



A team of technicians working to fix the VSAT antenna. In the background an operator is installing the GPS receiver.

Giving a second life to Senegal's auxiliary seismic station

BY MAPATHÉ NDIAYE

Of the 120 auxiliary seismic monitoring stations agreed under the Comprehensive Nuclear-Test-Ban Treaty to help verify compliance, 108 are now certified. This is the story of one of them.

Babate (BBTS) is a station in the CTBTO International Monitoring System (IMS) auxiliary seismic network in Senegal, with the Treaty code AS097. The installation of BBTS was completed in December 2006 with certification in February 2007. From 2007 to 2008, the station was actively managed by the Institute of Research for Development (IRD). After 2008, BBTS suffered from IRD activities being scaled back and was progressively abandoned. This resulted in the station being out of service for several years. In 2014, the General Direction of

Research of the Ministry of Research of Senegal, in collaboration with the CTBTO, decided to repair BBTS. A new team with a new focal point and a new station operator was created. The station went through several steps to restore its capability. This article is a review of the main steps performed to give a second life to BBTS.

The history of BBTS began in early 2001 when the first site survey was performed to verify if the site chosen under the Treaty was suitable for acquiring high quality seismic data

for the IMS. According to the Treaty, BBTS was to have been located inside the Geophysical Observatory, in the IRD Research Center, in the City of Mbour with the great advantage of being operated by the IRD.

Unfortunately, seismic background noise from industrial and other activities in Mbour, which is quite a large city, was too high and one of Senegal's busy main national roads borders the IRD Center. This made the Treaty site, despite all the advantages linked to its location, not suitable for AS097 installation. Alternate sites had therefore to be found. Potential replacement sites were selected not too far from the IRD Research Center at Wady Tabakaly and Babate, 144 km and 75 km away from Mbour. Site surveys showed that background noise at the two sites was almost identical, low and within the acceptable range. Babate was finally selected because it was closer to the IRD Centre. This explains the local name BBTS chosen for AS097.

Construction and installation of AS097 started in February 2004 and took two years. All the steps were completed on time except for installation of the seismic equipment, which was postponed due to technical problems from a borehole that was not waterproof. It took almost a year to resolve this issue by drilling a second borehole. From February 2007, the site was tested and certified and began providing accurate and reliable data. It was regularly maintained and monitored by the IRD. But after five years, in April 2012, BBTS was progressively facing issues. IRD decreased its activities and the station suffered from a lack of manpower. In January 2013 the station was completely abandoned and no data was received from AS097 between May 2012 and August 2015.

Giving AS097 a second life to become a major objective of the General Direction of Research (DGR) of the Ministry of Research of Senegal and

a new team was set up to restore the station, working hand in hand with the CTBTO to meet the challenge. In October 2015 an initial repair mission was organized consisting of CTBTO staff and technicians from the Senegalese Ministry of Research, scientists and the director of research. This first mission repaired the Global Communication Infrastructure (GCI) link, the Central Recording Facility (CRF) equipment and configured the station. It was successful in taking big steps in a single day mission, a real motivation for everybody.

Some weeks later, in November 2015, we noted that there was a data transmission failure every night, right after sunset. After investigation, we understood that the problem came from batteries that had lost their capacity after the five years break. The battery bank therefore had to be changed. After investigating the local market for several months and not finding good quality batteries to meet our technical specifications, we finally decided to import them. Once the power supply problem was fixed, we were proud to see AS097 running again and sending satisfactory data to the CTBTO's International Data Centre (IDC).

In October 2016 we ran a routine calibration. The results showed some problems on the sensor vertical component BH2 (component number 3 of the borehole sensor). In fact, the amplitude of the signal was twice as high on BH1 (component No 1 of the borehole sensor) than BH2. At a first sight, we suspected the problem coming from digitizer settings. But further verifications convinced us that both the sensor and the digitizer were faulty. Our first option was to send the sensor for repair but we finally decided to change the sensor. A lot of paperwork was needed regarding custom clearance but we stayed motivated until we got our new seismometer delivered. We planned a final mission to change

the seismometer. For precautions, we got assistance from a Guralp specialist who helped us change, configure and test the new seismometers. On 29 January 2018, months since our challenge started, AS097 was back to life and in good condition. We took advantage of Global Communication Infrastructure (GCI3) migration to setup a remote and redundant access to BBTS for full time monitoring to make sure AS097 is roadworthy.

EDITORIAL NOTE:

Since August 2019, AS097 at Babate has faced new technical challenges. Nevertheless, as of June 2020 it was continuing to transmit data to the IDC in Vienna.

Changing the old borehole seismometer

