

Adverse effects of night-time aircraft noise

Nicole Porter

**Environmental Research and Consultancy
Department (*previously DORA)**

UK Civil Aviation Authority

Aim of Presentation

- **To review the effects of aircraft noise at night-time**
- **To explain the context of recent research into the effects of night-time aircraft noise**
- **To consider future requirements**

Overview of presentation

- **Framework model for night-time noise**
- **CAA work and more recent US studies**
- **New UK work and progress**
- **Future research requirements to help inform policy?**

The problem.....

“ being woken in the middle of the night is the most terrible thing for our family”

“The airlines have to realise just how bad the problem is”

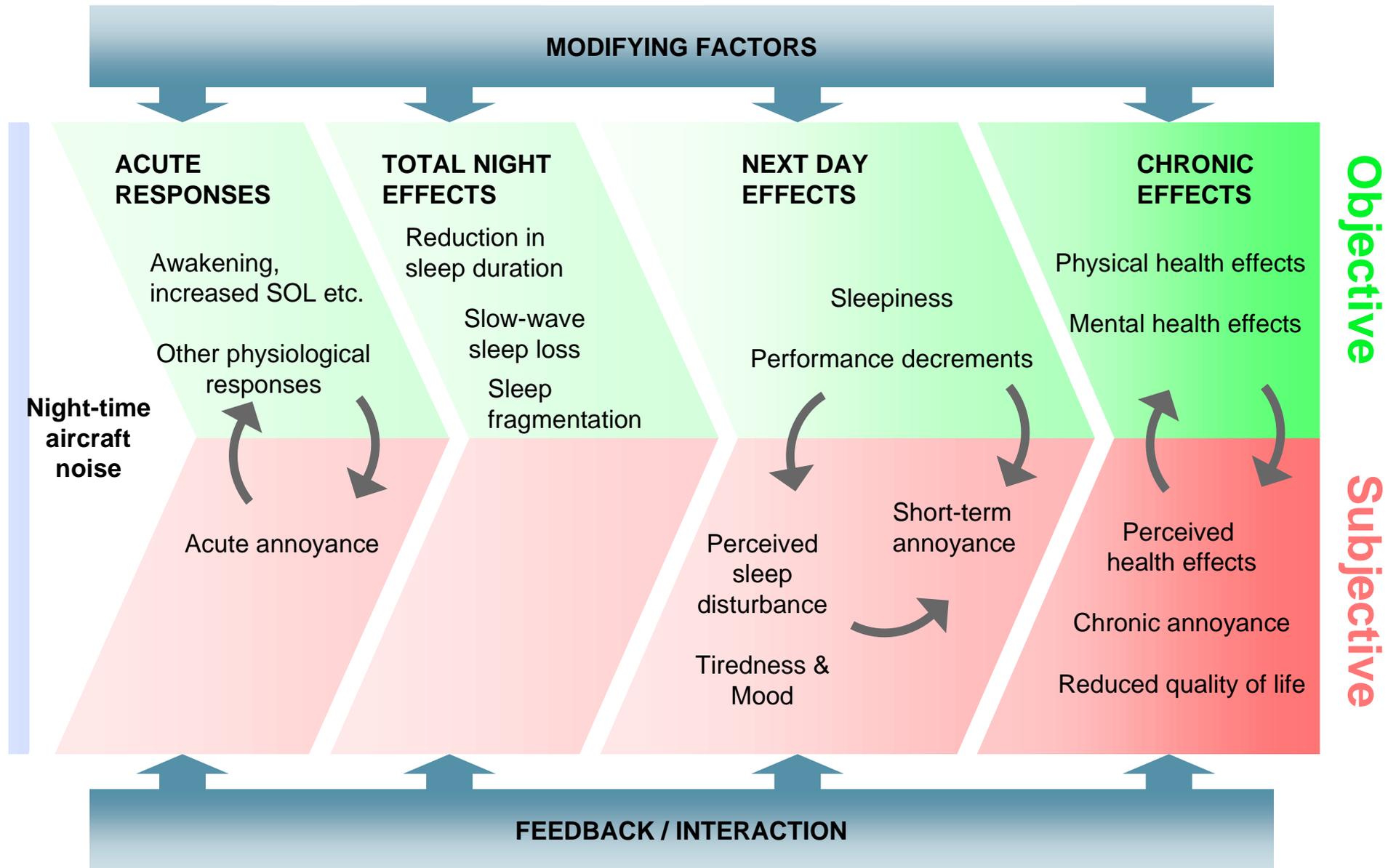
“The noise from these airplanes is making me ill”

UK national newspapers

© ENVIRONMENTAL RESEARCH & CONSULTANCY



Potential impact of night-time aircraft noise: Model framework



The role of actual noise-induced sleep disturbance

Sleep is only part of the complex web



Most research has concentrated on sleep disturbance



This research is mainly based on awakenings



Most guidance and criteria for night-time is therefore based on awakenings from sleep

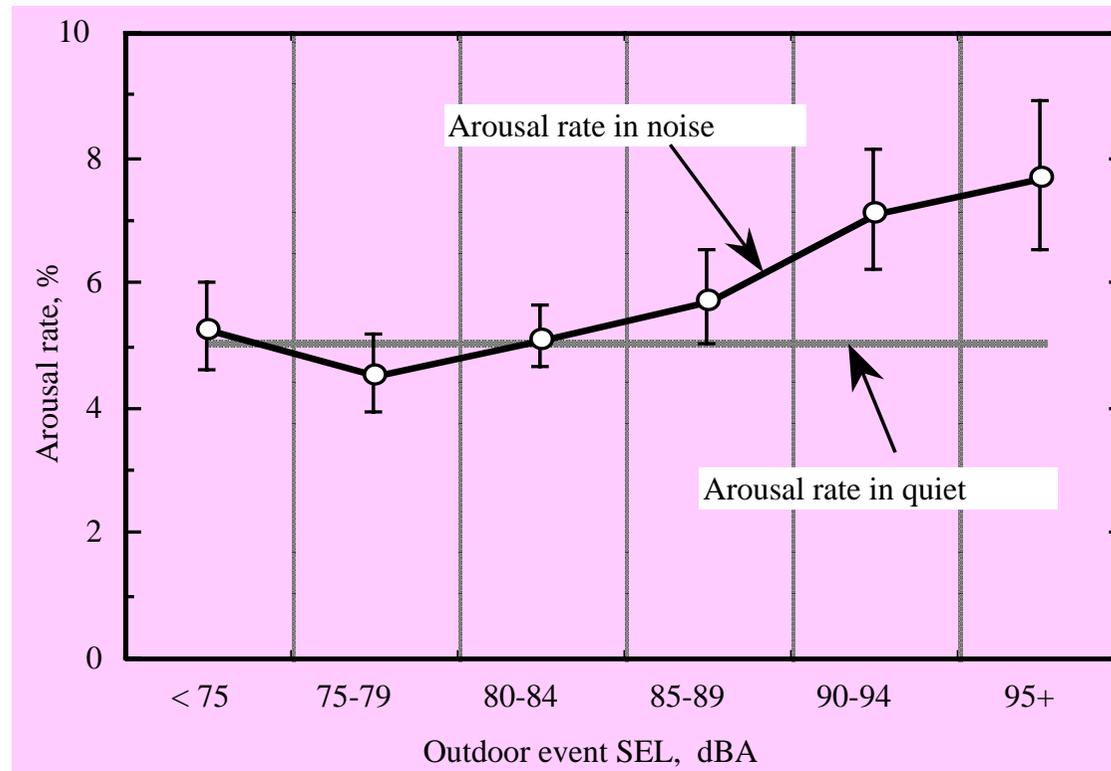
But what has this research shown ?

The 1992 UK field study of sleep disturbance

Equipment



1992 UK field study findings



Key Interpretation of the 1992 FS

At outdoor noise levels below **90 dB(A) SEL**, average sleep disturbance rates were unlikely to be affected and, at higher levels, the chance of the average person being awakened by an aircraft noise event was about **1 in 75**.

“But these findings are biased, politically slanted, counter-intuitive, conflict with public perception because people are woken up !”

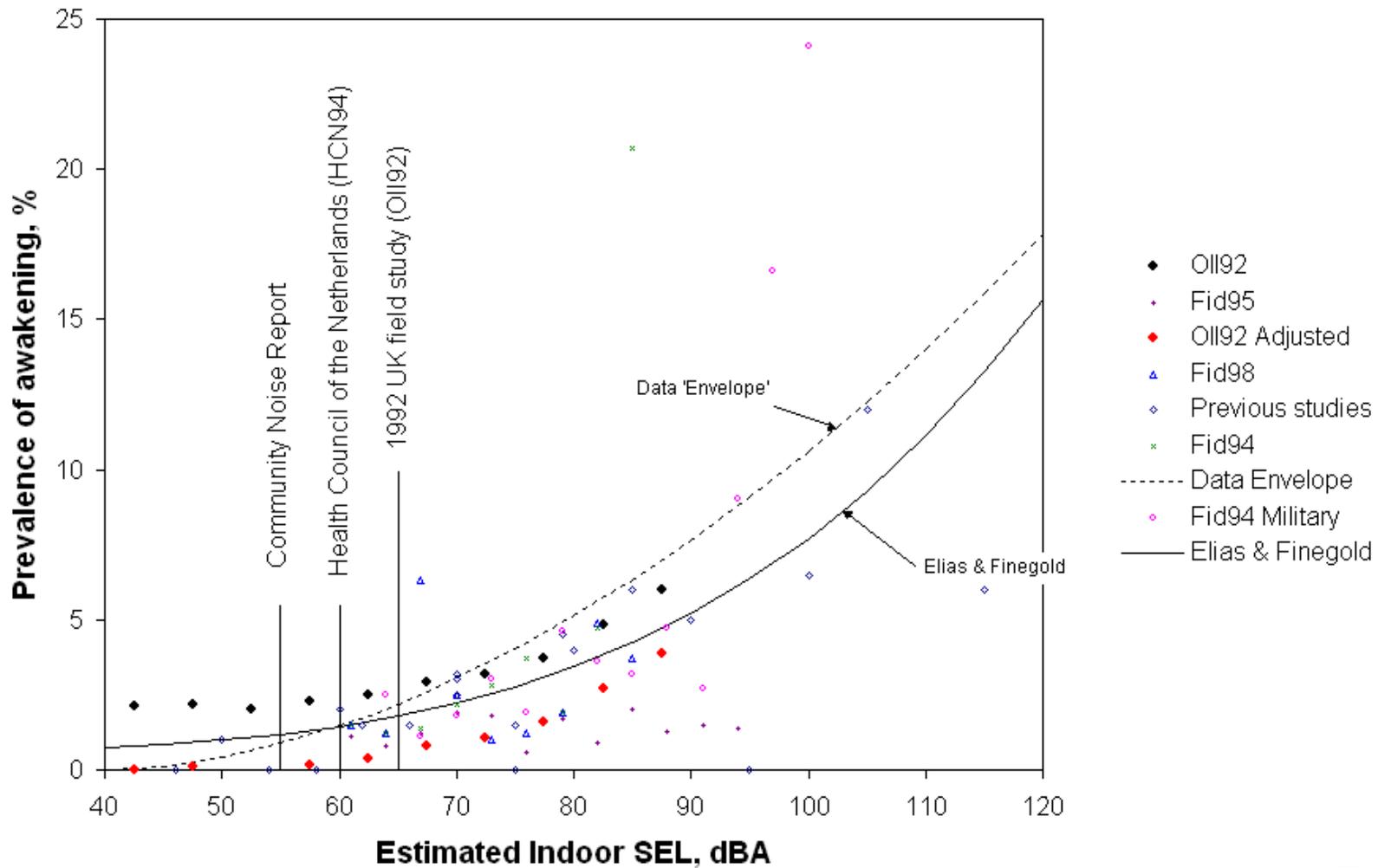
Misinterpretation: total disturbance can be significant !

- **Typical night in summer at Heathrow**
- **Findings suggest that 8,700 awakenings**
- **simplistic approach - does not taken into account a number of issues.**

Limitations of the 1992 Field Study

- focussed on disturbance within sleep
- relatively lower emphasis on perceived sleep disturbance and public perception
- meaning of noise not included

even so, do the key findings hold up today?

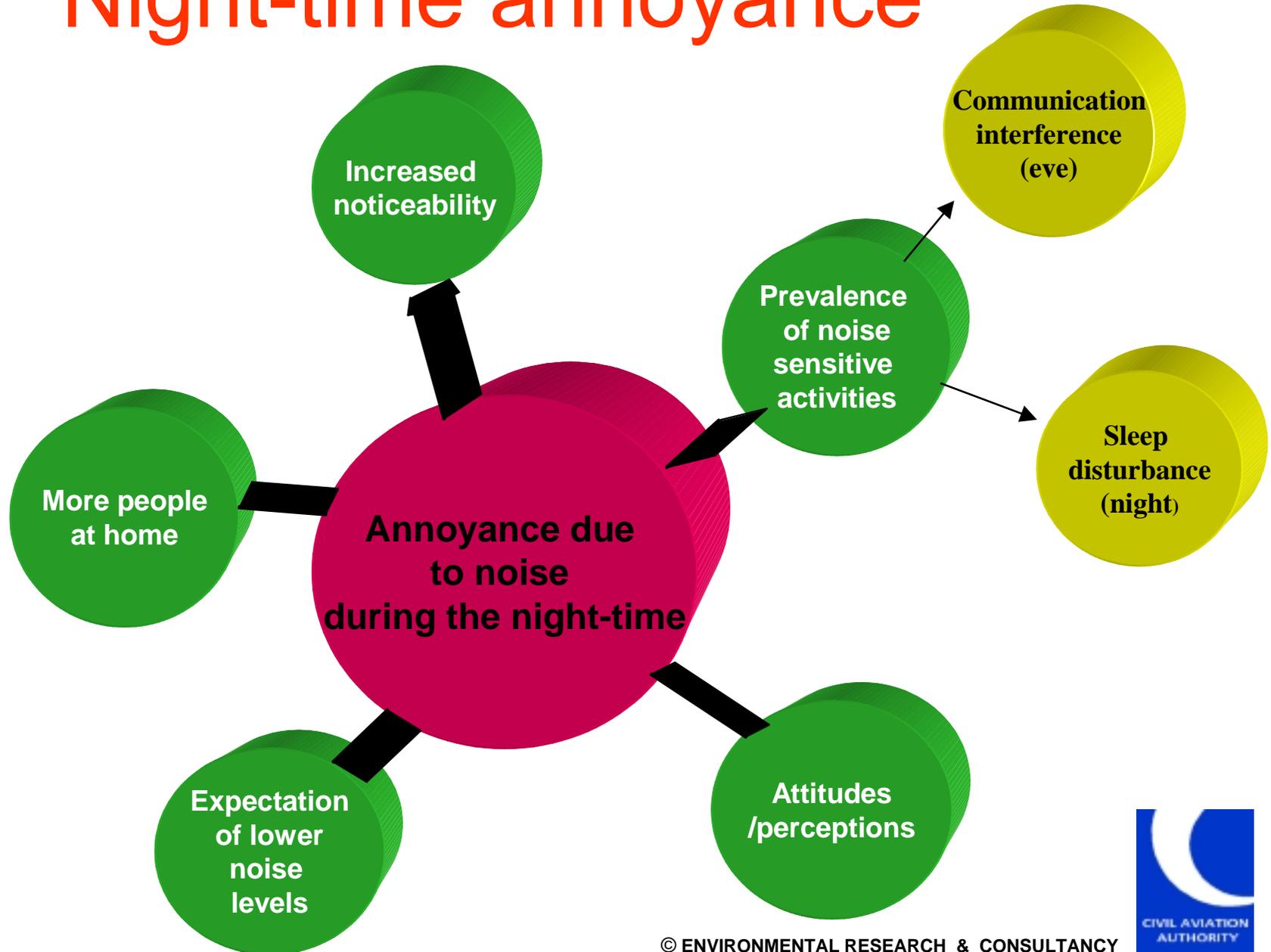


Comparison of UK 1992 Findings

- **More recent studies broadly convey same message: that, in the home, awakenings are infrequent and only weakly correlated with noise**
- **Various guidelines are in broad agreement with the observations: sufficiently conservative to ensure little or no noise-induced awakenings**

**Sleep disturbance is only
part of the story,
what about perceived effects
e.g. annoyance ?**

Night-time annoyance



Is the impact of night-time noise well understood?

Perceived impact of night-noise is **GREATER** than research suggests based on sleep disturbance work which shows that it is only a **weak** effect

NO: there are gaps in knowledge

Future research directions

- **Long term: can night-time aircraft noise lead to clinically significant health impairment (directly or indirectly)?**
- **Need to disentangle intermediate relationships**

Research Options considered by advisory groups



A - to 'extend' the 1992 FS to the shoulder hours

B - to compare sleep patterns in 'high noise' and 'low noise' communities

Research Options considered by advisory groups



C - to study sleep disturbance among noise sensitive people

D - to survey opinion of airport neighbours

Recent UK DETR activities

- Trial measurement study



- Public attitude survey



Trial methodology study

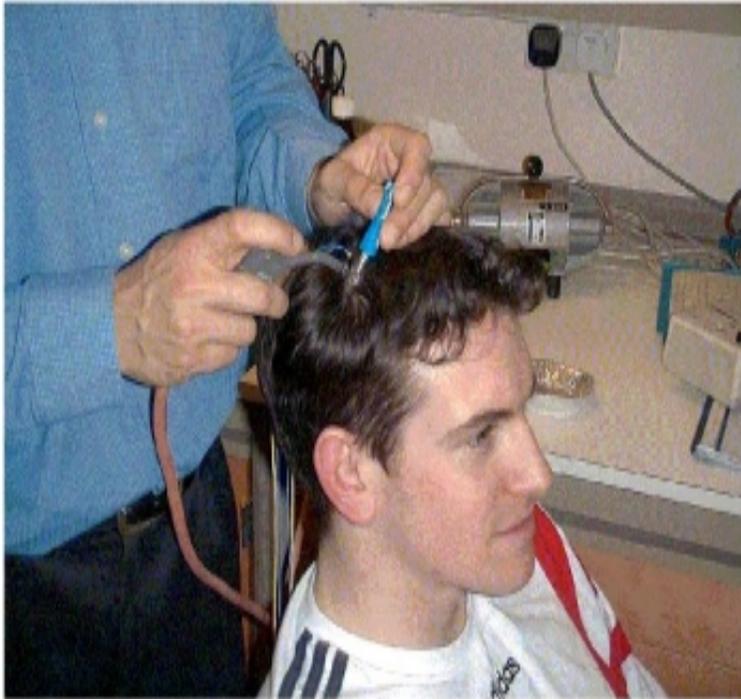


Objective of the work

To evaluate the research options A-C and to recommend the best way to proceed for any future full scale study of sleep disturbance and other effects of night-time aircraft noise.

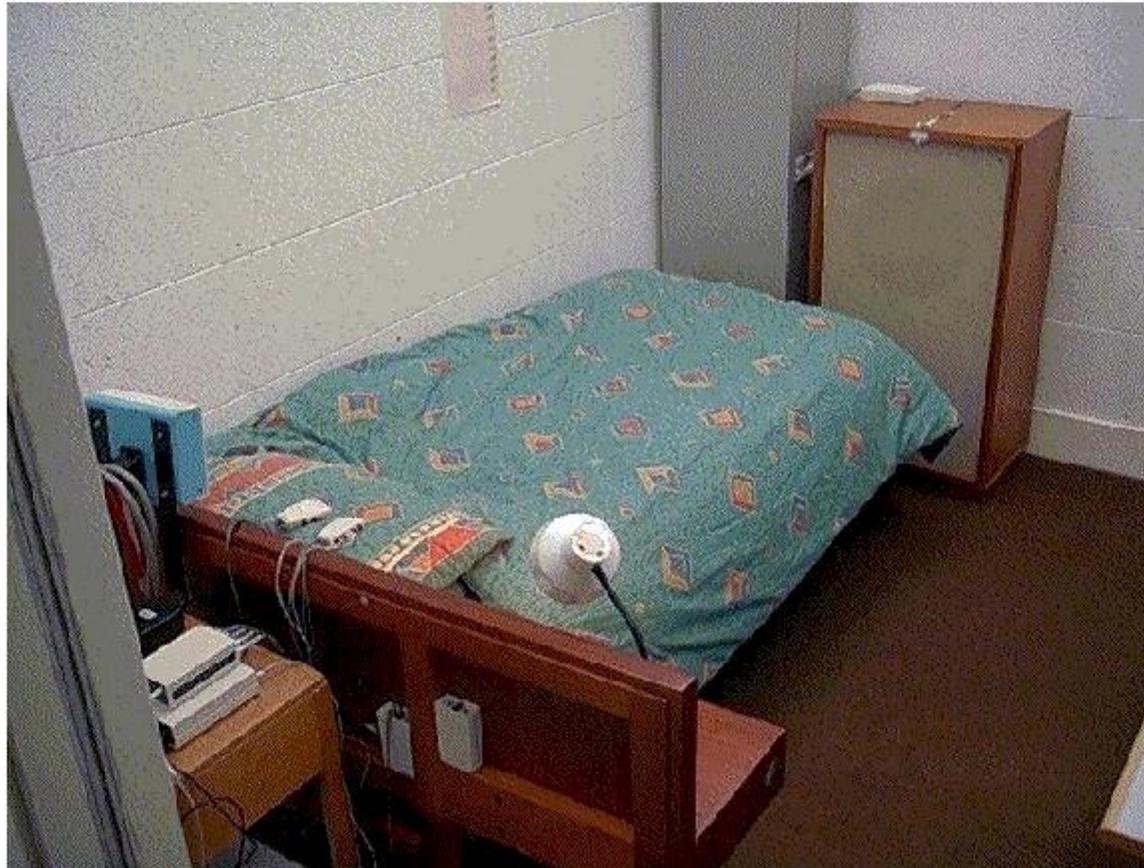
Measurements

Electrode application



- EEG
- Actigraphy
- Next day performance (Psions)
- MSLT tests

Laboratory study



Main findings and recommendations

- **In field work**: differences in number of awakenings, duration of stage 1 sleep, REM sleep; importance not yet clarified.
- **In lab work**: no difference in next day effects, reduced latencies, awareness whilst asleep; importance not yet clarified
- **Recommendations**: A-C all possible, should understand precise mechanisms before conducting a large scale study

A public attitude survey: perception of night-time aircraft noise

Primary objective:

to explore public perceptions of the effects of aircraft noise at night.

Secondary objective:

to inform a decision on whether more direct measurement of sleep disturbance should be pursued in order to guide policies with regard to night-time aircraft noise, and if so, which other factors should be taken into account and how.

Structure of questionnaires

Socio-demographic information

Home and community

Health and lifestyle

General wellbeing

Sleep

Perceived effects of noise

Attitudes to noise

Attitudes to aircraft noise



Main findings and recommendations

- **20-30% highly disturbed by noise in high noise areas**
- **20-30% report difficulties in going to sleep in high noise areas**
- **Over 60% perceive health to be affected**
- **Longitudinal studies recommended for establish causality**

So, where are we?

- problem of night-time noise is complex
- sleep disturbance and prevention is only part of the story
- awakenings from sleep is only part of that story
- past research is robust but provides incomplete story
- balance required between perceived disturbance and actual disturbance
- still a long way to go to answer long term question of whether night-time aircraft noise can lead to health impairment

Adverse Effects of Aircraft Noise

- By day - principally annoyance
- By night, a range of views, two extremes:
 - Physiological
 - Psychological

Night -time **physiological** effects

(most frequently researched)

People wake up because of aircraft noise?



Loss of sleep?



Next day effects?



Loss of performance or illness?

Night Noise: How Much Do We Know About **Physiological** Effects?

- Evidence WEAK
- Aircraft noise is a minor cause of sleep disturbance
- Little knowledge of links between actual and perceived disturbance
- Likelihood of useful new results or aids to policy very low

Night-time psychological effects

People suffer sleep disturbance for many reasons



Aircraft noise cited as cause because of its presence



Annoyance

Night Noise: How Much Do We Know About Psychological Effects?

- Evidence STRONG
- In highest aircraft exposure noise areas:
 - 20-30% report highly disturbed
 - 30-60% perceive health is affected
- Annoyance greater where traffic has recently increased

What Does the Public Think About Current Aircraft Noise Policy and Its Research?

- **Leq(16-hr) assessments are inadequate/insufficient**
- **Aircraft noise affects sleep and health**
- **Government are not tackling real issues (e.g. Early morning arrivals at Heathrow)**
- **Research results are biased and counterintuitive**
- **Economics gets 'vote' in policymaking rather than community's environmental concerns**
- **Attitudes have changed in last two decades – more up to date social survey work is required**

Policy/regulatory needs?

Methods for quantifying noise exposure that

- **Provide a sound and defensible basis for noise mitigation policies**
- **Can potentially be used to set limits on aircraft operations at different times of the day and night**
- **Are acceptable to both industry and the public**
- **Maintain continuity from past policy and compatibility with international guidance**

What Should New Research Do?

- **Have a practical application focus based on scientifically robust research**
- **Focus on the stronger link - the psychological one - to target key issues of concern to affected populations**
- **Establish relationships between index and public noise perceptions - annoyance and acceptability**
- **Involve public**

And should make sure that it adds value by:

- Meeting the need to address public views
- Considering changes in public attitudes after 2 decades
- Not duplicating well-understood research
- Focusing on policy value
- Minimising costs by eliminating physiological aspects of weak value