CAN DOGS FLY?

Improved methods of noise sources identification

"Can dogs fly?" This was a question asked when analysing a time history of aircraft noise measurements carried out in a residential area.

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When extracting aircraft noise from the data, one particular noise event was detected – but the noise clearly wasn't aircraft noise, it was coming from above the microphone, which was located 4m above the ground.

So what was it? Thanks to the audio recording, the analysis of the event indicated the noise to be a barking dog. But a dog barking above the station located at that height? How could that happen? There were several 'theories', did the dog climb a tree, did it jump out of a plane or could it fly?

The answer to this question lies with the selection of the measurement site. Importance of the measurement site is emphasised in ISO 1996-2: 2017, which states that sites for measuring microphones shall be chosen to 'minimise the effect of residual sound from non-relevant sound sources'.

Testing object and measurement performance

The location of the site is critical in obtaining accurate and useful data. So, this should be considered P54

in the early development of a measurement plan, once objectives for the measuring system have been clearly identified.

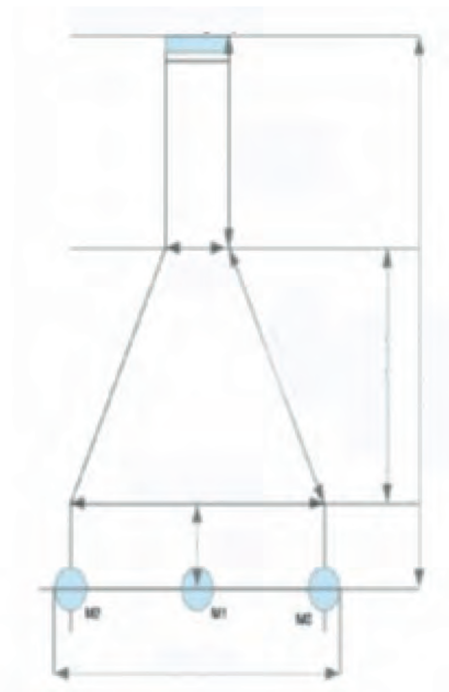
The goal of this particular experiment was to verify the influence of the selection of the measurement point on data accuracy and usability. For the purpose of this study; two measurements of aircraft noise in a close proximity to aircraft trajectories were performed.

Again, for the purpose of this experiment, location of the monitoring stations at two sites were compared. Both monitoring points were selected in proximity to the aircraft routes near the same airport.

The study was performed with SV 200A, SVANTEK's noise monitoring station meter designed to perform automated continuous noise measurements. The monitoring station was installed on a 4m mast and was remotely connected to the cloud server, SvanNET.

The noise monitoring station used in this project monitored noise directivity in both the horizontal and vertical axes. It had a single traditional condenser microphone mounted centrally and four additional microphones located equidistant from each other on the sides of the housing. These used a signal and phase difference

Above: Photo 1: Svantek SV 200A Noise Monitoring Terminal with noise directivity detection



Below: Photo 2: Location of side microphones in relation to the main microphone in SV 200A

technique to pinpoint the direction of a dominant noise source both in the vertical and the horizontal axes and the Leq distribution in angle sectors is saved as the time-history and to be used for data filtering and reporting.

The measurement settings were set to record data containing, 1s time history of LAeq, LAmax and 1/3 octave analysis, noise directivity in XY and Z direction and audio recording for listening (24 kHz). A built-in GPS was used for time synchronisation and localisation.

Measurement points were located in proximity to an airport in two locations:

- measurement point A – near a house and a road, located in a close proximity to trajectory; and
- measurement point B – in an open field located in a close proximity to trajectory.

The measurements were carried out on different days during the operational time of the airport.

In both cases, the microphone was located at the height of 4m. However, in the first location the nearest reflections came from the building wall around 3m from the microphone and a tree that stood around 4m from a microphone.

Measurement results and data processing

Event extraction from time history

Following ISO 1996-2:2017, environmental noise measurements require post processing of measured data. The method described in ISO 20906, distinguishes three stages of data postprocessing:

1. event extraction;
2. event classification; and
3. event identification.

Event extraction is based on acoustic criterions such as A-weighted sound pressure levels. Usually, post-processing software offers tools for data searching for a given query, e.g. LAeq above 55 dBA.

Event classification is based on additional acoustical information, for example an event duration, e.g. LAeq above 55 dBA with a minimum duration of 10s. Modern monitoring systems use information about direction of the noise to automate the event classification process – in addition to the threshold and minimum duration, events are classified based on the direction of the noise. For example, noise of an aircraft is expected to come from above the station's microphone.

Event identification uses non-acoustic data such as information from a radar or operational flight-plan from an airport.

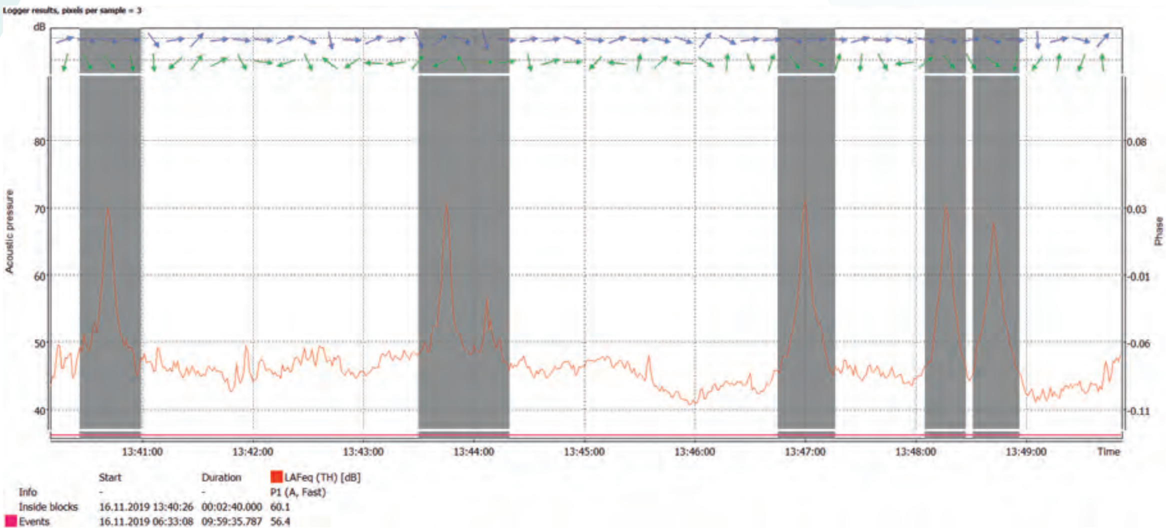
During the evaluation of the measurement results, it is necessary to remove unwanted events. Depending on the actual circumstances, different methods of elimination of unwanted sound can be used — and audio recording is an important tool in event identification.

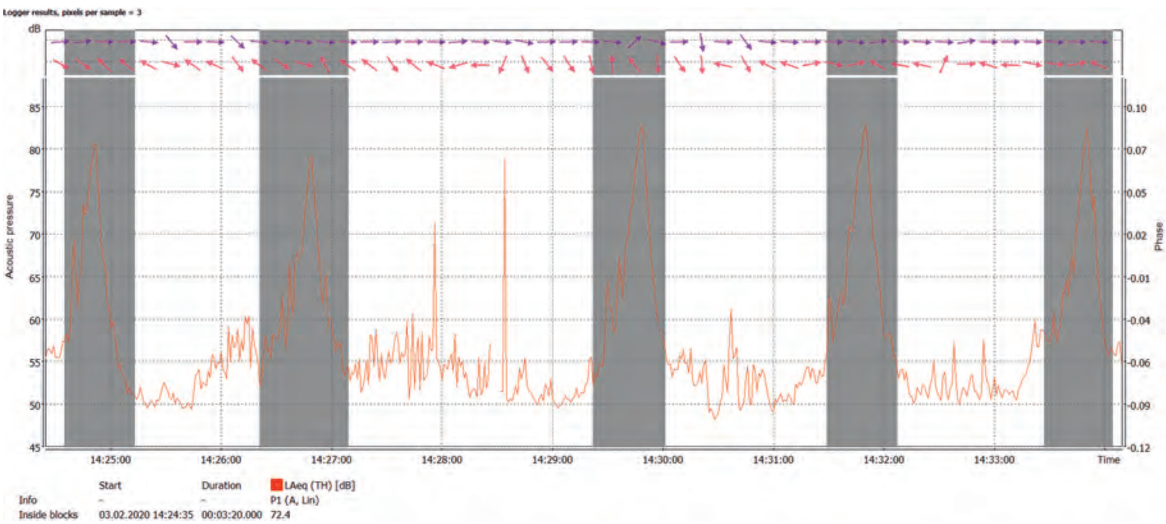
Events classification and identification

With use of SvanPC++ software, aircraft noise passages were extracted from the time history and during the data analysis in location A, suspicious events were detected. The analysis of directivity clearly showed that the dominant source was above the microphone and although the shapes of slopes differed from aircraft ones, the distance from a background was similar to aircraft events. Listening to the audio records indicated that the source of the noise was a barking dog and that was excluded from further analysis.

Photo 5 shows both vertical and horizontal directions where the noise came from, but still the question remained: how a dog could be above the station located at 4m?

To investigate further, a function of Google Map Street View was used. The XY noise directional analysis and further zoom in the P56





Above left: Photo 3: Location of the monitoring point A near a household

Above right: Photo 4: Location of the monitoring point B in the open field.

Top left: Graph 1: Selection of aircraft passages in point A

Bottom left: Graph 2: Selection of aircraft passages in point B

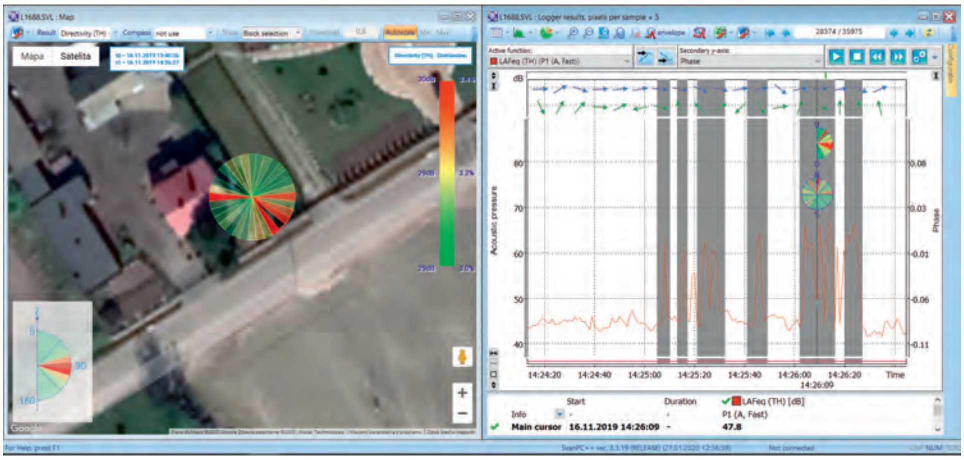
Street View mode led us to assume that the dog had been running near the gate while barking, and the noise was reflected by the roof of the house (Photo 5).

Conclusion

The study concluded that the selection of the measurement location has a great effect on automation of event identification in measurement data post-processing. The locality of the measurement point B in an open field with a non-reflecting surface enabled an automatic and accurate extraction of aircraft passages.

The positioning of measurement point A however, in accordance to measurements practise standards, caused difficulties because of noise reflections from the building wall located around three metres from the microphone.

Tools used in the data post-processing, such as audio recording, GPS localisation and noise directivity enabled a precise event verification and confirmed, at this stage that **dogs can't fly,** it's the noise that can.



Above: Photo 5: SvanPC++ software in a Google Maps Satellite mode

References

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