Airport Noise: overview of the challenge

Presentation to ICAO Green Airports Conference

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Progress in Commercial Aircraft Noise Reduction

Source: Boeing
Topics

- Noise metrics
- Health effects
- ICAO’s Balanced Approach
- Challenges faced by Airports
Noise Terminology

<table>
<thead>
<tr>
<th>Common Outdoor Sound Levels</th>
<th>Noise Level dB(A)</th>
<th>Common Indoor Sound Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Jet Flyover at 1000 Feet</td>
<td>110</td>
<td>Rock Band</td>
</tr>
<tr>
<td>Gas Lawn Mower at 3 Feet</td>
<td>100</td>
<td>Inside Subway Train (New York)</td>
</tr>
<tr>
<td>Diesel Truck at 50 Feet</td>
<td>90</td>
<td>Food Blender at 3 Feet</td>
</tr>
<tr>
<td>Concrete Mixer at 50 Feet</td>
<td>80</td>
<td>Garbage Disposal at 3 Feet</td>
</tr>
<tr>
<td>Air Compressor at 50 Feet</td>
<td>70</td>
<td>Shouting at 3 Feet</td>
</tr>
<tr>
<td>Lawn Tiller at 50 Feet</td>
<td>60</td>
<td>Vacuum Cleaner at 10 Feet</td>
</tr>
<tr>
<td>Quiet Urban Daytime</td>
<td>50</td>
<td>Normal Speech at 3 Feet</td>
</tr>
<tr>
<td>Quiet Urban Nighttime</td>
<td>40</td>
<td>Large Business Office</td>
</tr>
<tr>
<td>Quiet Suburban Nighttime</td>
<td>30</td>
<td>Dishwasher Next Room</td>
</tr>
<tr>
<td>Quiet Rural Nighttime</td>
<td>20</td>
<td>Small Theater, Large Conference Room (Background)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Library</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Bedroom at Night</td>
</tr>
</tbody>
</table>

1 Event/Day SEL 114 dB A = DNL 65
10 Events/Day SEL 104.4 dB A = DNL 65
100 Events/Day SEL 94.4 dB A = DNL 65

Threshold of Hearing

SEL = 59 dB
L_{max} = 84 dB
Potential Health Effects of Noise

Auditory:
- Hearing loss

Non-auditory:
- Annoyance
- Speech disruption
- Sleep disturbance
- Learning/cognitive impacts

Source: Cardiovascular Effects of Noise on Man – Wolfgang Babisch, 2015 ASA Meeting
ICAO’s Balanced Approach to Noise

1. Reduction of Noise at Source
2. Land-use Planning and Management
3. Noise Abatement Operational Procedures
4. Operating Restrictions

Balanced Approach
Reduction of noise at the source

- **Engine Technology:**
  - Ultra-high Bypass
  - Enhanced efficiency compressor
  - Enhanced efficiency high pressure turbine

- **Engine Technology:**
  - Ultra-high Bypass
  - Enhanced efficiency compressor
  - Enhanced efficiency HPT

- **Airframe technology**
  - Structurally Efficient Wing Technology

Source: Pratt & Whitney, 2019
Source: Honeywell, 2019
Source: Boeing, 2019
Land Use Planning and Management

- Local governments are usually responsible for land zoning
- Noise-sensitive areas should be avoided
- Air Navigation Service Providers should consider land use
- Aviation stakeholders must work with local governments
- Some governments have created national policy to restrict residential growth/encroachment near airports
- In high noise areas, existing homes and schools may be retrofitted with sound insulation and alternative ventilation
- Airport operators can purchase homes in high noise areas
Noise Abatement Operational Procedures

- Preferential flight track or runway use
- Performance-based navigation
- Noise abatement take-off or approach procedures
- Moving the nominal takeoff or landing points on the runway
- Restrictions on engine run-ups and/or ground equipment
Operating Restrictions

- Curfews
- Operational noise limits i.e. nighttime restrictions
- Noise quotas/budgets/charges
- Cap rules and non-additional rules
- Preferential runways
- Restrictions related to the use of ground infrastructure
Aircraft Annoyance Factors

ACOUSTIC
- Sound level
- Duration
- Number of events
- Tonal quality

ENVIRONMENTAL
- Time of day
- Home construction/insulation
- Outdoor living expectations

PERSONAL
- Noise-sensitivity
- Age
- Gender
- Cultural expectations
- Employment status
Thank you!

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