Greek Joint Ministerial Decision 13586/724 - 28/3/2006 under the auspices of the Ministry of Environment, Energy and Climate change the Civil Aviation Authority, has completed the necessary studies for the Strategic Noise Map (SNM) for the years 2006, 2011 & 2016 including an evaluation & review of the Action Plan. This project concerns the proposal - review – evaluation of an existing – proposed Action Plan based on accurate yearly traffic and flight paths data in order to eliminate the effects of Aircraft Noise in the vicinity of the airport and also to introduce a comprehensive Noise Abatement actions. The Action plan includes Noise Abatement Procedures (NAP) that either has been established prior to the airport opening (2001) or during the operation of the airport.

Keywords: airport noise, action plan, balanced approach, environmental noise

1. Introduction

"Athens International Airport S.A." (AIA) is responsible for the operation, management and development of the new Athens International Airport "Eleftherios Venizelos" at Spata just after the closure of Hellinikon Airport in 2001. This research project (2) concerns the Strategic Noise Map 2017 according to the European Directive 2002/49/EC (1) and JMD 13586/724 (3) (using traffic data for 2016) and includes the Strategic Noise Maps for both noise indicators $L_{den}$ & $L_{night}$ for the year
2016, based on the methodology ECAC.CEACDoc.29 "Report on Standard Method of Computing Noise Contours around Civil Airports" (5).

Table 1: Airport Characteristics

<table>
<thead>
<tr>
<th>Operation since</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runways:</td>
<td>2, approximately 4Km each</td>
</tr>
<tr>
<td>Main Terminal Building:</td>
<td>4 levels, 14 passengers + embarkation bridges, 150,000 sqm.</td>
</tr>
<tr>
<td>Satellite Terminal Building:</td>
<td>10 gates for passengers embarkation</td>
</tr>
<tr>
<td>Aircraft traffic (max capacity):</td>
<td>65 landings and take-offs per hour</td>
</tr>
<tr>
<td>Passenger Traffic 2017:</td>
<td>21.7 million passengers</td>
</tr>
<tr>
<td>Aircraft Traffic 2017:</td>
<td>195,951 movements</td>
</tr>
<tr>
<td>Cargo Traffic 2017:</td>
<td>90,157 tones</td>
</tr>
</tbody>
</table>

Table 2: Aerodrome geographical and administrative data

| 1. | ARP coordinates and site at AD | 375612.12N 0235640.20E |
| 2. | Direction and distance from (city) | BRG NIL, 20 km South East from Athens city centre |
| 3. | Elevation/Reference temperature | 94 M (308.39 FT)/ 30.8°C |
| 4. | MAG VAR/Annual change | 4°05’E (4.08°E)(JAN 2013)/ 5° 43”E (0.0953°E) |
| 5. | Types of traffic permitted (IFR/VFR) | IFR - VFR |

2. The Balanced Approach on Aircraft Noise.

The EU Environmental Noise Directive (EC/2002/49) (1) and the associated Balanced Approach Regulation (EU 598/2014) aim at promoting the sustainable development of air transport through the reduction of aircraft noise pollution at airports. This legislation introduced the principle of a ‘balanced approach’ to aircraft noise management at airports, in line with ICAO guidance (Doc9829 AN/451). Within this framework airports are encouraged to initially assess the current noise situation via the identification of specific issues using a mix of modelling and monitoring techniques. This should then be used by airports to define a noise baseline, future objectives and an accompanying noise management action plan.

This balanced approach consists of the following three main pillars:

i) Reduction of noise at source.

ii) Land-use planning and management policies.

iii) Operating restrictions on aircraft.

3. The AIA’s Action Plan for Aircraft Noise

The action plan was taken in AIA in collaboration with Civil Aviation Authority (HCAA) following the cooperation with stakeholders to reduce noise in the vicinity of the general residential airport area (2). The procedures have been published in the AIP Greece, Volume I and include measures concerning runway use including restrictions during the night, aircraft engine testing run-ups and Auxiliary Power Unit (APU) usage. In particular, the Noise Abatement Procedures include:

3.1 Use of runways

- Runway 21L is not used for landings during the night (11pm – 7am).
- Runway 03R is not used for departures during the night (11pm – 7am).
Chapter 2 aircraft licensed to use the airport cannot use runway 03R for take-offs or runway 21L for landings on a 24-hr basis.

Chapter 3 aircraft are not allowed to use runway 03R for take-offs or runway 21L for landings (implemented in April 2012) on a 24-hr basis.

All military aircraft are not allowed to use runway 03R for take-offs or runway 21L for landings on a 24-hr basis (implemented for 03R in April 2012 and 21L in December 2011). Military aircraft of civil aircraft type are excluded from this restriction.

Deviations of the above may be allowed for safety reasons during extreme meteorological phenomena or when capacity and operational procedures necessitate.

3.2 Aircraft operation: Procedures & Restrictions

- Reverse Thrust Use only under safety procedures in force.
- On Runways 03L & 03R. Unless necessary for safety reasons, all turbo-prop and jet-powered aircraft shall not reduce take-off thrust until a minimum altitude of 1800 feet MSL has been reached and shall not accelerate above initial climb speed (V2+10) or change take-off flap and slat configuration until a minimum altitude of 3300 feet MSL has been reached.
- Standard Operation Procedure (SID) were assessed on runway 03R (SID 3 “Tango” & SID 4 “ECHO”) in order to minimize the impact of A/C flying above residential areas.
- Restriction of take-offs from runway 03R and restriction of landings on runway 21L are also enforced from 15:00 to 18:00 through temporary NOTAMs which are renewed upon expiration.

3.4 Public complaint management system

AIA has created a special "We Listen" telephone line in which concerned citizens can call for information and to register their complaints. The telephone line operates on a 24-hour basis. The public may also submit noise-related comments via a special page on the AIA's website (www.aia.gr).

3.5 Flight paths

Flight paths: From 2013, the 'Tango' procedure was implemented as a preferred departure from the 03R corridor (were most inhabitants complaints may occurred), as per the Figure 3 hereafter:
The distribution of movements (on the representative flight paths inserted in the model that was used on the implementation of SNM and confirm the use of existing action plan), for each threshold, take into account the actual path of each aircraft movement in a range as defined in the model boundaries Airport - based on their actual dispersion, using the relevant flight paths data from the AIA's Noise Monitoring System (NOMOS), for each runway, threshold, and aircraft traffic type for the year 2016 (6), (7). In this way, the most representative horizontal profile was implemented based on actual recorded flight paths for all 2016 movements for all three distinct time periods track density pictures exported from Noise Monitoring System below (Figure 4a & 4b) (displaying the Civil Aviation radar), and all four runway thresholds in a linear form since no significant turnings were recorded.

Regarding the actual longitudinal profiles, all movements (especially for RW 03R) for the year 2016 compared with the suggested profiles as per AzB aircraft data base category. It was not established that the actual climbing is far more increased compared to all AzB relevant paths ensuring that the model take in to account the worst case scenario regarding the proximity to ground level.

In Figure 5 a comparison of actual recorded longitudinal flight paths vs AzB theoretical flight path for the most common aircraft category 5.1 vs Tango procedure is shown for all 2016 take offs on Runway 03R.
4. The alternative 03R Take off scenario: "Intersection Take-Offs"

As part of the further analysis of take-offs from the Eastern runway, it was considered appropriate to investigate the Intersection Take-off scenario (an operation procedure that widely followed to reduce ground traffic and realise time in airport capacity) as a possible additional measure in the AIA Action Plan which is expected to have a positive impact on the noise and acoustic burden of land-taxi procedures by deflecting a portion of the medium range flights from the intersection holding point "D4" relative to the 03R threshold to the BCR end of the 03R. This scenario based on the deflection of the take-offs of class P 2.1 - S 5.1 - S 5.2 aircrafts on the intersection holding point "D4" (A/C type ATR - De Havilland Dash - Avro and A320 - B737 by approximately 40% of departures from 03R -2016 Aircraft Mix data).

The results on the procedure of “intersection Take offs” was reported on the Strategic Noise Mapping of Athens Int. Airport 2017 (2016 Data) and the main conclusion was that even though the major of the A/C mix based on the deflection of the take-offs of class P 2.1 - S 5.1 - S 5.2 at the intersection holding point "D4" (a/c type ATR - De Havilland Dash - Avro and A320 - B737) by approximately 40% of departures from 03R.

From 2013, the 'Tango' AD2-LGAV-SID-4 on A.I.P GREECE has been assign as first priority departure procedure (Figure 8c) to the North (03R) by the Hellenic Civil Aviation Authority instead of the “Juliet” AD2-LGAV-SID-1 (Figure 6a), which is summarized in the following description and indicated in the accompanying Figures below:

Further to the procedure description, in the reality the air traffic control in cooperation with the Terminal Maneuvering Area (TMA) proceeds in many operations the "radar vectoring". The “vectoring” take in consideration that in an altitude 4000 ft MSL and above (Figures 9a & b) the attenuation and atmospheric absorption combine to reduce noise from the aircraft to near zero at ground level.
and direct the planes off the departure route towards a more direct heading to their destination that is also why most world CAA selects the 4000 ft MSL mark as a criteria for Leq contours.

![Figure 9a: Flight segments on 4000 ft.](image1)
![Figure 9b: Flight segments on 5000 ft.](image2)

### 6. Results

The reducing results on Noise indexes could be easily found in the Figure above. The map showing the results L_{den} Noise index could be shown below in comparison with the main SNM 2017 (8).

![Figure 10a](image3)
![Figure 10b](image4)

The results of the comparative views of the SNMs 2007, 2012 and 2017 (2006, 2011 and 2016 data) are given in Figures 10a & 10b for the L_{den} & L_{night} limits of the Greek legislation. The graphical distribution of the surface of the study area and of the relevant population exposure for both noise indicators L_{den} & L_{night} is presented in Figures 11 and 12.

![Figure 11](image5)
![Figure 12](image6)
7. Discussion

Environmental noise annoyance - especially from airport’s operation - is a growing concern in Europe and accepted as an end-point that can be taken as a basis for evaluating the impact of noise on the exposed population, which in many cases may experience a variety of negative responses of an important level introducing even "relocation" noise action plans (9).

In the case of A.I.A. is noted that the increase of the movements is approximately at the level of the movements of 2006, combined with the implementation of the "Tango" process, it contributes to the non-negative development of the effects of the air noise, resulting in the new isotonic curves of the highest statutory limits of the noise indicators: \( L_{den} \leq 70 \text{dB (A)} \) and \( L_{night} \leq 60 \text{dB (A)} \) continue to be limited within the boundaries of the airport without impact on built-up residential areas or other sensitive receivers.

This situation continues to be reflected in the take-off scenario of part of the aircraft from Intersection holding point "D4" - with respect to the threshold of 03R towards the BA edge of 03R. Based on the results of the SNM 2017 and their comparison with those of the SNMs 2007 and 2012, the noise limits defined in Joint Ministerial Decision 211773 / 27-4-2012 show that no limit values are exceeded and therefore the updated Action Plan for noise with the integration of the TANGO process is considered to be effective and does not require revision.

The most suitable regulation is to ensure the consistent application of the Balanced Approach to noise management as per the International Civil Aviation Organization (ICAO), aiming to strike a balance between citizens’ quality of life in terms of protection from aircraft noise, and the needs of the air transport.

8. List of references


