CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
J1610

Project Title
Airplane Take-off and Landing Noise Comparison by Power Measurement and Position Geolocation

Abstract

Objectives/Goals
The objectives of this experiment are (1) to demonstrate the feasibility of the geolocation of sound source by simultaneous noise power measurements at different locations, and (2) to compare the noise level generated by commercial airplanes during take-off and landing.

Methods/Materials
The proposed geolocation algorithm is based on the spherical dispersion characteristics of sound energy. Locations near LAX available for measurements of airplane landing and take-off were selected in advance. A sequence of measurements of the airplane noise level were made simultaneously by noise power meters at two different selected locations. The procedure was repeated with several airplanes to obtain averaged noise power variations during the take-off and landing processes.

Results
A comparison of the noise power difference at the two measuring locations can be translated to a ratio of the ranges to the airplane. The location of the airplane can then be evaluated by triangulation of the ranges. This enables the calibration of the airplane noise level based on the distance to the measurement. In this experiment, the commercial airplanes generated on average 9.5 dB higher noise level during take-off than that in landing at a constant normalized range.

Conclusions/Discussion
Geolocation of sound source can be achieved by multiple simultaneous sound power detections at different locations. This approach can be extended to civilian (airplanes) and military (missiles) applications for locating the sound source and estimating its velocity. Airplanes generate a higher noise level at take-off than that at landing. Off-hour flight scheduling of landing and take-off can consider this factor for environmental noise control.

Summary Statement
Target geolocation is demonstrated by simultaneous airplane noise measurements and applied to airplane take-off and landing noise level comparison.

Help Received
Dad helped in theory discussion and data measurement.