USING COMPLAINTS AS A MEASURE OF ANNOYANCE AT AIRPORT OPERATIONS

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ABSTRACT

The patterns of complaints, generated by aircraft at Manchester Airport, were investigated to determine the influence of a new runway, time of day, day of the week, month and noise level. The introduction of a new runway in 2001 increased complaints by more than threefold compared with 2000. In agreement with previous reports there was a clear circadian pattern in the number of complaints per 1,000 flights, with the highest values during the early part of the night and the lowest levels in the afternoon. There was twice as much annoyance with flights at the weekend compared with weekdays and there were clearly more complaints in the summer months. The numbers of complaints were directly related to the noise level.

INTRODUCTION

The transport industry continues to be one of the fastest growing industries in the world and exerts increasing pressure on the environment. The aviation industry has undergone enormous growth over the past ten years and is predicted to continue at 5-7% per annum (Airbus, 1997). This expansion can bring enormous benefit to the local economy e.g. employment, however these benefits can be counter-acted by adverse environmental impacts. Aircraft noise and the associated community disturbance is the most obvious environmental issue to restrict airport growth and although aircraft noise technology is continually improving, this benefit is offset by the increase in air traffic. This is the case in most busy airports, including Manchester Airport, which is expected to be the second busiest airport in the UK in next 15 years, following the opening of a second runway.

Complaints about aircraft movements can be used to assess the disturbance caused in the surrounding community (Hume et.al, 2002). This information can feature prominently in public inquiries associated with the development and growth of airports. In a recent study at Schiphol airport a relationship was demonstrated between aircraft noise exposure and complaint behaviour (van Wiechen et al, 2001). These authors also highlighted the importance of noise annoyance, sleep disturbance, concern about health and fear for an aircraft crash as determinants of complaint behaviour. Very few studies have been reported that deal directly with noise complaints. There is dispute about how useful complaints are in helping to quantify the problem. Some studies conclude that complaints are closely related to noise exposure by aircraft (Gillen & Levesque, 1994), while others state that noise complaints do not sufficiently measure the community response to aircraft noise pollution and do not represent the scope and scale of the environmental problem (Luz et al, 1983). Although noise complaints are generally perceived to be important, it seems that, as yet, there has been little effort to scientifically assess complaints data from airports (Hume et.al; 2002), and as this data can affect the growth and development of an airport it is important for an assessment of the complaint profile to be carried out.

METHOD

All data used in this study were collected from Manchester Airport, which is currently the third busiest airport in the UK. Data gathered were for the period 01/01/00 to 31/12/00, while total complaint numbers and Air Traffic Movements were taken from years 1991 to 2001.

Community Relations

All complaints regarding Manchester Airport's operations were received, investigated and logged in the Community Relations department. Complaints were received mainly via the telephone i.e. answered directly or recorded by answer phone if out of office hours, but were also received via letter, e-mail, on the Manchester Airport website and at Community Outreach centres. The Community Relations team received both general complaints about airport operations, and complaints that were specific to individual aircraft. Details of the complaint were logged on MANTIS (Manchester Airport Noise and Track Information System).

MANTIS

Noise and Track

The MANTIS computerised system records the movements of all aircraft up to a 30km radius and a height of 12,000ft. MANTIS receives aircraft noise level information from 13 remote sensors. Five sensors are situated at an internationally agreed distance of 3.5 nautical miles from the end of the original runway, two are situated 3.5 nautical miles from the end of the new runway and the remaining six are either on the airport site itself or at further points along the take-off and landing routes. MANTIS links noise readings and track keeping with specific aircraft in order that financial penalties may be imposed on airlines whose aircraft fail to comply with the locally agreed noise limits, and fail to remain within the Preferred Noise Routes (predefined corridors on departure) until set release altitudes. Noise readings on MANTIS are given as a maximum long-term average noise level LA_{eq} (LA_{max}), the maximum value of continuous steady sound during an aircraft flyover. Noise limits are set at 105PNdB (perceived noise decibels) in the daytime (0700hrs to 2259hrs) and 100PNdB at night (2300hrs to 0659hrs).

Complaint Procedures

Complaints are received via the Community Relations Team and are logged onto MANTIS. Complaints about specific aircraft are logged and then linked to a specific flight causing annoyance. MANTIS then establishes a protocol linking the associated flight data and noise level produced to specific complaints generated, within the database.

Data Gathered

Data gathered from MANTIS for manipulation were:

1. Complainant details:
    - Postcode
    - Region of residence
    - Gender
    - Day and date of the event causing disturbance
    - Time of disturbance
    - Personal identification number (used to protect identity of complainant)
    - Geographical co-ordinates of address
    - Complaint description (e.g. noise, track, odour etc.)

2. Details of flights causing annoyance (if complaint was specific)
    - Call sign
    - Aircraft type
    - Airline

- Operation (arrival or departure)
- Runway (24 or 06) relating to compass point and direction of air traffic
- Nominal route (departure route)
- Altitude of flight nearest to complainants home
- LA_{max} and PNdB (taken from noise monitor nearest to complainants home)
- Track violation

3. Total Air Traffic Movements:
    - Per year from 1991 to 2001
    - Per hour of the day in 2000
    - Per day of the week in 2000
    - Per month in 2000

4. Total complaint numbers:
    - Per year from 1991 to 2001

Data Manipulation

The data were used to compare trends in complaints per 1,000 Air Traffic Movements (ATM) to give an accurate rate of complaining in relation to ATM. Yearly data were compared. Complaint, noise and Air Traffic data were compared to give trends for hour of the day, day of the week and month in 2000. This was divided into total complaints (complaints due to noise, track, noise & track, odour, engine testing, low, general and other) and noise complaints (noise and noise & track).

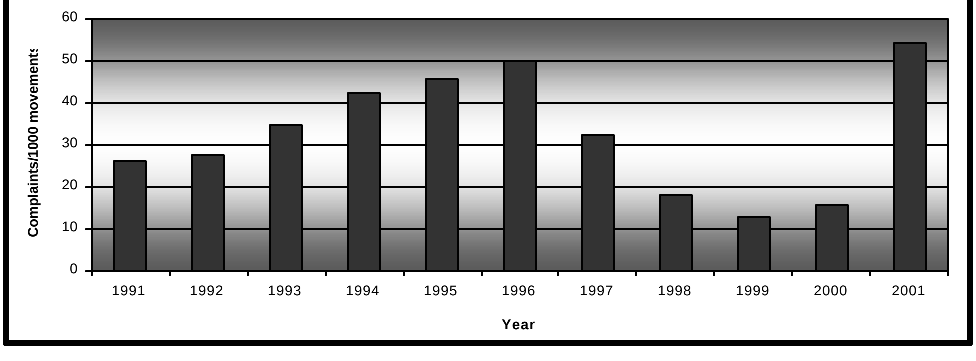
RESULTS/ DISCUSSION

In 2000 there were a total of 2,804 complaints from 618 complainants. 58% of complainants were male. There were a total of 178,968 Air Traffic Movements (ATM) in 2000 giving a mean value of 16 complaints per 1,000 ATMs. The majority of complaints were specifically caused by noise (72.1%) followed by track (14.5%), noise and track together (12.3%), with other making up 1.2% of complaints.

Yearly

Figure 1 shows a steady rise in complaints per 1,000 movements from 1991 to 1996, after which there is a drop in complaints down to the lowest point in 1999. A sharp increase to the highest value occurs in 2001. This trend can be explained by development of the second runway. The planning application for runway 2 was sought in 1993, corresponding to a slight rise in complaints. The Public Inquiry regarding the new runway was carried out from 1994 to 1996, giving rise to a year on year increase in complaints. This trend is possibly due to a steady increase in public awareness of the plan for a new runway. Following the approval of the

Figure 1: Complaints per 1000 Air Traffic Movements (ATMs) for years 1991-2001



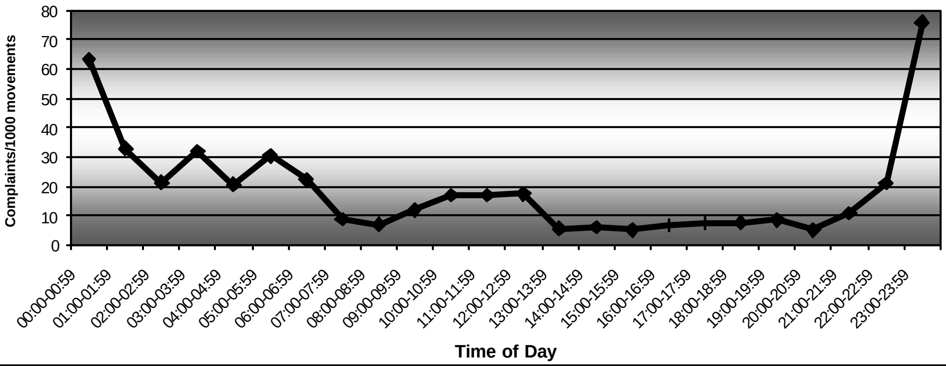
new runway the complaints were reduced from 1997 to 2000. Then in February 2001 the new runway began operations, leading to a new noise climate in areas along the new routes associated with the new runway. This new increased disturbance produces the largest value of complaints per 1,000 flights seen at Manchester Airport in the last ten years.

Time of Day

Relationships between complaining and flight frequency over the 24 period were found to be similar to previous findings in 1998 (Hume et al, 2002). The patterns of total complaints per 1,000 ATM per hour of the day, and noise complaints per 1,000 movements per hour of the day, followed the same basic pattern. ATM are at their lowest from 2300hrs to 0700hrs at between 1,000 and 2,000. ATM rise sharply at 0700hrs, to 15,000 movements, marking the end of the night noise policy and the departure of many European business flights and arrival of transatlantic flights. A second peak occurs from 1600hrs to 1900hrs, marking the return of the European Business Flights.

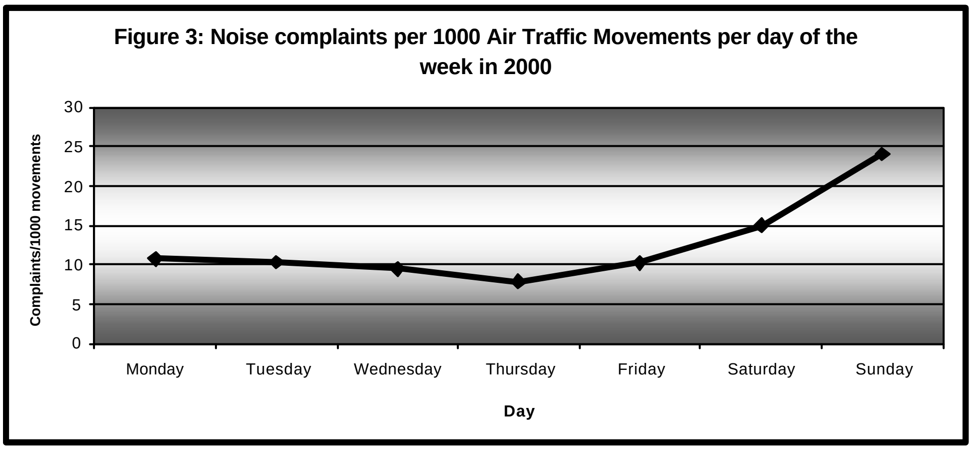
To better understand the pattern of complaints per hour of the day it is necessary to calculate the number of complaints per 1000 aircraft movements, thereby gauging sensitivity to noise. The pattern of complaints per 1000 ATM per hour of the day can be seen in figure 2. The largest peak, and therefore sensitivity, is seen between 2300hrs and 0100hrs. From 0100hrs to 0700hrs there are between 20 and 30 complaints per 1,000 ATM, followed by a smaller rise between 1000hrs to 1259hrs. The lowest sensitivity occurs between 1300hrs and 2159hrs. This pattern would correspond with most annoyance occurring when complainants are attempting to get to sleep between 2300hrs and 0059hrs, or that they have been aroused from sleep. A person would be more easily aroused later in the sleep period, but annoyance would still occur due to arousal from sleep being irritating and highly disturbing.

Figure 2: Noise Complaints per 1000 Air Traffic Movements per hour of the day in 2000



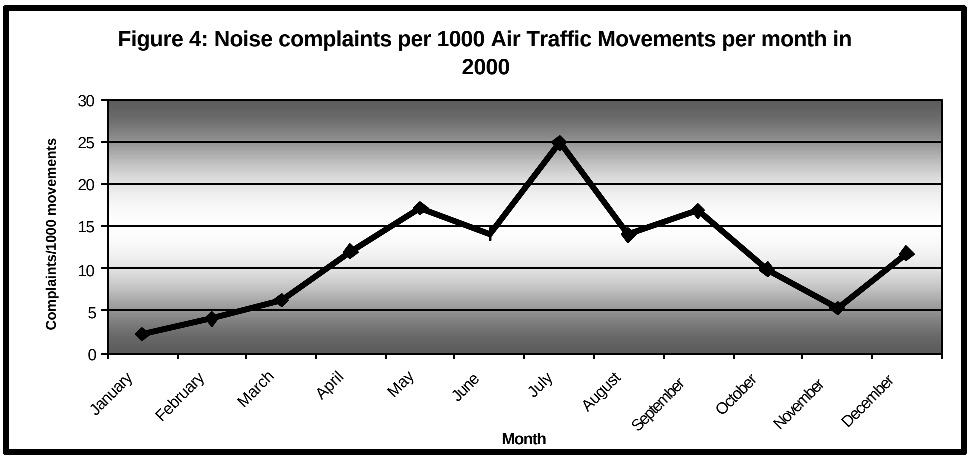
Day of the week

Analysis of data with day of the week shows that ATMs fall from a steady daily rate of around 30,000 flights between Mondays and Saturdays to around 23,000 flights on Sundays throughout 2000. Total complaint figures show only a slight difference to noise complaints, with slightly more on Saturdays, the overall trend is otherwise very similar. The trend in noise complaints per 1,000 ATM shows a relatively steady rate throughout the week, with a slight rise on Saturdays. This is followed by a greater rise on Sundays (figure 3). This rise is most likely due to the tradition of Sunday being the 'day of rest' when most people are relaxing at home. Aircraft noise would therefore be viewed as a bigger intrusion than during the week when many people are occupied at work and are less sensitive to noise. Noise on Saturdays may be slightly more tolerable than Sundays as Saturdays are generally more 'active' days when people tend to go shopping and socialise.



Month

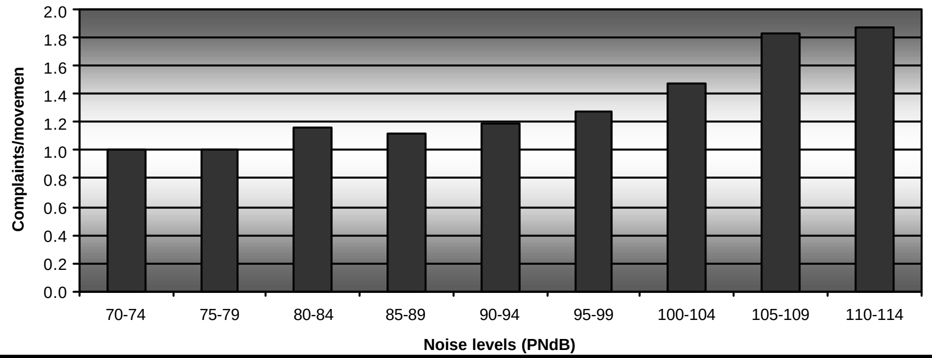
ATMs show an increase in numbers over the summer period when many people leave the country on holiday. The highest numbers of movements were seen from May to October at around 18,500 per month, whilst from November to April movements were about 14,000. Figure 4 shows that complainants appear to be most sensitive to aircraft noise in July, with the lowest sensitivity in January. A smaller peak in noise sensitivity was seen in December. Greater sensitivity to noise is likely to be seen in summer due to a tendency for time to be spent outdoors or for windows to be open, therefore aircraft noise will be more noticeable. Another reason reported by complainants was annoyance that they themselves are not going on holiday, so why should they listen to the noise of holidaymakers! The sight and/or sound of an aircraft travelling to a desirable destination will make aircraft noise seem far more annoying!! This reason is applicable all year round but perhaps it is more relevant in the summer months. Complainants also state that being subjected to aircraft noise when they themselves never actually use the airport leads to annoyance and complaint.



Noise

Noise readings were linked to only 1,039 complaints out of the 2,804, partly due to some noise complaints not being specific to a single flight, plus MANTIS does not operate at 100% accuracy when linking complaints with flight data. Additionally, the noise monitors introduce a margin of error. The threshold for complaint was 74PNdB and the average recorded noise level for complaint was 96PNdB. Analysis of flights that generated complaints showed that there was 1 complaint at 70-79PNdB with a steady rise to 1.88 complaints per flight (generating complaint) at the highest levels of noise i.e. 110-114PNdB (see figure 5). This can be expected as 'complaints are generated by unusual rather than typical noise levels' (Luz et al, 1983). Habituation will occur to flights occurring at the lower noise levels, in most cases, and will become merged with ambient background noise. However, when a loud aircraft noise event (ANE) occurs, the brain becomes alerted due to an out-of-the-ordinary occurrence and consequently there is a greater response.

Figure 5: Number of complaints per aircraft movement at specific noise levels



CONCLUSIONS

The hourly, daily and monthly patterns of complaint for 2000 agreed with previous published results for 1998 (Hume et al, 2002). There have been no major changes in the airport's operations between these two years, indicating that these temporal patterns of complaint and annoyance are a consistent feature, for a given airport. A new runway opened in 2001, which caused disturbance in some additional communities, resulting overall in a three-fold increase in complaints. It will be interesting to determine, in future work, if the temporal patterns of complaints are similar in the new unhabituated communities affected by the new runway.

The data collected from Manchester Airport reveals circadian variation in complaining with temporal factors. This should not be surprising as it is well known that circadian variation occurs in psychological, behavioural and physiological variables due to the presence of internal clocks (Moore Ede et al, 1982). Although, as stated, some literature concludes that complaints are not an accurate overall measure of annoyance or disturbance caused in the surrounding community of an airport, our findings show evidence that they are an indication of these factors if appropriately analysed. The manipulations carried out provide an insight into community opinion of an airport and gauge sensitivities at various times. This information is important to an airport, as the opinion of the surrounding community is an important factor when considering change or growth, therefore insight into sensitivities will aid in the continuation of sustainability. Creation of an internationally comparable measure of complaint levels around airports, to discover varying sensitivities of communities to aircraft noise, will be an interesting development of this study. The effect of the second runway at Manchester Airport needs more in-depth investigation to further understand the effect of airport growth on the community.

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