FAA CENTER OF EXCELLENCE FOR ALTERNATIVE JET FUELS & ENVIRONMENT

Noise Power Distance Re-Evaluation

Project 43

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ASCENT Project 43

Noise Power Distance Re-Evaluation

Georgia Institute of Technology

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Cost Share Partner: Industry in-kind

Objective:

Construct an NPD correction function for implementation in AEDT to account for changes in source noise due to flight configuration, speed from the baseline conditions

Project Benefits:

- AEDT can better capture changes in approach noise emissions due to aircraft configuration
- Potential improvement from default AEDT calculations for analyzing approach noise

Research Approach:

- ANOPP is used to capture configuration-related noise results for range of engine parameters across different aircraft classes
- Regression model is generated to calculate difference between baseline NPD and specific aircraft configuration NPD
- Correction function is implemented with FOQA data in AEDT and validated against real-world noise monitor data

Major Accomplishments (to date):

- Designed correction functions for 50, 150, 210, and 300pax aircraft classes
- Validated 150pax correction function against real-world noise monitor data at SFO; simulated tracks using the correction function resulted in noise readings closer to the noise monitor readings than default AEDT simulated tracks for 7/11 cases

Future Work / Schedule:

- AEDT corrected NPDs will be compared against high fidelity data to ensure accuracy
- Provide initial implementation plan for AEDT to developers and refine based on feedback for all classes

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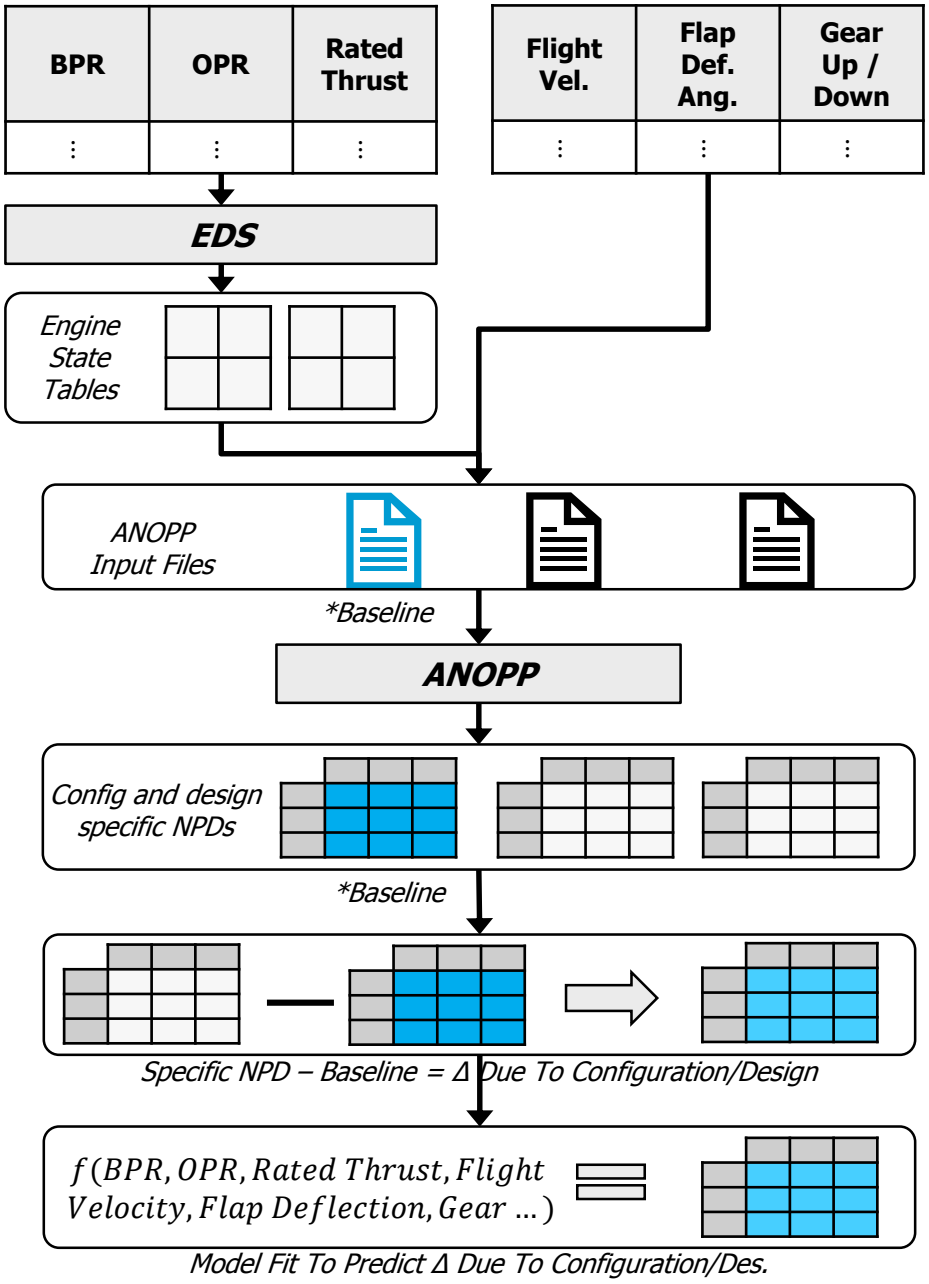
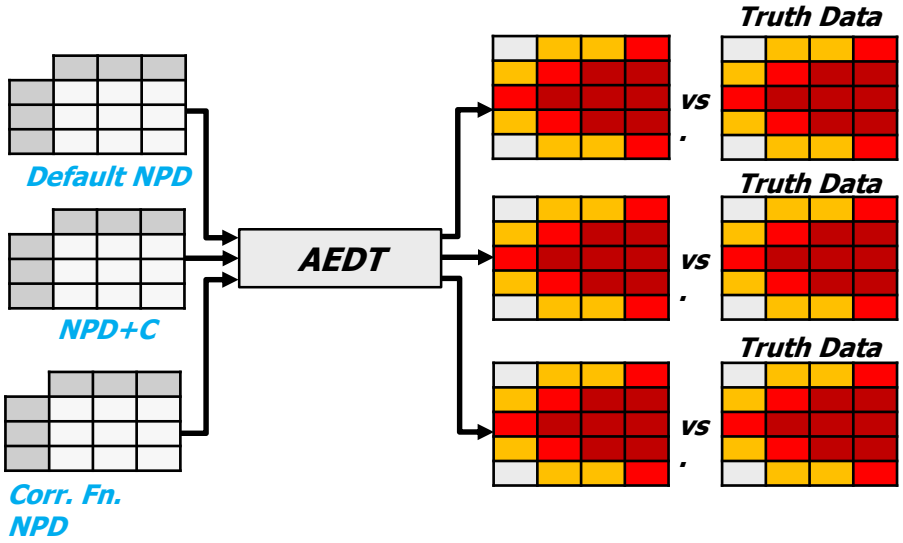
Correction Function Generation



Correction Function Validation



Running trajectories in AEDT with default NPDs, ANOPP-generated NPD+Cs, and correction function-adjusted NPDs to compare with SFO truth data. Three aircraft chosen for initial checkout:

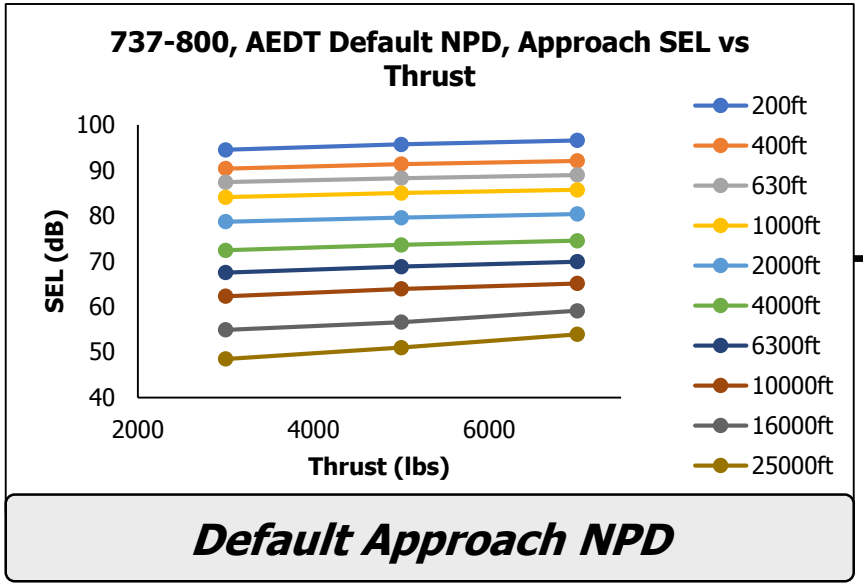
***Original Aircraft (ex: 737-800)**;*
- *Can correction function accurately account for configuration changes?*

***Aircraft Variant (ex: 737-900)**;*
- *Can correction function be applied to variants of the same aircraft?*

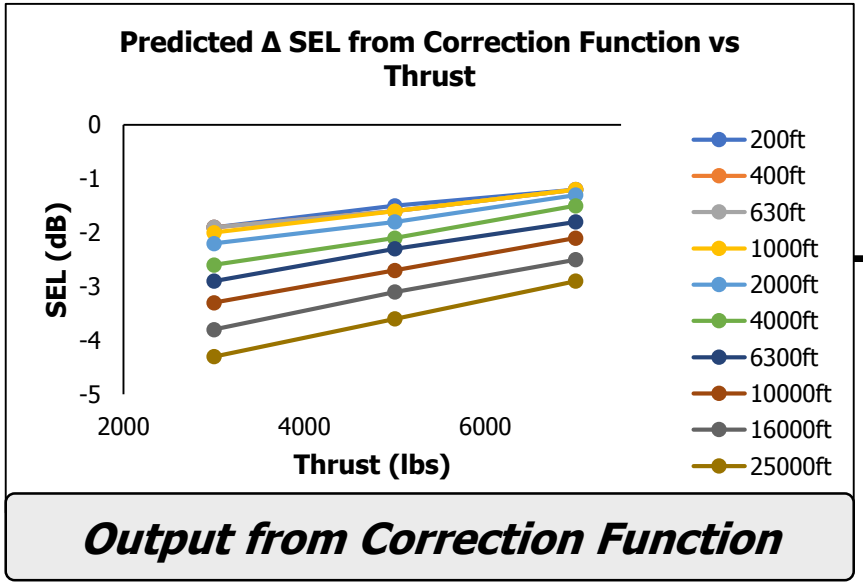
Different Aircraft in Same class (ex: A320);
- *Can correction function be applied to different aircraft in same class?*

Assessing which method provides the most accurate noise prediction compared to the truth data, and if correction function can be used across wider range of aircraft

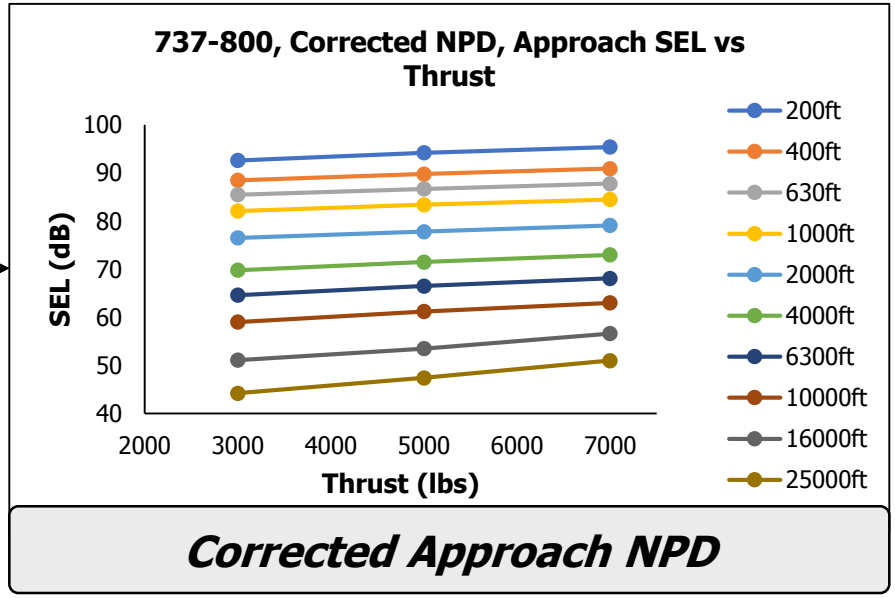
Example of Correction Function Output



Default Approach NPD



Output from Correction Function

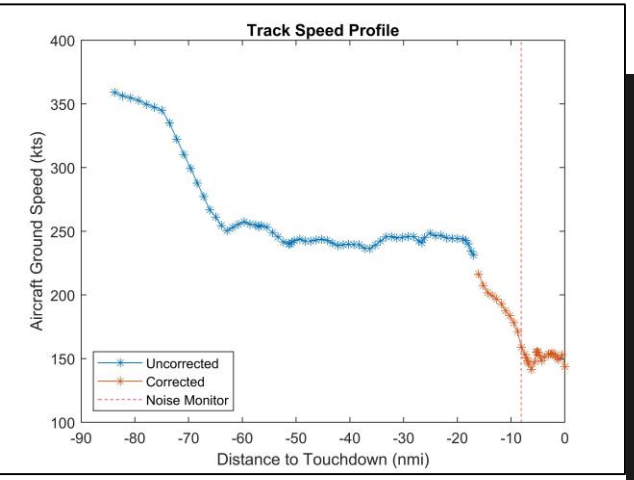


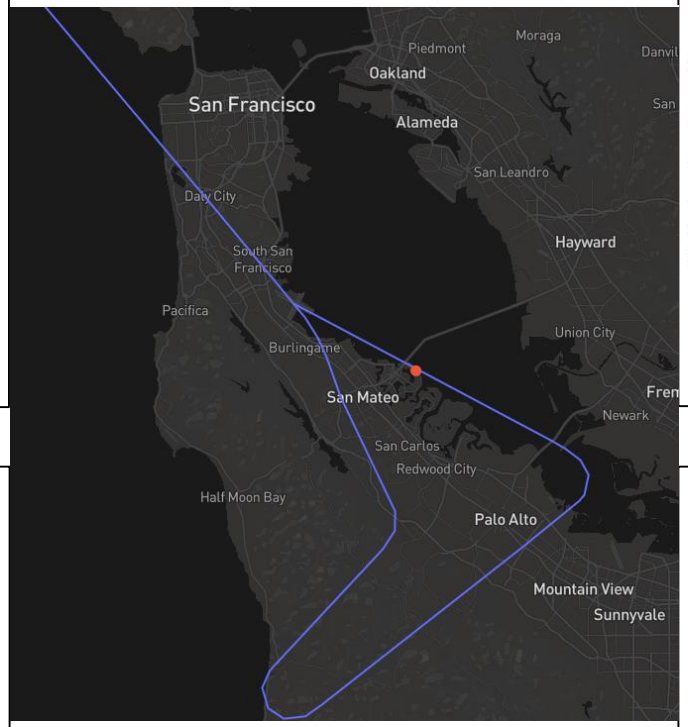
Corrected Approach NPD

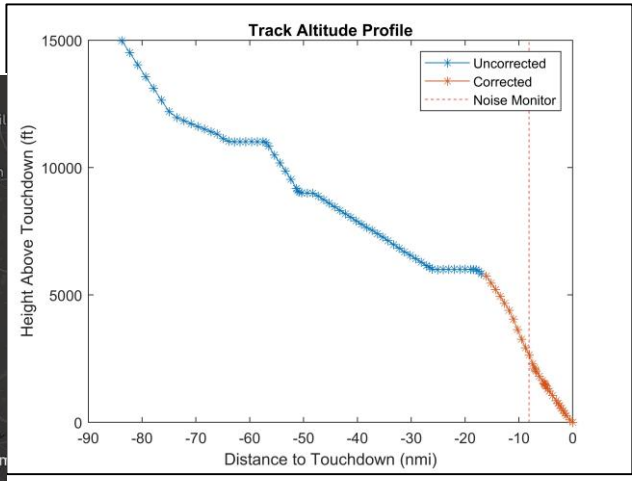
- Adding the predicted noise Δ to the default NPD creates corrected NPD for a given configuration

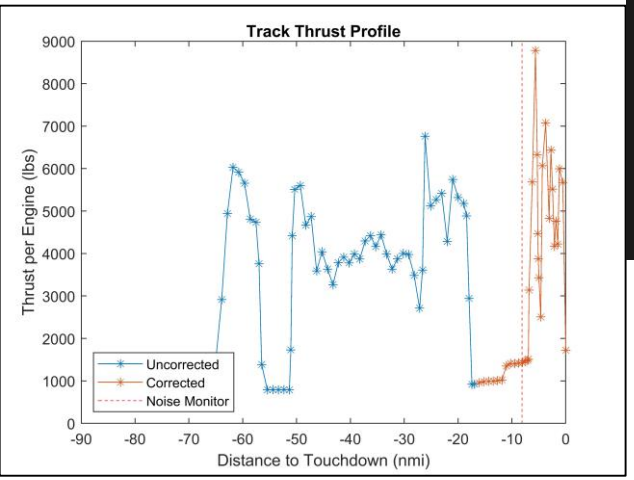
Application to FOQA Tracks

Sample B737-800 FOQA profile:

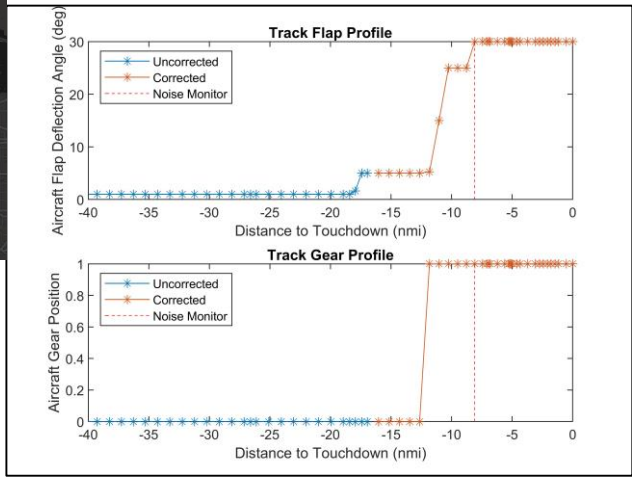








Track shown in blue, noise monitor shown in red



Noise comparison using FOQA and noise monitor data

Airframe	Noise Monitor Measurement (dB)	Modeled Uncorrected Value (dB)	Modeled Corrected Value (dB)	Difference Between Corrected and Noise Monitor (dB)	Difference Between Corrected and Noise Monitor (%)
B737-800	83.8	78.22	79.98	3.82	-4.56%
B737-800	81.4	77.72	76.83	4.57	-5.61%
B737-800	83.2	76.13	75.31	7.89	-9.48%
B737-800	79.1	76.75	77.9	1.2	-1.52%
B737-900ER	83.4	77.47	77.52	5.88	-7.05%
B737-900ER	80.5	74.84	74.36	6.14	-7.63%
B737-900ER	82.1	78.87	81.51	0.59	-0.72%
B757-300	80.8	71.95	75.06	5.74	-7.10%
B757-300	80.4	77.85	79.88	0.52	-0.65%
B757-300	79.8	80.91	81.06	-1.26	1.58%
A320-211	81.8	76.2	79.48	2.32	-2.84%

- 11 FOQA tracks were simulated using the 150pax CF
  - 7/11 cases corrected the AEDT noise measurement towards the real-world noise monitor measurement
  - All cases resulted in corrected noise values within 10% of the real-world noise monitor measurement