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## **GENERIC SYSTEMS TO PERMIT PUBLIC ACCESS TO ENVIRONMENTAL INFORMATION - A PROTOTYPE FOR AIRCRAFT NOISE AND FLIGHTPATH DATA**

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**ABSTRACT**

Aircraft noise has the potential to severely constrain the development of aviation due to the disturbance caused to local communities. This project describes prototype systems that permit corporate and public access to aircraft noise and flight path information to assist the dialogue between airports and their neighbours. Through the development of a dynamic web-based system which facilitates the analysis and visualisation of data the non technical user is guided through relevant information to aid understanding and support their participation in decision making processes. The system has been developed using real data from major European airports. The development of such generic systems actively supports European and national government thinking on public access to environmental information.

**1 - INTRODUCTION**

The continuing development and growth of aviation makes a significant contribution to regional development. However, the adverse consequences of the air transport industry on the environment, particularly the disturbance caused by aircraft noise, has the potential to constrain growth and hence the social and economic benefits which accrue from airport development. Noise disturbance is to a very significant degree a matter of individual perception and as a result, its control is best achieved through consultation with and the active participation of communities that are adversely affected by airport operations. This is a two way process which requires both the provision of information and the receipt of comment and/or response. The development and rapid growth of information and communication technologies and in particular the World Wide Web (WWW) provides a very effective tool to enable companies such as airports to facilitate greater public participation in their development and in their efforts to reduce disturbance. This paper describes the potential for a web-based geographic data visualisation system to enable the public direct access to airport environmental and other information in order to facilitate a constructive dialogue between airports and their neighbouring communities.

**2 - BACKGROUND AND RATIONALE**

One of the characteristics of modern democracies is the call for greater transparency in business and government and the provision of increasing amounts of information to the general public. The result being to create an open society that is capable of making more informed decisions on issues such as environmental protection and economic development. The availability of information and the development of a dialogue are seen as the key to enabling industry and government to become more responsive to different stakeholder needs.

The growth of air travel is intrinsically linked to that of the global economy and it is predicted that over the next 10-15 years, demand could double (Airbus 1997). Airports bring very significant social and economic benefit and have been shown to be some of the largest generators of economic activity in the regions they serve (ACI 1998). While these benefits can be felt across wide geographic areas, the adverse effects of airport operations are, with the exception of climate change (IPCC 1999), primarily borne by the local environment (Tunstall-Pedoe *et al.* 1996) and residents of neighbouring communities (Moss *et*

*al.* 1998, Zaporozhets and Tokarev 1998). These community impacts have the potential to constrain growth so there is a clear link between the ability of aviation to reduce its local environmental impacts and its potential to contribute to economic growth.

The disturbance caused by aircraft noise is the single most important environmental impact that is constraining the growth of airports. A number of major airports across Europe have reached their noise capacity before having made full use of the runway and terminal infrastructure they have provided (ACI Europe 1995, ICAO 1993). Others fail to gain approval for further development as a result of the noise implications of the additional traffic growth, despite the demand which exists in the regions they serve. Finally it is not uncommon for airports which are given approval for development to be set noise limits for future operations (e.g. Manchester, Schiphol).

The physics of sound can be described in terms of changes in air pressure, wavelength frequency, amplitude and purity (Sekuler & Blake 1994 Veitch & Arkkelin, 1995). However these components do not measure the level of disturbance caused in response. Noise is considered as a sound which has an undesirable effect upon people (Berglund and Lindvall 1995). Prolonged exposure to high levels of noise has been shown to cause serious physiological and psychological effects upon the human body and sleep deprivation which can lead to stress and immunological problems (Veitch & Arkkelin, 1995).

The problem of aircraft noise disturbance involves the complex interaction of a number of physical, biological, psychological and sociological processes (Schultz 1978). The relevant physical factors include those associated with noise generation e.g. aircraft type, mode of operation and the resulting noise level. The other critical components are the human factors which include the basic biological systems of audition followed by the psychological processes which interpret these signals and involve health status, annoyance and stress (Job 1996). The further interpretation of noise disturbance can be subject to sociological conditioning that may include factors such as socio-economic status. Finally, although individuals may complain about the 'noise' of aircraft a variety of other factors can be the underlying cause of annoyance (Moss *et al.* 1997).

The Environmental Information System described in this paper has been developed using aircraft noise, flight track and complaint data provided by Manchester Airport plc (MAplc) and Lochard PTY Ltd. MAplc has operated a noise control programme for over 20 years which is underpinned by policies designed to encourage the use of quieter aircraft and for pilots to fly them as quietly as possible (Thomas 1996). The Airport has designed, in consultation with the local community, a series of preferred noise routes designed as far as possible, to avoid aircraft over-flying houses. The noise control programme is supported by a monitoring system MANTIS (Manchester Airport Noise and Track information System, developed by Lochard PTY Ltd. Melbourne) which stores information about the route flown and noise generated by each arriving and departing aircraft. These data can be used to investigate complaints from the public, impose penalties upon airlines, track progress against targets and measure the local noise climate.

Most complaints received by MAplc (Thomas 1996) are initiated by the perceived excessive noise of some aircraft or by aircraft flying 'off track' over areas which are not believed to be under approach and departure routes. There is a correlation between the level of noise generated by different types of aircraft and the resulting level of complaints. However, some aircraft feature more frequently than expected e.g. the public complain more frequently about B747 'Jumbos' because their size makes them appear to 'too low'. Noise complaints can be triggered by a number of other factors also such as fear of air accidents (complaints increase following well publicised air crashes) or concern over the effects of noise upon house prices.

The number of complaints, per se, may not be an indicator of the level or extent of the noise problem as it is subject to distortion by serial complainers (Thomas 1996). It is suggested (Berglund & Lindvall 1995) that only 5-10% of residents exposed to noise actually complain or participate in related activities. Also, because of the strong influence of psychosocial factors (e.g. education, self confidence, political orientation) the number of complaints can be poorly correlated with noise exposure (Scumer & Zeichart, 1989). Therefore complaints may be a good indicator of the existence of a noise problem but not its intensity (Berglund & Lindvall 1995).

The response to such disturbance can be anger and frustration which results in opposition to growth, particularly because there is widespread belief that it is difficult for airports to reconcile their commercial interests with their responsibilities to their neighbours. It is evident that airports need a precise understanding of how they impact upon the lives of their neighbours if they are to develop strategies that address the real issues in a way which is meaningful to local residents.

A survey by the Airports Council International (ACI Europe 1995) has shown that, airports have recognised the need to maintain a dialogue with their neighbouring communities if they are to ensure their

own growth potential. Many provide noise complaints telephone lines and staff to handle calls from the public, some have public consultative committees. It is not uncommon, for airports to commission social surveys to elucidate community attitudes and clarify preferences where different options for development are being considered. Some have proactive community relations programmes designed to educate their neighbours about efforts being made to protect the local environment and about the benefits of further growth.

Airports therefore already receive information about their impact upon local communities from a variety of sources, from complaints and through public consultation and surveys. Communities in return can expect to receive reports on the causes of disturbance and proposals for action. The extent to which this can be regarded as an active dialogue is, however, limited, due to the time involved and the information available. At some larger airports (e.g. Schiphol, Paris CDG and Heathrow) local residents are actively encouraged to visit purpose built community relations centres where they can address staff directly with their concerns, find out about airport operations and development plans and express their preferences. Such facilities are, however, expensive and outside the scope of most airport companies.

### 3 - COMPONENTS OF THE ENVIRONMENTAL INFORMATION SYSTEM

Current and anticipated Information and Communications Technologies have very significant potential to speed up and allow a far more sophisticated dialogue between airports and their neighbours. The World Wide Web (WWW) is already a significant provider of information and links between business, government and the public and has considerable potential to facilitate public participation. The generic tools developed in this project make use of a series of WWW and additional technologies to enable the public to access information on aircraft noise and flight-paths, submit complaints or participate in interactive consultative decision-making processes. The system has been developed in consultation with Manchester Airport Noise and Community Relations staff, with local community representatives on the Manchester Airport Consultative Committee and local government Environmental Health Officers.

**Complaints investigation:** The system is designed to enable the public to access data relating to the noise levels of particular aircraft in particular localities. A Geographical Information System facilitates the manipulation and visualisation of spatial data (e.g. aircraft flight tracks) in a format that is defined by the user and can be customised and made relevant to their locale. The selection of flights triggers the provision of additional supporting information which would set the data in context, with a commentary on action being taken by the airport (or the airline) and where the system user could obtain further useful information or help.

Once the user has investigated a particular occurrence, the facility would exist for them to submit a formal complaint on a pro forma that would facilitate rapid analysis. Supporting databases would enable the airport to seek additional information from the complainant so as to clarify possible underlying causes of complaints and also to enable profiling and other analysis of complainants. An additional service would include a facility to design an individual report format on the site which would automatically collate, store and analyse complaints entered by the same individual, from a particular location, or by time of day, airline etc...

**Public Consultation:** One of the major elements of the WWW that has considerable potential in terms of airport community relations is the two way communication that can be enabled between individuals. This can be extended through use of technologies such as database driven web sites to enable one-to-many and many-to-one communication systems. In this way the airport can develop specific consultation tools which provide information relating to a particular proposal (e.g. options for the rerouting of an approach or departure flight path), seek comment from the user and then depending upon their response, provide new information or automatically answer specific questions. This would enable a more sophisticated form of dialogue to develop which has the potential to make the airport more responsive to the wishes of its neighbours.

Key elements in the design of a system to enable public involvement in the environmental performance of airports would be:

1. A system which is accessible and relevant to a variety of users ( e.g. local residents, elected representatives, environmental health officers, NGOs.).
2. A facility to investigate individual aircraft movements and to present noise and flight-path data in a format which is meaningful to the user.
3. A system for receiving complaints with a facility to enable the complainant to be presented with relevant supporting information.

4. A mechanism for collating, selecting, and presenting an analysis of complaints according to particular selection criteria.
5. The provision of wider information relating to the airports growth and development or its environmental protection programme which is specific to the users concerns, the area in which they live etc.
6. The provision of questionnaires and supporting information to enable greater public consultation and influence over airport growth and development.

One of the critical issues in the development of such systems is the extent to which processes can be made transparent and lend themselves to third part auditing. This ensures public confidence and adds weight to information provided.

#### 4 - CONCLUSION

The development of the WWW and information and communication technologies will provide significant opportunities for airports to undertake meaningful dialogue with their neighbours in order to arrive at the best compromises for reducing their local environmental impact. Such technologies have the potential to introduce far greater transparency of environmental monitoring and reporting which will have the benefit of engendering trust. They can also facilitate greater public participation in airport development.

The success of such systems will be dependent upon the extent to which potential users are involved in their design and the extent to which the system enables information and data to be customised and presented in a way which is meaningful to the users own requirements and specific locale.

Airports provide a very good example of the challenges being faced by business and industry in modern affluent democracies where people want the benefits of development but not the adverse social and environmental costs. Such a system has considerable potential for uses in other industries and as a mechanism from public consultation by Governments or indeed any other organisations.

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