliers and customers.²⁰

Weighing support for and opposition to the agenda as well as overall comprehension of the agenda is difficult because general discussion of the issues is not prevalent despite endorsements from international organizations and discussion

within foreign associations.²¹ What needs to be communicated better is that according to Munsami, chair of the AU Space Working Group, “of the 40 core AU objectives an incredible 35 of them require space technology in some form or other”.²²

The Space Working Group has been the main actor group in the development of the Policy and Strategy. Comprised of members from Algeria, Cameroon, Congo, Egypt, Ghana, Kenya, Namibia, Nigeria, South Africa and Tanzania, the majority of these countries do have active space programs and agencies. The AU itself, through the Human Resources, Science, and Technology (HRST) department, developed a task force composed of all departments. Namely the Department of Infrastructure and Energy, HRST, Department of Peace and Security and Department of Rural Economy and Agriculture, to coordinate activities and establish a secretariat to support the technical activities of the task force for all space initiatives. With national space actors and the AU working together, some of the initial issues have been addressed regarding who should be involved in developing a regional program, bearing in mind concerns that African space actors were not consulted during the AU’s initial investigation into an African Space Agency.

In light of the challenges highlighted above in African regional cooperation, the internal capacity, that is the sufficiency of money and related sources to effect regional action, is a fundamental consideration, while the external capacity, which refers to the skill and reach of the actors to connect to and secure external resources to support the group goal can not be downplayed. To this point, the role of the private sector and non-governmental organizations appears to be minimized and must be addressed. Implementing experience shows that buy-in and ownership from diverse actors is necessary to carry projects along, and not simply a reliance on government actors. However, the policy stresses that funding

²⁰ EARSC (2014), “Developing the European EO Services Industry.”

²¹ Planet Earth Institute, “Exploring the Potential around Africa’s Space Strategy”,

Online:<<http://planetearthinstitute.org.uk/news/exploring-the-potential-around-africas-space-strategy/>>

²² Kathryn Cave (2016) “Why Africa Needs a Space Program”, Online:< <http://www.idgconnect.com/blog-abstract/15612/why-africa-space-program>>

schemes of space activities must preserve the independence of the African space program and as such calls for African governmental financial support as the main funding source.

The experience of the African Regional Center for Space Science Technology and Education in Nigeria, a United Nations supported centre, which seeks to make space education available to African participants through post graduate diploma programs is noteworthy here. According to Aganaba-Jeanty,²³ “[d]espite a governing board made up of 13 African member countries and several calls to increase financial contributions, Nigeria is the sole financier having sponsored to date [in 2013] over 200 participants from 17 African countries. Indeed while these countries have all benefited from the regional initiative, through access to space technology education, they are yet to contribute to it.”

V. IS REGULATION AT THE REGIONAL LEVEL BETTER?

The idea of regional space policy, however, leads to a fundamental question raised by Rebbelink, “Does the development of regionally concentrated applications eventually lead to regulation on a regional level instead of at the universal level and would such a development be desirable?”²⁴ A primary first question, however, would be, what are the shortcomings of the global regime which a regional regime should seek to address, in support of African objectives?

The African Space Policy highlights two goals relating to Standards, which raise an important issue with respect to international regulation:

- [T]he quality and process maturity of an indigenous space industry must meet the globally accepted space industry

standards, as such the African space industry can capture a market share of the global space market;

- African member states will need to harmonize and standardize all infrastructure to ensure interoperability and seamless integration of data, data integrity and data security/protocol.

Dennerly²⁵ highlights that the development of international regulatory regimes and industry standards can run the risk of being dominated by more powerful, industrialized countries that invest resources and time into ensuring that their technology, and regulatory standards prevail. There are several factors that could explain this dominant standard setting position, such as: “the development of regulations and standards by established space nations relevant to their domestic space industries; established space nations public commitment to the development of international standards; their cultivation of international partnerships to achieve these ends; their increased and active presence in international standard setting bodies; and their allocation of resources to ensure they meet these objectives”. Therefore, Dennerly argues “the potential inequality between emerging space nations, as compared to established space nations, may stem from the manner in which international standards are developed and set.”²⁶

Standards are designed to create a common language between states and across industry and once the standard is set, that technology, product or process becomes standardized thus inhibiting alternatives, establishing ‘trade barriers’ and impeding competitors.²⁷ The impetus of Africa to ensure that it can create its own standards, and

²³ Timiebi Aganaba-Jeanty (2013) “Precursor to an African Space Agency: Commentary on Dr Peter Martinez “Is there a Need for an African Space Agency?”” 29:3 Space Policy 168-174.

²⁴ Oliver Rebbelink (1997) “Technological Development and the Development of the Law of Outer Space” in A.C. Kiss, J.G. Lammer (Eds.), *Hague Yearbook of International Law*, vol. 10.

²⁵ Joel A. Dennerley (2016) “Emerging Space Nations and the Development of International Regulatory Regimes” 35 Space Policy 27-32.

²⁶ United States Government Accountability Office, *U.S. AEROSPACE INDUSTRY Progress in Implementing Aerospace Commission Recommendations, and Remaining Challenges*, (Report to the Ranking Democratic Member, Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives, September 2006), 26.

²⁷ Marcel Heires (2008) “The International Organization for Standardization (ISO)” 13:3 *New Political Economy* 357–358, 360.

develop interoperable solutions, will ensure its relevance on the international level. This will therefore involve increased participation at international fora.

VI. CONCLUSION

Agbaje and Olusoji²⁸ in their recommendations for the fundamental ingredients for the realization of AfriGEOSS coordination role provides some distinct advice for the development of the coordination of the African Regional Space Program. First, “the Condition for the assignment of stakeholders (experts) to regional projects by nations should be strict with clear requirements fulfilled in terms of knowledge, status, availability, and the expected country’s contribution.” This hopefully fixes the issue of domestication. To this end, they must also “design a robust and enduring capacity building program that will build on the existing capacity to enable each country enhance its scientific and technical knowledge and experience in space science and technology in addressing Africa’s needs.”

Secondly some basics need to be taken care of. There is a need to fix basic infrastructure, particularly low internet bandwidth and lack of basic technology equipment and for sensitization and awareness to be built into the projects. But even at a more fundamental level, there must be a realization that space is not just some distance otherness but is important for the ability for us to perceive ourselves, manage our resources and inspire our potential. It is not simply a tool to show dominance or as part of a hubris of activities that show “development”. As such, it must be recognized that there are certain conditions that must be fulfilled to be able to effectively compete on the world stage as an effective space actor. Ultimately, to maximize benefits, emerging participants have to be prepared to consider the following issues and work together to address them:

- a) It is fundamental to focus on the ability to conceptualize first before looking for technology solutions otherwise technological projects will fail and look like white elephant projects;
- b) There must be a willingness to “pay to play” at certain times because essentially space is a business/industry/sector where profit is an objective;
- c) Small players may first focus on developing niche strategies and technologies because “space” is a small and competitive sector and the average population will not understand “big” space projects in a challenging financial environment;
- d) There must be recognition that space is no longer just a domain for governmental activity. There must be a multiplicity and diversity of actors ready, willing and enabled to engage. This includes encouraging grassroots initiatives and taking note of the words of Abiodun²⁹ that “the acquisition of fundamental scientific knowledge and the evolution of the technologies needed to initiate, develop, design, fabricate, build and test, locally, a variety of hardware and software components, some of which may end up in a variety of products including space-related ones.” In other words, for emerging nations, the immediate focus should be on investing in knowledge generation in the enabling technologies.

The African Space Policy and Strategy is a welcome development in light of the AU Agenda 2063 objective to “exploit all possible opportunities available in the short, medium and long term, so as to ensure positive socioeconomic transformation within the next 50 years”. The ARMC satellite project could have been an interesting place to start for the region to develop

²⁸ Ganiyu Agbaje & John Olusoji (2016) “Cooperation in Earth Observation Missions in Africa: A Role for AfriGeoss”, Paper presented at the 67th International Astronautical Congress, Guadalajara, Mexico.

²⁹ Abiodun Adigun Ade (2013) “Trends in the Global Space Arena - Impact on Africa and Africa’s Response” 28:4 Space Policy 283-290.

interoperable technology, rather than in a piecemeal nationalistic manner in which the partner is or is not developing their contribution, for example Spaceteq is currently developing the South African contribution independent of the other African partners for launch in 2019.

More detailed plans must emerge as to exactly how an African market will be created and stimulated, bearing in mind the challenges other regions have faced and the peculiarities of African regional cooperation.