



## Project 005 Noise Emission and Propagation Modeling

**Pennsylvania State University  
Purdue University**

### Project Lead Investigator

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### University Participants

#### Pennsylvania State University

- P.I.: Victor W. Sparrow, United Technologies Corporation Professor of Acoustics
- FAA Award Number: 13-C-AJFE-PSU, amendments 005, 015, 029
- Period of Performance: August 18, 2014 to December 31, 2017
- Task(s):
  1. Assess applicability of meteorological reanalysis models for possible use in FAA noise tools
  2. Assess measurement data sets for noise propagation model validation

#### Purdue University

- P.I.(s): Kai Ming Li, Professor of Mechanical Engineering
- FAA Award Number: 13-C-AJFE-PU, amendments 002, 007, 009, 016
- Period of Performance: June 1, 2014 to June 2017
- Task(s):
  3. Extend model for fast moving sources

### Project Funding Level

FAA funding to Penn State in 2014-2015 was \$132K and in 2015-2016 was \$110K. FAA funding to Purdue in 2014-2015 and 2015-2016 was \$80K and \$90K, respectively.

In-kind cost sharing from Vancouver Airport Authority received in October 2016 was \$294,500 to Penn State and \$294,500 to Purdue. The point of contact for this cost sharing is Mark Cheng, mark\_cheng@yvr.ca. Project support is in the form of aircraft noise and trajectory data, meteorology data, and consulting on those datasets.

### Investigation Team

#### Penn State

Victor W. Sparrow (PI)  
Graduate Research Assistant Rachel Romond (meteorological reanalysis data investigation)  
Graduate Research Assistant Manasi Biwalkar (measurement data sets for model validation investigation)

#### Purdue

Kai Ming Li (PI)  
Graduate Research Assistant Bao Tong (moving source investigation)  
Graduate Research Assistant Yiming Wang (moving source investigation)



## Project Overview

The FAA has been funding research efforts in developing enhanced noise emission and propagation capabilities to better support environmental impact studies at both local and national levels. The main emphasis in the near and mid-term is to increase the Research Readiness Level (RRL) of the capabilities so that they can be further matured for implementation into the FAA tools. Validation of the modeling capabilities has been the central focus of the project. Via recent US-EU research collaboration, the field measurement database (BANOERAC) is becoming available for model validation. This database contains acoustic time history of flight events from various types of commercial aircraft during cruise, climb and descent phases of the flight. In addition the DISCOVER/AQ and Vancouver Airport Authority databases have already come on line for use in this and other FAA projects. These datasets make model validation possible. In addition the work will make existing models ready for simulating real weather conditions via proper treatment of the meteorological input parameters and to establish a common basis for comparing US and EU models.

## Task #1: Assess Applicability of Meteorological Reanalysis Models for Possible Use in FAA Noise Tools

Completed

## Task #2: Assess Measurement Data Sets for Noise Propagation Model Validation

Pennsylvania State University

### Objective(s)

The objective of Project 5, Task 1 was to determine if meteorological reanalysis datasets and corresponding input parameters are useful for aircraft noise propagation prediction and whether the same can be integrated into the AEDT noise analysis framework. The objective of Project 5, Task 2 was to begin examination of aircraft measurement databases and ascertain their applicability for validating aircraft noise prediction tools.

### Concluding Work

All of the tasks for ASCENT Project 5 has been completed except for one remaining item. Since the beginning of the project, Penn State has been working with ANOTEC Engineering of Motril, Spain to obtain suitable data sharing agreements with the European Aviation Safety Agency (EASA) for the use of the BANOERAC dataset for ASCENT research. BANOERAC stands for "Background noise level and noise levels from en-route aircraft" and that European project concluded in 2009. Specifically, Project 5 had funds budgeted to obtain the BANOERAC flight trajectory data through ANOTEC. ANOTEC had the raw ADS-B data to calculate the flight trajectories, but never produced those trajectories under EASA funding. ASCENT Project 5 was no-cost extended to December 31, 2017 to ensure that a Penn State purchased services agreement to ANOTEC would remain in place so that ANOTEC could provide those flight trajectories.

In early 2017, the data sharing agreements were put into force, and in the spring and summer of 2017 Penn State worked with ANOTEC to establish a purchased services agreement. Currently, ANOTEC is on schedule to deliver the BANOERAC flight trajectory data to Penn State and Purdue by 15 December 2017. Hence, with this data receipt, Project 5 will conclude on time on 31 December 2017. The BANOERAC data will then be available for use in other ASCENT projects at Penn State and Purdue, such as ASCENT Project 40.

All the other accomplishments in Project 5 have previously been reported in the 2015 and 2016 ASCENT annual reports, and ongoing research can be found in the 2017 annual report of Project 40. The final report for Project 5 will be submitted by 31 January 2018.

### Milestone(s)

N/A

### Major Accomplishments

The BANOERAC data sharing agreement between EASA, Penn State, and Purdue University was established.



### **Publications**

None.

### **Outreach Efforts**

None.

### **Awards**

None.

### **Student Involvement**

None.

### **Plans for Next Period**

Project 5 at both Penn State and Purdue will be completed by 31 December 2017.

### **References**

BANOERAC Project final report, Document ID PA074-5-0, ANOTEC Consulting S.L. (2009).

## **Task #3: Investigate the Convective Amplification Effects of Fast Moving Sources**

Purdue University

At present, we are on the process to formally complete the project by filing appropriate document for record. Nevertheless, the effort of the Purdue team on Project 5 has been integrated to Project 40 as we move on to look into the impact of uncertainties in predicting en-route aircraft noise. More details can be found in the annual report of Project 40.

### **Milestone(s)**

N/A

### **Major Accomplishments**

None.

### **Publications**

None.

### **Outreach Efforts**

None.

### **Awards**

None.

### **Student Involvement**

None.

### **Plans for Next Period**

Project 5 at both Penn State and Purdue will be completed by 31 December 2017.

### **References**

None.