



Aviation Environmental Design Tool (AEDT)

22nd Annual UC Symposium on
Aviation Noise and Air Quality

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U.S. DOT/Volpe Center

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AEDT Development Team



**Georgia
Tech**



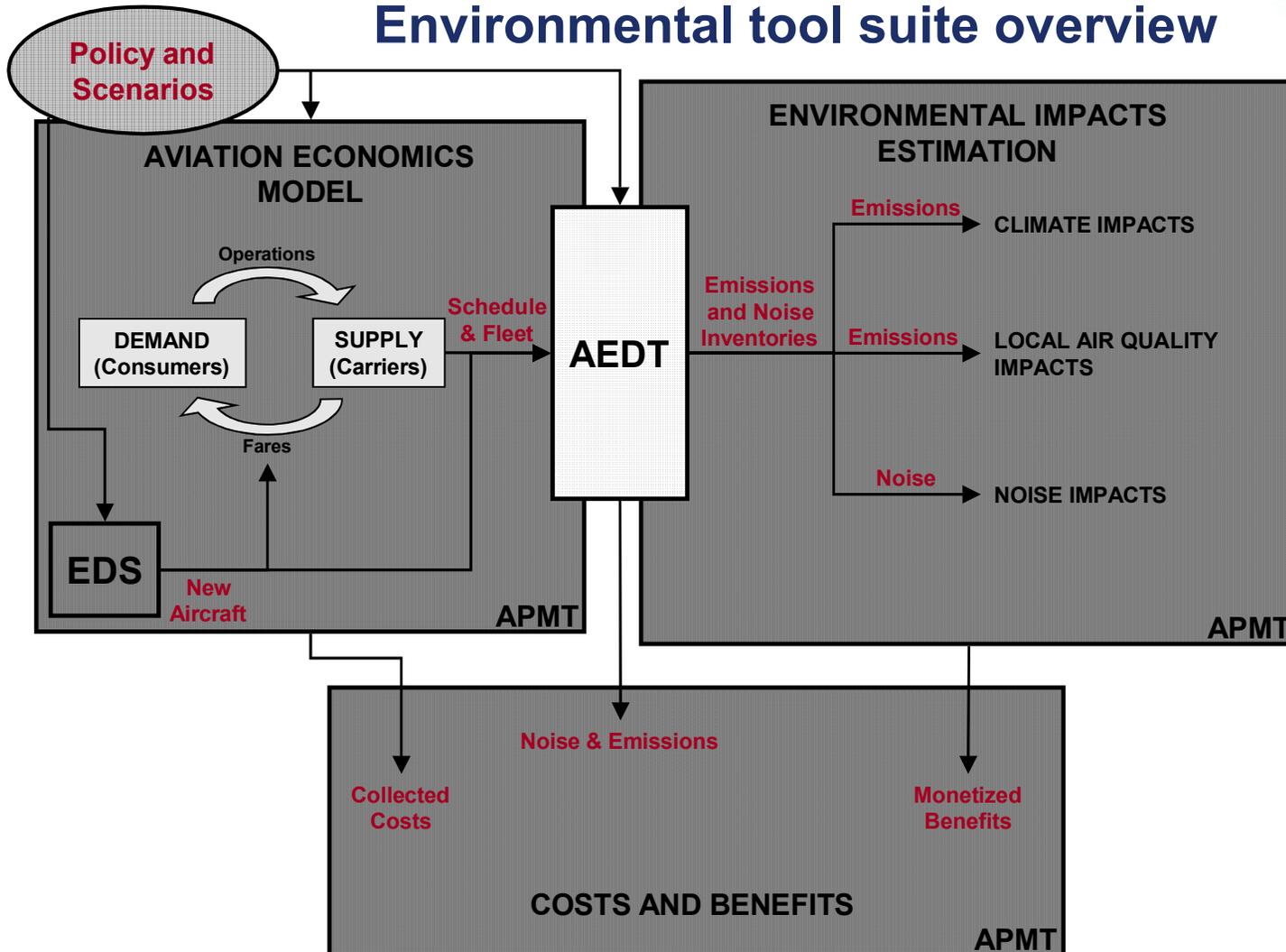
wyle
laboratories



Outline

- Statement of needs and motivation
 - ICAO/CAEP and JPDO
 - Legacy Models and User Community
- AEDT Version 1.0 – Current State
 - Databases
 - Modules
- Capability Demonstration
- Schedule
- Next Steps

Environmental tool suite overview





Motivation: ICAO/CAEP and JPDO

- Upon completion AEDT is designed to interface with EDS and APMT to provide users with the necessary information for future aircraft so as to:
 - Enable more informed Federal research, policy and budgetary decision-making (JPDO, FAA, NASA, EPA, Industry)
 - More effectively assess and communicate environmental effects, interrelationships, and economic consequences based on integrated analyses (JPDO, FAA, ICAO-CAEP, Industry)
 - Facilitate international agreements on standards, recommended practices, and mitigation options for international policy making (ICAO-CAEP, FAA, Industry)
 - Serve as a mechanism for an expert-driven process for collecting, incorporating and quantifying long-term technology impact assessments (JPDO, FAA, NASA, ICAO-CAEP, Industry)



AEDT Users

SAGE and MAGENTA

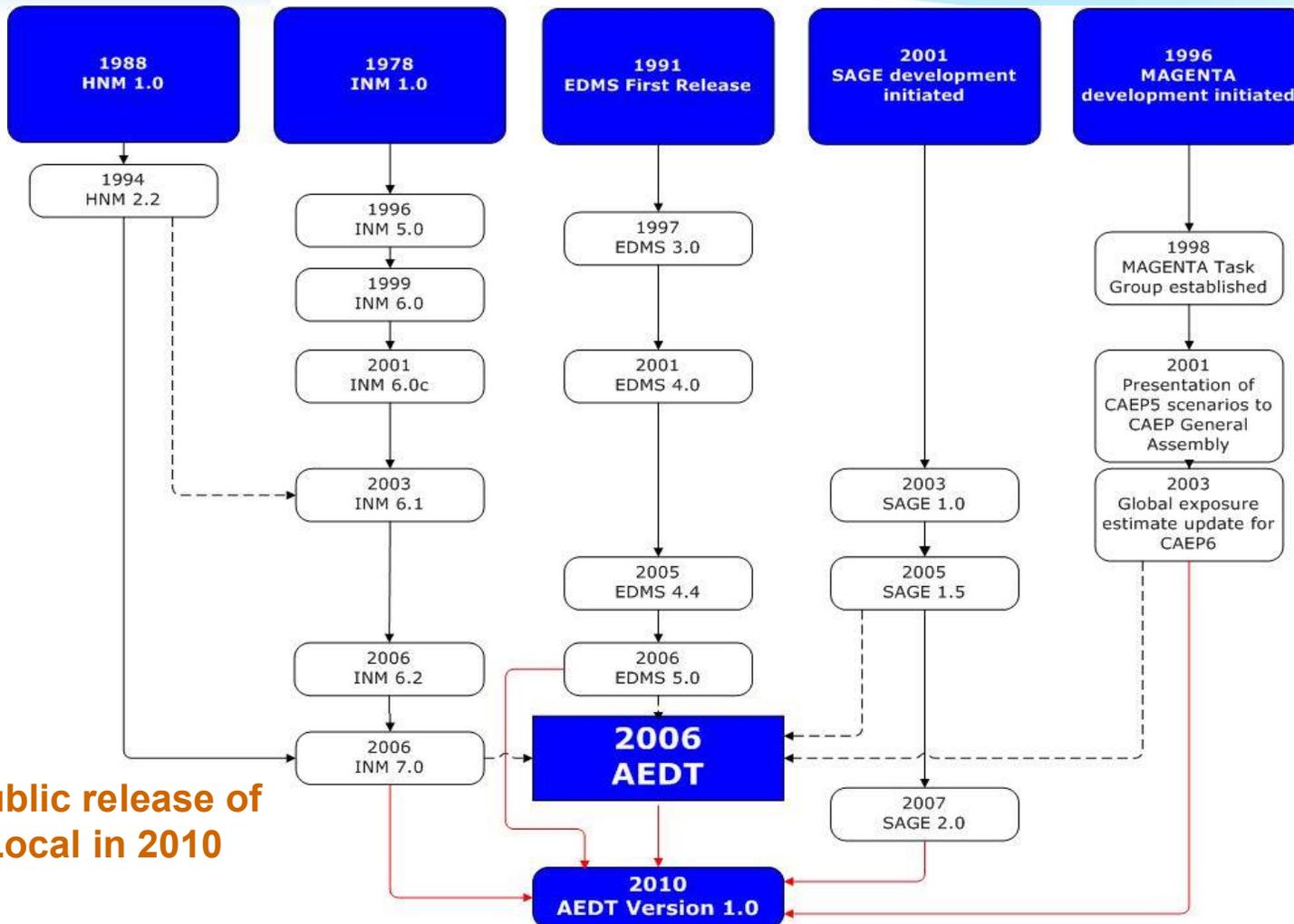
- Used by FAA and FAA development team
- Support ICAO/CAEP and JPDO analyses
- Migrates to **AEDT-Global**

EDMS and INM

- Used by over 1000 organizations worldwide
- Support various environmental analyses, e.g., EIS, Part 150s, etc.
- Migrates to **AEDT-Local**
- AEDT-Local Design Review Group (DRG) 8-9, March



Legacy Model Development Timelines



First public release of AEDT-Local in 2010



Airport Database

Relevant airport information,
e.g., latitude, longitude,
runway, country, etc.

AEDT-Local: Provides
basic airport template to
support analysis



AEDT-Global: Provides
“key” for attributing noise
and emissions to airport,
country, region, etc.



Fleet Database

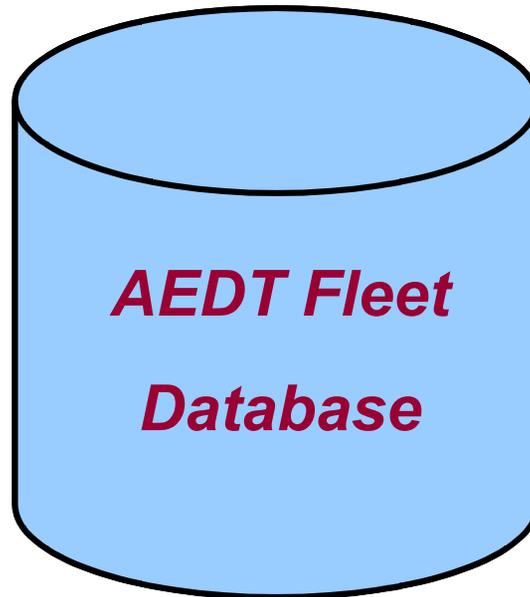


Aircraft/engine model and registration information



AEDT-Local: Provides information on aircraft/engine

AEDT-Global: Additional aspects to include certification and registration information



MAGENTA

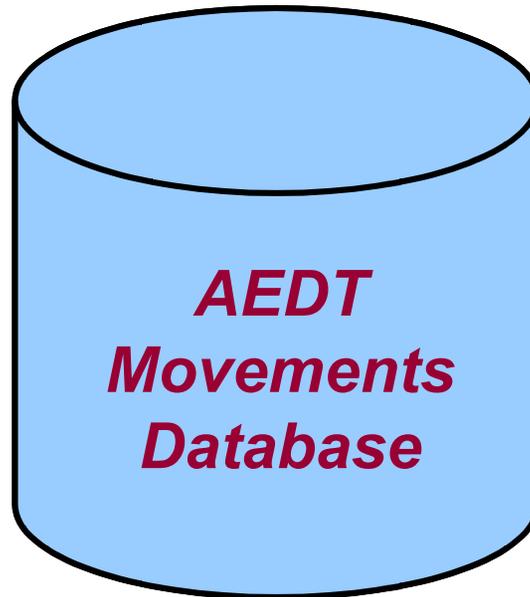




Movements Database



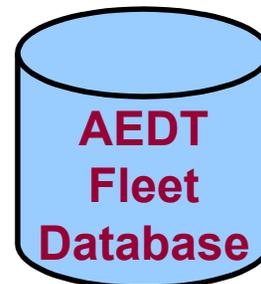
Operations and trajectory information



AEDT-Local: Operational data by airport; limited terminal area trajectory information

AEDT-Global: Operational data by airport; gate-to-gate trajectory information

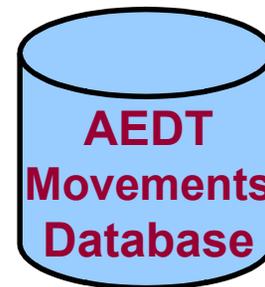
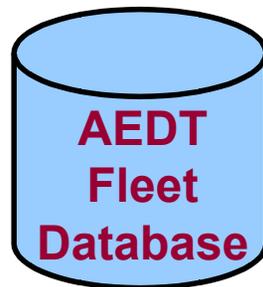
MAGENTA





Project Status - Databases

- Redesigned database structure to support all legacy tools (i.e., INM, EDMS, MAGENTA, SAGE)
- Data harmonized across legacy tools
- Harmonization with available international sources ongoing
- Scaled-down version of global databases available to AEDT-Local tools





Aircraft Acoustics Module



Acoustic computation in AEDT; compliant with international standards



Aircraft Acoustics Module

MAGENTA





Aircraft Acoustics Module

- **Thrust Reverser usage modified to better fit with emission calculations**
 - No change to modeled noise levels during reverse thrust operations
- **Lateral Attenuation**
 - SAE-AIR-5662
 - ECAC Doc 29 Compliant

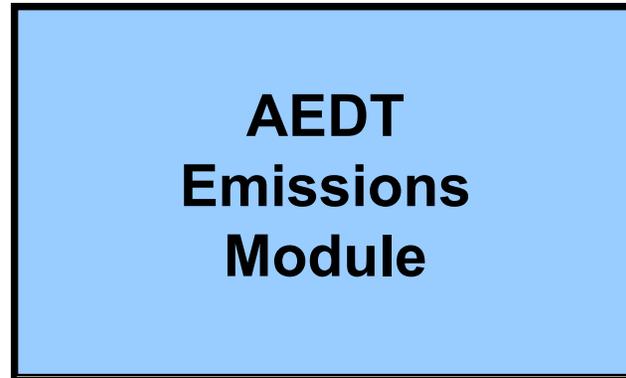




Emissions Module



Emissions computation in AEDT; currently no applicable international standards



MAGENTA





Dispersion Module



Emissions dispersion
computation in AEDT;
based on EPA's AERMOD



**AEDT
Dispersion
Module**

MAGENTA





Fleet and Operations Module



**Generates a future fleet,
based on ICAO/FESG
forecast**



**AEDT
Fleet and
Operations Module**

MAGENTA

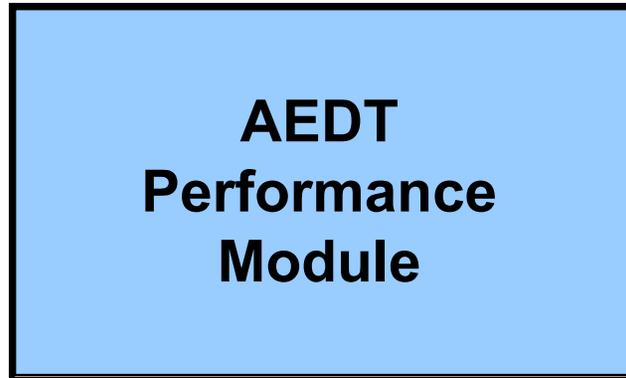




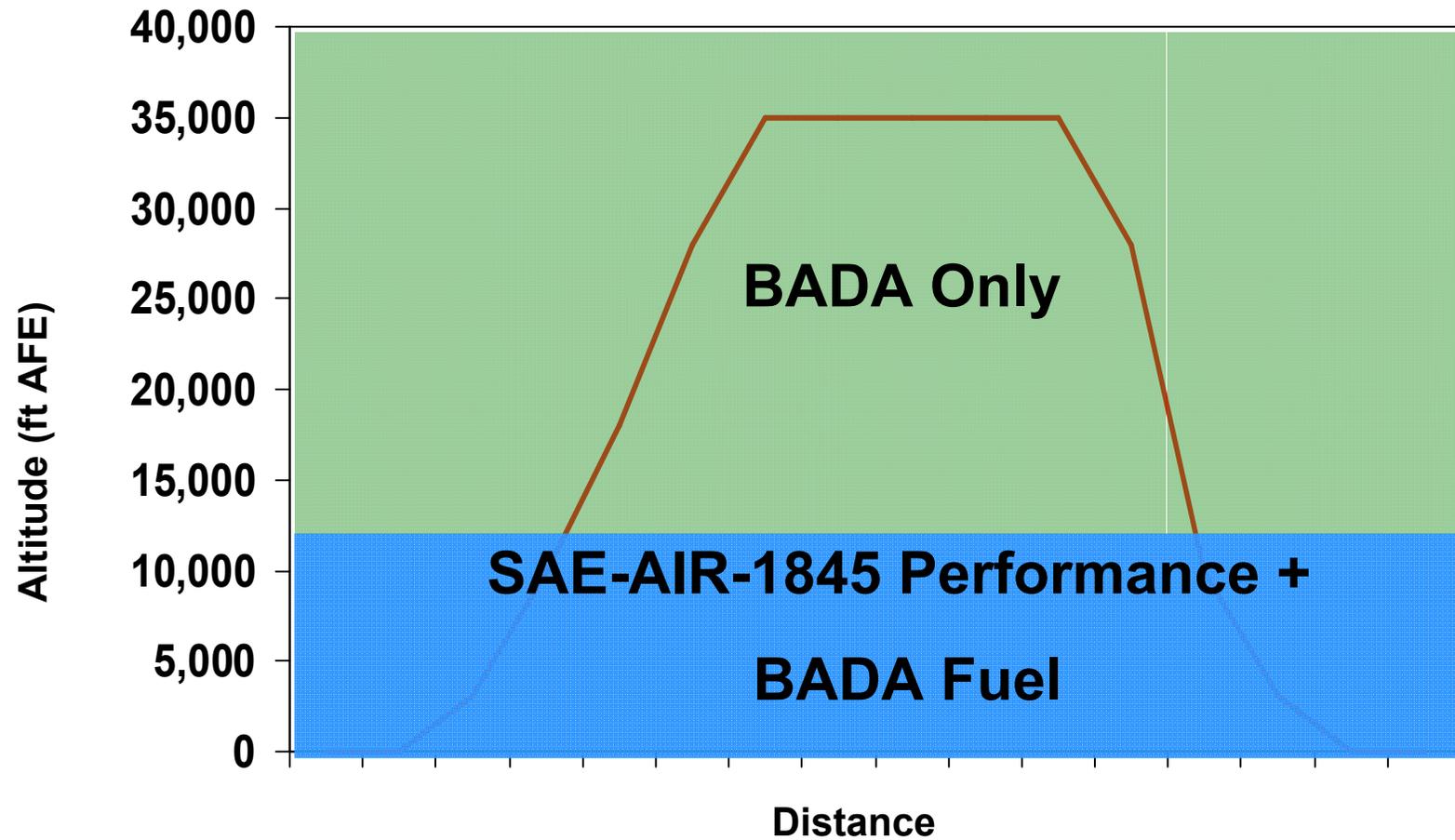
Performance Module



Computes aircraft performance parameters required for noise and emissions computations, e.g., speed, thrust, etc.



Performance Module





Project Status - Modules

- Redesigned computational modules, e.g., emissions (Boeing Fuel Flow Method 2), aircraft performance (including BADA fuel burn)
- Harmonized common modules across legacy tools
- Integrated common modules across legacy tools

**Aircraft
Acoustics
Module**

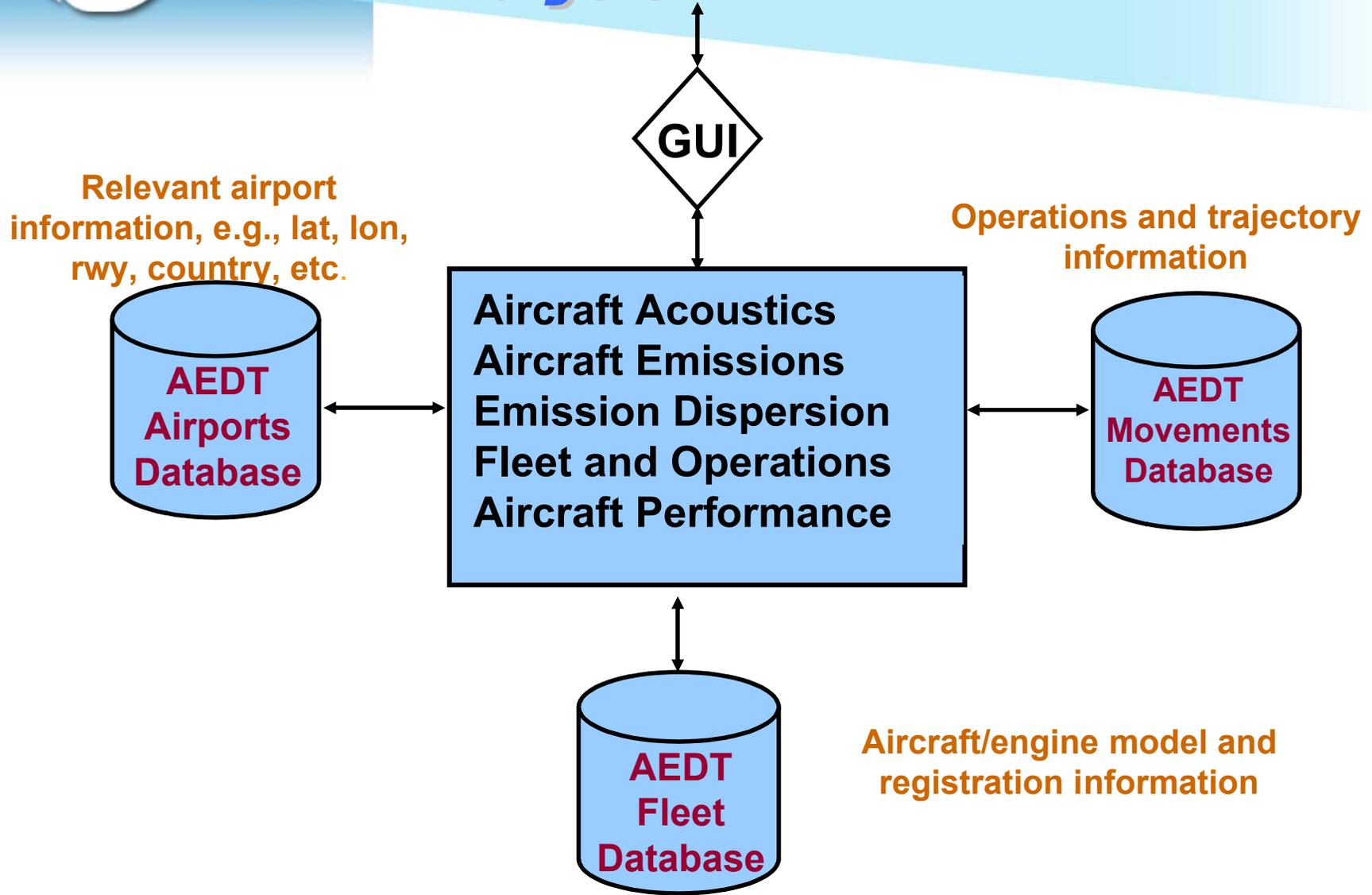
**Aircraft
Emissions
Module**

**Emissions
Dispersion
Module**

**Fleet and
Operations
Module**

**Aircraft
Performance
Module**

Analysis with AEDT





Initial AEDT Capability Demonstrations

- AEDT Initial Capability Demonstrations:
 - NOx Stringency
 - Continuous Descent Arrival (CDA)
 - Trends Assessment (ICAO/CAEP)
 - Reduced Vertical Separation Minimum (RVSM)

Analysis with AEDT



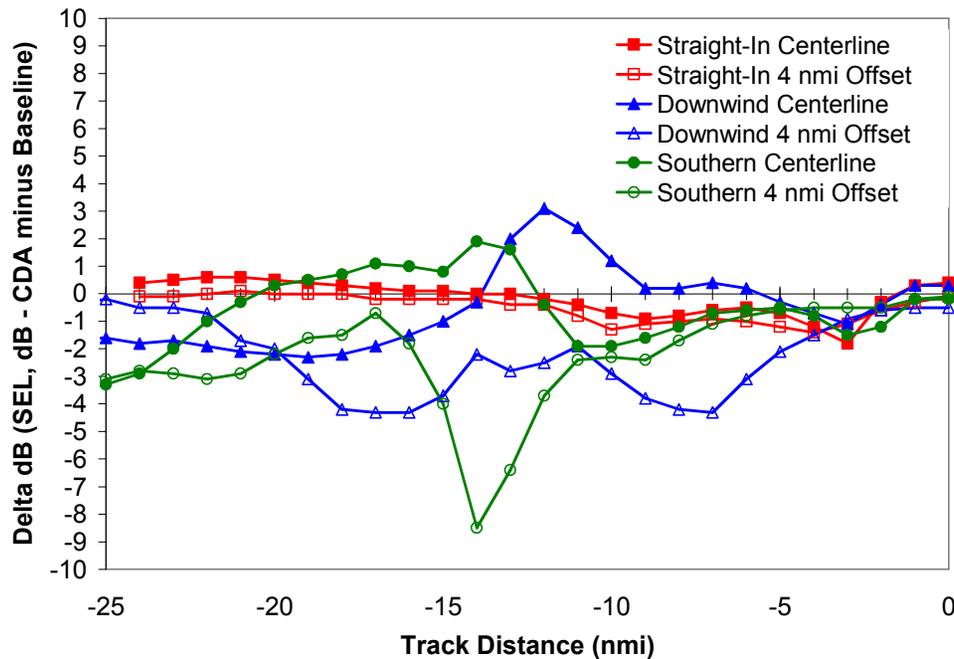
NOx Stringency

RANK	Below 3,000 Feet AFE		Below 10,000 Feet AFE	Entire Flight
	CAEP/6-IP/13	AEDT NOx Modeling Demonstration	AEDT NOx Modeling Demonstration	AEDT NOx Modeling Demonstration
	Stringency	Stringency	Stringency	Stringency
Highest	-30% in 2008	-30% in 2008	-30% in 2008	-30% in 2008
2nd	-25% in 2008	-25% in 2008	-25% in 2008	-25% in 2008
3rd	-20% in 2008	-20% in 2008	-20% in 2008	-20% in 2008
4th	-15% in 2008	<i>-30% in 2012</i>	-15% in 2008	-15% in 2008
5th	-30% in 2012	<i>-15% in 2008</i>	-30% in 2012	-30% in 2012
6th	-25% in 2012	-25% in 2012	-25% in 2012	-25% in 2012
7th	-10% in 2008	<i>-20% in 2012</i>	-10% in 2008	-10% in 2008
8th	-20% in 2012	<i>-10% in 2008</i>	-20% in 2012	-20% in 2012
9th	-15% in 2012	-15% in 2012	-15% in 2012	-15% in 2012
10th	-10% in 2012	-10% in 2012	-10% in 2012	-10% in 2012
11th	-5% in 2008	-5% in 2008	-5% in 2008	-5% in 2008
Lowest	-5% in 2012	-5% in 2012	-5% in 2012	-5% in 2012

*** Preliminary Data – Do Not Cite or Quote**



CDA

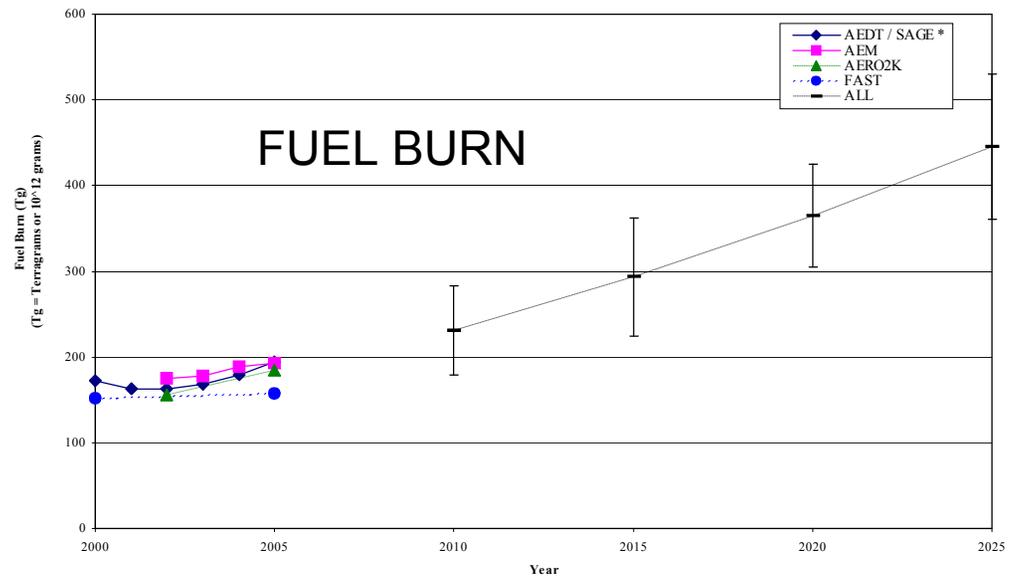
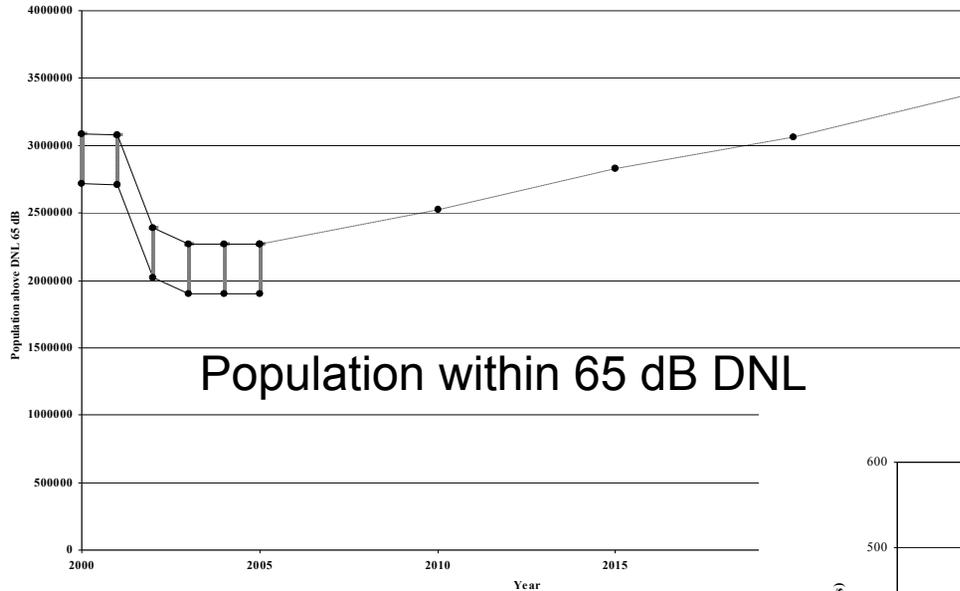


Emiss	% Change Relative to Baseline		
	Straight-In	Downwind	Southern
CO	-8.7	-13.8	-26.7
THC	-8.8	-11.0	-23.9
NMHC	-8.8	-11.0	-23.9
VOC	-8.8	-11.0	-23.9
NOx	-18.1	-32.3	-51.8
SOx	-14.7	-26.9	-46.1
CO ₂	-14.7	-26.9	-46.1
H ₂ O	-14.7	-26.9	-46.1
Fuel	-14.7	-26.9	-46.1

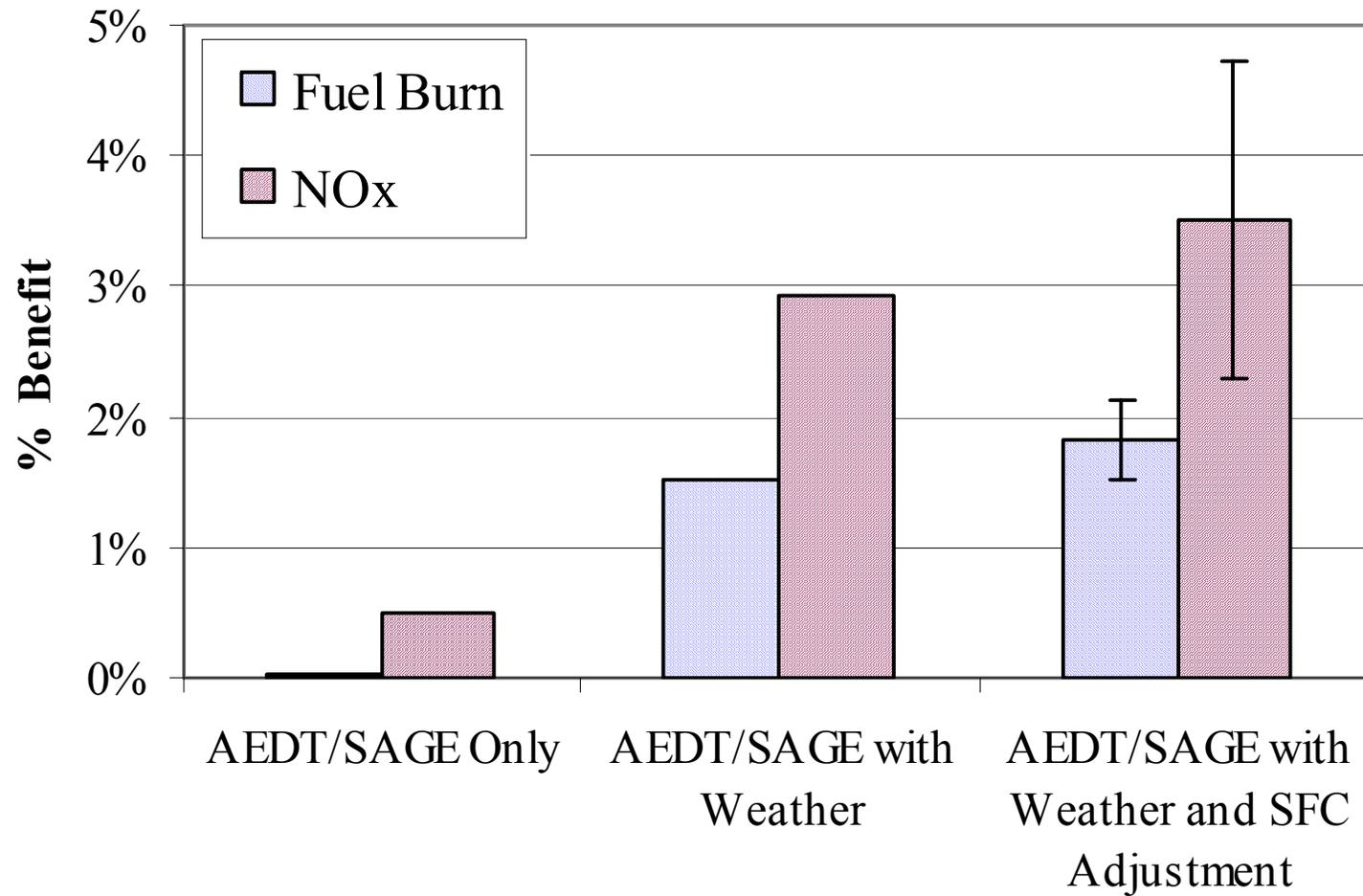
* Preliminary Data – Do Not Cite or Quote



Trends Assessments (ICAO/CAEP)



* Preliminary Data – Do Not Cite or Quote



* Preliminary Data – Do Not Cite or Quote



AEDT 2006 Accomplishments

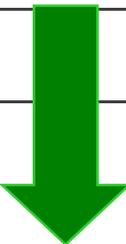
Standardized software and database documentation discipline (i.e., ICDs, etc.)	
Standardized software development environment, including architecture design tools (i.e., MS.NET, MS Visio)	
Software module exchange protocol (including source code)	
Annual global noise and emissions inventories (AEDT/SAGE and AEDT/MAGENTA)	



AEDT 2006 Accomplishments

Legacy model releases (INM 6.2, 6.2a, 7.0-BETA; EDMS 4.3, 4.4, 4.5, 5.0)	
Society of Automotive Engineers (SAE) Aerospace Information Report (AIR) 5662, <i>“Method for Predicting the Lateral Attenuation of Airplane Noise”</i>	
ICAO/CAEP Support (Goals Assessment, Model Evaluation, Database Harmonization, Circular 205 Update, Reduced Thrust Sample Problems)	

Long-term Schedule

End of CY	CAEP Cycle	AEDT Deliverable
✓ 2004	<u>End CAEP/6</u> CAEP/7	AEDT Work Plan Completed and Development Effort Initiated
✓ 2005		EDS (v 0.0) and Breadboard AEDT (v 0.0)
✓ 2006		AEDT Version 1.0 for CAEP/7 Introduction <i>Not a seamless model</i>
ON TRACK 2007	CAEP/8	AEDT Version 1.1 <i>First generation assessment of air toxics and PM</i>
2008		AEDT Version 1.2 for CAEP/8 Application <i>Fully validated; May not be a seamless model</i>
2010	CAEP/9	AEDT Version 2.0 for Airport Planning Application <i>Meets criteria for seamless and publicly available</i>



Next Steps

- **AEDT**
 - JPDO analysis support
 - Database harmonization process (primarily ICAO/CAEP-centric)
 - Migrating JPDO Evaluation and Analysis Division's Analyses to AEDT
 - Verification and Validation
- **AEDT-Global**
 - ICAO/CAEP model evaluation and acceptance process, sample problems and analyses
 - Web-based query tool migrating to full application (limited availability)
- **AEDT-Local**
 - INM 7 and EDMS 5.1 release
 - Integrated local graphical user interface (GUI); developed and coordinated with an integrated design review group (public availability)



??? Questions ???

FAA Environmental Tools web site:

[http://www.faa.gov/about/office org/headquarters offices/aep/models/](http://www.faa.gov/about/office_org/headquarters_offices/aep/models/)