



SARAO
South African Radio
Astronomy Observatory



SARAO's Geodesy: Hardware Design, Installation and Support

B. Ngcobo



www.sarao.ac.za

The South African Radio Astronomy Observatory (SARAO) is a National Facility managed by the National Research Foundation and incorporates all national radio astronomy telescopes and programmes.



SARAO

South African Radio
Astronomy Observatory



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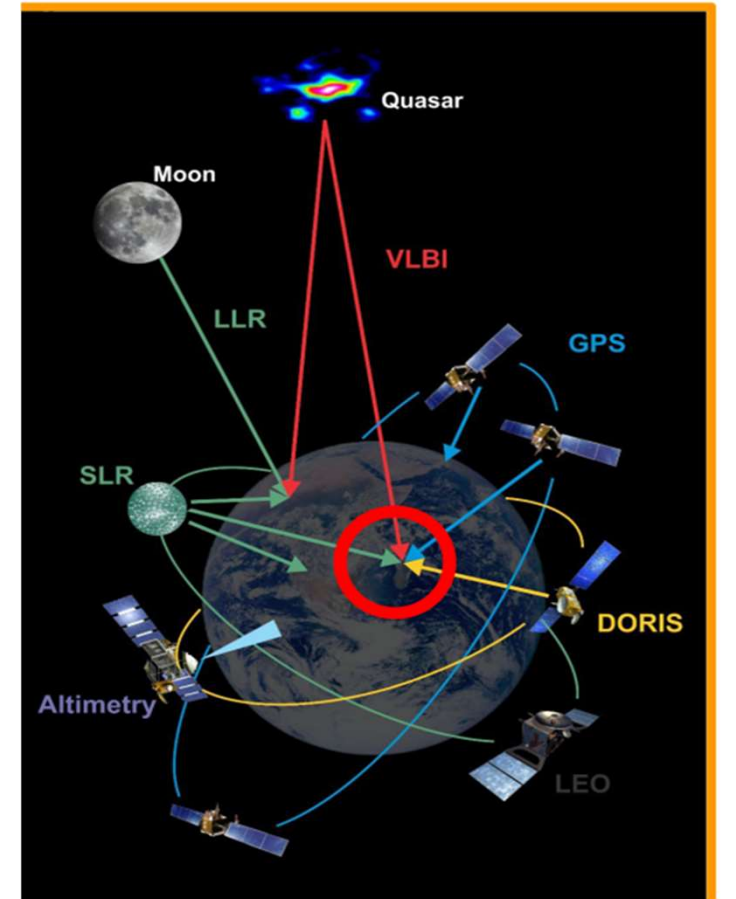
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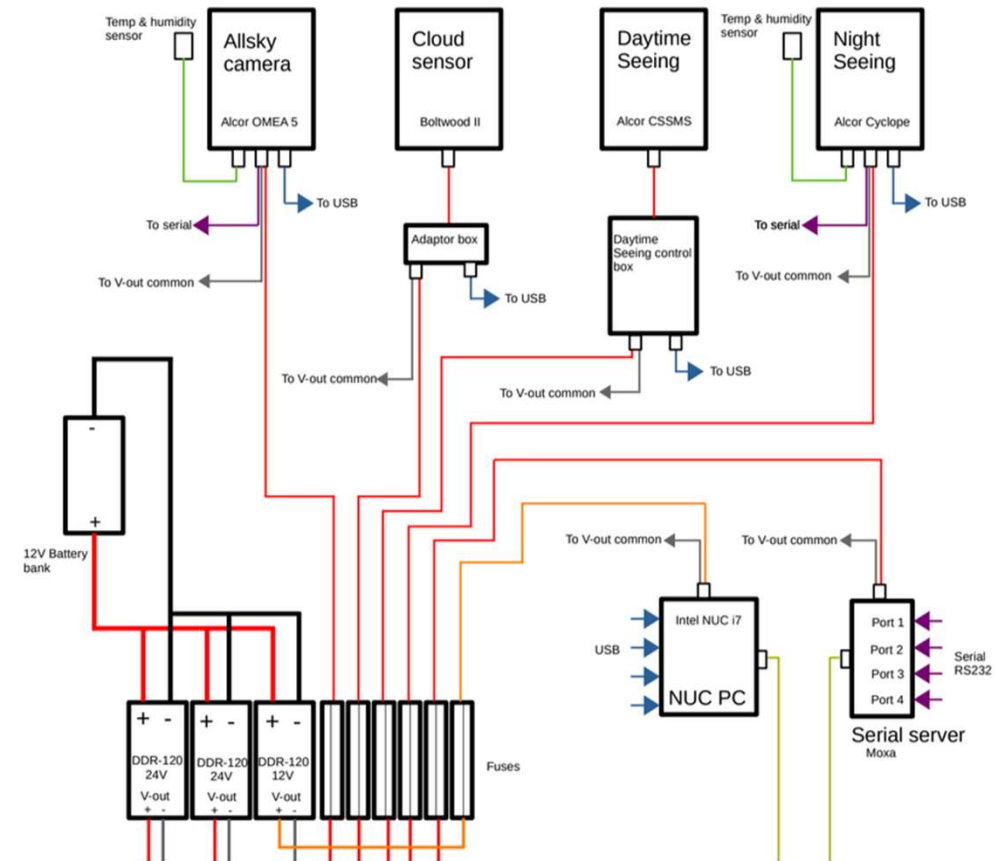
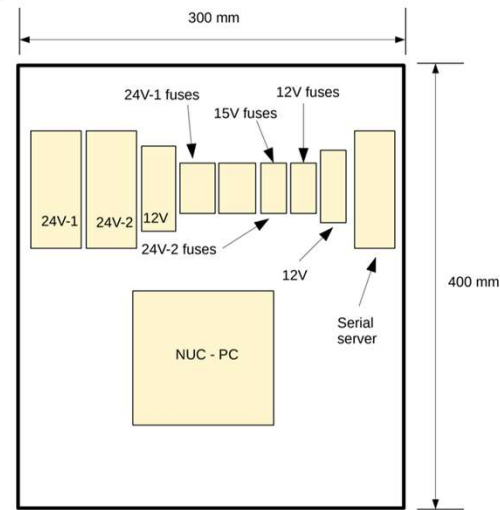
Reference Station Design GNSS and SLR support

- **95% GNSS/GPS**
- **5% Other- +NASA
/RUSSIAN LLR**

Core site: 1mm Site

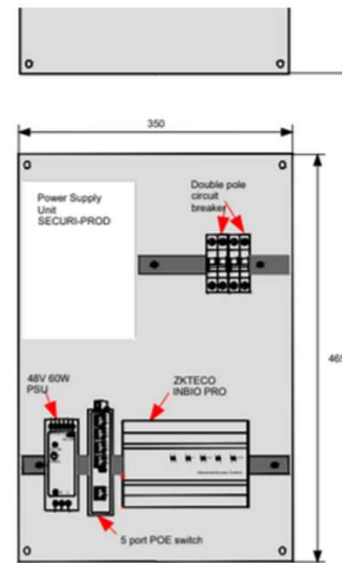
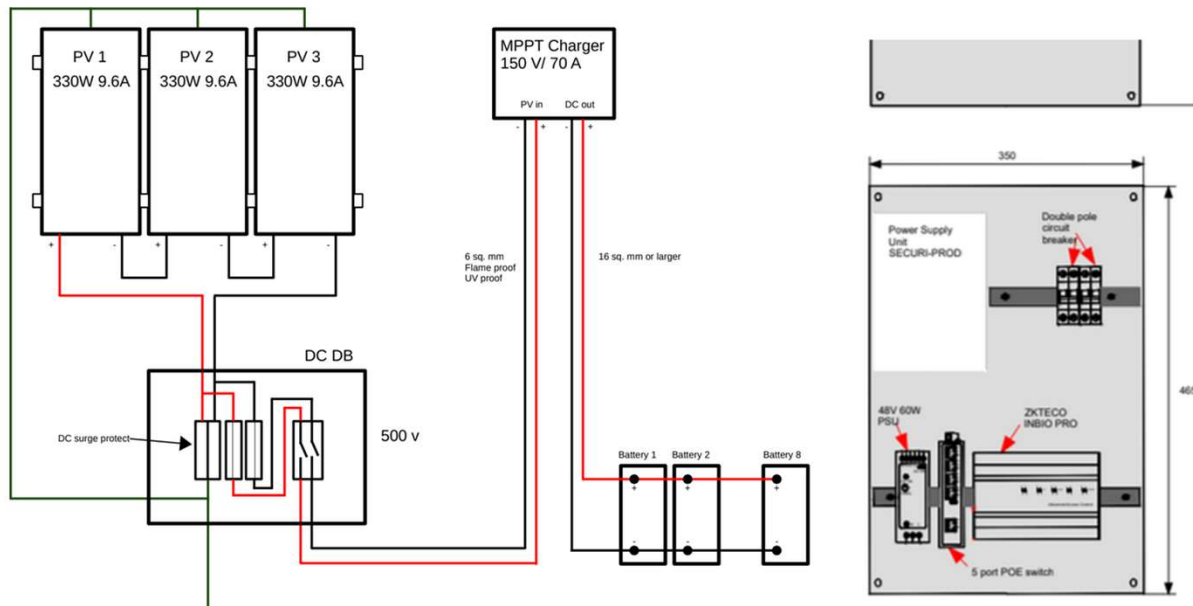


Design and Assembly



Atmospheric Monitoring System(AMS)

Design and Assembly



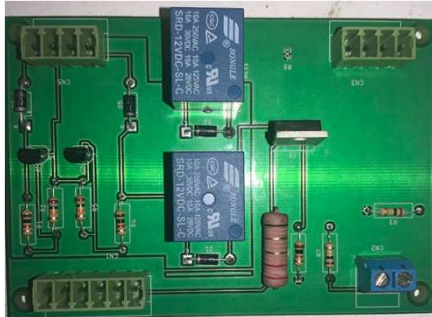
	
NRF National Research Foundation	SARAO South African Radio Astronomy Observatory
Drawn By: Sydney Madi	Role/Title: Draughtsman
Signature: _____	Date: _____
Checked By: _____	Role/Title: _____
Signature: _____	Date: _____
Approve By: _____	Role/Title: _____
Signature: _____	Date: _____
Project Manager: _____	Capacity: _____
Signature: _____	Date: _____

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<div><div>NRF</div><div>SARAO</div></div>	<div>Project Title:</div> <div>HARTRAO</div>	<div>Drawn by:</div> <div>TSHIAMO</div>	<div>Date:</div> <div>04/11/2024</div>	<div>Designed by:</div> <div>BONGANI NGCOBO</div>	<div>Scale:</div> <div>N.T.S</div>
		<div>Dwg No.</div> <div>XXXX-XXXX-XXX</div>			<div>Rev.</div> <div>01</div>
	<div>Drawing Title:</div> <div>HARTRAO ACCESS CONTROL</div>	<div>Checked by:</div> <div>BONGANI NGCOBO</div>	<div>Issued for</div> <div>AS BUILT</div>		
		<div>Approved by:</div> <div>ROELF BOTHA</div>	<div>Project No.</div> <div>2024-000</div>		

Systems design and Layout

Custom Products



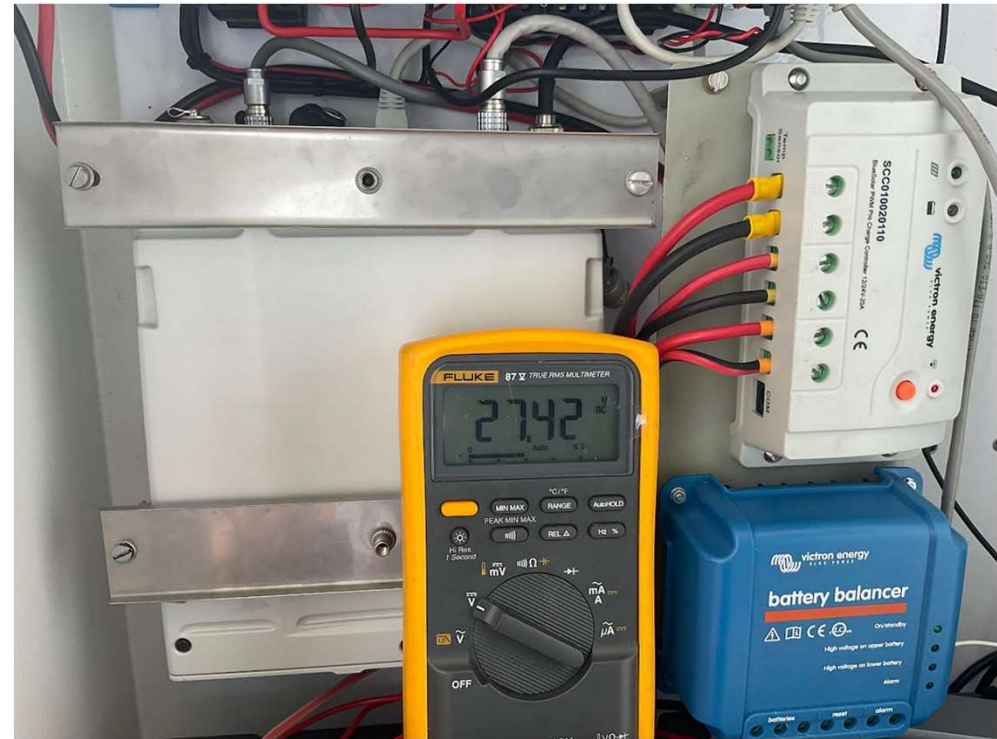
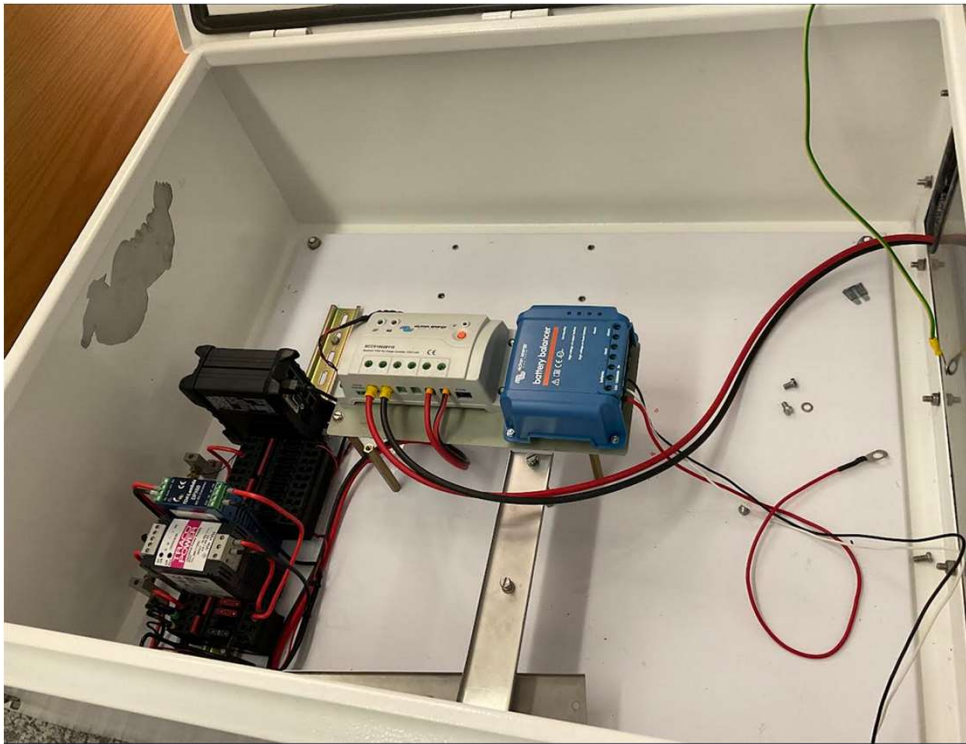
Integration & Testing



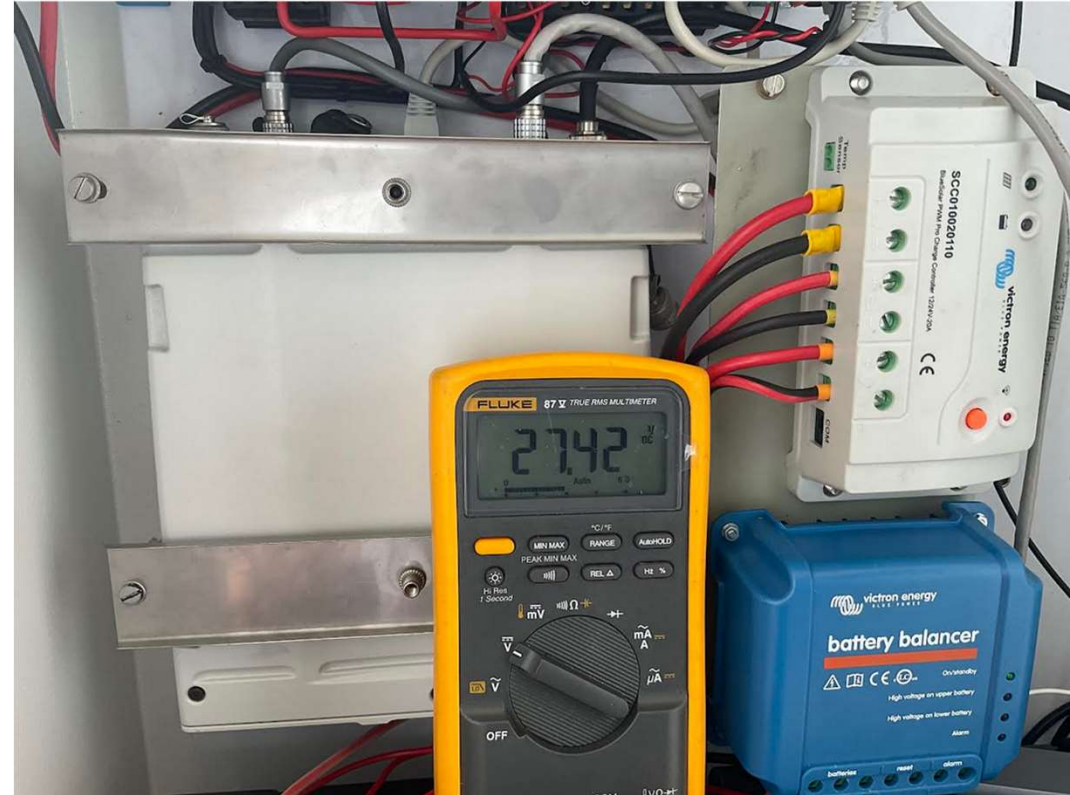
Integration & Testing



Integration & Testing



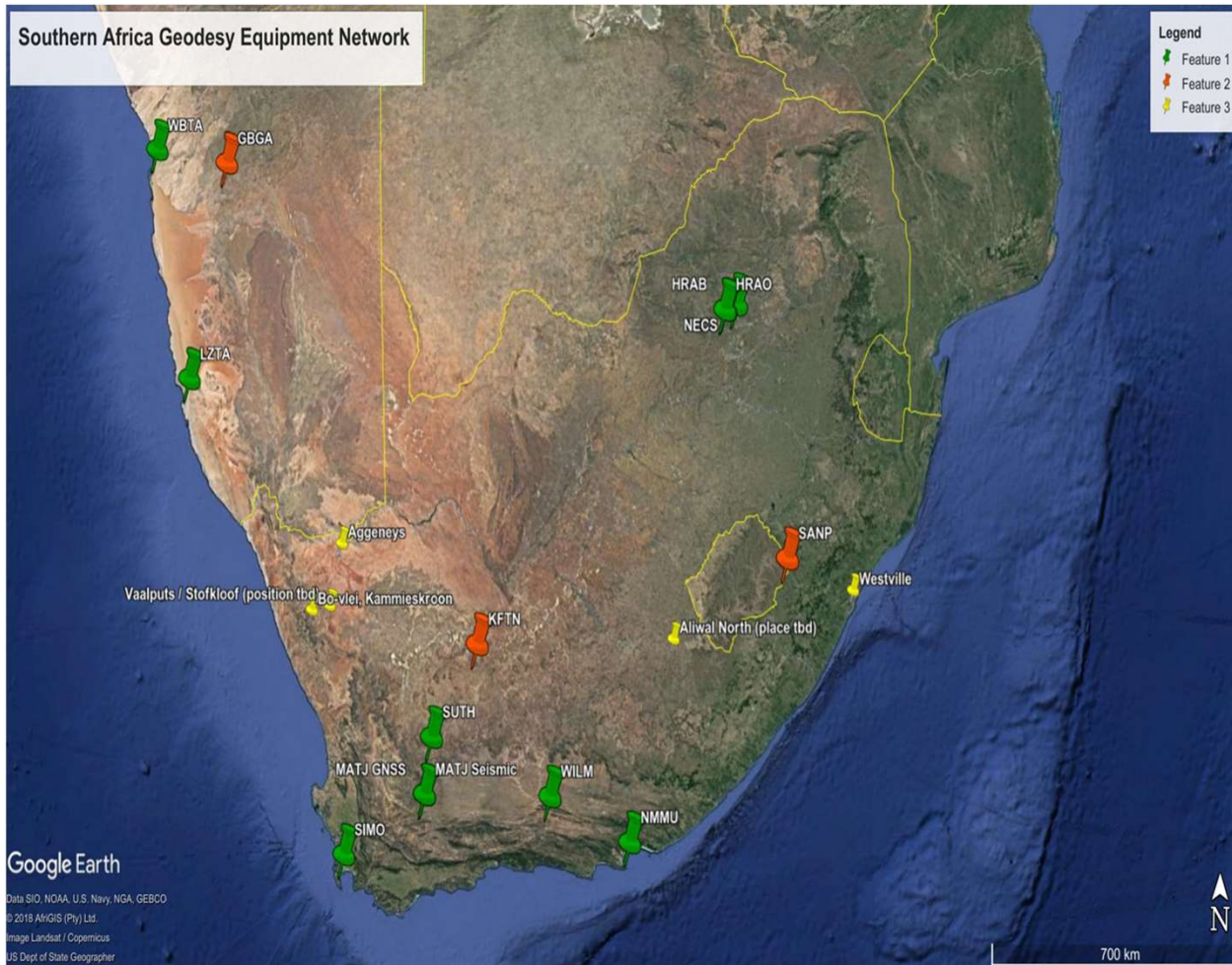
Integration & Testing



Integration & Testing



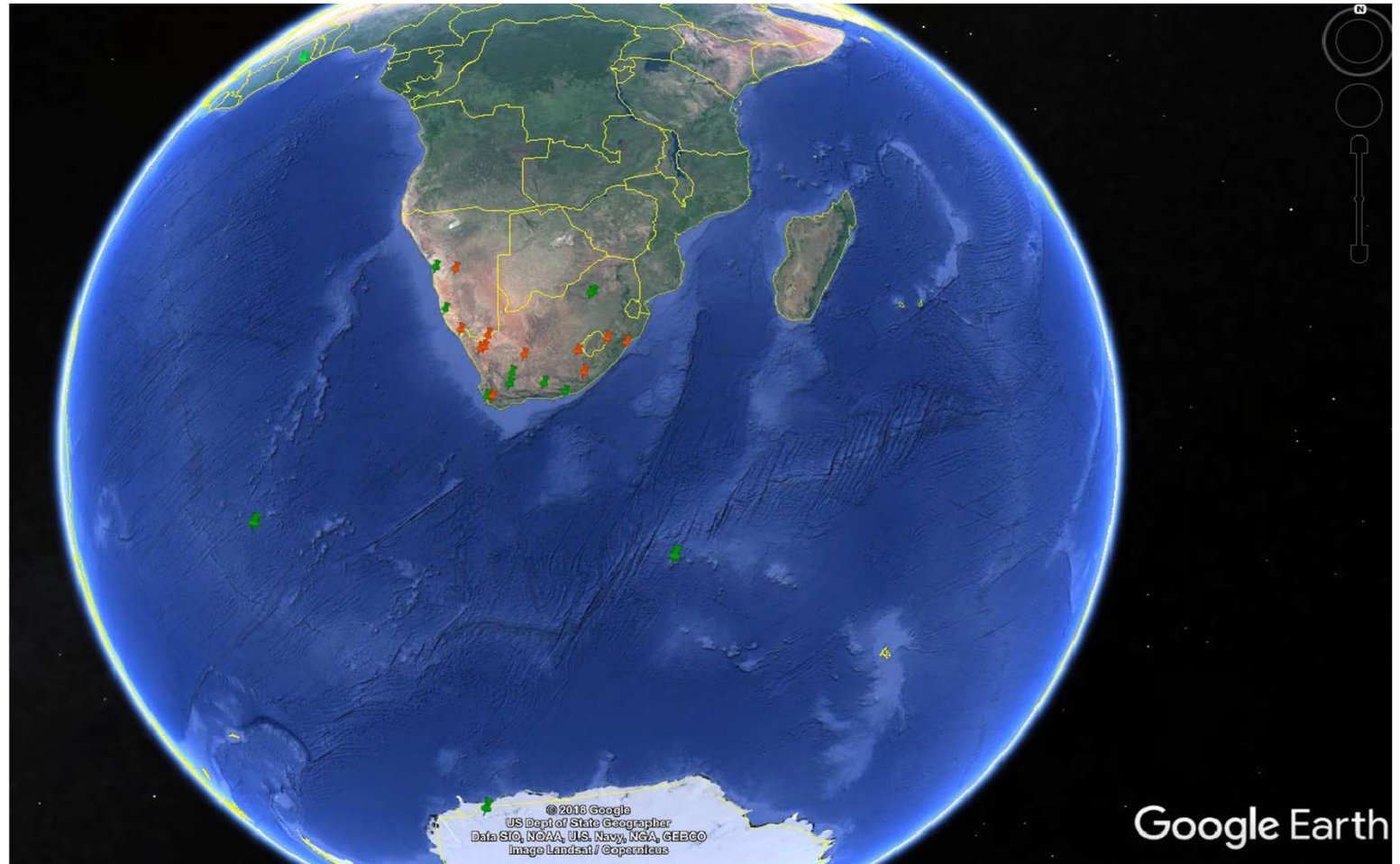
Geo-stations Network/ Locations



- Active
- To be installed

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- Active
- To be installed



Deployment & Commission



Deployment & Commission



Deployment & Commission



Deployment & Commission



Ghana Site Tie

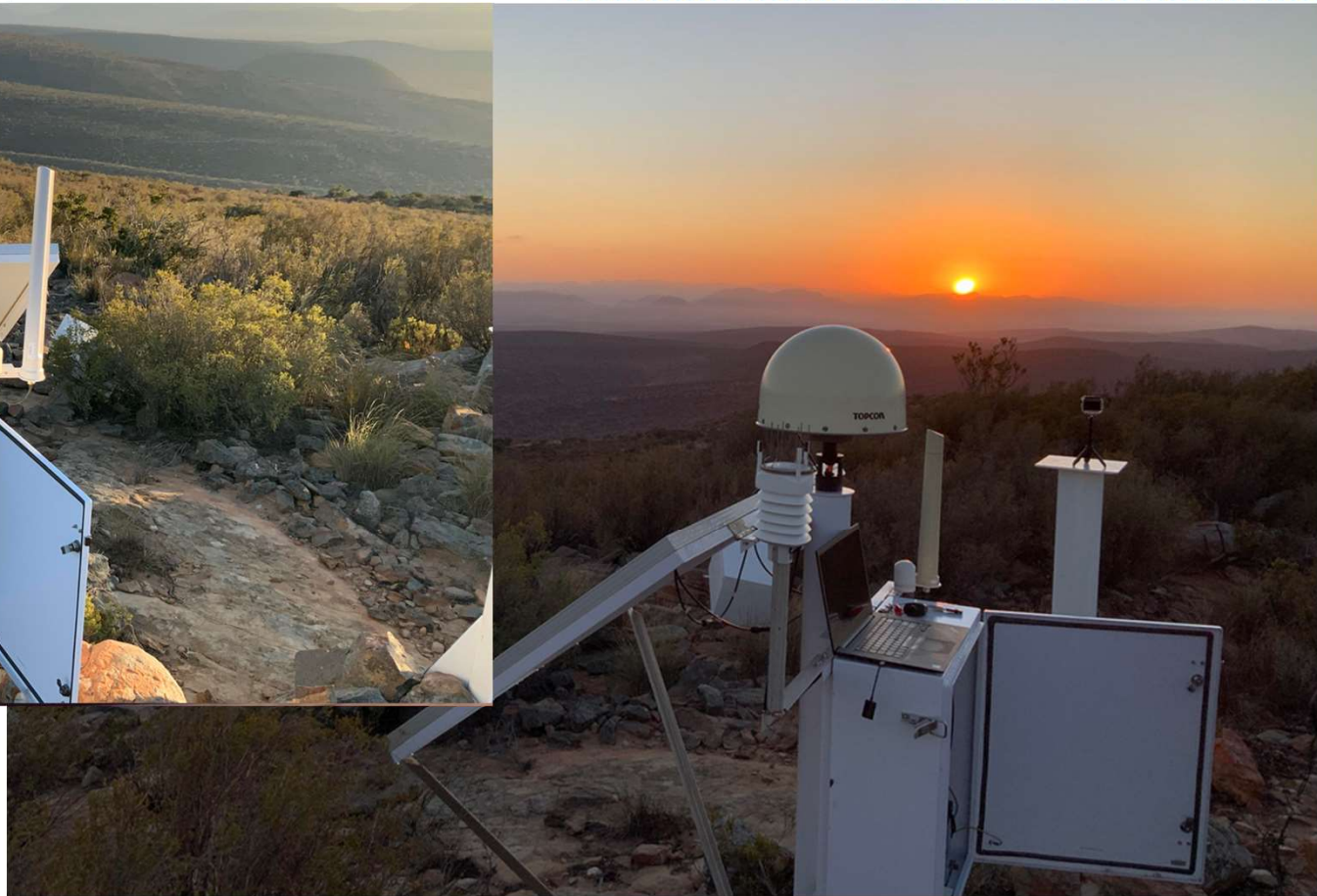
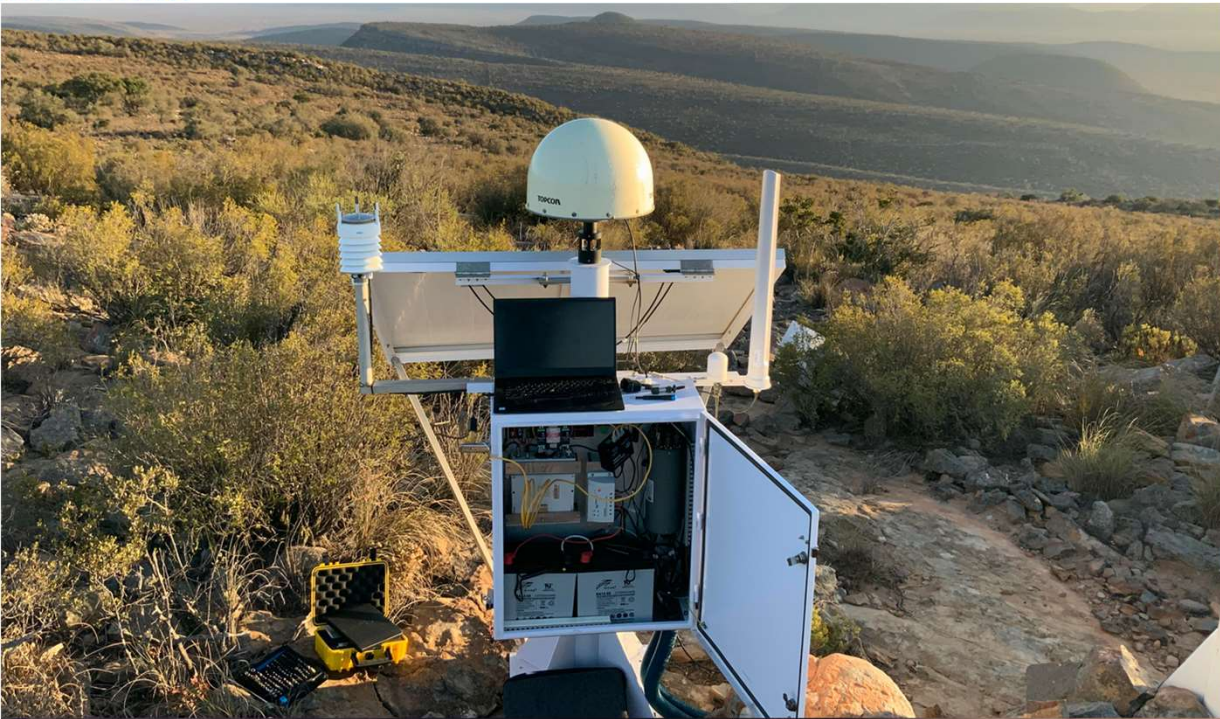
Deployment & Commission



Deployment & Commission



Deployment & Commission



Remote Site Eastern Cape-WillowMore

Network roll-out

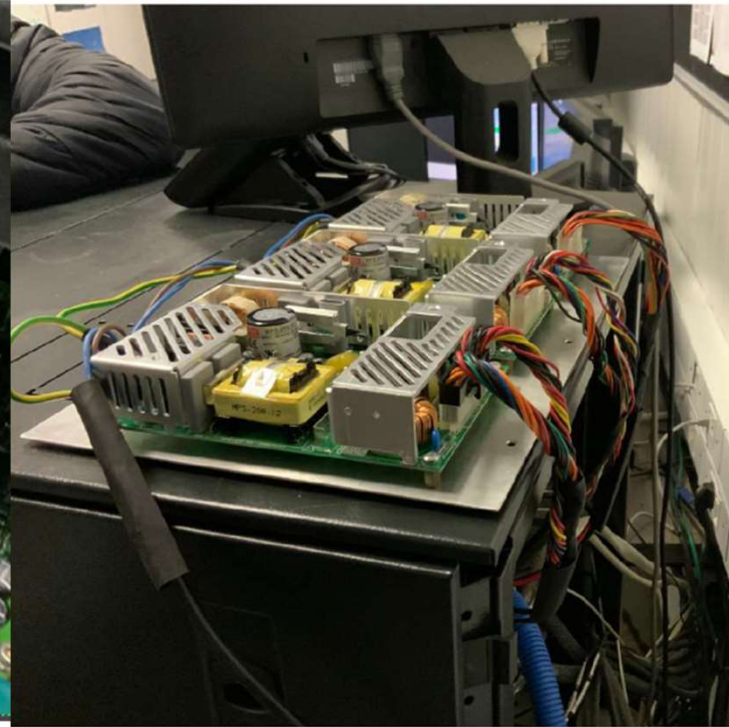
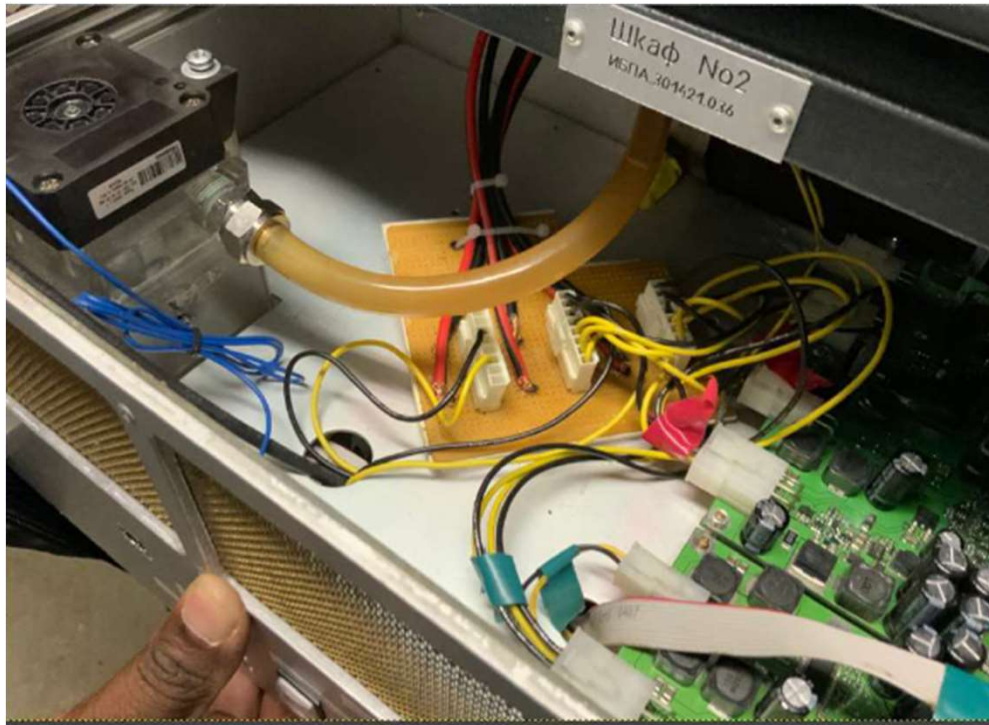


SLR Intervention Support

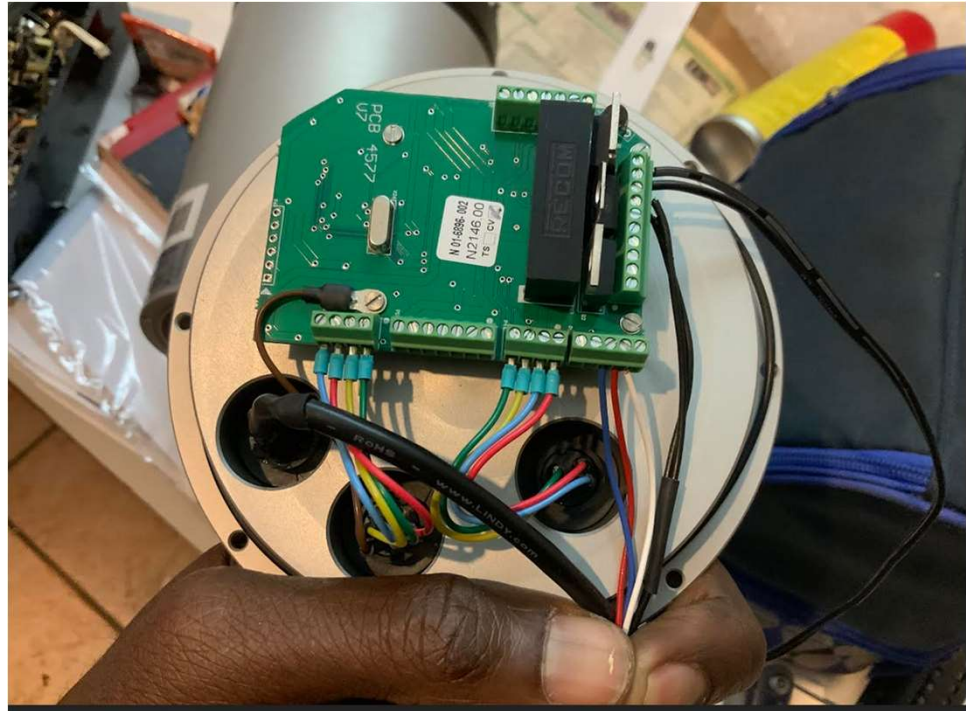


NASA left HV Power & Russian SLR LV power Repairs

SLR Intervention Support



Maintenance and Repairs



SKY-CAMERA Diagnostic

Maintenance and Repairs



Data Center Upgrades

Maintenance and Repairs

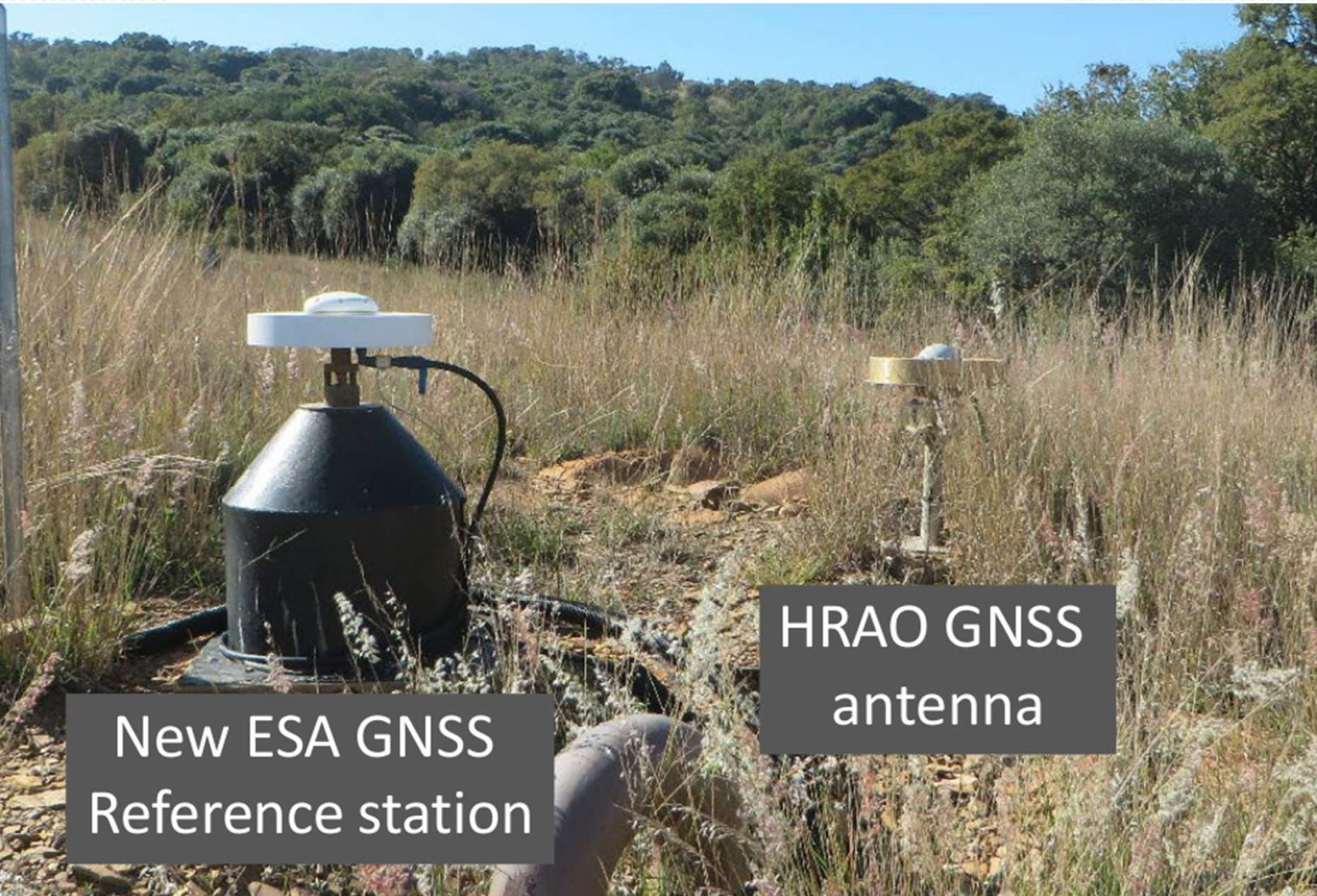


Maintenance and Repairs



**Botriver
Western Cape
Station repairs**

Reference Station Network: Hosted GNSS stations



Also:

- DLR
- ROSCO
SMOS
- NASA

Core site: Site Tie



Leica MS50 total station
With at least a Leica GRZ4 360° prism and Leica GPH1P prism
on each major instrument on site



Ongoing hardware-related activities:

Troubleshooting - network and communications

Station Remote Management System

DEVICE MAP				
	STATUS	ACTIONS	NAME	MODEL
	●	⊙ ≡ >_ ⇄	01HRAO	RUT955
	●	⊙ ≡ >_ ⇄	02MATJ	RUT955
	●	⊙ ≡ >_ ⇄	03NMMU	RUT955
	●	⊙ ≡ >_ ⇄	04GBGA	RUT955
	●	⊙ ≡ >_ ⇄	05NECS_new	RUT955
	●	⊙ ≡ >_ ⇄	06TOMR	RUT955
	●	⊙ ≡ >_ ⇄	07SIMO	RUT955
	●	⊙ ≡ >_ ⇄	08WILM	RUT955
	●	⊙ ≡ >_ ⇄	09ALWN	RUT955
	●	⊙ ≡ >_ ⇄	10KZNP	RUT955
	●	⊙ ≡ >_ ⇄	10KZNW	RUT955
	●	⊙ ≡ >_ ⇄	11KUTU	RUT955
	●	⊙ ≡ >_ ⇄	15VPS1	RUT955
	●	⊙ ≡ >_ ⇄	18BOTR	RUT955
	●	⊙ ≡ >_ ⇄	18BOTR_old	RUT955
	●	⊙ ≡ >_ ⇄	19TEST	RUT955
	●	⊙ ≡ >_ ⇄	20TEMP_Seismic_maser	RUT955
	●	⊙ ≡ >_ ⇄	21WBTA	RUT955
	●	⊙ ≡ >_ ⇄	22LZTA	RUT955
	●	⊙ ≡ >_ ⇄	24OFFS	RUT955
	●	⊙ ≡ >_ ⇄	25SiteTie	RUT955
	●	⊙ ≡ >_ ⇄	AVNTest	RUT955
	●	⊙ ≡ >_ ⇄	Debbie	RUT955
	●	⊙ ≡ >_ ⇄	DLR_GNSS	RUT955

Router showing connected devices loss

LAN Information

LAN Information				
Name	IP address	Netmask	Ethernet MAC address	Connected for
Lan	10.254.18.1	255.255.255.0	00:1E:42:19:E0:29	1d 19h 39m 49s

DHCP Leases

Hostname	IP address	LAN name	MAC address	Lease time remaining
gnss	10.254.18.2	Lan	00:80:0F:11:70:00	7h 32m 58s
Cam1	10.254.18.7		B8:A4:4F:11:78:A3	10h 21m 0s
Cam2	10.254.18.8		B8:A4:4F:11:78:99	10h 20m 59s

Ports



Refresh

GENERAL METRICS DATA USAGE LOCATION

DYNAMIC INFORMATION MOBILE DATA INFORMATION I/O INFORMATION GPS INFORMATION

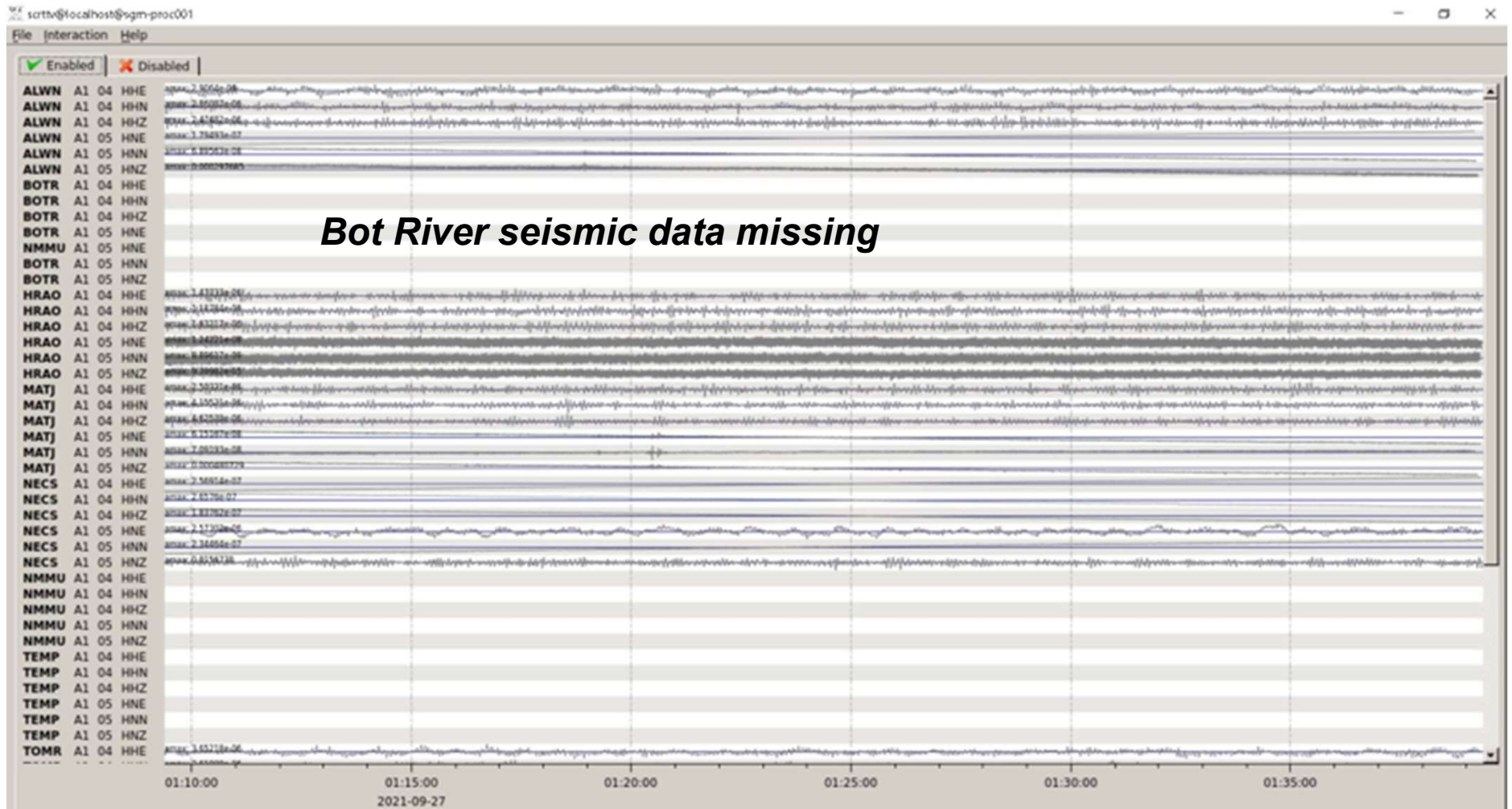
Date range
2021-08-01 00:00:00 - 2021-09-27 23:59:59



Bot River periodic power loss

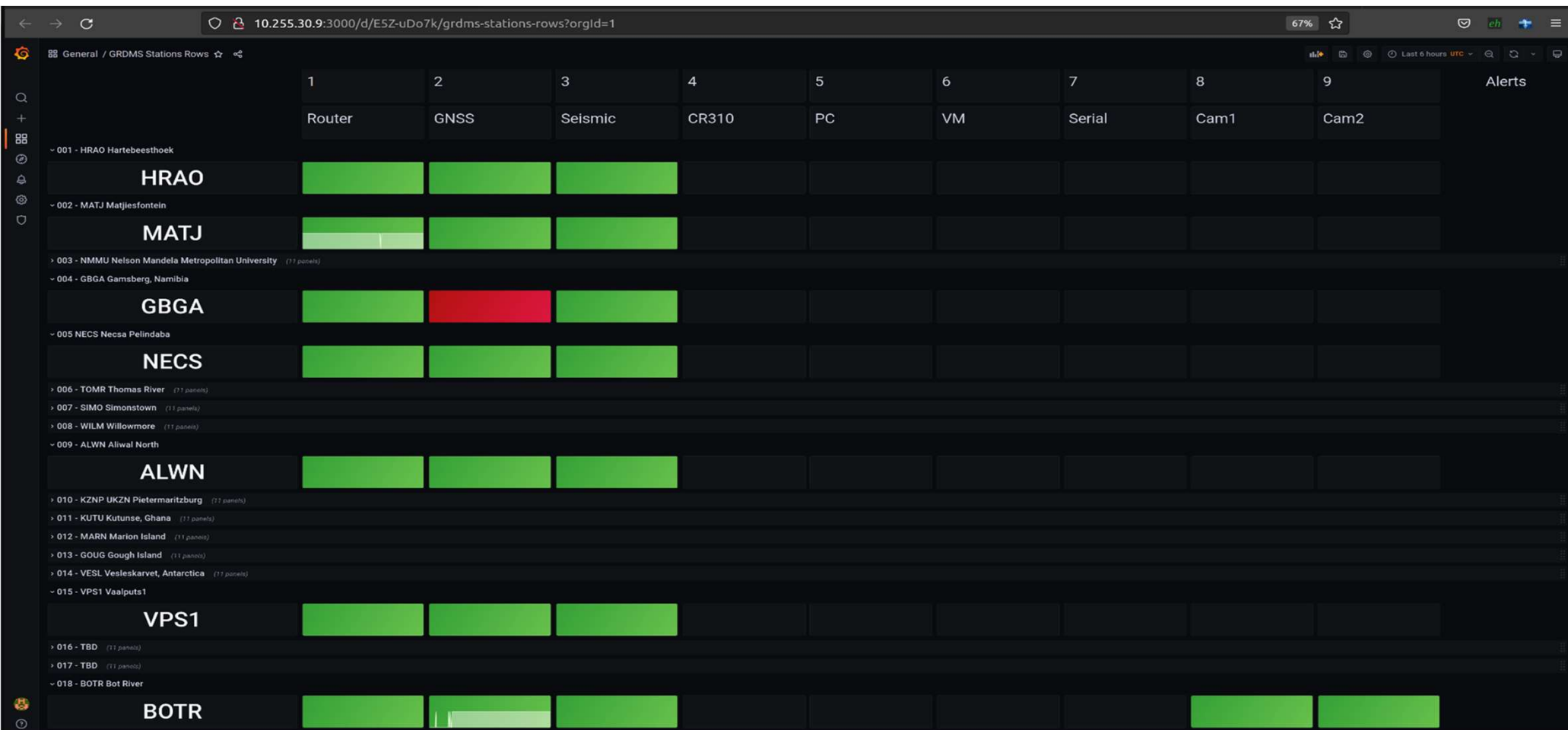
Ongoing hardware-related activities:

Monitoring - Seismic data stream



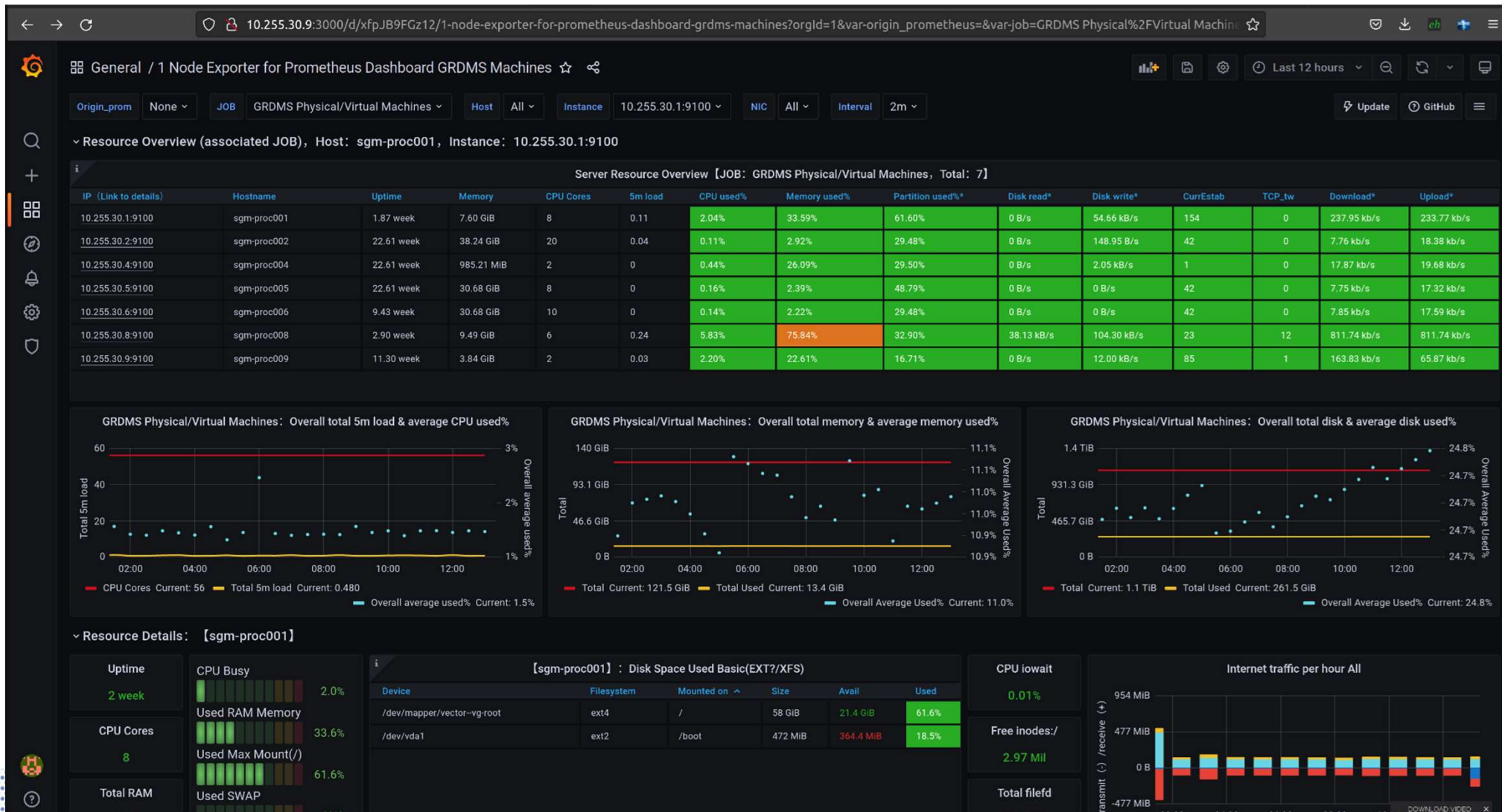
Software and data systems:

- Monitoring - stations and related hardware

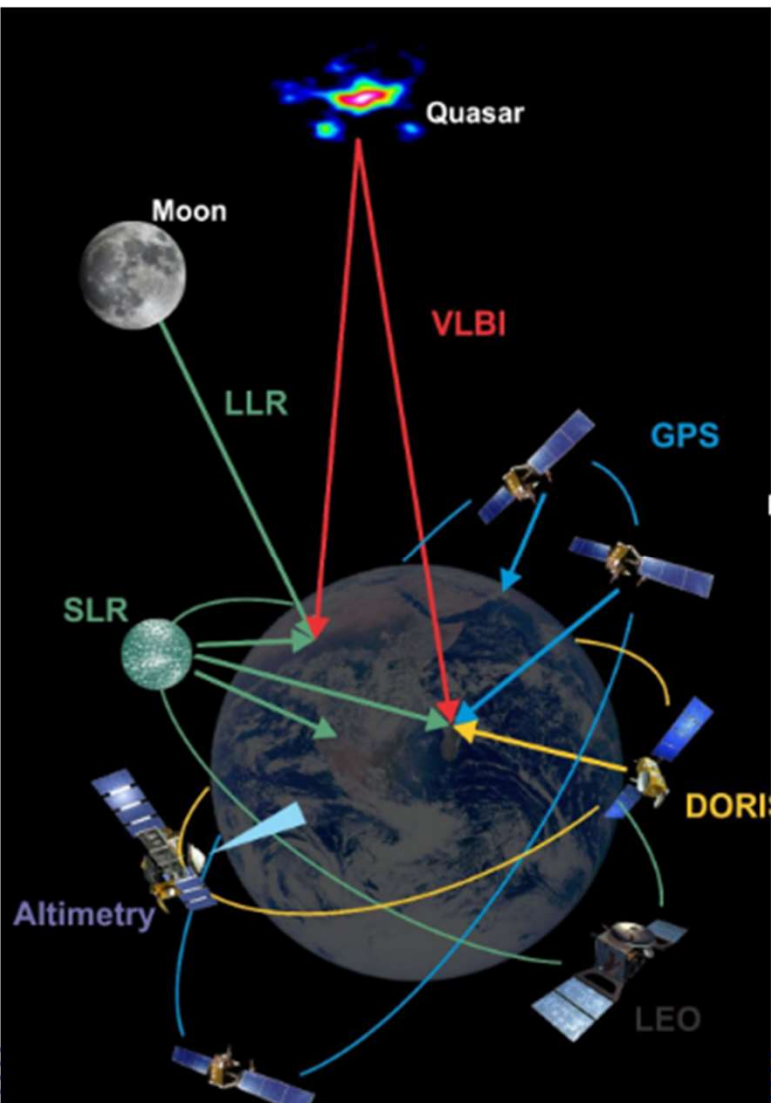


Software and data systems:

Monitoring - Compute and IT



Summary - Hardware



- Integrate → Various support equipment
- Custom Design → Electronics, Mechanical, Modification
- Monitor Remote Sites → SARAO + Hosted
- Maintain and Repair → Troubleshoot, replace or repair when necessary
- Collaborate → SARAO Software & Data + SLR + external Stakeholders ESA, NASA, ROSCOSMOS, SA Geo-Council, Universities, Citizen scientist etc

