ACRP Problem Statement No. 13-02-06  

Recommended Allocation: --

*Evaluation of Single Event Aircraft Noise Events on Noise Annoyance*

**ACRP Staff Comments:** The problem statement appears to complement research undertaken in ACRP Project 02-35, Research Methods for Understanding Aircraft Noise Annoyance and Sleep Disturbance. The funding level appears appropriate.

**TRB Aviation Group Committees Comments:** ENVIRONMENTALIMPACTSOFAVIATION: Do not support – This problem statement appears to overlap in part with PARTNER Project 24, Noise Exposure Response: Annoyance. There is clearly a need to better understand the relationship between repetitive low-intensity aircraft noise and annoyance; however, those studies and research may be best conducted under other programs such as PARTNER or with direct FAA funding. The use of information generated by this study would be dependent upon FAA’s National Noise Policy and notable dovetailing with the PARTNER projects.

**Review Panel: Not recommended** — There is a PARTNER project focused on noise annoyance, and FAA is initiating a new study on surveys related to noise annoyance. The proposed research would not result in something useful for airports, as FAA does not have regulatory guidance for single event noise impacts.

**AOC Disposition:** No funds allocated. No discussion.
I. Problem Title:

Evaluation of Single Event Aircraft Noise Events on Noise Annoyance

II. Problem statement:

For the last several decades, the DayNight Average Sound Level (DNL) has been the primary metric used in evaluating airport noise exposure for land use planning. The well-known work of Schultz (1978) resulted in the so-called Schultz curve, which predicted aircraft annoyance levels based on DNL exposure. However, the DNL metric has become controversial in recent years, in part due to the implementation of quieter aircraft.

The number of flights has increased at many commercial service airports, leading to more noise events; although they are generally quieter. Subsequently, communities may have an increasing number of aircraft noise events concurrent with decreasing DNL values. Similarly, as performance based navigation (RNAV and RNP) becomes more commonplace, aircraft activity will be concentrated over narrower areas. This may lead to substantive increases in the number of aircraft noise events for some areas, while not altering DNL values enough to warrant mitigation or adjusting of the flight routes. Therefore, fewer options are available to the airport operator to reduce noise exposure.

While jet aircraft are indeed much quieter than they were several decades ago, the increase in aircraft traffic has created a problem that the DNL metric does not adequately address: specifically, the impact of repetitive, low-intensity noise events. Much like the proverbial dripping faucet, ongoing noise may be bothersome, although it is low in acoustical energy. Research into how this phenomenon translates into community annoyance may be useful in considering the benefit of reducing the number of aircraft noise events even when DNL values remain constant or decrease.

III. Objectives:

- A better understanding as to the psychoacoustic impacts of repetitive, low-intensity aircraft noise.
- An examination as to how background noise affects the perception of repetitive, low-intensity aircraft noise.
- Comparison of findings with the noise annoyance predictions from the existing DNL metric.
- Recommendations as to how the findings could be used to enhance airport noise compatibility planning.
IV. Research Proposed:

It is proposed to study the relationship between repetitive low-intensity aircraft noise (perhaps in the 40-55 dB Lmax range) and annoyance in both a laboratory environment and residential setting.

A laboratory experiment could be developed to expose participants to varied levels of persistent low-volume aircraft noise in conjunction with normal neighborhood background noise. The results would be reviewed to see if a relationship existed between the reported level of annoyance and the number of aircraft noise events and if so, at which levels of aircraft activity the noise became bothersome. Similarly, the amount of background noise could be varied to see as to what level the background noise reduces the level of annoyance from repetitive, low volume aircraft noise.

This data could then be field tested by selecting random households in varied areas subject to frequent, low intensity aircraft noise (such as near arrival or departure fixes or under RNAV departure/arrival routes) that have a similar low aircraft DNL value (in the 40-55 dB DNL range). Participants would report their annoyance with background noise and this would be compared to the number of aircraft noise events that occurred during that time period.

In both cases, research subjects should be screened for unusually high noise sensitivity (such as misophonia and phonophobia), as the goal should be evaluate noise exposure for a sample generally representative of a standard population. Also, to reduce the influence of cognitive biases, the study subjects should not be told that the study is looking at aircraft noise specifically, but rather evaluating community response to background noise. Lastly, measures should be taken to reduce the level of recency bias, such as having a constant feedback system where the subjects can immediately record their level of annoyance, rather than doing it at predetermined intervals where the most recent noise events could impact their perception.

V. Estimate of the Problem Funding and Research Period:

This project could likely be completed in the $300,000 to $500,000 range, as the project does not require the development of a substantial amount of innovative equipment.

The research could be completed in less than two years. It might be desired to conduct the laboratory experiments in one year, evaluate that data and then conduct the field experimentation in the second year. Also, the exact costs and time frame might vary based on the sample size used and the particular methodology adopted.
VI. Urgency and Payoff Potential

As the FAA moves forward with the widespread development and implementation of performance based navigation, a larger number of flights will be concentrated in narrow corridors. An understanding as to how repetitive low intensity aircraft noise relates to annoyance is essential for airport operators to evaluate their noise abatement strategy in light of increased use of RNP and RNAV procedures.

Similarly, as aircraft fleets continue to become quieter, the DNL metric alone may become less effective at predicting community annoyance. Since DNL is the determinant used by the FAA to evaluate noise exposure, the options available to airport operators to reduce noise impacts and improve community relations may be constrained, despite an increase in aircraft operations.

VII. Related Research:

Ongoing/Current Related Research:

PARTNER:
- Project 24 “Noise Exposure Response: Annoyance”

ACRP:
- Project 0235 “Research Methods for Understanding Aircraft Noise Annoyance and Sleep Disturbance”

Historical Research:

A literature review shows that there has been some research in the area of repetitive noise. However, most of the research is not recent and little of it examines the issue of low intensity aircraft noise specifically. Here is some of the research that may be useful on the subject:


VIII. Persons Developing the Problem:

Name: Jonathan Collette, A.A.E. Title: Airport Noise Abatement Program Manager Division of Aviation, City of Philadelphia, PA (Philadelphia International Airport and Philadelphia Northeast Airport) Address: Airport Noise and Community Service Office 2801 Island Ave. Suite. 13 Philadelphia, PA 19153 Phone: 2159376233 Fax: 2153657207 Email: Jonathan.Collette@phl.org

• Process Used to Develop the Problem Statement:

• Date and Submitted By:

This problem statement was developed by the individual above.

2/29/12 by Jonathan Collette