SnT 2025 8 SEPTEMBER ONLINE DAY 9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

Upgrade of the Swedish auxiliary seismic array AS101 in Hagfors

Henrik Olsson, Jon Grumer, Monika Ivandic

FOI, Swedish Defence Research Agency

INTRODUCTION AND MAIN RESULTS

Since the 1960s, the Swedish Defence Research Agency (FOI) and its predecessor organizations have conducted seismological measurements in the Swedish region of Värmland.

The auxiliary seismic station Hagfors (HFS) was upgrades with new instrumentation in 2021. This work presents the status of the station, highlighting the experience gained in addressing new challenges and upgrading legacy equipment.

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A station dating back to 1969

The inauguration of the Hagfors station took place in 1969 with Alva Myrdal, then Minister of Disarmament, quoted saying “The globe is very small thanks to the seismological instruments”.

The motivation for building the station was acquisition of seismological signals from nuclear tests for research and data sharing with other countries. The house quickly became known in Hagfors as the “Secret house”.

The Hagfors central facility

The station is located in Värmland, Sweden. The site was selected after extensive geological reconnaissance in the 1960s. The site is located on homogeneous bedrock of granite with only very local disturbances.

Located roughly 10 km north of Hagfors, the station is far away from industries and antropogenic noise, while still being connected to the power grid.

Construction of the current array 2001

10 new sites were selected during the 2001 upgrade. The pits are constructed with polyethylene pits on top of poured concrete. The main facility was also renovated and most of the interior is still used today.

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Upgrade of seismometer equipment 2021

When the old Nanometrics equipment, installed in 2001, reached the end of its technical lifetime a public call for tender offers was issued in 2020.

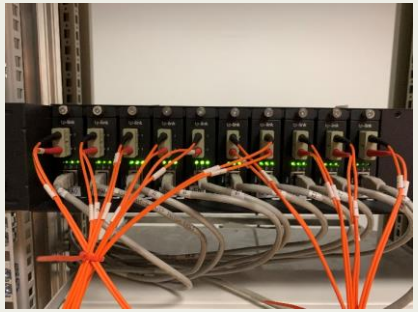
The station was upgraded in 2021 with Güralp 3T-120 seismometers and Güralp Affinity digitizers.

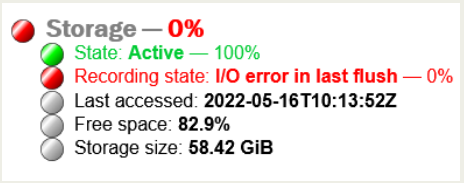
Existing fiber optic cables between the pits and the central facility were reused, with Ethernet media converters installed on both ends to enable remote access and data transfer to and from the digitizer.

Status of installation

As a test during initial installation, the GPS receivers were places inside the pit, directly under the lid. The GPS signal was sufficient, even during winter with large amounts of snow, and it was opted to no move the units to the poles next to the pit.

Unfortunately, some of the GPS units started experiencing intermittent outages that ultimately lead to a complete loss in GPS timing. The manufacturer was contacted and broken GPS modules were replaced under warranty. The new modules have been performing as expected.





The new data acquisition hardware experienced some major issues after final deployment. For unknown reasons the Linux file systems in the digitizers started becoming corrupt, leading to data outage. Some digitizers were sent to the manufacturer and others could be repaired with a firmware restoration. Some digitizers suffered repeated occurrences of the corruption.

No major hardware issues have occurred since July 2024, the systems now appear stable.

Problem	Cause	# of times
Data outage	Corrupt storage	6
Timing	Broken GPS module	4
Other	Minor and intermittent issues	5

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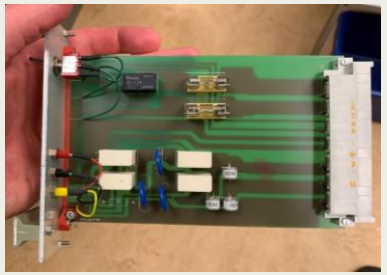
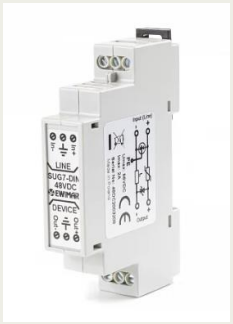
Other noteworthy activities

Ongoing work to inspect the electrical system, including assessing the condition and functionality of the electrical ground. Surge protectors were originally designed by Norsar for the 2001 upgrade and are still in operation. Components are replaced as needed. We are planning to move to standard components.





Our local station assistant, Sven-Inge, has retired after helping us at the station for 30 years. He still visits the station from time to time.

The roof of the central facility has been replaced during 2025 by a local contractor. Additionally, the roof protecting the GCI dish from snow was also replaced.

The waveform group at FOI

The waveform group at FOI is growing!

Back in 2020, waveform analysis at the Swedish NDC was a one-person effort. Today, our team has grown to five scientists. The two newest members joined us in August 2025.

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