SOUTH AFRICAN NATIONAL SPACE AGENCY

2020-2025
SANSA Strategic Plan

Foreword

Since its inception in 2011, SANSA has taken a conservative approach in the planning and implementation phases of its various programme of activities. The planning for the next five-year cycle provides for an ideal opportunity to rethink the programmatic focus of the Agency; and this is especially important given the current financial climate and the need for ensuring the long-term sustainability of SANSA and the local space sector.

Whilst we have still taken a conservative approach in ensuring alignment between the suite of activities we will embark on and the fiscal allocation committed for the next five-years, we have also described aspirational programmes that the Agency will pursue, which is subject to securing the requisite funding, in order to move the national space programme closer toward its originally envisaged mandate. The aspirational programmes are subject to the following pre-conditions, which the Agency is committed to implementing:

1. Raising the additional funding required, in partnership and consultation with Government Departments and sister Agencies;
2. Reviewing the Business Model and Organisational Design to position the Agency appropriately, whilst ensuring the long-term sustainability of the organisation;
3. Undertake an Institutional Review to ascertain the purpose of fit of SANSA with respect to its delegated mandate, but subject to the financial and human resourcing; and
4. Resetting the organisational culture to embrace a new philosophy of operating, whilst mitigating against any associated risks.

The commitment of programmes against the fiscal allocation will ensure continuity of those activities that have proved successful over the last five years; whilst the pursuit of the aspirational programmes will drive the Agency to greater relevancy and is reflective of the myriad of growth opportunities that lie before us. These opportunities are, in part, already being implemented and is mirrored in the adoption of a new Vision, which is Africa-centric, and a Mission Statement that positions SANSA centrally to the development of the local space sector by providing the appropriate 'leadership' that is required for such development.

Our commitment is premised on the realisation of the powerful impact space has on addressing our manifold socio-economic-environmental challenges. Moreover, the development of the SADC (Southern African Development Community) Space Programme and the African Space Programme are clear indications of the realisation of this value proposition to socio-economic-environmental development of the Region and the Continent, respectively. SANSA has been central to the developments of these Programmes and this provides SANSA with a significant growth potential, which is contingent on how we position and integrate the suite of existing initiatives into these broader Programmes.

The Board and Management of SANSA remain optimistic and committed to ensuring that the national space programme is taken beyond its current nascent state. We are heartened by the philosophy of former President Nelson Mandela, "It is not where you start, but how high you aim that matters for success". I therefore embrace this opportunity to present SANSA's Strategic Plan for the next five-year cycle between 2020 and 2025, and to invite all our stakeholders to walk with us as we turn the sector around to embrace a brighter future that is built on a solid foundation that characterises the relevancy, efficiency and effectiveness of our National Space Programme and its contextual positioning within and linkages with the Regional and Continental Space Programmes.

Ms Xoliswa Kakana
Chairman of the SANSA Board
Accounting Authority

Official endorsement

It is hereby certified that the SANSA Strategy 2020-2025:

- was developed by the Executive and Board of the South African National Space Agency (SANSA) in consultation with the Department of Science & innovation;
- takes into account all the relevant policies, legislation and other mandates for which SANSA is responsible;
- accurately reflects the strategic outcome-orientated goals and objectives. which SANSA will endeavour to achieve during the period 2020-2025.

Ms Bulelwa Pono **Signature:** _____
Chief Financial Officer

Dr Valanathan Munsami **Signature:** _____
Chief Executive Officer

Ms Xoliswa Kakana **Signature:** _____
Chairperson of SANSA Board
Accounting Authority

Approved by:

Dr Blade Nzimande **Signature:** _____
Minister of Higher Education and Science and Technology
Executive Authority

Table of Contents

ACRONYMS

ABBREVIATION	MEANING
AfriGEOSS	African Group on Earth Observation System of Systems
AIT	Assembly Integration and Testing Facility
ARMC	African Resource Management Constellation
AU	African Union
BRICS	Brazil Russia India China and South Africa
CASI	Committee of African Space Institutions
CBERS	China Brazil Earth Resource Satellite
CEOS	Committee on Earth Observation Satellites
COSPAR	Committee on Space Research
CSP	Corporate Support Programme
DST	Department of Science and Technology
EO	Earth Observation
EISCAT	European Incoherent Scatter Scientific Association
EODC	Earth observation Data Centre
EOP	Earth Observation Programme
ESA	European Space Agency
GEO	Group on Earth Observation
GICs	Geomagnetically Induced Currents
GNSS	Global Navigation Satellite Services
GPS	Global Positioning System
HF	High Frequency
ICAO	International Civil Aviation Organisation
ICT	Information Communication Technology
ISES	International Space Environment Service
LEO	Low Earth Orbit
MODIS	Moderate Resolution Imaging Spectro radiometer
MTEF	Medium Term Expenditure Framework
MTSF	Medium- Term Strategic Framework
NASSP	National Astronomy and Space Science Programme
NDP	National Development Plan
NRF	National Research Foundation
NSS	National Space Strategy
R&D	Research and Development
SAASTA	South African Agency for Science and Technology
SADC	Southern African Development Community
SAEOS	South African Earth Observation Strategy
SCAR	Scientific Committee on Antarctic Research
SEP	Space Engineering Programme
SET	Science Engineering and Technology
SMEs	Small Medium Enterprises
SOP	Space Operations Programme
SSP	Space Science Programme
STEM	Science, Technology, Engineering, Mathematics
STI	Science Technology & Innovation

EXECUTIVE SUMMARY

Daily weather forecasts, instantaneous worldwide communications, and a constant ability to take snapshots of the Earth through satellite images are all examples of space technologies that we have come to rely upon. Even basic commodities, such as food and energy resources, are facilitated by space-based technology. In fact, the high standard of living in developed countries is largely attributed to the adoption and application of space-based technologies. This convenient lifestyle is supported by the instant access to information and space-based applications, such as the global positioning system (GPS) and global television coverage. While some of these products and services have helped to serve the social, economic and environmental needs of the country, we cannot boast of possessing all the requisite capacity to effectively address all of the needs of the country. However, moves are afoot to change this situation by building an indigenous space capability that would fully service the needs of the country and continent, and the South African National Space Agency (SANSA) is central to these developments.

Based on our situational analysis, SANSA has through its foundational years, spanning between 2011 and 2019, been able to achieve over 80% of its targets committed to from its 2015-2020 Strategic Plan and its respective Annual Performance Plans on a year-on-year basis, but this did not necessarily translate into SANSA achieving its full mandate, as expressed in the National Space Policy and National Space Strategy. The 2015-2020 Strategic Plan was tailored to fit the funding allocations to SANSA with following observed challenges during the implementation phase:

- SANSA has been unable to fulfil its full expected mandate with the key focus areas of global navigation satellite services and satellite telecommunications not prioritised during the foundational phase.
- SANSA has not been able to provide the support expected of it to the broader South African space sector resulting in a less than optimal growth and development of the industry.
- SANSA's operational expenses far exceed its parliamentary grant, which has implied that SANSA has to generate its own revenue sources to ensure continuity of operations during the foundational phase and consequently the organisation having to focus on revenue generating activities.
- Whilst the global space sector has grown steadily by approximately 8% per annum, the South African space sector has not been able to secure an appreciative level of the global market share.

It is timely, given the above mentioned challenges and constraints, for SANSA to chart a new trajectory that will ensure that the South African space sector is able to develop and compete globally, whilst responding to the critical needs of its user community, primarily represented by all tiers of government (i.e. national, provincial and municipal). This necessitates that the Strategic Plan for SANSA be revised to articulate the aspirations of the sector for the next five years spanning 2020 to 2025. These aspirations, which are captured in a separate Section, are in keeping with the expected mandate of SANSA and the value proposition of achieving this mandate includes:

- Broader support to the South African space sector.
- A bigger human capital development programme with an increased absorptive capacity into the local space sector.
- A broader spectrum of products and services that assists in responding to the nation's socio-economic-environmental challenges.
- A reduced outflow of local capital to foreign markets and an increased market share of the global space industry.
- An increasing focus on the African continent and the SADC (Southern African Development Community) region through alignment with the implementation of the African Space Strategy

and African Space Policy, and the envisioned SADC Space Strategy, and thereby fulfilling South Africa's foreign policy to lead developments on the continent.

Failure to adopt and implement the aspirational segments of this Strategic Plan will mean certain stagnation of the South African space sector. Consequently, the ability of the space sector to respond to the national and continental needs will remain suboptimal thus affecting the quality of support provided for key decision-making platforms that should be effectively engineered to support governments' priority of addressing the nation's and the continent's socio-economic-environmental challenges.

This Strategic Plan is intended to relook at the mandate of SANSA and thereby extract the key activities that SANSA should be implementing. This exercise has allowed SANSA to take a fresh look at its existing activities and make a realistic assessment of where it should be focusing in the next five years, over and above what it commits to achieving against the parliamentary grant allocation and specific grant allocations. The new vision of SANSA focuses on Africa, and this provides many growth opportunities for SANSA, as the African space programme becomes a reality. For this reason, concerted effort will be asserted in assisting the process of developing the African space programme and the envisioned SADC Space Programme and developing and positioning a transformed South African space sector to play a leading role in the implementation phases.

New areas of focus, i.e. GNSS and Satellite Telecommunications have been earmarked for development in the national space sector and SANSA will work with the relevant government departments to support the policy processes that will birth these new focus areas, which are deemed vital for South Africa. Expertise that is needed to support these focus areas will be developed internally in SANSA and within the broader space sector. This Strategic Plan provides a basis upon which new funding opportunities could be pursued to ensure that SANSA's full mandate is achieved.

PART A: OUR MANDATE

1. LEGISLATIVE AND POLICY MANDATE

1.1 Legislative Mandate

The legislative mandate is premised on two primary Acts, namely (i) the Space Affairs Act (Act No. 84 of 1993) and (ii) the South African National Space Agency (SANSA) Act (Act No. 36 of 2008). The former, an instrument of **the dti**, caters for the regulatory/policy context for the South African space programme, whereas the latter, an instrument of the DSI, enables the establishment of SANSA as an implementing agency for the South African space programme.

1.1.1 Space Affairs Act

The Space Affairs Act is currently being updated in line with current policy drivers for a national space programme, particularly industrial development, as opposed to the policy driver of non-proliferation of dual use technology in the early 1990s. The Space Affairs Act, which is the responsibility of the Minister of Trade and Industry, is intended for:

- Meeting all the international commitments and responsibilities of the Republic in respect of the peaceful utilisation of outer space, in order to be recognised as a responsible and trustworthy user of outer space.
- Controlling and restricting the development, transfer, acquisition and disposal of dual-purpose technologies, in terms of international conventions, treaties and agreements entered into or ratified by the Government of the Republic.

1.1.2 South African National Space Agency Act

The SANSA Act is a regulatory instrument that provides the Minister of Science and Innovation the powers to establish SANSA as an implementing agency for the national space programme. The primary objectives of SANSA are to:

- Promote the peaceful use of outer space.
- Support the creation of an environment conducive to industrial development in space technology.
- Foster research in space science, communications, navigation and space physics.
- Advance scientific, engineering and technological competencies and capabilities through human capital development outreach programmes and infrastructure development.
- Foster international cooperation in space related activities.

In pursuit of the achievement of these objectives, SANSA is expected to carry out the following functions:

- Implement any space programme in line with the policy determined in terms of the Space Affairs Act.
- Advise the Minister on the development of national space science and technology strategies and programmes.
- Implement any national space science and technology strategy.
- Acquire, assimilate and disseminate space satellite imagery for any organ of state.

1.2 Policy Mandate

Aligned to the legislative instruments above the National Space Policy provides an overarching guideline to all national space actors on the key principles for implementation of a South African space programme. The National Space Policy is an instrument of **the dti** and is aligned to the Space Affairs Act.

The National Space Policy is the anchor tenet and reference point by which all other policy and strategy instruments are crafted. The primary objectives of the National Space Policy are to:

- Improve co-ordination throughout the South African space arena to maximise the benefits of current and planned space activities, avoid or minimise duplication of resources and efforts, and organise existing initiatives, programmes and institutions into a coherent network for all providers and users of space systems.
- Promote capacity building initiatives, both as a means towards effective participation in the space arena, as well as to develop capacity in space science and technology, and science and technology in general.
- Facilitate the provision of appropriate and adequate space capabilities to support South Africa's domestic and foreign policy objectives.
- Foster a robust science and technology base in research institutions and the higher education sector.
- Promote the creation and implementation of a supportive regulatory environment to facilitate industrial participation in the space arena, in accordance with domestic law and South Africa's foreign policy objectives and international obligations.
- Promote the development of an appropriate and competitive domestic commercial space sector in order to provide the industrial base to meet the nation's needs for space technology.
- Promote improved cooperation with other nations in the mutually beneficial peaceful uses of outer space.
- Promote greater awareness and appreciation, at all levels of South African society, of the relevance and benefits of space science and technology.

2. INSTITUTIONAL POLICIES AND STRATEGIES

The architecture for any programme or institution is directly informed by the key priorities of government policies and is derived from related strategies. The key policies of government are the Nine-Point Plan, the National Development Plan (NDP), the Triple Challenges, the Medium-Term Strategic Framework (MTSF) and the Sustainable Development Goals (SDGs). In particular for the space sector, the National Space Strategy and the South African Earth Observation Systems (SAEOS) Strategy provide directives that directly inform the operationalisation of the national space programme, inclusive of the role that SANSA should play.

2.1 Institutional Strategies

The National Space Strategy and the South African Earth Observation Systems (SAEOS) Strategy provide directives that directly inform the operationalisation of the South African space programme, inclusive of the role that SANSA should play. The National Space Strategy provides a blueprint for the innovative utilisation of space science and technology to enhance economic growth and sustainable development. Given the critical importance of Earth observation applications for informing decision-making and evidence-based policy making in government spheres, the objectives of the SAEOS Strategy is to coordinate the collection, assimilation and dissemination of Earth observation data and information.

2.1.1 National Space Strategy

The National Space Strategy seeks "for South Africa to be among the leading nations in the innovative utilisation of space science and technology to enhance economic growth and sustainable development and thus improve the quality of life for all". The primacy in pursuing this vision is embedded in three primary goals, namely:

1. To capture a global market share for small to medium sized space systems in support of the establishment of a knowledge economy through fostering and promoting innovation and industrial competitiveness.
2. To empower better decision making through the integration of space-based systems with ground-based systems for providing the correct information products at the right time.
3. To use space science and technology to develop applications for the provision of geospatial, telecommunication, timing and positioning products and services.

2.1.2 South African Earth Observation Systems Strategy

Given the critical importance of Earth observation applications for informing decision-making and evidence-based policy making in government spheres, the objectives of the SAEOS Strategy is to coordinate the collection, assimilation and dissemination of Earth observation data and information. This is deemed to be achieved through:

- Identifying and correcting shortcomings in the sampling, data processing, systems modelling and information dissemination processes.
- Ensuring that the information needs of users are met, in the form that they require, when they need it, and at an affordable cost.
- Exploiting the opportunities for synergy and cost-saving between previously separate systems by, among other things promoting the development of open, interoperable information and communications technologies for earth observation.
- Developing or promoting standards for earth observation information interchange.
- Ensuring that crucial datasets are securely archived.
- Creating value enhanced datasets by linking together previously stand alone, incompatible and mutually inaccessible observations, and by linking observations with models.
- Accessing relevant data from observation systems in neighbouring countries and from global observation systems, and in return supplying data needed for the solution or regional or global problems.

2.2 Linking Space to Government Policies

The highest priority of any government is to ensure (i) sustained economic growth and (ii) improvement in the quality of life of its citizens. It is therefore imperative that investments in space science and technology are geared towards addressing these fundamental priorities. In fact, the notion of a national space programme is premised on the potential benefits that can accrue to the country from directed investments in developing the local space sector.

The process for drafting the National Space Strategy included extensive consultation with national government departments to ascertain what the key priorities for a national space programme should be. This methodology for framing the national space programme has significant implications for achieving the broader policy mandate of government. The key priorities of government that need to be addressed by a national space programme was collated and clustered into three key priority areas, namely, (i) Environmental Resource Management, (ii) Health, Safety and Security, and (iii) Innovation and Economic Growth.

Each of these clusters further comprise of a list of associated user needs. A summary of this exercise is shown in Table 1 below. It is important to note that the success of the national space programme will be assessed by how well these user needs are responded to and whether the appropriate data and information has been provided on time and is of an acceptable quality standard. In addition, the use of the predefined data and information reside in different and multiple government departments, where these specific datasets could have multiple uses.

Environmental Resource Management	Health, Safety and Security	Innovation and Economic Growth
• Environmental and geospatial monitoring • Ocean, coastal and marine management • Land management • Rural development and urban planning • Topographic mapping • Hydrological monitoring • Climate change adaptation and mitigation • Meteorological monitoring	• Disaster monitoring and relief • Hazards forecasting and early warning • Cross border risk • Disease surveillance and health risk • Asset monitoring • Regulatory enforcement • Defence, peacekeeping and treaty monitoring	• Tourism and recreation • Communications • Space science and exploration • Space technology transfer and spinoffs • Development of the space industry

Table 1: Key priorities of government

In 2015, the Administration of South Africa announced a Nine-Point Plan to boost economic growth and create much needed employment. The Nine-Point Plan serves as a response to the slow economic growth of South Africa by transforming the economy and increasing investments. The main tenets of the Nine-Point Plan are as follows:

1. Revitalising the agriculture and agro-processing value-chain – by increasing support for existing smallholder farmers and exploring ways to substantially expand the number of agricultural producers.
2. Advancing beneficiation and adding value to our mineral wealth – by advancing a special support package to revitalise distressed mining towns and promoting a sustainable mining industry.
3. More effective implementation of the Industrial Policy Action Plan – by introducing black industrialist programme, which is designed to transform the manufacturing sector and unlock the potential of black entrepreneurs.
4. Unlocking the potential of small, medium and micro enterprises, cooperatives and township enterprises – by facilitating access to finance.
5. Operation Phakisa, which is aimed at growing the oceans economy and other sectors such as, mining, health, tourism and basic education.
6. Encourage private sector investment –by stopping the decline of key sectors and increasing investments in others, whilst attracting investments into the industrial development zones.
7. Resolve the energy challenge – by working towards a reliable energy supply to ensure energy security and to enable economic growth.
8. Moderating workplace conflict – by introducing a code of conduct for strikes, lockouts and compulsory arbitration.
9. State reform and boosting the role of state-owned companies, information and communications technology infrastructure or broadband roll-out, water, sanitation and transport infrastructure.

The National Development Plan 2030 is aimed at eliminating poverty and reducing inequality by 2030. The Plan comprises of thirteen chapters, inclusive of a set of objectives and actions for each, which details how government intends to respond on different fronts to the manifold challenges facing South Africa. The chapter headings are:

1. Economy and employment.
2. Economy infrastructure.

3. Environmental sustainability.
4. An integrated and inclusive rural economy.
5. Positioning South Africa in the world.
6. Transforming human settlement.
7. Improving education, training and innovation.
8. Promoting health.
9. Social protection.
10. Building safer communities.
11. Building a capable and development state.
12. Fighting corruption.
13. Transforming society and uniting the country.

South Africa is burdened with the triple challenge of poverty, inequality and unemployment and resolving this challenge will emancipate the marginalised communities of South Africa to their full economic and social potential. Space science finds resonance with the triple challenge, as follows:

1. Poverty – broaden opportunities through education, health, nutrition, public transport and access to information through the delivery of essential services using space-based platforms.
2. Inequality – drive unity and social cohesion through understanding the impacts of social and economic divisions using geospatial information.
3. Unemployment – inform the removal of structural impediments, such as poor-quality education or spatial settlement patterns that exclude the majority.

The current administration has also chosen to focus on a key set of priorities for the country, called the MTSF, that coincides with their term of office extending between 2019 and 2024. It is expected that national entities will align their strategic focus with the MTSF priorities, for which there are seven such priorities, namely:

- Priority 1: A Capable, Ethical and Developmental State, and
- Priority 2: Economic Transformation and Job Creation,
- Priority 3: Education, Skills and Health,
- Priority 4: Consolidating the Social Wage through Reliable and Quality Basic Services,
- Priority 5: Spatial Integration, Human Settlements and Local Government,
- Priority 6: Social Cohesion and Safe Communities,
- Priority 7: A better Africa and World.

Apart from these national priorities, South Africa has also committed to the global Agenda 2030, commonly referred to as the SDGs, which comprises of seventeen sustainable development goals, namely:

1. End poverty in all its forms everywhere,
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture,
3. Ensure healthy lives and promote well-being for all at all ages,
4. Ensure inclusive and quality education for all and promote lifelong learning opportunities for all,
5. Achieve gender equality and empower women and girls,
6. Ensure availability and sustainable management of water and sanitation for all,
7. Ensure access to affordable, reliable, sustainable and modern energy for all,
8. Promote sustained, inclusive and sustainable economic growth, employment and decent work for all,
9. Build resilient infrastructure, promote sustainable industrialisation and foster innovation,
10. Reduce inequality within and among countries,

11. Make cities inclusive, safe, resilient and sustainable,
12. Ensure sustainable consumption and production patterns,
13. Take urgent action to combat climate change and its impacts,
14. Conserve and sustainably use the oceans, seas and marine resources,
15. Sustainably manage forest, combat desertification, halt and reverse land degradation, halt biodiversity loss,
16. Promote peaceful and inclusive societies for sustainable development and provide access to justice for all, and
17. Strengthen the means of implementation and revitalise the global partnership for sustainable development.

Taking the user needs identified in Table 1 as the primacy of the national space programme, Table 2 reflects how many priorities of the above-mentioned policy instruments are impacted by each of these user needs. Table 2 reinforces the critical role and impact that space science and technology can play in realising the many aspirations of government in bringing about radical socio-economic-environmental change within the country.

Priority Areas	Nine Point Plan	NPD (13)	Triple Challenge	MTSF (7)	SDGs (17)
Environmental and geospatial monitoring	5	7	3	`5	2
Ocean, coastal and marine management	4	8	3	5	3
Land management	4	10	3	7	3
Rural development and urban planning	4	13	3	7	2
Topographic mapping	3	5	2	7	15
Hydrological monitoring	3	12	3	7	2
Climate change adaptation and mitigation	5	13	2	7	1
Meteorological monitoring	3	8	2	5	5
Disaster monitoring and relief	5	11	2	5	3
Hazards forecasting and early warning	5	11	2	5	5
Cross border risk	4	8	3	4	2
Disease surveillance and health risk	3	9	2	4	1
Asset monitoring	4	5	3	5	2
Regulatory enforcement	5	5	3	7	17
Defence, peacekeeping and treaty monitoring	1	4	2	4	1
Tourism and recreation	6	6	3	5	16
Communications	5	9	3	7	17
Space science and exploration	2	8	3	5	3
Space technology transfer and spinoffs	4	4	3	4	4
Development of the space industry	4	4	2	5	3

Table 2: Responding to the broader policies of government.

PART B: OUR STRATEGIC FOCUS

3. VISION

SANSA's vision statement for repositioning the South African space programme is:

An integrated National Space Capability that responds to socio-economic challenges in Africa by 2030

4. MISION

SANSA's mission statement for what it is the South African space programme does is:

To provide leadership in unlocking the potential of Space for the advancement and benefit of humanity

5. VALUES

SANSA has six core values, called STRIPE, that its employees pledge to uphold through an "earn your STRIPE" campaign, namely:

1. **S**ervice- deliver superior customer value on time every time;
2. **T**eamwor**k**- consult, inform and share knowledge;
3. **R**espect - acknowledge and value what is good;
4. **I**ntegrity- keep promises and own up to mistakes;
5. **P**ersonal Growth- acknowledge potential and grow competence; and
6. **E**xcellence- go the extra mile and implement tasks to the best of our ability.

6 SITUATIONAL AWARENESS

6.1 Working in a Constrained Operational Environment

During the first eight years of SANSA's operations, its Annual Performance Plans and Strategic Plans have been pragmatically aligned against the budgetary allocations made to it for both its internal business operations and broader support to the local space sector. This approach vis-à-vis the budgetary allocations imposed a limitation on SANSA's scope of initiatives that were planned and implemented versus implementation of initiatives actually needed to achieve the full mandate. However, this does not necessarily translate into SANSA implementing its full scope of activities and the need therefore arises to take a mandate-based approach to identify what is required of SANSA at a national level.

A consequence of the alignment of SANSA activities to the funding only is as follows:

- SANSA's inability to fully meet its mandate, especially with regards to global navigation satellite services (GNSS) and satellite telecommunications solutions and applications; and
- Limited support to the local space industry, as per SANSA's mandate.

This situation necessitates that SANSA raises a sustained base-funding to support its mandate. However, this warrants that SANSA defines a predetermined strategic direction that will inform its funding requirements to support the local space sector and its growing internal operations in order to effectively respond to its end user requirements. In its effort to support the local industry, SANSA will work closely with the broader space industry.

The activities committed to in this current Strategic Plan are aligned to our parliamentary grant, the revenues generated, and additional grants secured. However, we also highlight a suite of aspirational

initiatives that is intended to ensure potential alignment to the expected mandate. This approach is intended to demonstrate the full value SANSA can deliver to the broader public and the local industry, thus ensuring full delivery on its mandate as enshrined in the SANSA Act and policy mandate. The value proposition for the aspirational initiatives include:

- Broader support to the South African space sector, including extended support to small, medium enterprises;
- A bigger human capital development programme in line with the extended mandate, thus ensuring better absorption of the human capital development pipeline into the broader space sector;
- A wider array of space application products and services, which creates decision-making efficiencies that ultimately impact on how we respond to our socio-economic-environmental challenges;
- A reduced outflow of local capital to foreign markets, which will be offset by technology localisation and a growing market share of the approximately 350-billion-dollar global space market; and
- A greater focus on the African continent to tackle global challenges that transcend national boundaries, thus effectively contributing to the African Union Vision and Agenda 2063 for "An integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena".

6.2 Performance Against SANSA's Mandate

The key priorities of government, as shown in Table 1, can be mapped against the space thematic areas of Earth Observation, Navigation and Positioning, Satellite Communications, and Space Exploration. The outcome of this exercise is shown in Table 3, which forms a convenient technical reference map for SANSA's key programmes and activities in meeting government's needs. Table 3 is thus central to the core business of SANSA and can be effectively used to assess whether the internal value chain of SANSA is aligned to delivering on the user needs of government. Using a colour coding classification, we are able to assess whether SANSA is optimally meeting its mandate or not. Table 3 is colour coded, with the following classifications:

- Green – SANSA is meeting its mandate.
- Yellow – SANSA is partially meeting its mandate.
- Red – SANSA is not meeting its mandate.

Currently, SANSA is fulfilling its obligation in providing Earth observation data, products and services for applications requiring above 1m resolution. However, this is realised with no effective mechanism in place to recoup costs, thus leaving SANSA with the burden of fully subsidising government from its parliamentary grant for these services. The applications requiring sub-1m resolution are costly, as access to the data is commercially available but relatively expensive – more can be done in this domain if SANSA is appropriately funded to access these datasets. However, if we were to consider the number of national missions that support our Earth observation needs, then the situation in Table 3 is much more dire; with no such missions currently in operation.

Key Priority Areas	Specific Needs	Earth Observation									Navigation & Positioning	Communication	Space Exploration
		Spatial Resolution Required							Temporal Frequency	Geographic Area			
		< 50cm	50cm - 1m	1m - 2.5m	2.5m - 5m	5m - 10m	10m - 20m	20m - 30m	>30m					
Environmental Resource Management	Environmental and geospatial monitoring				•	•	•	•	•	Annual	National	•	•	•
	Ocean, coastal and marine management		•	•	•	•	•	•	•	Annual	SADC	•	•	•
	Land management				•				•	Seasonal	National	•	•	•
	Rural development and urban planning		•	•	•					Annual	National	•	•	•
	Topographic mapping						•	•		Annual	National	•	•	•
	Hydrological monitoring					•	•			Twice per annum	National	•	•	•
	Climate change mitigation and adaptation					•	•			Daily	SADC	•	•	•
	Meteorological monitoring		•	•	•	•	•	•	•	Daily	SADC	•	•	•
Health, Safety & Security	Disaster monitoring and relief	•	•	•	•	•	•		•	Daily when required	SADC	•	•	•
	Hazard forecasting and early warning					•	•	•	•	Twice per annum	SADC	•	•	•
	Cross-border risks	•	•	•		•			•	2-4 times per annum	SADC	•	•	•
	Disease surveillance and health risk					•	•			Twice per annum	National	•	•	•
	Asset monitoring									Continuous	SADC	•	•	•
	Regulatory enforcement	•	•	•		•			•	2-4 times per annum	National	•	•	•
	Defence, peacekeeping and treaty monitoring	•	•	•		•			•	High turn around time	Africa	•	•	•
Innovation & Economic Growth	Tourism and recreation				•	•	•	•	•	Annual	National	•	•	•
	Communication									Continuous	SADC	•	•	•
	Space science and exploration										National	•	•	•
	Space technology transfer and spin-offs			•	•	•					National	•	•	•
	Development of the space industry			•	•	•					National	•	•	•

Table 3: Meeting the full mandate of SANSA.

The worrisome aspect is that SANSA is currently not servicing its mandate with respect to products and services applications for Navigation and Positioning, and Satellite Communications. The primary responsibility for these thematic areas reside in other government departments, other than the DSI. On the latter point, the Department of Transport (DoT) is responsible for Navigation and Positioning products and services, and the Department of Telecommunications and Postal Services (DTPS) is responsible for Satellite Communications products and services. DTPS, in conjunction with the DSI, are currently motivating for a national Telecommunications Satellite, which will have implications for SANSA. A plan for a regional satellite-based augmentation system has been developed by SANSA but will be implemented once the requisite investment is secured.

With regards to space exploration, firstly, SANSA Space Science is implementing a number of programmes, but these and the potential of doing more is contingent on securing additional funding. Secondly, there are other areas of space exploration that sit outside of SANSA, a prime example being space geodesy which is critically important for SANSA's business but sits in the nexus between space science and astronomy[1]. Thirdly, SANSA Space Operations is largely reliant on the generation of external revenue, which would constrain the unit from supporting space exploration missions. Hence, in the area of space exploration more can be done if (i) additional investments were secured and (ii) relevant structural reforms were made to optimise cross-collaboration with other public entities.

6.3 Delivery Against the 2015-2020 Strategic Plan

Table 4 below seeks to give progress made by SANSA in relation to the approved 2015-2020 Strategic Plan and the targets set against that plan. Note that the target achieved to date only reflects the organisation's performance over a four-year period, and therefore the 2019/20 financial year targets are not included in the year to date but is reflected in a separate column. What should be noted is that a number of indicators articulated in the Strategic Plan have been eliminated, due to either

[1] By definition, space science includes astronomy, but in South Africa an artificial divide has been created resulting in two disparate competing disciplines that also reduces the effectiveness of cross-collaboration.

funding constraints or that they reflect operational targets – for which approval was sought over the five-year term. The greatest challenge experienced to date relates to delays in completing the EO-Sat1 project.

Strategic Obj. No.	Indicator	5-year target	Target to Date	Target achieved to date	Target for 2019/20
S1.1	M1.1 Number of national high-impact products and applications services	22	17	17	5
S1.2	M1.2 The number of government decision or policy support tools	10	6	8	n/a
S2.1	M2.1 The national research productivity score for space supported R&D	7250	4550	7176	1300
S3.1	Number of youth directly engaged	53 300	40 800	85 134	26750
S3.2	M3.2 Number of students and interns supported for formalized training	350	210	251	50
S4.1	M4.1 Successful satellite pass monitoring rate for Earth Observation	98%	99%	99.9%	99.5%
	M4.2 Total income generated from space operations activities	R326m	R242m	R308.7m	R76m
	M4.3 Total amount of space operations income invested in other SANSA programmes	R60m	R33m	R36m	n/a
S4.2	M4.4 The number of direct jobs supported externally through SANSA programme	390	190	167	n/a
	M4.5 The progress status on the EO-Sat1 development project	Launch	75% completion	Preliminary Design Review Completed	n/a
	M4.6 The total contract expenditure to SMEs for core space projects	R65m	R46.9m	R51m	n/a
	M4.7 The total contract expenditure to broad space related industry for core space projects	R306m	R166m	R253.1m	n/a
S5.1	The equivalent revenue generated through partnerships as a proportion of the SANSA revenue	10%	7%	4%	n/a
S6.1	M6.1 Total SANSA income	R1,259Bn	R711m	R690m	n/a
	M6.2 Estimated monetized impact per annual	R600m	R330m	R299,6m (On hold)	n/a
	M6.3 SANSA's public value awareness	90%	70%	97%	n/a
	M6.4 High-level NSP implementation progress status	70%	50%	50%	On hold
S7.1	M7.1 Implement identified initiatives that enhance organizational performance	4	4	3.9	n/a
	M7.2 Proportional (%) representation of permanent staff from designated groups in the top two management levels (manager, senior manager)	65%	65%	75.7%	n/a
	M7.3 Proportional (1%) of total operating expenditure invested in staff training and development	1%	1%	1%	n/a

Table 4: Performance against the targets set in the 2015-2020 Strategic Plan

6.4 SWOT Analysis

The central purpose of a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is to identify strategies that align, fit, or matches SANSA's resources and capabilities to the demands of the environment in which the Agency operates. In other words, the purpose of the strategic alternatives generated by a SWOT analysis should be to build on SANSA's strengths in order to exploit the opportunities, counter threats, and correct weaknesses. Included in Table 5 is the SWOT analysis for SANSA, noting that the strengths and weaknesses is internally focused, and the opportunities and threats are external factors. This analysis is then followed by a reflection on how the various elements will be dealt with going forward.

It should be noted that many of these elements will naturally be captured by the activities stipulated for the respective goals and objectives per each of the business units of SANSA. In addition, the weaknesses and threats captured in Table 5 will form the basis for the strategic risk register of SANSA for the duration of implementation of this strategic framework. In responding to the manifold opportunities and threats posed by the external environment, SANSA will forge strategic partnerships with institutions in the national system of innovation, in the region and abroad to capitalise on the opportunities and minimise the impending threats.

STRENGTHS	WEAKNESSES
• A proven space heritage relating to historic missions. • A core skills base is in place to deliver on a national space programme. • There are strong strategic partnerships that SANSA is currently engaged in. • SANSA has the base space Infrastructure needed for a national space programme. • A suite of space products and services have already been produced, giving us the know-how for future developments. • SANSA's mandate is stipulated as a matter of law.	• Ineffective performance management system within SANSA. • Lack of capacity within SANSA to secure new opportunities. • Organisational culture that hampers performance. • Lack of a common identity and strategic direction. • Insufficient funding to achieve our full mandate. • Lack of internal and external visibility for SANSA. • Ageing infrastructure that needs to be replaced in the very near future.
OPPORTUNITIES	**THREATS**
• External partnerships with other countries or entities/universities in foreign countries. • Access to funding through strategic partnerships. • Potential to grow our own revenue stream by leveraging funds. • Organisation of choice in as far as space science and technology is concerned. • Building brand identity will help increase SANSA's institutional value. • Going back to the mandate to scope out new opportunities. • The district model provides an opportunity to ensure adoption of space products and services at a local level.	• Competing government priorities that could reduce potential funding streams. • Unhealthy competition within the South African national system of innovation. • Technology advances faster that what SANSA is able to capitalise. • Radio and magnetic interference that could adversely hamper operations. • Many African countries are establishing space programmes, which impacts our competitive advantage.

Table 5: SWOT analysis

6.4.1 Building on the Strengths

The following reflects how SANSA will build upon its inherent strengths:

- *A proven space heritage relating to historic missions* – document the IP, register it and make it available for the broader industry to use and commercialise. Associated with this space heritage, SANSA must build its brand value and market the national capabilities both nationally and internationally, ensure staff retention within the space sector, and maintain and upgrade critical infrastructure to reinforce and build upon the heritage.
- *A core skills base is in place to deliver on a national space programme* – create an innovation platform that will build upon and utilise the current skills base. Personal development and career growth opportunities need to be instituted that will include mentoring, coaching and training. In addition, universities will be engaged to develop space curricula that will be supported by SANSA.
- *There are strong strategic partnerships that SANSA is currently engaged in* – focus will be extended on joint partnership frameworks such as Brazil, Russia, India, China and South Africa (BRICS) and the African Resource Management Constellation (ARMC). Collaborative projects

and resource sharing with the international community will be operationalised through formal Memorandums of Understanding/Agreements.

- *SANSA has the base space Infrastructure needed for a national space programme* – efforts will be targeted at maintaining and upgrading the current infrastructure, as well as lead and develop needed infrastructures such as calibration/validation sites and the assembly, integration and testing facility. These efforts will be validated through quality assurance processes and certification of facilities and products, where necessary.
- *A suite of space products and services have already been produced, giving us the know-how for future developments* – the broader industry will be empowered to develop and provide innovative base-line products and services to end-users. Improvements will also be focused on stakeholder engagement and customer relationship management in order to improve customer services.
- *SANSA's mandate is stipulated as a matter of law* – where there are conflicts due to delineation of roles and responsibilities, SANSA will use its mandated powers to provide leadership and support to industry and the broader space sector. SANSA will also facilitate and coordinate stakeholders to ensure optimum development and advancement of the sector.

6.4.2 Addressing the Weaknesses

The inherent weaknesses of SANSA will be addressed as follows:

- *Ineffective performance management system within SANSA* – a new performance management system will be developed for SANSA that will take into account this strategic framework when contracting for performance management.
- *Lack of capacity to secure new opportunities* – appropriate recruitment and selection of staff will be pursued and in tandem a continuous development programme will be instituted. Effective capacity will be created in areas that SANSA is not currently operating in.
- *Organisational culture that hampers performance* – an organisational culture change process will be undertaken to reset the underlying culture. This will allow management to correct any behavioural identity that is not in keeping with what is required for SANSA and to establish new behavioural norms.
- *Lack of a common identity and strategic direction* – this strategic framework will help set a new strategic direction for SANSA, which will be regularly communicated and reinforced throughout the organisation and also externally. Monitoring and evaluation of progress along the new strategic direction will be periodically measured and corrective action will be taken, where necessary.
- *Insufficient funding to achieve our full mandate* – in line with this strategic framework and a Financial Sustainability Framework, new funding opportunities will be explored. Where possible SANSA's existing resources will be utilised to leverage additional funding through joint partnerships or incentive schemes.
- *Lack of internal and external visibility for SANSA* – measures will be taken to improve marketing and communications of the core activities undertaken and supported by SANSA. For this purpose and integrated marketing and communications plan will be developed and implemented to promote national space activities, both internal and external to SANSA.
- *Ageing infrastructure that need to be replaced in the very near future* – where possible the lifespan of existing infrastructure will be extended through maintenance and upgrade initiatives. Where necessary, recapitalisation of critical infrastructure will be prioritised to ensure continued or expanded operations.

6.4.3 Capitalising on the Opportunities

External opportunities that are presented to SANSA will be capitalised upon in the following manner:

- *External partnerships with other countries or entities/universities in foreign countries* – SANSA will tap into Memorandums of Understanding/Agreements it has with other space agencies and science institutions to forge collaborations that will benefit the national space sector. This will also include piggybacking on pre-existing and new inter-Agency and inter-governmental bilateral agreements.
- *Access to funding through strategic partnerships* – SANSA will work together with institutions within the National System of Innovation to leverage additional funding. This will require firmer stakeholder management with government entities and its agencies and pursuing public-private-partnerships where necessary.
- *Potential to grow own revenue stream by leveraging funds* – SANSA must reorganise itself to leverage external funds by establishing a business development team that will strategically pursue opportunities. Co-investments or self-investments in joint collaborative projects will also be pursued to reduce the financial burden and thereby leverage financial efficiencies.
- *Organisation of choice in as far as space and technology is concerned* – SANSA must be seen as an organisation of choice for national socio-economic-environmental programmes where space applications products and services are required. SANSA will then be able to coordinate efforts within the national system of innovation. Examples of such initiatives are the National Development Plan, Operations Phakisa and the Sustainable Development Goals.
- *Building brand identity will help increase SANSA's institutional value* – where the different business units are differentiated in terms of brand value, this will be collapsed into a single brand for SANSA. All marketing and communications efforts must be appropriately coordinated across SANSA.
- *Going back to the mandate to scope out new opportunities* – through this strategic framework, SANSA will relook at its business model and focus on strengthening the space value chain. Where key focus areas are not currently being implemented by SANSA, these will be embedded in SANSA's operational focus.
- *The district model provides an opportunity to ensure adoption of space products and services at a local level* – SANSA will work with the DSI to ensure that the relevant products and services are implemented and used at a local district/municipality level.

6.4.4 Managing the Threats

External threats posed to SANSA will be circumvented through the flowing interventions:

- *Competing government priorities that could reduce potential funding streams* – SANSA must establish a strong business case that demonstrates significant value proposition for government activities. SANSA must also use the said value proposition to secure a baseline of funding at the appropriate levels required to sustain its operations.
- *Unhealthy competition within the South African national system of innovation* – SANSA must define its role and responsibilities vis-à-vis other role players in the space sector. SANSA must protect its mandated responsibilities, and coordinate and support activities implemented by external stakeholders.
- *Technology advances foster that what SANSA is able to capitalise* – SANSA will need to invest more in R&D and improve on the innovative use of its existing technologies. Where necessary, capitalisation on new technologies and recapitalisation on existing technologies will be prioritised to ensure that the space value chain is strengthened.
- *Radio and magnetic interference that could adversely hamper operations* – use the Astronomy Geographic Advantage Act to declare and protect the area around Space Science and Space Operations against magnetic and radio interference, respectively. A closer working relationship will also need to be established with the Independent Communications Authority of South Africa (ICASA).

- *Many African countries are establishing space programmes, which impacts our competitive advantage* – SANSA will forge strategic collaborative partnerships with most of these countries to ensure a win-win situation that is of mutual benefit.

PART C: MEASURING OUR PERFORMANCE

7 INSTITUTIONAL PERFORMANCE INFORMATION

Goals reflect the expected or desired outcome for SANSA that comprise of broad, general expressions of the guiding principles and operation of the organisation. SANSA has adopted five strategic goals that collectively contribute to the achievement of the Vision for the local space sector and the Mission of SANSA in order to respond to the South African and broader African agenda, and these are described in what follows.

7.1 Strategic Goals

Goal 1: The development of a suite of space application products and services that directly respond to user needs

Space has a crucial role in providing operational applications/solutions that will address national/regional challenges and provide decision support tools for government. These include applications in natural resource management, climate change and environmental management, disaster management, rural development and urban planning, magnetic technology, aviation compliance, and national safety and security.

SANSA may develop some of these applications within the Agency, but the primary approach should be to leverage domain expertise externally. SANSA's approach, therefore, should not be focused on implementing everything internally, but to focus on a few operational applications that require significant state investment and are not commercially viable for private industry or are essentially public good services and therefore a state responsibility.

Goal 2: The building of core space infrastructure, both ground and space based, that will enable the delivery of essential space services

Infrastructure development forms the critical backbone for the South African space programme. This is especially important for the efficient and effective delivery of products and services, across the space value chain, through to the end-users. SANSA will ensure that there is seamless interfacing between its programmes across the space value chain so that its infrastructure operate in concert to deliver on national/regional requirements.

SANSA will take stock of the current infrastructure base and the future infrastructure requirements and plan accordingly to ensure an optimal infrastructure capacity that is adequately able to respond to user requirements both nationally and at a continental scale. SANSA will work with the local industry and other agencies on the continent to promote the infrastructure expansion required to respond to the growth potential of the African market.

Goal 3: The generation of space relevant knowledge that supports the developmental agenda

SANSA firmly believes in the value of fundamental and applied science to create new knowledge that leads to new technologies and innovation that directly impact on the economy and society. Science also increases our knowledge and understanding of ourselves, our universe and its sustainability. Therefore, SANSA will foster and lead collaborative R&D in space-related areas on a national scale. SANSA will set the national R&D agenda, its priorities, targets and outcomes in line with this Strategic Plan. An appreciation for the value of fundamental research and its long-term benefits to the country will be fostered.

Through such R&D, provision will be made for the leadership, coordination and support to applied research in order to increase the knowledge base, devise new applications through space missions, and allow the transfer of intellectual property and enabling technologies to local industry, academia,

and government organisations. Such interventions will ensure that South Africa remains on the cusp of cutting-edge space technologies and applications.

Goal 4: The development of requisite human capacity that is needed for the implementation of key space initiatives

A significant increase in the interest in STEMI (science, technology, engineering, mathematics, innovation) fields, as well as the development of rare and transferable skills are required to meet national demand for a viable space programme that can deliver against its targets. Capacity development in space-related areas will not only benefit space but will have an impact in other areas that require scientists, engineers and technicians. Skills development with a solution driven mindset will be promoted, and space will be utilised as a driver to prepare the youth for the fourth industrial revolution.

All capacity development initiatives should be conducted with a transformational agenda to redress inequality in terms of race, gender and people with disabilities. Such initiatives will target the transformation of both the student cohort and the broader industry expertise base. These initiatives will ensure that the representative demographics is reflected in our local space initiatives.

Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives

Government has articulated a number of key national priorities for the country, which is reflected in a number of policy instruments. An indication of the key priorities is included in Section 1.2.4, for which it must be noted that SANSA was established to assist the State in responding to these challenges. SANSA will reaffirm its position as an institute within the National System of Innovation that is effective in responding to the socio-economic-environmental challenges of the country.

Rather than responding to the national priorities in a piecemeal fashion, as is currently the case, SANSA will position itself to respond more comprehensively to a larger proportion of these priorities in a more cost-effective and impactful manner. Such interventions will encompass using the existing capabilities and infrastructure, with the requisite marketing and business development focus, that supports a more structured approach.

7.2 Strategic Objectives

The Strategic Objectives reflect the actions to be implemented and the results to be achieved to realise the desired Strategic Goals. The Strategic Objectives assists us in focusing on a core set of focus areas that if implemented effectively would help realise the intended Strategic Goals, and there are five such objectives proposed for SANSA, namely:

1. To support the development of a critical mass of skills and expertise needed to give effect to local and regional space initiatives;
2. To expand and exploit our knowledge base for the development of essential services and products that respond to user needs;
3. To develop, grow and transform the indigenous space industry that is responsive to local needs and is globally positioned;
4. To build and host the appropriate infrastructure that will support the local space sector; and
5. To foster strategic partnerships that will allow us to respond to national and continental developmental agendas.

The mapping of the Strategic Objectives to the Strategic Goals are shown in Table 6.

		Strategic Objectives				
		To support the development of a critical mass of skills and expertise needed to give effect to local space initiatives	To expand and exploit our knowledge base for the development of essential services and products that respond to user needs	To develop, grow and transform the indigenous space industry that is responsive to local needs and is globally positioned	To build and host the appropriate infrastructure that will support the local space sector	To foster strategic partnerships that will allow us to respond to national and continental developmental agendas
Strategic Goals	The development of a suite of space application products and services that respond to user needs		✓	✓		
	The building of core space infrastructure, both ground and space based, that will enable the delivery of essential space services			✓	✓	
	The generation of space relevant knowledge that supports the developmental agenda		✓			
	The development of requisite human capacity that is needed for implementation of key space initiatives	✓				
	The positioning of SANSA as a key enabler of government's policy imperatives	✓	✓	✓	✓	✓

Table 6: Mapping of Strategic Objectives to the Strategic Goals.

7.2.1 Strategic Objective 1 – To support the development of a critical mass of skills and expertise needed to give effect to local and regional space initiatives

Under this Strategic Objective, SANSA will pursue the following activities:

S1.1 Increase youth awareness of science

To achieve this SANSA will:

- attract, develop and grow the national space science and technology skills base,
- develop, maintain and market space science and technology related platforms to deliver appropriate science engagement programmes,
- use SANSA facilities to expose young people to science,
- have a focused science engagement programme at each facility with dedicated personnel to drive the initiative, and
- partner with SAASTA (South African Agency for Science and Technology Advancement) and national science centers.

S1.2 Support student and intern training

To achieve this SANSA will:

- provide postgraduate student research support (funding, supervision, data, research facilities) to students,
- conduct short course training at universities and SANSA facilities,
- ensure that its researchers co-supervise research students,
- partner with national and international universities,
- run internship programmes and workplace training initiatives, and
- ensure that the above are underpinned by a transformation agenda.

The **implementation** approach will include using SANSA facilities to expose young people to science. Partnering with SAASTA (South African Agency for Science and Technology Advancement) and national science centers will be crucial. SANSA will provide research support (funding, supervision, data, research facilities) for training students.

SANSA will also conduct short course training and the Agency's researchers will co-supervise research students. As SANSA is not a registered academic institution, student training will always be done in partnership with national and international universities. Internship programmes and workplace training initiatives are also crucial components of skills development. Although these are not measured, they will still be pursued. The indicator table for Strategic Objective 1 is shown in Table 7.

Strategic Objective 1: To support the development of a critical mass of skills and expertise needed to give effect to local and regional space initiatives								
Activities	**Measure**	**5-year Target**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**Impact**
S1.1 Increase youth awareness of science	M1.1.1 Number of youths directly engaged	T1.1.1 Total of 185 000 young people directly engaged by March 2025	25 500	31 750	37 250	42 500	48 000	An increased uptake of STEM subjects by the youth
S1.2 Support students and interns	M1.2.1 Number of students and interns supported for formalized training	T1.2.1 Total of 350 students and interns supported by March 2025	50	50	70	90	90	A skilled workforce that can effectively contribute to the knowledge economy

Table 7: Indicator table for Strategic Objective 1.

7.2.2 Strategic Objective 2 – To expand and exploit our knowledge base for the development of essential services and products that respond to user needs

Under this Strategic Objective, SANSA will pursue the following activities:

S2.1 Lead and facilitate the creation of products and applications

To achieve this SANSA will:

- identify and work closely with government departments that have an impact on societies,
- continually assess user needs by engaging service providers (including government) and private sector users,
- continually scan the global landscape for new applications that meet societal needs,
- work with public service providers to translate their needs into technical requirements for developers who develop the necessary operational applications,
- identify unique space-based products and services to enhance the South African non-space industry,
- utilise space know-how and facilities to provide technology solutions for the space and non-space industries,
- collaborate with science councils, Higher Education Institutions (HEIs) and industry to develop operational applications,
- ensure that there is synergy between the R&D agenda and the applications,
- fund applications development projects,
- set and monitor the delivery standards of space related applications, and
- continually monitor the impact of the applications.

S2.2 Increase the national space research output

To achieve this SANSA will:

- develop and implement a clear national space R&D plan,
- lead the national space R&D plan with high impact relevant research outputs,
- provide national space R&D infrastructure (observational networks, data centers, facilities),

- conduct collaborative R&D with science councils, universities and industry,
- ensure that there is synergy between research and applications,
- support national R&D through funding,
- foster international partnerships and facilitate national access to multinational projects, and
- provide national seed funding that will unlock matching national and international funding.

The **implementation** approach will entail the identification of required applications and national policy and strategy requirements. This will be done in collaboration with the user community and applications development community. SANSA will serve as the lead entity to solicit and interpret user needs and translate them into technical requirements or specifications. Collaborative teams will be constituted to develop the applications based on the technical requirements. Where appropriate, calls for proposals for applications development will be made and awarded competitively. SANSA will also provide a solution driven approach to the utilization of space know-how and facilities for the benefit of national government and industry.

SANSA will provide the necessary support for space related R&D. While SANSA researchers are encouraged and expected to conduct and lead research, increased output and impact can only be achieved by adopting and enforcing a more national collaborative approach. SANSA's primary focus should be on creating a research platform that facilitates national research and development. SANSA should, therefore, provide the necessary research infrastructure as well as leadership in space environment research. This will include developing and maintaining an extensive observational network, providing data resources and access to research facilities and acting as the centre for research. The indicator table for Strategic Objective 2 is shown in Table 8.

Strategic Objective 2: To expand and exploit our knowledge base for the development of essential services and products that respond to user needs								
Activities	**Measure**	**5-year Target**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**Impact**
S2.1 Lead and facilitate the creation of high-impact applications to address society's needs and challenges	M2.1.1 Number of products and applications	T2.1.1 9 operational space-related applications by March 2025	9	9	9	10	10	Coordinated and streamlined development of products and services that responds to the socio-economic priorities of the country
S2.2 Increase the national space research output	M2.2.1 The national research productivity score for space supported R&D	T2.2.1 Achieve a total research productivity score of 2000 by March 2025	1 300	1 300	1 500	1 800	2 000	Creation of new knowledge; developing the knowledge economy; providing a foundation for the enhancement of the understanding and development of applications.

Table 8: Indicator table for Strategic Objective 2.

7.2.3 Strategic Objective 3 – To develop, grow and transform the indigenous space industry that is responsive to local needs and is globally positioned

Under this Strategic Objective, SANSA will pursue the following activities:

S3.1 Generate greater benefit for the space programme through space operations activities

To achieve this SANSA will:

- support EO data acquisition, and
- increase the in-orbit-testing business.

S3.2 Grow the local space industry

To achieve this SANSA will:

- grow a share of South Africa's participation in the international space market,
- Support new entrants into the industry, and
- ensure that a significant component of SANSA work (in terms of monetary value) is outsourced to the space industry (both public and private).

Strategic Objective 3: To develop, grow and transform the indigenous space industry that is responsive to local needs and is globally positioned								
Activities	**Measure**	**5-year Target**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**Impact**
S3.1. Generate greater benefit for the space programme through space operations activities	M3.1.1 Successful satellite pass monitoring rate for Earth Observation	T3.1.1 Successful satellite pass monitoring maintained at a rate of 98% by March 2025	98%	98%	98%	98%	98%	A quality service in line with international standards to maintain relevance and recognition in the global space value chain thus ensuring SANSA's market share for teleport services in South Africa and Africa.
	M3.1.2 Total income generated from space operations activities	T3.1.2 Total income of R352 million generated from space operations activities by March 2025	R68 million	R69 million	R70 million	R72 million	R73 million	An increased market share of the global space operations market and recognition as a leader of space infrastructure and a preferred partner on the African continent.
S3.2 Grow the local space industry	M3.2.1 The total contract expenditure to SMEs for core space projects	T3.2.1 A total contract expenditure of 20% to SMEs for core space projects by March 2025	20% of total contracted value	20% of total contracted value	20% of total contracted value	20% of total contracted value	20% of total contracted value	Growth of the space sector through the establishment and support of SMEs and in the process ensure the transformation of the sector.
	M3.2.2 The total contract expenditure to the broad space related industry for core space projects	T3.2.2 The total contract expenditure of R306 million to the broad space related industry for core space projects by March 2025	R50 million	R55 million	R61 million	R67 million	R73 million	Growth of the space sector and the creation and maintenance of high-level engineering skills

Table 9: Indicator table for Strategic Objective 3.

The **implementation** approach requires SANSA to be the anchor client for the space industry through a sustained South African space programme. SANSA will also seek to create an environment that is conducive to and stimulates the local space industry. SANSA's partnerships will be used to strategically position the South African industry within open foreign markets, particularly those on the African continent and in emerging countries. SANSA will also focus on the data value-adding industries and space engineering sectors.

Attracting private investors for mature technologies and innovations will be critical for the sustainability of the programme. SANSA will also expand the space operation services and attract foreign direct investment. The Innovation Hub's facilities and initiatives will also be crucial in the business incubation of space SMMEs, as well as their professional development and exposure to venture capital. SANSA will work closely with State-Owned Enterprises (SOEs) with large infrastructure procurement programmes to leverage some of their off-set initiatives. The indicator table for Strategic Objective 3 is shown in Table 9.

7.2.4 Strategic Objective 4 – To build and host the appropriate infrastructure that will support the local space sector

Under this Strategic Objective, SANSA will pursue the following activities:

S4.1 Successful launch and operations of EO-Sat 1 and CubeSat missions

To achieve this SANSA will:

- develop the country's space industrial capability,
- develop competitive space technologies,
- provide leadership to implement a domestic space engineering programme with clear performance measures, and
- develop South African satellites and the local space industry in accordance with the funding allocations.

S4.2 Development or upgrade infrastructure

To achieve this SANSA will:

- develop the country's operational capability,
- position the core capabilities for use by the broader industry,
- Use the infrastructure to strengthen our research, development and innovation initiatives, and
- promote the long-term sustainability of the local space sector.

The **implementation** approach requires SANSA to provide system engineering oversight for CubeSat missions. SANSA will contract with a prime contractor to provide oversight for the design, development and manufacture of the satellite segments, but with a significant proportion sub-contracted to the local space industry to ensure effective stimulation of the local industry. SANSA will also ensure that any intellectual property developed through the CubeSat projects will be available for use by the broader space industry.

SANSA will also focus on developing and strengthening the operational infrastructure and facilities that will support the long-term sustainability of the broader space sector. These developments will also ensure an expanded focus of SANSA from its current mode of operations. Many of these developments will be unique on the continent and will be positioned as such within the broader African space programme. The indicator table for Strategic Objective 4 is shown in Table 10.

Strategic Objective 4: To build and host the appropriate infrastructure that will support the local space sector								
Activities	**Measure**	**5-year Target**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**Impact**
S4.1 Development or upgrade of infrastructure	M4.1.1 A new operational space weather centre	T4.1.1 Proportional progress of an operational space weather centre, as per an approved Business Case	20% completion	70% completion	100% completion	An operational space weather centre	An operational space weather centre	A state of the art facility that will ensure aviation safety and therefore the safety citizens traveling on the African continent
	M4.1.2 Development of Digital Earth South Africa	T4.1.2 Proportional progress towards an operational Digital Earth South Africa	Ingestion of SPOT archive	Ingestion of additional (1) sensor & product development	Ingestion of additional (1) sensor & product development	Ingestion of additional (1) sensor & product development	Ingestion of additional (1) sensor & product development	Raw data transformed into fundamental geospatial data sets that are used as input in a variety of services and products for use by key decision makers.
	M4.1.3 An upgraded AIT Facility	T4.1.3 AIT facility upgraded as per approved plan by March 2025	20%	60%	100%	An operational AIT facility	An operational AIT facility	An AIT facility that is modernised to international standards that promotes industry development and positioned for use by local, regional and international users.

Table 10: Indicator table for Strategic Objective 4.

7.2.5 Strategic Objective 5 – To foster strategic partnerships and implement changes that will allow us to respond to national and continental developmental agendas

Under this Strategic Objective, SANSA will pursue the following activities:

S5.1. Leverage a significant benefit for the space programme through global partnerships

To achieve this SANSA will:

- develop a clear partnership strategy,
- enter into formal strategic partnerships aligned with the partnership strategy,
- involve national partners in SANSA's strategic inter-agency partnerships,

- involve national partners in multi-national proposals,
- actively participate in multi-national forums,
- enter into long-term funding agreements with partners,
- develop and implement a cost-benefit framework for partnerships (this is to be used to quantify partnership value), and
- monitoring and reporting of all partnership engagements.

S5.2 Develop and implement an Organisation Design and Marketing Initiatives

- develop and implement a clear Marketing Strategy for the South African space sector,
- optimize the use of space products and services by government and industry,
- provide training to increase the demand of space-based products and services,
- improve the visibility and branding of the South African space sector,
- Communicate and publicize the service offering of the South African space sector, and
- Implement initiatives to transform SANSA into a high performing Agency.

The **implementation** approach will require SANSA to be more strategic in entering into partnerships. These should be informed by mutual benefit and a clear strategic rationale for the partnership. SANSA will use its partnerships to involve national partners in global projects. SANSA will also aim to become the hub for space partnerships, as the repository and conduit for international opportunities, and to facilitate national and international engagements. SANSA will facilitate these partnerships to ensure economies of scale and cost sharing benefits and to address any capacity gaps the national space sector may have.

Strategic Objective 5: Develop active partnerships and implement changes								
Activities	**Measure**	**5-year Target**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**Impact**
S5.1 Leverage a significant benefit for the space programme through global partnerships	M5.1.1 Number of active formal oversees partnerships	T5.1.1 A total of 15 active formal oversees partnerships by March 2025	9	10	11	13	15	Access to international opportunities through joint collaborative initiatives
	M5.1.2 Number of active formal African partnerships	T5.1.2 A total of 15 active formal African partnerships by March 2025	9	10	11	13	15	South African developed products and services positioned for use in the African continent
	M5.1.3 Number of active formal national partnerships	T5.1.3 A total of 15 active formal national partnerships by March 2025	12	13	13	14	15	Public sector institutions working together on resolving common challenges
S5.2 Develop and implement an Organisation Redesign and	M5.2.1 Percentage of government departments and public	T5.2.1 80% of government departments and public entities that	30%	40%	50%	70%	80%	Improved access to data to users and developers of services

Strategic Objective 5: Develop active partnerships and implement changes								
Marketing Initiatives	that use geospatial information using space products and services	use geospatial information using space products and services by March 2025						and products that support spatial planning and decision making processes across all tiers of governmen t
	M5.2.2 Number of awareness and training interventions to key users of space based products and services	T5.2.2 39 awareness and training interventions conducted by March 2025	7	8	8	8	8	An end user community that is capacitated to use the products and services produced by the sector
	M5.2.3 Number of initiatives to transform SANSA into a high performing Agency	T.5.2.3 6 initiatives to transform SANSA by March 2025	4 Initiatives	2 Initiativ es	-	-	-	A high performing Agency that is effective and efficient

Table 11: Indicator table for Strategic Objective 5.

A concerted marketing drive will form the mainstay of SANSA's and the South African space sector's long-term sustainability. SANSA will quantify the equivalent value leveraged through its strategic partnerships that will not always involve direct financial transactions, but will include non-transactional partner matching funds, equivalent/estimated expenditure if SANSA has to pay for the associated benefit and direct transactional project funding, among others. The business development focus is to ensure the maximum number of government departments using space-based products and services emanating from the space sector, including the provision of training courses to increase the uptake. The indicator table for Strategic Objective 5 is shown in Table 11.

GOAL	EXPECTED OUTCOME	EXPECTED IMPACT
Goal 1: The development of a suite of space application products and services that directly respond to user needs	• A suite of products and services that assist with evidence based policy making • Stimulation of an inclusive and transformed local industry through the development of products and services • Use our international partnerships to enhance our product and services as global offerings	• Our socio-economic-environmental challenges are addressed in a rational and sustainable manner • An increased market share of the global space applications market
Goal 2: The building of core space infrastructure, both ground and space based, that will enable the delivery of essential space services	• Stimulation of an inclusive and transformed local industry through the development of space technologies and platforms • Comprehensive space infrastructure that allows South Africa to play across the space value chain • Position infrastructure as part of a global space network through international partnerships	• An increased market share of the global space technology market • Recognition as a leader of space infrastructure and a preferred partner on the African continent.
Goal 3: The generation of space relevant knowledge that supports the developmental agenda	• A research productivity score for the space sector that performs above the national average • Improved products and services through the innovative use of our knowledge base • Leverage off our international partnerships to enhance our knowledge base	• The space sector as a significant contributor to the knowledge based economy • Local solutions that address local challenges • Increased access to global research opportunities that promotes the national capability and expertise
Goal 4: The development of requisite human capacity that is needed for the implementation of key space initiatives	• A cohort of graduates, addressing transformation, that are well trained to service the needs of the space and other economic sectors • Increased excitement in science, technology and innovation • Increased public access to scientific general knowledge and platforms	• A skilled workforce that can effectively contribute to the knowledge economy • Increased public support for space enabled applications and platforms
Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• A greater proportion of government institutions using space based services • The socio-economic-environmental challenges are responded to • SANSA is a known brand name	• Socio-economic priorities are achieved in a cost-effective and sustainable manner • The value proposition of space is appreciated by all South Africans

Table 12: Expected outcomes and impact in achieving the strategic goals.

7.3 Expected Outcome and Impact of the Strategic Goals and Objectives

Delivery on the Strategic Goals will have manifold outcomes and impact to the space sector and the broader public, both in terms of commercial opportunities and public good. Over the next five years, the expected outcomes and impact for the respective goals are as per Table 12 above.

DSI Strategic Outcome oriented Goals Outcomes	Appropriate SANSA Goals	Appropriate SANSA Targets
A transformed, inclusive, responsive and coherent NSI	Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• The total contract expenditure to SMEs for core space projects • Number of active formal national partnerships
Increased knowledge generation and innovation output	Goal 3: The generation of space relevant knowledge that supports the developmental agenda	• The national research productivity score for space supported R&D
Human capabilities and skills for the economy and for development	Goal 4: The development of requisite human capacity that is needed for the implementation of key space initiatives	• Number of youths directly engaged • Number of students and interns supported for formalized training

Knowledge utilisation for economic development	Goal 1: The development of a suite of space application products and services that directly respond to user needs	• Number of products and applications
Knowledge utilisation for inclusive development	Goal 1: The development of a suite of space application products and services that directly respond to user needs, and Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Number of products and applications
Innovation in support of a capable and developmental state	Goal 3: The generation of space relevant knowledge that supports the developmental agenda, and Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Number of active formal oversees partnerships • Number of active formal African partnerships • Percentage of government departments and public using space products and services • Number of initiatives to transform SANSA into a high performing Agency

Table 13: Relating SANSA Goals and Targets to the DSI Strategic Outcomes

7.4 Alignment of the Strategic Goals and Objectives with the DSI Outcomes

The DSI has adopted six Strategic Outcome Oriented Goals-Outcomes for its next five-year strategic planning cycle and these are as follows:

1. A transformed, inclusive, responsive and coherent NSI - over the next 5 years expand, transform and enhance the responsiveness of the NSI;
2. Increased knowledge generation and innovation output - over the next 5 years, to maintain and increase the relative contribution of South African researchers to global scientific output;
3. Human capabilities and skills for the economy and for development - over the next 5 years improve the representivity of high-end skills and increase the development of technical and vocational skills for the economy;
4. Knowledge utilisation for economic development - over the next 5 years improve the sustainability and competitiveness of traditional sectors of the economy and initiate/continue research and development in emerging/nascent technology areas;
5. Knowledge utilisation for inclusive development - over the next five years, expand the use of scientific knowledge (as evidence) in support of innovation for societal benefit and public good;
6. Innovation in support of a capable and developmental state - over the next 5 years, increase the use of innovation as an enabler in the delivery of efficient services and access to government programmes.

For each of these Outcomes, we demonstrate in Table 13 the appropriate SANSA Strategic Goals and Objectives, which relate to the achievement of the DSI Outcomes.

MTSF Priorities	Appropriate SANSA Goals	Appropriate SANSA Targets
A Capable, Ethical and Developmental State	Goal 3: The generation of space relevant knowledge that supports the developmental agenda, and Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Percentage of government departments and public using space products and services • Number of initiatives to transform SANSA into a high performing Agency • Number of National Partnerships
Economic Transformation and Job Creation	Goal 3: The generation of space relevant knowledge that supports the developmental agenda, and Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Number of active formal oversees partnerships • The total contract expenditure to SMEs for core space projects

Education, Skills and Health	Goal 3: The generation of space relevant knowledge that supports the developmental agenda Goal 4: The development of requisite human capacity that is needed for the implementation of key space initiatives	• The national research productivity score for space supported R&D • Number of youths directly engaged • Number of students and interns supported for formalized training
Consolidating the Social Wage through Reliable and Quality Basic Services	Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Percentage of government departments and public using space products and services
Spatial Integration, Human Settlements and Local Government	Goal 1: The development of a suite of space application products and services that directly respond to user needs, and Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Number of products and applications • Percentage of government departments and public using space products and services
Social Cohesion and Safe Communities	Goal 1: The development of a suite of space application products and services that directly respond to user needs, and Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Number of products and applications • Percentage of government departments and public using space products and services
A better Africa and World	Goal 1: The development of a suite of space application products and services that directly respond to user needs, and Goal 5: The positioning of SANSA as a key enabler of government's policy imperatives	• Number of products and applications • Number of active formal African partnerships

Table 14: Relating SANSA Goals and Targets to the MTSF Priorities

7.5 Contribution to the Medium-Term Strategic Framework

As already indicated in Section 2.2, the MTSF has seven key priorities for the current administration. In Table 14 we demonstrate relevance of the SANSA Goals and Targets to the respective priorities of the MTSF.

7.6 Implementation of the Planned Performance

In pursuing these identified Strategic Goals and Objectives, SANSA will deliver in four thematic areas that are identified as important for an effective space programme. These thematic areas include:

1. **Earth observation** – we will continue to increase our knowledge and expertise in the development of space applications products and services to address our socio-economic-environmental challenges;
2. **Navigation and positioning** – we will focus on the development of augmentation technologies, applications and services in navigation, timing and positioning including the development of know-how in the means to protect and improve these applications;
3. **Communication** – we will focus on the development of telecommunications technologies and applications in collaboration with end users; and
4. **Space science and Exploration** – we will foster and support knowledge generation (fundamental and applied research) as well as mission driven space science and exploration projects, which are of strategic interest to the region.

The expected focus for each of these thematic areas, as reflected in the Ten-Year Innovation Plan that extended from 2008 to 2018, and which is still relevant is shown in Table 15 below. These deliverables still form the bedrock and focus of the South African space programme.

Earth Observation	Satellite Communications
• Establish an Earth observation data centre • Develop a platform to integrate satellite and in-situ data • Develop medium to high resolution payloads • Establish centres of competence for optronics and synthetic aperture radar • Develop the African Resource and Environmental Management Constellation in partnership with other African countries • Consolidate the acquisition of space data for government	• Develop technologies for low data rate payloads • Develop technologies for applications in e-education, telemedicine and rural communication and disaster support • Develop a geostationary (GEO) communications system • Launch a small GEO satellite
Navigation and Positioning	**Space Exploration**
• Develop a navigation augmentation system – a satellite based augmentation system (SBAS) • Develop navigation applications to support user requirements • Develop space weather applications to enable the protection of navigation and positioning applications	• Grow the knowledge economy through space environment research, and applications development • Develop joint partnerships in space science payloads • Establish and support centres of excellence • Establish an operational space weather centre to enable and facilitate the protection of space and non-space assets and technologies

Table 15: Expected deliverables for the four space thematic areas.

Going forward and impressing on the need to deliver on government priorities in a cost-effective and efficient manner, SANSA needs to prioritise the development and strengthening of the local space value chain, as opposed to severally developing and strengthening the four thematic areas. Specifically, the different functions of the respective Programmes must be integrated to allow for value creation by helping to drive down costs and increasing the perception of value through differentiation. The notion of a space value chain refers to the idea that SANSA led activities comprise of a chain of activities for transforming inputs into outputs that end-users would value; and thus, achieve the intended outcomes and impacts identified in Table 12.

The value chain process of transforming inputs into outputs is composed of a number of primary and support activities. The primary activities relate to the design, creation, and delivery of products and services, as well as its marketing and post-delivery service. The support activities of the value chain provide administrative and technical support that allow the primary activities to take place. Critically important to interfacing between the primary activities is the cross-functional interfacing needed to achieve enhanced efficiency, quality, innovation and responsiveness to user needs.

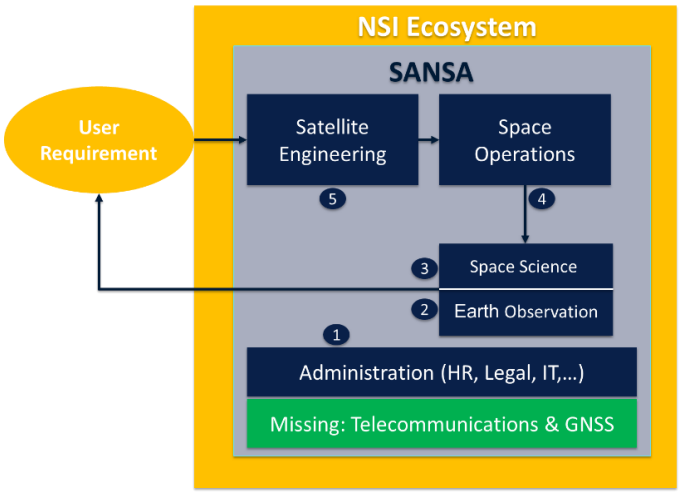

Figure 1: Space Value Chain

Figure 1 shows the space value chain of SANSA embedded in the local space sector, which comprise of the following key elements:

- Users – the value proposition of the South African space programme is determined by how well the requirements of users are met.
- NSI Ecosystem – comprise of public, private and NGO institutions that are involved in either the development of space products and services or the use of such offerings for decision making purposes.
- Primary activities, as per the various SANSA Programmes, ordered along the space value chain include:
    - **SANSA Space Engineering Programme [SE]** – The Space Engineering Programme (Programme 5) provides systems engineering and project management expertise and drives a satellite build programme in South Africa in partnership with primary contractors, R&D institutions and private sector partners. The programme conducts satellite and sub-systems analysis, leads the technical side of space programme project management, supports human capital development in space engineering and facilitates private space industry partnerships.
    - **SANSA Space Operations Programme [SO]** – The Space Operations Programme (Programme 4) is responsible for the acquisition of satellite data for the Earth observation programme and the provision of ground segment support. Through this programme, SANSA conducts various space operations, including launch and early-orbit support, in-orbit testing, satellite life-cycle support and satellite mission control for national and international space industry clients and governments;
    - **SANSA Space Science Programme [SS]** – The Space Science Programme (Programme 3) leads multi-disciplinary space science research and applications. Key functions include fundamental and applied space science research, the support of space facilitated science through data acquisition, the coordination and administration of scientific data, and the provision of space weather and magnetic technology products and services on a commercial and private basis. The programme also provides leadership in post-graduate training as well as providing science engagement, public engagement, and learner and educator support with STEM subjects; and
    - **SANSA Earth Observation Programme [EO]** – The Earth Observation Programme (Programme 2) is responsible for the collection, processing, archiving and distribution of Earth observation data, value-added data products and services for societal benefit. SANSA maintains an Earth observation portfolio of sensors, provides an R&D platform, conducts satellite image processing and correction, and supports human capital development and science engagement in Earth observation that will be positioned for takeup in South Africa through the SAEOS initiative and in Africa through the AfriGEO initiative.
- Support activities for facilitating the primary activities is through the Administrative Programme:
    - **SANSA Administration Programme [SA]** – The Administration Programme (Programme 1) provides management, administrative and technical support across all operating units. This facilitates operational efficiency and cost-effective management, aligned with sound governance principles and the seamless integration and collaboration between SANSA Programmes.
- There are currently two thematic focus areas that are missing from SANSA's portfolio of activities, namely, satellite telecommunications and global navigation satellite services (GNSS). This Strategic Plan attempts to establish programmes related to these thematic focus areas within SANSA and falls under SANSA's aspirations.

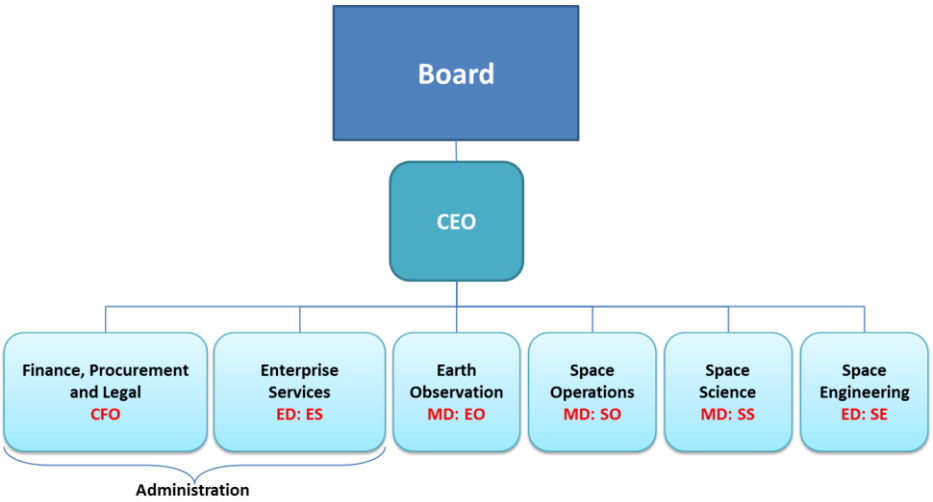

Figure 2: SANSA's Organisational Structure.

Strategic Goals	Programmes				
	Administration	Earth Observation	Space Science	Space Operations	Space Engineering
The development of a suite of space application products and services that respond to user needs	✓	✓	✓		
The building of core space infrastructure, both ground and space based, that will enable the delivery of essential space services	✓	✓	✓	✓	✓
The generation of space relevant knowledge that supports the developmental agenda	✓	✓	✓		✓
The development of requisite human capacity that is needed for implementation of key space initiatives	✓	✓	✓	✓	✓
The positioning of SANSA as a key enabler of government's policy imperatives	✓	✓	✓	✓	✓

Table 16: Contribution of SANSA Programmes to the Strategic Goals.

The organizational structure for SANSA is shown in Figure 2. Each of the Programmes will operate along the space value chain and will work seamlessly in addressing the socio-economic-environmental challenges it has been mandated to. Each of the Programmes contribute in varying degrees to the Strategic Goals highlighted in Section 7.1, and these contributions are indicated in Table 16.

7.7 Key Risks

It is important for SANSA to recognise any risks and manage it appropriate. There are five such identified risks which follows and further captured in Table 17:

1. Catastrophic failure of infrastructure,
2. Inability to secure the funding required to meet the current and future needs of SANSA,
3. Limited ability to attract, retain and afford the full skills-set required SANSA to deliver on its strategy and mandate, and
4. Inability to deliver on the SANSA mandate.

Risk Description	Root Causes	Consequences	Control Actions
Catastrophic failure of infrastructure	• Use of aged corporate and operational ICT infrastructure. • Use of aged product/service infrastructure (e.g. Magnetic technology infrastructure) • Inadequate product/service infrastructure (Partial implementation infrastructure specification – compromise due to funding constraints) • Shortage and/or retention of specialized technical skills • Electrical, RF and magnetic interference • Disruption in the supply of satellite data for the two products and services offered by Earth Observation.	• Deliver poor quality product and services • SANSA will be in breach of contract for the supply of products and services • Higher production costs • Termination of contracts by customers. • Negatively impacts SANSA's creditability and reputation nationally and internationally. • Reduction in research productivity • Growth and development of the national space industry stagnates, and/or declines	• Planned preventative maintenance system • Purchase of extended warranty • ICT Disaster Recovery Plan • Talent Management Framework • Divisional Training Plans • Daily monitoring of the environment for electrical, RF, and magnetic interference • Building of awareness on the impact of electrical, RF and magnetic interference • Planned and designed redundancy • Quality control of product and services • Contract Management System
Inability to secure the funding required to meet the current and future needs of SANSA.	• As a Schedule 3A entity as per the PFMA – SANSA is prohibited from taking loans, earning interest income from investment activities; saving funds for large infrastructure investments and self-insurance • Current Parliamentary Grant of R138 million accounts for approximately 25% of the budget required for SANSA to conservatively deliver on its mandate. • The lack of an appropriately positioned champion(s) to grow and develop the space industry. • The lack of a parliamentary liaison officer, to strategically drive and position the achievement of the National Space Strategy. • Decline in grant funding nationally and internationally. • Commercial income is under threat – perception of international clients that it is risky to do business with SANSA • Commercial income is under threat – Decline in the budgets of national clients.	• Researchers spend more of their time writing proposals for funding, as opposed focusing on research outputs. • SANSA executives spend more of their time on trying to manage and mitigate the negative impacts of limited funding, as opposed strategically leading and driving the organisation, and ultimately the achievement of the National Space Strategy. • Researchers and technical staff are being over-stretched – limited human resources are required to deliver the same output. • Lower output, in terms of quality and quantity; and longer lead-times to achieve outputs. • Growth and development of the national space industry stagnates, and/or declines. • SANSA's ability to pursue new opportunities is negatively impacted.	• Financial Sustainability Framework • Bi-annual engagement between the Minister and the Chairperson of the Board • Bi-annual bi-lateral meetings between SANSA and the DSI • AENE process • Submission of funding proposals

Risk Description	Root Causes	Consequences	Control Actions
Limited ability to attract, retain and afford the full skills-set required SANSA to deliver on its strategy and mandate	• Shortage and/or retention of specialized skills • Geographic location of SANSA's facilities • Social dynamics of the areas in which SANSA's facilities are located, may not be attractive to potential staff. • Performance management system currently used by SANSA • Insufficiently exciting and challenging projects • Loss of key staff to industry • Uncertainty around the sustainability of SANSA	• Disengaged staff • Appointment of staff to positions that they are not skilled and/or appropriate for • Critical posts are vacant for protracted periods • Increased burden on existing staff • Perception that SANSA is not an employer of choice	• Job Evaluation Committee • Recruitment and Selection Policy • Remote Location Policy • Performance Policy • Performance Management Committee • Remuneration and Rewards Policy • Talent Management Framework • Promotions, Secondments and Transfers Policy • Culture Change best practices
Inability to deliver on SANSA mandate	• Lack of political buy in for a National Space Programme • Lack of growth in investment to fund SANSA • Lack of institutional review since the inception of SANSA • Incorrect implementation of reporting lines into the Ministry • Relevance of the Business Model/Design in line with strategy • Inability to look at potential re-scheduling in line with business requirements	• Demotivated and misdirected employees • Inefficiencies within the organization • Misinterpreted role of SANSA within the Space environment • Misalignment of expectations	• SANSA new 5 year Strategy (2020-2025) • PPC oversight • DSI/SANSA Bilaterals

Table 17: Strategic Risks of SANSA

7.8 Delivery at Institutional and Community Levels

The ownership of the government priorities elucidated in Table 1 above reside across many national and provincial government departments and also at the local district and municipality levels. In order to ensure that the implementation of these priorities is impacted at the correct level, SANSA will:

1. Work closely with the DSI in engaging other line departments (at national and provincial levels) so that our interventions have maximal impact to the priorities of these institutions.
2. Work according to the District Delivery Model, that has recently been adopted by government, to ensure maximal impact at the local district and municipality levels.

SANSA will also introduce a number of interventions (subject to funding) to assist in ensuring impact at the institutional and community levels through awareness and training interventions.

8 ASPIRATIONAL INITIATIVES

This Section presents an extended Plan for SANSA, which essentially reflects the additional activities, per the various Programmes, that the organisation should take on subject to the appropriate levels of funding being committed or secured. These activities will be undertaken in partnership with the broader space sector but will also require a refinement of SANSA's roles and responsibilities in providing the appropriate leadership to the sector.

8.1 Earth Observation

The Earth Observation Programme is responsible for the collection, processing, archiving and distribution of Earth observation data, value-added data products and services for societal benefit. SANSA maintains an Earth observation portfolio of sensors, provides an R&D platform in Earth observation technologies, conducts satellite image processing and correction, and supports human capital development and science advancement in Earth observation. Earth observation products and services provided by SANSA are already playing a fundamental role in supporting policies and activities linked to food security, water resource management, human settlements mapping, disaster management, environmental monitoring, climate change, urban sprawl, census planning and electrification planning.

The Earth Observation Programme will continue to play a supporting role in (i) the sustainable development and monitoring of the environmental, (ii) minimising the health, safety and security risks, and (iii) promoting innovation and economic growth, through the provision of geospatial and in-situ products and services to lead government users. In so doing, SANSA will pay a pivotal role in providing the essential data and tools to decision-makers for evidence-based policy making. The archived data, together with space-based and in-situ environmental parameters, provides a powerful source of information for change detection studies.

8.1.1 Data and Infrastructure

The collection, storage, archiving, processing and dissemination of satellite imagery, together with the development of fundamental data sets and the coordination of the development of value-added products and services through the National System of Innovation (NSI) are the core functions of the Earth Observation Programme. The development of geospatial products and services is reliant on the availability of satellite and in-situ data and IT infrastructure. For this purpose, access to a portfolio of sensors, the integration of disparate datasets, and the ability to process data, are vital to achieving the core functions of the Programme.

The acquisition, archiving and dissemination of satellite datasets is thus also a core function of the Earth Observation Programme. Satellite datasets are a critical input in stimulating innovation and the

development of value-added products and services within the entire Earth observation landscape across the African continent. To meet the wide user demands, SANSA anticipates widening its sensor portfolio to increase its range of satellite data products to improve the diversity of its offerings at various spatial, spectral and temporal resolutions. The GEO Open and Free Data Policies have significantly increased the range of open and free datasets that SANSA will archive and distribute freely to various users.

The multi-user single licence negotiated by SANSA for high-resolution satellite data will continue to provide government users with a cost-effective means of acquiring satellite data. New datasets, as they become available, will also be sourced for use nationally and on the continent. Collaboration with a number of countries, both in Africa and abroad, becomes important especially when considering large scale phenomena that transcend national and regional boundaries, such as climate change modelling and food security applications.

The Earth Observation Data Centre, as part of the SAEOS initiative, will be positioned as a central hub for Earth observation data archiving, storage and dissemination of data and information and will be called Digital Earth South Africa (DESA). This will be achieved through implementing a High-Performance Computing Centre for Earth observation enabled for Big Data processing and with the capacity to provide cloud services. The cloud solutions will enable better scalability, as new sensor data requirements emerge. This new state of the art High Performance DESA will be comprised of an EO-hybrid cloud and innovative technologies and tools for image processing and data dissemination. Establishing the EO cloud as a node will facilitate enhanced data access services, joint technology development, sharing of distributed infrastructure and involvement in strategic and collaborative data systems research programmes. It will further support delivery on the SAEOS Portal.

8.1.2 Development of National Land Use and Land Cover Base Datasets

The development of national base datasets such as biophysical variables, water bodies, human settlements, vegetation layers and satellite mosaics is critical in supporting the Earth observation user community with fundamental environmental parameters for further manipulation and transformation. Access to base datasets will provide scientists and industry professionals with the opportunity to develop specific value-added products and services to meet dedicated user needs. We aim to focus on key base layers that fulfil multiple user needs such as water, vegetation and human settlements. SANSA's new strategic goals are intended to be responsive to the user needs in Earth observation and have been tailored to bridge existing gaps in the provision of essential public good national base products and services.

A base map provides a user with context for a particular product or service in that you can add information to a base map by overlaying other information over it. Base maps contain reference information that may provide geospatial information based on what the user is trying to convey. For example, water body base maps provide the baseline information of assessing the rate at which important small water bodies, such as farmland reservoirs and wetlands, recede and how agricultural intervention measures could be put in place to remedy agricultural water security. Thus, base maps provide essential information that can be used to manage the use and preservation of vital resources, as part of a broader sustainable development agenda.

SANSA researchers and experts will focus on the development of essential base products and services that is needed by the end-users and also by public and private sector entities for use in their respective products and services. The development and distribution of these base products and services will provide an enabling environment for other entities to further pursue business and development opportunities; thus, meeting SANSA's mandate of developing the local space industry. SANSA will also provide essential training, where required, to develop the skills of the Earth observation sector in using the base products and services, thereby increasing the demand for such products and services.

SANSA will engage with the Earth observation sector and the user community for the effective development, access and distribution of the base maps. Partnerships and discussions will be entered into with local and international institutions for further developing and improving the base maps to create the most optimal solutions based on current technological capabilities. The demand for the base maps will be increased through appropriate awareness campaigns and training interventions, especially at provincial, local and municipal levels where the uptake and use of space applications could be improved.

8.1.3 Co-ordination of the Development of Products and Services

The thrust on co-ordinating the development of Earth observation products and services is critical for enabling SANSA to contribute to national priorities and strategies such as the National Development Plan (NDP), the 9 Point Plan, Operations Phakisa, the NSS, the SAEOS, the Ten Year Innovation Plan and international imperatives such as United Nations Sustainable Development Goals and the African Union Agenda 2063. In line with the new proposed vision and given the development of the African space programme, developments of these products and services on the national front will be extended for use on the African continent or through the co-development and use of such products and services with African partners.

Cutting edge research and development will remain fundamental in driving the innovation process for product development. This will be achieved through algorithm development for image processing and information extraction from satellite imagery, i.e. on the processing chains. Efforts are underway in partnering with a number of local institutions to develop an African Research Cloud server, where geospatial information can be archived and processed at a continental level. Such involvement will allow SANSA immediate access to potential African users, thus increasing the demand for the local space sector's portfolio of products and services. Key partnerships will be forged and maintained with the New Partnership for Africa's Development (NEPAD) and the African Union space initiatives to provide expertise and leadership in developing the African space programme.

The collection and consolidation of user requirements is a critical element in addressing the wide range of customer requirements. SANSA will use platforms such as the communities of practices and various platforms in Africa, together with survey tools, to collect user requirements. The development of value-added products and services will thus be responsive to the user needs of stakeholders in all three spheres of government (national, provincial and local) and public entities. SANSA will lead innovation challenges and funding calls to drive the development of products and services. Joint proposals will also be exploited as a means of soliciting funding from funding instruments and agencies to drive the innovative development of products and services.

Leveraging off international partnerships will also be essential for coordination efforts in the Earth observation sector. As a primary agency of government mandated with the coordination of the Earth observation sector, international partnerships at an intergovernmental and interagency level, will be implemented/coordinated by SANSA to ensure that new technological developments and potentials for collaboration are optimised for the Earth observation sector. For example, SANSA's participation in the Group on Earth Observation (GEO), AfriGEO, and the Committee for Earth Observing Satellites (CEOS) must flow back into the national Earth observation sector as avenues for new opportunities or technological advancements.

8.2 Space Science

The Space Science Programme within SANSA leads multi-disciplinary space science research and applications. Key functions include fundamental and applied space science research, the support of space facilitated science through data acquisition, the coordination and administration of scientific

data, and the provision of space weather and magnetic technology products and services on a commercial and private basis. Through the Space Science Programme, SANSA contributes to the worldwide network of magnetic observatories responsible for monitoring the Earth's magnetic field and participates in global scientific projects.

The SANSA Space Science Programme is based within a magnetically clean environment located in Hermanus in the Western Cape with facilities that contribute significantly to space systems and applications development through, for example, space qualified magnetic sensors and space weather information. The programme also provides leadership in post-graduate student training as well as providing science advancement, public engagement, and learner and educator support with STEMI subjects.

8.2.1 Space Environment

The space environment segment will aim to create knowledge, deepen understanding, and develop applications that enhance the know-how and usability of the near-Earth space environment. This segment's most significant contribution will be to the knowledge economy. This will involve fundamental and applied space science research in the following areas: space weather, geomagnetism, ionospheric science, space climate studies, plasma physics, solar physics, heliophysics, and atmospheric physics. In addition, Space Situational Awareness and Space Safety, which will involve the study of the space environment and hazardous situations caused largely by harmful (highly energetic) particles ejected from the sun and man-made space debris, will be included.

A 24/7 operational space weather centre will be maintained providing a platform for products and services that are developed for mostly industry applications. These product and service offerings will mainly be for the defence, aviation, and energy sectors, and will serve primarily communications, and navigation applications. In order to ensure quality and growth within the centre, a space weather forecast verification project will be put into operation that will aim to analyse and verify forecasts for past space weather events, feeding this information into improvements within the centre's output. This activity is in line with international trends within the space weather field. Space environment training will be provided to industry, and university partners to create awareness of space weather impacts and the need for mitigation techniques. To ensure capacity building and growth within the research of the space environment a Research Chair in Space Weather (preferably within the Solar Physics field) will be appointed in partnership with the National Research Foundation (NRF) and DST.

The use of space-based information has increased in the last decade and therefore there is a need to protect space assets, as well as technological systems from the hazards of space. A strong space science research programme will produce essential scientific data and understanding of the source processes of space weather dangers and thus enable effective forecasting and mitigation of these dangers. Collaborations with the South African national disaster centre, and city centre disaster control centres will be forged. The aim will also be to have space weather listed as a national risk to the economy and industry.

The currency of space environment research is high quality internationally accredited data. SANSA has developed expertise and capability in measuring space from the ground and owns an extensive database of geophysical ground-based space data. This needs to be supplemented by in-situ space data collected using scientific payloads on-board satellites. SANSA will aim to eventually launch a national space weather satellite in the long term, however, in the next 5-year period the aim will be to place strategic in-situ experiments as scientific payloads on existing satellites.

8.2.2 Space Science over the Southern Oceans and Polar Regions

The convergence of geomagnetic field lines at the Polar Regions makes Antarctica a window into the near-Earth space environment providing excellent space weather data. Space science studies

undertaken in Antarctica include the understanding of the dynamics of the high latitude ionosphere and magnetosphere and coupling of the layers of the atmosphere. In addition, installing infrastructure on the Southern Ocean Islands provides the opportunity to investigate the dynamics of space over a wide range of latitudes, in particular in relation to the South Atlantic Magnetic Anomaly (SAMA). Also, South Africa is seen as a gateway to Antarctica and the Southern Ocean Islands by international partners and therefore it is important that South Africa participates in the discovery of unknown space dynamics in these regions. This segment will deal with the quest for the answers to unknown space science questions in the Southern Oceans and Polar Regions, as well as the infrastructure required to enhance the database for this scientific discipline.

The SAMA is a region currently located over central Brazil where the geomagnetic field is significantly weaker, and the shielding effect of the magnetic field is severely reduced (approximately 30% in comparison to similar latitudes around the globe). Reliable determination and evaluation of the radiation hazard in the SAMA region is very important for institutes operating satellites in low-Earth orbit, and particularly for the assessment of radiation risks to humans in space. Further studies are needed to fully understand this anomaly. A microsatellite space weather mission would be the best opportunity to monitor this region.

SANSA's High-Frequency (HF) radar located in Antarctica provides extensive opportunities for unique research, and international partnerships. This radar is part of the SuperDARN network and through this international network, SANSA has access to a global network of instruments. Due to the specialised capabilities required to maintain the radar, an RF development laboratory has been established at SANSA to facilitate the specialised training of students and engineers. The development laboratory will be exploited for training in a variety of other areas as well. The instrumentation network on Antarctica and the Southern Ocean Islands (Marion and Gough) will be maintained and strategically grown with the aim of enhancing the possible science and providing a geo-space window platform as the foundation for space weather applications.

The training of engineers and take over personnel for the Antarctica and Southern Ocean islands is essential for the success of the project. This training should include competency testing, rope climbing ability, and technical skills needed for remote station operations. There should also be long term support (pre- and post-assignment) to the engineering personnel. As a long-term activity, it is proposed that a satellite ground station for polar orbiting satellites be installed in Antarctica. The investigative groundwork could be accomplished in the 5-year term period with a longer-term goal being the installation and operation of such a station.

8.2.3 Applied Electromagnetic Technology

The applied electromagnetic technology segment allows for the provision of space and non-space applications from the specialised capabilities afforded by a space science programme and the unique facilities owned by SANSA in Hermanus.

SANSA plays a very important role in advising users of the commercial off the shelf (COTS) magnetometers in the use as well as acquisition of the magnetometers and magnetic sensors. A magnetic sensor integration service is also provided, with expertise being directed towards solutions for specific customer needs. The unique calibration services offered by SANSA have become essential to users. For example, the calibration and maintenance of magnetic navigation instruments, such as landing/reference compasses is imperative in order to adhere to international flight safety regulations. The characterisation of the magnetic and electric signature of naval vessels and aerospace platforms for various purposes is another unique service provided by SANSA. The client base for the products and services provided through applied electromagnetic technology will be expanded to allow access to other African countries and international partners.

Superconducting Quantum Interference Devices (SQUID) magnetometers are ultra-sensitive and can monitor minute variations in the global magnetic field caused by solar or geological activity and thus provide means of predicting costly environmental disasters. Deployment of SQUIDs in South Africa is important because of South Africa's close proximity to SAMA and for good latitudinal coverage. The SQUID project has a strong collaboration with France, bringing international expertise to the programme. Further intention is to investigate the possibility of deployment of a 2nd SQUID magnetometer to a remote location such as within Africa, Antarctica or the Islands.

Geomagnetic field modelling is important for the provision of accurate magnetic maps that are utilised in a wide variety of applications, such as land surveying, aviation etc. The updating and continued improvement to the Southern African geomagnetic field model will remain an ongoing activity.

The area of space qualified magnetometry will be grown to accommodate the satellite build support needed. Working with the space industry, more international customers will be sought, and the expertise and capability will be grown in this area. Additional satellite support options will be explored, such as the integration of payloads, sensor testing, and satellite characterisation.

The magnetically clean environment that has been built over the years in Hermanus will be modernised and expanded to accommodate a growing need. The magnetic laboratory infrastructure requires modernised controller systems and upgrading to ensure that a state-of-the-art environment is maintained. This is also important for enhancing service delivery and overall performance. An essential requirement, which is also pertinent to the other segments, is the legislative protection for the Hermanus Facility. The facility is over 80 years old, has an environment that has been nurtured and built up over the years, and provides the unique value add to the space science programme in South Africa. The magnetically clean aspects of the facility make it an ideal location for the provision of unique products and services, as well as for the provision of a data intensive platform for applications and research. To recreate this environment would be extremely costly.

8.2.4 African Instrumentation Network

Africa has a unique geographic advantage in that a wide range of geographic latitudes is reached in one continent and the magnetic dip equator passes through the middle of the continent. In addition to the SAMA (mentioned in segment 2), another anomaly of interest is the Bangui anomaly, which is a controversial region of high magnetisation in the Central African Republic. There is a lot of potential for expanding the SANSA geophysical instrumentation network within South Africa and into Africa. South Africa has a role to play in partnering with Africa, and SANSA could be positioned to lead a scientific effort in space science exploration on the continent.

The field of space science offers a gateway to new technology in the sense that the requirements to understand the space environment push the limits of technology. Currently there exists an extensive ground-based network providing data on the space environment over South Africa. This needs to be expanded to widen the observable area into Africa. The research infrastructure requirements include distributed ground networks, access to satellite data, and high-performance computing requirements. The aim is to build on the existing infrastructure, stretch the capacity to include satellite data from the African region, and build on the existing computational capacity. Expansion would include the introduction of African ionosondes, and GPS scintillation receivers strategically placed in the north to supplement the existing network, an optical scanning Doppler imager in Sutherland, and a LOFAR station in Hermanus. Long term plans include a low-latitude radar located in South Africa. Expanding the instrumentation network into Africa is a requirement for the operational space weather centre as well since providing regional space weather information requires real time data access throughout Africa.

The opportunities for hosting infrastructure for national and international partners will be explored with the view to becoming a strategic hosting partner in the future. This will entail utilising SANSA expertise, and regional partners to broker locations and commissioning of hosted infrastructure for stakeholders in space science. For example, the hosting of equipment for the Satellite Based Augmentation System (SBAS) project, and the hosting of a European GPS receiver in Zambia.

Given the growth and interest in CubeSAT programmes around the region, as well as the suitability of these small satellites to do scientific missions, there is potential to become more involved by offering ground station support for CubeSAT missions. By developing a network of ground stations, the possibility for more data downloads is increased and missions can be enhanced. The development and implementation of a ground station can give rise to a large number of engineering projects. Initially a VHF/UHF system (144-146MHz, 430-440MHz) would be installed and possibly then an L band or S Band dish. Instead of using expensive radio receivers, Software Defined Radio (SDR) (with FPGA technology) would be utilised as a cost-effective approach to the back end. This would create excitement and provide a useful data set for African science.

The currency of space science is high-quality data, and, therefore, a data management tool for all scientific data collected over Africa is being developed. The South African National geophysical Data and Instrumentation Management System (SANDIMS) has been designed to manage the extensive instrumentation network, and ensure that all data is collected, processed, archived and appropriately distributed. In addition, the data management process will include a data policy for accessibility and usage; data archiving and distribution procedures, records and statistics; and a common point of contact for all data requirements.

8.3 Space Operations

The Space Operations Programme is responsible for the acquisition of satellite data for other SANSA Programmes and the provision of ground segment support. Through this Programme, SANSA conducts various space operations, including launch and early orbit support, in-orbit testing, satellite life-cycle support and satellite mission control for both national and international space industry clients and governments. The Programme also supplies hosting capabilities with the intention of expanding this capability to teleport and deep space network services.

The Space Operations Programme is largely business focused in terms of providing essential services to clients at a fee and is perhaps the area that has the greatest potential for growth and income generation for SANSA. It also forms a vital link between the satellite platform and the data segments, by providing seamless integration between these disparate systems through data telemetry support, which downloads the data into the relevant data infrastructure.

8.3.1 Teleport services

Teleports are the ground-based side of the global satellite network. They provide terrestrial networks with access to satellite transponders in orbit 36,200 km above the Equator. Teleports are thus the channel by which a satellite can be integrated into complex networks involving fibre, microwave, wireless and mobile technologies in order to expand their reach beyond the edge of the network, broadcast one-to-many, or feed bandwidth-hungry applications. Teleport operators have become experts at bridging "incompatible" systems and solving "impossible" problems in content delivery or end-to-end networking and know how to simplify the complexities of space-based networks in order to make satellite links just another port on the router.

The purpose of Investing into teleports is aligned to the expansion of the Space Operations business portfolio to enhance the future oriented growth potential. The intended teleport hosting is in line with the present offerings of the space operations business and will complement the expansion of the

present hosting portfolio. Due to the nature and requirements of teleport hosting where communications are crucial, it will help expand the SANSA portfolio of offering to include space-based internet connectivity. The expertise that will be developed will enable SANSA to win over business enterprises that involves no local satellite segments at all, whether it is providing hosted mobile switching or managing video distribution on terrestrial networks.

The expansion into teleports will ensure financial sustainability of the organisation and ultimately the expansion of the workforce and the retention of highly skilled staff. The expansion into the Teleport market will ensure that SANSA has the capability and skills for any envisaged South African Satellite build projects, thus catering for mission control, satellite-based augmentation systems (SBAS), data management and many other satellite applications required for local and African communities. Furthermore, the investment into the teleport business would give comfort to the present international stakeholders as this would be seen as an improvement in terms of reliability, staff compliment, skills level and business growth.

The expansion of the space operations business into teleport services will also help create a market entry into Africa, as these are essential services that is needed throughout the African continent. Whilst VSAT technologies are widely used in Africa to access geostationary communications services, the emergence of a suite of low to medium Earth orbiting satellites to provide connectivity requires a different receiving platform for such services. This requires dedicated teleport facilities in Africa, which provides important partnership opportunities that could help spur growth.

8.3.2 Deep Space Network hosting

When it comes to making a long-distance call, it's hard to top the Deep Space Network. It’s the largest and most sensitive scientific telecommunications system in the world. The Deep Space Network - or DSN - is an international array of giant radio antennas that supports interplanetary spacecraft missions, plus a few that orbit Earth. The DSN also provides radar and radio astronomy observations that improve our understanding of the solar system and the larger universe. The DSN consists of three facilities spaced equidistant from each other – approximately 120 degrees apart in longitude – around the world. These sites are at Goldstone, near Barstow, California; near Madrid, Spain; and near Canberra, Australia.

As more and more planetary missions are planned, for example, to Mars and beyond, the current DSN is overloaded and NASA, and other leading space agencies, are in the process of expanding DSNs to accommodate the workload, as well as moving to new technologies. The existing DSN operates in the normal S-band, but since the requirement for higher bandwidth, NASA has decided to move to Ka-Band. Ka-band gives us significantly more data throughput, but the higher frequencies of Ka band are significantly more vulnerable to signal quality problems caused by rainfall, known as rain fade. The strategic placement of these sites permits constant communication with spacecraft as our planet rotates – before a distant spacecraft sinks below the horizon at one DSN site, another site can pick up the signal and carry on communicating.

Currently NASA is in discussion with SANSA to establish a DSN site in South Africa. SANSA has proposed a site close to the Karoo town of Maatjiesfontein, due to ideal weather and precipitation conditions and a quite radio frequency environment that is already regulated. SANSA believes that establishing a DSN site at the town of Maatjiesfontein will also add value by extending the SANSA facilities to an area where higher frequency bands can be supported from. This helps bring new opportunities to SANSA, as we expand to a new location and attract new facilities and infrastructure hosting in South Africa.

This potential DSN expansion will also help create opportunities for social development within the Western Cape area, which is much needed for the people living in the Karoo. In line with the introduction of DSN services in Maatjiesfontein, NASA in partnership with SANSA will provide internet

connectivity to the local community. This internet penetration will help create new opportunities for social and economic development, as access to information and e-services are vastly improved leading to improvements in the quality of life and wealth creation through, for example, increased tourism.

8.3.3 Telemetry, Tracking and Command

The SANSA Space Operations facility is geographically ideally positioned as a centre for Tracking, Telemetry and Command (TT&C) for geo-synchronous, polar orbiting and scientific spacecrafts. The facility has over 52 years of experience in the field of TT&C support that started with NASA and JPL in 1960 and continues with support from the French Space Agency (CNES), Boeing, Intelsat, other national space agencies, and aerospace companies. SANSA currently operates antenna systems in the S, C, X, Ku, DBS, Ka bands and uses state-of-the-art communications and reliable power distribution.

Thus, the TT&C activities of SANSA is driven primarily by the needs of international clients in Europe and the USA. The operational efficiencies that these clients require to remain competitive in the space industry have driven the consistently reliable performance of the Hartebeeshoek station, which has established itself as the most reputable TT&C tracking station on the African continent. Since 1984, th facility has supported over 300 spacecraft in low-Earth orbits and high-altitude geostationary orbits. The ground station notched up an unprecedented 10 launch supports during 2010 alone, while maintaining service levels at 100%.

To enhance these TT&C services, SANSA has to build on its recipe of success, including quality of service, adaptability, state of the art equipment, skilled staff, favourable geographic location enabling the support of a wide range of satellite orbital slots, 24/7 operations – 365 days of the year, market related pricing and the automation of TT&C services. In order to fulfil these challenges, SANSA has to continuously develop its infrastructure by way of maintenance and capital expansion. Dedicated investments will be sourced for this purpose, as well as positioning these facilities for the hosting of data receiving stations of foreign satellites for local and regional usage.

TT&C services will also be enhanced for future South African missions. In particular, TT&C support services will be established for the current EO-Sat 1 mission and future satellite missions that are planned over the medium to long-term for South Africa. Dedicated mission control segments will be established at the facility together with effective ICT linkages to the on-site data storage, processing, and distribution chains. This enhancement will also support potential African missions.

8.4 Space Engineering

The Space Engineering Programme leads systems engineering and project management excellence and drives a satellite development programme in South Africa in partnership with external contractors, R&D institutions and private sector partners. The Programme conducts satellite and sub-system analysis leads the technical side of the space programme project management, human capital development in space engineering, as well as facilitates private space industry partnerships.

The Space Engineering Programme supports the development of space systems to meet the broader user requirements for operational and scientific requirements of the country. The characteristics of these missions will largely be in the area of Earth observation, marine applications, communication and science. In order to ensure that these capabilities are maintained over the long-term, it is critical that space missions are properly phased in to ensure the sustainability of the space sector through the satellite missions.

8.4.1 Space Missions

A critical role for the Space Engineering Programme, in partnership with the other SANSA Programmes, is to engage users on the user requirement and specification of a satellite. Due to the

dynamic nature of satellite requirements these often change and are managed independently. The Programme will define missions, which will include various payloads for different applications. It is envisaged that through a systematic approach, satellites will be developed to meet the key areas of environmental resources management, health, safety and security and innovation and economic growth. The Space Engineering Programme is also critical for the purpose of planning and resourcing skills required by various entities to support government initiatives.

In order to fulfil the technology risk and the use of various major components, a Space System Technology Ready Level (TRL) scale will be used. SANSA will determine the technology readiness level and the level of maturity to be included in the subsystem design process. This further allows an assessment of development areas within the industry. There are a number of key areas that needs attention within SANSA when looking at a particular space mission and that includes the integration of activities along the space value chain so that the mission is an exercise of programme management rather than project management of different segments of the value chain devolved to the level of the separate Programmes within SANSA.

The focus of space missions is to identify the key satellite missions over the next five years and to ensure that the base competencies and technologies are available to support the various missions. This will then translate into a technology roadmap in terms of how the missions will be realised over time, taking into account the requirements for financial and human resourcing. Particular attention will also be paid in developing partnerships on the African continent to ensure that the vision of SANSA is fully realised. Such partnerships will focus on the development of key space based and ground based technologies and on the use of satellite data coming from such missions.

Currently, the national priorities in terms of missions include optical and synthetic aperture radar (SAR) missions. These are vital for fulfilling the user requirements of all of government. However, we also need to phase in the development a continuity mission that will ensure data continuity along the EO-Sat family of missions. Current technological achievements relating to radar technology for defence purposes are being put to use towards the development of a SAR mission, which is in the conceptualisation phase. In addition, due consideration will also be given to future CubeSat and scientific missions.

8.4.2 Industry development

SANSA will lead the development of the Space Industry across the different segments of the value chain, whilst optimising the capital investment made available by government. The identification and development of technologies required to fulfil niche market opportunities will provide impetus to the South African space industry. This development will take place through either Centres of Excellence or Centres of Competence that will help in the design and development of those technologies, both at a component and sub-system level. This will further add value to human capital development by encouraging the participation of universities, through grants, to offer new courses or improve existing courses in science and engineering with the potential for the development of human and infrastructure capability. The new capacity will be sustained by the growth and expansion of the market segment captured.

It is envisaged that a platform for business incubators will help foster business networks, facilitate the commercialisation of products by industry, and promote the marketing of the local product offering. This will help South Africa position itself to take advantage of distinct market opportunities to optimise the generation of employment, increase our research capabilities and the expansion of local human capital and infrastructure. Such developments will further assist the South African space industry to secure a market share of the global satellite segment.

SANSA will also use the Houwteq facility to develop new technologies in conjunction with industry. Start-ups would be assisted by Houwteq located engineers in the development process, thereby fulfilling the role of one of the space technology incubators. A contracts Department would assist the start-ups to commercialise new technologies and would prepare contracts that would help the management of Intellectual property and assure that upon successful launch some of the financial benefits would be returned to SANSA so that this assistance to industry could be continued into the future.

SANSA will assume responsibility for the scoping, development and implementation of an Industry Development Framework. Such a framework will be developed in consultation with the Departments of Science, focusing on R&D led industry development, and Trade and Industry, focusing on the localisation of mature technology platforms. Partnerships will also be entered into with the Technology Innovation Agency, for the development to prototype phase, and with the Industrial Development Cooperation, for market ready products and services within the space sector. SANSA will work with **the dti** in opening up its incentives for industrial development of the space sector.

8.4.3 Facility development

In order to embark on providing space solutions to government users, facilities become crucial in the implementation of the plan. It is important that important facilities on the space value chain reside within SANSA. For this reason, ownership of Houwteq within SANSA will ensure that assembly, integration and testing (AIT) services are provided to the South African space, automotive, and defence industries, designed to incentivise the growth of those industries. An added benefit is that through this AIT activity, SANSA will keep a much closer contact with the various stakeholders and be more in tune with their needs and aspirations. The Houwteq facilities will be specifically earmarked for upgrading to bring the facilities up to modern standards for industry use.

Ultimately, South Africa must provide the full space mission life-cycle capabilities for the development and operations of optical, SAR and scientific payloads. These capabilities must include the design, modelling, development, measurement, calibration, test and evaluation of technology options. This will make South Africa an attractive partner for human capital development, while ensuring a sustainable payload and full satellite development programme. On the payload side, there are many opportunities arising where South Africa is able to provide specific payloads hosted on foreign satellite missions. This will alleviate the cost of a full satellite mission, but yet still deliver useful data.

Calibration and validation (Cal-Val) is a national strategic capability, which needs to be maintained in order to support the national and global space programmes. It cannot be a sustainable business case on its own but becomes more attractive when offered as part of a full satellite sensor development programme, which will include a strong pre-launch payload calibration facility and post-launch sensor calibration leading to expertise on data product validation. Cal-Val capability in SA is managed by SANSA, but with a strong expert base residing at universities (WITs, NWU, UCT) and science councils (CSIR, NMI, ARC, SAWS).

A study will be conducted to evaluate the benefits, the cost, and the schedules required to establish a launching capability to service the national and potential international requirements. Important facts to establish during this study are the identification of potential national and international clientele, the functional requirements for such a facility, the break-even point in terms of income and expenditure, the country’s capacity to satisfy the initial capital investment, the strategic requirement in terms of independence from other launch providers, and the benefits for the country in terms of HCD and industry development.

8.5 Navigation and Positioning

Navigation and positioning is a new area that SANSA is venturing into. Work has advanced, through international partnerships, for the development and testing of an operational satellite-based augmentation system (SBAS), which has proven operational. The standard Global Positioning System (GPS) is free of charge and nominally provides 5-10 meters accuracy, but it can be significantly worse in some cases. SBAS improves the accuracy to around 1 meter and is much more reliable. Critically, SBAS services are relatively inexpensive and many existing GPS receivers can already receive SBAS services.

These SBAS benefits are well-understood internationally and have led to the deployment of SBAS services in the US, Europe, Japan and India. Countries/regions have moved to have independent SBAS services given their use for defense purposes and safety of life applications. It is therefore important that South Africa and the region adopt an independent SBAS to ensure independence and operational efficiencies.

8.5.1 Establish Open service SBAS System

SANSA has done a number of pre-cursor projects and studies around the business case and system requirements for SBAS. Most recently the SBAS-Africa has deployed a test-bed system. The preliminary SBAS business case has been produced in accordance with National Treasury's capital planning guidelines. Four options have been considered and the preferred option delivers R15.6 billion (discounted) to the South African economy over 25 years with a return on investment of better than 10:1. The proposed SBAS can also be extended to deliver major economic benefits to countries in the Southern African region and further extended and integrated into the rest of Africa.

In order to capitalise on the legacy of the SBAS–Africa project and thus save significantly on the cost of developing an SBAS system, some critical activities need to be completed. These include acquiring SBAS satellite access codes, acquiring the legacy elements from the SBAS–Africa project, developing a navigation payload strategy (NigComSat -1R has an available navigation payload, but consideration must be given to including such a payload on a future South African communications satellite), building institutional capacity, business and market development, and confirming and demonstrating benefits to potential users of the services.

8.5.2 Establish GNSS applications and configurable user terminal

SBAS-Africa positions this service to improve many market sectors (e.g. agriculture, aviation, geomatics, logistics and maritime) and to support policy delivery by stimulating innovation and growing industrial capacity, creating jobs, reducing inequality, improving safety, increasing productivity and enhancing environmental sustainability. In order to verify the business case medium term applications needs to be launched. Some of these applications are already in place and needs support (Post Office GNSS database, agriculture, mine safety application, Stats SA).

For the existing requirements and the development of other applications, the programme needs in house capacity that can assist the domain experts in integrating SBAS into their solution. In order to further promote the use of SBAS in the user community we suggest the development of a very low-cost terminal that is SBAS capable that can be integrated into other systems using standard protocols. This would use embedded electronics that can easily be made part of high-volume production of application hardware such as location-based system i.e. vehicle tracking systems.

8.5.3 International coordination

SBAS system spans across regions and international coordination is of utmost importance. A Southern African solution will also impact neighbouring systems such as EGNOS and GAGAN. In order not to interfere with these operational system RSA-SBAS needs to coordinate with these entities. South Africa also needs to acquire a PRN number for their system and SANSA will represent South Africa in the forums where these decisions are made. The SBAS program has ideals to operate beyond the

borders and also integrate with the implementation of the African Space Strategy. Coordination on sub-continental and continental level needs to be done as well.

8.6 Telecommunications

The telecommunications satellite market is certainly the most mature space market in terms of generating commercial revenues. Given its inherent cost and capability advantages for supporting many global mobile services, satellite telecommunications have evolved into a core part of the global telecommunications marketplace. Satellite telecommunications systems have important features that fibre optics lack, namely, (i) mobility – mobile users cannot be connected to the fibre network directly, (ii) flexibility – once terrestrial infrastructure is built, it is extremely expensive to restructure it, (iii) rural and remote connections – it is still not cost effective to deploy high-capacity fibre networks in areas with low-density traffic and difficult topography, and (iv) broadcast capability – where point-to-multi-point connections are able to reach millions simultaneously in a cost-effective way.

Satellite communications is thus a key technology that could enable South Africa to participate in the build-up of the global information infrastructure. Satellite communication systems, featured by large "footprints", ranging in size from a country to a continent, avoid the need for terrestrial infrastructure and shorten the time for establishing basic and advanced communications in rural areas. Most areas in developing countries are sparsely populated and highly rural such as the case in South Africa. Satellite communication is an excellent option for meeting this and many other pressing communication needs of developing economies. Access to information and communication infrastructure greatly enhances economic growth. When a reliable and affordable medium for information exchange is available, previously unanticipated developments ensue.

In order to cover the full value chain of activities for satellite communications, all SANSA Programmes will be involved in the conceptual phase of a national satellite telecommunications programme. SANSA has a good understanding and capability in satellite communications, through services it renders in the international market. SANSA will use its capabilities to interpret the potential user requirements from a public goods perspective into technical requirements for a satellite telecommunication system for South Africa. SANSA through the DST and DTPS will provide support on the user requirement, a focused system design and ground based infrastructure. However, given that this is a new domain for SANSA from a national operational perspective, there is a need to build and strengthen the requisite capacity and capabilities by establishing a programme that focuses on satellite telecommunications, including the development of the local industry.

8.6.1 Telemetry, Tracking and Control

SANSA, in line with the requirement of ensuring full national satellite communication ground support systems, will strengthen and complement its existing capabilities. SANSA will operate the gateway Earth station (teleport) for such a system under its recently adopted teleport strategy. The mission control of such a satellite will also be operated from SANSA. To this end SANSA will install the required systems at its ground station and operate it from its existing operations facilities. SANSA staff will be upskilled for this new activity.

A telecommunications satellite programme in South Africa will ensure that SANSA develop skills and knowledge to mission control and manage Geo-Stationary satellites. This would be a first, as South Africa has not endeavoured into this technology environment, although SANSA has performed such support services for international clients. In order to fulfil such a requirement at the home front, SANSA will undertake the following actions:

- Establish a new centre for the control of Geo-Stationary satellites,
- Establish a new dedicated antenna,
- Undertake training of staff abroad with partners who have such experience,
- Link fibre to the national backbone, and

- Licence the necessary frequency bands for operations.

8.6.2 Public Good Products and Services

There are currently other public sector institutions that have an interest in satellite telecommunications and these include (i) Sentech, which has a commercial interest and offers signal distribution services to most of the country's licensed broadcasters, (ii) SITA, which has a government focus and uses information technology to support the delivery of e-Government services to all its citizens. In terms of the SANSA mandate, the Agency should provide products and services for the broader public good that is not in competition with other public sector institutions. In this regard, SANSA will endeavour to develop and provide specific product and service offerings in partnership with other key institutions within the national system of innovation.

Through the use of telecommunications signal and other advanced technologies, we will be able to penetrate the sparsely populated and rural areas of our country and provide vital services that hitherto have been conceptualised, but not implemented. Basically, these services are taken to the people in the environment in which it is needed and not the other way around. Services that can easily be deployed through the use of satellite telecommunications include:

- Affordable broadband access to marginalised communities,
- e-Education with full bi-direction interactions,
- e-Medicine services to clinics and hospitals,
- Mobile clinics for point of care services,
- Law enforcement requirements that require on the move communications access,
- Access to secure communications and networks to government departments,
- Post disaster management and guaranteed access to communications, and
- SBAS payload operations in support of GNSS strategy

8.6.3 Development of the Local Industry

The South African position with regards to geostationary communications satellite is a little more challenging than that of either optical or SAR platforms. The primary question is whether South Africa should pursue this capability for communications satellites that will be built once every 15 years on average. Unless dictated by market feasibility, some important policy decisions need to be made with respect to whether South Africa should pursue an indigenous industrial capability for communications satellites and there are three possible approaches for this platform:

1. Procure the full communications satellite from international vendors with a limited South African contribution;
2. Procure a communications satellite with some South African technology or engineering options embedded into the platform; or
3. Build a communications satellite, inclusive of SBAS payloads, through partnerships with other technologically advanced partners.

These approaches are not necessarily mutually exclusive, but dependent on where we are in terms of technology readiness levels and in the life-cycle stage of a telecommunications mission. Irrespective of the approach, there must be an element of local industry development and localisation of key technologies. In general, the pursuit of procuring (approaches 1 and 2 – phase 1) a communications satellite could have the net effect of migrating the relevant capability towards greater South African industrial self-sufficiency with the end effect of a local telecommunications satellite build (approach 3 – phase 2).

Another sector that the South African industry could become effective in is in the design and manufacture of "end-user" type products, for example:

1. Satellite dishes of the order of 1m,
2. High Powered Amplifiers, and
3. Block up/down converters.

South Africa has the sheet metal technology and microwave and associated radio technologies that are required for satellite dishes and components, respectively. In addition, the CubeSat platform will be explored for low data rate communications and capture, store and forward applications. These initiatives provide economic growth potentials that require immediate up skilling of our labour force, and will result in improved factory conditions, such as clean environments that are a must for such technologies.

8.7 Resource Requirements

This Strategic Plan is intended to relook at the mandate of SANSA and thereby extract the key activities that SANSA should be implementing. SANSA is currently not implementing all of the activities it should due to budgetary constraints. This exercise has allowed SANSA to take a fresh look at its existing activities and make a realistic assessment of where it should be focusing in the next five years through the expansion of existing programmes and the identification of aspirational initiatives.

New areas of focus, i.e. GNSS and Satellite Communications have been earmarked for development in the national space sector and SANSA will work with the key government departments to support the policy processes that will support these new focus areas, which are deemed vital for South Africa. Expertise that is needed to support these focus areas will be developed internally within SANSA and in the broader space sector.

Although the funding for the national space programme is still constrained, this Plan provides a basis upon which new funding opportunities could be pursued in line with ensuring that SANSA's full mandate is achieved.

PART D: TECHNICAL INDICATOR DESCRIPTIONS

M1.1.1 Number of youth directly engaged

M1.2.1 Number of students and interns supported for formalized training

M2.1.1 Number of products and applications

M2.2.1 The national research productivity score for space supported R&D

M3.1.1 Successful satellite pass monitoring rate for Earth Observation

M3.1.2 Total income generated from space operations activities

M3.2.1 The total contract expenditure to SMEs for core space projects

M3.2.2 The total contract expenditure to the broad space related industry for core space projects

M4.1.1 A new operational space weather centre

M4.1.2 Development of Digital Earth South Africa

M4.1.3 An upgraded AIT Facility

M5.1.1 Number of active formal oversees partnerships

M5.1.2 Number of active formal African partnerships

M5.1.3 Number of active formal national partnerships

M5.2.1 Percentage of government departments and public that use geospatial information using space products and services

M5.2.2 Awareness and training interventions to users of space products and applications

M5.2.3 Number of initiatives to transform SANSA into a high performing Agency

Indicator title	Name of Indicator
Short definition	Provides a brief explanation of what the indicator is, with enough detail to give a general understanding of the indicator
Purpose/importance	Explains what the indicator is intended to show and why it is important.
Source/collection of data	1. A description of **what source documentation or information** is used as a basis for actual performance achievements. 2. A description **where this source documentation or information originates from** – by indicating name of responsible unit, person, etc.
Method of calculation	Describes clearly and specifically how the indicator is calculated.
System Used	Indicate the name of the system used to process the performance information and indicate whether this system is electronic or manual in nature
Description of KPI reporting activities	1. Describe the reporting activities per indicator by indicating the name of the report, frequency of reporting and to which level 2. Indicate where this output document or report originates from by referring to responsible person, supporting info and standard reporting requirements 3. Document the related control activities relevant to outputs/reporting
Means of Validation	Describes clearly and specifically how the indicator is validated
Data limitations	Identifies any limitation with the indicator data, including factors that might be beyond the directorates control
Type of indicator	Identifies whether the indicator is measuring inputs, activities, outputs, outcomes or impact, or equity
Calculation type	Identifies whether the reported performance is cumulative, or non-cumulative
Reporting cycle	Identifies if an indicator is reported quarterly, annually or at longer time intervals
New indicator	Identifies whether the indicator is new, has significantly changed, or continues without change from the previous year

Indicator title	M1.1.1 Number of youth directly engaged
Short definition	This refers to the number of young people engaged directly through some specific activity (e.g. visit by learners to a SANSA facility, learner workshop/lesson, SANSA visit to a school) and **will exclude a count of young people who visit SANSA stands at exhibits**.
Purpose/importance	To indicate the extent to which SANSA is promoting science and increasing awareness amongst young people
Source/collection of data	Hard copies of attendance register of activities PDF of attendance registers and summary.
Method of calculation	Manual calculation
System Used	Manual System
Description of KPI reporting activities	1. Attendance register is completed at the event and signed by external supervisor of the participating group. 2. Number of attendees get captured into excel spread sheet
Means of Validation	Signed-off attendance registers
Data limitations	Omission of full details on register. Data would not reflect some of the demographics (race, gender) required by the PPC for example.
Type of indicator	Output
Calculation type	Non-cumulative
Reporting cycle	Quarterly
New indicator	No

Indicator title	M1.2.1 The Number of PDI students supported for formalised training
Short definition	The total number of students currently linked and supported by SANSA through bursaries, or supervised. **SANSA employees who are supported under any SANSA staff development scheme should not be counted. Further this excludes short courses and focuses on students that are registered for some formal training for a degree, diploma, or certificate within the South African National Qualification Framework**
Purpose/importance	This measures the level to which SANSA contributes to the development of external human capacity through formal degree training.
Source/collection of data	Contracts and student agreements & student records Proof of supervision engagement
Method of calculation	Manual head count. Since the academic year and financial year are different – students are added in the quarter in which they joined SANSA for that financial year. **That is, students have to be counted once per financial annum in the quarter in which they joined or began to be supported by SANSA.** To simplify students will not be counted in quarter 4, however, all supported students will be counted in quarter 1 (April) for the new financial and academic year.
System Used	Excel Spreadsheet
Description of KPI reporting activities	All student contracts counted
Means of Validation	Contracts and student agreements, proof of student supervision contracts/register are available.
Data limitations	There is no distinction between students; the level of training is not indicated. Therefore, it is important that data on the level of training and the successful graduates is also kept and reported on in the main narrative of the report.
Type of indicator	Output
Calculation type	Non -cumulative
Reporting cycle	Quarterly
New indicator	No

Indicator title	M2.1.1 Number of products and services
Short definition	The number of products/services (PS) delivered within any one of the following PS areas, (i) PS1-Data as a Service, (ii) PS2 – Remote sensing products, (iii) PS3 – Infrastructure as a Service , (iv) PS4 - Magnetic technology services.
Purpose/importance	This is intended to demonstrate a sample of the products and applications that are impactful and delivered utilising space science know how, expertise and facilities.
Source/collection of data	Reports that document what has been achieved or produced including appropriate statistics for each product. Some of the specifics may include some or all of the following: **PS1 – Data as a Service** • Data collected (sensor portfolio) • Contracts and active agreements on data access • Data distributed including online data access • Data request & distribution statistics • Report on use & impact **PS2** – Remote sensing products • Confirmed orders for services/products • Frequency of production or publication of base remote sensing & fundamental data products • Industry contracts/agreement to deliver services/product • Report on use & impact **PS3 – Infrastructure as a Service** • Use cases built on Digital Earth South Africa • Confirmed orders for services/products • Report on use & impact **PS4** • Industry contracts/agreement to deliver services/product • Confirmed orders for services/products • Report on use & impact PS5 • Stakeholder engagement report • Data acquisition plan.
Method of calculation	A brief qualitative report of the services/products that have been delivered will be used as the products/services are not a simple statistical/numerical activity. The report will also contain how the impactful product/service was determined for this KPI.
System Used	Manual
Description of KPI reporting activities	Compilation of detailed products/service reports. Recording of any activities, events, that can be used for validation e.g. data transmission logs, client acceptance signatures, contract registers, progress reports.
Means of Validation	Sample testing some of the assertions in the Product/Service report against some of the validation material e.g. data transmission logs, client acceptance signatures, contract registers, progress reports.
Data limitations	Some of the meaningful activities cannot be necessarily independently validated. Further, given the qualitative nature of the KPI or associated reports, it will take some time to refine some of the metrics. Not all of the elements should and can be measured at inception, e.g. how to measure impact. However, the difficulty in the measurement should not be a reason for trying to find a meaningless metric that can be easily counted. This KPI is intended to progressively concretise the SANSA product/service portfolio and to quantify its impact.
Type of indicator	Output and impact/ Progressive qualitative
Calculation type	Cumulative and progressive throughout the year.
Reporting cycle	Quarterly
New indicator	No

Indicator title	M2.2.1 The national research productivity score for space supported R&D
Short definition	The research productivity score for R&D
Purpose/importance	This is meant to demonstrate SANSA's research output and is an indicator of research output, quality, impact and relevance
Source/collection of data	This productivity score is based on a function of research funding sourced + publications (journals, books, reports, proceedings) + students graduated + research rating status 1. Published papers in PDF and hard copy available. For books Front pages available in pdf. 2. Grant funding listed in grant award registers, and award letters available - also available from finance system as grant income received, copy of register from NRF system indicating payments received for that year up to end of quarter. Only grant funding for research projects or grant holder linked student funding should be included – no independent student (PDP) or post doc or science engagement funding. 3. Students graduated – list is maintained with PDF copies of Degree certificates or award letters. 4. Research rating status – determined by rating award letters.
Method of calculation	Composite function as described in "determination of research productivity score" document
System Used	Manual, Excel spreadsheet
Description of KPI reporting activities	Information is collected monthly on an ongoing basis, and collated and verified quarterly.
Means of Validation	Count the hard copies of publications and books Verify that evidence exists for all aspects included in the formula Verify excel sheet with calculation
Data limitations	A composite score masks some of the key elements that are, in their own right, important for SANSA performance review e.g. number of publications, grant amount raised, number of graduates, number of rated researchers and their ratings. Therefore, it is important that data on these base elements is also kept and reported on in the main narrative of the report.
Type of indicator	Output
Calculation type	Non-cumulative
Reporting cycle	Quarterly
New indicator	No

Indicator title	M3.1.1 Successful satellite pass monitoring rate for Earth Observation
Short definition	The measurement of the rate of success in downloading SANSA EO data measured in proportional time achieved.
Purpose/importance	To measure the success rate of the SANSA Space Operations in supporting SANSA Earth Observation. It is important to measure the effectiveness of this support given the internal contracting for these services between the two directorates. It also shows the impact of SANSA's space operations activities to EO.
Source/collection of data	1. Data acquired is calculated minutes of a pass or a fraction thereof. 2. Data losses are calculated in minutes or fractions thereof 3. Operational workload is calculated in passes per day
Method of calculation	Systematic Count of minutes of data captured and demodulated
System Used	Daily passes requested from EO as per flight plan, SO data acquisition pass summary from QF and database entries
Description of KPI reporting activities	1. Operations manager totals the minutes from passes completed 2. Operations manager completes KPI quarterly
Means of Validation	SO verifies with EO on quantity (minutes) and quality of data acquired
Data limitations	
Type of indicator	Output
Calculation type	Non-cumulative
Reporting cycle	Quarterly
New indicator	No

Indicator title	M3.1.2 Total income generated from space operations activities
Short definition	The income generated by the Space Operations Programme for the financial year, includes all forms of income e.g. inter-company contractual revenue, external contracts, ring fenced grant income
Purpose/importance	This measures the revenue generation capacity of the Space Operations activities. This is important given the commercial emphasis of this programme.
Source/collection of data	This information is based on signed contracts and the actual financial transactions on the financial system and reported numbers on the financial statements.
Method of calculation	This would be the total of all the contractual revenue generated under the space operations programme.
System Used	Financial systems
Description of KPI reporting activities	Generate income financial statement from the ERP system Cross reference with contracts received & invoices issued & grant awards Cross reference with income contract spreadsheets Marketometer
Means of Validation	Contracts with the clients and invoices
Data limitations	The value does not give an indication of the different sector income streams. Such information would give SANSA the necessary intelligence for making strategic choices. Therefore, information on the different income streams should be kept and reported in the report narrative.
Type of indicator	Output
Calculation type	Non-cumulative
Reporting cycle	Annually
New indicator	Yes

Indicator title	M3.2.1 The total contract expenditure to SMEs for core space projects
Short definition	The KPI measures the contract value that is outsourced too **Small to Medium Enterprises (SMEs)** for all SANSA programmes including EO, SS, SO and SE programmes, in the main SE. **This should include the component that Denel outsources to SMEs as part of the EO-Sat1 project. This should exclude the EO-Sat1 money spent within Denel. This should not include consultancy expenditure for general support initiatives.**
Purpose/importance	This measures the extent to which SANSA is supporting SMEs through its core space projects.
Source/collection of data	Internal contracts and invoices and auditable reports from the supported companies, such as Denel.
Method of calculation	Manual
System Used	Contract register and financial system
Description of KPI reporting activities	Quarterly
Means of Validation	Invoices
Data limitations	Accuracy in classifying which companies are SMEs and which are not. This information is dependent on the annual turnover of the relevant company and this information is not necessarily readily available.
Type of indicator	Input
Calculation type	Non-cumulative
Reporting cycle	Annually
New indicator	Yes

Indicator title	M3.2.2 The total contract expenditure to the broad space related industry for core space projects
Short definition	The KPI measures the contract value that is outsourced to **Small to Medium Enterprises (SMEs) and big industry players (This should not include consultancy expenditure for general support initiatives).**
Purpose/importance	This is a true measure of the capital invested in re-establishing the space industry in South Africa
Source/collection of data	Internal contracts and invoices and auditable reports from affected companies.
Method of calculation	Manual
System Used	Contract register and financial system
Description of KPI reporting activities	Quarterly: The Contracts Manager must keep an updated account of all funds invested, per contract, in industry. This is to be reported in the quarterly report every quarter
Means of Validation	Invoices: The Contracts Manager will compare his figures against those held by Finance before releasing his numbers to the quarterly report
Data limitations	SANSA can only report on the funds expended on Programmes under its control
Type of indicator	Input: Broader impact on space industry
Calculation type	Non-cumulative
Reporting cycle	Annually
New indicator	This is an existing but modified indicator

Indicator title	M4.1.2 A new operational space weather centre
Short definition	This indicator shows progress towards achieving the aim of a 24/7 operational space weather centre
Purpose/importance	The development of an operational space weather centre for SANSA is a priority project to bring about sustainability and this indicator demonstrates achievement against project goals
Source/collection of data	Quarterly reports are prepared on the project progress against the approved business case; Tracking of progress against key milestones.
Method of calculation	Compare the project progress with the project action plan and calculate a percentage based on the estimate progress towards the final goal.
System Used	. Manual
Description of KPI reporting activities	On a quarterly basis, a report is generated to represent the important events of the quarter and detail progress against the key milestones. This report is presented to the Hermanus Management Team who are responsible for the project. Once approved, the report is then submitted to the DSI
Means of Validation	Comparison of latest project schedule against the original project schedule and approved business case
Data limitations	The project schedule and milestones may be affected by external factors that limits the accuracy
Type of indicator	Output – measures scheduled performance
Calculation type	Non-cumulative
Reporting cycle	Annually
New indicator	New Indicator

Indicator title	M4.1.2 Development of Digital Earth South Africa
Short definition	Provision of progress towards the development of an operational data cube platform, namely, Digital Earth South Africa.
Purpose/importance	SANSA is mandated to acquire, assimilate, process and distribute satellite imagery, in order to deliver and maintain relevance SANSA needs to improve its data management and delivery mechanism, keeping up to speed with the international market.
Source/collection of data	Quarterly reports prepared on the project progress against the project concept document.
Method of calculation	Tracking of progress (in percentage) against the project action plan.
System Used	Manual.
Description of KPI reporting activities	Quarterly reporting on implementation progress done by the EO Management Team for submission to EXCO.
Means of Validation	Comparison of the current project schedule against original project action plan.
Data limitations	As it is intended to be an open system, data on system users developing use cases may be limited – sampling of use cases will be provided.
Type of indicator	Output – measuring progress on planned activities.
Calculation type	Cumulative.
Reporting cycle	Annually.
New indicator	New indicator.

Indicator title	M4.1.3 An upgraded AIT facility
Short definition	The AIT facility upgrade is to support the Space Industry. The current facility will undergo various areas of improvement to support the development of Satellites
Purpose/importance	The indicator is to support the National Space program and the industry. The development is critical to create a successful satellite program and support private companies for their own development.
Source/collection of data	As per project plan on the upgrade of the AIT facility.
Method of calculation	Compare the project progress with the project action plan and calculate a percentage based on the estimate progress towards the final goal.
System Used	Manual
Description of KPI reporting activities	On a quarterly basis, a report is generated to represent the important events of the quarter and detail progress against the key milestones as per project plan. Comparison of latest project schedule against the original project schedule and approved business case
Means of Validation	Comparison of latest project schedule against the original project schedule and approved business case
Data limitations	The project schedule and milestones may be affected by external factors that limits the accuracy
Type of indicator	Output – measures scheduled performance
Calculation type	Non-cumulative
Reporting cycle	Annually with progress reports every quarter
New indicator	New Indicator

Indicator title	M5.1.1 Number of active formal oversees partnerships
Short definition	This indicator establishes the number of activities engaged in with overseas partners
Purpose/importance	Space is a global endeavour and requires active partnerships at a number of different levels
Source/collection of data	Tracking of actual projects implemented with partners
Method of calculation	Manual
System Used	Spreadsheet of active projects kept at a Programme level
Description of KPI reporting activities	Each project title will be recorded together with the activities engaged in per quarter.
Means of Validation	Partnership reports are signed off on a quarterly basis
Data limitations	The partnership reports may not include the costing of the activities, as some projects are based on equal contributions or on funds secured from funding instruments.
Type of indicator	Output: Number of activities engaged in
Calculation type	Cumulative
Reporting cycle	Quarterly
New indicator	No – this was introduced in the 2019/20 Financial Year

Indicator title	M5.1.2 Number of active formal African partnerships
Short definition	This indicator establishes the number of activities engaged in with African partners
Purpose/importance	Space is a global endeavour and requires active partnerships at a number of different levels
Source/collection of data	Tracking of actual projects implemented with partners
Method of calculation	Manual
System Used	Spreadsheet of active projects kept at a Programme level
Description of KPI reporting activities	Each project title will be recorded together with the activities engaged in per quarter.
Means of Validation	Partnership reports are signed off on a quarterly basis
Data limitations	The partnership reports may not include the costing of the activities, as some projects are based on equal contributions or on funds secured from funding instruments.
Type of indicator	Output: Number of activities engaged in
Calculation type	Cumulative
Reporting cycle	Quarterly
New indicator	No – this was introduced in the 2019/20 Financial Year

Indicator title	M5.1.3 Number of active formal national partnerships
Short definition	This indicator establishes the number of activities engaged in with national partners
Purpose/importance	Space is a global endeavour and requires active partnerships at a number of different levels
Source/collection of data	Tracking of actual projects implemented with partners
Method of calculation	Manual
System Used	Spreadsheet of active projects kept at a Programme level
Description of KPI reporting activities	Each project title will be recorded together with the activities engaged in per quarter.
Means of Validation	Partnership reports are signed off on a quarterly basis
Data limitations	The partnership reports may not include the costing of the activities, as some projects are based on equal contributions or on funds secured from funding instruments.
Type of indicator	Output: Number of activities engaged in
Calculation type	Cumulative
Reporting cycle	Quarterly
New indicator	No – this was introduced in the 2019/20 Financial Year

Indicator title	M5.2.1 Percentage of government departments and public entities using space products and services
Short definition	The measurement of the usage of space data and value-added products by government (all three spheres) and its entities.
Purpose/importance	The return on investment on space heavily lies on the impact and value space has on driving informed decision making, in particular by government and its entities.
Source/collection of data	Reports that document provision of data and value-add products to government and its entities, including appropriate statistics. This information may include some or all of the following: • Stakeholder registry • Data and product distribution stats • Online access of data and products • Industry contracts/agreement to deliver services/product • Confirmed orders for services/products • Report on use & impact
Method of calculation	A brief qualitative report of the organs of states that use using services/products that have been delivered to which government stakeholders will be used as the products/services are not a simple statistical/numerical activity. The report will also contain how the impactful product/service was determined for this KPI.
System Used	Manual, supported by system reports from platforms such as the Earth Watch, EO catalogue, EO webservices etc.
Description of KPI reporting activities	Compilation of Organs of State using Space Products/Service Report. Recording of any activities, events, that can be used for validation e.g. data transmission logs, client acceptance signatures, contract registers, progress reports.
Means of Validation	Sample testing some of the assertions in the Organs of State using Space Products/Service Report against some of the validation material e.g. data transmission logs, client acceptance signatures, contract registers, progress report.
Data limitations	Some of the meaningful activities cannot be necessarily independently validated. Further, given the qualitative nature of the KPI or associated reports, it will take some time to refine some of the metrics. Not all of the elements should and can be measured at inception, e.g. how to measure impact. However, the difficulty in the measurement should not be a reason for trying to find a meaningless metric that can be easily counted. This KPI is intended to progressively concretise SANSA's provision of space product/service to government and its entities and to quantify its impact.
Type of indicator	Output and impact/ Progressive qualitative
Calculation type	Cumulative and progressive throughout the year.
Reporting cycle	Annually
New indicator	Yes

Indicator title	M5.2.2 Number of awareness and training interventions to key users of space products and services
Short definition	The indicator is designed to measure the marketing of space products and services to key users
Purpose/importance	It is important to establish a base of key users of space products and services and ensure awareness and appropriate training on the use of these products and services is in place.
Source/collection of data	Tracking of awareness and training interventions, including the users reached.
Method of calculation	A spreadsheet will be maintained indicating the users reached, the awareness or training intervention undertaken, and the related products and services. Attendance registers will be kept as a record.
System Used	Manual
Description of KPI reporting activities	A record of awareness or training interventions undertaken will be kept.
Means of Validation	Records are signed off on a quarterly basis.
Data limitations	It may be challenging to secure the key users for an awareness or training intervention as they have their own programmes.
Type of indicator	Output – number of activities undertaken
Calculation type	Cumulative
Reporting cycle	Quarterly
New indicator	New Indicator

Indicator title	M5.2.3 Number of initiative to transform SANSA into a high performing agency
Short definition	This indicator provides the interventions needed to improve the performance of SANSA
Purpose/importance	It is important for SANSA to be prepared to implement this Strategy and specific interventions are required for this.
Source/collection of data	The EXCO approved strategies and plans relating to these interventions and the implementation thereof, as per the respective work/project plans.
Method of calculation	A count of the number of strategies and interventions that have been approved and implemented.
System Used	Manual
Description of KPI reporting activities	A report will be produced annually indicating the number of interventions achieved.
Means of Validation	Interventions/strategies presented to and approved by EXCO
Data limitations	Extensive consultations are required to ensure effective implementation, and this requires buy in from the entire organisation
Type of indicator	Output – number of initiatives to transform SANSA into a high performing agency
Calculation type	Non-cumulative
Reporting cycle	Quarterly
New indicator	New Indicator