Technical Note

A review of a proposed noise quota system for Dublin Airport

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Introduction

In 2007, the airport authority for Dublin Airport (DAA) was granted planning permission to build a new runway. This permission included several planning conditions, including operating restrictions during the night-time due to noise considerations. The plans were then put on hold due to the economic downturn, but in 2016, with increasing passenger numbers, the plans were revived. In the intervening years, the planning and legislative environment related to aircraft noise changed in Ireland, particularly with the implementation of Regulation 598/2014 and the establishment of the Aircraft Noise Competent Authority (ANCA).

In December 2020 the DAA submitted a planning application to the Planning Authority seeking to amend those 2007 conditions associated with night-time operating restrictions. The application was then referred to ANCA for an assessment of the associated noise impact, and in November 2021 they issued a draft regulatory decision report. This report proposes a number of mitigation measures for Dublin airport, including the introduction of a noise quota system.

ANCA then opened a 14-week public consultation on its draft recommendations regarding DAA's application to amend aircraft operating restrictions at Dublin Airport when the new north runway opens. This technical note is a submission to this consultation, and provides comment on the proposed Noise Quota Scheme. It considers the following items in some detail:

1. The proposed noise quote scheme
2. The use of an EPNL system alone
3. The Proposed NQS Limit of 16,260

The technical note concludes with some recommendations for revisions of the Noise Quota Scheme.

The ANCA Draft Regulatory Decision

The 2007 planning conditions included a condition that the average number of night time aircraft movements at the airport shall not exceed 65 per night (between the hours of 2300 and 0700). It is proposed that this limit be replaced by a Noise Quota Scheme (NQS). The ANCA Draft Regulatory Decision recommends a Noise Quota Scheme, which could be considered, a 'Noise Budget' that allocates a certain number of 'points' to be spent on the night time period across the year. Each aircraft carries a Quota Count ('points') depending on how noisy they are, and each flight takes points off the total noise quota for the year [1].

Aircraft are allocated a number of points at production relating to the amount of noise they make. The Quota Count (QC) of each aircraft is based on internationally recognized noise certification data. The proposed total for Dublin Airport is 16,260 points per year.

The hope is that a Quota Count system will promote the use of quieter aircraft at night. The idea is that noisier aircraft contribute more towards the noise budget, and this should provide an incentive to operate quieter aircraft, in order to allow more flights.

1. The Proposed Noise Quota Scheme

DAA suggested a NQS in their application to modify the planning conditions. Their proposed NQS was based on the system adopted by the United Kingdom (UK) Department for Transport (DfT) in restricting night time aircraft noise at Stansted Airport [1]. The Quota System in Stansted Airport is actually applied across three airports in London; Heathrow, Gatwick and Stansted.

The scheme proposed by the DAA has been adopted by ANCA as its proposed scheme, with some modifications, particularly related to the time period.

There are two significant differences between the proposed NQS for Dublin, and that applied in the London airports. These include:

- The London airports set two separate quotas, one to be applied in the summer the other in the winter. The Proposed NQS for Dublin does not distinguish between seasons.
- The London airports include a movement limit. The movement limit and quota count restrictions work together to make sure the overall number of night flights are limited and that the quietest planes are used [2]; if newer quieter planes are used their night quota scores will be low – but the total number will be restricted by the movement limit, whereas if noisier aircraft are used their night quota scores will be high and their number will be restricted by the quota count limit. The Proposed NQS for Dublin does not include any movement limit.

The above, including associated movement and QC limits, is summarized in the below table:

<table>
<tr><th></th><th></th><th>Movement Limit</th><th>Noise Quota Limit</th><th>Ban on QC4 rated aircraft</th><th>Time Period</th></tr>
<tr><td>Heathrow</td><td>Winter</td><td>2,550</td><td>2,415</td><td rowspan="2">Yes</td><td rowspan="2">23:30 – 06:00</td></tr>
<tr><td></td><td>Summer</td><td>3,250</td><td>2,735</td></tr>
<tr><td>Gatwick</td><td>Winter</td><td>3,250</td><td>1,785</td><td rowspan="2">Yes</td><td rowspan="2">23:30 – 06:00</td></tr>
<tr><td></td><td>Summer</td><td>11,200</td><td>5,150</td></tr>
<tr><td>Stansted</td><td>Winter</td><td>5,600</td><td>3,310</td><td rowspan="2">Yes</td><td rowspan="2">23:30 – 06:00</td></tr>
<tr><td></td><td>Summer</td><td>8,100</td><td>4,560</td></tr>
<tr><td>Dublin</td><td>Winter</td><td rowspan="2">None</td><td rowspan="2">16,260</td><td rowspan="2">Yes</td><td rowspan="2">23:00 – 07:00</td></tr>
<tr><td></td><td>Summer</td></tr>
</table>

The proposed NQS for Dublin is therefore an incomplete interpretation of the Quota scheme operated in the London airports; the proposed NQS includes a Noise Quota Limit without an

accompanying movement limit. Further, the QC limit of 16,260 proposed for Dublin far exceeds the limits in place at the London airports.

2. Effective Perceived Noise Level & the NQS

The points system in the NQS involves the classification of aircraft into different categories, based on the Effective Perceived Noise Level (EPNL), as determined from their ICAO noise certification data. The EPNL a measure used to express noise levels which analyses the frequency spectra of noise events as well as the duration of sound. Different types of aircraft are classified separately for landing and take-off into one of the following QC categories [3]:

Noise Classification [EPNLdB]	Quota Count
Below 81	0
81 – 83.9	0.125
84 – 86.9	0.25
87 – 89.9	0.5
90 – 92.9	1
93 – 95.9	2
96 – 98.9	4
99 – 101.9	8
Greater than 101.9	16

In brief, the Quota Count doubles for every 3dB increase in measured EPNL. In a logarithmic scale, a 3dB increase is equivalent to a doubling of energy – therefore a doubling of sound energy leads to a doubling of the Quota points [4]. By extension, one movement of a QC/2 aircraft is equivalent to two movements of a QC/1 aircraft, and four movements of a QC/0.5 aircraft and so on. Aircraft quieter than QC/0.125 are currently exempt from the noise quotas but, importantly, they do count towards each airport's movement limits in London airports [3]. If not for the movement limit, any aircraft movement with a quota count value of zero would in effect be unlimited, despite the fact that it is a noise generating movement. Thus, the use of a Noise Quota system alone is not appropriate, and it needs to be operated in parallel with a Movement Limit, as in the case in Heathrow, Gatwick, and Stansted (the airport upon which the proposed scheme is based).

In the wider context of noise impact on health, the quota system fails to account for the spread of events over time. Energy wise, it is clear that one movement of a QC/2 aircraft is equivalent to two movements of a QC/1 aircraft, but this does not account for the temporal spread of events, i.e. if the two movements of a QC/1 aircraft occur one hour apart, the quota system cannot adequately account for this. The Noise Quota scheme fails to account for the number of events, which many consider to be a good indicator of noise annoyance.

This is an important consideration in the wider context of assessing overall impact from aircraft noise. It is quite likely that the L_{night} noise indicator underestimates the extent of sleep disturbance because it averages noise over a long period effectively smoothing out and

downgrading the impact of intermittent and impulsive noise events that are known to have a highly negative effect on sleep patterns [5].

Ultimately, the purpose of the proposed NQS is to limit the L_{night} level in the environs of the airport. Recently, the Government Accountability Office in the US examined the use of the DNL indicator for aircraft noise, and found that because DNL combines the effects of several components of noise into a single metric, it does not provide a clear picture of the flight activity or associated noise levels at a given location. It goes on to recommend that the Federal Aviation Authority identify supplemental noise metrics for use in noise impact analyses [6]. There has been a push toward this in the case of aircraft noise; in a recent report for the European Parliament on the impact of aircraft noise pollution on residents of cities, one recommendation included the development and improvement of noise indicators, particularly frequency metrics (including, for example number of events above a certain noise value)[7].

3. The Proposed NQS Limit of 16,260

As observed above, the proposed limit of 16,260 far exceeds the limits imposed in the London airports. In discussing the proposed NQS limit of 16,260, it is useful to first consider the candidate Noise Abatement Objective described by the DAA in their initial application to modify the planning conditions. This proposed a NQS which would apply over the period 23:30-05:59 local time with a total annual noise quota of 7,990 for this period. This was developed according to the following steps [8]:

1. Determine the QC values for typical aircraft operating at Dublin Airport (future forecasts to 2025 are known).
2. Determine the Total QC and the average fleet noise per movement (QC/ATM) for each year (2018-2025).
3. The objective was to reduce the average fleet noise per movement in 2025 compared to 2018. The target QC/ATM was identified as 0.49; this was the mid-point between the value derived from the actual movements in 2018, and that forecast is 2025.
4. Apply this target QC/ATM to the total number of ATMs forecast in 2025 to determine the Annual Night Quota. The ANQ was determined to be 7,990.

The date used to determine the target of 7,990 are reported below [8]. It is interesting to note that while the QC/ATM is seen to reduce between 2022 and 2025, at the same time the actual quota count increases. Further, the limit of 7,990 appears to be chosen as it would allow the airport to operate as forecast, with no restrictions related to noise.

	2016	**2017**	**2018**	**2019**	**2022**	**2023**	**2025**	**2030**	**2035**
6.5hr ATM	10,850	12,641	13,479	14,263	12,016	13,362	15,292	15,292	15,292
6.5hr QC	**5,857**	**6,741**	**7,004**	**7,650**	**6,684**	**7,302**	**7,931**	**7,198**	**6,507**
QC/ATM	*0.54*	*0.53*	*0.52*	*0.54*	*0.56*	*0.55*	*0.52*	*0.47*	*0.43*

(ATM = Air Traffic Movement; QC = Quota Count)

Upon a request for information from ANCA, the analysis was repeated for the time period that covers the entire eight hours night period, and following the same procedure a target QC/ATM of 0.51 was determined, leading to an 8-hour ANQ of 16,260 [8].

While a change in target from 0.49 to 0.51 might be considered minimal, it is important to understand how this change came about. The 0.49 target was initially developed as part of the DAA's application for modifying the planning conditions. ANCA then requested more information from the DAA and asked them to revise the quote from 6.5 hours to 8 hours. This analysis was reported in July 2021. In the analysis the report notes that "*Reflecting uncertainty in post-pandemic recovery, the original application forecasts have been revised*", and these revised forecasts meant that a "*higher total QC is forecast."* This resulted in an increased QC/ATM target of 0.51. It is clear that the proposed target is set to accommodate forecasted QC, with changes in the forecasted QC leading to changes in the target. It is noteworthy that the overall noise impact does not seem to have been a feature of the proposed change in target.

The date used to determine the target of 16,260 are reported below.

	2016	**2017**	**2018**	**2019**	**2022**	**2023**	**2025**	**2030**	**2035**
8hr ATM	24,756	27,283	27,896	29,319	24,633	27,345	31,885	31,264	31,866
8hr QC	13,182	14,289	14,484	15,426	13,368	14,294	15,902	14,194	12,363
QC/ATM	*0.53*	*0.52*	*0.52*	*0.53*	*0.54*	*0.52*	*0.50*	*0.45*	*0.39*

The following is noted:

- In both cases a target average fleet noise per movement was used to determine the overall Annual Night Quota. Setting an average fleet noise per movement is a needlessly complex approach to determining an overall noise quota. It would be more straightforward to simply set an Annual Night Quota independent of average fleet noise per movement. Further, while the QC/ATM is seen to reduce between 2022 and 2025, at the same time the actual QC increases. This suggests many more air traffic movements are projected, and while they may be quieter aircraft, with a slightly lower average fleet noise per movement, the overall noise will increase.
- The DAA's RFI response indicates that the objective is to deliver a reduction of average fleet noise per movement (QC/ATM) in 2025 compared to 2018. In this author's opinion, a more appropriate objective would be to deliver a reduction of overall QC instead. With increasing ATMs the overall QC actually increases and as such, the noise impact of operations at the airport will be increased. The objective of the scheme proposed in London includes the objective to "*limit or reduce the number of people significantly affected by aircraft noise at night…*". ANCA has set the high-level objective for Dublin Airport to "*Limit and reduce the long-term adverse effects of aircraft noise on health and quality of life, particularly at night, as part of the sustainable development of Dublin Airport*". Setting a target QC/ATM is not the most appropriate way to achieve this objective.

- The limit 16,260 (and the limit of 7,990) appears to simply be a representation of what the DAA needs the quota to be, in order to operate as forecast with as little restriction as possible. It seems unrelated to overall noise control. Indeed, this is recognized by ANCA in Appendix J of the Draft Regulatory Decision, *Cost Effectiveness Methodology and Results*. It states "…*the 8-hour alternative noise quota limit of 16,260 as suggested by ANCA can be met without imposing any restrictions on how an airline may wish to operate…*".

  To put it simply, the noise quota is based on the DAA's forecasted fleet mix and night-time movement, whereas, the fleet mix and night-time movements should be based on the noise quota.

- The target QC/ATM is exceeded in 2022 and 2023, but at the same time the ANQ is not exceeded.
- The target quota of 16,260 significantly exceeds the year of 2018.
- Analysis of the historic QC/ATM suggests that 2018 had the lowest QC/ATM in the period 2016-19. However, 2018 did not have the lowest QC. This demonstrates that a lower QC/ATM does not result in lower overall levels, and hence highlights the flaw in developing a target based on QC/ATM.
- In all cases the projected ATM exceed each of the three movement limits set out in the London airport scheme.
- It is also worth considering the difference in projected ATM over the different definitions on night time. Take 2025 for example, the data suggest that the DAA forecast a total of 16,593 annual movements between 90-minute period that had been previously omitted (23:00-23:30 and 06:00-07:00). On average, this represents approximately 45 flights per night in that additional 90 minute period.

	2016	**2017**	**2018**	**2019**	**2022**	**2023**	**2025**	**2030**	**2035**
1.5hr ATM	13,906	14,642	14,417	15,056	12,617	13,983	16,593	15,972	16,574

- It is unclear how the figure of 16,260 was eventually determined. It seems this figure is simply a number that exceeds all projected QCs

Conclusions & Recommendations

- The proposed Quota system is an incomplete interpretation of that operated in the London airports. The London airports operate a Noise Quota System together with a movement limit. If the Dublin approach is based upon the London Stansted approach, then it should also include a movement limit.
- The use of a quota system based on EPNL fails to account for noise events. A movement limit in parallel with the noise quota would go some way to address this issue.
- If there is no movement limit, any aircraft movement with a quota count value of zero would in effect be unlimited, despite the fact that it is a noise generating movement.

- The total of 16,260 QC points far exceeds the totals in Gatwick, Heathrow, and Stansted. It should be reduced significantly. A reduction in this limit would go some way in to meet that stated objective of limiting and reducing the long-term adverse effects of aircraft noise on health and quality of life.
- The total of 16,260 was based on a goal of reducing the average fleet noise per movement. This does not necessarily lead to a decrease in overall noise levels. For 2022, 2023 and 2025, the average fleet noise per movement decreases, but the overall QC points increase each year. A more appropriate approach would be to deliver a reduction of QC instead.
- In this authors opinion a target QC of 14,000 in parallel with a movement limit would represent a more progressive approach. These should be considered minimal targets and I encourage ANCA to consider lower limits. The QC target of 14,000 is based on a slight improvement of 2018 data. An appropriate movement limit would also need to be determined. By analyzing the average relationship between the Movement/Noise Quota Limits described in the London airports, a movement limit of 21,000 would appear in line with international practice. Similar to the London schemes, these limits could be revised to account for summer/winter variation.
- The above limits are based on 2018 data, as 2018 is the year identified by the DAA in the development of the target QC/ATM. However, the data suggest the limits would also be applicable to 2017, which might be more appropriate to set as a pseudo baseline year against which improvements are assessed. This would align with the timing of EU Directive 2002/49/EC as well the European Commission's 'Towards Zero Pollution for Air, Water and Soil' Action Plan.

References

[1] ANCA Draft Regulatory Decision Report

[2] https://www.heathrow.com/company/local-community/noise/operations/night-flights

[3] Quota Count validation study at Heathrow Airport CAA, 2020

[4] Review of the Quota Count (QC) System Used for Administering the Night Noise Quotas at Heathrow, Gatwick and Stansted Airports UK Department for Transport (2004). Available from: http://www.dft.gov.uk/stellent/groups/dft_aviation/documents/page/dft_aviation_022749.hcsp

[5] Murphy E., King E.A., Environmental Noise Pollution: Noise Mapping, Public Health and Policy, Elsevier, 2014.

[6] US GAO, 2021. Report to Congressional Requesters, FAA Could Improve Outreach through Enhanced Noise Metrics, Communication, and Support to Communities. United States Government Accountability Office.

[7] Elliff, T., Cremaschi, M., Huck, V., 2021. Impact of Aircraft Noise Pollution on Residents of Large Cities. Policy Department for Citizens' Rights and Constitutional Affairs, Directorate-General for Internal Policies PE 650.787, European Parliament, Brussel

[8] Dublin Airport North Runway Relevant Action Application, Environmental Impact Assessment Report Volume 4 - Appendix 2A. Dublin Airport Proposed Night Quota System