A JOURNEY FOR TOMORROW

WATCH THIS SPACE

South African Space Newsletter

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Mrs GNM Pandor

Developing the South African National Space Programme

Minister of Science and Technology

The South African Government recognises the potential role of space science and technology to deliver on a wide array of our national priorities, including job creation, poverty alleviation, resource management and rural development. Given the relative importance and role of space technology in transforming our economic and social landscape, we needed to urgently reflect on the state of our space arena and seek transforming strategies that could help leverage these assets to assist our nation in every facet of its economic and social endeavour.

For this reason the Department of Science and Technology identified space science and technology as one of five grand challenges in its 10 Year Innovation Plan. To this end major advances have been made in moving toward formalising a National Space Programme.

At the highest level, the National Space Policy, an instrument of the Department of Trade and Industry, provides an overarching set of guiding principles that inform stakeholders on how best to conduct their activities in the space landscape and with the commitment of utilising outer space for peaceful purposes and the benefit of all humankind. The National Space Policy was approved by Cabinet in December 2008 and launched in March 2009.

The primary strategies to be implemented are the South African Earth Observation Strategy (SAEOS) and the National Space Strategy, both instruments of the Department of Science and Technology. SAEOS, officially launched in November 2007, is a response to the need for coordinating the collection, assimilation and dissemination of Earth observation data so that they can be fully utilised to support policy, decision making, economic growth and sustainable development. SAEOS also responds to the Group on Earth Observation System of Systems (GEOSS), an initiative of the Group on Earth Observation (GEO), wherein it will form a regional node of GEOSS.

The National Space Strategy was approved by National Cabinet in December 2008 and provides a convenient set of guidelines on the building blocks and the expected outcomes for a national space programme. It focuses on space-based services and applications, particularly those in the domain of satellite Earth observations, communications, and navigational positioning and timing. These services and applications will be harnessed to respond to the national priority areas.

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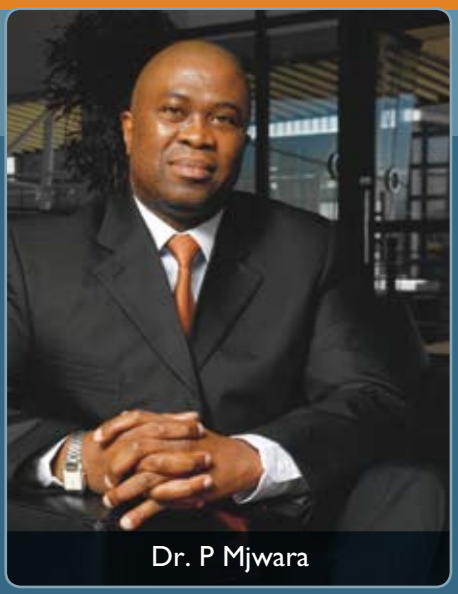
A decade from now South Africa will be a primary user of space-based products and services, be a thriving space nation and be an important contributor to the global space science and technology arena.

The landscape of the space sector has been fraught with difficulties due to a lack of coordination among the many stakeholders and a central authority to lead the development of the sector. It was therefore realised that a National Space Agency was needed to act as a central point of convergence in which all space related activities could be fostered and promoted. The South African National Space Agency Act was assented into law in December 2008 and provides the mandate for the establishment of a National Space Agency.

As the above mentioned instruments are implemented it becomes necessary to inform all stakeholders of their progress and to promote understanding of the strategic intent. It therefore gives me great pleasure to launch this quarterly newsletter for exactly that purpose and I trust that stakeholders will find it informative.



Dr. P Mjwara

SOUTH AFRICA AND GEO

"South Africa stands to not only benefit from GEO but we can also contribute immensely in the generation, analyses and dissemination of new knowledge in this regard." ***Dr. P Mjwara***

The use of data gathered from satellites, air, sea and ground based sensors, together with the information and data products derived from them, are essential tools in developing informed responses to the many environmental challenges facing our society. The implementation of the South African Earth Observation Strategy (SAEOS) promises to support effective decision making, by providing access to integrated environmental information to decision makers, managers and experts, when they need it and in a format they can use.

However, the complexity and interconnectedness of the Earth system, and the information required to understand it, necessitates a collective, global response to environmental information provision. Combining observations from multiple systems, both at the national and international level, can generate the integrated data set that decision makers, managers and experts may need. Similarly, a data set collected for one purpose will often be of value for another. For example, land-cover data gathered for the forestry and agriculture sectors could be equally useful for forecasting and abating the risks that severe weather events pose to people, infrastructure and the environment. Similarly, solar radiation data targeted to the energy sector could be useful for predicting future movements of threatened and endangered species. The SAEOS is leveraging South Africa's involvement in the Group on Earth Observations (GEO) to provide environmental information to decision makers, managers and experts.

Recognizing the need for globally coordinated Earth observations, the need to link existing and future Earth observation systems for effective environmental stewardship and to reduce costs, over 100 governments and leading international organizations, including South Africa, founded the Group on Earth Observations, or GEO, in February 2005. GEO was mandated to establish a Global Earth Observation System of Systems (GEOSS) by the year 2015 . GEO is a voluntary partnership of governments and international organizations providing a framework within which these partners can coordinate their investments in Earth observations.

As of January 2010, GEO's Members include 80 Governments and the European Commission. In addition, 58 intergovernmental, international, and regional organizations with a mandate in Earth observation or related issues have been recognized as Participating Organizations. SAEOS and the various environmental information platforms such as the South African Environmental Observation Network (SAEON), the Earth Observation Data Centre (EODC) and the South African Risk and Vulnerability Atlas (SAVA) will be components of the GEOSS.

Interlinking observation systems will require common standards for the architecture of GEOSS and data sharing. Through these common standards, GEOSS will improve the quantity, quality and compatibility of environmental information by making the worlds observation systems "interoperable". GEOSS, through collectively adopted Data Sharing Principles, aims to improve the quality and availability of Earth observation. The GEOSS Data Sharing Principles aim to encourage the full and open exchange of data, metadata and products, with minimum time delay and at minimum cost. They aim to provide all shared data, metadata and products to research and education institutions free of charge or at the cost of reproduction. South Africa has extended GEO's Data Sharing Principles through its Data Democracy initiative and its collaboration

with Brazil, to provide free data from the China Brazil Earth Resources Satellite, CBERS. It has contributed to the GEOSS architecture by leading the development of Sensor Web, an integrated web based network linking earth observation sensors.

Through the implementation of SAEOS, and its linkage GEOSS, our ability to reduce the loss of life and property from natural and human-induced disasters, address human health issues such as malaria, air quality and manage land, energy, water, biodiversity and ecosystems resources more effectively will be enhanced.

"Observing the Earth and monitoring its host of complex systems is a role no one organization masters. GEO is providing the structure and opportunity for governments and organizations to actively seek better solutions for our changing planet. GEOSS as an emerging public infrastructure could prove as essential to economic and social progress in the 21st century as new transport and communications systems were in the 20th." José Achache, GEO Secretariat Director.

PARTNERING WITH THE IEEE

IEEE/DST/NRF Steering Committee in Washington D.C. (Left to right – Dr Jay Pearlman (IEEE), Dr Andrew Kaniki (NRF), Dr Val Munsami (DST), and Dr Melba Crawford (IEEE))

South Africa, through the Department of Science and Technology and the National Research Foundation, has partnered with the Institute for Electrical and Electronic Engineering (IEEE) for promoting and supporting the development of cooperation in the fields of Science and Technology. This partnership is informed and necessitated by advances in space science and technology with a prime focus on human capital development in South Africa.

The primary objective of the partnership is to contribute to the development of scientific and technological cooperation through participation of public and private organisations, including scientific institutions, higher education institutions, societies and research centres.

The modalities of cooperation include:

- Joint identification of scientific and technological projects, formulation and implementation of research projects and programmes, application of the results in specific sectors and exchange of experiences resulting there from;
- Exchange of scientists, researchers and technological experts;
- Exchange of scientific and technological information, materials and documents;
- Organisation of conferences, seminars, courses, workshops, symposia and exhibitions in areas of mutual interest;
- Advice in the establishment and operation of research institutions, laboratories or advanced training centres;
- Advice in the formulation and implementation of science and technology programs and applications; and Capacity building.

The partnership is managed through two committees, namely, a Steering Committee, which provides strategic direction and takes key decisions relating to the partnership, and a Management Committee, responsible for the operational and administrative aspects.

Two projects have been identified that typifies the nature of projects to come.

The first is an audit of human capital development needs in space applications in South Africa. This involves an assessment of space application curricula offered in the country, requirements of end users and a gap analysis using international benchmarks. The outcome of the project will be a suite of recommendations that will be translated into funded instruments that address the identified gaps. The second project is on building the requisite national capacity in calibration and validation of Earth observation space systems through a series of workshops, ground measurement campaigns and development of a permanent calibration-validation site in South Africa.

SumbandilaSat update:

SumbandilaSat, Proudly South African Earth Observation micro-satellite was successfully launched on 17 September 2009 from Russia.

SumbandilaSat, which is the second South African earth observation micro-satellite after SUNSAT was developed as technology demonstrator to illustrate the technological know how in micro-satellite manufacturing industry.

Sunspace & Information Systems and Stellenbosch University are currently tracking the satellite for commissioning purpose in order to ensure that our satellite is stable in its orbit and all the subsystems are in good standing before handover to Satellite Application Centre (SAC) for operations. It is envisaged that commissioning and training of SAC operators will run from Electronic Student Laboratory (ESL) ground station at Stellenbosch University until mid March 2010 then SAC will take charge with operations (imaging and downloading experimental data) and satellite housekeeping to the life-span of the satellite
The commissioning of the satellite is expected to take six months (from date of launch), during which time our primary focus is on demonstrating success with the high-resolution imager 6.25m Ground Sampling Distance(GSD) which is the main payload on the satellite.

There are secondary payloads from local universities such as Nelson Mandela Metropolitan University; Stellenbosch University and University of Kwa-Zulu Natal flying scientific experiments and other payload is from the Department of Communications and South Africa Amateur Radio League.

Given the recent success with the SA-AMSAT payload on the satellite, SumbandilaSat has been officially assigned the OSCAR (Orbiting Satellite Carrying Amateur Radio) number of SO-67 by AMSAT (USA). The activation schedule for the SA-AMSAT payload will be published on the AMSAT-BB, in addition to being visible on the Google Group, as and when our satellite commissioning schedule permits activation.

Sunspace: Commissioning timelines
There remains just under two months available to complete the outstanding commissioning activities. Thereafter the plan is to transfer operations of the satellite to the SAC at Hartebeeshoek.

The following is a list of the main outstanding commissioning activities to complete:

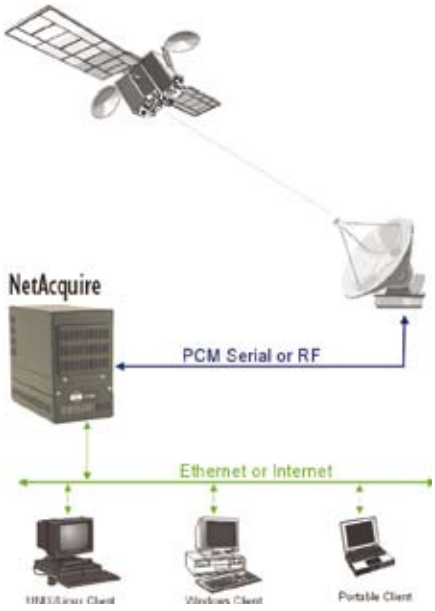
- Star camera
- Propulsion system
- GPS
- Resistive magnetometer
- Experimental payloads
- Viewfinder functionality

WHAT IS A SATELLITE?

A satellite is an object that goes around, or orbits, a larger object, such as a planet.
While there are natural satellites, like the Moon orbiting the Sun. Hundreds of man-made satellites also orbit the Earth.

- What are the components of a satellite?
- communication capabilities with earth
- a power source
- a control system to accomplish its mission

Communications antennas, radio receivers and transmitters enable the satellite to communicate with one or more ground stations, called command centres. Messages sent to the satellite from a ground station are “uplinked”; messages transmitted from the satellite to Earth are “downlinked.” Many satellites are battery-powered, taking advantage of the ultimate battery recharger, the sun. Silvery solar panels are prominent features on many satellites. Other satellites have fuel cells that convert chemical energy to electrical energy, while a few rely on nuclear energy. Small thrusters provide attitude, altitude, and propulsion control to modify and stabilize the satellite’s position in space. Energy is also required to provide climate control onboard for delicate instruments (and sometimes for people).
Specialized systems accomplish the tasks assigned to the satellite. These often include sensors capable of photographing a range of wave lengths. Telecommunications satellites require no optics, while environmental satellites do. Environmental satellites transmit data as numbers to a computer on Earth which translates this digital data into images.



THE IMPLEMENTATION OF SOUTH AFRICAN EARTH OBSERVATION STRATEGY (SAEOS)

1. Introduction

Reliable information on a wide range of areas, such as weather and climate, water resources, land cover and the status of marine resources is essential for sound planning in the management of natural resources and agriculture, and the protection of human life, health and property, as well as for optimal economic development and infrastructure performance. This information, referred to as "earth observations", is obtained by measuring and recording signals taken on, above and below the Earth's surface, in the oceans and atmosphere, and from space, and ranges from primary observations to derived, value-added products that convert raw data into useful information. Earth observations are collected and stored by a wide range of institutions at international, national and local level. Most earth observation activities are in, or receive most of their funding from, the public sector. SAEOS is intended to maximise the benefits that society gets from current investment, principally through adding value to the observations by making them widely accessible and usable. This may have the secondary effect of improving efficiency in the collection and use of observations.

The objective of the SAEOS is to coordinate the collection, assimilation and dissemination of Earth Observations, in order that their full potential to support policy, decision-making, economic growth and sustainable development in South Africa may be realised. This will be achieved by adding value to the existing expenditure on Earth Observations and related activities in South Africa, through making the information available to a broad spectrum of users in an integrated, timely and easily accessible form.

2. Functions of SAEOS

SAEOS will establish an overarching national framework for earth observations in South Africa, covering -

- oversight, coordination and integration of existing observation systems;
- the control and finance of new elements for the integrated observation system, where such elements are agreed to be necessary, but do not fall logically or efficiently under any existing institution.

It will not be responsible for the operations of existing systems, or the funding of their core functions.

Figure1. The operating systems structure for SAEOS

In this context, "architecture" refers to systems and components that contribute to SAEOS, and how the contributing systems fit together and interact with one another and the user environment.

The architecture (depicted in Fig. 2) takes into account -

- international trends in information and communication technology, especially in relation to open standards and distributed data systems;
- the realities of existing systems and communication capacities;
- the implications of the data policy.

please see Figure 2. below

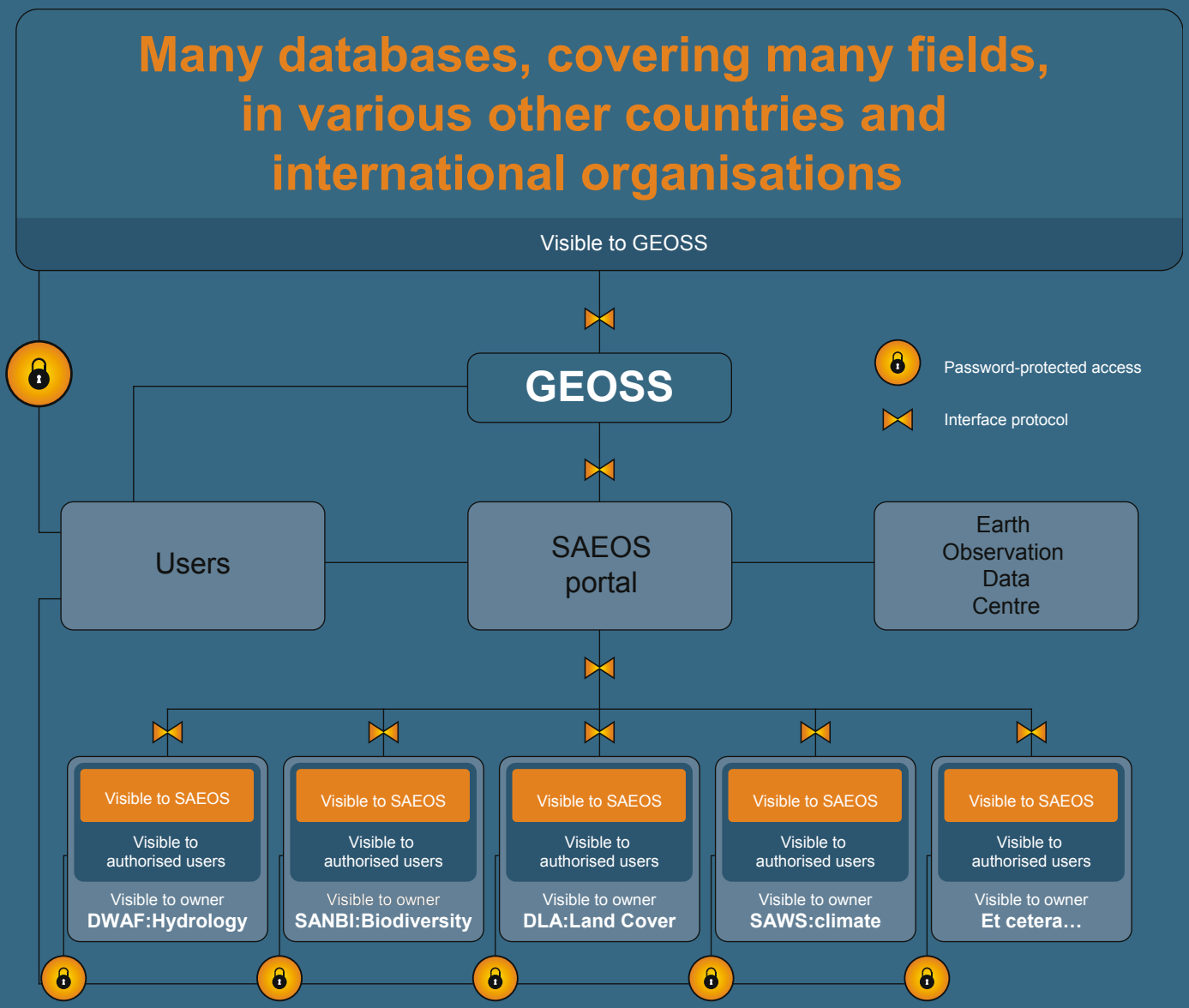


Figure 2: SAEOS broad conceptual architecture

2.1. The SAEOS Portal

The SAEOS Portal will be a user-oriented entry point to SAEOS. It will be a web-accessible software entity, hosted on a server system with the necessary bandwidth and reliability, and will -

- provide metadata to potential users;
- collect SAEOS usage statistics and information;
- inform users of their obligation to acknowledge the source of data;
- translate user enquiries into instructions to access data from the contributing databases, and return such data promptly enough to meet user requirements, and in a format and language that the user can understand.

The South African Environmental Observation Network (SAEON) is responsible for the development of the SAEOS portal in recognition of other portal developments (both locally and globally) such as the Spatial Gateway for Government by State Information Technology Agency (SITA), the development of EO metadata database by the National Spatial Information Framework (NSIF) as well as the Global Earth Observation System of Systems (GEOSS) Common Infrastructure and Data Sharing Principles.

A full technical assessment of the portal's architecture has been completed (see figure 3 below). The SAEOS Portal should be viewed as an aggregator of the meta-data, data sources or products and services from various existing systems. The Portal will serve as a standardized, interoperable repository for any system or facility worldwide and will expose the resource to a wider community of users. The alpha version of the Portal has been released (see figure 3 on page 7).

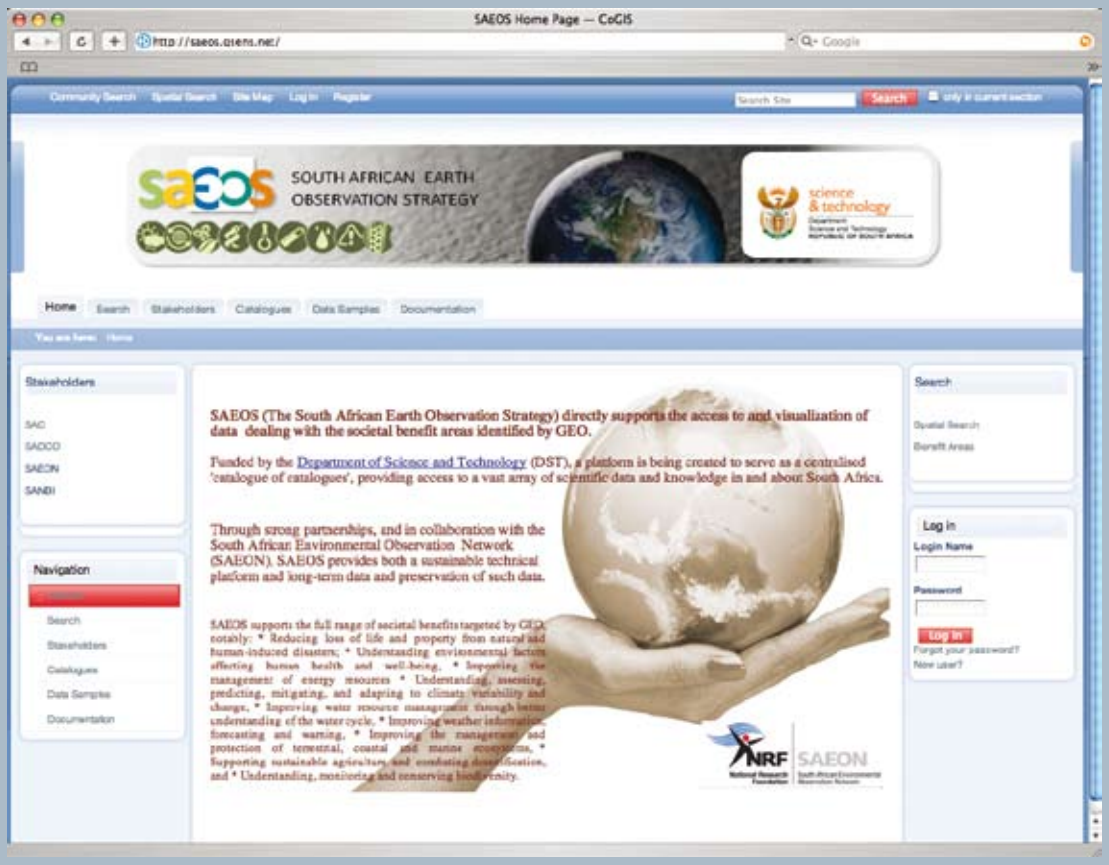


Figure 3: Alpha version of the SAEOS Portal

The beta version of the Portal will be released by the end of March 2010. Stakeholders and Earth observation user community in South Africa will be able to access the information available on the Portal. The review of the Portal's functionality, updated systems engineering documentation, user requirements, prioritisation of extensions and refinements will be done regularly.

CONFIGURATIONAL

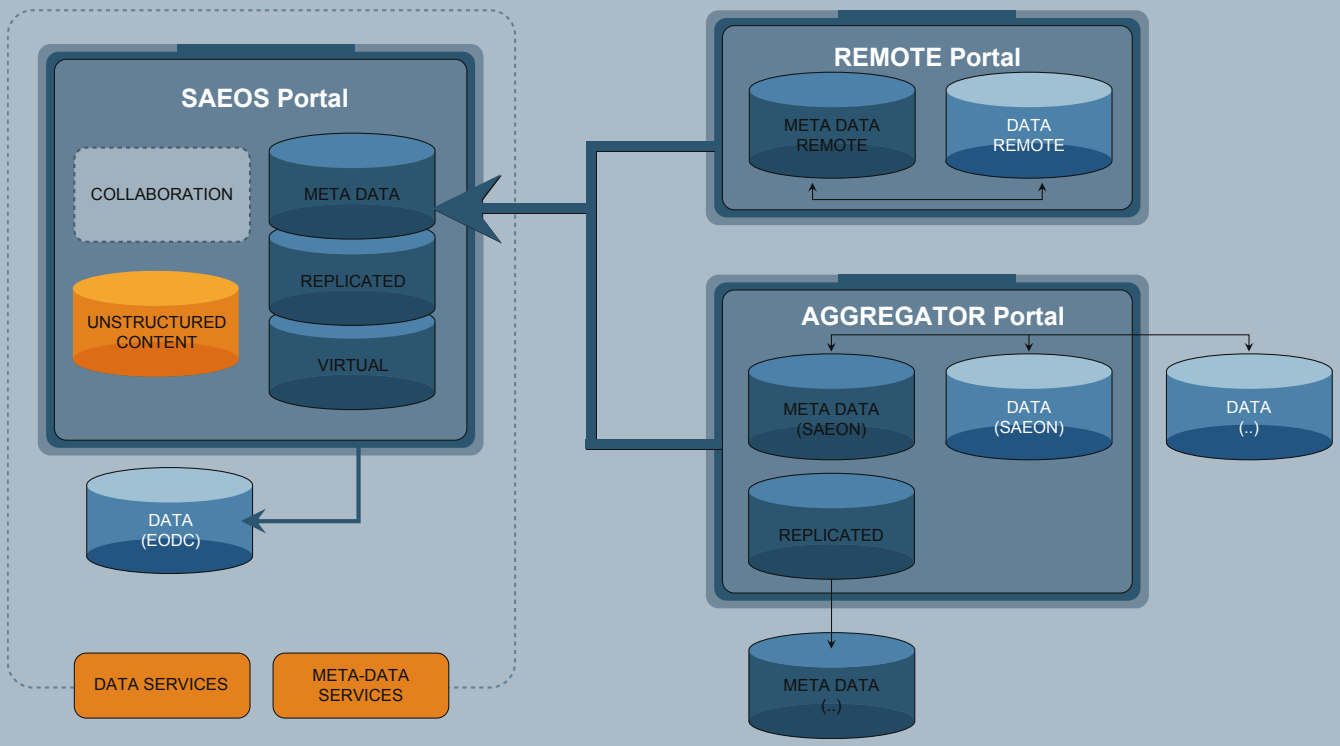


Figure 3: SAEOS Portal

2.2. The Earth Observation Data Centre (EODC)

The South African Earth Observation Data Centre (EODC) will have the mandate to ensure the secure archiving and curatorship of earth observation data, and the provision of data deemed to be in the public domain to users free of charge. The two phases (1&2), which are mainly the, architectural design, development of the necessary hardware and software required for the geoprocessing of the satellite earth observation data; and storage array network (SAN) for archiving both raw and processed data have been completed.

The centralisation of an earth observation spatial portal as a final result of the SAEOS project also requires an advance Earth Observation Data Centre to feed the EO portal with a remote sensing imagery archive, and new products and services. The collection and image processing of terabytes of imagery requires an advance automated supply chain to control and manage the workflow of image processing. An advanced user's interface to request and search the required products and services from the EODC is essential. The CSIR-Satellite Applications Centre (SAC) is in the final stages (phase 3) of developing the Earth Observation Data Information Management System (DIMS-EO). This system will enhance operational control, quality and throughput within SAC's remote sensing supply chain.

3. Conclusion

South Africa has a reasonably well developed Earth Observation policy framework that creates an enabling environment for generation and consumption of Earth Observation products and services. Fundamental planning information will play a key role in responding to the key focus areas as outlined in the National Space Strategy. Remote Sensing data has been identified as a fundamental data set from which this planning information can be directly derived.

The SAEOS programme initiated by Department of Science and Technology will enable the CSIR-SAC to re-engineer the EODC service. The EODC hardware architecture and software components will result in a world class remote sensing supply chain centre. This centre will contribute and support various national, regional and international Earth Observation programmes. The Earth Observation service provided by SAC will play a vital role in the South African National Space Programme and impact positively through its service to all relevant stakeholders. The SAEOS Portal will play a significant role in promoting global integrated earth observation system. It will ensure that earth observation data (*in-situ* and space-based) are operationally controlled, timely and easily accessible to research scientists, policy and decision-makers for socio-economic growth and sustainable development in the region and globally.

Other current and forthcoming events

Through other structures within Space Science and Technology, a couple of events are scheduled between January and March 2010.	
CEOS Climate Workshop 1 Feb 2010, Geneva, Switzerland	CEOS Working Groups (WGCV) Calibration and Validation 2-4 Feb 2010, Bolder, USA
DST/NRF/IEEE workshops for HCD on Space Applications 5 Feb 2010 CSIR Convention Centre 8 Feb 2010 NMMU 9 Feb 2010 UKZN CEOS Virtual Constellations Interface International Ocean Colour Coordinating Group (IOCCG) 18-20 Feb 2010, Brazil	Media event for SumbandilaSat Imagery 22 Feb 2010 SAC, South Africa
Land Surface Imaging (LSI) 22-24 Feb 2010, Brazil	Education and Capacity Building (WGEdu) 29-31 March 2010, Brazil

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