

# SPACE BRIEF

## ROUND THE SPACE-WORLD IN TIME

08 January 2015

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## EXTENDED BRIEF ON SPACE POLICY

### INTRODUCTION

Every national, cooperative or international space endeavour begins with goal(s) in mind. The goal(s) may be to achieve national prestige, demonstrate international leadership, strengthen national security, enhance military capabilities, discover the unknown in the universe, increase scientific capacity and knowledge, stimulate technological development, manage natural and man-made resources, ignite or boost space commerce and foster socio-economic development, among others. A space policy, which sets out guidelines and principles, is then developed in pursuit of the goal(s). In line with the policy, a strategy is developed on how the goal(s) would be attained. Such strategy often consists of programme(s) and/or project(s). The decisions that border on policies, programmes and projects are made by leaders, who are elected or selected via a political process.

Space policy is important as it facilitates harmonization, coordination, and sustenance of different space activities within an organization, nation or cooperative body. Such policy will take the interests of small groups into consideration, while not overlooking the overall interest of the whole. The success lies on having a clear focus on policy goals, institutional governance framework, adequate long-term funding and fruitful collaborations.

### THE AFRICAN SPACE POLICY

#### Background

In 2010, at the Third Ordinary Session of the Conference of African Ministers in charge of Communication and Information Technologies (CITMC), the Ministers requested the African Union to embark on a feasibility study of the creation of an African Space Agency. This assignment was managed by the Department of Infrastructure and Energy (DIE) of the African Union Commission (AUC) and carried out by Telespazio VEGA UK Limited (formerly, Vega Space Limited). The report proposed the establishment of an African space agency, after a space policy has been drafted and adopted, and a governance structure has been put in place. It also recommended the setting up of a Space Secretariat within the AUC, to facilitate the drafting and adoption of the policy, while the primary objective of the agency would be to implement the policy. After deliberations by African space professionals at home and in diaspora concerning the establishment of an African space agency, the

consensus reached was that Africa may consider establishing such a body in future, after a space policy has been adopted, some member-states have attained threshold space capability, a governance and funding mechanism has been acceded to, and other necessary prerequisites for successful programmes have been put in place.

In 2012, at the Second Ordinary Session of the Conference of Ministers in charge of Meteorology (AMCOMET), the Ministers established a Task Force to investigate the feasibility of developing an African Regional Space Programme. In the same year, the Conference of Ministers in charge of Science and Technology (AMCOST) established a Space Working Group to develop an African Space Policy and Strategy, and made reference to the future need of relevant institutions for the implementation, such as an African space agency. It will be observed that while the Ministerial Conferences reached their decisions independently, there are some concurrences in the decisions.

Furthermore, in 2013, at its Twenty-Second Ordinary Session, the Executive Council requested the Commission to “coordinate with the Science and Technology sector to implement the recommendations of the feasibility study on the African Space Agency (AfriSpace) and develop a space policy for the Continent taking into account remote sensing applications and satellite imagery processing.” Then, in January 2014, the AU Summit of Heads of States established a Joint Task Force on an African Regional Space Programme to be led by AMCOST under the African Union Commission of Human Resources and Science and Technology (AUC-HRST).

#### The process of developing the space policy

The process of development of the African Space Policy and Strategy has being a unique blend of research, consultations, mediation and democratic consensus. First, in 2012, AMCOST established the African Union Space Working Group (AU-SWG) whose mandate is to develop a space policy and strategy for the continent. The SWG is chaired by South Africa, with members from Algeria, Cameroon, Congo-Brazzaville, Egypt, Ghana, Kenya, Namibia, Nigeria, Tanzania, and Tunisia. There are also representatives from New Partnership for Africa’s Development (NEPAD) Planning and Coordinating Agency, and from the United Nations Economic Community for Africa (UNECA). The AUC also has representatives from the Departments of Human Resources, Science & Technology, Infrastructure & Energy, Rural

Economy and Agriculture, and Peace & Security. The SWG has held five sessions in Nigeria, South Africa, Egypt and Congo Brazzaville.

The draft space policy and strategy documents were produced after its 4<sup>th</sup> Session in Cairo, Egypt; these were presented in different Ministerial conferences, professional meetings and to other stakeholders. The feedbacks were incorporated into the document and the 5<sup>th</sup> session was held back-to-back with a Validation workshop in Congo-Brazzaville. Participants of the Validation Workshop were drawn from member-states, Regional Economic Communities (RECs), and professional associations. The Validation workshop served as a public endorsement of the draft documents.



Cross-section of participants at the Validation Workshop on 9 December 2014, in Brazzaville, Republic of Congo

The 6<sup>th</sup> Session of the SWG is scheduled for February 2015. During this session, the space policy, strategy and governance framework documents would be finalized, and then submitted to the African Heads of States of Governments for adoption in June 2015. Following this process, a well-rounded and acceptable document will be available for Africa.

### The Space Policy Document

The overarching objective of the African Space Policy is to maximize the benefits of space for socio-economic development of the continent. The space-derived services to be exploited are Earth Observation, Satellite Communication, Navigation & Positioning, Space Science & Astronomy. In practice, these are being applied in agriculture, education, health services, natural resource management, environmental management, prevention & management of disasters, transportation and communication. Currently, Africa does not have the capability to engage in provision of space-derived products and services. The policy and strategy framework is aimed at developing this capability, and in building the necessary industry and people that will use these products and services.

The high-level policy goals are:

(i) 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.

(ii) 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.

The following objectives have been set as a means of achieving these goals:

(i) Addressing user needs – To harness the potential benefits of space science and technology to address Africa's socio-economic opportunities and challenges.

(ii) Accessing space services – To strengthen space technology applications on the continent in order to ensure optimal access to space-derived data, information services and products.

(iii) Developing the regional and international market – To develop a sustainable and vibrant indigenous space industry that promotes and responds to the needs of the African continent.

(iv) Adopting good governance and management – To adopt good corporate governance and best practices for the coordinated management of continental space activities.

(v) Coordinating the African space arena – To maximise the benefit of current and planned space activities, and avoid or minimise duplication of resources and efforts.

(vi) Promoting international cooperation – To promote an African-led space agenda through mutually beneficial partnerships.

To address user needs, the following principles will be followed:

(i) Improve Africa's economy and the quality of life of its people - Space applications, particularly Earth Observation, will be used to address the socio-economic developmental needs of Africa through sustainable usage of its natural resources.

(ii) Address the essential needs of the African market – The space resources vested in a few African space nations will be used to provide technological know-how and knowledge transfer on data and information dissemination, and operational services and products to non-space nations in Africa in order to leverage the full socio-economic benefits.

(iii) Develop services and products using African capacities – Develop African space technology services and products through African capacity so as to ensure sustained ownership of the space resources managed by Africans.

(iv) Develop the requisite human resources for addressing user needs - adopt learning programmes to build Africa's human capacity and maintain the widespread use of space applications.

(v) Maintain an efficient and sustainable African space programme – Develop an efficient monitoring and evaluation mechanisms during the implementation phase of the African space programme. Also, adopt key performance indicators for regular reviews of its products and services.

To access space services, the following principles will be followed:

- (i) Use existing space infrastructure – Develop Joint Research and Development (R&D) initiatives using existing space infrastructure so as to strengthen the capacity of African countries.
- (ii) Promote capacity-building for the development of space services - Develop capacity and capabilities in space science and technology, and create an enabling environment for knowledge generation and exploitation.
- (iii) Adopt data-sharing protocols – Adopt and implement data-sharing protocols so as to ensure wider, easier and equitable access to geospatial data that is cost-effective and acceptable to all member states. Also, encourage data gathering and sharing among member-states.
- (iv) Develop and increase Africa's space asset base - Develop and increase Africa's current space asset base so as to ensure optimal accessibility, interoperability and complementarity, while reducing duplication.
- (v) Establish regional and subregional centres - Establish regional and subregional centres that have a localised span of control that links up with the continental space agenda so as to cater for the varied interests of all regions of the continent.

To develop the regional and international market, the following principles will be followed:

- (i) Create a people-centred, market-based industrial capability - Rightsize the market-based industrial capability with the relevant human expertise and skills and encourage free-market transactions on the African continent.
- (ii) Develop a globally competitive African space programme – Put in place appropriate interventions to ensure the global competitiveness of African space technologies, products and services.
- (iii) Promote public-private partnerships – Pursue public-private partnerships that draw on the complementary capabilities and expertise through effective technology transfer and intellectual property management arrangements, at an intra-continental level. Also, encourage collaborative R&D efforts that focus on the development of space services and products in response to market needs and implement appropriate commercialisation frameworks and agreements to service the regional and foreign export markets.
- (iv) Develop, upgrade and operate cutting-edge African space infrastructure - Ensure the coherent development, upgrading and operation of cutting-edge African space infrastructure that ensures optimal coordination, utilisation and cost-effectiveness.
- (v) Promote R&D-led industrial development – Develop Africa's technical capability and infrastructure through investment in Research and Development
- (vi) Use indigenous space technologies, products and services – Develop the African space market through the commercialisation and intelligent use of indigenous space technologies, products and services.

To adopt good governance and management, the following principles will be followed:

- (i) Establish an organizational framework - Establish an organisational framework that will integrate all African space capabilities and assets to serve the goals of Africa's space policy, in an efficient and cost-effective manner. Ensure that the organisational framework provides equal opportunities for accessing space services and products by all African states.
- (ii) Financially support the African space programme – Implement funding schemes that preserves the independence of the African space programme and thus guarantee the orientation of space activities with user needs.
- (iii) Promote knowledge sharing – Disseminate knowledge over the African continent in a non-contradictory way, and in a way that will promote the development of an African space market. Also, develop appropriate mechanisms for space-based intellectual property exchanges that will assure proper usage and avoid improper dissemination.
- (iv) Monitor and evaluate space activities – Develop monitoring and evaluation procedures that will ensure compliance and achievement of the broad objectives set for an African space agenda.
- (v) Regulate space activities – Develop a regulatory framework to ensure attainment of strategic objectives, resolve conflicting interests, promote African commercial space sector, and compliance with international treaties and conventions.
- (vi) Maintain an awareness campaign – Engage in awareness campaign that will educate and inform African decision makers, politicians and the public for their collective buy-in and ownership of the African space programme.

To coordinate the African space arena, the following principles will be followed:

- (i) Promote partnerships across all sectors – Foster joint collaboration and synergy among academia, industry and government in all fields of space science and technology in Africa.
- (ii) Commit funds to optimise and improve effectiveness – Encourage African nations to commit funds to the African space programme.
- (iii) Harmonise and standardise all infrastructure - Harmonise and standardise all infrastructure to ensure interoperability and seamless integration of data, data integrity and data security/protocol.
- (iv) Establish communities of practice - Establish communities of practice for the sharing of experiences and best practices.
- (v) Preserve and maintain the long-term sustainability of outer space – Enforce transparency and confidence building measures so as to preserve and maintain the long-term sustainability of outer space.
- (vi) Secure the space environment for Africa's use – Secure assets related to space such as spectrum, orbital locations, and quiet areas for radio-astronomy, and ensure Africa's active representation in relevant international bodies.

To promote international cooperation, the following principles will be followed:

- (i) Promote space in Africa, for Africa, and by Africans – Ensure the independence of the African space programme when forging strategic international partnerships
- (ii) Ensure a reasonable and significant financial and/or social return – Ensure that all international partnerships are fair and mutually beneficial and provide acceptable socio-economic returns for the African continent while also strengthening the African space asset base.
- (iii) Observe international agreements - Observe all appropriate international treaties, conventions and agreements after forging a consolidated African position that best serves the African space programme.
- (iv) Promote intra-continental partnerships – Promote Intra-continental partnerships so as to leverage on national strengths, activities and programmes.

In general, the policy document provides for the necessary ingredients of a successful space programme. These include strategic goals, guiding principles, development of human capital and knowledgebase, funding mechanism, provision of infrastructure, space outreach and awareness, viable market and international cooperation. A Space Strategy, Implementation Plan and Governance Framework are equally under development, based on the policy.

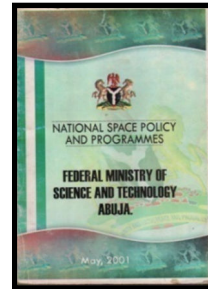
Unlike several other space policy documents, one of the key features of the African Space Policy is gender mainstreaming. The policy statement in this regard is stated thus: “It is imperative that the benefits accruing from and the involvement in continental level space activities must reflect gender parity and promote the empowerment of women, as a way of advancing development and reducing poverty. Women who are healthy, educated and confident contribute to the health and wellbeing of whole families, communities and their nations. Thus, promoting the political, economic and social status of women is a critical precursor for advancing the development of the African continent and therefore priority attention must be placed on ensuring gender equality in space activities, both in terms of participation and the recipients of associated benefits. This imperative will be driven across all policy principles advocated for in this document.”

### COMPARISON OF POLICIES

All policy documents begin by highlighting the benefits of space to humanity and stressing the importance of space in our everyday lives. Some common issues addressed in policy documents include education, research and development, workforce development, private sector engagement, need to preserve space access, space sustainability and need for international cooperation. In this section, we compare the policy documents of two African nations (Nigeria and South Africa) and three partners of the African Union Commission (European Union, Germany, and United States of America).

### Nigeria

While Nigeria’s space agency – the National space Research and Development Agency (NASRDA) - was established in 1999, its space policy was adopted in 2001. The National Space Council is responsible for setting out the space policy, while the Ministry of Science and Technology supervises NASRDA.



The space policy begins by stating the benefits of space to man. It sets as its objectives, the development of basic space science & technology; remote sensing; satellite meteorology; communication & information technology; defence & security.

Nigeria’s overarching goals are stated thus:

(i) Nigeria shall vigorously pursue the attainment of space capabilities as an essential tool for its socio-economic development and the enhancement of the quality of life of its people.

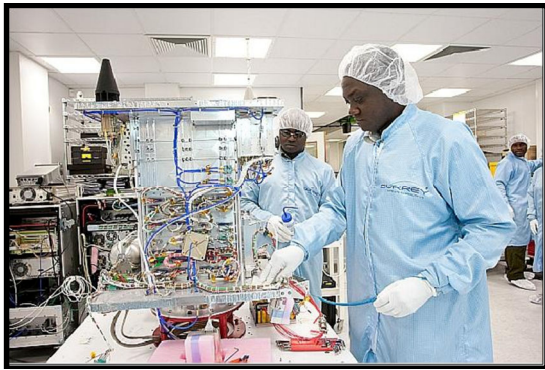
(ii) Nigeria shall foster bi-lateral and international cooperation in all aspects of space science and technology in order to ensure that Nigerian scientists and engineers benefit from global developments in the space enterprise.

The document identifies the following application areas: human resources & capacity building; poverty alleviation and food security through management of Nigeria’s natural resources; disaster prediction, warning & mitigation; defence, national security and law enforcement; understanding of the Earth; education and training; commercial aspects and spin-off benefits; and promotion of international cooperation. For each of these application areas, there is a policy statement, set of objectives and strategies for achieving them.

The document also highlights some of projects that are planned in Nigeria’s space programme. These projects include:

- (i) building of a national planetarium in the capital city, Abuja
- (ii) design and fabrication of instruments and systems
- (iii) development, design and building of a national Earth Observation ground receiving station
- (iv) building of laboratories, and procurement of laboratory equipment and computers for signal/image processing
- (v) development and building of mobile receiving stations for special purposes
- (vi) development of the Nigerian satellite

The following Centers of Excellence have been established to implement the space programme: Center for Basic Space Science, Nsukka; Center for Remote Sensing, Jos; Center for Satellite Technology Development, Abuja; Center for Geodesy and Geodynamics, Toro; Center for Space Transport and Propulsion, Epe; Center for Space Science and Technology Education, Ile-Ife; and Center for Atmospheric Research, Ayangba.



Nigerian engineers working on NigeriaSat-X (Credit: SSTL)

## South Africa

All space activities in South Africa are regulated by the Space Affairs Act of 1993, with the Department of Trade and Industry charged with setting the National Space Policy direction. The South African National Space Agency, which was established in December 2010, is charged with the implementation of the National Space Programme, while the South African Council on Space Affairs exercises regulatory and advisory functions.



The overarching principle in the policy document is that all space activities should contribute to the country's socio-economic development. The guiding principles include:

- (i) use of space for peaceful purposes and benefit of all humankind
- (ii) development and maintenance of a robust and appropriate space

capabilities, services and products to support national priorities

(iii) responsible use of the space environment and alignment of space activities with national legislation, relevant international treaties, appropriate international best practices

(iv) promotion of science and technology in space science and technology

(v) patronage of domestic commercial space sector and development of the industry

(vi) international cooperation, particularly in activities that will aid African nations

These principles will guide in the achievement of the following objectives:

- (i) improve coordination in the South African space arena
- (ii) promote capacity-building initiatives
- (iii) provide appropriate and adequate space capabilities to support South Africa's domestic and foreign policy objectives
- (iv) foster a robust science and technology base in research institutions and the higher education sector
- (v) create a supportive regulatory environment
- (vi) develop a competitive domestic commercial space sector
- (vii) promote international cooperation
- (viii) promote greater awareness and appreciation of space at all levels of the society.

The policy document also sets out implementation requirements such as coordination among relevant government departments and adopt a cooperative governance structure; optimal use of resources such as data, facilities and programmes; address national scientific, technical and industrial requirements, as well as future requirements; establishment of a vibrant industrial base; acquire capabilities relating to space project management and space situation awareness; pursue at least two independent means of access to space, while developing indigenous space launch capability; development of space professionals and strategic interventions for capacity building; strengthening of national science and technology knowledgebase and facilities; optimal use of current space infrastructure; development of a National Industrial Policy Framework; create a supportive regulatory environment; healthy management of spin-offs and technology transfer; adequate space awareness at all levels of society; and active participation in regional and global space initiatives.

One outstanding feature of the South African space policy is the commitment to ensure that other African nations benefit from space, have access to space and acquire indigenous space capability. The space policy is to be reviewed after every ten years, or at any time before then, as deemed necessary by the Minister of Trade and Industry.



MeerKAT, located in Karoo, South Africa, is the largest and most sensitive radio telescope in the Southern Hemisphere (Credits: SKA Organisation)

## European Union

The European Space Policy was jointly drafted by the European Commission and the Director General of the European Space Agency (ESA). At its 4<sup>th</sup> Space Council in 2007, Ministers in charge of Space in the member-states of ESA and the European Council, adopted the Space Policy, the first policy since the establishment of ESA in 1975. (ESA was formed through a merger of the European Launcher Development Organisation and the European Space Research Organisation, both of which were established in 1964.) The European Parliament also approved of the Space Policy in November 2008.



As contained in the policy document, the strategic mission of the European Space Policy is "to develop and exploit space applications serving Europe's

public policy objectives and the needs of European enterprises and citizens, including in the field of environment, development and global climate change; to meet Europe's security and defence needs as regards space; to ensure a strong and competitive space industry which fosters innovation, growth and the development and delivery of sustainable, high-quality, cost-effective services; to contribute to the knowledge-based society by investing strongly in space-based science, and playing a significant role in the international exploration endeavour; and to secure unrestricted access to new and critical technologies, systems and capabilities in order to ensure independent European space applications."

The document proposes a European Space Programme, the coordination of national and European-level space activities, and coordination between civil and military space programmes. It is noteworthy that the European Space Policy and the European Space Agency (ESA) exist in harmony with existing functional national space policies and vibrant space agencies of individual European nations.

The document also highlights the need to invest and obtain maximum benefits from space applications, particularly in satellite navigation, Earth Observation, Satellite Communications, and Security & Defence. It equally addresses issues like public investment in space, the European space industry, market regulatory framework, institutional governance framework and international relations. Key projects include the complete deployment and operation of GALILEO; Global Monitoring for Environment and Security (GMES), now called Copernicus; Single European Sky Air Traffic Management Research Programme; integration of satellite communication networks with terrestrial networks; Implementation of 'European Security and Defence Policy (ESDP) and Space' Roadmap; Cosmic Vision Programme; International Space Station (ISS) programme; and European Launcher Programme.



Participants of the fourth Space Council, held in Brussels on 22 May 2007  
(Credits: ESA)

## Germany

Unlike most other space policy documents, the space policy of Germany is lumped together with its space strategy in a document called "Making Germany's space sector fit for the future: The space strategy of the German Federal Government." This document was adopted in November

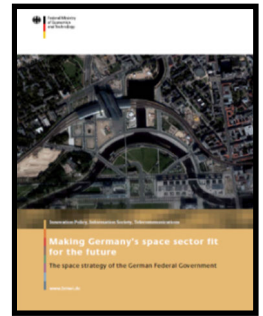
2010. It first highlights the contributions of Germany to the global space enterprise and potential future challenges that Germany would be facing. The overarching goal is to continuously improve the living conditions of humankind.

The guiding principles of the document are as follows:

- (i) orientation toward benefits and needs – "The Federal Government focuses its space policy strictly on benefits and needs while, at the same time, targeting visionary goals."
- (ii) orientation toward the principle of sustainability – "Germany's contributions to space activities are consistently oriented toward the notion of sustainability – that is, they are implemented in a way that will also allow future generations to take full advantage of the possibilities of space."
- (iii) intensifying international cooperation – "Strategic space activities affect German national interests (including commercial interests) and therefore require Germany to maintain its own competencies and expertise; large-scale scientific or operational space missions are to be carried out through international cooperation."

Specific implementation plan towards making Germany's space sector fit for the future include:

- (i) expansion of strategic space expertise in Earth observation, satellite communication, satellite navigation, robotics, mechatronics, Artificial Intelligence and autonomous systems.
- (ii) establishment of a unified, comprehensive and dependable legal framework
- (iii) sustainably reinforce strong position in space research (astronomy, space exploration), basic research (physics, biology) and applied research (materials science, medicine).
- (iv) tapping into new satellite-based services and emerging markets.
- (v) exploitation of space for civil and military security purposes
- (vi) shape the distribution of roles at all levels in the European space institutions and companies, particularly in senior leadership positions.
- (vii) define the roles of Germany and Europe in exploration
- (viii) secure technological independence and access to space, at the lowest possible cost.



Sigmund Jahn, Germany's first astronaut  
(Credits: Wikipedia)

## United States of America



The space policy of the United States of America is often reviewed with each new administration. The current space policy was adopted in June 2010. It contains principles, goals, intersector guidelines and sector guidelines, and recognizes three distinct but interdependent sectors namely: commercial, civil, and national security. Measures to develop each of these sectors are outlined in the document.

As in other space policies, the document highlights the benefits of space. It states five principles that it would abide by, and encourages other nations to abide by the principles. These principles are:

- (i) responsible use of space and transparency in space operations
- (ii) support of a robust and competitive commercial space sector
- (iii) allowance for all nations to access space for their national and homeland security activities
- (iv) no-claim of space or any celestial body and non-interference with the space operations, space systems and supporting infrastructure of other nations
- (v) develop measures to ensure free use of space for all responsible parties

Consistent with these principles, five goals were set for its national space programmes. These are:

- (i) energize competitive domestic industries to participate in global markets
- (ii) expand international cooperation on mutually beneficial space activities
- (iii) strengthen stability in space
- (iv) increase assurance and resilience of mission-essential functions
- (v) pursue human and robotic initiatives
- (vi) improve space-based Earth and solar observation capabilities

Long-term goals were also set for the US space agency – National Aeronautics and Space Administration (NASA). These include:

- (i) by 2025, begin crewed missions beyond the moon, including sending humans to an asteroid.
- (ii) by mid-2030s, send humans to orbit Mars and return them safely to Earth
- (iii) continue the operation of the International space Station (ISS) to 2020 or beyond.
- (iv) collaborate with the private sector for the transportation of crew and cargo to the ISS
- (v) develop a new rocket/launch system
- (vi) maintain a sustained robotic presence in the solar system

(vii) maintain a strong program of space science for the study of the universe

(viii) pursue capabilities to track Near-Earth Objects

The policy document places emphasis on pursuit of US national interests, development of US commercial space sector, international cooperation, responsible use of space by nation-states, and reservation of space. The US space policy is the only space policy document that seeks develop space nuclear power. Furthermore, US seeks to remain the leading spacefaring nation by:

- (i) conducting basic and applied research that increases its capabilities and decreases costs
- (ii) ensuring that space systems and payloads are launched via vehicles manufactured in the US, except on special waivers. It also seeks to develop launch systems and technologies needed for future launch purposes.
- (iii) leading in the provision of GNSS while promoting compatibility and interoperability among GNSS service providers and facilitate market access for US industry.
- (iv) developing and retaining space professionals
- (v) strengthening inter-agency partnerships
- (vi) developing transparency and confidence-building measures
- (vii) developing of space nuclear power systems



President Obama speaking at Kennedy Space Center, where he hinted on the new policy direction of his administration (Credits: Wikipedia)

## CONCLUSION: LEADERSHIP

Every successful space adventure is hinged on inspirational leadership with passion and vision. Leaders directly or indirectly set up the space policy direction. Leaders set the timeline and performance of space programmes and project. Leaders inspire the existing space workforce and future generations. Leaders are needed to inspire young people to take up careers in sciences, engineering and space. They seek for the good of the whole. They seek to lay a legacy. Political, technical and business leadership are sine qua non for a successful space programme. It all boils down to leadership.



# Africa's First Moon Mission

For Inspiration | Education | Science

## **"KE NAKO – IT'S TIME"**

It's time to show the world what Africa can do!

It's time to inspire the minds and dreams of the "youngest" continent on Earth (50% - 19 or younger!)

It's time to send African ingenuity to the Moon and provide future generations a reminder that we will always be there!

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2. Become a #GivingTuesday Social Media Ambassador & promote us online. You can sign up at the UN Foundation GivingTuesday Site ([www.givingtuesday.org](http://www.givingtuesday.org))
3. If you would like to host a regional fund-raising event for the mission for #GivingTuesday; OR
4. If you would like to be involved in Outreach; OR
5. If you would like to collaborate with the Mission Team's scientists or engineers; then please contact us directly:

### Address

B4 Century Square, Heron Crescent  
Century City,  
Cape Town  
7441  
Republic of South Africa

Email: [africa2moon@developspacesa.org](mailto:africa2moon@developspacesa.org)

Web: [developspacesa.org](http://developspacesa.org)

Facebook: [facebook.com/developspacesa](https://facebook.com/developspacesa)

Twitter: [@developspacesa](https://twitter.com/developspacesa) & [@africa2moon](https://twitter.com/africa2moon)

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