



# Development Update: The FAA's Aviation Environmental Design Tool (AEDT)

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Research and Innovative Technology Administration

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AIRPORTS COUNCIL  
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# AEDT Development Team



*This work is funded by the U.S. Federal Aviation Administration (FAA)  
Office of Environment and Energy (AEE),  
under the FAA/Volpe General Working Agreement.*

*The AEDT effort is co-managed by Lourdes Maurice and Gregg Fleming.*

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# Outline

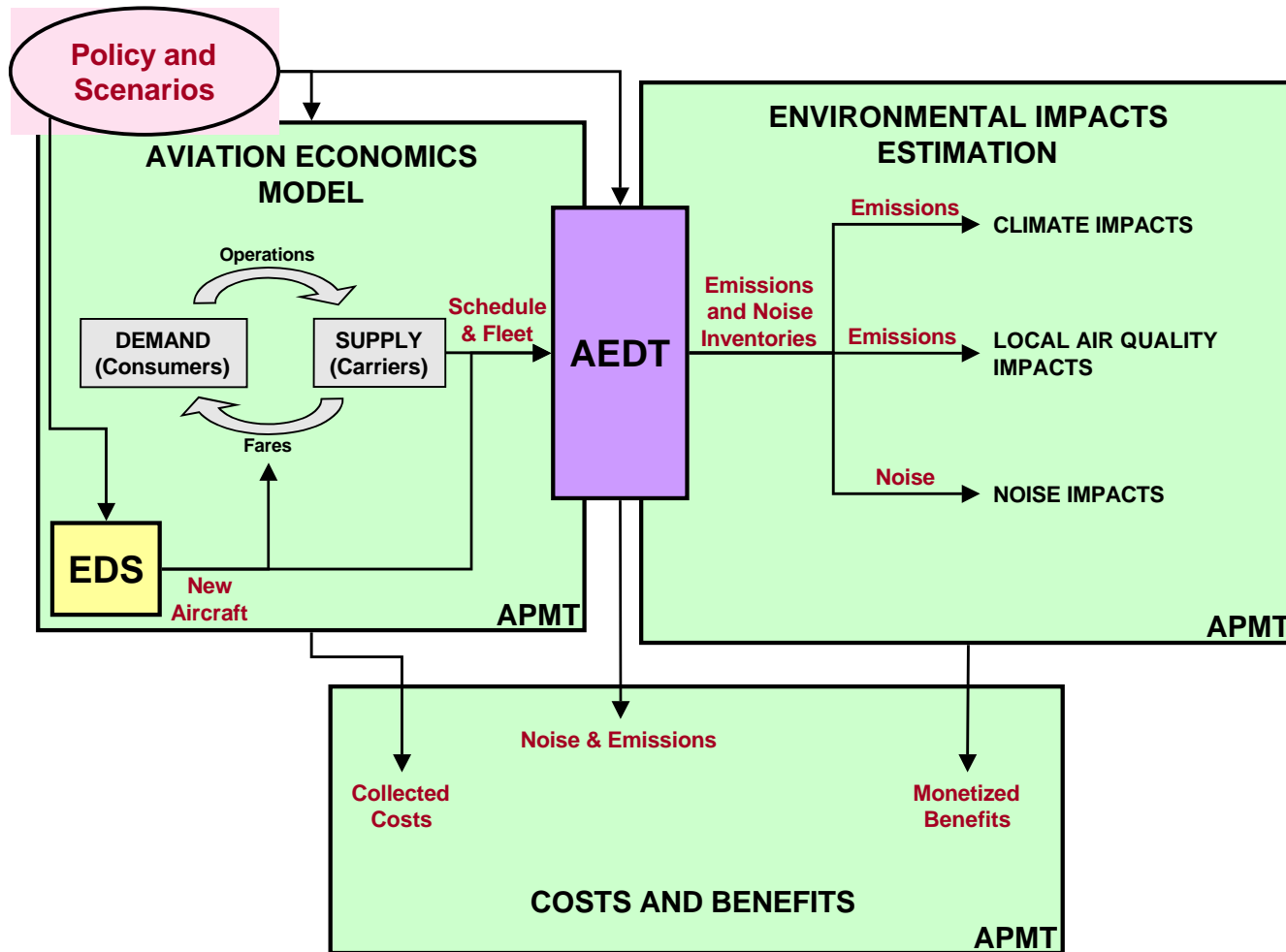
- What is AEDT?
- Need and motivation for tool
- AEDT Version 1.0 – Current State
  - Databases
  - Modules
- Capability Demonstrations
- Schedule
- Next Steps
- What AEDT means for Airports

# What is AEDT?

- Single, Integrated Aviation Environmental Tool
  - Scale
    - Global / Regional / Local
    - Noise / Emissions / Fuel Burn
  - Interdependencies / Tradeoffs
- 
- Future Technologies (EDS)
  - Integrated Economic Analysis (APMT)

5/1/2007 EDS – Environmental Design Space = “Future Technology” APMT – Aircraft environmental Portfolio Management Tool = “Economics” 4

# AEDT: Part of FAA/AEE Tool Suite



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# Motivation for AEDT

AEDT designed to interface with EDS and APMT to provide users with the necessary information for future aircraft so as to:

- Better inform Federal research, policy and budgetary decision-making
- More effectively assess / communicate environmental effects, interrelationships, and economic consequences based on integrated analyses
- Facilitate international agreements on standards, recommended practices, and mitigation options for international policy making
- Mechanism for an expert-driven process for collecting, incorporating and quantifying long-term technology impact assessments

# AEDT Users

## SAGE and MAGENTA

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

## EDMS and INM

- >> 1000 users worldwide
- Environmental analyses, e.g., EIS, Part 150s, etc.
- Migrates to **AEDT-Local** (*standalone program*)
- AEDT-Local Design Review Group (DRG)

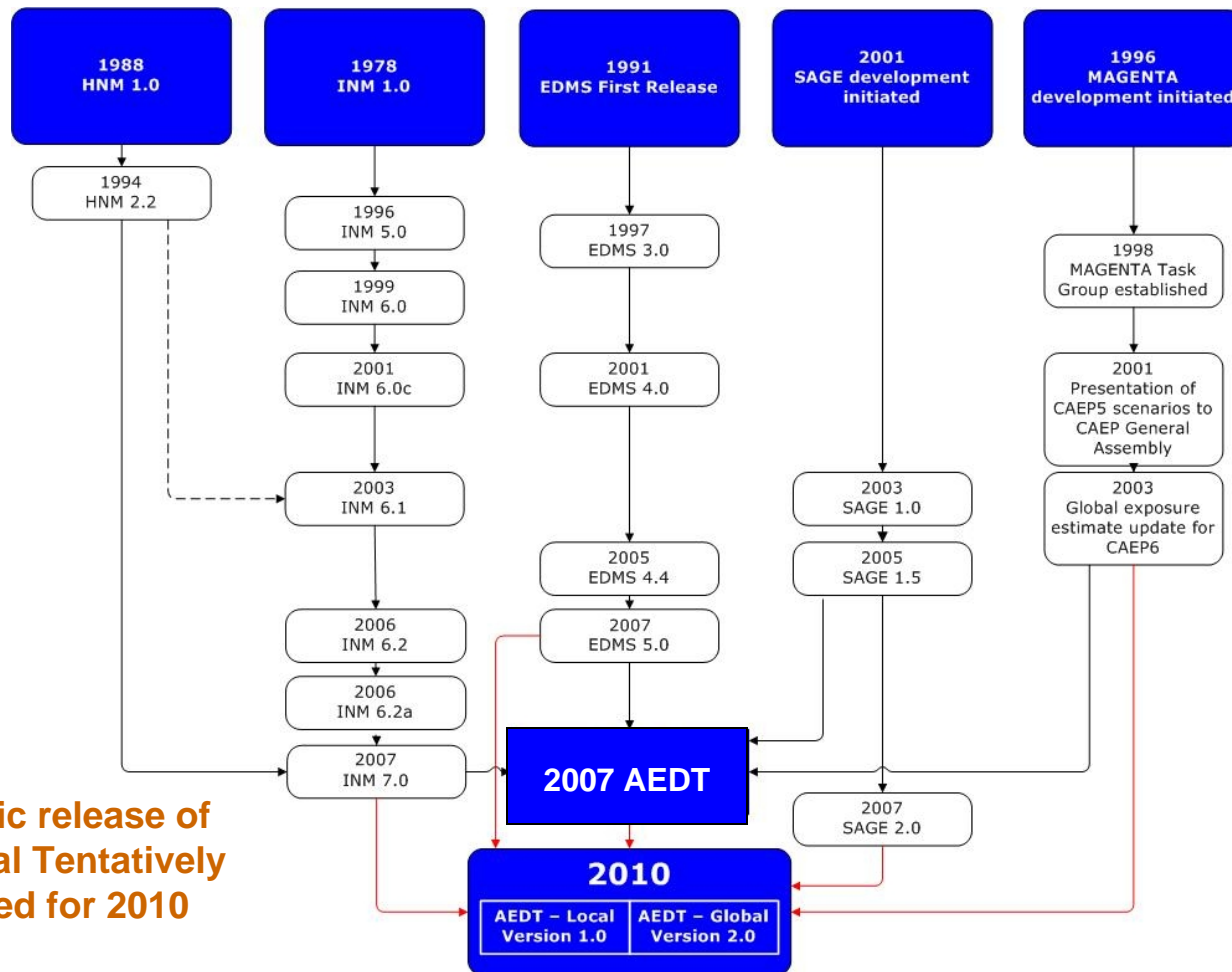
*INM – Integrated Noise Model*

*MAGENTA - Model for Assessing Global Exposure from Noise of Transport Airplanes*

*EDMS – Emissions and Dispersion Modeling System*

*SAGE – System for assessing Aviation's Global Emissions*

# Legacy Model Development Timelines



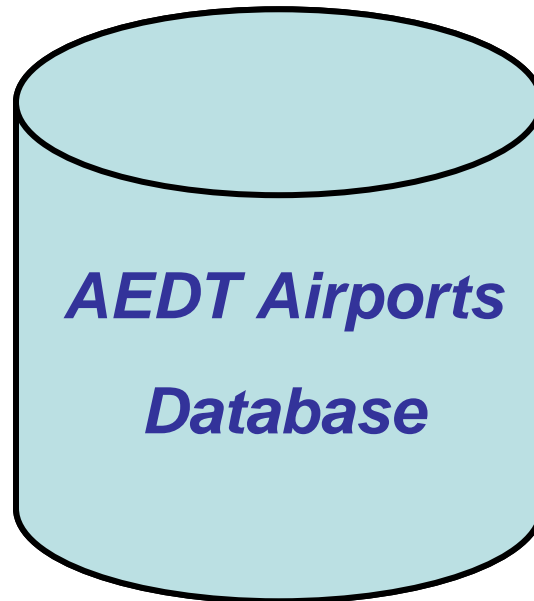
First public release of AEDT-Local Tentatively Scheduled for 2010

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# Airports 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.

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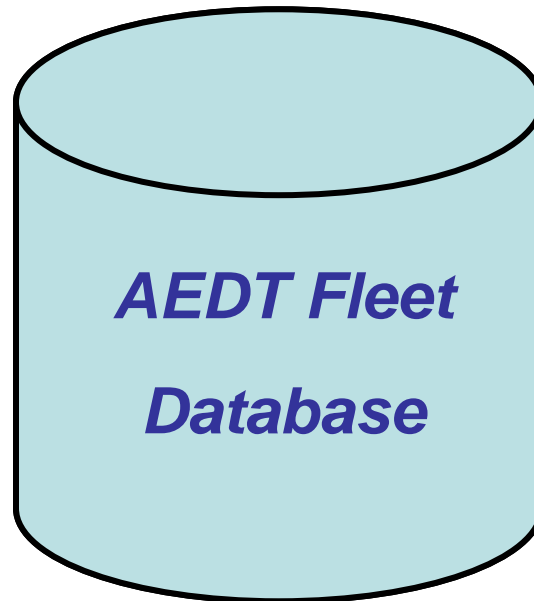
# Fleet Database



Aircraft/engine model and registration information



AEDT-Local: Provides information on aircraft/engine



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

**MAGENTA**

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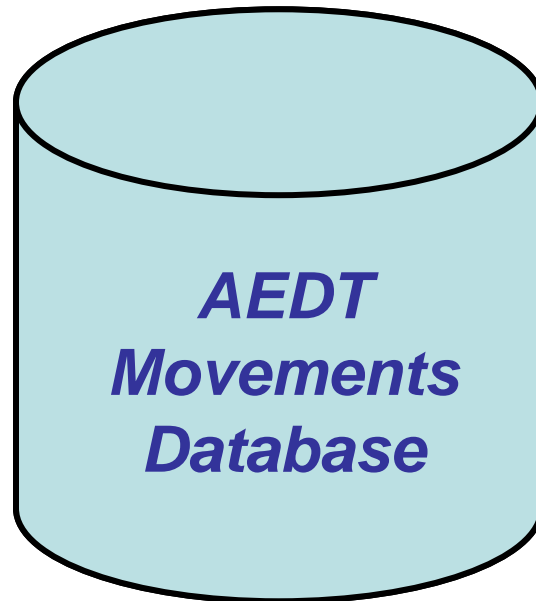


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# Movements Database



Operations and trajectory information

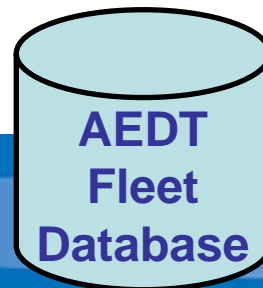


**AEDT-Local: Operational data by airport; limited terminal area trajectory information**

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

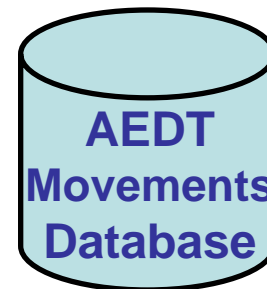
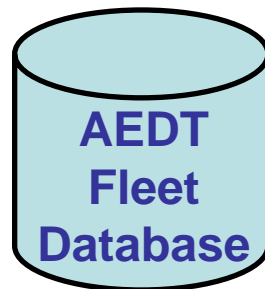
**MAGENTA**

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# 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



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# Aircraft Acoustics Module

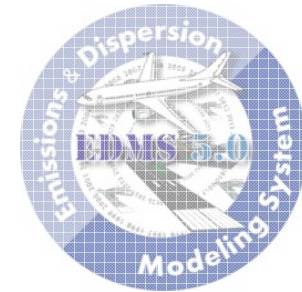


Acoustic computation in AEDT; compliant with international standards



**MAGENTA**

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# Aircraft Acoustics Module

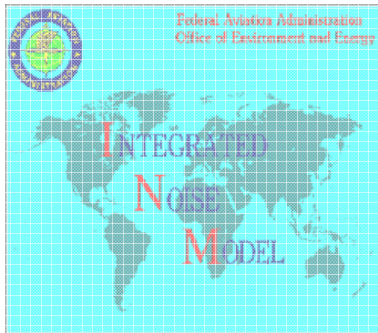
- Thrust Reverser usage modified to better fit with emission calculations
  - No change to modeled noise levels during reverse thrust operations
- Lateral Attenuation
  - SAE-AIR-5662
  - ECAC Doc 29 Compliant



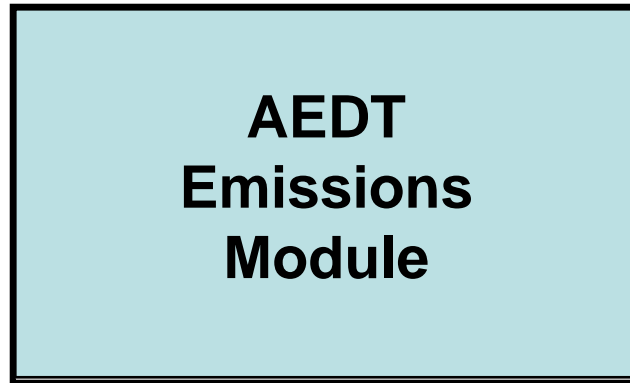
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# Aircraft Emissions Module



Emissions computation in AEDT;  
utilizes state-of-the-art, dynamic  
emission methodologies



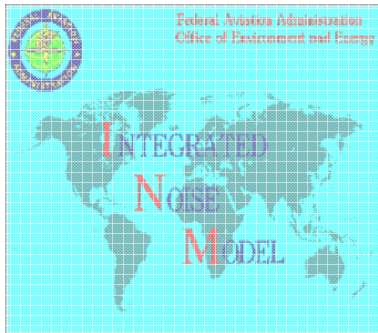
**MAGENTA**

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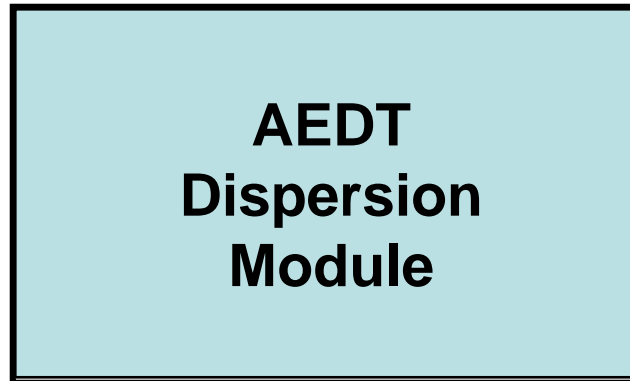


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# Emissions Dispersion Module



Emissions dispersion computation in AEDT; latest version of EPA's AERMOD



**MAGENTA**

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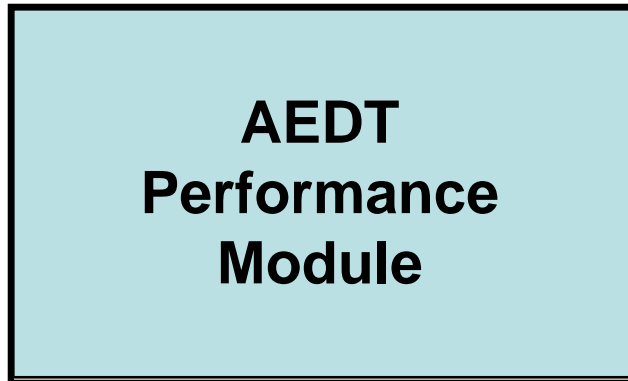
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# Aircraft Performance Module



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



**MAGENTA**

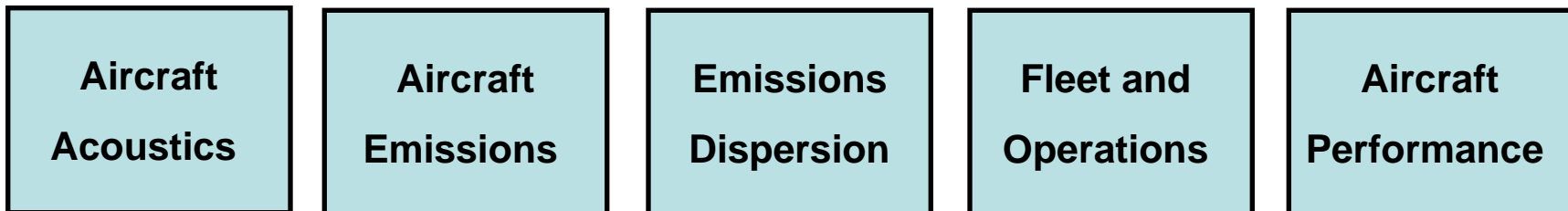
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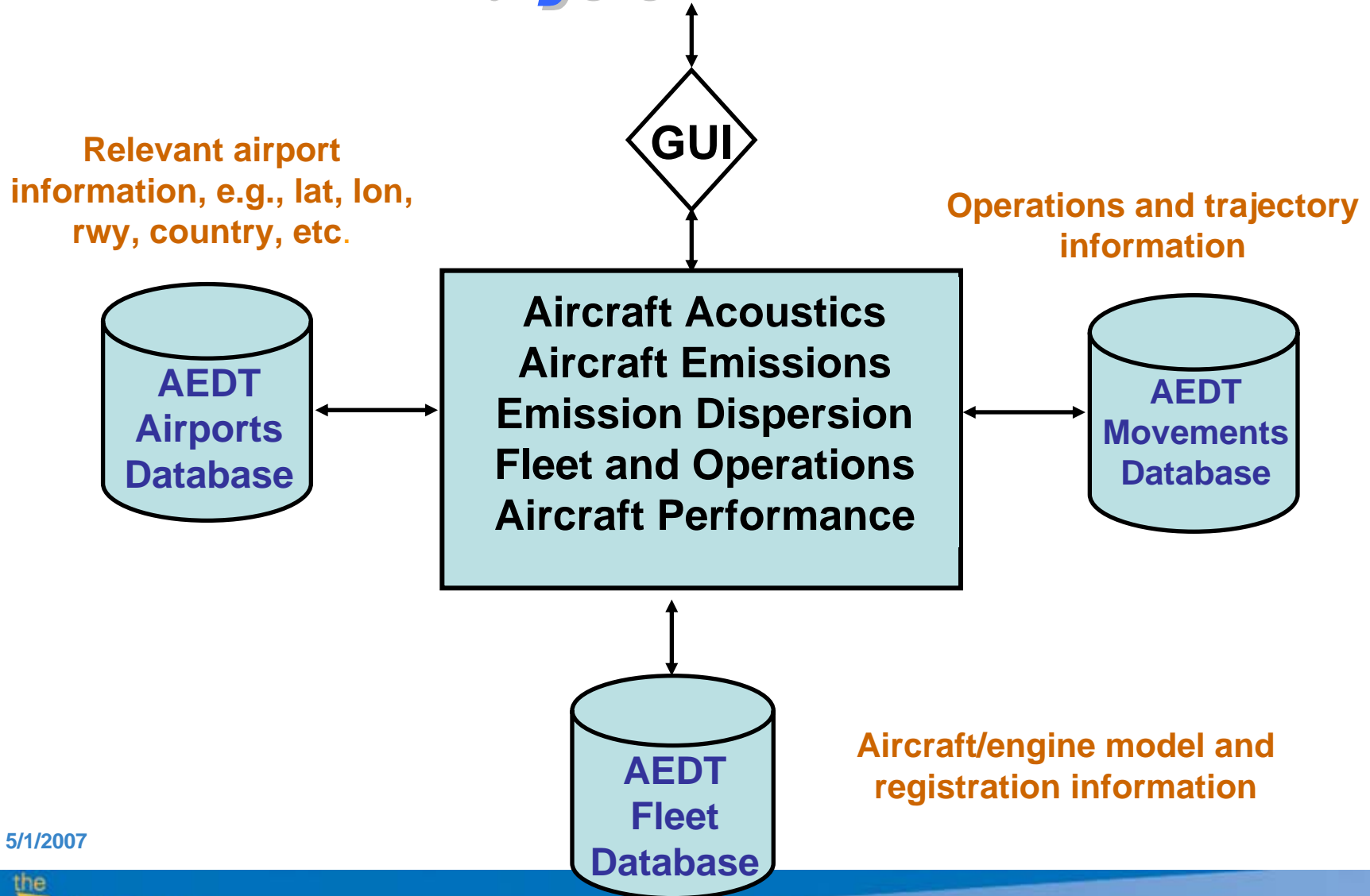
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# Project Status - Modules

- Redesigned computational modules, e.g., emissions (Boeing Fuel Flow Method 2), aircraft performance (including BADA fuel burn)
- Noise and emissions analyses utilize harmonized, integrated common modules



# Analysis with AEDT



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# AEDT Capability Demonstrations

## AEDT Initial Capability Demonstrations:

- Global NOx Stringency (ICAO/CAEP)
- Continuous Descent Approach (CDA)
- Local Air Quality Assessment (ICAO/CAEP)
- Trends Assessment (ICAO/CAEP)
- Reduced Vertical Separation Minimum (RVSM)
- *...more to come...*

## *Latest AEDT Analyses*

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# NOx Stringency

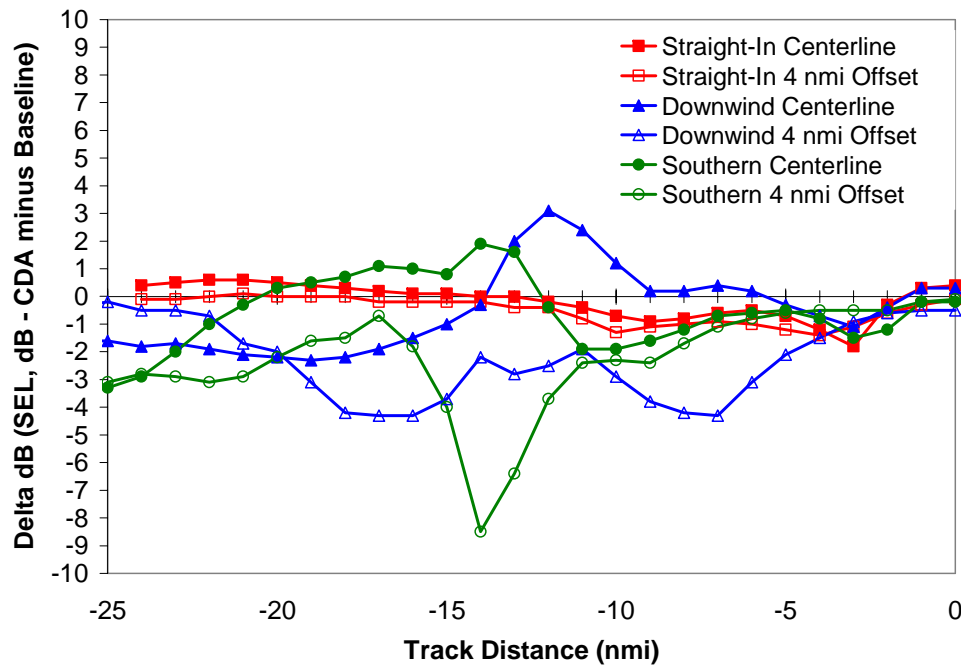
\* Preliminary Data – Do Not Cite or Quote

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

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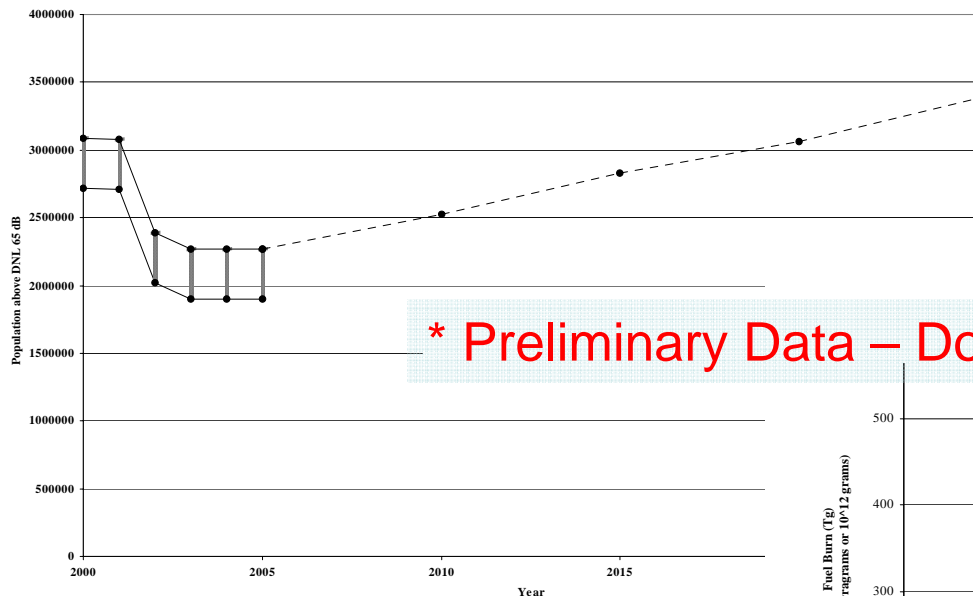
# Continuous Descent Approach (CDA)



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 <sub>2</sub>	-14.7	-26.9	-46.1
H <sub>2</sub> O	-14.7	-26.9	-46.1
Fuel	-14.7	-26.9	-46.1

\* Preliminary Data – Do Not Cite or Quote

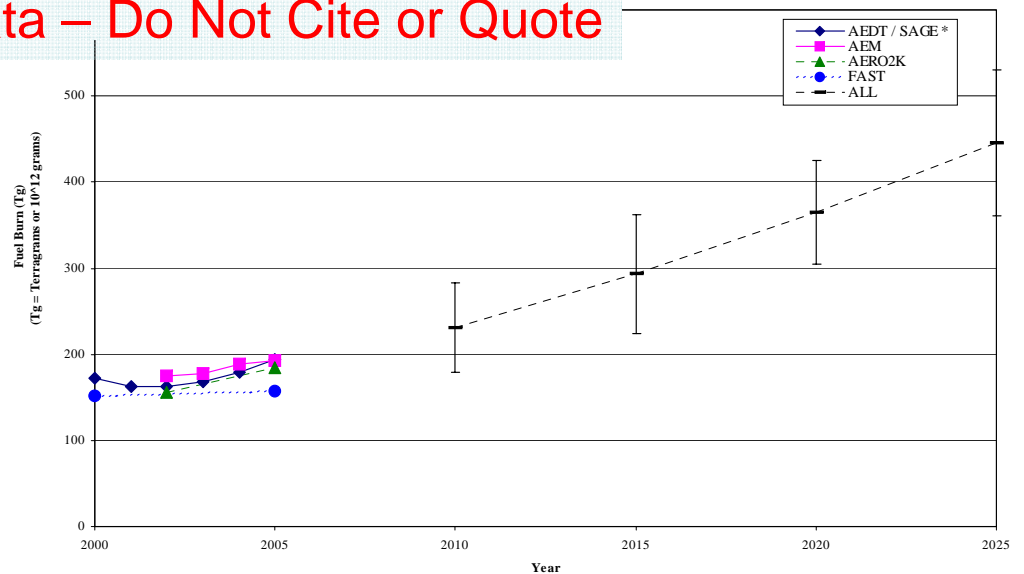
# Trends Assessments (ICAO/CAEP)



\* Preliminary Data – Do Not Cite or Quote





Population within 65 dB DNL

## FUEL BURN






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# Recent AEDT Accomplishments



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



# Recent AEDT Accomplishments

<b>Latest model releases (INM 6.2, 6.2a, 7.0-BETA; EDMS 4.3, 4.4, 4.5, 5.0, 5.0.1)</b>	
<b>Society of Automotive Engineers (SAE) Aerospace Information Report (AIR) 5662, <i>“Method for Predicting the Lateral Attenuation of Airplane Noise”</i></b>	
<b>ICAO/CAEP Support (NOx Demonstration, Goals Assessment, Model Evaluation, Database Harmonization, Circular 205 Update, Reduced Thrust Sample Problem)</b>	

# 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>
2007		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		AEDT Version 2.0 for Airport Planning Application <i>Meets criteria for seamless and publicly available</i>



ON TRACK

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# Next Steps

- AEDT - General
  - JPDO analysis support
  - Database harmonization process
  - Migrating JPDO Evaluation and Analysis Division's Analyses to AEDT
  - Verification & Validation (V&V) and Uncertainties Assessment
  - Migration of modules to .NET environment
- 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)

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# What AEDT means for Airports

- Streamlined / improved
    - Data input processes
    - Analysis capabilities
  - Tool that meets all needs
    - Regulatory
    - User expectations
    - Public's expectations
- 
- More consistent noise & emissions analyses
  - Cost savings re defining model scenarios
  - Easier / more effective communication with stakeholders

# Questions / Discussion

**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/)**

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**<http://www.volpe.dot.gov/air/>**

# Acronyms

AEDT – Aviation Environmental Design Tool  
APMT – Aviation environmental Portfolio Management Tool  
CAEP – Committee for Aviation Environmental Protection  
BADA – Base of Aircraft Data  
CDA – Continuous Descent Approach  
DRG – Design Review Group  
EDMS – Emissions and Dispersion Modeling System  
EDS – Environmental Design Space  
EIS – Environmental Impact Statement  
EPA – Environmental Protection Agency  
FAA – Federal Aviation Administration  
GUI – Graphical User Interface  
ICAO – International Civil Aviation Administration  
ICD – Interface Control Document  
INM – Integrated Noise Model  
JPDO – Joint Programs Development Office  
NASA – National Aeronautics and Space Administration  
NOx – Nitrogen Oxides  
SAE – Society of Automotive Engineers

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