Appendix C - Comments

Appendix C - Comments

Sleep Comments

Jim Fields

Sleep disturbance steering group:

This message contains two parts.

First: I had some thoughts about the sleep disturbance outline after our Ottawa meeting. I don't seem to have a MS Word file for pasting in my thoughts, so here goes with a richtext file that has my comments in MS Word.

Second: I probably have some misconceptions and incorrect assumptions. To try to root these out I have tacked on a section at the end labeled: "JIM FIELDS' QUESTIONS AND ASSUMPTIONS (reality check needed)". I would appreciate any comments on this section so that I might correct any erroneous assumptions.

Hope this is helpful.

Jim Fields

COMMENTS ON OUTLINE AND QUESTIONS FROM THE WORKSHOP

1. Is it possible to design a new research project that will provide significant information in the short-term to markedly strengthen FAA's review and reformulation of policy regarding night-time flights?

Yes: I think it should start with an examination of previous work before planning a new study. I would suggest that the focus should be on issues such as:

- Determining what single-event and nighttime noise metrics are best able to predict each measure of sleep disturbance.
- Determining the best predictions for total number of sleep disturbances as measured by:
    - Morning-after surveys (recalled periods of not being able to get to sleep, not getting back to sleep, and being awakened)
    - Motility
    - Signaled awakening
    - ECG
- Summarizing the best available knowledge about the relationship between polysomnographic EEG awakenings and each of the above. Such an evaluation may be needed before deciding what combination of methods should be used in any new study.
- Determining the extent to which sleep disturbance occurs within and outside of night-time periods of different lengths with different beginning and ending times.

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2. **If there should be a new study for short-term research, how should it be designed. Specifically, is there a preferred measure of sleep disturbance - behavioral awakenings, motility, etc. - what are the strengths and weaknesses of these various measures and do some address the differences between**

"spontaneous" and "aircraft noise induced" awakenings better than others?

It seems to me that all four of the above methods are flawed, but all are useful. There appears to be a hierarchy of cost and difficulty which is inversely related to study sample size and also the representativeness of the sample.
By comparing aircraft noise nights and other nights, wouldn't it be possible to adjust for spontaneous awakenings for any method except the "morning after" surveys.

3. Should a new study incorporate vulnerable groups (children, diseased, elderly, shift workers) and if so, how?
How can vulnerable subgroups be investigated, and does the expected small size of these subgroups make meaningful research in any reasonable time frame infeasible?

I am less concerned with deriving separate estimates for these groups, than with being certain that we have not biased our estimates of effects by excluding such groups in past studies. Morning-after surveys and motility measurements might provide this evidence.

4. Should there be an epidemiologic study on the effects of (nocturnal) aircraft noise?

It seems to me that the FAA cannot justify devoting resources to the design of health effect surveys. The basic sleep science knowledge is not sufficient to determine the health effects of lack of sleep, let alone the small contribution that noise is likely to make to diminished sleep. With the exceeding weak relationships between noise and health that have been discussed thus far, it seems to be unrealistic to expect that any such research will provide evidence of sufficient specificity to guide FAA decisions. About all that would seem to be justified would be to offer to provide small amounts of money and technical consultative support to other sleep studies if they would include aircraft noise as a source of disturbance.

TYPES OF METRICS
5. For data collection and analysis, what is the most appropriate descriptor of an aircraft noise event – is either SEL or Lmax sufficient, or should additional variables such as event time history or frequency content be investigated?

It seems to me that this question has not been answered and that the primary task for the FAA is to determine the relative value of different descriptors to explain the alternative measures of sleep disturbance. The effects of rise-time and other characteristics of the events should be studied as well as the effects that are associated with the location of an event within the sleep period and the effects that may derive from interdependencies between different awakenings.

As for suitability for public understanding, this should be considered only after the relative value of different metrics is know. Efforts should be made to develop, test, and refine methods for explaining the best metric rather than immediately assuming that we can pre-judge whether or not the public can understand a method.

6. How should sleep disturbance results be extended to an entire night, to

populations, to sub-populations?

Perhaps I am naïve, but it seems to me that sleep disturbance results would be extended to a whole night by studying the total number of aircraft noise-induced awakenings within the context of the whole night's awakenings. It seems like most analyses (at least those that I am aware of) have only analyzed noise induced awakenings as a function of the immediately preceding noise and the time of night. I wonder if analyses could explore more complex dependencies, such as the effect of previous awakenings (noise or non-noise) on the probability of another noise-induced awakening.

As noted above, my concern is less with sensitive subpopulations, than with being confident that we can produce good estimates for the population as a whole and not for only some smaller group that is typically recruited for standard sleep studies. One approach to this is to examine data from surveys that have weaker sleep disturbance measures (for example, motility) but have studied representative population groups.

7. What metric(s) are most suited to regulation? (Lnight,% "impacted") and why?

As noted above, I think we should first determine the extent to which different metrics provide accurate predictors of sleep disturbance and then be concerned about regulation. However, it seems to me that one important side issue that should be explored is the implications of different criteria for aircraft noise management. A sensitivity analysis could determine whether different metrics would lead to different operational changes around airports, while recognizing the non-noise constraints on airport operations.

SETTING CRITERIA

8. Exposure-response relationships are usually "s-shaped" continuous functions, and not "all-or-nothing" relationships. In this situation, what is the best way to select scientifically based limit values or goals for mitigation measures?

While this causes great '*angst*' among regulators, I don't see that there is much prospect that scientific research will be able to help on this. Unless there was an enormous sound insulation program and the population rigorously kept their windows closed, I would suspect that there will be a rather gradual continuous relationship between outdoors aircraft noise (the only level that can be modified in the absence of insulation) and awakenings. Even if there were a sharp threshold for one indicator, the ambiguities about the various sleep disturbance definitions and health implications would seem to me to mean that keep regulators would still not have a definite scientifically-defined threshold.

JIM FIELDS' QUESTIONS AND ASSUMPTIONS (reality check needed)

Here are some questions that are relevant to my own conclusions:

1. Am I right that the primary sleep disturbance indicators are:
    a. Morning-after surveys
    b. Actimetry
    c. Signaled awakening (button pushing)
    d. ECG (Are "cardiac activations" measures of changes in heart rate or are other physiological characteristics also measured and important?)
    e. polysomnographic EEG awakenings
    f. polysomnographic sleep stage changes
2. Can we reach some agreement among ourselves on the labels and definitions that we will use for the above sleep disturbance measures? (It would help our discussion.)
3. Have sufficient data been analyzed to estimate the relationship between the number of awakenings for each of the above indicators and the 'gold standard', polysomnographic EEG awakenings?
4. Have important data been gathered, but perhaps not fully analyzed, that might help to understand the relationship between each of the above indicators and the 'gold standard', polysomnographic EEG awakenings? I am mainly aware of the Ollerhead study. Are there other important data sets?
5. Which sleep disturbance indicators, if any, measure how many minutes subjects are awake each night? (That is, the above indicators define awakenings, but I am not clear on whether they can determine when a person goes to sleep again.) This seems like an important indicator of sleep quality but I am not aware that it is measured.
6. Are there variations between studies within each of the major sleep disturbance study methods listed above that may be the cause of major differences in estimates of awakenings? If so, do we have a clear understanding of what the best procedures would be for each of the types of sleep disturbance study approaches
7. What proportion of the general population falls in a subpopulation that would be 1) eligible or 2) likely to participate in each of the different types of sleep studies? I have the impression that a large proportion of the population (primarily the most sensitive portion) would be excluded if we considered all the preconditions for participation in EEG studies and, perhaps, even signaled awakening studies.
8. Is there good evidence about the extent to which the various measurements methods themselves distort sleep patterns and thus lead to biased estimates of either noise-induced sleep disturbance or sleep disturbance in the absence of noise? If not, would some type of study that gradually introduced more intrusive measurement methods provide insight?
9. Are there models of noise-induced sleep disturbance that take into account the sleep patterns for the part of the night that precedes the noise event?
10. Are there models of noise-induced sleep disturbance that take into account the pattern of noise events during the entire night and the possible dependencies between awakenings to predict the total number of awakenings during the night? (This is in addition to a simple subtraction of the expected number of spontaneous awakenings.)
11. Is there information about whether different sleep disturbance indicators would support the same or different noise metrics?
12. If sleep disturbance were monitored with some metric, is there research evidence to support a nighttime weighting for any other type of impact at night?
13. Is there enough unexplained variation in sleep disturbance that representative samples of the population are needed for making estimates that could be used for policy purposes?

14. Is the clear evidence about which of the following sleep quality characteristics would be most likely to be related to health effects or to subjective evaluations of sleep quality: average number of awakenings per night (i.e. the sum of awakenings over many nights), being awakened at least once during a night, or the total amount of time awake?

Here is my tentative summary (subject to revision):

A few main problems that the FAA might be able to resolve are:

- What noise metric provides good unbiased estimates of the relative impact of different operations and the resulting noise environments on the population around airports?
- What proportion of the population experiences sleep disturbance according to each of the sleep disturbance indicators at specified values of the best noise metrics?
- Are the best indicators of sleep disturbance unbiased by:
    - Biased selections of the parts of the population that are studied
    - The impact of the study method on the quality of the subject's sleep

Problems that I do not think research can be expected to resolve for the FAA are:

- What are the health effects associated with FAA decisions about alternative airport operation scenarios?
- What are the noise levels at which regulations should be set? (This seems like a cost-benefit analysis.)

Appendix C - Comments

Annoyance Comments

Jim Fields

Comments on "Key Questions for Designing Research Roadmap":
Comments relating to the Post-Internoise-2009, August 27, FAA Forum in Ottawa
(Prepared by Jim Fields, September 18, 2009)

INTRODUCTION

The follow section reproduces the "Key Questions for Designing Research Roadmap" (highlighted in yellow) and provides comments on each of the questions.

KEY QUESTIONS FOR DESIGNING RESEARCH ROADMAP

1:15 ANNOYANCE QUESTIONS
ANNOYANCE

POLICY RELATED RESEARCH
If the current basis for establishing impact (percent population highly annoyed or %HA vs. DNL) needs updating, what issues need to be researched?

Currently, 65 dB DNL
sets the significant impact and land use compatibility threshold, which has been assumed to limit the number of people highly annoyed.

Even though the percentage of people annoyed outside DNL 65 is lower, so many more people live outside DNL 65 that the most significant impact is outside DNL 65. As a result, limiting the number people annoyed, even for a high level of annoyance, means that steps must be taken outside DNL 65.

1. Assuming %HA vs DNL is an important measure of noise impact, what types of research would:
Reduce the scatter of annoyance versus DNL?

The issue of scatter is best divided into two types of scatter: scatter in individual reactions within communities and scatter in the average reactions between communities. The individual scatter is largely irrelevant because we know and expect that individuals give different answers to questions that have qualitative judgments at different times and that different people, even within the same family, react differently to the same noise exposure. The key question is whether there are differences between communities or other situations which could be legitimately used as a basis for FAA regulations. Research should be directed at any variables that the FAA could incorporate into regulations, if the issue has not been thoroughly studied before. I give my suggestions for future research in the second section of this document.

Update the relationship of annoyance to DNL - e.g., to account for changing conditions such as increased sensitivity to noise

"Updating the relationship" and thus obtaining a good measure of the current DNL/response relationship cannot be achieved by conducting a single survey around a small number of airports. The reason is that past surveys conducted at about the same time period have provided different relationships. The Schultz curve is just the average of some of those previous disparate surveys. Since the previous surveys had such different annoyance and acoustical measures, we do not know whether the differences in reactions were due to differences in methods or to genuine differences in reactions. If the FAA only conducts one limited survey now, we have no way of knowing whether this single new survey would measure a change in reactions or a change in methods or survey conditions. If a new survey were conducted around in only a small number of airports and study areas, the "update" might be a function of the particular airports chosen.

Due to the methodological difficulties considerable care would be needed to decide how to determine whether there has been a genuine change in sensitivity to noise or whether any differences are an artifact of the noise or social survey measurement techniques or of having studied different populations at different times. For example, almost all older surveys used interviewer-administered questionnaires, but recent surveys have been more likely to use self-administered questionnaires without random selection of households or respondents within households. Some research in the Netherlands has indicated that these self-administered, questionnaires yield higher estimates of annoyance than do interviewer-administered questionnaires. To determine whether the population is becoming generally more sensitive, a secondary analysis could be conducted of surveys that were conducted around the same airport at different times with the same methodology.

Possible strategies for determining whether updates are needed include:

1) making carefully controlled comparisons between the DNL/response relationships at two or more points of time around the same airport following the same methodolgies. (Some data sets are available that would permit such analyses with existing data around some airports.)
2) determining whether the factors that have changed (for example increased numbers of aircraft) are sufficiently large to not be accurately predicted by DNL. For example, the numbers of aircraft at airports has generally increased, however, previous studies examined neighborhoods with numbers of flyovers that were much higher than the average at the time of those studies and may in fact be as high or almost as high as the numbers experienced in the most heavily impacted neighborhoods around current airports.

or increasing numbers of quieter operations (does "equal energy" apply),

Although there may be increasing total numbers of operations at airports, it is the number of operations for individual residents that is important. At least two steps should be taken before assuming that this requires major new research:

- Determine the numbers of operations that are currently experienced in individual neighborhoods and then examine past studies to determine whether high number areas in those studies included most current conditions.
- Compare the ratio of current to previous numbers for those studies and, in light of the equal energy principle consider whether the ratios are so high that it is reasonable to expect differences in reactions based solely on numbers. My own expectation is that if the equal energy principle is incorrect, it is probably for very small numbers of operations not for very large numbers of operations.

to focus solely on aircraft noise?

If the "focus solely on aircraft noise" phrase means that reactions to different noise sources are different, then a large amount of data are already available and have been analyzed, at least for Western countries. There are more than 20 years of research that show that reactions to aircraft noise are more severe than those to road traffic or railways. However, some care is needed in using this information in light of the fact that Japanese surveys do not find the same pattern for railways in Japan. This suggests that the differences in reactions may be at least partly cultural rather than acoustical in character.

Identify alternative or additional metrics to DNL that correlate with %HA?

Because debate about the value of equivalent energy indices continues, it would be useful to reanalyze existing data to determine whether there is evidence that rejects the equal energy principle. It must be noted, however, that such reanalyses would only be useful if they included large numbers of studies that include variations in the variables of interest and values of those variables that are not highly correlated. Conducting a new study of alternative metrics would be of almost no value unless sufficient numbers of study areas can be studied so that findings about differences between metrics would not be confounded with random differences between study areas.

It seems to me that it is very unlikely that new studies will provide an improved metric unless the purpose is to study strikingly different types of aircraft noise (for example, low altitude helicopters in comparison to distant jet aircraft). Within very broad groups of aircraft types, it is likely that new metrics will have no important effect on our ability to predict annoyance within communities.

The scatter we now have means that the response curve is an average with little or no predictive ability.

My points on "scatter" above may help to provide a more useful way to think about the scatter in reactions. Annoyance is a subjective feeling and, like all attitudes that are studied in social science, differs greatly for individuals who are exposed to nominally identical circumstances. The assertion of "little or no predictive ability" is fundamentally incorrect when applied to estimates of overall impact using variables that can be used in public policy. All community noise studies find that, on the average, a reduction in noise level leads to a reduction in reactions and that negative reactions are quite low as noise levels become very low.

Reducing the scatter could help us better understand the concept of "impact."

I am not clear about what the above statement means.

Also, there
are some indications that populations have become more sensitive to (more annoyed with) aircraft noise at a given level (in terms of equivalent level), and one hypothesis is that this increase results from having more operations despite having quieter aircraft.

This was discussed in some detail above. Another hypothesis for continued annoyance and community action in the face of reduced noise levels is that, as explained above, the very large population at lower noise levels with small percentages of people being impacted still translate in to very large numbers of impacted individuals. The assumption that DNL65 was an adequate limit for defining impact was based on the percentage of people impacted not the number of people impacted.

2. Assuming impact should be based on more than annoyance, what further research is required, if any, to develop defensible relationships between aircraft noise and such effects as:

Sleep disturbance (was discussed this morning)

Daytime annoyance (or other times of day)

It is not obvious that the impact on annoyance should be different at different times of day. Residents are likely to be especially annoyed if they are kept awake at night, but they are unconscious most of the night and are more likely to be in a shielded indoors environment and are thus may be less likely to hear nighttime than daytime events. Residents are more likely to be at home in the evening, but are more likely to be indoors. It seems very unlikely that a survey can accurately estimate time-of-day weightings because the levels at different times of day are highly correlated. There may be some value in repeating earlier attempts to estimate time-of-day weightings from an analysis of community survey data. Since this was last performed in the 1980's new analysis techniques have become widely used,

Induced house vibrations and audible rattle

Feelings about vibration and rattle are related to annoyance. Assuming that home construction and the placement of furnishings cannot be controlled in existing residences, it would seem that the main implication would be that a new metric would need to give greater emphasis to frequencies and characteristics of sounds that would be more likely to induce vibration. Since such change in a metric might not correlate as well with other reactions, it would seem that any testing should be directed at testing alternative metrics in surveys or in settings that would as fully as possible reflect the range of activities encountered in normal living conditions. I am not clear about just how this would be done. It would seem that this topic would only be of great importance to the FAA if an index is needed that accurately represents aircraft noise environments that differ greatly in the characteristics that induce vibration or cause rattles.

Interference with learning

Speech interference indoors and outdoors
Etc.

Studies of aircraft noise annoyance have wrestled with this problem since the very first aircraft noise reaction surveys in the 1950's. The early surveys asked for separate reactions to different types of activity interference such as sleep, concentration, and various types of speech interference (television, telephone, speaking indoors/outdoors, etc). They also asked separate questions about vibration. The response indices formed using these items did not provide a generally more precise DNL/reaction relationship than the simple, overall annoyance indices. In addition, the respondents' self reports of such interference levels are averaged over such a complex mix of conditions that they are probably no more objective than are their reports of annoyance.

3. Assuming impact should be based on more than annoyance, what studies can be done to combine, relate or prioritize multiple effects in a way to inform a policy that needs to be implemented across the wide variety of airports in the country?

It is important to distinguish between impacts in residential areas and impacts in more specialized, goal-directed settings such as schools. In goal-directed settings, it is possible to allow information about the goals in the contexts to identify the effects that are of importance.

It is not clear that measures other than annoyance can make an important contribution in residential environments in which the goal is diffuse (to live in a pleasant setting) and the method for combining different effects is determined by multiple, complex different objective conditions and subjective, personalized values, life styles and conditions. For example, speech interference can be objectively described under specified conditions such as distance, level of speaker's voice, attentiveness of listener, and familiarity with the message. However, in the course of a year, a resident experiences an enormous variety of such communication conditions. In addition, evidence is not available about the relative importance of different situations (for example: speech interference out-doors at twenty feet and clearly hearing the television from an adjacent room indoors) and how the relative importance would vary between individuals. The uncertainties of weighting these complex, varied exposure conditions and residents' varying values largely explain why researchers use the residents' own summary judgments of annoyance to asses noise impact in residential areas.

4. What research can identify whether impact from steady-state or gradual change in exposure can be assessed in the same manner as impact caused by a step change; if not how should it be done?

Research could provide answers if step-change situations could be identified in advance and if reactions could be tracked from before the change until several years after the change. I prepared a NASA report on the requirements for this type of survey that still appears to be relevant. Lex Brown reports that an answer has been found on the topic, at least for road traffic. It would be useful to evaluate that report to see if the findings are sufficiently strong to provide a

basis for policy. In the past, it is been very difficult to locate aircraft noise areas with substantial, long-term step changes in noise exposure.

5. What research can inform the process of setting thresholds of impact?

Any research on dose/response relationships is useful by detailing the impacts at different noise levels. However, the research shows that over moderate or high levels of exposure there are no sharp thresholds of reactions upon which regulations could be based.

PUBLIC COMMUNICATION RESEARCH

This category relates primarily to proposed projects that will result in changes in aircraft noise and should be considered unrelated to the above policy issues. Communities / individuals can react very negatively after changes in aircraft noise occur. There is a general perception and considerable experience that providing better, clearer information to the public and to aviation stakeholders in general about aircraft noise and the expected changes can reduce the negative reactions and / or increase acceptance of the changes.

I would suggest that it would be very useful if we clearly distinguish between two concepts that are often confused because they both come under the label of "community response". These two concepts are:

1) Personal impact (annoyance, speech interference, other interruptions, etc.)
2) Public action (individual complaints, legal action, community organization, political action, etc).

If the steering committee could decided on a single term for each and no longer use the term "community response" there might be more useful, clearer discussions about future research and aircraft noise impacts.

6. What research can identify the types of information that should be provided, the forums / presentation formats, and the extent and timing of outreach that are most effective?

This seems to me to be a very promising area of research. It would be very useful to consider all the issues that are involved and then determine how each issue might be addressed. For at least some issues, for example explaining the equal energy principle, the best approach may not be field research, but rather basic laboratory research with communication experts who develop and test alternative methods for presenting the basic principles.

PUBLIC REACTION RESEARCH

From the perspectives of an airport that wishes to be a good neighbor and still respond to the needs of increased operations, of the FAA that needs to increase national airspace system efficiency and ensure the ability of the air transport system to grow to respond to increasing demand, and of the elected official whose limited resources can be consumed trying to mediate between irate citizens and an airport or the FAA, it would be valuable to know before changes in aircraft noise occur, where strong community reactions are

likely to occur and if so, whether and how they can be minimized or avoided.

A major question is whether a program like this will direct government and community action away from dealing with a legitimate problem that impacts many residents while instead manipulating communities so that the individual residents' problems are ignored. On the other hand, research that would examine the relationship between personal impact and public action, could lead to a better understanding of when public actions from an area are indicators for serious impacts on a population or, alternatively, only indicate that the particular community has been more effective in obtaining government attention than other similarly impacted communities.

7. **What research will identify which acoustic and non-acoustic factors are correlated with negative community reactions such as complaints, legal action, and involvement of politicians that can occur after noise changes from airport actions or airspace redesign?**

Research could uniformly collect information about all of these variables for all large airports in the United States and for a stratified random sample of smaller airports. This research would obtain community-level information from officials, knowledgeable informants, and documents.

The statement refers to public actions after changes. The greatest amount of public action may be during the planning period, not after a change.

Please submit to us your comments and/or responses in writing (ahead of or at the end of the meeting).
FAA Background, Objective and Timeline
Key Annoyance Research Questions
Do they capture the most important issues? If not, what other questions need to be posed?
How would you answer them?
Prioritization of Key Research Questions - Annoyance
Which research would yield the greatest payoff?
In which areas are we most likely to make substantive progress: in the near term (within 2 years) and in the next 5 years?
Ongoing or Near-Term Planned Related Research; Opportunities to Collaborate
What related research is already ongoing or planned in the near term? (Please provide project title, principal investigator, sponsor, and any descriptive information or links.)
Are there opportunities to collaborate – in terms of study design, sharing data, testing analytical approaches, etc?
Whom should we contact for further discussion?
Study Costs and Duration
How much would it cost and how long would it take to conduct the high priority research items?

Appendix C - Comments

Annoyance Comments

Vic Sparrow

Attachment 5
Annoyance Research Comments

Please submit to us your comments and/or responses in writing (ahead of or at the end of the meeting).

FAA Background, Objective and Timeline

__*All very reasonable._Raquel Girvin has done a good job with this.*_____
_____

_____

_____

Key Annoyance Research Questions

- Do they capture the most important issues? If not, what other questions need to be posed?

_____

___Yes, most of the important points. However, as I mentioned at the forum, I suspect that a good bit of the uncertainty in our current knowledge of annoyance to subsonic aircraft noise is related to our limited understanding of *low frequency noise* and how it affects people. There is tremendous variability in home construction, and we have very little data taken for indoor to outdoor transmission below 50 Hz, where people seem to react strongly._____
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- How would you answer them?

___Regarding low frequency noise, I think it would be helpful to do a few things. 1. There should be an in-home study conducted to see how people react to low-frequency noise specifically. This could be conducted in parallel with laboratory type studies of low frequency noise annoyance, at NASA Langley or elsewhere. In addition there needs to be continued study on the artificial generation of low frequency noise, and study on how low frequency noise transmits from outdoors to indoors. PARTNER is looking at this artificial generation of low frequency noise and its transmission, and that should continue. However, nothing has been started regarding the in-home or lab studies of low frequency noise and its resulting annoyance._____
_____

_____

Prioritization of Key Research Questions - Annoyance

Which research would yield the greatest payoff?
In which areas are we most likely to make substantive progress: in the near term (within 2 years) and in the next 5 years?

_I suggest at least one study should be conducted addressing low-frequency noise annoyance in homes. This would be a 2 year effort, with at least a 2 year lead time to set it up.____Another idea would be to make a good set of measurements of low frequency transmission from outdoors to indoors for different types of home construction. Such a study requires specialized low frequency microphones and instrumentation, and this hasn't already been done, surprisingly.

Ongoing or Near-Term Planned Related Research; Opportunities to Collaborate

What related research is already ongoing or planned in the near term? (Please provide project title, principal investigator, sponsor, and any descriptive information or links.)
Are there opportunities to collaborate – in terms of study design, sharing data, testing analytical approaches, etc?
Whom should we contact for further discussion?

_PARTNER work related to low frequency noise transmission should be continued. One idea for collaboration would be to use the data the sleep disturbance people have taken over the years to assess outdoor to indoor transmission. This is usually approximated by the noise annoyance community and not measured. The sleep disturbance researchers have measured this, and those datasets could be helpful for annoyance prediction. It is doubtful, however that the sleep disturbance folks measured the sound down to the low frequencies that would REALLY be helpful.___

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Study Costs and Duration

How much would it cost and how long would it take to conduct the high priority research items?

_____

___Good question. Since this low frequency noise annoyance study would involves interviews and working with people in their homes, this is not an inexpensive new project._____ _____

___I would be happy to comment more or answer questions about this idea. An in home study looking at low frequency noise is for someone else to work on …. Definitely not me. Thanks, Vic Sparrow, vws1@psu.edu

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Appendix C - Comments

Annoyance Comments

Ken Hume

From Ken Hume,

Following reflection on the Ottawa meeting/forum the one issue that I am not sure was made strongly enough is that I think that the research work road-map should include some aim to investigate the links/relationship between annoyance and complaints. This may need to involve a systematic adoption of a prescribed method by which complaints are collected, coded, analysed and reported - this may involve development of complaint metrics, in order to improve the validity, transferability and usefulness of the data.

Appendix C - Comments

Comments

Pieter Stallen

Pieter wanted us to have these comments that he submitted recently to a somewhat similar effort (UK Draft).

'ENVIRONMENTAL NOISE AND HEALTH IN THE UK' - DRAFT REPORT [1]

Comments by Pieter Jan M. Stallen [2]
Professor Community Noise Annoyance
Leiden University, The Netherlands

It is a generally clear review of scientific findings. My comments concern inaccuracies and incompleteness on two subjects: causation and effect of noise annoyance. Results from scientific studies presented in journals and conference proceedings that have been consulted by the authors of the draft report justify a more advanced and different description of causes and effects than presented in the draft report, however much I agree that much is still unknown or unresolved. Particularly as it concerns the assessment of *social* scientific progress I belief that the report might benefit from a more explicitly differential assessment of theory-based and exploratory studies.

****

ON CAUSES.

In the Executive Summary it is stated as Observation 7 that the typical scatter in the measurement of noise annoyance, labeled as "probably the most widespread adverse effect of noise", is due to "variations in individual sensitivity to noise and/or susceptibility to annoyance. These variations are not well understood (…)"(p. 1-2).

Comment 1.

A. The concept 'susceptibility to annoyance' is not common in the literature on non-acoustical determinants of environmental noise annoyance. I have seen it referred to only by Van Kamp *et al.* (2004) as "susceptibility to annoyance, not necessarily by noise" and, therefore, as "general sensitivity" (p. 3472), with no further attention paid to it in their study. I also do not know of any significant number of later environmental noise studies where the trait has been measured or reported to be an important cause of noise annoyance. Indirectly, the draft report itself testifies to this theoretical and empirical scarcity by nowhere explaining the term 'susceptibility', and by using it only one second time and in a different context.[3]

B. Social scientific findings on non-acoustical factors other than noise sensitivity have been reviewed by various authors several times, with the first extensive review by Fields (1993).[4] They have been referred to succinctly as "attitudes towards the noise source" by Van Kamp *et al.* (2004, p.3472). To my knowledge, the most recent overview of non-acoustic determinants of environmental (aircraft) noise annoyance was presented by Maris *et al.* (2007ab).

→ **I suggest to stay clearer and closer to the (sets of) variables that have been identified in the social scientific literature on environmental noise annoyance, such as sensitivity** [which you did identify] **and attitudes towards exposure.** Repeatedly mentioned examples of negative affect associated with exposure (generally leading to increased noise annoyance) are: fear, distrust.

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[1] Draft as available 07/22/09 at http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1246433634856

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[3] At the end of the report it is recommended to do "further research on the susceptibility of population groups to health effects of environmental noise" (p.84). By the way, should this 'groups' be taken seriously, that is, does it mean something different from some aggregate of 'individuals'? If so, it would help the reader to know which particular groups the authors are assigning priority here.

[4] In 1999 a special issue ' non acoustical factors of environmental noise' of the scientific journal *Noise & Health* was edited by Flindell and Stallen.

Comment 2.
Evidently, each of the above identified non acoustical variables has its own history. For example, distrust, in turn, may (in part) have originated from being (purposefully or not) misled by inappropriate information. When discussing possible causes and effects it is generally helpful to distinguish between first and second order explanatory variables. If this distinction would be adopted in clarifying the various causal paths of noise annoyance, then I think that the message which observation 7 intends to convey is

- there have been identified first-order variables other than dose-variables which help to explain the scatter in the relationship 'annoyance ⇔ dose';
- this scatter can be reduced more and/or more effectively to the extent that first-order acoustical and first-order non-acoustical factors are addressed at the same time.

I do not think that it is the intention of observation 7 to emphasize that we must know better how second-order variables lead to differences in the major first-order non acoustical determinants of noise annoyance: sensitivity and attitudes towards exposure. Also the conclusion 8.8. (p.81) suggests that the better understanding of first-order determinants is the primary interest of the report. Indeed, detailed knowledge about second-order processes are not a prerequisite for effective action regarding first-order relationships.[5] I also do not think that it is the intention of observation 7 to state that we do not know much about what are the major factors causing the scatter in the dose-response (=annoyance) displays. This would be in contradiction with the last but one sentence where the very message was that there already exists "important" knowledge about the scatter: it is "*due to* variations in individual sensitivity (…)[emphasis mine]".

→ **In order to convey a consistent and scientifically clear message, I suggest to drop the final sentence of observation 7 entirely**.

Comment 3.
Environmental injustice and perceived unfairness have become known as major obstacles to the efficient abatement of pollution in general. It is unfortunate that the 2007-studies by Maris *et al.* (see footnote 1) have been overlooked as these are the first to have showed, by controlled experiments, that the *social* factor of 'unfair treatment' is also a major determinant of environmental noise annoyance. This result is particularly relevant to policy makers who, when facing situations of *collective* exposure, would like to take action by addressing causal factors at the supra-individual level first. Fairness, almost by definition, is such a supra-individual factor. Given the recognition by the authors that, particularly in the area of noise, "more subjective factors" (p. 4) need to be addressed to enable policy makers to take financially healthy decisions, the facts found by Maris *et al.* deserve wider attention.

→ **I suggest to expand items 1.5 and 1.6 of Chapter 1 with information on the psychological and political significance of social factors, and to adjust the relevant observations of the Executive Summary accordingly.**

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[5] A good example is noise sensitivity itself. In general, individual persons themselves know best whether they are (highly) noise-sensitive and whether they wish to be eligible for noise-reduction support. Then, noise(policy) need to do no more than designing the opportunities (with degrees of freedom appropriate to the level of sensitivity) that allow the individual person to make his personal choices. E.g., establishing a system of partial reimbursement of costs of moving to quieter place. For such measures to take effect it is not necessary to know *who* in particular is noise sensitive, nor *how* it has come about.

ON EFFECTS.
In the Executive Summary it is stated that recent research shows that long term exposure to transport noise is "related to likelihood" (p. 2) of developing elevated blood pressure (Observation 10), and that "there is increasing evidence that environmental noise, from both aircraft and road traffic noise is associated with raised blood pressure" (Observation 15).

Comment 4.
When human health is addressed by (psycho)somatic measures like changed blood pressure it is important to be as clear as possible about paths of causation as well as about their effect-sizes. In this respect, the observations 10 and 15 do not reflect significant information about the important mediating status of noise annoyance as reported in sources consulted by the authors at the time of drafting the report. In particular, it concerns three large scale investigations:

- The study by Kroesen *et al.* (2008) regarding 'self reported health status' and 'health complaints' as predictor/proxy of 'health'.
  The analysis by these authors of data from more than 10.000 residents in the Amsterdam Airport area showed that "inclusion of the mediating paths between aircraft noise exposure and perceived health renders the direct effect between these two variables insignificant." (p.6).
- The epidemiological study by Niemann *et al.* (2006). This Large Analysis and Review of European housing and health Status (LARES; about 8500 residents of 8 European cities) revealed that there is "increased health risk from chronic noise annoyance" (p.78). This finding was explained by "the negative emotionality" of annoyance" which " can be converted into reactions that show up in the neural, hormonal and immune systems as well as in the basic structure of the extracellular matrix (connective tissue)."(p.77) .
- The study by Babisch *et al.* (2007)[6], also Babisch *et al.* (2008), regarding 'hypertension' as predictor/proxy of 'health'.
  The analyses by these authors of data from nearly 5000 residents who had lived for at least 5 years near any of six major European airports showed that noise annoyance is positively associated with blood pressure (Babisch *et al.* 2007)[7]; that aircraft noise during the day was not significantly associated with hypertension; that aircraft noise during the night was significantly associated with hypertension only for residents highly annoyed by aircraft noise during the day, but not for residents less annoyed (Babisch *et al.* , 2008).

Thus, there is clear evidence[8] provided by the above studies that there is, within the ranges of sound-exposure levels assessed, no direct effect of environmental noise exposure on health as measured by raised blood pressure when controlled for by noise annoyance. With Kroesen *et al.* I concur that in situations of no noise there will be no noise annoyance. But in most real life situations zero noise is highly unlikely to become any near-term goal. Then, it will stay important to know the (cost-)effectiveness of alternative measures reducing detrimental health effects from noise exposure. Consequently, information about the role of potential mediators will be of utmost importance.

→ In line with the emphasis of Observation 15 of the Executive Summary on 'well being', and of Observation 7 on noise annoyance as a major risk to this well being **I suggest to rewrite Observation 10 and 15 so as to better reflect the empirical evidence of the pivotal role of noise annoyance (and, thus, of measures to reduce noise annoyance) in preventing or reducing detrimental health effects like hypertension.**

[6] Although this study is referenced in the draft report (p. 66), nowhere in the report I have found the findings of the report discussed.
[7] See also the
[8] On the basis of the strengths of effects reported from these large scale studies, I would call the evidence *fairly strong* for aviation noise exposure. For road traffic noise exposure a different evaluation may be required.

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