



# Noise mitigation action plan of Pisa civil and military airport and its effects on people exposure



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## ABSTRACT

The “Galileo Galilei” airport is a civil and military airport quite close to central Pisa. Although the airport brings benefits in terms of tourism and different types of income, the air traffic growth exacerbates the exposition to aircraft noise. This could significantly affect public health. To this day, a small number of studies takes into account the standard indicators of Europe by considering noise emission data for military aircrafts. We estimated the noise impact produced by the airport and we evaluated the related exposed population by using the Integrated Noise Model (INM). The noise power levels of both commercial and military flights have been considered as an input to the model. Predicted levels were validated by means of a noise-monitoring network. A new tracking system (AirNav Radar) that captures Automatic Identification System (AIS) signals emitted by each aircraft has been used to emulate takeoff and landing procedures. This improves the accuracy of the input to the model. We simulated noise maps for present and future scenarios, including those following the application of noise reduction measures. For each situation, we also estimated the exposure of the population and the percentages of highly annoyed and highly sleep disturbed people. We show the utility of AIS data and their specific elaboration to draw up noise abatement measures in order to reduce the noise impact on population and allow the airport development.

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## 1. Introduction

Acoustical emission and air pollution are environmental factors that can make the difference to health and the quality of life. Many authors have studied the relationship between possible citizen risks and the distance from airports to residential areas [1–3]. It is also well known that exposure to certain noise levels increases the onset of diseases affecting cardiovascular system [4,5], mental health [6], learning and cognitive ability in children [7,8], endocrine system [9] and immune system [10]. Prolonged exposure to noise is also indicated as a cause of irritability, lack of sleep, fatigue, headache, decrease in performance and annoyance [1].

Socio-acoustical surveys [11] have shown that aircrafts are the most disturbing noise sources among the transport infrastructures

and their noise can lead to severe conflict with people living in the areas surrounding airports.

There is a clear need of solutions that can quantify the aircraft noise of an airport and reduce it [12,13]. The reduction of noise is essential when the airport needs to be expanded.

The airport “G. Galilei” of Pisa will soon have 50,000 flights per year, the threshold set by the European Noise Directive 49/2002 [14] to realize the strategic noise mapping and the noise action plan, which includes strategies to be implemented for mitigation. The authorities of Pisa have already approved the zoning of the surrounding area and have suggested some interventions and procedures for noise abatement [15,16].

The airport is a military one that is open to civilian traffic. It is located quite close to the city. Thus, one of the possible expansion plans is the relocation of the most impacted residential area.

The airport uses a continuous monitoring system to measure the noise produced by the flights. The monitoring system is composed of four fixed sound level metres. The radar tracks are not provided. These would be essential for the proper identification of trajectories [17] and for noise abatement procedures. These con-

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Fig. 1. Pisa International Airport (source: [www.onacrew.com](http://www.onacrew.com)).

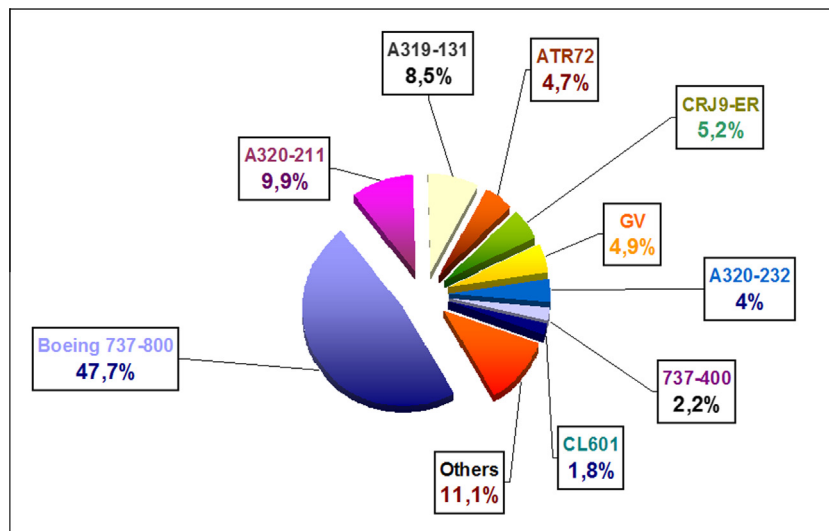


Fig. 2. Statistics of flights by type of aircraft.

strain the takeoff procedures and the directions of use of the runways.

We have compensated the lack of radar tracks by using a new method of trajectories reconstruction, which consists of the use of a flight tracking system installed near the airport (AirNav Radar). This tool uses AIS signals and gives second by second updates on flight number, aircraft registration, altitude, speed, heading and real-time flight tracking.

The extension of the runways is another intervention planned to reduce the noise impact that originates from the north side of the airport. This area is the most disturbed and suffers from the increasing number of flights. In the following, we list some solutions that could mitigate the problem but cannot be applied: (a) al-

ways using the direction towards the south, (b) building a new runway and (c) changing the orientation of the existing ones.

Since the airport wants to increase the number of flights, it is necessary to perform an evaluation of the mitigation actions already planned and undertake the design of new actions. This must be done by selecting the aircraft authorized to land and a careful planning of flights during the night.

In this paper, we analyse the potential environmental and health consequences produced by the various noise mitigation measures planned for the airport of Pisa.

We considered the possible actual and future alternative scenarios, by considering numerical modelling. This includes the infrastructure changes and the new departure procedures. The

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