

GHANA SPACE POLICY

Taking Ghana to Space





Unlocking the Infinite Potential of
Space for Ghana's Prosperity

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FOREWORD

Space exploration has captured humanity's imagination for centuries. Today, space science and technology (SST) is no longer the realm of science fiction; it is a powerful instrument for improving lives and driving economic growth. Ghana is poised to become a significant player in the global space arena. Our strategic location and abundant natural resources present an opportunity to attract investment and collaborations that will fuel innovation and propel us towards a future driven by science and technology.

The Ghanaian Government is fully aware of the significant role of space science and technology in advancing communication, aviation, transportation and defense amongst others. Its application in addressing issues of national importance including; Climate Change, resource management, disaster management, explosive population growth, low agricultural productivity, poverty reduction, human capital development, rural and urban development cannot be overemphasised. For this reason, the government is committed to ensuring that the institutional systems and infrastructural investments required to accelerate Ghana's Space Programme is prioritised for accelerated socioeconomic transformation. The formulation of this Space Policy has therefore set the stage for government action.

Just like many countries, Ghana is learning from the experiences of countries with advanced Space Programmes to keep up with the technological progress in the field. International Cooperation and Partnerships will continue to be at the centre of our space programme.

The emergence of frontier technologies interlaced with space technology has created a complex system of innovation in internet of things, autonomous vehicles, metaverse, telecommunication, global connectivity, earth observation and environmental monitoring amongst others. The countries that continue to invest and innovate in the space technology will remain dominant in this critical industry.

As a lower middle income country, we recognise the role of a Space Agency to coordinate and harmonise all the space related projects in Ghana into a National Space Programme that sets us up for the current wave of industrial revolution. The role of critical ministries like Communication and Digitalisation, Lands and Natural Resources, Transport and Agriculture is very well acknowledged in this important national agenda.



This is why the Ministry of Environment, Science, Technology and Innovation wants to rely on all actors in the space technology for smooth implementation of this policy.

The formulation of the Ghana Space Policy started in 2017 with contributions from relevant stakeholders in the ministries, agencies, academic and research institutions, policy makers, regulators, and space technology users. This was coordinated by the Ghana Space Science & Technology Institute (GSSTI) under the auspices of the Ministry of Environment, Science, Technology and Innovation (MESTI) and finally submitted to cabinet for approval in 2022.

With the same level of cooperation, all challenges will be surmounted and opportunities leveraged for the economic transformation of Ghana.

This policy serves as a roadmap to :

- Coordinate and maximize the impact of Ghana's diverse SST activities.
- Build a critical mass of human capital with expertise in space science and technology.
- Develop the infrastructure necessary to support a thriving space sector.
- Foster a national research and development ecosystem that drives innovation in SST.
- Promote the commercialization of space products and services.
- Establish strong international collaborations for mutual benefit.
- Integrate SST into national development strategies to address challenges in areas like agriculture, resource management, disaster preparedness, and communication.

By embracing the opportunities presented by SST, Ghana can take a giant leap forward in its pursuit of a sustainable and prosperous future. This policy serves as a call to action for Ghanaians from all walks of life to participate in this exciting endeavor. Together, we can transform Ghana into a regional leader in space science and technology.

Hon. Ophelia Mensah Hayford
Minister, MESTI

5th November 2024



ACKNOWLEDGEMENT

The completion of the Ghana Space Policy is a significant milestone in our nation's commitment to advancing space science and technology for sustainable development. This achievement would not have been possible without the immense dedication and contributions of various individuals, committees, and institutions.

We extend our deepest gratitude to the President of the Republic of Ghana, H.E. Nana Addo Dankwa Akufo-Addo, for his visionary leadership and for prioritizing space science and technology as a strategic component of Ghana's national development agenda.

We acknowledge the Ministry of Environment, Science, Technology, and Innovation (MESTI), under the guidance of the Honourable Ministers Prof Frimpong Boateng, Dr Kwaku Afriyie, and Hon. Ophelia Mensah Hayford, for their steadfast support and advocacy for this policy. Their leadership has been essential in realizing Ghana's space science ambitions. We recognize the Ghana Atomic Energy Commission (GAEC), under which GSSTI resides, for its institutional support and facilitation of this important initiative.

The Ghana Space Science and Technology Institute (GSSTI) and its staff receive special appreciation. Our sincere gratitude extends to the GSSTI board for its strategic oversight and support throughout the process.

We are also deeply grateful to the Committee for Developing the Ghana Space Policy, which comprises experts from various sectors, including academia, industry, government, and international bodies. This dedicated team worked tirelessly to craft a forward-looking and impactful policy, laying a strong foundation for Ghana's future in space science.

A special note of appreciation goes to all the stakeholders whose invaluable inputs helped shape the policy. This includes representatives from various ministries, agencies, and departments.

Lastly, we thank all individuals and working groups who provided feedback and recommendations during the consultations. Your insights were critical in ensuring that this policy serves as a guiding framework for Ghana's space program and positions the country as a leader in Africa's space science and technology landscape.

This policy reflects the collaborative effort, vision, and hard work of all involved. We look forward to its successful implementation and its positive impact on Ghana's socio-economic development.

Thank you.

LIST OF ABBREVIATIONS AND ACRONYMS

AIT:	Assembly, Integration and Test
AVN:	African VLBI Network
BRRI:	Building and Roads Research Institute
CERSGIS:	Centre for Remote Sensing and Geographic Information Services
CORS:	Continuously Operating Reference Station
CSIR:	Council for Scientific and Industrial Research
DST	Department of Science and Technology
EO:	Earth Observation
ESA:	European Space Agency
GDP:	Gross Domestic Product
GEO:	Group on Earth Observations
GNSS:	Global Navigation Satellite System
GPS:	Global Positioning System
GRN:	Geodetic Reference Network
GSSTI:	Ghana Space Science and Technology Institute
GUITA:	GNSS Upgrade In Tide Gauges in Africa
IGS:	International GNSS System
ISSET:	International Space School Educational Trust
ITU:	International Telecommunication Union
LISAG:	Licensed Surveyors Association of Ghana

M&E:	Monitoring and Evaluation
NCA:	National Communications Authority
R&D:	Research and Development
RTK:	Real Time Kinematic
SBAS:	Satellite Based Augmentation System
SDGs:	Sustainable Development Goals
SFM:	Structure For Motion
SKA:	Square Kilometer Array
SMART:	Specific, Measurable, Attainable, Relevant and Timely
SST:	Space Science and Technology
STEM:	Science, Technology, Engineering and Mathematics
STI:	Science, Technology and Innovation
UAV:	Unmanned Aerial Vehicle
UK:	United Kingdom
UN:	United Nations
UNFCCC:	United Nations Framework Convention on Climate Change
USA:	United State of America
VLBI:	Very Long Baseline Interferometry
NADMO:	National Disaster Management Organization
GCAA:	Ghana Civil Aviation Authority



EXECUTIVE SUMMARY

The space industry plays a crucial role in every country's socioeconomic development and stability. The first satellites, designed to study the space environment and test initial capabilities in Earth's Orbit, contributed vital knowledge for developing satellite telecommunications, navigation systems, advanced weather forecasting, and other technologies to enhance communication, transportation, agriculture, health, and IT.

Ghana, even though considered among new space actors, has a vast number of ministries, agencies, institutions, regulators, and policymakers employing Space Science Technology (SST) in the delivery of their mandate. The use of these technologies is not properly coordinated to ensure the full realization of the potential benefits of SST. Inputs were received from most of these users to properly understand the user needs of Ghana and develop a policy that will be effective and useful to the local space industry.

Therefore, the Ghana Space Policy has been formulated with the main goal of coordinating the development and application of SST for sustainable development through education and cutting-edge research for effective management of resources, natural disasters, climate, air, and water quality, among others. Additionally, the policy document exists to enhance international cooperation, peace and security, economic activity, job creation, and infrastructure. These align with the overall national development agenda of the Coordinated Programmes for Social and Economic Policies (2017-2024) and the STI Policy of seeking to transform the economy by promoting the effective application of science, technology, and innovation.

Policy objectives include promoting a well-coordinated and monitored space science and technology programme in Ghana to ensure effective use of resources as well as a coherent national space programme; developing and maintaining the required space science and technology human resources; building national space infrastructure for education, research, and application; promote space science and technology research and development; promote commercialization of space technology, applications, and products; promote local and international cooperation; institute appropriate legal and regulatory framework to promote industrial participation in national space activities; and promote citizen science in SST. A key part of the policy also, is the establishment of the Ghana Space Agency, a statutory organization established under the Ministry of Science, Environment, Technology and Innovation (MESTI), to oversee space programmes in Ghana. The functions of the Space Agency will include but not limited to, oversight, coordination, regulation, licensing, exploration, research, and development of the space industry to enhance economic prosperity, national security, and development.

MESTI will coordinate the policy through the Ghana Space Agency, serving as a guide for the Agency's operations. MESTI will also lead the monitoring and evaluation process of this policy with assistance from institutions such as the Ghana Space Agency, academia, the private sector, scientific councils, and other relevant stakeholders.

Space technology has enhanced the quality of life in countries that have invested heavily in its development. Ghana has many challenges in education, health, agriculture, security, etc. We must, therefore, intensify our efforts to educate stakeholders and the general public on the benefits of this platform so they will all embrace it.



1



GHANA SPACE SCIENCE AND TECHNOLOGY LANDSCAPE

1.1 Background:

Ghana's strategic location on the globe and its abundant natural resources place it in a position to attract investment from international space institutions, which presents great opportunities for the needed accelerated and sustainable growth for its socio-economic development. This potential growth could be achieved when modern technology is employed judiciously in exploiting these natural and human resource endowments. One major way to realizing our development agenda is to explore, adapt, and apply space science and its related technologies. This will not only improve the quality of business and life in the country but also enable the government to make savings in its expenditure. Ghana has been a user of Space Science and Technology (SST) products and services for the past fifty years, starting with its application in communication through to significant progress in other areas: agriculture, aviation, weather forecasting, and climate monitoring, amongst others.

SST has the potential to improve the livelihood of our citizenry from its impact on natural resources management (land, oil, minerals, water, forestry and more) and conflict resolution. It has the potential to strengthen international co-operations among neighboring economies and the world at large. Moreover, the cross sectoral application of SST would also provide a vehicle for the country in its quest to achieve the targets of the Sustainable Development Goals (SDGs) through partnerships that have a multiplier effect from the use of space science.

In recent times, Ghana has initiated a number of programmes and activities in space science that show the Government's resolve to propel the country to the league of countries pursuing space science: the establishment of Ghana Space Science and Technology Center in May, 2011, which has been upgraded to an Institute since 2012; the signing of the African Square Kilometer Array (SKA) partnership bid agreement led by South Africa involving 9 African countries in 2007; and the historic launch of GhanaSat-1 in 2017, Ghana's first satellite developed by the All Nations University which has put Ghana among the space-faring nations. The African SKA partnership led to the establishment of the Ghana Radio Astronomy Observatory (launched in 2017) as part of the African VLBI (Very Long Baseline Interferometry) Network (AVN) being implemented by the Department of Science and Technology (DST), South Africa.

Currently, there are many national institutions embarking on different endeavors, which are SST related but are uncoordinated and not monitored to ensure they are making the right impact with the implementation of national development policies and plans. The Ghana Space Policy will provide guidance to the Ghanaian public and private sector in the arena as well as promote coordination of national space programmes and activities. It focuses on research and development as well as services of space technology applications and space exploration, ensuring the peaceful use of outer space; as well as to harness space sciences and technology applications for national development.



Research Scientist picks crop sample for research and monitoring

1.2 Current Space Science and Technology Activities in Ghana :

Different institutions in Ghana have embarked on diverse activities in the space arena towards national development. Most of these activities being currently undertaken in Ghana have largely centered on space science and awareness education, research, satellite building and receiving earth observation data. Table 1 below provides a list of SST activities in Ghana.



Night view of the 32m Ghana Radio Telescope at GRAO, Kuntunse



H. E. Nana Addo Dankwa Akufo-Addo, the President of Ghana, inaugurates the Ghana Radio Astronomy Observatory at Kuntunse, August 24, 2017.

Institute	Activity/Focus	Achievements	Projections
Ghana Space Science and Technology Institute	Research/Establishment of Radio Astronomy Observatory/Space infrastructure Earth Observation Research Climate Change Research	Ghana Radio Astronomy Observatory/Research publications Farm monitoring and Crop Yield prediction. Contribution to National Communication to the UNFCCC Climate information services Contribution to international VLBI experiments	Build satellite ground receiving station and telescopes/build human capacity. Increased farmlands. Crop yield estimation. Provision of space science and technology related consultancy services.
All Nations University College	Building Human Capacity in Satellite Mission design and Development. Building Space Application Systems. Driving Space Education in Ghana through outreach activities. SST research and development	First to design and launch a satellite (GhanaSat-1) for Ghana on June 3rd 2017 First to design University amateur satellite ground station in 2014 First to design a deployable educative satellite (CANSAT) in May, 2013. Hosting of NASA'S 1st satellite validation instrument AERONET in Ghana	Building and launch of GhanaSat-2 Become a center of excellence for satellite development with state-of-art. Assemble Integration and Testing (AIT) facility for up to 50kg satellites. Reach all the 275 constituencies in Ghana with Space Science and Satellite development programs to promote Science Technology Engineering and Mathematics (STEM) in Ghana
Earth Observation Research and Innovation Centre, University of Energy and Natural Resources	Building human capacity/Space infrastructure/Research.	Ground receiving stations for both uplink and downlink possibilities/Research publication	Build human capacity
Kwame Nkrumah University of Science and Technology	Aerospace engineering Telecommunications engineering Geomatic engineering Settlement planning	More than 300 undergraduate and graduate students trained.	More students to be trained.
CERSGIS	Earth Observation	Disaster and Risk Maps for Ghana.	Analysis of Disaster and Risk maps for Ghana
University of Ghana	Climate Change Research	Contribution to National Communication to the UNFCCC	Provision of climate change services. Climate downscaled information
Lands Commission SMD in collaboration with University FAF of Munich	Establishment of CORS network for the Ghana's Geodetic Reference Network (GRN) under LAP1	Established CORS network in the Golden Triangle in 2007 and linking it to the International GNSS System (IGS) in the ITRF05 realization in Geocentric Coordinate System	Aimed at densifying the network to cover the whole country
Licensed Surveyors Association of Ghana (LISAG)	Establishing CORS Network in Ghana, LISAGNET, (Private Sector driven)	Broadcasting Differential Corrections to users in Real-Time-Kinematic (RTK) mode	To establish a Network RTK which will drastically reduce the cost of GNSS survey
Ghana Metrological Agency	Weather and climate forecast	Use of satellite data for weather monitoring and forecasts	Use of Satellite data to produce early forecast.
NADMO	Use of satellite data for early warning and emergency response operation Request for flooded areas from the UN-SPIDER	Subscribed to authorized user of UN Outer Space Data	To map disaster prone areas
GCAA	Use of satellite for communication, navigation and surveillance in the Aviation industry	Created safe and secured skies over the years. The use of satellite communication also allows the search, locate and rescue persons and aircraft in emergency situations	To have a seamless airspace
LISAG, CSIR-BRRI Meridia GeoSpace Eng. VMAP (USA)	Building Capacity on the Drone Technology	Organized workshop on Drone Technology and captured orthophotos for mapping using locally assembled drones	Drone Assembly and Structure for Motion (SFM) Technology
CSIR-BRRI in collaboration with Avant Communication on a UK Space Agency Project, SBAS-Africa	Developing Satellite Based Augmentation System (SBAS) in Africa	Workshops, Technical meetings, Technical Papers on Agriculture, Land Management and Marine and Offshore applications in Ghana and West Africa	Aimed at getting 1 meter or better accuracy using low grade receivers
CSIR-BRRI SMD in collaboration with SEGAL of Portugal	GNSS Upgrade In Tide Gauges in Africa (GUITA) project	Co-located GNSS CORS at the Tide Gauge at the Takoradi Harbour and connected it to the GRN station in Takoradi	Monitoring of sea level rise and altimetry studies
National Communications Authority	Responsible for regulating and managing frequency allocations.	Operationalized Electronic Communications Act, which serves as a guide for satellite activities in Ghana, as well as the protection of Ghana's orbital resources and its associated spectrum at the international level.	Ensure interference free of Ghana's space activity



2

RATIONALE FOR NATIONAL SPACE POLICY



2.1 Background

Ghana is faced with a wide range of environmental, social, and economic challenges. The country has challenges, including illegal mining (popularly known in Ghana as *galamsey*), water pollution, land degradation, poverty and unemployment due to unsustainable management of natural resources, and government revenue loss. Science and technology provide critical solutions to these challenges, and SST, in particular, has several tools to serve as solutions to reduce environmental degradation, improve the management of natural resources, create jobs to reduce unemployment, address societal challenges, and stimulate economic growth.

The imperative to develop a national space policy also lies in the fact that Ghana already uses space technology in many sectors of the economy, such as communication, transportation, health, agriculture, forestry, energy, environment, and security. Ghana is, thus, already enjoying the spin-offs from SST and, therefore, should not only be a consumer but a contributor. A national space policy will provide the means to coordinate the fragmented activities in the various sectors to ensure that the country pursues a common agenda, albeit with multiple actions.

Moreover, Ghana is close to the equator and shares a border with the Atlantic Ocean, giving it a geographic advantage that most countries do not have when it comes to exploring the space frontier, especially in the launch of satellites. This advantage could fully be exploited if the country develops its SST capabilities by pursuing a national space policy agenda. Other countries can leverage Ghana's position to launch their satellites if Ghana provides the needed enabling environment through deliberate policy actions. Since the benefits of SST are enormous, Ghana should not be left behind in the pursuit of SST. The following highlights some of the specific benefits Ghana would gain from a deliberate pursuit of SST through a national policy agenda:

2.2 Managing the Biophysical Environment

Through the deliberate pursuit of an SST agenda, Ghana can harvest the technology to better manage the biophysical environment towards achieving sustainable development (environmental, social, and economic). For instance, the use of SST would be pertinent to the acquisition, processing, and dissemination of weather and climatic data for the purposes of improving agricultural productivity and, therefore, achieving the objectives of government flagship projects such as planting for food and jobs and for ensuring environmental quality and sustainability.

SST is important for disaster risk management, evolving and systemic risk assessment, monitoring, and emergency response. Furthermore, using SST, Ghana can better monitor and manage the utilization of the country's natural resources (forestry, fisheries, minerals mining on both large and small scales, fresh water, and aquaculture) in a sustainable manner. This could reduce over-exploitation.

Managing the biophysical environment will also include that of human settlement planning as well. A coordinated policy on SST will ensure that various tools in space technology are developed or contextualized for the planning and management of human settlements and urban development in Ghana.



2.3 International Scientific Cooperation

With a well-coordinated SST programme riding on an articulated space policy agenda, opportunities exist for Ghana to establish international cooperation in the areas of SST. The corporation will include human resources development and knowledge exchange, investment in SST infrastructure, and the pursuit of scientific research in SST. Since the pursuit of SST requires significant investments, a national space policy allows for targeted collaborations with relevant stakeholders for the pursuit of national interest in SST. Moreover, it is the anticipation of this policy that Ghana should become the hub for SST in the West Africa Sub-Region within the shortest possible time.



Hon. Sherry Ayithey, the former Minister for Ministry of Environment, Science, Technology and Innovation, and CEO of Vodafone signing an agreement to hand over Vodafone's satellite station to MESTI for conversion to radio astronomy observatory

2.4 Peace and Security

A well-coordinated policy will ensure that SST is used for the maintenance of peace and security in Ghana and the sub-region. Threats to peace and security go beyond the military balance of power to include economic, political, cultural, and material values. Thus, the benefits for peace and security will include the reduction of military and non-military threats to the nation, involvement in international peacekeeping, monitoring, and exploitation of terrestrial and extraterrestrial resources.

2.5 Increased Economic Activity and Job Creation

The development of Ghana's space sector can potentially generate revenue and create employment opportunities across various domains. However, with deliberate policy direction, a critical mass of human resources can be developed to not only cater for the core SST sector, but also cater for spin-off industries in key sectors such as energy, health and agriculture, that will arise from efforts in the SST sector. Here's an overview of potential revenue streams and job creation prospects:



Revenue Streams



Satellite data and imagery services:

- Providing earth observation data and imagery products to sectors like agriculture, mining, forestry, urban planning, and environmental monitoring can generate revenue for Ghana's space sector.
- Collaborations with research institutions and commercial enterprises for data analysis and interpretation can also be a source of income.



Space-based telecommunication services:

- Leasing transponder capacity on commercial satellites for communication and broadcasting services can generate revenue.
- Offering specialized satellite communication services to businesses, government agencies, and international clients can be a lucrative revenue stream.



Space technology development and exports:

- Designing, manufacturing, and exporting satellites, components, or related technologies to regional and international clients can contribute to revenue generation.
- Providing services like satellite assembly, testing, launch support, and ground station operations can also generate income.



Space education and training programs:

- Academic programs in space science and engineering, as well as specialized training courses, workshops, and certification programs, can generate revenue through tuition fees and institutional collaborations.
- Attracting international students and professionals for these programs can further enhance revenue potential.



Space tourism and outreach activities

- Developing space-themed visitor centers, museums, and educational facilities can generate revenue through ticket sales, merchandising, and event hosting.
- Potential future opportunities in space tourism, such as suborbital flights or space camps, can also contribute to revenue generation.

2.6 Job Creation Prospects



Scientific and technical roles:

- Satellite design, development, and operations
- Earth observation data analysis and interpretation
- Space technology research and development
- Space mission planning and execution



Engineering and manufacturing:

- Satellite and component manufacturing
- Ground systems and infrastructure development
- Telecommunication and broadcasting services



Education and training:

- Academic faculty and research positions
- Instructors and trainers for space-related programs
- Curriculum development and educational resource creation



Business and support services:

- Space industry consulting and advisory services
- Legal and regulatory support for space activities
- Marketing and sales for space-based products and services
- Logistics and supply chain management



Tourism and outreach:

- Space museum and visitor center operations
- Event management and public outreach initiatives
- Space tourism operations (if developed in the future)

2.7 Contribution towards the SDGs



SST has varied applications across various sectors of Ghana's national and international development. From the onset of the SDGs, the application of space technologies was established as essential to achieving the goals. With the SDGs, there is an overwhelming emphasis on data collection alongside their geolocation for the purposes of measuring and monitoring progress. SST can directly contribute to the achievement and monitoring of the SDGs through, for instance:

Natural disaster forecasting and crop productivity optimisation to meet SDGs 1 and 2;

- Prevention of vector diseases and air quality monitoring to meet SDG 3;
- Water quality monitoring and meteorological forecasting to meet SDG 6
- Infrastructure monitoring, power grid synchronisation, seismic surveying, solar and wind energy to meet SDG 7;
- Through partnerships that yield multiplier effects, provide decent work, and grow the economy to meet SDG 8;
- Climate monitoring and disaster management to meet SDG 13; and
- Mapping and monitoring of natural and protected areas to meet SDG 14.

SUSTAINABLE DEVELOPMENT GOALS



2.8 Enhance Communication Infrastructure

SST application provides universal coverage to unserved and underserved areas where conventional means of access to communication services cannot reach and serve as an alternative during disaster management. A well-coordinated SST program will therefore help to provide the vehicle to achieve the nation's quest for a connected society.





POLICY GOAL AND OBJECTIVES

3.1 Goal

The goal of this policy is to guide the use and development of SST for national technological advancement towards sustainable development through education, cutting-edge research, and commercialization.

This goal is in line with the overall national development agenda of the Coordinated Programmes for Social and Economic Policies (2017-2024) and the STI Policy of seeking to transform the economy by promoting the effective application of science, technology, and innovation.

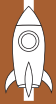
3.2 Objectives

To achieve the policy goal, the policy objectives are as follows:

1. Promote a well-coordinated and monitored space science and technology programme in Ghana to ensure effective use of resources as well as a coherent national space programme;
2. Develop and maintain the required space science and technology human resources;
3. Build national space infrastructure for education, research, and application;
4. Promote space science and technology research and development;
5. Promote commercialization of space technology, applications, and products
6. Promote local and international cooperation;
7. Institute appropriate legal and regulatory framework to promote industrial participation in national space activities; and
8. Promote citizen science in SST.



4



POLICY STRATEGIES AND INSTITUTIONAL FRAMEWORK

4.1 Policy Strategies

4.1.1 Establish the Ghana Space Agency

This strategy is in line with the objective I in section 3.2.1. It is expedient to have an institution in Ghana that will promote the harnessing, oversight, coordination, regulation, licensing, exploration, research, and development of the space industry as a significant backbone to Ghana's economic prosperity, national security, and development. The agency will be a statutory government organization established under the Ministry of Environment, Science, Technology and Innovation (MESTI) to oversee space programmes in Ghana. The functions of the agency will be as follows:

- The agency will champion the utilization, regulation, licensing, and coordination of all SST activities in Ghana.
- The agency will ensure the full utilization of Ghana's SST capabilities which will create new markets, make agriculture and natural resources management efficient and sustainable, provide geospatial information, enhanced the telecommunication industry, provide early warning towards disaster risk reduction and management, provide timely access to weather forecasting, climate information, and many others.
- The agency will promote research and development, as well as its application, innovation, and commercialization to the benefit of Ghana.
- The agency will liaise with institutions responsible for national security in Ghana to monitor and protect our sovereignty and privacy.
- The agency will promote science, technology, engineering, and mathematics activities in relation to space activities.
- The agency will promote the development of the intellectual base for the nation.

4.1.2 Space Education and Human Resource Development

This strategy is in line with objective II in section 3.2.2. The pursuit of coordinated national space programmes via a national space policy requires a critical mass of human capital and planned programmes to continuously produce the needed human capital. To this end, the objectives of this policy strategy are to increase the number of skilled professionals in space education, science, multi-wavelength astronomy, engineering, and entrepreneurship in Ghana. In addition to these, the objectives also include an increase in other operational disciplines that can be identified as key to building the SST capabilities of Ghana. Specifically, this policy will:

- Promote support for science, technology, engineering, and mathematics with the focus of mainstreaming space science and related subjects into the curricula of basic and senior high schools
- Increase support for demand driven SST related programmes in higher education
- Promote practical or hands-on training on SST such as internship programmes and mentorships, in collaboration with multiple organizations
- Support capacity development by supporting local and international training programmes in space science.
- Encourage youth and women's participation in the national space programme
- Institute programmes to attract Ghanaians into SST, education, engineering, and in the diaspora to participate in Ghana's space programme
- Increase awareness of space science and applications in the country



4.1.3 Build Space Infrastructure

This strategy is in line with objective III in section 3.2.3. Infrastructure development remains one of the key areas to promote and enhance space technology research and development toward the advancement of the country's space programme. High capital investment in space infrastructure will lead to achieving a sustainable space programme for socio-economic benefit. SST infrastructures should therefore be tailored to advance the following space technological and application areas; Earth Observation, Navigation and Positioning, Satellite Communications, and Space Science and Astronomy. The infrastructure should be established to cater for ground-based and space-based technology applications and should include the following:

- Establish a Ground Station and Mission Control Center to serve as the command and control facility for satellite. Existing ground stations should be consolidated for satellite data services, management, and training.
- Establish AIT facilities, clean rooms, and laboratories. This will promote homebased satellite development facilities and capacity for system integration and testing.
- Promote the establishment of the capacity towards manufacturing facilities for the development and manufacturing of space-qualified components.
- Establish facilities for SST research and development.
- Establish national space related science centers which would include a planetarium and museums for education and tourism.
- Establish the capacity for launch and develop flight centers to serve the purpose for launching homemade satellites, and to be used as training and testing facilities which can also be commercially exploited by other counties to launch their satellites.

4.1.4 Promote Space Science Research and Development

This strategy is in line with objective IV in section 3.2.4. The pursuit of a national space agenda cannot be complete without the vigorous pursuit of a national space science research programme. Therefore, under this policy, a national strategy will be developed for vigorous SST research and development. This strategy will be aligned with Ghana's national STI policy and will:

- Develop a framework programme, to be reviewed periodically, that identifies strategic goals of national interest for SST research. These goals must be Specific, Measurable, Attainable, Relevant, and Timely (SMART).
- Promote the active participation of industry in research development and innovation programmes
- Identify and take advantage of international opportunities and programmes toward building a national research base to drive research and development in SST.
- Identify and establish a mechanism for the sustainable funding of space science research

4.1.5 Space Application and Commercialization of Space Product

This strategy is in line with objective V in section 3.2.5. The national economy stands to gain immensely as space activities can produce commercial activities. For effective commercialization of space activities, the government should:

- Provide incentives for private entities that engage in space activities
- Provide incentives for the establishment of business startups that manufacture space products and provide space services locally, for a specified period of their establishment.
- Create a dedicated market by patronizing space products and services provided by local companies.



4.1.6 Collaboration with relevant local and international organizations

This strategy is in line with objective VI in section 3.2.6. The execution of a national space programme requires the engagement of multiple organizations at the regional and international levels. This policy seeks to ensure that activities and programmes of relevant organizations such as the United Nations Office for Outer Space Affairs (UNOOSA), International Telecommunication Union (ITU), and national institutions such as the National Communication Authority (NCA) are assessed and harnessed for the development of the national space programme. In addition, this policy will deliberately target specific organizations and nations to establish and strengthen cooperation for education, human capital development, research, development, and application of SST. Thus, this policy will:

- Pursue mutually beneficial and appropriate international co-operation opportunities on a bilateral basis in conformity with Ghana's foreign policy
- Promote regional and global cooperation and partnerships toward the use of SST
- Promote regional and global cooperation and partnerships for research in space science, as well as technology development, and application
- Intensify Ghana's participation in global space science and technology activities through memberships, involvement in committees, decision-making roles, treaties, and the signing of appropriate conventions.
- Develop partnership programmes with international organizations, including those in the private sector, pursuant to Ghana's foreign policy, for the purposes of education, research and development, commercialization, and the application of SST.

4.1.7 Legal and Regulatory Framework

This strategy is in line with objective VII in section 3.2.7. Space science and technology laws and regulatory systems will be put in place for the standardization of both ground-based and space-based activities and the mitigation of both environmental and societal impact of space activities. Currently, Ghana has already signed onto and ratified the ITU Convention and Constitution, therefore the following five UN Peaceful use of Space Treaties should be ratified. Space laws address diverse issues such as the preservation of the space and Earth environment, liability for damages caused by space objects or activities, protection of national interests, sharing of information about potential dangers in outer space, the freedom of exploration, scientific investigation, and the exploitation of natural resources in outer space. Ghana will sign onto and ratify the following five United Nations Peaceful Uses of Outer Space Treaties, constituted to diligently deal with the above-mentioned issues:

- The Outer Space Treaty, 1967: it is the treaty on principles that govern all activities of states in the exploration and use of outer space.
- The Rescue Agreement, 1968: it is an agreement on the rescue and return of astronauts, and objects launched into outer space.
- The Liability Convention, 1972: the convention explains the international liability for damages caused by space objects/activities.
- The Registration Convention, 1975: this convention is on the registration of all objects launched into outer space.
- The moon Agreement, 1979: it is an agreement that governs the activities of states on the moon and other celestial bodies.

4.1.8 Promote Space Science Outreach, Education, and Awareness in Schools and to the Public



The Ghana Space Agency will establish a unit with the sole aim of reaching out to citizens at all levels with the Agency's activities. The department should organize programs for Primary, Secondary, Tertiary education, and Science Clubs, among others. Advocacy programs will also be organized on community, district, regional and national platforms. In addition, a platform that ensures frequent meetings and interaction between staff of the Agency and Citizens of Ghana will be established to engage citizens. Citizen Science is a powerful user engagement tool for engaging community members of the public with research and other activities that the Agency undertakes.



5

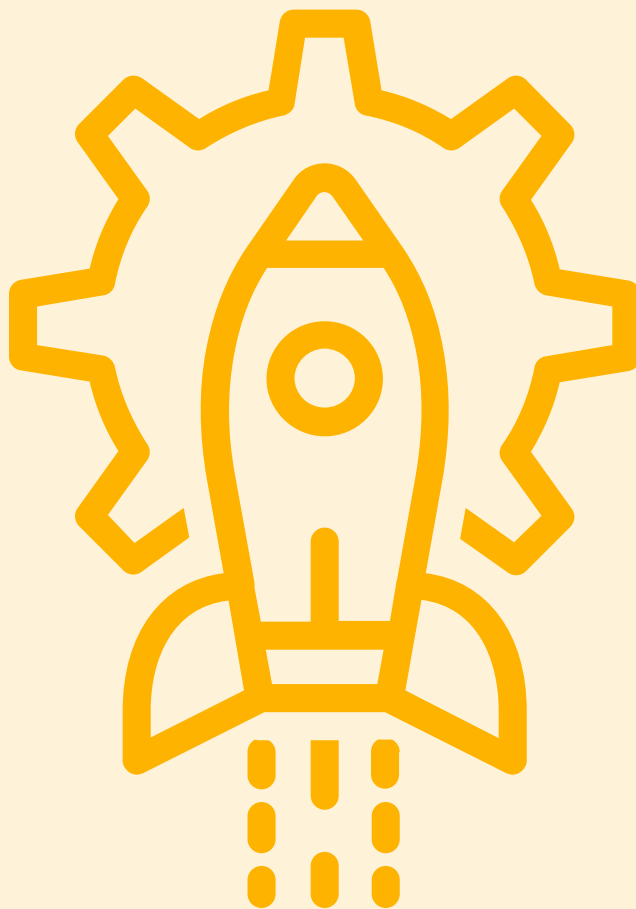


FINANCING OF SPACE SCIENCE AND TECHNOLOGY

Funding is a very important aspect of the space programme as none of the outlined goals can be achieved without adequate funding.

In order to adequately finance and implement SST activities, the Government shall:

- Allocate at least 0.1% of GDP for SST activities.
- Provide adequate annual budgetary support to the national space agency that coordinates space activities in engaging both commercial activities and international collaborations.
- Establish an SST development fund where local and international organizations can contribute therein.



6

IMPLEMENTATION AND COORDINATION



The Policy recognizes the continued growth of the SST sector and the continuous improvement of the industry's best practices based on new and emerging technologies. The underlisted guidelines will be followed in implementing the policy.

1. Once the policy is approved by Cabinet for implementation, the policy will go into effect and guide all activities relating to SST activities in Ghana.
2. The implementation strategy and communication plan will be finalized.
3. After approval of this policy, a formal letter with a copy of this policy will be communicated to all relevant stakeholders.
4. The Policy will officially be launched to improve public awareness of the policy.
5. Key objectives and their respective strategies set out in this policy will be evaluated at the end of each year to gauge the progress made in implementing this policy.
6. The Policy will be coordinated by MESTI through the National Space Agency as owners of the policy. This policy will guide the National Space Agency operations.
7. This policy should be evaluated at the end of ten (10) years after its implementation, and revisions should be made if recommended.



7

MONITORING AND EVALUATION SYSTEM FOR SPACE SCIENCE AND TECHNOLOGY DEVELOPMENT



It is necessary to put in place the various mechanisms to ensure that the development and implementation of the national space policy, as well as plans and programmes that are to be well coordinated. To realize good progress towards the achievement of the policy goal and objectives, an effective monitoring and evaluation system will provide the institutional framework for designing mechanisms to ensure the implementation of the policy is on track, and regularly monitored and evaluated. The Ministry of Science, Technology and Innovation will lead the monitoring and evaluation process with assistance from institutions such as the Ghana Space Agency, academia, private sector and Scientific Councils, and will provide quarterly and annual reports. The SST monitoring and evaluation systems will seek to implement the following strategies:

1. Outline national space science and technology indicators
2. Monitor the flow of resources into the development and application of space technology for the sustainable development of Ghana
3. Monitor the space activities of research and development institutions in order to identify and address key issues affecting their performance.
4. Assess the effectiveness of the application of space science and technology in the various sectors of the economy.
5. Assess the positive and negative impact of the application of SST in the various sectors of the economy.
6. Provide feedback for the implementation and revising of SST policy, programmes and projects.
7. Review the policy after 10 years of implementation

ANNEX:

1 USER NEEDS ASSESSMENT

NO.	USER	AREA OF USE
1.1	Health	Satellite technologies give natural means in public health emergencies for tracking the extent of disease outbreaks and natural disasters that may impact on the health of the people. Other areas in health include the space station led studies of microbial vaccine development to improve vaccines. Space technology could also be used to allow medical access by people living in remote locations where expert medical practitioners will be unwilling to be physically present.
1.2.	Disasters	Earth observation (EO) satellites are used in rapid mapping in all phases of disaster management. The process provides images at various wavelengths which gives detailed information about the area of interest. Hence allows mitigating potential risks in a given area, improving emergency preparedness for future disasters, immediate response to a disaster event, and the recovery efforts after that.
1.3.	Energy	Satellites can be used to monitor the Earth to obtain credible meteorological, hydrological and other relevant data for proper siting of energy infrastructure including that of renewable energy systems such as hydropower, solar energy, wind energy, etc. SST can also enhance our emerging oil and gas sector for providing satellite images for use in oil exploration, monitoring of oil spills, oil and gas installations, oil and gas operations and data acquisition. With this technology, there is no need to travel to sites, thereby preserving a large amount of energy. More importantly, Space engineers are energy conscious as they try to maintain every single microwatt used in their operations. This knowledge for the use of energy is shared in many applications on Earth.
1.4.	Water	Most of the water bodies in Ghana are polluted and also drying up. Water is key to human survival and will soon be the next scarce commodity in the world. Space research has developed great strides in water purification with its water processing technology. Space technology can also be used in search of water availability both surface and underground.
1.5.	Weather and Climate	The uncertainties associated with weather prediction is high. Weather predictions have significantly improved elsewhere in recent years through the use of satellite technology. Drought forecasts informed directly by satellite data have been valued at \$6 billion to 8 billion annually. Weather information is useful for Marine weather forecasting, aeronautical meteorological forecasting, information for agriculture, etc. Climate change adaptation and mitigation is an area where space science exploration has significantly been of aid. It is undoubted that the world's climate is rapidly changing. Research in climate science, knowing the dynamics of climate and the past climate allows prediction into future climate. This will inform building resilience environment or mitigation programmes to save lives, properties, and funds.
1.6.	Ecosystem and Biodiversity	Remotely sensed data have enhanced scientific understanding of water cycles, air quality, forests and other aspects of the natural environment which provide valuable information on the state of ecosystems, as well as offering objective support for positive environmental action, including conservation and sustainable resource management. Satellites could provide data by monitoring crops in remote locations for potential diseases. They could also be used to identify crop types and crop growth stages, the extent of logging and deforestation, the availability of water, and to accurately monitor biodiversity in general.
1.7.	Peace and Security	Security and defense, the safety of our nation and partner nations are of the essence. Through space exploration and other space monitoring systems with satellites, the territories of the country could be maintained and guarded at all times. SST will be used for crime prevention, control and investigation in the country.

1.8.	Education	Providing students and scientist with a platform to explore their science prowess. It is evident that the various fields of science that Ghanaian and Africans engage are limited. With the establishment of a space agency, the typical Ghanaian student or scientist will be exposed to the merits of space exploration. Again, employment and entrepreneurial advantages are assured.
1.9.	Communication	Information sharing through mobile phones, personal computers, and other electronic communication devices has become part of our daily life. Communications satellites which are a space-based technology, enable global telecommunications systems by relaying signals with voice, video, and data to and from one or many locations. Although there are possibilities of Earth-based alternatives to space technologies, space-based technology can often reduce infrastructure requirements and offer more cost-effective service delivery options. For instance, instead of constructing a series of transmission and relay towers to broadcast television programmes to far-to-reach places, satellite dishes could be provided to remote communities to pick up broadcast signals sent from a satellite.
1.10.	Transport	The best trajectory to employ in our technologically advanced world for traffic surveillance, monitoring, and management, transportation infrastructure management, hazards, safety, disaster assessment among others is space technology. Obtaining relevant information on vehicle traffic volumes, classification, speed, potholes, track weights, etc. will come at a high cost and will not be efficient without SST. The aviation industry needs to deploy satellite navigation with the establishment of routes system to enhance direct route entering a waypoint and exit waypoint. This will enable Ghana Air Space to improve on an interoperable global air traffic management system for all users during all phases of flight that meet agreed levels of safety, provides for optimum economic operations, is environmentally sustainable and meets national security requirements.
1.11.	Maritime security	Coastal Engineering and Management, Tidal – Sea surface height measurements, and Vessel Identification and Tracking over broad areas are critical needs of the Ghana Maritime Authority. Space technology is vital to orbital tracking, radio communications, and navigation that affect the operation of ships, utilization of the near-space and space environment of the Earth. The best technology available on the globe for effective monitoring and protection of life and property in real time is space science and technology. Countries who have employed this technology have been effective in protecting and safeguarding their territorial borders be it water or land. Ghana will be better in the protection of its maritime resources by using space technology.
1.12.	Land Use and Spatial Planning Authority	Space science offers the most sublime technology that is very useful in Ghana's land use and spatial planning. Space technology will aid us to plan from the village level to the national level and monitor development in real time. This technology provides a synoptic view, and multi-temporal land use land cover data required by researchers and policymakers for planning and decision making. Ghana needs to leverage the use of Earth Observation products, to have regular and up to date access to images will allow for adequate monitoring of changes in the development scape. The purchase of these products from vendors on the internet are often expensive, and institutions requiring these products are unable to foot the associated bills.

IMPLEMENTATION MATRIX

Strategic Objective	Key Actions	Stakeholders	Timeline	Resources	Outcome Indicators
1.1 Institutional Establishment	Establish Ghana Space Agency as a national entity with legal authority.	GSSTI, MESTI, Parliament, Ministry of Finance, Ministry of Justice and Attorney General Department	1 year	National budget allocation	Agency established, framework in place
1.2 Stakeholder Engagement	Coordinate with Ministries and Agencies for policy and law development regarding the application of space technologies and systems	Ministries (Defense, Health, Lands, etc.), GCAA, NADMO, Ministry of Communication and Digitization	Ongoing, reviewed annually	Ministry and Agency budgets	Policies and laws developed
1.3 Space Education & HR Development.	Incorporate space science and technology in the national curriculum from basic to tertiary level	Ministry of Education, , GSSTI,	Short-term: 1-3 years	Educational budget, international grants	Space science and technology curriculum developed and adapted
	Establish scholarships, internships, and exchange programs.	GSSTI, MOE, international partners	Medium-term: 3-10 years	Scholarships, internships, grants	Scholarship scheme and international partnerships established for capacity building initiatives
1.4 Infrastructure Development	Develop national satellite data receiving, processing, storage, and distribution facilities.	GSSTI, MESTI, private sector, UENR, All Nations University	Short-term: 1-3 years	National and international funds	Satellite data processing and distribution center established
	Build national Earth Observation and Communications Satellites with Ground receiving station.	GSSTI, MESTI, international partners	Medium-term: 3 -10 years	Government, private sector, grants	Satellites launched and Ground receiving station operational
1.5 Space Application & Commercialization	Establish a center for space commercialization and create market incentives.	GSSTI, Private Sector	Short-term: 1-5 years	Commercial investment, incentives	Indigenous Space products in market, new space startups established
	Establish space tourism initiatives like museums, planetariums, and observatories.	GSSTI, Ministry of Tourism	Long-term: 10+ years	Tourism and private investment	Facilities established and generating revenue
1.6 Citizen Awareness & Outreach	Conduct public awareness campaigns on the benefits of space science and technology.	GSSTI, Media houses, educational institutions	Ongoing	Public relations budget	General public informed about benefits of space science and technology
1.7 Coordination & Collaboration	Strengthen partnerships with local and international institutions for capacity building.	GSSTI, Academia, Research Institutions, UNOOSA	Ongoing	Government and international grants	Number of partnerships, joint projects undertaken
1.8 Financing	Establish SST Development Fund for local and international contributions.	GSSTI, MESTI, Ministry of Finance, Private Sector	Short-term: 1-5 years	National budget, private contributions	SST Development fund established
	Secure at least 0.1% of GDP per annum for SST activities.	Ministry of Finance, GSSTI	Annual	Government allocation	Annual budget allocated
1.9 Monitoring, Evaluation & Learning	Develop an M&E framework with indicators for SST policy performance.	MESTI, GSSTI, academia, private sector	Ongoing	M&E experts, data tools, M&E reports	Annual M&E reports, policy performance evaluations



 +233 302 951 830

 gssti@gaec.gov.gh

 www.gssti.org

 Atomic-Haatso Road
Kwabanya, Accra