space OPERATIONS

NAVIGATION SERVICES

Combining creative energies and leading-edge technologies to provide real-world solutions to everyday challenges

SANSA envisages having a fully functional, open-service navigation augmentation system at an advanced safety-of-life certification stage within the next five years.

SANSA Space Operations participates in satellite navigation through:

- exploring applications for SADC (Southern African Development Community)
- ESESA FP7 investigation into EGNOS (European Geostationary Navigation Overlay Service) extension to Southern Africa, primarily for aviation
- developing technical requirements for an extended EGNOS to South Africa
- building South Africa's navigation signals capacity
- developing a Southern African satellite-based augmentation system (SBAS)
- global and regional to improve the accuracy and reliability of navigation signals.

SANSA'S envisaged space navigation activities:

Operations and monitoring

- Operate Southern African SBAS
- Monitor GPS and SBAS signals
- Provide intelligence to users
- Execute certification framework

Applications

- Develop SBAS applications
- Promote SBAS in industry

Engineering

- Establish, maintain, upgrade, grow and monitor SBAS system

International co-operation

- Participate in navigation forums, such as EGNOS regional extension.

Our greater goal is **excellence in helping South Africa take its place among the space faring nations of the world**

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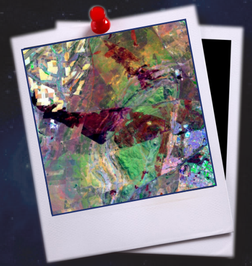
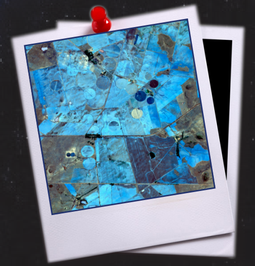
THE IMPACT

Through innovation and foresight, we are expanding knowledge, fostering new technologies and developing space applications that will benefit society as a whole

SANSA Space Operations
maintains exceptionally high service standards in an industry with no margin for error and little tolerance for poor performance.

The IMPACT of our endeavours has positioned South Africa globally and regionally in the space industry. Our activities support our clients in successfully completing their space missions and enable the application of satellite technologies in all spheres of daily living for people across South Africa and the African region.





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THE EXPERTISE

Since the advent of the space age in 1957, South Africa has established a remarkable reputation for accuracy and reliability within the international space community. Today, this strengthens SANSA's ability to use the benefits of space science and technology to help grow and develop the African region.

SANSA Space Operations, previously the CSIR Satellite Applications Centre (SAC), has a 50-year track record in leading Africa's satellite tracking and ground support services for a range of clients in the international space industry.

The journey started with NASA in the 1960s. Since 1982, the ground station at Hartebeesthoek performed more than 400 successful launch supports. On 1 April 2011, CSIR SAC became a SANSA directorate, still providing clients globally with world-class TT&C services for geo-synchronous and polar orbiting spacecraft.

We look forward to providing clients with the accuracy, reliability and service excellence that they have come to expect from the truly remarkable team at Hartebeesthoek.

SANSA Space Operations
SOME Fast facts

- 57-year track record in the global space industry
- 400+ launch supports since 1982
- 29+ antennas at the 2 890 ha Hartebeesthoek 'antenna farm'
- Operates 24/7 throughout the year
- Installed 13.2 m Ku/DBS- and Ka-band antenna systems within nine months
- Handled mission support and control of South Africa's satellites
- 46 launch supports in 2017 with 100% service level
- Located at the bottom tip of Africa (latitude 25° 53' South, longitude 27° 42' East)
- Unique work environment shared with a herd of indigenous antelope
- Easy access to the site from the OR Tambo International Airport in Johannesburg.

Ground station hosting services
Client facilities at Hartebeesthoek:

- Galileo Ground Sensor Station to monitor navigation signals from Galileo satellites to provide GPS coordinates
- 7.3 m X-band state-of-the-art antenna to track and download data from Earth observation satellites
- ORBCOMM Gateway Earth Station linked to a global network of low-Earth orbiting satellites that provide asset tracking and management services
  - Intelsat TT&C antennas
  - Eutelsat Carrier Monitoring Station
  - CNES S-band network
- EGNOS Ranging and Integrity Monitoring Station.

Discovering **new solutions, encouraging innovation, building alliances,** *expanding the frontiers of knowledge, this is the launch pad for our journey into tomorrow.*

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THE SERVICES

World-class tracking, telemetry and command services for more than 55 years

SANSA Space Operations operates and maintains the more than 29 locally installed antennas and a number of ground stations at Hartebeesthoek.

Our services are tailored to meet client needs. We use a rigorous systems engineering approach based on well-defined user requirements to establish new infrastructure or upgrade existing facilities for hosted infrastructure.

We have:

- excellent infrastructure (power, roads, security)
- state-of-the-art communications
- an exceptionally experienced, skilled and expert team committed to long-term support
- the proven ability to operate and maintain technologically advanced systems impeccably.

We offer:

- nine full-motion TT&C antennas and five remote sensing systems
- VHF/UHF, L, S,C, Ext C, X, Ku/DBS and Ka frequency bands and S-band mobile support
- 24/7 project management and maintenance
- spacecraft launch, life-cycle and emergency support
- transfer orbit support, in-orbit testing and carrier monitoring
- Teleport hosting
- system and radio-frequency engineering
- soil testing, civil and electrical, HVAC works
- procurement, importing and logistics, installation and integration
- acceptance testing and commissioning.

We deliver:

- globally competitive applied research, development and innovation in key space operations and applications
- launch, TOSS, LEOP, IOT support and TT&C services
- ground station installation and management for international clients
- human capital development and science advancement in space operations and applications.

Whatever the challenge,
SANSA Space Operations is making a difference, living its vision of making an indelible contribution to the space faring nations of the world.

HBK-2: 12 m Antenna

Slew rate : 5°/sec
Dish diameter : 12 m
Tracking modes : Program and Autotrack
Polarisation: LCP and RCP
Receive
Frequency range : 2.2 - 2.29 GHz
G/T: 22.4 dB/°K

Transmit 1
Frequency range : 6.7 – 7.2 GHz
EIRP: 88dBW
Transmit 2
Frequency range : 2.025 – 2.12 GHz
EIRP: 71dBW

HBK-5: 10m Antenna

Slew rate : 10°/sec
Dish diameter : 10 m
Tracking mode : Program and Autotrack
Polarisation: LCP and RCP
Receive
Frequency range : Rx1: 2.2 - 2.29 GHz

Rx2: 8.0 – 8.4 GHz
G/T: Rx1: 22.5 dB/°K
Rx2: 31.0dB/°K
Transmit
Frequency range: 2.025 – 2.11GHz
EIRP: 64dbw

HBK-7: Ku and DBS band Receive/ Transmit Antenna

Slew rate : 2 °/sec
Dish diameter : 13.2m
Tracking mode : Program and Autotrack
Polarisation : Circular & Linear
Receive
Frequency Range: 10.95-12.75 GHz

G/T : 38.25 dB/°K (@12.75 GHz)
Transmit
Frequency Range: Tx1 : 12.75-14.5 GHz
Tx2 : 17.3-18.1 GHz
EIRP1 : 91 dBW (@12.75 GHz)
EIRP2 : 92.6 dBW (@ 17.5GHz)

HBK-8: Ka band Receive/Transmit Antenna

Slew rate : 2 °/sec
Polarisation : Circular & Linear
Dish diameter : 13.2m
Receive
Frequency Range: 17.7 – 21.2 GHz
G/T : 41.8dB/K

Tracking Range 18.2 – 21.2 GHz
Transmit 1: 29.25 – 29.65 GHz
Transmit 2: 27.7 – 30.0 GHz

HBK-9: X band Receive Antenna

Slew rate : 3°/sec
Dish diameter : 5.4 m
Tracking mode : Program and Autotrack
Polarisation: RCP

Receive
Frequency range : 8.0 – 8.5 GHz
G/T: 30.5dB/°K

HBK-10: C Band Antenna

Slew rate: 5°/sec Azimuth, 1,4°/ sec Elevation
Polarisation: Circular
Dish diameter: 11 m
Receive
Frequency range: 3,625–4,2 GHz
G/T: 31,7 dB/K

Tracking mode: Program and Autotrack
Transmit
Frequency range: 5,85–6,425 GHz
EIRP: 89.5 dBW

MO-1: S Band Mobile Antenna

Slew rate : 20°/sec
Dish diameter : 15 ft
Tracking mode : Program and Autotrack
Polarisation: LCP and RCP

Receive
Frequency range : 2.2 - 2.4 GHz
G/T: 11.6 dB/°K

HBK-16: X Band Antenna

Slew rate : 3°/sec
Dish diameter : 7.3 m
Tracking mode : Program and Autotrack
Polarisation: LCP and RCP

Receive
Frequency range : 8.0 – 8.5 GHz
G/T: 32.2 dB/°K

HBK-17: Ku IOT Antenna

Slew rate AZ = 0.43 EL = 0.27 deg/s
Polarisation: Linear and Circular
Dish diameter: 9m
Receive
Frequency range: 10.95 –12.75 GHz
G/T: 35 dB/K

Tracking mode: Program and Autotrack
Transmit
Frequency range: TX1 (Ku): 12.75 – 14.5 GHz
TX2 (DBS): 17.3 – 18.1 GHz
EIRP: 85 dBW