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LIEGE-AIRPORT: NOISE MONITORING SYSTEM AS PART OF GLOBAL NOISE MANAGEMENT POLICY

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ABSTRACT

Liège-Airport is a regional freight airport located in the southern region of Belgium. Its main noise problem was to implement at night, since March 1st, 1998, a mean number of 80 movements where there was no night traffic. A global noise management policy covered the following: a first evaluation of short and long term noise impact and a first public enquiry in 1996; the consecutive build-up of a detailed Geographical Information System (GIS) in 1997; the optimisation of the departure routes (SIDS), so as to minimise the long term global noise impact, and a thorough public enquiry on noise contours (noise quota); the acquisition on voluntary basis of about 900 houses in 1998; a permanent noise and track monitoring system of the latest generation to stabilise noise contours (global noise quota), to manage traffic expansion, to select new companies and to inform people (inclusive noise event listening).

1 - INTRODUCTION

Liège-Airport is a regional airport located in the southern region of Belgium. It is ideally situated at the centre of the "Paris – Amsterdam – Köln" triangle and it is also part of the "Aéroports de Paris (ADP) Consortium". Its 3300 meters long runway is mainly dedicated to freight until the arrival at Liège of the high speed train (TGV) in 2002. Liège-Airport has sustained a rapid growth since March 1998 with the implementation of the European hub of an express courier company.

Hence the main noise problem was to implement at night, since March 1st, 1998, a mean number of 70 to 80 movements where no night traffic had ever been allowed. A global noise management policy has then been set up as described below. Part of that policy consists of a permanent noise and track monitoring system used as a monitoring tool, as a repressive tool, as a management tool and as a communication/information tool.

2 - GLOBAL NOISE MANAGEMENT POLICY

The global noise management policy started at Liège-Airport in January 1996, i.e. two years before night operations began.

The first step of that policy was to evaluate the short-term potential noise impact of night operations, as well as the long-term impact due to traffic growth, especially by day. Simulations based on large assumptions were carried out to size up the maximum potentially annoyed area around the airport. 30 measurement points were spread over that area for a complete week to fix the environment before night operations started.

The second step of the global noise policy consisted of the build-up of a detailed and interactive Geographical Information System (G.I.S.) in 1997. As illustrated in figure 1, this tool allows for the exact location of any house inside the area resulting from the first step. It also allows for a keen and global picture of the urbanisation of that area and, as follows, for the identification of high density outskirts not to be flown over.

The third step of the procedure associated the GIS tool with noise modelling tools to optimise departure routes (SIDS). Routes were proposed by ATC. Associated noise contours were computed and the corresponding total number of houses was assessed.

At this stage assumptions were to be made relative to:

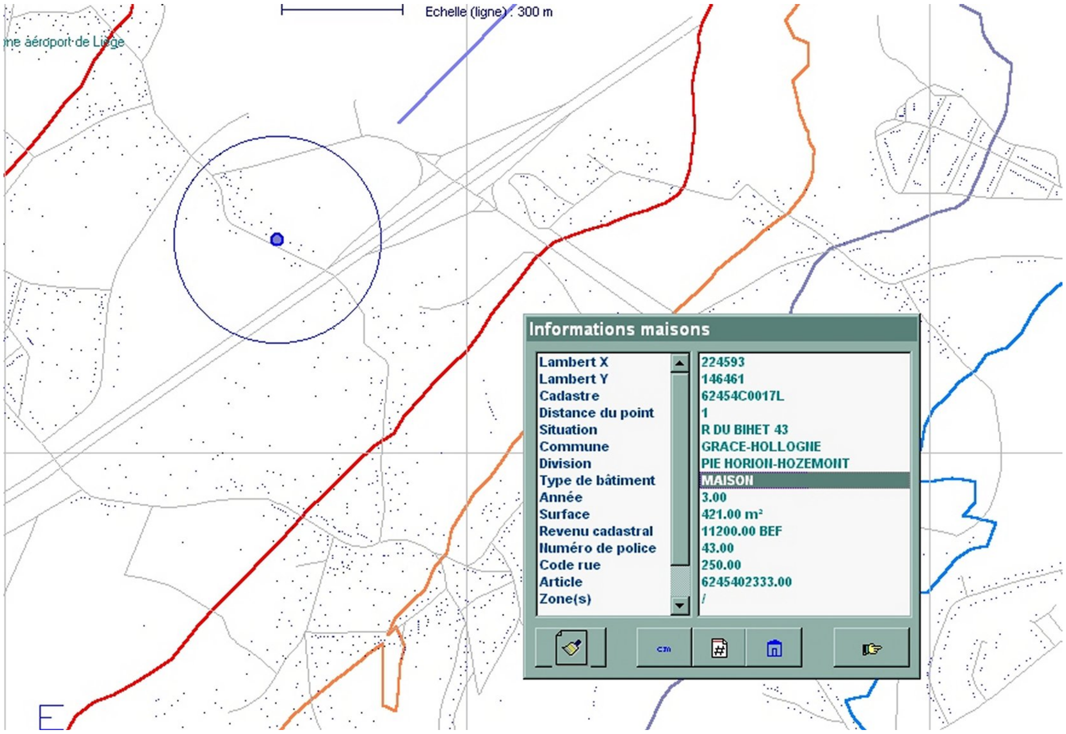

Figure 1: Geographical information system.

1. the airport capacity – to be able to anticipate air traffic growth (avoid too tricky noise contours);
2. the noise index – to account for global impact (number and type of aircraft, day-night exploitation);
3. the limit-values on noise index – as much representative as possible of aircraft noise impact on human health and/or annoyance [ref. 1];
4. and the strategic policy:
   - either concentrate traffic on specifically chosen low density areas and set up strong mitigation measures (e.g.: buying houses, sound-proofing others, land use planning measures, etc) [ref. 2];
   - or spread aircrafts above a large area reducing thereby the global impact, affecting more people and making it difficult to set up consistent mitigation measures at the receiver. Indeed, as the number of passages and type of aircraft vary from day to day – night to night – for a given house, induced maximum noise levels may drastically vary. Soundproofing should then be designed for the highest noise levels and for a larger number of houses.

LDN index had been chosen and noise contours had been computed and plotted for each scenario with pivot-values as below [ref. 1]:

- *Zone A: LDN* $\geq$ *70 db(A)*
- *Zone B: 65* $\leq$ *LDN* $<$ *70 db(A)*
- *Zone C: 60* $\leq$ *LDN* $<$ *65 db(A)*
- *Zone D: 55* $\leq$ *LDN* $<$ *60 db(A)*

Optimised departure routes [SIDS] have then been chosen to minimise the total number of houses to be located in noise contours. These contours should therefore be regarded as "Global Noise Quota" not to be exceeded. They define geographical zones within which the day-to-day noise impact of Liège-airport activities should remain. This concept is of particular importance regarding mitigation measures. It is no need sound-proofing a house that would soon be located in "Zone A", where houses are bought on voluntary basis.

"Noise Quota" then consist of the union of noise contours induced by short-term expected fleet and long-term airport exploitation (i.e. runway saturation for specific types of aircrafts), both for optimised departure routes.

3 - PERMANENT NOISE AND TRACK MONITORING SYSTEM AND SOUND-PROOFING OF HOUSES

The fourth step of the global noise policy was to install a permanent noise and track monitoring system. This system was required to give control on:

1. "Global Noise Quota" – management tool:
   Not only to permanently monitor the compliance of measured LDN values with noise contours, but also to validate the assumptions that sustained the definition of these contours. Figure 2 shows an example of statistics performed on radar tracks per type of aircraft. These statistics led to the final definition of the "Global Noise Quota";

2. day-to-day airport activities – management tool:
   Statistics on noise levels per type of aircraft and per company make it easier:
   - to negotiate fleet renewing;
   - to set up guidelines for commercial negotiations with new companies;
   - to anticipate on traffic growth;
   - and to specify rates for sound-proofing houses of Zones B, C and D (see further);

3. event noise – repressive tool:
   Thresholds are to be set at each monitoring station, so as to identify noisy aircrafts (and set financial penalties) and to highlight deviations from optimised SIDS;

4. information – communication tool:
   Inform on aircraft altitudes, noise levels, Global Quota compliance, 2D tracks of aircraft, etc, are of prior importance. As an example, figure 4 shows on the right, statistics on noise levels induced by 4 aircrafts and on the left, for one of them, its track and noise induced time evolution together with its audio listening.

The final step of the global noise policy is on the way. It consists of sound-proofing houses of zones B, C and D (houses of zone A are bought on voluntary basis) and of specifying long-term land use planning measures.
Figure 5 shows an example of statistical distribution of maximum noise levels. It shows how the noise and track monitoring system was used to fix the sound-proofing rate of houses in zone B. According to [ref. 3] a public health objective of maximum 45 dB(A) not more than 10 to 15 times per night is sought inside bedrooms.

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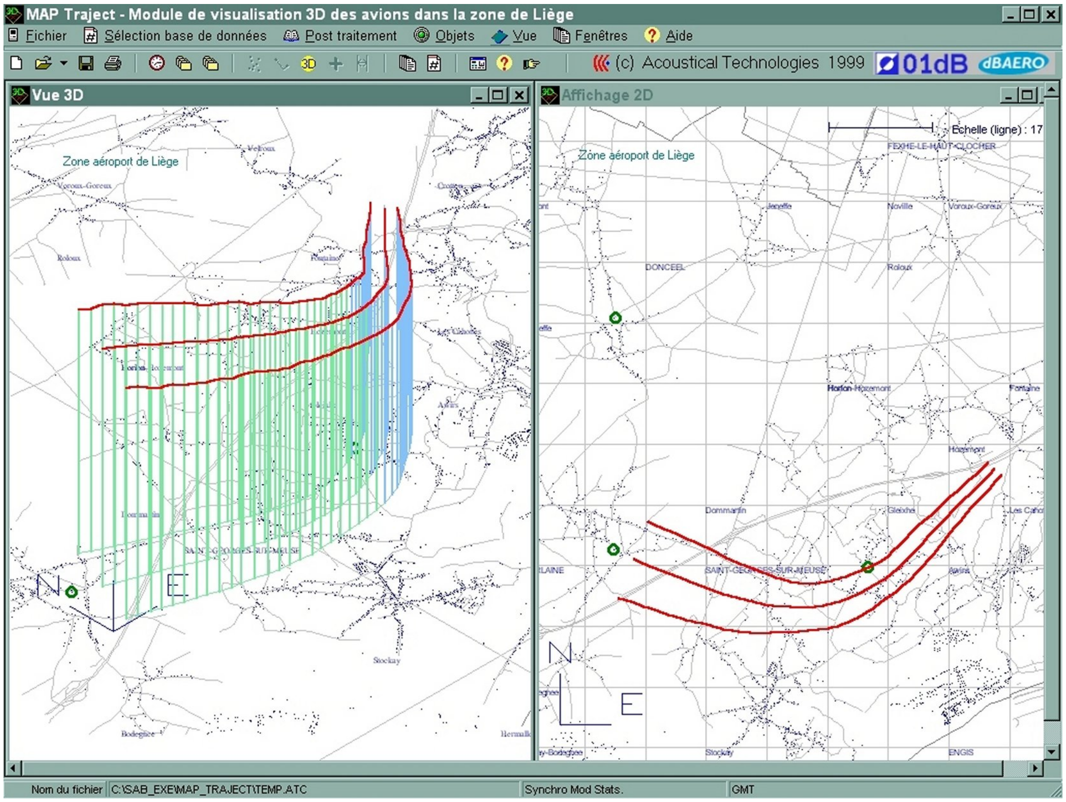

Figure 2: 2D and 3D statistics on radar tracks per type of aircraft.

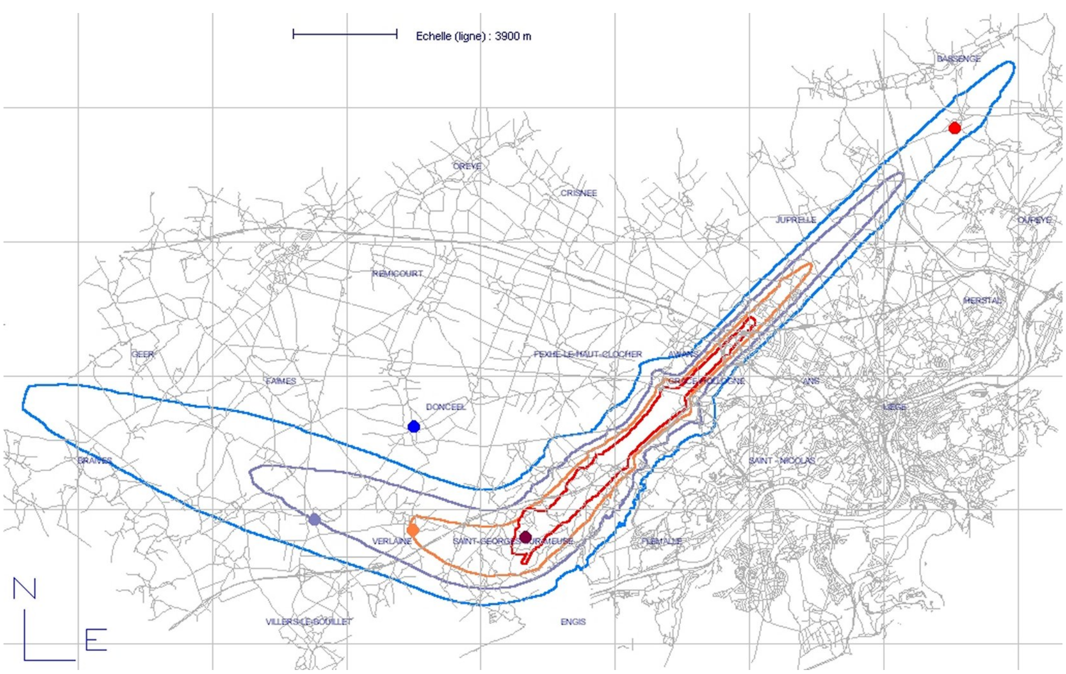

Figure 3: Noise contours based on real tracks, and location of noise monitoring stations.

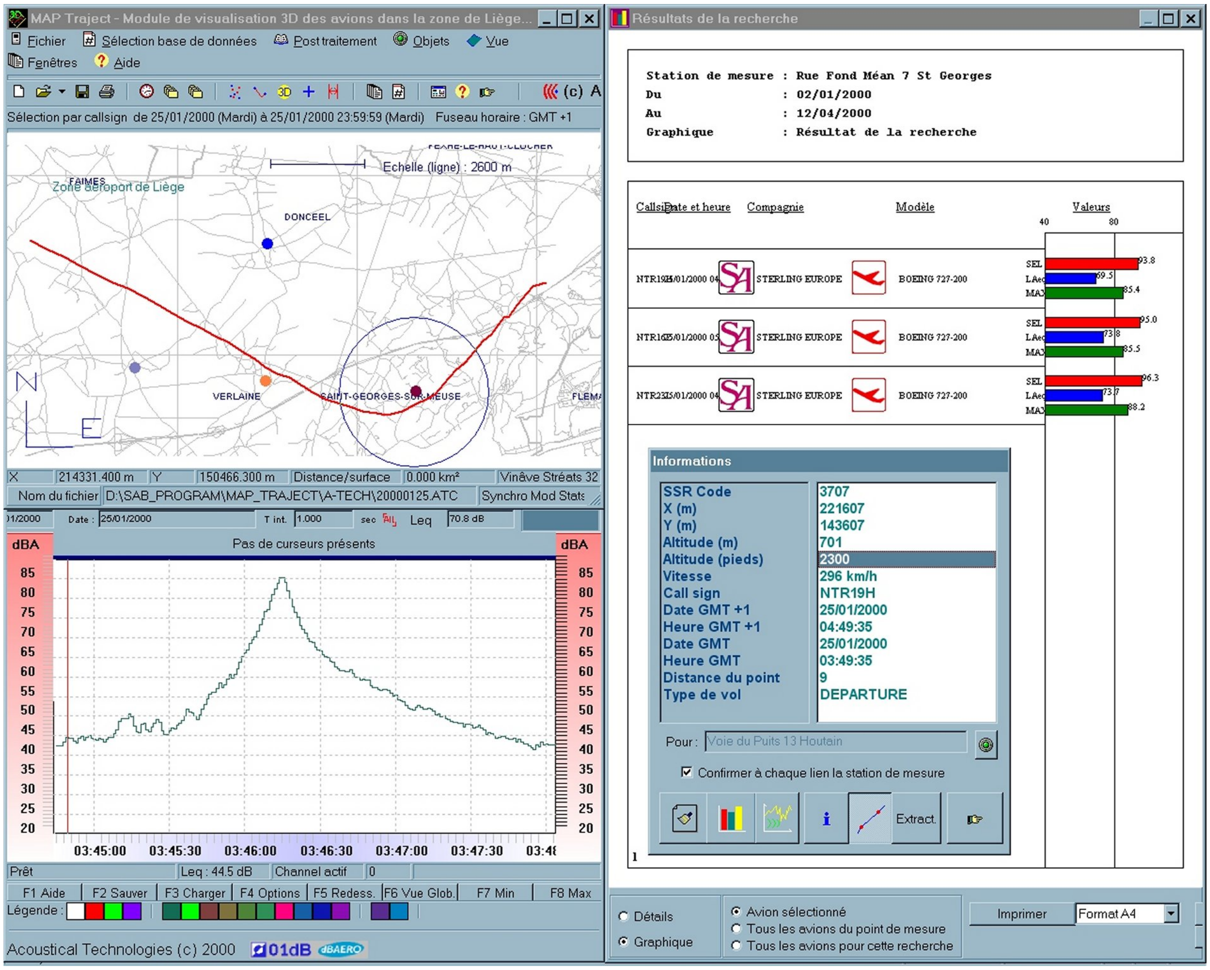

Figure 4: Noise monitoring as information tool on track, noise induced time evolution, audio listening and statistics on noise levels.

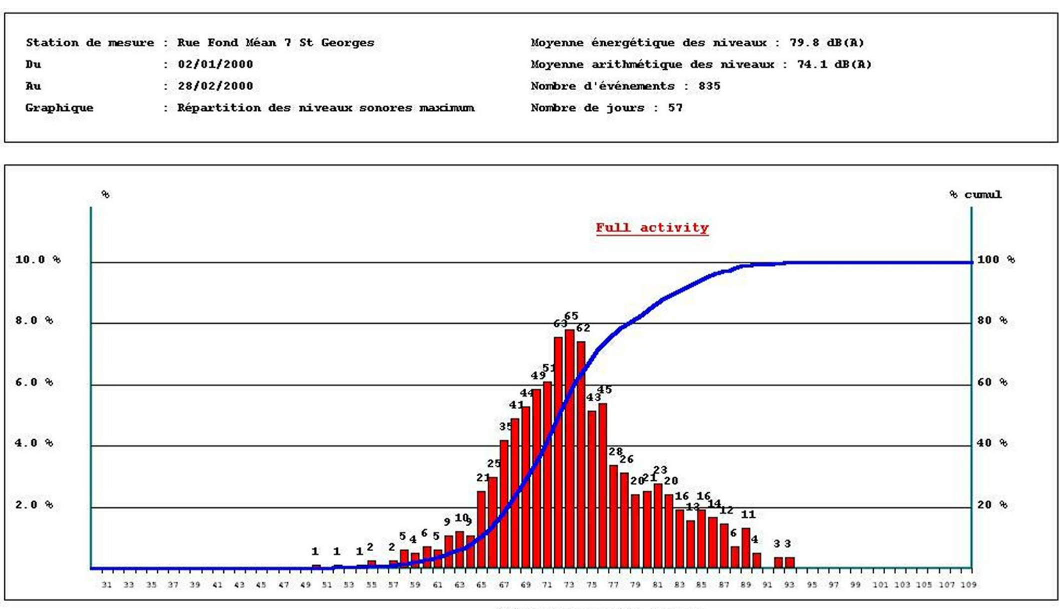

Figure 5: Statistical distribution of maximum noise levels at the beginning of Zone B.