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## Effects of Military Aircraft Overflights on Recreational Users of National Parks

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### Abstract

This study was initiated as part of the cooperative US Air Force / National Park Service efforts to understand and effectively manage the potential adverse effects military air crew training can have on the National Parks. Through simultaneous sound data acquisition and Park user interviews, data were collected that provided a basis for determining how military jet overflights can affect visitor experience at a site in White Sands National Monument, New Mexico. Several useful findings resulted from the analysis. First, visitors can distinguish between the concepts of “annoyance” and “interference” produced by aircraft sound. Annoyance is an emotional reaction, while interference is more of an objective judgment. Visitors can find that the sound of aircraft interferes with the natural soundscape, but are not necessarily annoyed. Visitors believe annoyance results if the interference is often or severe enough. Second, visitors tend to be less annoyed by aircraft noise if they remember learning that they could hear or see aircraft while in the Park. This finding shows the importance of informing visitors about possible aircraft overflights - i.e., managing visitor expectations. Finally, aircraft noise is likely to produce less annoyance if aircraft fly over in close succession, rather than widely spaced, one at a time. [1]

### 1. Introduction

The Department of Defense is aware that military flight training activities may adversely affect some recreational users of public lands, and is interested in exploring whether there are management or operational means for reducing such adverse effects. Accordingly, the U.S. Air Force contracted with Harris Miller Miller & Hanson Inc. (HMMH) to develop and conduct a study that has two goals:

1. Quantify National Park visitors’ reactions to military jet aircraft overflights;
2. Determine whether three specific management actions can significantly reduce or mitigate adverse visitor reactions to these overflights. The three specific actions are:
  - a. Providing visitors with information about overflights,
  - b. Altering the temporal spacing of overflights,
  - c. Increasing aircraft distances from the visitors.

## 2. Method

### 2.1. Data Collection

Two types of data collection provided the information necessary to meet the study goals. Primarily, dose-response data were collected at Big Dune Trail in White Sands National Monument, New Mexico. This park is near Holloman Air Force Base, and departing military jet aircraft regularly fly over the site at the rate of 100 to 150 departures per day. These data, derived from simultaneous sound monitoring, noise source logging, and visitor interviews, formed the basis for relating how visitors rated the sounds they heard (response) with the measured sound levels and sources that were present (dose). To investigate the effects of providing information about overflights to visitors, a sign was posted for about half the visitors. The sign indicated: “Military aircraft can regularly be seen and heard on this trail.”

Second, prior to conducting the dose-response data collection, the survey questionnaire was pre-tested with cognitive interviews of some 21 visitors over three days. These interviews use the actual dose-response questionnaire, but in addition to asking the prepared questions, “probe” questions were asked after selected questions to better understand the responses. Specifically, probe questions were asked after the annoyance question to learn how visitors interpret the concept of “annoyance.” Probe questions were also asked to learn what visitors thought the words “interference with natural quiet and sounds of nature” meant.

### 2.2. Data Analysis

The dose-response data were reduced and analyzed by associating visitor times on site with the second-by-second A-weighted sound levels and source identification logs. Figure 1 shows a one-hour time history with sources of sound identified from the observer logs.

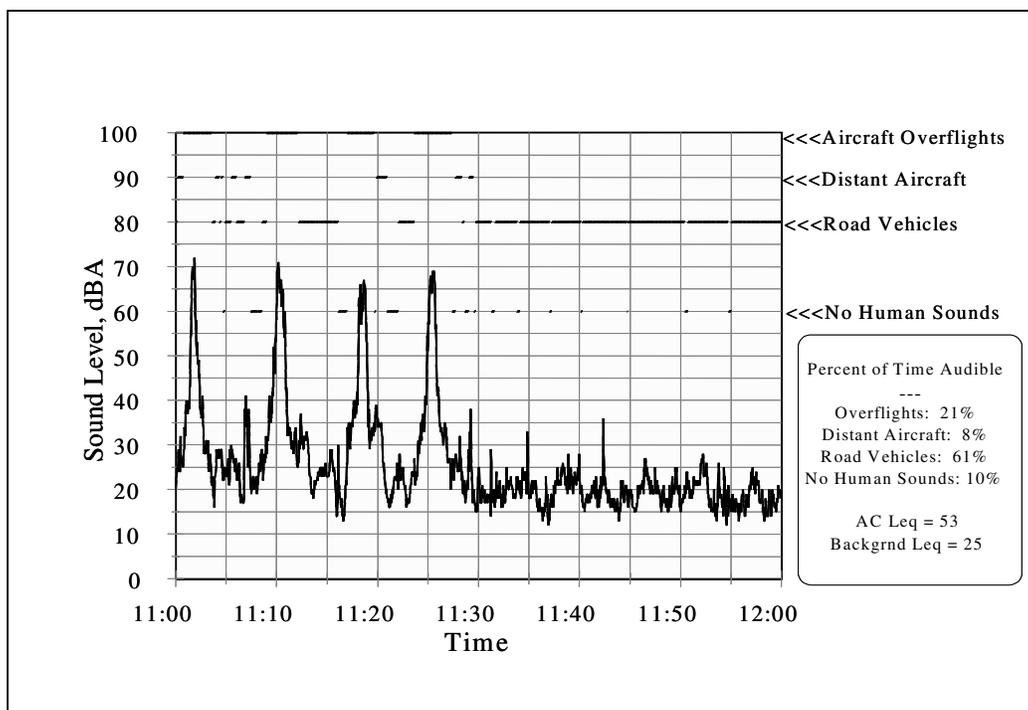


Figure 1: One hour A-weighted time history showing the logged sources of sound and resultant percent times audible and equivalent sound levels.

Visitor responses were associated with two metrics of the aircraft sound that were measured for the time period the visitors were at the site: 1) percent of time aircraft were audible; 2) difference between aircraft  $L_{eq}$  and background (non-aircraft)  $L_{eq}$ .

The cognitive survey results were reviewed and the results summarized.

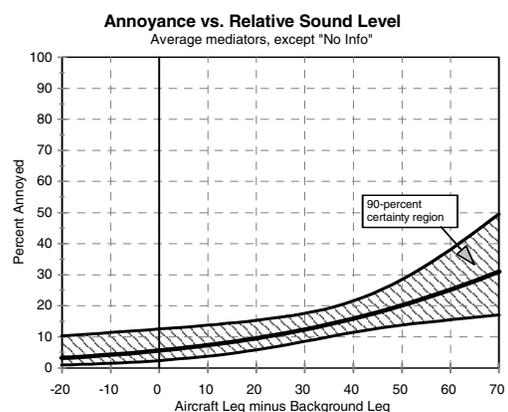
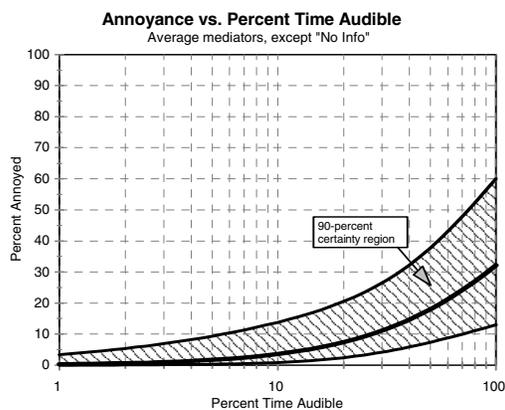
### 3. Results

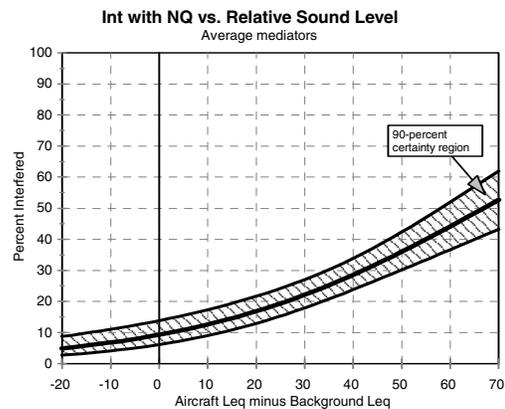
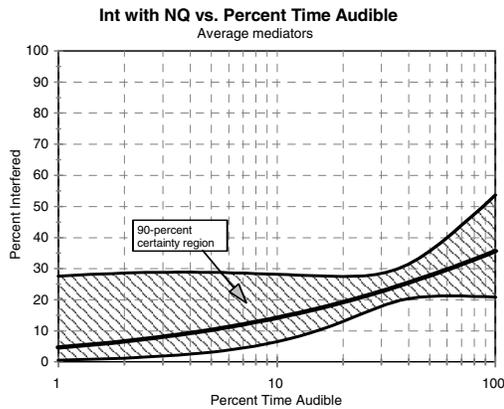
#### 3.1. Cognitive Interviews

1. Aircraft noise appears to be a factor that visitors may not consider when asked to evaluate their park experience in an open-ended question format. As a result, open-ended questions, such as “What did you like the least about your visit to [Park]?” are probably not good indicators of the seriousness of problems from aircraft overflight noise at parks.
2. Visitors have a clear and widely shared understanding of the concept of “natural quiet and the sounds of nature.” Natural quiet is viewed as the absence of any man-made sounds, allowing them to hear nature as it is.
3. Most visitors make a distinction between the terms “interference” and “annoyance.” Interference is perceived as an objective term, describing something that prevents them from doing what they want to do; it is an interruption or a distraction. Annoyance is perceived as having an emotional, evaluative component. For example, many respondents associate a negative reaction “makes me mad,” “causes my blood pressure to rise”- with the term annoyance.
4. Aircraft noise interference can result in annoyance but does not necessarily do so. The aircraft noise probably must exceed a certain level or number threshold before it is perceived as annoying.
5. Respondents indicate that interference can be a short-term occurrence, such that once the noise source has passed the perceived interference ends. Annoyance, however, because of the emotional component is more long lasting. It seems reasonable to consider annoyance as the reaction that causes a visitor to evaluate the experience as negative or to consider registering a complaint.

#### 3.2. Dose-Response

The four figures below show the dose-response results for percent of visitors annoyed and percent of visitors who felt the aircraft sound interfered with their appreciation of natural quiet as a function of the two metrics.





### 3.3. Management Actions

The effects of the three management actions were evaluated through regression analysis of the dose-response data. First, visitors who remembered hearing or seeing information about aircraft flights in the area were less annoyed, at the 90% certainty level, than those who did not recall such information. Figure 2 shows how responses differed when visitors remembered information about aircraft. Analysis also showed that annoyance is somewhat less when aircraft flights are close together, rather than separate events. Finally, increased distance from visitors to aircraft had no effect other than that attributable to decreased sound level.

### 4. Conclusions

First, park visitors have consistent, understandable interpretations of the concepts of annoyance, interference and natural quiet. Hence, questionnaires that elicit visitor opinions in these terms should provide readily interpreted results. Second, management actions, from both the park perspective and from the airspace perspective can affect visitor reactions to aircraft overflights.

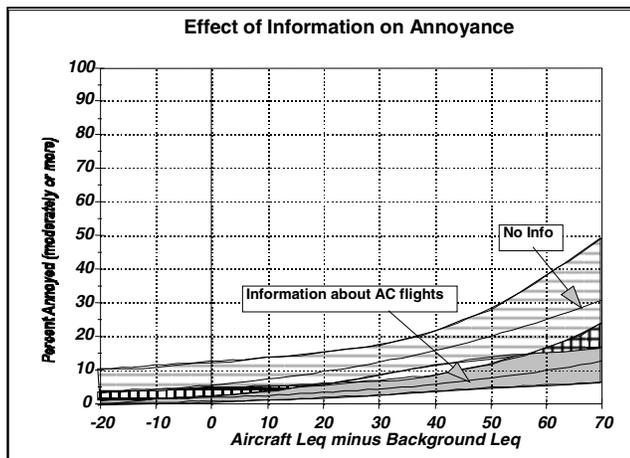


Figure 2: Effect of Information on Annoyance Response

### 5. Acknowledgements

Col. Fred Pease of the Air Force (XOOA) and Dr. Wesley Henry of NPS (WASO) developed the concepts and supported the study. With their initiative, Dr. Bartholomew Elias and Robert Lee at Wright-Patterson AFB, provided the contract and the guidance to insure the study became a reality.

### 6. References

1. For a full description of the study, its methods and results, see N.P. Miller, *et al*, "Mitigating the Effects of Military Aircraft Overflights on Recreational Users of Parks," USAF Report AFRL-HE-WP-TR-2000-0034, (or DTIC ADA379467 at <http://www.ntis.gov/>), July 1999.