



# Relocating Port Stanley Observatory



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## INTRODUCTION

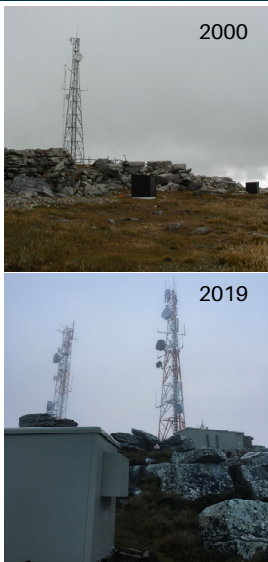
Port Stanley Observatory (PST) was established in 1994 on Sapper Hill, 2km south-west of the Falklands town of Stanley, and was accepted as an INTERMAGNET observatory in 2003. PST has therefore been providing continuous long-term monitoring in the region of the South Atlantic Anomaly for three decades.

While the observatory is operated by BGS, the Sapper Hill facility is managed by a local utilities company and was chosen to site the observatory in part for its accessibility and readily available power and network communications.

However, having an unobstructed aspect towards the town has meant that third-party communications infrastructure has gradually increased over the last 30 years to the extent that today there are several high-power transmitters operating near the observatory including microwave, TV broadcast, cell phone and VHF radio. The increase in radiated power has led progressively to a worsening of the RF interference picked up by the DTU FGE fluxgate and Gem Systems GSM-90 Overhauser magnetometers and a subsequent degradation in the quality of PST observatory data.

Over the years, several mitigations have been put in place to minimise the effect of the interference, including Faraday shielding on the sensors, analogue filtering in the electronics, shortening, re-routing and installing ferrite sleeves on the cables. The absolute pillar was also moved 50 metres further away from the antenna masts in March 2013. However, the quality of the data from the variometer has continued to degrade, most significantly after an upgrade to a TV transmitter in March 2017.

RF interference now appears as multiple steps, spikes and corrupt periods per day, which require significant staff time to identify, quantify and adjust, where possible. A decision was therefore made in 2020 to establish a replacement observatory, and to operate both sites in parallel for sufficient time to assess the continuity in the time series from current site to new.



Above: Growth in communication infrastructure at Sapper Hill. The huts in foreground are part PST observatory.

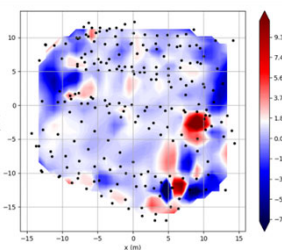
## NEW (PST2) INSTALLATION

The new observatory site is located ~2km south of Stanley and 3.5km east of PST observatory, as shown in the schematic on the right. The future of the site is secure from developments owing to its proximity to a Falkland Islands Defence Force (FIDF) facility.

Prior to constructing the observatory, the new site was surveyed and found to be free of magnetic anomalies or high gradients within 1nT/m, as shown on the right. The new site was also verified to be free from disturbance or interference (including RF) by monitoring the magnetic field using a Sensys FGM-3D magnetometer for approximately 12 months.

Surrounding the FIDF facility is a 1.2km residential development exclusion zone. The site, accessed by a 1km unpaved road is on open, common land and has a clear line of sight to Sapper Hill where a fixed mark is located, as shown on centre image below.

Construction of the new observatory began in Feb 2023 when concrete foundations were poured and the recording house, absolute hut, junction box, variometer enclosure and proton tube were installed. In Nov 2023 the instrumentation, consisting of a DTU tri-axial FGE fluxgate variometer and Gem Systems GSM90 PPM, were installed. The first data were recorded at the new site on 2nd Dec 2023.



Above: Total field anomalies in the vicinity of the new PST2 site

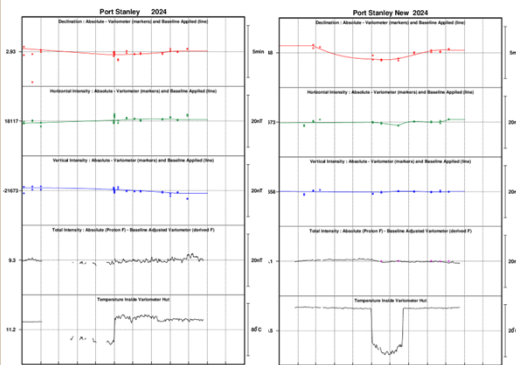
**Recording House**  
Enclosure to house recording, power and network equipment.  
Data are recorded on an Amplicon PC, running Linux CentOS7. Data collection is managed via the BGS' SDAS.  
Mains power is supplied via a spur from the FIDF Bunker.  
Network is via a modem and antenna connected to the building.

**Variometer enclosure**  
DTU tri-axial fluxgate variometer  
Thermally insulated, custom built fibreglass enclosure shipped from UK. Enclosure is temperature regulated and maintained at 19C via a 50W heater and smart temperature controller.

**Absolute Hut**  
Pillar and absolute hut installed at new site. Pillar and foundations connected in single concrete pour. Foundations 2m x 2m x 0.5m.  
True North azimuth surveyed using differential GPS to 1982 memorial cross 3km away.

**PPM enclosure**  
GEM GSM90

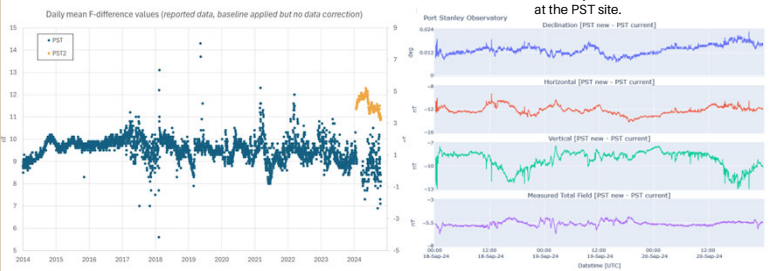
## EVALUATION OF THE NEW (PST2) SITE



Above: Provisional 2024 baselines at PST (left) and new PST2 (right). Short term periods of noise are evident in the deltaF (fourth panel) for PST old, despite data correction. At the new PST the deltaF is significantly improved.

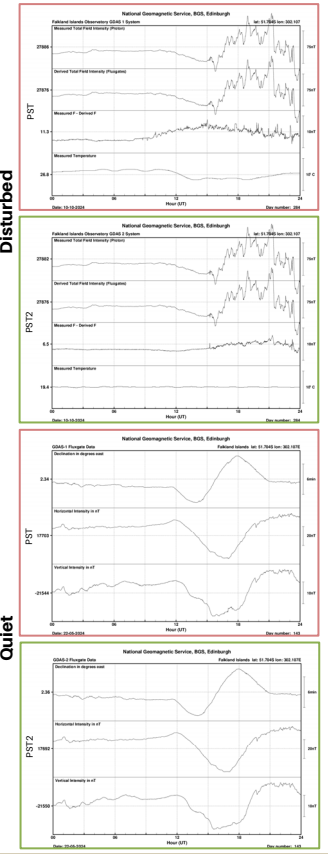
While under evaluation, the new PST2 site has been operated as an independent observatory, with separate absolute and site difference measurements. Although data were lost due to a logger failure, change of observer and heating failures, comparisons show that both sites record the same natural signal, with the new site being less affected by cultural noise.

Right: Daily magnetograms from the current PST (pink, marked as GDAS1) and new PST (green, marked as GDAS2) demonstrating that similar ionospheric signal is seen at the two sites during both quiet and active periods. Both days also show evidence of noise at the PST site.



Above: A long-term plot of daily mean F-difference values of uncorrected reported data demonstrates the increasing degradation of the current PST data quality.

Above: A plot of one-minute differences between the new PST2 and the current PST site over three days.



## DISCUSSION

The initial intention was to run the two installations as independent observatories for two years to provide an ample overlap in time series to assess data quality and evaluate an annual mean step between the two sites. However, analysis has highlighted that the PST data quality is worse than anticipated. Whilst we will continue to operate both sites for some time, we may need to accelerate the transition to the new observatory site for definitive data results to meet INTERMAGNET specifications. To support any decision to continue the PST IAGA code from old site to new, we also looked at the theoretical induction properties at both sites.

The Falklands area is dominated by the Stanley formation which is made up of Devonian quartz sandstone ('Stanley quartzite'). Quartz may not be strongly conductive, but the formation is porous with space for fluids, suggesting a skin depth of several kilometres at 1Hz. Hence, with a DC offset, field variations at both the current and new locations are expected to be very similar.

We plan to do some further verification, including establishing a third remote total field monitor, but we may need to consider publishing PST definitive data from the PST2 site as soon as 2025.

Reference: Aldiss, D.T., Edwards, E.J. 1999 *The geology of the Falkland Islands*. British Geological Survey, (WC/99/010)

Acknowledgement: We thank Dr Juliane Huebert for discussions on the conductivity of the sites.