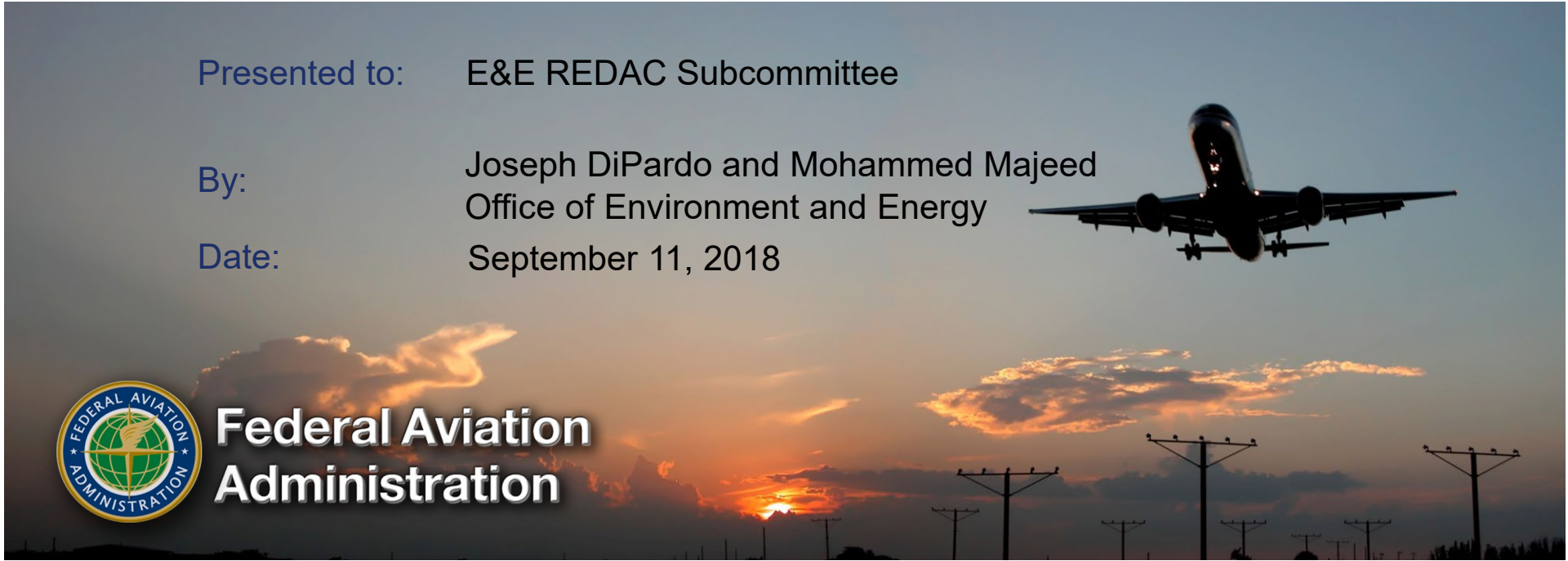
AEDT Status and Development Plan



Presented to: E&E REDAC Subcommittee

By: Joseph DiPardo and Mohammed Majeed
Office of Environment and Energy

Date: September 11, 2018

Federal Aviation Administration

Outline

- **AEDT Current Status**
  - New Performance Model (BADA 4)
  - Reduced Thrust Takeoff and Alternative Weight
- **AEDT Near Term Development (FY19 – FY21)**
- **AEDT Future Development (FY22+)**
- **Summary**

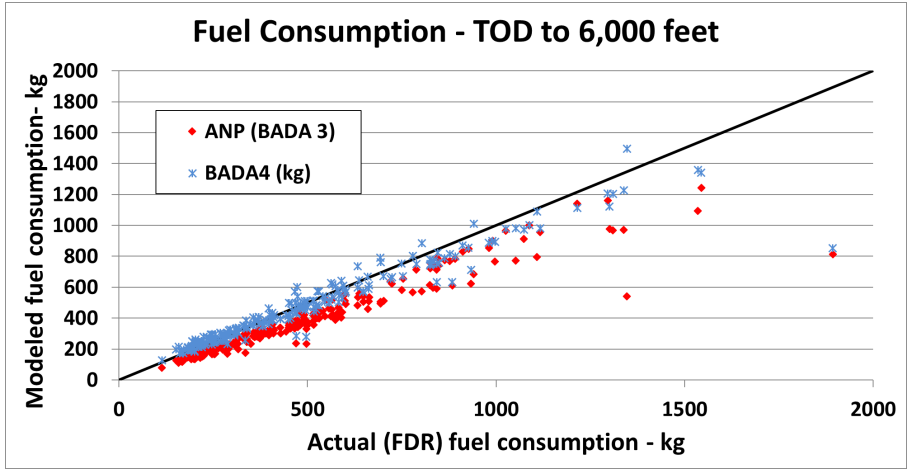
AEDT Status

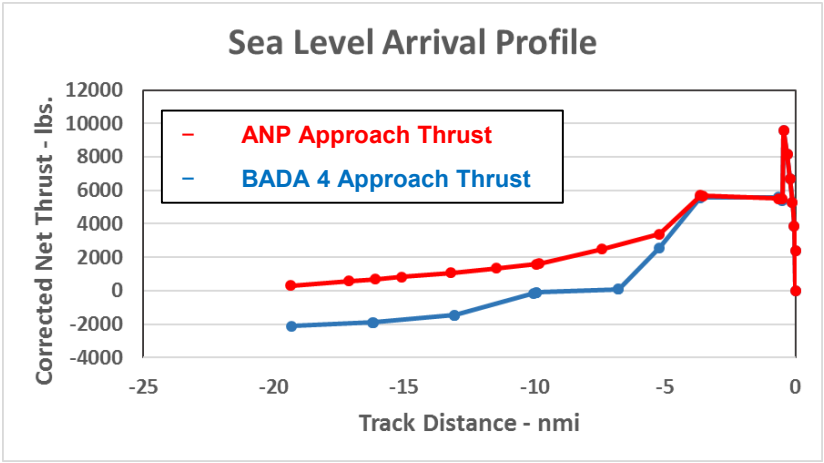
- **AEDT 3a scheduled for release in September 2018**
- **Aircraft performance modeling update**
  - BADA4 implementation provides more accurate and unified modeling of aircraft performance for both terminal area and cruise operations
  - Improved aircraft takeoff weight and takeoff thrust modeling to better represent flight operations
  - Guidance document for reduced thrust and alternate weight modeling
- **nvPM methods for CAEP analysis**
- **Fleet database updates**
  - Gulfstream G650; Boeing 737- MAX8; Boeing 737-800 Approach
- **Windows 10 compatibility**

Notes:
1. BADA = Base of Aircraft DAta
2. nvPM = Non-Volatile Particular Matter
3. CAEP = International Civil Aviation Organization (ICAO) Committee on Environmental Protection

Improved Performance Model

- **BADA 4 improves accuracy of fuel burn calculation below cruise.**
  - Necessary for NextGen procedure benefits analysis



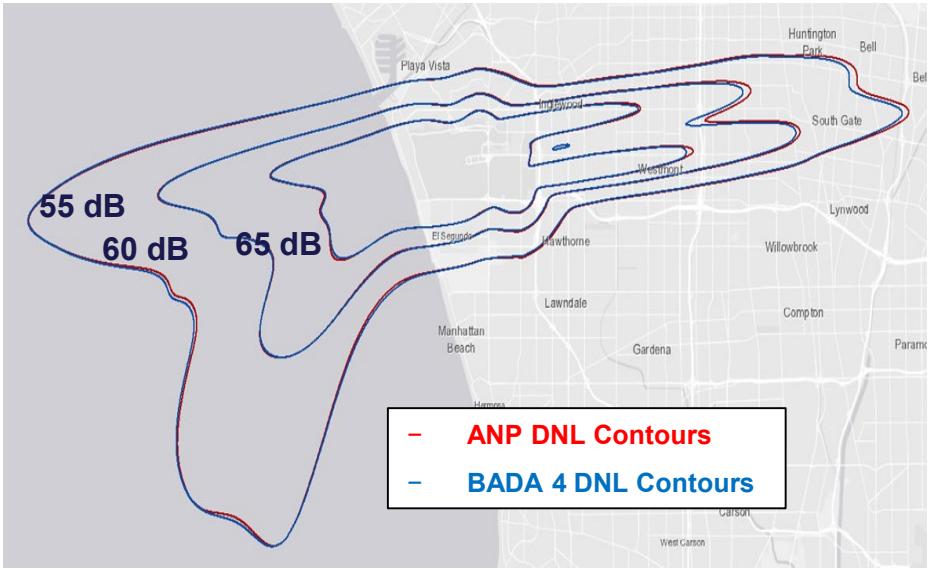


- **BADA 4 improves fidelity on approach modeling producing more accurate thrust levels compared to ANP model.**

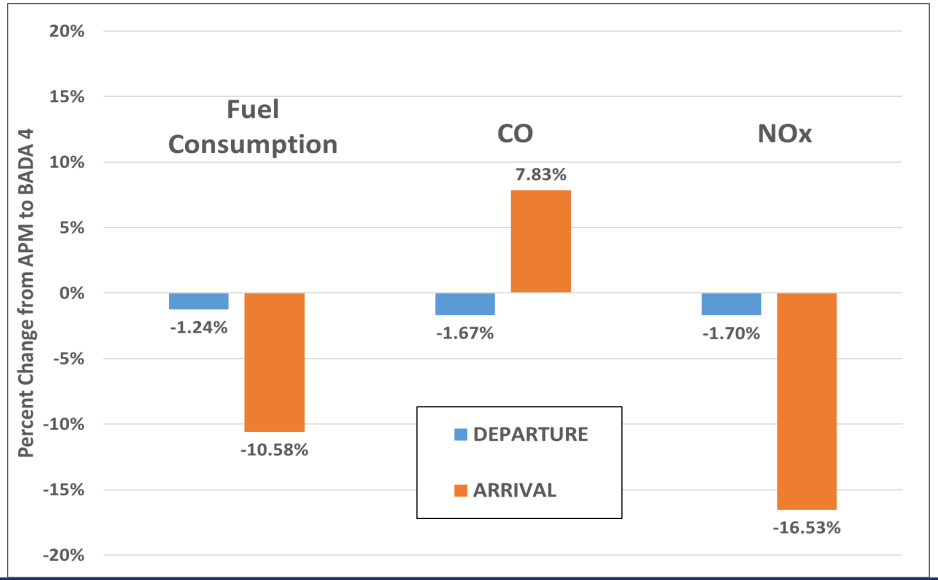
Notes:
1. ANP = Aircraft Noise and Performance

Airport Level Results

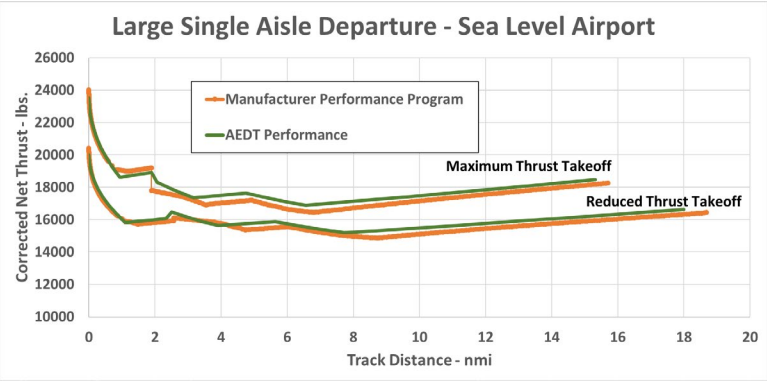
- **BADA 4 performance has small effect on noise**
  - DNL noise contours roughly 2% smaller with BADA 4 on average

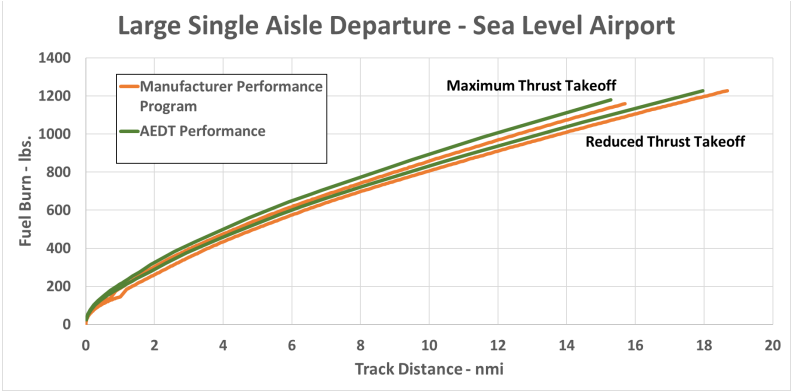


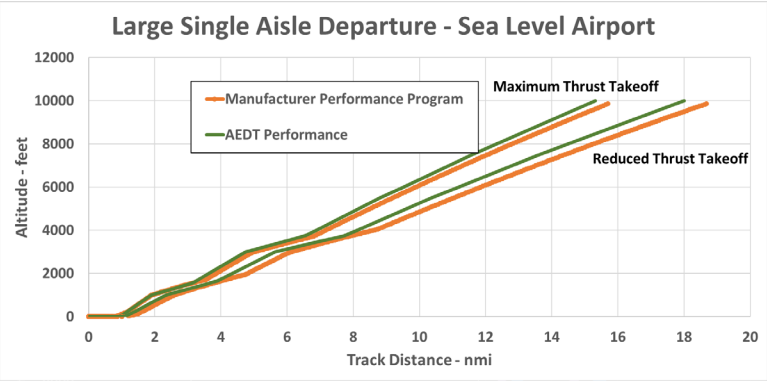
- **BADA 4 performance effect on fuel burn varies by fleet mix**
  - Total (departure and arrival) fuel burn below 10K feet roughly ±5% change with BADA 4

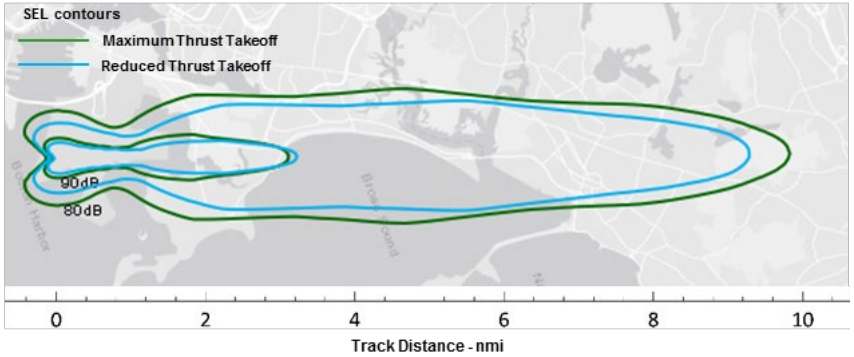


Reduced Thrust Takeoff



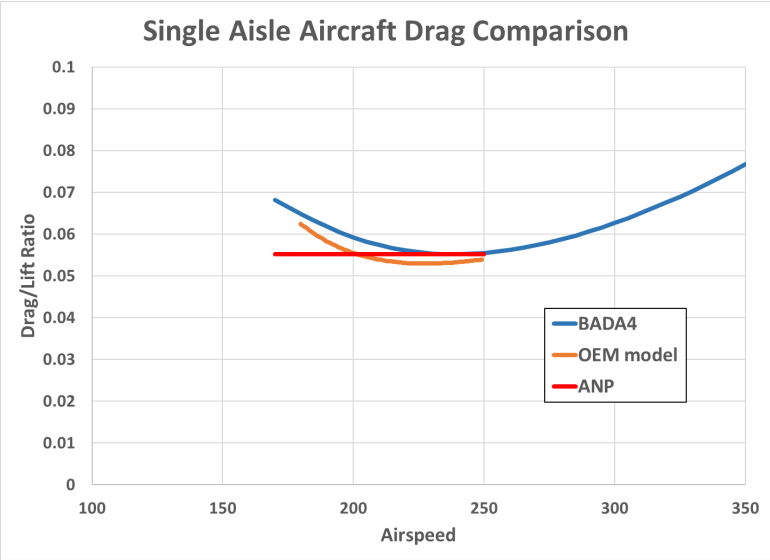


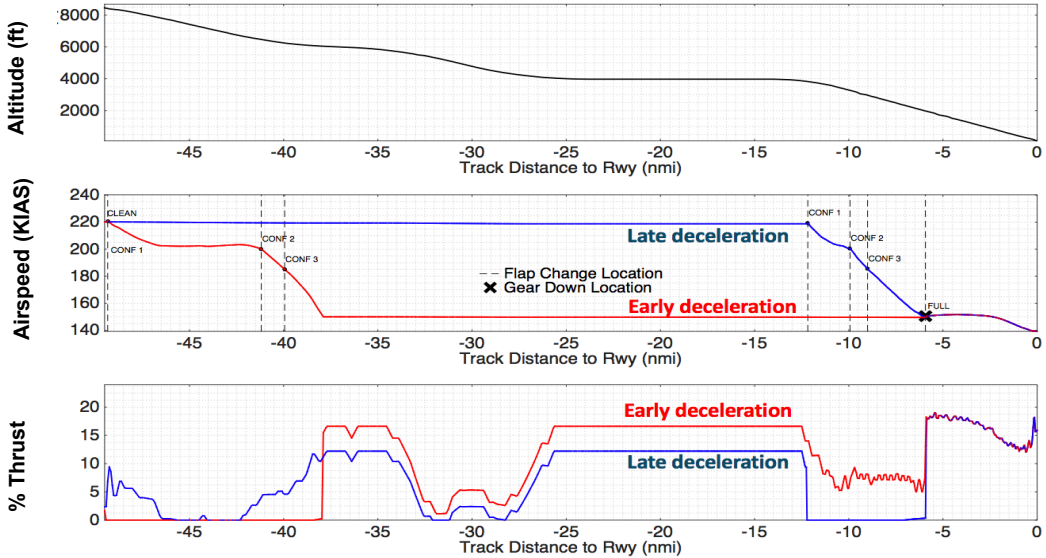




Higher Fidelity Modeling

- **Higher fidelity BADA 4 performance data will allow for more detailed procedure modeling**
  - **Captures configuration and speed changes of advanced operational procedures**





AEDT 3x Development Goals (FY19-FY21)

- **Further improve the tool's efficiency and user workflow**
  - Apply lessons learned from user feedback and improved technologies
- **Expand and refine ground operations modeling capabilities**
  - Implement latest Taxi operations research
- **Improve terminal area noise modeling for airports near water**
  - Implement latest noise propagation research
- **Improve helicopter noise modeling**
  - Expand helicopter noise database
  - Improve helicopter procedure modeling
- **Enhance air quality modeling**
  - Provide EPA screening options for 1-hour NO_2 modeling
  - Improve characterization of aircraft exhaust emissions

AEDT 4 Development Goals (FY22+)

- **Higher fidelity noise characterization**
  - More accurately model benefits of NextGen advanced operational procedures and support innovative noise abatement procedure designs aimed at preserving fuel efficiency
- **Incorporate improved version of EPA's AERMOD for local-scale airport air quality modeling**
  - Improvements critical to achieving NAAQS and NEPA compliance thereby avoiding delays in project milestones or schedule
- **Include capabilities to model supersonic aircraft performance in cruise which is critical to support rulemaking**
  - Complete the supersonic modeling capability to cover the full gate-to-gate operation
- **Environmental analysis of commercial space operations**

ASCENT Projects Supporting AEDT Development

- **ASCENT 9 GIS-based Noise Estimation Tool**
  - Update AEDT GIS engine to improve efficiency and lower development costs
- **ASCENT 10 Aircraft Technology Modeling and Assessment**
  - Enable modeling of supersonic aircraft in AEDT
- **ASCENT 19 Development of Aviation AQ Tool for Airport-Specific Impact Assessment: AQ Modeling**
  - Enhance air quality modeling in AEDT
- **ASCENT 23 Noise from Advanced Operational Procedures**
  - Account for airframe noise in AEDT noise model
- **ASCENT 36 Parametric Uncertainty Assessment for AEDT**
  - Provide uncertainty evaluation of the AEDT to inform future development
- **ASCENT 38 Rotorcraft Noise Abatement Procedures Development**
  - Develop noise abatement modeling capability in AEDT

ASCENT Projects Supporting AEDT Development

- **ASCENT 40 Quantifying Uncertainties in Predicting Aircraft Noise in Real-world Situations**
  - Support development of AEDT enhanced aircraft noise model
- **ASCENT 43 Noise Power Distance Re-Evaluation**
  - Develop higher fidelity aircraft noise characterization
- **ASCENT 44 Aircraft Noise Abatement Procedure Modeling and Validation**
  - Support validation of AEDT aircraft noise model
- **ASCENT 45 Takeoff/Climb Analysis to Support AEDT APM Development**
  - Develop reduced thrust takeoff capability in AEDT
- **ASCENT 46 Surface Analysis to Support AEDT APM Development**
  - Support development of taxiway noise and emissions modeling in AEDT

AEDT Future Development Goals

ACRP 02-27 Aircraft Taxi Noise Database
ACRP 02-52 Noise Modeling of Mixed Ground Surfaces
ACRP 02-55 Enhanced AEDT Modeling of Aircraft Arrival and Departure Profiles
Volpe helicopter polar sphere research
ASCENT 19 Development of Aviation AQ Tool for Airport-Specific Impact Assessment: AQ Modeling
ASCENT 36 Parametric Uncertainty Assessment for AEDT
ASCENT 38 Rotorcraft Noise Abatement Procedures Development
ASCENT 45 Takeoff/Climb Analysis to Support AEDT APM Development
ASCENT 46 Surface Analysis to Support AEDT APM Development

ACRP 02-66 Commercial Space Operations Noise and Sonic Boom Modeling and Analysis
ACRP 02-79 Aircraft Noise with Terrain and Manmade Structures
ACRP 02-81 Commercial Space Operations Noise and Sonic Boom Measurements
ACRP 02-85 Commercial Space Vehicle Emissions Modeling
ASCENT 9 GIS-based Noise Estimation Tool
ASCENT 10 Aircraft Technology Modeling and Assessment
ASCENT 19 - Development of Aviation AQ Tool for Airport-Specific Impact Assessment: AQ Modeling
ASCENT 23 Noise from Advanced Operational Procedures
ASCENT 36 Parametric Uncertainty Assessment for AEDT
ASCENT 40 Quantifying Uncertainties in Predicting Aircraft Noise in Real-world Situations
ASCENT 43 Noise Power Distance Re-Evaluation (Research)
ASCENT 44 Aircraft Noise Abatement Procedure Modeling and Validation

2019 | 2020 | 2021 | 2022

- Infrastructure and usability updates to improve efficiency and workflow
- Software maintenance updates
- Updates to add new airplane and helicopter models to the noise and performance database
- Enhance enroute performance calculations
- Potential enhancements of reduced thrust and takeoff weight implementation
- Enhance noise modeling for airports near water
- Taxiway Modeling (Noise and Emissions)
- Helicopter noise modeling improvements
- Air quality modeling enhancements

- Higher fidelity aircraft noise characterization
- Update GIS engine to reduce development costs
- Supersonic airplane performance (gate to gate)
- Modeling noise with Terrain and Manmade Structures
- Commercial Space
- New Air Quality model

AEDT 3x – Release AEDT updates biannually

AEDT 4a

AEDT 4x – Release updates biannually

Summary

- **AEDT 3a will introduce two new features to its users**
  - An improved performance model that results in more accurate fuel burn and emissions estimates below cruise, and;
  - Reduced Thrust Takeoff and Alternative Weight procedures that offer greater flexibility in modeling aircraft departures
- **ASCENT research supported reduced thrust and alternative weight implementation and provided critical V&V of BADA 4 implementation**
- **ASCENT will continue to support near term (AEDT 3x) and future (AEDT 4) development**
  - ASCENT projects include helicopter noise modeling, taxi modeling, high fidelity noise characterization, supersonic aircraft modeling, and air quality modeling
- **Delays in ASCENT funding will impact AEDT development timeline**