

# Introduction to Regional Space Weather Centre

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South African National Space Agency (SANSA)

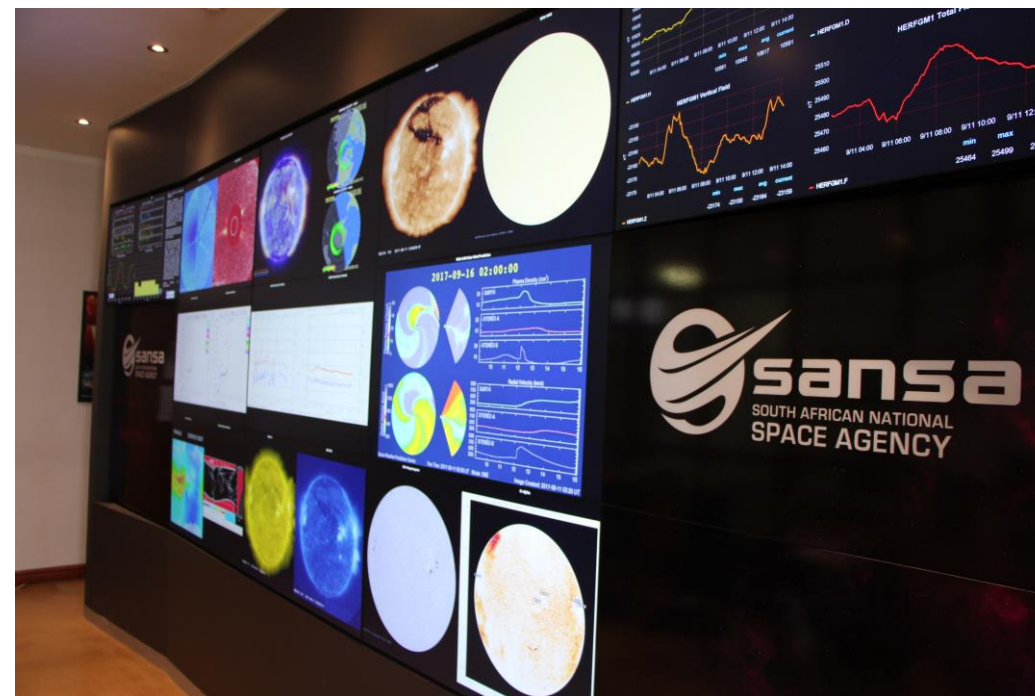
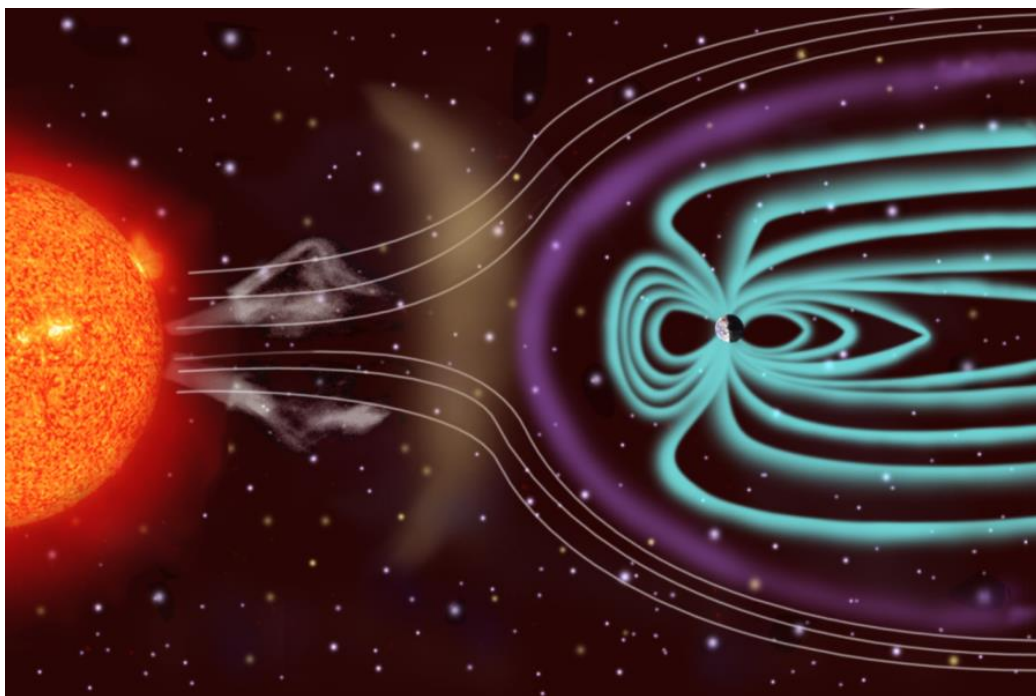


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# SPACE WEATHER



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# What, Where, How, and Why of Space Weather



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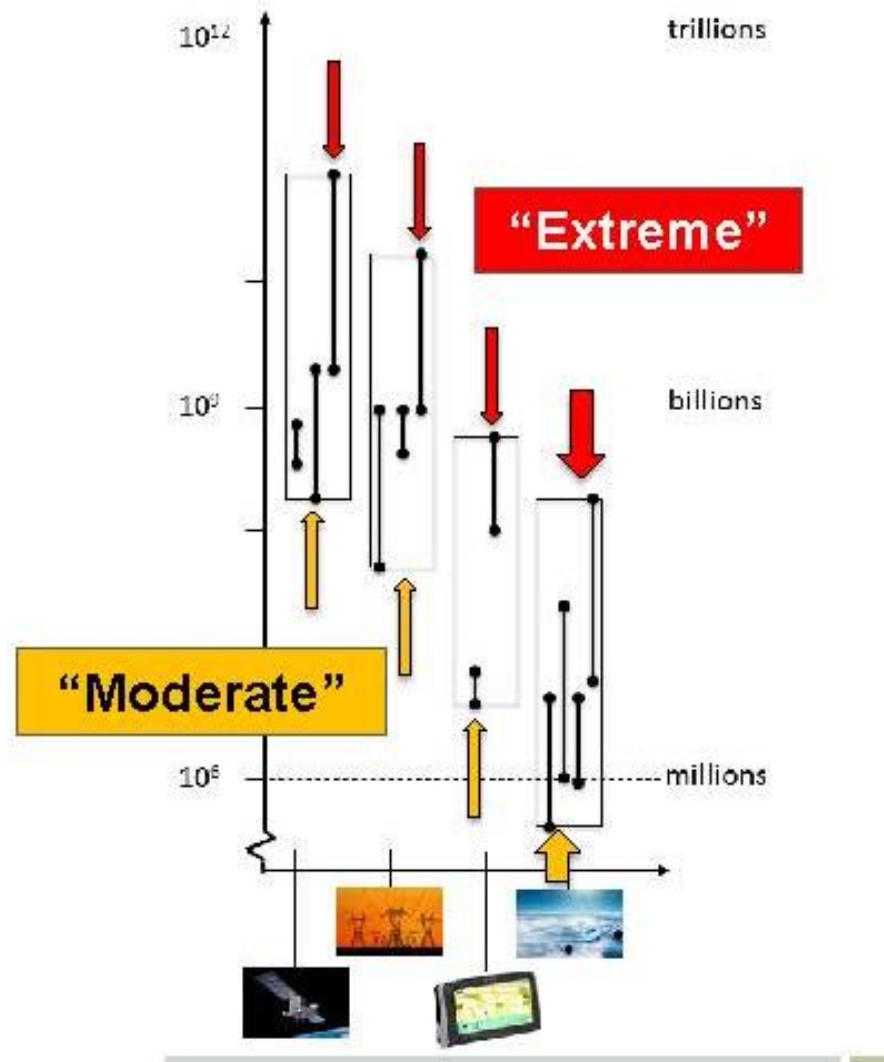






- In the 4IR technology continues to play an ever-increasing role in our society and the potential for space weather storms from the Sun to impact our daily lives is also growing.
- Technological infrastructure, including the power grid, GPS and satellites used for communication and navigation, are vulnerable to space weather effects caused by the Sun.

# ECONOMIC IMPACT OF SPACE WEATHER



## Satellite Technology

- cost of engineering & loss of applications
- Moderate , 1 satellite
- Extreme , 10 – 100 satellites

## Energy

- Wide-spread blackouts
- Moderate , R 600 million in losses
- Extreme , R 1 – R 2 trillion in losses
- Recovery could be 4 – 5 years

## Communication & Navigation

- Loss of GNSS capability
- GNSS outage could cost \$1 billion / day
- Can have devastating social and economic repercussions

## Security

- Radio blackout in all cases

## Transport

- Aviation, rail, maritime
- Severe economic repercussions

# SPACE WEATHER AS A NATIONAL RISK

<https://www.gov.uk/government/publications/national-risk-register-of-civil-emergencies>

## UK RISK REGISTER RISK MATRIX

Figure 2: Risks of natural hazards and major accidents



Impact score based on

- Fatalities
- Injuries/illness
- Social disruption
- Economic harm
- Psychological impact



# ICAO COMPLIANCE

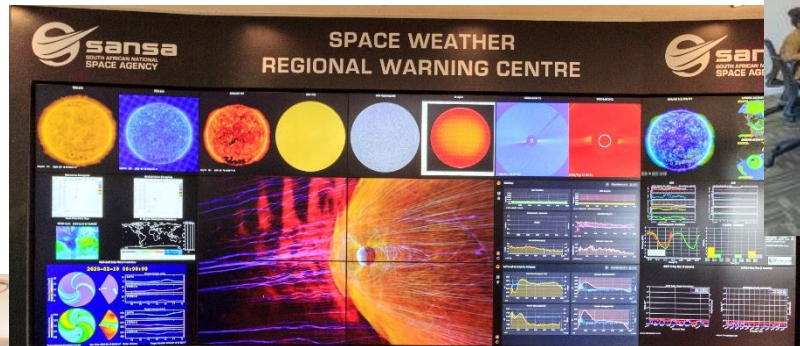
- Space weather phenomenon relevant to the whole flight route has been added to the information to be provided to operators and flight crew members.
- Space weather information shall be provided as part of the flight documentation.
- Space weather advisory information will include one or more of the following effects:
  - a) high frequency (HF) radio communications;
  - b) Satellite communications
  - c) GNSS-based navigation and surveillance; and
  - d) radiation exposure at flight levels;

**IMPLEMENTATION IS  
SET FOR BETWEEN  
NOV 2019 (Global) &  
Nov 2022 (Regional)**



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2007

Member of ISES  
(Space Weather  
Community)

2010

Space Weather Regional  
Warning Centre for Africa

2018

Space Weather Regional  
Warning Centre Upgrade

2022

24/7 Operational  
Space Weather  
Centre



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# REQUIREMENTS FOR CENTRES

→ Provider States need to be able to

A) monitor relevant ground-based, airborne and space-based observations to detect, and predict when possible, the existence and extent of space weather conditions that have an impact in the following areas:

- high frequency (HF) radio communications;
- Satellite communications;
- GNSS-based navigation and surveillance; and
- radiation exposure at flight levels;

B) Issue advisory information

C) Supply the advisory information to appropriate aviation channels

D) Maintain a 24 hour watch

E) Ensure active collaboration with other regional centres and global centres to ensure a continuity of information



# OPERATIONAL SPACE WEATHER SERVICES PROJECT

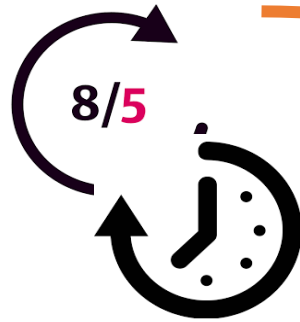
## Overarching Goal

To establish a 24/7 Operational Space Weather Capability by October 2022 that

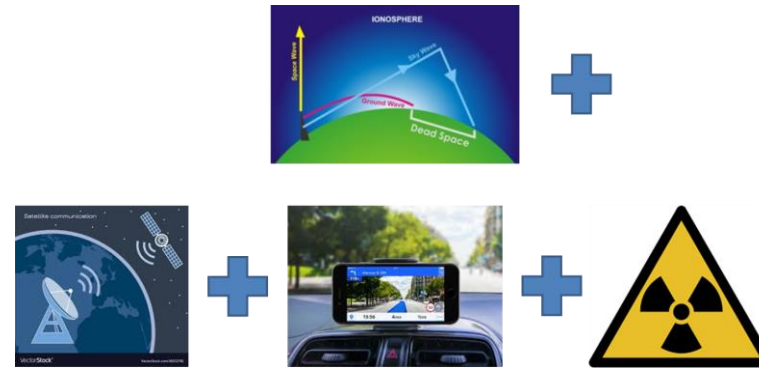
- provides services in accordance with the ICAO requirements to international air navigation
- is ISO 9001: 2015 certified
- provides products and services related to space weather impacts to the African market
- ensures a future value proposition for the South African space science programme



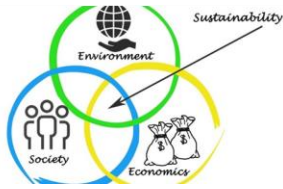
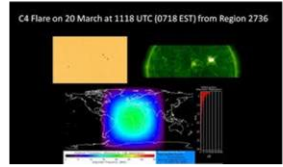
# PROJECT OBJECTIVES



24/7 operational centre



Increase products & services



Meet user requirements



Ensuring required foundation for services



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# DEVELOPING A CAPABILITY



- ✓ develop capability
- ✓ derive economic benefit
- ✓ provide a national platform
- ✓ ensure credibility
- ✓ fill the expertise gap
- ✓ provide quality services
- ✓ contribute to the knowledge economy
- ✓ create opportunities & partnerships
- ✓ increase the value proposition of space science



# SANSA – Designated Regional Space Weather Information Provider

- ✓ 24/7 Operational Centre & capability will be launched in October 2022
  - ICAO Compliant
  - ISO 9001: 2015 Certified
- ✓ Research, Forecasting and Prediction in the domains of
  - GNSS (navigation)
  - Communications (HF and Satellite)
  - Radiation Exposure
- ✓ Training, Interpretation and User Requirements
- ✓ SANSA is in a position to enable the mitigation of the risk created by Space Weather

# LAUNCH OF SPACE WEATHER CAPABILITY



THE VILLAGE NEWS

## SANSA opens state-of-the-art facility

Photographer: [Name]

The design of the brand new SANSA Space Weather Station in Hermanus is a reflection of the fascinating and interesting spaces SANSA studies between the sun and the earth. The new building features curved lines throughout to emulate space.

This state-of-the-art regional Space Weather Centre was launched on Thursday 3 November by Minister of Higher Education, Science and Innovation, Blade Nzimande, who said the space weather station will provide space weather services, including solar storm forecasts and warnings to the global aviation community.

The initial concept for the Hermanus Space Weather Station was not yet another plain square building. The new building is anything but, with hanging circular acoustic discs inside and curved lines outside. The team that worked tirelessly to finish on budget and on time are Dean Harris, Associate Contractor; Edge To Edge; Keenan Janneker, SANSA Project Lead for Space Weather; Christopher Denny, Owner-Director; Edge-to-Edge; Deputy Mayor Lindile Ntsho; Wesley Dingley, Principal Contractor; Edge-to-Edge; Heidi McAllister, Associate Architect; AVNA Architects; Mayor Annelie Rabie; Dr Lee-Anne McKinnell, SANSA Hermanus Managing Director; Gideon Schoonraad, Architect and Principal Agent; and Sakkin Franken, Mayor of the Overberg District Municipality.

Nzimande values his commitment to research as she's a research junkie herself. "If there's no research, we won't go places," Rabie thanked the minister for choosing Hermanus. She highlighted the fact that SANSA explained they compiled a business case study which included a cost recovery model and revenue generation for the Space Weather Centre.

International Civil Aviation Organisation said they would work with the regional and global centres to develop a cost recovery model so we can provide them with the customised service they want.

also to create awareness and low in terms of cost.

Dr McKinnell



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- ✓ SANSA is in a position to enable the mitigation of the risk created by Space Weather, and to represent the African Continent

# SPACE WEATHER SOLUTIONS

- ✓ Provision of space weather information and forecasting
- ✓ Expertise and prediction in HF communications
- ✓ Information related to impacts on navigation applications
- ✓ Space Weather research into impacts and forecasting
- ✓ Needs analysis and impact studies
- ✓ Advice and information on how to best utilise space weather information to mitigate the impacts
- ✓ Space Weather Training for industry



**24/7 Operational  
Space Weather Centre**

# PROJECT IMPACTS

**Project Investment  
= R 107 million**

**Indirect Impacts**  
Public interest in Science  
& Technology  
Knowledge generation  
International Prestige &  
Standing

**Direct Impacts**  
15 Professional Jobs  
45 Temporary Construction Jobs  
10 Subcontractors  
Local housing rental in Hermanus  
for 18 months  
All material local content with  
70% from Hermanus suppliers

**Induced Impacts**  
Secondary spend in the local  
community through jobs  
created and increase in  
local income  
Associated upgrades to the  
SANSA Hermanus Facility (a  
national platform)



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# HUMAN CAPITAL DEVELOPMENT

## Space Weather Forecasters

- Training and development of competent professional space weather forecasters
- Target is unemployed graduates who have a honours degree in Physics or Meteorology
- 7 trained during the project – target is 12

## Research Students, Postdoctoral Fellows and Interns

- SARCHI Research Chair providing projects in Solar Physics
- Other SANSA Researchers have developed space weather related research projects
- On-site student accommodation has been expanded to allow for greater numbers of students
- Annual International Space Weather Camp provides intervention for final year students
- Opportunities for interns, and postdoctoral fellows
- Target is 12 postgraduate students per annum working on Space Weather projects

# NATIONAL PARTNERS

- ✓ Air Traffic and Navigation Services (ATNS)
  - ✓ South African Weather Services (SAWS)
  - ✓ Department of Transport
  - ✓ National Universities
- 
- ✓ A **National Space Weather Working Group** under the ATMS ATM/cns implementation committee was set up in 2018 to coordinate national efforts to implement the ICAO Space Weather Information requirements

# INTERNATIONAL PARTICIPATION

- ❖ Member of International Space Environment Service
- ❖ Designated ICAO Regional Space Weather Information Provider
- ❖ Co-Chair of WMO Expert Group on Space Weather
- ❖ Leading Space Weather Voice for Africa - SANSA is leading the AFI Region project for the African Aviation Sector





# SPACE WEATHER CAPABILITY BENEFITS

## Tangible Benefits (Conservative)

Return on Investment period = 10 years  
Possible Revenue Generation  
Benefit to Cost Ratio  
9.7 (with indirect benefits)  
0.5 (revenue generation only)

## Additional Benefits

HCD Opportunities  
Increased Knowledge Generation  
International Prestige  
Recognition as continental leader  
Increase in professional skilled jobs  
Increased visibility

## Intangible Benefits

Calculated over 10 years (Conservative)  
Public Good Benefit = R 50.87 million  
User Domain Benefit for Aviation = R 149.03 million  
User Domain Benefit for Navigation for Aviation = R 1 362.13 million

# CONCLUSION

- Space Weather events can create vulnerabilities within our technology dependencies, and is a risk to the 4IR
- Space Weather affects safety of live principles for aviation operations, and compliance with ICAO is now a requirement
- SANSA is addressing operational capability for Space Weather information provision as a service to the African region
- SANSA will continue to utilize its existing capability and global networks to ensure that the most optimum solution for dealing with the threat of Space Weather is developed for the continent
- SANSA will continue to partner with the various role players to ensure an adequate readiness level on both sides (provider & user) for space weather information

# SUMMARY

## The South African Space Weather Capability

- Builds on a research and development legacy
- Meets the requirements for international compliance
- Provides a domestic capability to enable risk mitigation and empowered decision making
- Contributes towards the development of a national capability in critical skills that improves domestic and regional know-how
- Demonstrates the value in research to operations
- Positions South Africa to make a significant contribution to the global challenge of Space Weather



# THANK YOU

<http://www.sansa.org.za>

<http://spaceweather.sansa.org.za>

<http://research.sansa.org.za>



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