

Defining the Effects of Aircraft Overflights on Parks and Wilderness Areas

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INTRODUCTION

What is "natural quiet"? How does one protect it? Is the aircraft overflights issue a resource allocation issue similar to protection and management of other park resources and values?

These are some of the questions explored by Aircraft Overflight Study Project being conducted by the U.S. National Park Service (USNPS) and the U.S. Forest Service (USFS). From 1989 to 1992, research on the effects of aircraft overflights will be conducted under this project at an average cost of about US\$1 million per year. Virtually all types of potential effects of aircraft overflights on park visitors and resources, positive as well as negative, will be studied, as funding and time permit. What may at first seem a fairly simple subject turns out to be extremely

complex, involving the fields of psychoacoustics (the study of the effects of sound on people), outdoor recreation sociology, computer modeling, acoustics (the science of measuring sound), airspace management, statistical sampling, and technology development. The diversity of fields and the highly controversial and far-reaching nature of the subject make this an extremely challenging project.

CONGRESSIONAL MANDATE FOR THE STUDY

In the mid-1980s, aircraft overflights at Grand Canyon National Park were a hot topic for the news media, receiving emotional attention from environmentalists, the aviation industry, and government agencies in several federal departments. Congress took note of all this, and the result was Public Law 100-91, signed into law in August 1987. Sometimes called the "National Parks Overflights Act," Public Law 100-91 did several important things. It required development and implementation of an aircraft management plan at Grand Canyon which would "provide for substantial restoration of the natural quiet and experience of the park and protection of health and safety from adverse effects associated with aircraft overflight." It also established temporary altitude restrictions for overflights at Yosemite and Haleakala national parks.

As significant as those requirements are, the most important provision of the law is the requirement that the USNPS do a study "to determine the proper minimum altitude which should be maintained by aircraft when flying over units of the National Park System." The law requires the USNPS to specifically evaluate the impacts of aircraft noise

on the safety of park visitors, impairment of visitor enjoyment associated with overflights, other injurious effects of overflights on park resources (natural, historical, and cultural), and the values associated with overflights (e.g., visitor enjoyment, protection of persons and property, search and rescue, firefighting). The law also requires the USNPS to develop recommendations for legislative and regulatory action which could be taken regarding the information collected.

Under the law, the USFS is also required to do a study, but it has a more limited requirement to "conduct an assessment to determine what, if any, adverse impacts to wilderness resources are associated with overflights of National Forest System wilderness areas." The USFS is not required to develop recommendations.

The law requires the USNPS to study at least eleven parks, seven of which are named in the law. The required parks are: Cumberland Island National Seashore in Georgia, Glacier National Park in Montana, Grand Canyon National Park in Arizona, Haleakala and Hawaii Volcanoes national parks in Hawaii, Mount Rushmore National Memorial in South Dakota, and Yosemite National Park in California. A minimum of four additional parks will be selected from a list of those that have indicated concerns about aircraft overflights.

Because the results of the study must be extrapolated to the entire U.S. National Park System as much as possible, an attempt is being made to develop a statistical sampling plan which balances requirements for reliability, validity, and cost-effectiveness. Estimates of aircraft noise exposure and visitor use are

the two major criteria being used in developing this sampling plan.

It is important that information on each park be accurate and up-to-date to receive full consideration in determining from the sampling plan which other units will be studied. In addition, parks will be contacted to verify the information used in the draft sampling plan, and to determine logistical feasibility and special mitigating factors that might influence the selection of each park for further consideration.

USEFUL PRODUCTS EXPECTED FROM THESE STUDIES

The primary thrust of this project is to develop products that parks will find useful to address concerns regarding aircraft overflights, consistent with the mandates of Public Law 100-91. Some examples:

1. An attempt will be made to develop models of aircraft noise propagation in park environments, using USNPS geographical information system capabilities, so that the effects of a change in overflights at a particular park can be predicted with a minimum of new data being collected.

2. A standard methodology will be developed to characterize park noise levels, both with and without aircraft and other non-indigenous noise sources.

3. A standard methodology will be developed to characterize the nature of overflights in a particular area, in such terms as flight altitudes, aircraft types, estimated number of flights, etc.

4. The state of knowledge and probability of effects of overflights on natural and cultural resources will be assessed.

5. The feasibility and effectiveness of certain mitigation measures will be assessed, including the effects of flight altitude on noise levels and visitor reactions on the ground.

6. Baseline data on the ambient noise environment of a variety of park units will be collected, which will aid park managers in assessing the effects of any noise source.

7. Extensive sociological studies will be done which are intended to support development of a dose-response relationship between aircraft noise levels and visitor response, as well as to provide information on visitors and motivations.

8. Practical guides will be developed for park personnel on such subjects as how to recognize and properly report problem overflights and get results.

EARLY DECISIONS SET THE STAGE

For many reasons, the USNPS and USFS decided to fund and manage this project cooperatively through a contract administered by USNPS's Denver Service Center. To ensure the most scientifically defensible, objective, and effective methodologies and results, and to ensure credibility with the many competing publics interested in this project, nationally recognized contractors were selected to design and do the research. The two primary contractors are BBN Systems and Technologies Corp. (BBN) and Harris Miller Miller and Hanson, Inc., (HMMH). Subcontractors and consultants provide the required expertise in the fields listed above. Individual research projects are funded as separate work orders negotiated with one of the primary contractors.

In addition, a Technical Review Group was formed as an informal steering committee to provide input to the USNPS-USFS management team from a technical as well as a managerial perspective. This group comprises technical advisors at the senior level, senior management personnel, and representatives of key interest groups. In addition, the project management team has made a strong commitment to publish research methods and results, both in project reports available to the public and in professional and scientific journals. Formal peer review will be sought whenever possible.

RESEARCH DESIGN

There is an impressive body of scientific literature on the effects of aircraft overflights. However, most of it relates to urban environments near airports, and it was discovered early in the project that many of the basic assumptions underlying that literature are not applicable to most park environments. This meant that, to accomplish the goals for this project, innovative methods were necessary to advance the state of the art much more than was originally anticipated.

A research program was developed by BBN under the project's first work order. Because the USFS had earlier funding and reporting dates than the USNPS, the plan was oriented to accomplish USFS objectives and test several hypotheses early in the project. The USNPS portion of the work later in the project was left deliberately flexible to take advantage of knowledge gained in the earlier stages. The USNPS-USFS management team decided to re-evaluate the research design based on the experience of the first year of the project. BBN and HMMH have been directed

to develop a revised and more detailed research program for the remainder of the project, which will involve primarily USNPS work.

The revised research program is intended to guide allocation of resources and scheduling of research for the duration of the project, and to document the rationale for major project decisions. The USNPS expects to have two full field seasons so that testing and refinements of methodologies and design are still possible as the project progresses.

As of November 1, 1990, only one report had been fully accepted from the contractor and was made available to the public ("Acoustic Measurements of Sonic Booms and Ambient Sound Levels in the Selway-Bitterroot Wilderness Area," NPOA report No. 90-2).

An evaluation of aircraft noise models has been completed which showed major problems with using any of them to map aircraft noise exposure in most park and wilderness settings. A proposal is now being considered for developing a new model. Considerable acoustical data have been collected at Grand Canyon, and will be used in any attempt to model the noise environment as soon as a decision is made. It is expected that this Grand Canyon model will serve as a prototype for noise modeling and assessment efforts in other parks under this study.

An experiment with a microphone array and meteorological station has also been completed and is being analyzed. It is hoped that this study will help to develop a cheaper way to characterize ambient sound levels in park environments, and to determine how meteorological variables affect noise measurements in these types of environments. Most of the acoustic data that has been collected

so far has been one-third octave band recordings which require extensive (and expensive) analysis. A method of automatically eliminating the effects of wind blowing across the microphone on these recordings has been developed as a useful side effect of the data analysis. Also, there is hope that correlations will be found between the sophisticated acoustical methodology employed for field data collection so far in the project and cheaper data collection methods, such as using A-weighted decibel meters, to facilitate acoustic data collection in subsequent stages of the project.

Acoustic and sociological data are being collected in parallel with USFS areas to try to define a dose-response relationship. The methodology is expected to be refined and tested further in USNPS areas over the next two years.

Much has been learned about the effectiveness of acoustic equipment configurations under park and wilderness field conditions, and on exactly how the park and wilderness environment differs from the urban airport environment in terms of characterizing aircraft noise effects. We are steadily moving from a situation where much was "known" anecdotally about aircraft effects in park and wilderness environments, to a situation where much is now known scientifically. The paucity of hard scientific data which characterized much of the debate about Grand Canyon overflights a few years ago is gradually becoming a thing of the past as the issue is considered for the rest of the U.S. National Park System.

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