Comments on "Study of Visitor Response to Air Tour and Other Aircraft Noise in National Parks"

James H. Gramann, Ph.D.
Professor, Texas A&M University

National Park Service policy recognizes the need to protect natural soundscapes both for their inherent value as physical resources and for the enjoyment of visitors. Although soundscapes conceivably could be managed without considering the effects of noise on people, preserving the opportunity for visitors to hear the natural landscape is integral to the management of many units of the National Park System. For this reason, information is needed on how visitors respond to non-natural sounds in various park management zones, especially those in which the preservation of natural processes and landscapes is a desired condition.

Given this, I have serious reservations about basing air tour management planning on the findings summarized in Rapoza et al. I am familiar with this line of research from my previous work with BBN Systems and Technologies on the effects of overflights on wilderness users in the National Forest System, and from my own 1999 literature review on the topic as it relates to the National Park System.[1]

My major criticisms of the current review as a scientific basis for air tour management plans are threefold:

1. The limited number of psychoacoustical studies (i.e., dose-response research) reviewed by Rapoza et al. focus on scenic overlooks and short hiking trails. These are frontcountry areas where protecting natural soundscapes is not a primary concern.

2. It is inappropriate to generalize dose-response relationships obtained at frontcountry locations to wilderness and backcountry areas where protecting the natural soundscape is a management priority. The summary ignores a significant amount of research that demonstrates that frontcountry and backcountry visitors differ in their evaluations of aircraft noise.

3. Even in a dose-response paradigm, the response metrics chosen for re-analysis by the Volpe Center may not be the most relevant or sensitive measures of visitor reaction to aircraft noise in national parks. As a result, the dose-response curves obtained may under-predict visitors' negative responses to aircraft noise, even in frontcountry areas.

My specific concerns follow:

1. Although dose-response studies have acknowledged strengths in other contexts, the application to national parks poses significant challenges. The dose-response method was developed for studies of noise impacts in neighborhoods near airports. Because houses are immobile, it is easy to measure how much noise they are exposed to using stationary

[1] Gramann, J.H. 1999. The effect of mechanical noise and natural sound on visitor experiences in units of the National Park System. *Social Science Research Review*, 1(1), Washington, D.C.: NPS Social Science Program.

instruments. And the noise level in dwellings is consequential for policy, even if residents are not always home. For these reasons, noise dosages received *by locations* are appropriate measures in airport studies. However, national park visitors move, so their noise exposure during visits is hard to quantify with immobile devices. And it is of little value to a policy aimed at protecting visitor experiences to measure noise when visitors are absent. Thus, dosage measurement in national parks should not be location-based; it should be *visitor-based.* Unfortunately, obtaining accurate exposure measurements for mobile visitors over an extended stay is virtually impossible, given current technology.

But if the goal is to develop dose-response curves, then it is necessary to measure the actual noise that visitors are exposed to on the ground. In a typical national park, the closest one could come to doing this, and still employ the dose-response method, would be to find places where large concentrations of visitors stay in small areas long enough to be exposed to overflight noise that can be measured using stationary instruments. Viewpoints and short frontcountry trails are such areas. Unfortunately, these are not the types of locations where the NPS would normally protect natural ambient sound.

2. National Park Service policy considers natural sound to be an integral part of the visitor experience in backcountry and wilderness areas of the National Park System. In fact, research indicates that users of backcountry and wilderness areas are more affected by overflights than are frontcountry visitors. For example, one survey at Grand Canyon National Park found that backcountry and river corridor visitors were more sensitive to aircraft noise than people in developed areas of the park,[2] and exit interviews at 23 NPS units reported that a higher percentage of backcountry than frontcountry users recalled hearing aircraft and were more likely to experience interference with enjoyment and natural quiet because of this.[3] These results strongly suggest that dose-response curves developed from observations in frontcountry areas cannot be applied uncritically to backcountry areas.

3. Because Rapoza et al. confine their review to psychoacoustical studies, they do not address the much more voluminous research on visitors' reactions to noticeable aircraft noise conducted outside the dose-response paradigm. This includes the 39 visitor surveys done in national parks and reported by the NPS in 1995.[4] As a group, these studies found that interference with natural quiet was a more commonly expressed reaction to noticeable aircraft noise than annoyance, although the two measures tended to move together.

However, even in the dose-response studies summarized by Rapoza et al., interference with the appreciation of natural quiet and the sounds of nature was a far more frequently reported response to aircraft noise than either annoyance or interference with enjoyment of the site, the two response variables chosen for the dose-response analysis.[5] For example, when combining survey data from all overlooks, 21% of visitors said that aircraft noise interfered with their

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[2] HBRS/HMMH, 1993. *Aircraft Management Studies, Grand Canyon Visitor Survey*. NPOA Report No. 93-5/HMMH Report 290940.19 prepared for the NPS Denver Service Center. (NTIS no. PB94-154804).
[3] National Park Service, 1995. *Report on Effects of Aircraft Overflights on the National Park System.* Denver CO: National Park Service.
[4] National Park Service, op. cit.
[5] Rapoza, A., G. Fleming, C. Lee, & C. Roof. 2005. *Study of Visitor Response to Air Tour and Other Aircraft Noise in National Parks* (Appendix B). Cambridge, MA: Volpe National Transportation Systems Center.

"enjoyment of the site" a moderate to extreme amount, compared to 45% who said it interfered with their "appreciation of natural quiet and the sounds of nature." For reasons not explained, Rapoza et al. did not examine the functional relationship of this second response to dosages. As a result, the dose-response curves may under-predict the impact of aircraft noise on visitors' experiences, even in frontcountry settings.

A highly replicable finding in social psychological and recreation behavior research is that the strongest relationships between two variables occur when they are measured at the same level of specificity.[6] For example, studies of recreational carrying capacity find that the number of encounters with others is often weakly related to general feelings of visit satisfaction, but more strongly related to specific perceptions of crowding.[7,8] One reason seems to be that visit satisfaction has multiple determinants, only one of these being the number of encounters with others. However, encounters are much more directly related to feeling crowded, since both are indicators of use density, the first measure being objective and the second evaluative. Similarly, one would expect that exposure to aircraft noise would be less strongly associated with a general measure, such as "enjoyment of the site," than with a specific evaluative measure of sound, such as "appreciation of natural quiet and the sounds of nature." However, Rapoza et al. chose not to examine this relationship in their re-analysis.

Simply because a response metric lacks a history of use in airport studies does not mean that it is irrelevant to visitors or to managing natural soundscapes in the National Park System. If one goal of protecting natural soundscapes in parks is to minimize the impact of noise on visitors' experiences, then information is needed on how visitors *evaluate noise*. Indeed, it should be the primary metric of interest.

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[6] See, for example, Ajzen, I. & Fishbein, M. 1980. *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall.
[7] Haas, G. 2001. Visitor capacity in the National Park System. *Social Science Research Review*, 2(1), Washington, D.C. NPS Social Science Program.
[8] Shelby, B. & Heberlein, T. 1986. *Carrying Capacity in Recreation Settings*. Corvallis, OR: Oregon State University Press.