U.S. Department of Transportation
Federal Aviation Administration

FINAL PROJECT REPORT

Form Approved:
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PART I - PROJECT IDENTIFICATION INFORMATION

1. Institution and Address	2. FAA Program	3. FAA Award Number
Georgia Tech Research Corporation	Environment and Energy	13-C-AJFE-GIT-065
505 Tenth Street NW Atlanta, GA 30332-0420	4. Award Period From 06-05-20 To 09-30-25	5. Cumulative Award Amount $600,001

6. Project Title

ASCENT Project 60: Analytical Methods for Expanding the AEDT Aircraft Fleet

PART II - SUMMARY OF COMPLETED PROJECT (For Public Use)

The goal of this research is to increase the accuracy of AEDT noise and emissions modeling of aircraft not currently in the ANP database. Georgia Tech will identify, and review aircraft not currently modeled in the AEDT, and will collect information and necessary data to better understand the characteristics of these aircraft. Various statistical analysis methods will be used to classify the aircraft into different types in terms of size, age, technologies, and other engine/airframe parameters. Quantitative and qualitative analytical methods will be identified and evaluated for each aircraft type, to develop ANP noise data for the aircraft. Validation data from certification data or airport planning documents will be gathered to validate the methods. After validation, the models will be applied to develop ANP and noise data for the aircraft. Finally, recommendations and guidelines will be developed for implementing the developed data in the AEDT, to expand the AEDT Fleet dB to include noise and performance data for aircraft currently not in the ANP database. The final deliverable to the AEDT development team was a series of recommendations on changes needed for the Fleet dB.

PART III - TECHNICAL INFORMATION (For Program Management Uses)

1. **ITEM** (Check appropriate blocks)	NONE	ATTACHED	PREVIOUSLY FURNISHED	TO BE FURNISHED SEPARATELY TO PROGRAM	
				Check (X)	Approx. Date
a. Abstracts of Theses	✘				
b. Publication Citations	✘				
c. Data on Scientific Collaborators	✘				
d. Information on Inventions	✘				
e. Technical Description of Project and Results				✘	
f. Other (specify)					

2. Principal Investigator/Project Director Name (Typed)	3. Principal Investigator / Project Director Signature	4. Date
Dimitri Mavris	Dimitri Mavris	10/30/25

FAA Form 9550-5 (03-03) Supersedes Previous Edition

Project 060 Analytical Methods for Expanding the AEDT Aircraft FLEET Database

Georgia Institute of Technology

Project Lead Investigator

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University Participants

Georgia Institute of Technology (Georgia Tech)

- P.I.: Prof. Dimitri Mavris
- FAA Award Number: 13-C-AJFE-GIT-065
- Period of Performance: March 19, 2024, to September 30, 2025
- Task:
  1. Enhancement of the Aviation Environmental Design Tool (AEDT) Fleet database (Fleet dB)

Project Funding Level

The Federal Aviation Administration (FAA) funding for this project is $150,000 from March 19, 2024, to September 30, 2025. Georgia Tech has agreed to a total of $150,000 in matching funds.

Investigation Team

Dr. Dimitri Mavris (P.I.)
Dr. Michelle R. Kirby
Dr. Mayank Bendarkar, All Tasks
Dr. Ameya Behere, All Tasks
Bilal Mufti (graduate student)

Project Overview

The AEDT relies on aircraft noise and performance (ANP) data provided by aircraft manufacturers to support the calculation of aircraft trajectories and noise at receptors by using aircraft performance information and noise-power-distance relationships for specific aircraft/engine combinations. In the ANP/Base of Aircraft Data (BADA) workflow, ANP performance data are also used in the calculation of emissions inventories and air quality dispersion. However, not all aircraft in the fleet are represented in the ANP database. When ANP data are not available for a specific target engine/airframe combination, the AEDT uses a substitute aircraft from the ANP database to model the target aircraft by closely matching the certification noise characteristics and other performance parameters. However, a problematic issue is that the best substitute according to noise criteria does not always match the best substitute for emissions criteria. In addition, substitute aircraft do not capture the environmental benefits of newer aircraft with noise- and emissions-reduction technologies, thus resulting in overly conservative noise and emissions estimates.

The goal of this research is to increase the accuracy of AEDT noise and emissions modeling of aircraft not currently in the ANP database. Georgia Tech will identify, and review aircraft not currently modeled in the AEDT, and will collect information and necessary data to better understand the characteristics of these aircraft. Various statistical analysis

methods will be used to classify the aircraft into different types in terms of size, age, technologies, and other engine/airframe parameters. Quantitative and qualitative analytical methods will be identified and evaluated for each aircraft type, to develop ANP noise data for the aircraft. Validation data from certification data or airport planning documents will be gathered to validate the methods. After validation, the models will be applied to develop ANP and noise data for the aircraft. Finally, recommendations and guidelines will be developed for implementing the developed data in the AEDT, to expand the AEDT Fleet dB to include noise and performance data for aircraft currently not in the ANP database.

Task 1 - Enhancement of the AEDT Fleet Database

Georgia Institute of Technology

Objective

The objective of the last year of this research is to finalize the review of the AEDT Fleet dB entries for each unique equipment identifier, denoted as EQUIP_ID, and provide guidance to the AEDT development team on how to clean up the entries for more suitable noise and emissions modeling for stringency or inventory analysis.

Research Approach

Building upon the prior year approach to developing an ANP extension database, the final thrust of the research focused on finalizing the recommendations on erroneous EQUIP_ID entries in the Fleet dB. To accomplish this task, certification data from the FAA and the European Union Aviation Safety Agency (EASA) for each airframe and engine family. Certification data included the type certificate data sheet (TCDS), the EASA noise certification noise level database, and International Civil Aviation Organization's (ICAO) engine emissions databank (EEdB).

The methods used for matching the engine and airframe combinations comprised the following steps. In the ANP database, a total of 990 airframe/engine candidate combinations for noise data population were selected. The population procedure was started by selection of a specific airframe of interest (e.g., the Airbus A321-200 Series AIRFRAME_MODEL and "common aircraft name"). For that airframe, a specific engine, ENGINE_MODEL, among the different options available, was selected (e.g., the CFM56-5B3/2P). After the specific airframe/engine combination was defined, the same combination was searched and selected in the EASA certification noise level database. For matching to be performed, the selected airframe/engine combination in EASA database was required to be unique. To ensure this unique matching, a set of successive selection criteria was used involving the following sequence of steps:

1. Use the EASA TCDS to verify that the variants are actually on the airframe; use the EASA certification noise level database (e.g., Model Aircraft Database Jets) to cross-reference that the engine is certified for noise at the various maximum takeoff masses allowable (MTOM) as defined in the TCDS.
2. Use the EASA TCDS to verify that the engine emissions and thrust parameters in the ANP database are correct for the specific ENGINE_MODEL, as cross-referenced to the ICAO EEdB.
3. Identify and register identified differences by matching the ANP Equipment ID and EASA Record number.
4. For the certified airframe/engine combination in the EASA certification noise level database, select the maximum take-off weight (MTOW).
5. If no unique combination is obtained, proceed to select the maximum landing mass.
6. If the combination still has more than one option, the maximum cumulative noise level can be selected.
7. In cases in which multiple airframe/engine combinations have the same noise values, the first entry is selected.
8. Finally, if more than one combination remains after application of the preceding criteria, the most recent modification date for the data of the remaining combinations is selected. This modification date corresponds to the most recent date when the existing values for the selected combination were entered in the database.

The rationale underlying these selection criteria was to choose the most representative noise value of the airframe and engine combination selected. After a unique combination was found, the corresponding noise value was transferred from the EASA database to ANP extension database. To increase the number of combinations available for which noise values were obtained, engines with similar designation codes for some airframes were utilized. In this case, the criterion for selection was a direct comparison of the main parameters (bypass ratio, overall pressure ratio, and rated thrust) of the similar engines were selected. If the parameters were within 5% of each other, the combination was considered valid and was added to the ANP database. This process yielded data for less than 60% of the 990 unique EQUIP_IDs of interest. Upon further investigation of a unique EQUIP_ID entry for which noise data could not be established, erroneous and

questionable entries were identified when the ENGINE_MODEL was cross-referenced to FAA or EASA airframe TCDS. Four variables in the AEDT Fleet dB represent the proper entry in the flying fleet: AIRFRAME_MODEL, ACFT_DESCR, MANUF_DESC, and ENGINE_MODEL. In last year's research efforts, only a portion of these erroneous entries were documented, which was finalized in the current research.

Multiple teleconferences were held with the AEDT development team to walk through the recommendations for changes or removal of specific EQUIP_IDs to ensure a thorough understanding. The final ANP extension database and the compiled airframe and engine TCDS were also provided.

Milestone

- Developed a framework for identification of erroneous entries in the Fleet dB.

Major Accomplishments

- Finalized the ANP extension database and created additional certification database and provided to the AEDT development team at the Volpe National Transportation Systems Center.

Publications

None.

Outreach Efforts

None.

Awards

None.

Student Involvement

Bilal Mufti (graduate student): assisted in cross-checking of the Fleet dB with certification data and compiling that data from public sources.

Plans for Next Period

None. All tasks accomplished.

References

None.