

Analysis & Tool Development



Federal Aviation
Administration

Presented to: REDAC E&E Subcommittee

By: Joe Dipardo, Sean Doyle,
Fabio Grandi, Mohammed Majeed

Date: March 18, 2020



Presentation Outline

- **Data and tools infrastructure development implementation**
- **Tools Development**
 - AEDT
 - Noise Screening
 - EVT
- **ASCENT Projects**



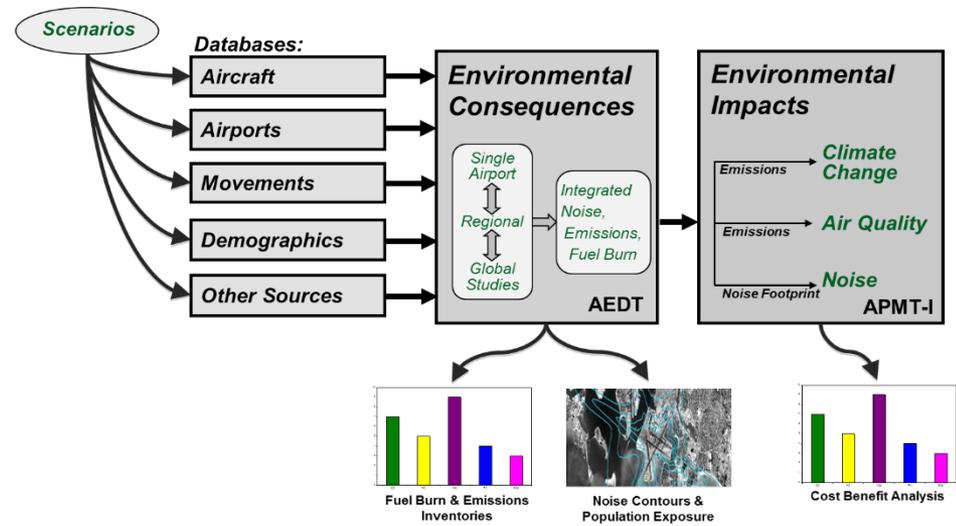
Presentation Outline

- **Data and tools infrastructure development implementation**
- **Tools Development**
 - AEDT
 - Noise Screening
 - EVT
- **ASCENT Projects**



Importance of supporting FAA's renewed vision on sharing resources

- FAA new polices and infrastructure are focused on sharing
- Environmental issues have high visibility
- AEE has developed a variety high quality and high fidelity tools and databases
- Those resources are used for analysis to support
 - Internal and external decision making
 - Public communication
- Agency-wide use of these data and information will improve agency consistency on environmental issues



Providing Consistency across the Agency

- Link data processing and warehousing to a common validated set of data
 - Facilitate access to the data
 - Support a variety of use cases, and promote consistent presentation
- 
- A digital data center visualization. The scene is dark with a strong green glow. In the foreground, several server racks are visible, each displaying a vertical column of binary code (0s and 1s). The racks recede into the distance, creating a sense of depth. Above the racks, a large number of binary digits are scattered across the upper half of the frame, appearing to flow or radiate from a central point. The overall effect is that of a high-tech, data-driven environment.
- Integration will benefit the key environmental programs
 - Aviation Environmental Design Tool (AEDT)
 - Environmental Visualization Tool (EVT)
 - Updated Noise Screening Approach
 - Community Outreach
 - Consistent and validated data and information will ensure better outcomes for the Agency



Technology Welding and Deployment Plan (TWD)

- **Reference data infrastructure fabrication**
 - Identify authoritative data sources
 - Link authoritative sources and reference databases
 - Automation of updates, validation, and maintenance
- **Data processes infrastructure fabrication**
 - Identify existing processes agency-wide
 - Continue development of AEE's processes
 - Plan the integration into a single system
- **Tools infrastructure fabrication**
 - Ensure all environmental tools are linked to the infrastructure
 - Support linking of other tools (e.g. TARGETS)
 - Provide access through a portal

Integrated infrastructure is to reside on the FAA Enterprise Information Management (EIM) system



Progress toward TWD

- **Reference data infrastructure fabrication**
 - The FAA's Data Catalog will be the reference for authoritative data
 - Some external databases will still be required
 - EVT already provides access to authoritative Geographic Information System (GIS) layers
- **Data processes infrastructure fabrication**
 - Trajectory data processing is migrating to the EIM
 - Data access is being provided to existing and upcoming tools
- **Tools infrastructure fabrication**
 - AEDT is integrated
 - The new screening approach will work within the infrastructure
 - EVT is nearing its transition to the FAA's EIM



Presentation Outline

- Data and tools infrastructure development implementation
- **Tools Development**
 - AEDT
 - Noise Screening
 - EVT
- ASCENT Projects



AEDT 3d Current Status

- **AEDT 3d release planned for March 2021**
- **Focus on AEDT maintenance**
- **Usability Improvements**
 - Support for ASIF* import of aircraft noise spectral data
 - Statistical compression for time-above metrics
 - Multi-pollutant modeling for emissions inventory and dispersion modeling
 - Eliminates runs for each pollutant
 - Re-implementation of SOG* emissions generation
 - Workflow changes
 - nvPM* computing method update
 - Measured and smoke number methods
- **Aircraft Fleet Database Update**
 - nvPM database update for engines with measured data

* ASIF: AEDT Standard Input File
SOG: Speciated Organic Gases
nvPM: Non-volatile Particulate Matter



AEDT External Feedback

- **AEDT User Review Group (URG)**
 - Group continues to be fully engaged and is providing valuable feedback on AEDT 3d Sprint releases
 - URG augments system testing of new AEDT features
 - Receiving positive feedback on usability improvements
 - Next meeting (virtual) planned for April 2021
- **AEDT development process review follow-up**
 - Immediate and longer term recommendations will be implemented during AEDT 3e release cycle to improve quality and efficiency
 - Recommendations include virtual classroom training and real-time coaching throughout the development process.



AEDT 3e Development Plan

- **Aircraft Performance**
 - Reconcile APM workflows
- **Emissions & Dispersion Modeling**
 - Aircraft lead emissions and dispersion modeling
 - Update AERMOD source characterization
 - Update to latest AERMOD/AERMET
 - Revise stationary source emissions modeling
 - Taxi fuel burn improvements from ASCENT Project 46
- **Noise Modeling**
 - Mixed ground impedance and terrain modeling (research)
- **User Review Group Recommendations**

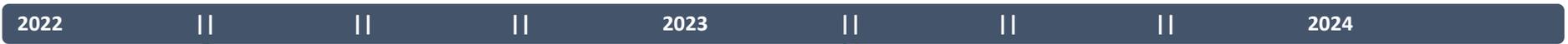


AEDT Future Development Timeline

ACRP 02-52 Noise Modeling of Mixed Ground Surfaces
 ACRP 02-79 Aircraft Noise with Terrain and Manmade Structures
 ASCENT 19 Development of Aviation AQ Tool for Airport-Specific Impact Assessment: AQ Modeling
 ASCENT 45 Takeoff/Climb Analysis to Support AEDT APM Development
 ASCENT 46 Surface Analysis to Support AEDT APM Development
 ASCENT 54 AEDT Evaluation and Development Support



ACRP 02-27 Aircraft Taxi Noise Database
 ASCENT 9 Geospatially Driven Noise Estimation Module
 ASCENT 10 Aircraft Technology Modeling and Assessment
 ASCENT 19 - Development of Aviation AQ Tool for Airport-Specific Impact Assessment: AQ Modeling
 ASCENT 40 Quantifying Uncertainties in Predicting Aircraft Noise in Real-world Situations
 ASCENT 43 Noise Power Distance Re-Evaluation
 ASCENT 54 AEDT Evaluation and Development Support
 ASCENT 60 Analytical Methods for Expanding the AEDT Aircraft Fleet Database



- Aircraft lead emissions and dispersion modeling
- Infrastructure and usability updates to improve efficiency and workflow
- Enhance noise modeling for airports near water
- Modeling noise with Terrain and Manmade Structures
- Updated Delay and Sequencing Model
- APM Reconfigure
- Air quality modeling enhancements



- Higher fidelity aircraft noise characterization
- Supersonic Aircraft performance modeling
- Update GIS engine to reduce development costs
- Helicopter noise modeling improvements
- Taxiway Noise
- Updated Standard Profiles
- Updated Fleet Mapping
- New Air Quality model



Presentation Outline

- Data and tools infrastructure development implementation
- **Tools Development**
 - AEDT
 - **Noise Screening**
 - EVT
- ASCENT Projects



Noise Screening Overview

Rethinking Noise Screening

- **Based on additional intra-agency coordination and feedback two key areas for improvement were identified:**
 - Increased Efficiency – both Time and Resources
 - Ability to share more detail from noise screening with the public

A “Traditional” noise screening approach can address efficiency, but is limited in the detail it can provide
- **Can the concept of Noise Screening be refactored to improve fidelity based on emerging data and analytical capabilities?**



Noise Screening Data

Capabilities and Data Now available:

- **Pre-conditioned Flight Track Data**
 - Automation of an AEDT optimized flight track dataset and storage on FAA Enterprise Information Management (EIM) System
 - Validated against all requirements required for public distribution
- **Airport specific Noise and Emissions Inventory Datasets**
 - Processing now deployed to AEE's Virtual Private Cloud (VPC)
 - Development of automation tools for Aircraft Fleet Assignments and Flight Track data refinement/management
 - Quarterly release cycle
- **Integrated results data storage and visualization capabilities**
 - EIM data storage and management of noise and emissions results
 - GIS enabled noise screening reports



Proposed Noise Screening Process

Proposed Process

1. Noise inventory results will be used to provide the overall baseline noise exposure conditions : **Available in EIM**
 2. Inputs specific to flight track and operations associated to just the proposed action (before and after action) will be identified and modeled in AEDT through a streamlined process: **Limited development required**
 3. The acoustic difference associated with the change identified in step 2 will be applied to the baseline noise from step 1 to determine the final overall proposed action noise result: **Limited development required**
 4. The specific noise changes determined in step 2 and the final overall proposed action noise results from step 3 will then be visualized through EVT on a noise screening report template: **Coordinating with EVT development**
- FAA is coordinating internally to inform the format of the noise screening report as well as to identify any tool or analysis gaps
 - A validation study will be required prior to final implementation
 - Release schedule is TBD, targeting the beginning of FY22 and also seeking coordinating with any required changes needed with FAA Order 1050.1F and the associated desk reference



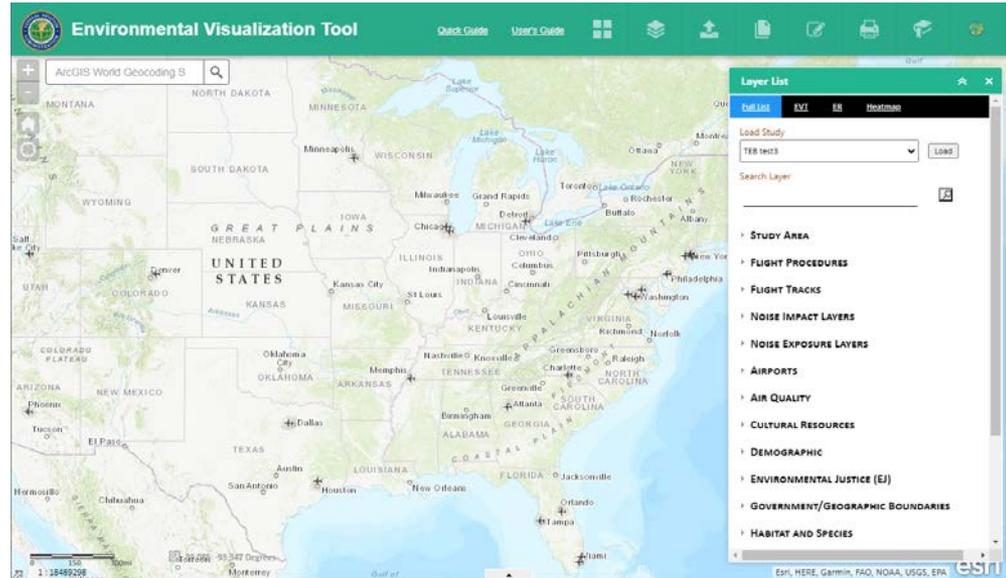
Presentation Outline

- Data and tools infrastructure development implementation
- **Tools Development**
 - AEDT
 - Noise Screening
 - **EVT**
- ASCENT Projects



Environmental Visualization Tool (EVT)

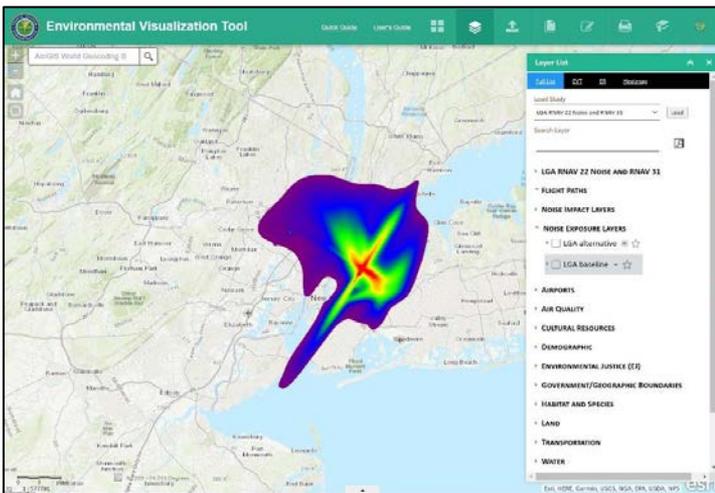
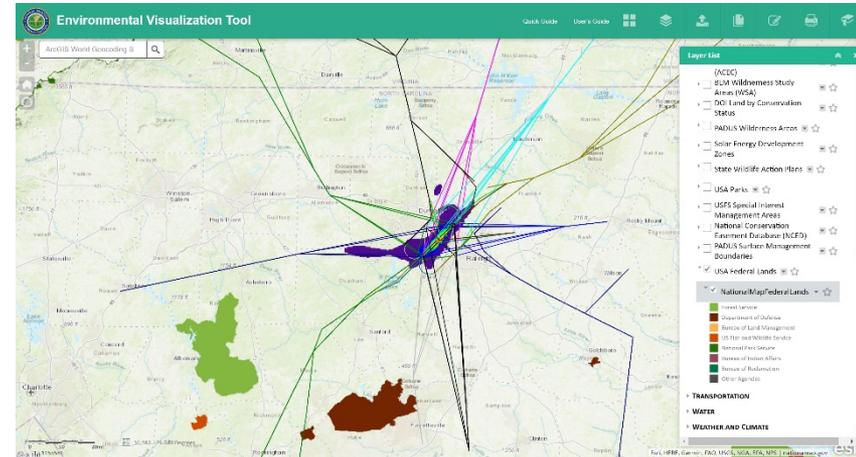
- A Web-mapping application to quickly and easily create customized maps using uploaded or built-in data layers
- Support Environmental Specialists in viewing and creating customized maps to assess environmental impacts
- Available within the FAA network via a web browser (<http://evt.faa.gov/>)
- Can help maintain consistency of information and presentation in community outreach activities
- Links to over 100 layers from a variety of authoritative sources
- Allows user-data upload in a variety of formats



EVT Development Updates (1 of 2)

• System Level Updates

- Updated to the latest release of the ESRI software
- Released updated user guide
- Continuing to work on the Migration to the EIM and FCS* systems
- Continuing the development of the 3D version
- Assessing AEDT-TT* data integration approach



• Recently released App Functionality

- Ability to create a Heatmap layer from uploaded noise data
- Ability to visualize waypoints
- Ability to upload data using MSEXCEL files or comma-delimited formatted text files
- Allow the user to edit the symbology for noise data to customize size and attributes

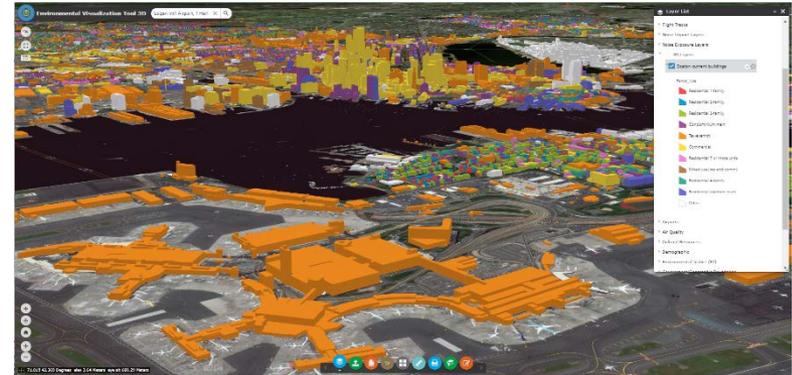
* FCS: FAA Could Services
AEDT-TT: AEDT Threaded Tracks



EVT Development Updates (2 of 2)

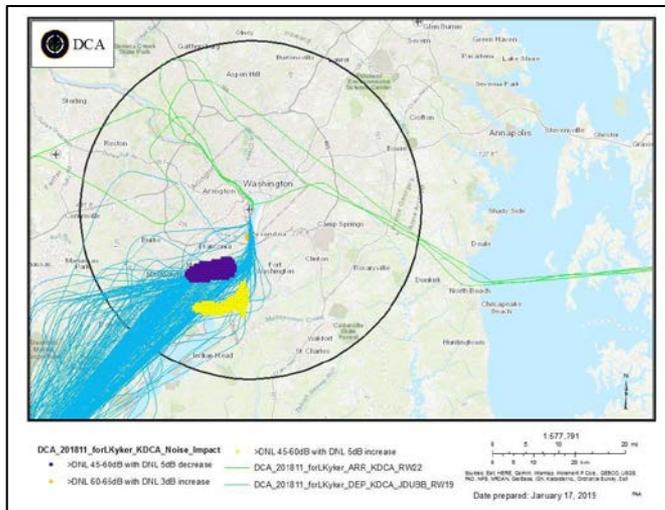
- **Ongoing Development**

- Explore visualizing only one segment of a procedure at a time
- Complete Heat Map widget in EVT 3D
- Add title and legend to print output in EVT 3D Print widget
- Research 3D building data layer providers



- **Planned work (preliminary)**

- Complete migration to the EIM and implementation of PIV-managed access
- Complete development of 3D functionality and release merged application
- Continue implementation of stakeholder requested functionality (e.g. easier TARGETS* integration, email address for support, 3D ‘curtains’ visualization)
- Ability to query georeferenced information based on map features
- Add more advanced trajectory data functionality



* TARGETS: Terminal Area Route Generation and Traffic Simulation



Presentation Outline

- Data and tools infrastructure development implementation
- Tools Development
 - AEDT
 - Noise Screening
 - EVT
- **ASCENT Projects**



ASCENT Project 9: Geospatially Driven Noise Estimation Module

Institution: Georgia Institute of Technology

Funding: \$250,000/yr. for 3 years

Objective: Develop a novel geospatially driven noise estimation module to support computation of noise resulting from the operation of Unmanned Aircraft Systems (UAS) and other upcoming vehicle concepts.

Approach:

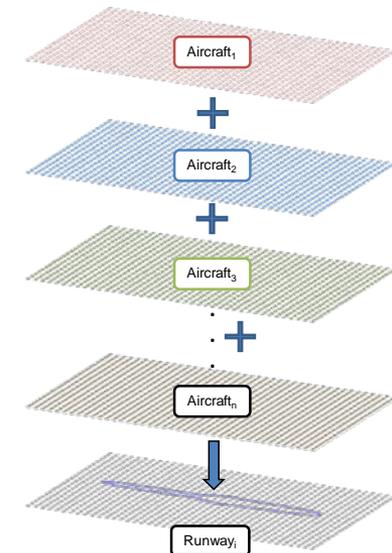
- Leverage emerging computational technologies
- Develop a module that can be connected to other applications
- concept of precomputed noise grid tiles addition

Expected Impact:

Develop a tool to evaluate noise exposure from UAS/UAM vehicles to provide decision-makers with insight on where the noise might be distributed or concentrated.

Status:

- Reviewing option for using Open Source GIS software
- Coordinating with Assure COE eCommerce projects on input/outputs



ASCENT Project 53: Validation of Low-Exposure Noise Modeling by Open-Source Data Management and Visualization Systems Integrated with AEDT

Institution: Stanford University

Funding: \$400,000/yr. for 4 years

Objective: MONA aims to provide real-time and objective data, analyses, and reports on Metroplex operations. The focus of the first year of this ASCENT project is to improve upon the noise predictions of MONA through tighter integration with AEDT.

Approach:

- Integrate and automate AEDT's noise analysis capabilities to MONA
- Validate and Verify (V&V) AEDT's noise predictions in 55-65 db DNL areas
- Propose software engineering/architectural choices for AEDT v5 to enhance usability

Expected Impact: Provide the capability to perform timely complex noise analyses in metroplexes with the development of a validated data science scalable infrastructure that can serve very large analyses and impact analyses. Apply the capability to develop a proposal for approach routes into SFO (focusing on the SERFR, BDGA, and PIRAT routes) that have the potential to reduce noise impacts on the overflowed public.

Status:

- Working on the automated setup and execution of AEDT
- Setting up the processes necessary to allow comparison between measured and modeled noise exposure levels below DNL 65dB



* MONA: Metroplex Overflight Noise Analysis



ASCENT Project 54: AEDT Evaluation and Development Support

Institution: Georgia Institute of Technology

Funding: \$700,000/yr. for 3 years

Objective: Provide data and methods to continue to improve the aircraft weight, takeoff thrust, and departure and arrival procedure modeling capabilities within the FAA's Aviation Environmental Design Tool (AEDT).

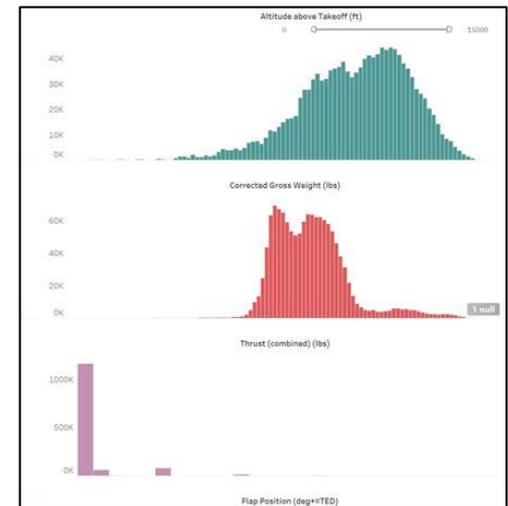
Approach:

- Improve AEDT modeling assumptions through the use of industry and airport flight operational data
- Utilize real-world data flight and noise monitoring data to improve departure, full flight, and arrival modeling
- Evaluations and assess AEDT's software releases

Expected Impact: Improve AEDT's accuracy by modernizing its departure profiles and arrival procedures to reflect current airport operations and enroute modeling and by providing recommendations for enhancements to the AEDT APM*.

Status:

- Recommended two Noise Abatement Departure Procedures (NADP1 and NADP2) to replace the outdated ICAO A and ICAO B procedures in AEDT.
- Continuing to provide critical system level testing of new AEDT features



* APM: Aircraft Performance Module



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

Institution: Georgia Institute of Technology

Funding: \$150,000/yr. for 3 years

Objective: improve the accuracy of Aviation Environmental Design Tool (AEDT) noise and emissions modeling of aircraft not currently in the Aircraft Noise and Performance (ANP) database.

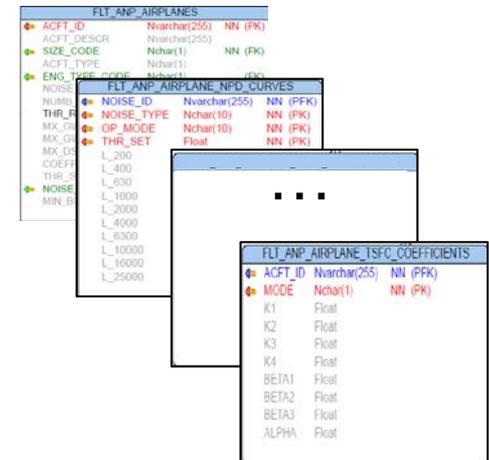
Approach:

- Study the characteristics of the aircraft currently missing from the AEDT database and identify distinct types
- Use quantitative and qualitative analytical methods to develop the aircraft ANP and noise data and validate them against flight data and physics-based modeling data
- Develop recommendations and guidelines for how to implement the developed data in AEDT

Expected Impact: Enhance AEDT's environmental modeling accuracy by expanding the AEDT FLEET database to include the noise and performance data of aircraft types that are currently missing

Status:

- Working with the AEDT development team on identifying aircraft without native ANP representation.
- Working on clustering methods for identifying best representative vehicles for modeling these aircraft.



ASCENT Project 62: Noise Model Validation for AEDT

Institution: Georgia Institute of Technology & Pennsylvania State University

Funding: \$350,000

Objective: This project focus is to assess the accuracy of AEDT in estimating noise in both the vicinity of airports as well as further afield.

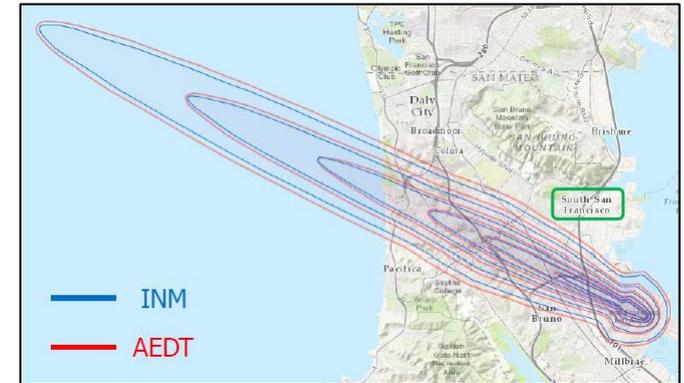
Approach:

- Quantify the new noise modeling capabilities based on comparison to field measurement data from DIA and other airport monitoring systems.
- Include in the validation the effects of noise propagation, ground terrain, and meteorological conditions using data from low-earth-orbit satellites.
- Combine the DIA results with those from the prior validation and verification of the Integrated Noise Modeling (INM)

Expected Impact: Provide a noise model validation benchmark that can be used not only to respond to questions on AEDT noise prediction accuracy, but also to allow the tool development team to prioritize further development of modeling features and enhancements that will improve the predictive capability with respect to real world measurement data.

Status:

- Evaluating the latest AEDT capabilities and data availability in predicting both aircraft performance and acoustic propagation.
- Gathering noise monitoring, flight operations, trajectory, flight recorder and detailed weather data
- Reviewing the INM “Denver Study” data and experience for applicability to the current work and tools



Questions?

