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AIRPORT NOISE - MODELLING AND MITIGATION MEASURES (SUMMARY)

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1. INTRODUCTION

Over the years there has been considerable success in developing technologies for quieter aircraft. However, with the uncertainty that future technologies can continue to deliver ever reducing noise emissions, what else can be done to reduce noise around airports ?

The major airports are leading the way in developing alternative noise management options, but given the continuous growth in aircraft traffic throughout the UK, regional airports are increasingly facing similar challenges to manage their noise environments. This paper considers the applicability of some typical noise abatement practices at smaller regional airports.

To illustrate some of the issues, a theoretical analysis has been undertaken using DORA's Aircraft Noise Contour model (ANCON) to assess the merits of some noise mitigation measures for application at smaller airports. Some regional airports are already adopting their own noise mitigation practices, but many are yet to embark on pro-active noise management. This brief analysis is intended to offer an insight into the kind of benefits that might be attainable and the factors that have to be considered. For this purpose a representative regional airport is hypothesised; the conclusions would not necessarily apply to any specific airport.

2. THE MODEL REGIONAL AIRPORT

Regional airports vary enormously in terms of their size, location, aircraft fleet, numbers of flights etc. Consequently each creates a unique noise environment. The model airport has been chosen to have characteristics similar to those of a busy regional airport. The assumed aircraft fleet comprises three main categories of aircraft - turbo-props, small commercial jets, and executive jets - all of which are characterised by good climb performance. Aircraft movements are distributed across nominal flight routes - two for arrivals and four for departures - and then dispersed around each by applying typical spread functions.

Noise exposures are presented as 57, 63 and 69 dB(A) L_{eq} (16-hr) noise contours because of their relevance to community annoyance due to long term noise exposure (Ref 1). The areas within each contour are compared to indicate the noise mitigation benefits that are achieved. To allow realistic population exposures to be estimated the airport has been positioned near the edge of a large town.

Aircraft profiles (height, speed and noise versus distance) have been generated within the noise modelling process using DORA's latest ANCON computation methodologies and databases. Reference 2 describes an earlier version of the ANCON noise model; subsequently it has been developed considerably, and that report is due to be updated.

3. DEPARTURE PROCEDURES

The analysis considers principally the noise mitigation potential of ICAO Noise Abatement Take-Off Climb - Procedures A and B (Ref 3) at the model regional airport. These procedures allow operators a choice as to when to reduce engine power and change flap settings after take-off, a process usually referred to as 'cutting-back'. Procedure A allows for cut-back at a height of 1,500 ft and procedure B at 1,000 ft. These are called 'distant' (A) and 'close-in' (B) abatement options. Because thrust determines noise emission level, the comparative benefits of these options depends on the distribution of populated areas around the airport.

For the model airport it is found that following procedure B as opposed to procedure A reduces the area of the 57 dB(A) contour by about 15% with a smaller reduction in the area of the 63 dB(A) contour and little change in the 69 dB(A) contour. For this particular case similar benefits in population exposures are achieved. The aircraft studied reach a height of 1000 ft at distances of between 3 and 4 km from their start of roll and hence the benefits increase through and beyond this region. If the fleet includes slower climbing aircraft the effect will tend to be spread further away from the airport. More generally the scale of the potential benefit will also depend on such factors as the number of operations, aircraft fleet mix, aircraft routeings, runway modal split, and the distribution of populated areas in the vicinity. Hence it is not possible to generalise this result.

4. NOISE MITIGATING FLIGHT ROUTES

Major airports have been routeing aircraft departures away from populated areas for many years, but does the technique offer useful benefit for smaller airports ? The design of such routes may be constrained by air traffic control, safety requirements, or other operational factors. But, to illustrate the potential benefit for the model airport a set of nominal alternative departure routes has been assumed so that flights over the villages near the airport can be reduced. The results indicate that contour areas show little change but in this particular case the population within the 57 to 63 dB(A) band is reduced by more than 10% without significant change to the population counts in the higher bands.

Next, the unavoidable spread of aircraft around the nominal departure routes was investigated. In the base case the spread (or dispersion) function is typical of that seen at similar sized airports. The spread function was then reduced by about 50% to be more typical of aircraft flying specified noise mitigating routes. The results indicate a further reduction of about 10% in the population within the 57 to 63 dB(A) band, although in this case the area of the 69 dB(A) contour is increased. It should be stressed that these results are entirely dependent on the distribution of the population in the relevant areas (and hence the availability of effective mitigating routes), and also on the other factors mentioned above. However, it is clear that the benefits of adopting particular noise mitigation routes for airports similar to the model airport may be significantly enhanced by reducing the spread of aircraft around those routes.

4. DISCUSSION

An imaginary airport has been used to illustrate the noise exposure benefits that might accrue from the use of the different operational procedures and the use of noise mitigating flight routes at a regional airport. It is clear that the potential benefits are significant but a final word of caution is required. There are many local factors that will determine if these mitigation measures are feasible, and if so to what extent they will be successful. These will be discussed more fully in the presentation.

REFERENCES

1. Critchley JB, and Ollerhead JB: The Use of Leq as an Aircraft Noise Index: Civil Aviation Authority DORA Report 9023: September 1990.

2. Ollerhead JB: The CAA Aircraft Noise Contour Model; ANCON Version 1: Civil Aviation Authority DORA Report 9120: 1991.

3 International Civil Aviation Organisation (ICAO) : Procedures For Air Navigation Services, Aircraft Operations, Volume 1 Flight Procedures, Part V Noise Abatement procedures.