ACRP Problem No. 12-02-24

*Develop a Generic Commercial Jet Taxi Noise Directivity Pattern for AEDT*

**ACRP Staff Comments:** The proposed research would be the last piece of the taxiway noise modeling effort to provide important input to AEDT.

**TRB Aviation Group Committees Comments:** ENVIRONMENTAL IMPACTS OF AVIATION CMTE - Support. A reasonable addition to improve taxi noise modeling. Would benefit airports to some degree by assuring that the Integrated Noise Model (INM)/Aviation Environmental Design Tool (AEDT) represented taxiing aircraft more appropriately. The project statement seems to rely heavily on measurements in one setting, which should be expanded, and operational information (speed, thrust) must be known. Budget would need to be at least $300,000 to produce meaningful information.

**Review Panel Comments: Recommended** — The proposed research should have been introduced as a continuation to ACRP 02-27, Aircraft Taxi Noise Database for Airport Noise Modeling. There is a need to test or calibrate data against a real case study, which would make the overall taxiway study more widely applicable. The overall objective of this study would be to complete the analysis that has already been part of ACRP 02-27. If there were a need to test or calibrate data against a real case study, then additional funds would be required.

**AOC Disposition:** Approved and funded at $75,000 as a continuation to ACRP 02-27, Aircraft Taxi Noise Database for Airport Noise Modeling, subject to panel approval.
AIRPORT COOPERATIVE RESEARCH PROGRAM – 2012 PROBLEM STATEMENT

I. PROBLEM TITLE

Develop a Generic Commercial Jet Taxi Noise Directivity Pattern for AEDT

II. RESEARCH PROBLEM STATEMENT

The aircraft taxi noise modeling has been investigated in response to a growing understanding that continuing reduction of noise levels related to aircraft flight operations means that previously ignored noise from aircraft ground operations, such as taxiing, now has more of an effect on nearby communities. Taxiing and idling in runway queues, especially during peak hour operations or at night, can significantly contribute to noise contours and Day-Night Average Sound Levels (DNL). This is particularly true when taxiways are very close to the airport property lines and near neighborhoods or other noise sensitive locations.

The Federal Aviation Administration’s (FAA) Integrated Noise Model (INM) is the agency’s required tool for environmental impact statements, environmental assessments, and Part 150 studies. Currently, INM users who need to assess the contribution of noise from aircraft ground operations must develop a workaround approach within the model or externally. Developing this new capability directly within the tool would be a natural extension of other currently planned enhancements of the Aviation Environmental Design Tool (AEDT) and INM, such as better modeling of start of the take-off roll, and thrust reversal and it would enable the FAA and users to cover all modes of operations in the vicinity of an airport.

Prior ACRP projects have created many of the elements of a taxi noise model to be incorporated into the Aviation Environmental Design Tool (AEDT). These include a Taxi Noise-Power-Distance dataset compatible with the dataset for flight operations, taxi noise spectral classes, and taxi noise sensitivity. However, as noted in the conclusions to ACRP Web-only Document 9: Enhanced Modeling of Aircraft Taxiway Noise - Scoping, before the model can be successfully applied, additional information is needed to define taxi noise directivity which has a direct impact on the shape of the taxi noise contours, especially in regions close to the airport. This final piece of the taxi noise modeling capability will increase the accuracy of airport noise modeling, thus improving chances that significant noise impacts and incompatible land-uses are properly identified, and that appropriate mitigation strategies are addressed. Failure to properly consider taxiway noise in airport environmental assessments with quantifiable metrics, such as DNL, could lead to airport procedures that inadvertently increase noise and create problems between communities and airports.

III. OBJECTIVE

This Problem Statement proposes the development of a generic taxi noise directivity pattern for inclusion in AEDT. A single nominal taxi longitudinal directivity pattern should be based on a representative established fleet mix incorporated into INM and AEDT. This approach is directly analogous to the current treatment of aircraft noise directivity behind the start of takeoff roll and should be based on the same aircraft fleet distribution. The directivity pattern should be applicable to the AEDT commercial jet fleet database and consistent with the taxi scoping recommendations developed under ACRP Project 11-02 Task 08 and taxi NPD and spectral class database developed under ACRP Project 02-27.

IV. RESEARCH PROPOSED
A review of recent literature will be conducted together with an assessment of data from recent taxi noise measurement surveys to identify possible new empirical datasets applicable to the taxi noise condition. Maximum use will be made of the data collected by the Universidad Politecnica de Madrid. Aircraft types for which no data exists will be identified as gaps in knowledge. A directivity substitution procedure will be developed for those underrepresented aircraft configurations based on an analysis of engine type and configuration.

A generalized full taxi directivity pattern will be developed for the low thrust taxi operation analogous to the existing high thrust INM/AEDT directivity pattern behind the start of takeoff roll. The generic pattern will be based on the current US operational fleet mix obtained from FAA’s ETMS operations data, and weighted by noise contribution, and will be defined in a manner suitable for incorporation into INM/AEDT.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding: $75,000
Research Period: 9 months

VI. URGENCY AND PAYOFF POTENTIAL

The product of this research is a taxi noise directivity pattern suitable for incorporation into the INM/AEDT taxi noise computational module.

The payoff is to have a directivity pattern that:
- is based on empirical taxi noise data;
- is representative of the current aggregated fleet mix;
- permits creation of realistic and accurate taxi noise contour shapes, especially in areas sensitive to airport taxiway operational noise; and
- is ready for immediate incorporation into AEDT.

The risks for this project is considered low since a significant number of empirical taxi noise directivity datasets already exist and since there is a precedent for incorporation of aggregated aircraft noise directivity “behind the start of takeoff roll” into AEDT.

VII. RELATED RESEARCH

The project is based on ACRP 11-02 Task 8 “Enhanced Modeling of Aircraft Taxi Noise – Scoping” and ACRP 02-27 “Aircraft Taxi Noise Database for INM and AEDT”.

VIII. PERSON(S) DEVELOPING THE PROBLEM

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IX. PROCESS USED TO DEVELOP PROBLEM STATEMENT

This problem statement is the product of the ACRP 02-27 Project Team and is submitted by the ACRP 11-02 Task 8 and ACRP 02-27 Project Manager (PM) identified in Sec. VIII.

X. DATE AND SUBMITTED BY

Date: March 9, 2011
Submitted by: Juliet Page (See Section VIII)

Submitted to: Michael R. Salamone, C.M., ACRP Manager