

Aviation Environmental Design Tool

Interdependencies of aircraft
noise, emissions, & fuel burn

Presented to: Noise Workshop

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Federal Aviation
Administration



Outline

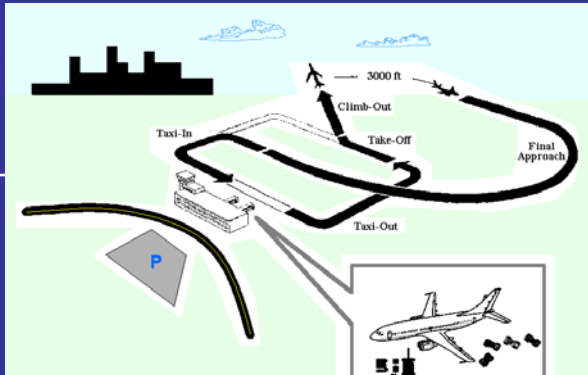
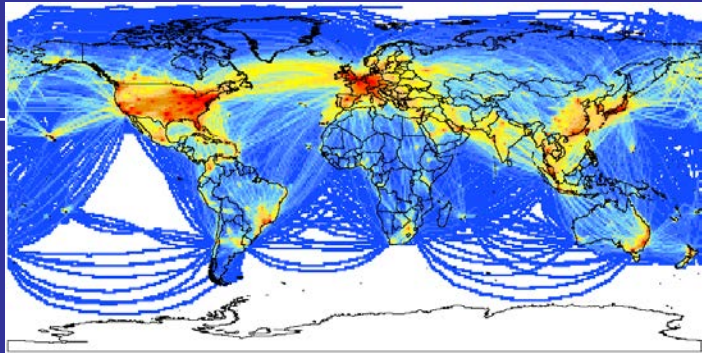
- **Why AEDT?**
- **What is AEDT?**
- **AEDT Timelines**
- **Uncertainty Quantification**



Why AEDT?



2004 FAA Environmental Tools

Tools	Environmental Consequence
<p>Emissions Dispersion Modeling System</p>	<p>Individual Airport Emissions Inventories / Pollutant Concentrations</p> 
<p>Integrated Noise Model</p>	<p>Individual Airport Noise Contours</p>
<p>Noise Integrated Routing System</p>	<p>Regional Noise Impacts from changes to Airports + Airspace</p>
<p>MAGENTA</p>	<p><i>Model for Assessing Global Exposure to Noise from Transport Airplanes</i> U.S. Flight Plan Inventories Global Noise Exposure</p>
<p>System for Assessing Aviation Global Emissions</p>	<p>Global Emissions Inventories</p> 

Informed Decision?

JOHN WAYNE AIRPORT

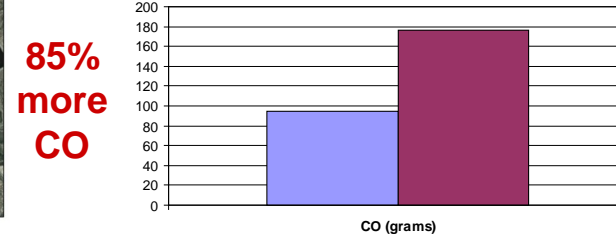
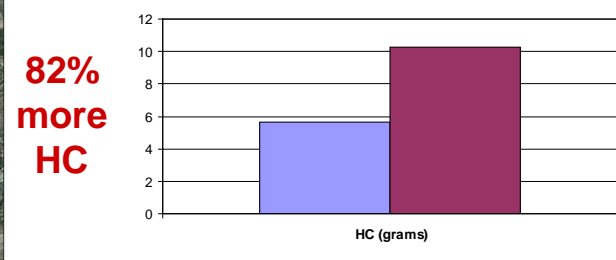
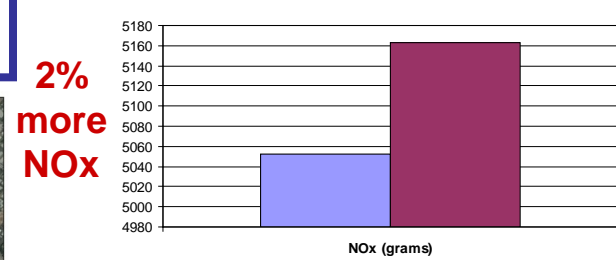
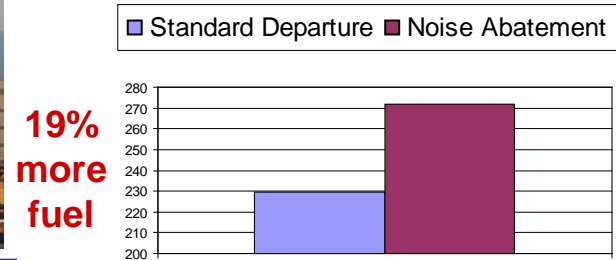
▶ Noise Monitoring Stations (NMS)
Location Map



B757 Departure



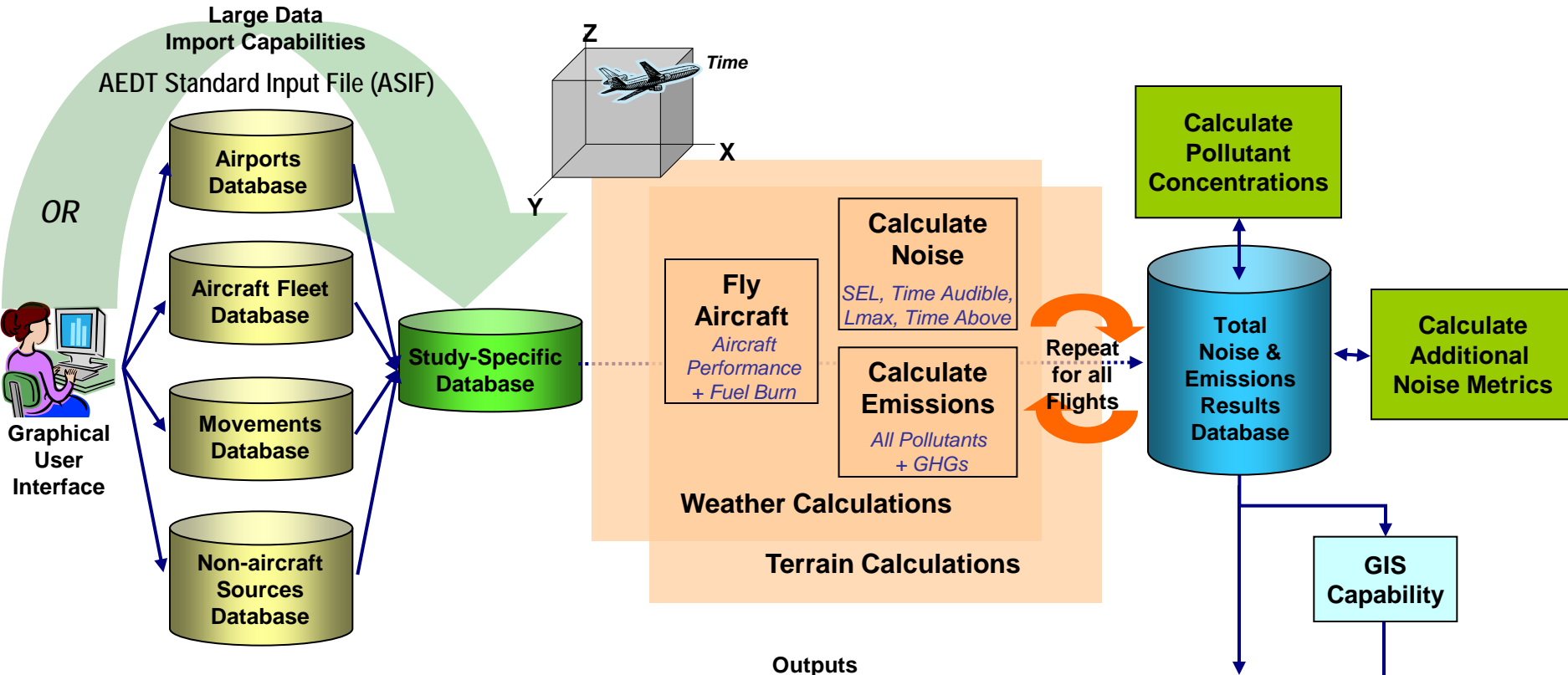
Noise abatement departure
= quieter at monitors



What is AEDT?



AEDT Overview



Outputs

Fuel Burn & Emissions Inventories

Noise & Pollutants Grids

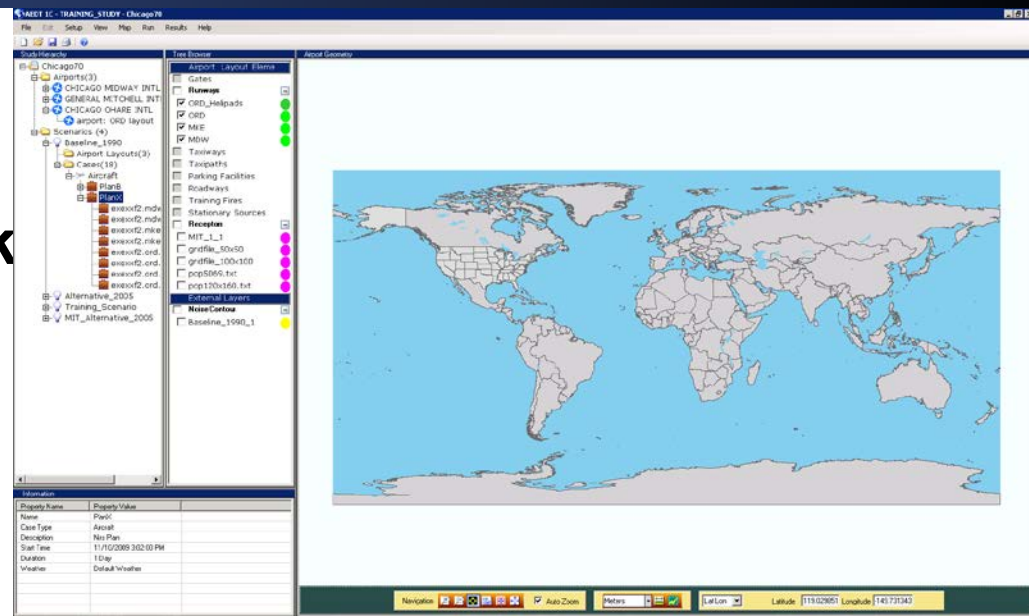
Noise Change Analyses

Contours



AEDT System Overview

- Microsoft .NET Framework
- Data-Driven
- Modular Processes
- System Databases
 - 35,000+ Airports Worldwide
 - 3,200+ Airframe/Engine Combinations
- Scalable information technology
 - SQL Server 2008 relational database
 - Geographical Information Systems (GIS)
 - From a single operation to global dataset
- When released, will be the official aviation environmental regulatory compliance tool for the U.S.



Procedure-based Performance Modeling

- **Scope**

- Terminal area
- Regional (user-defined maximum altitude)
- Runway-to-Runway (user-defined cruise altitude)

- **Terminal Area**

- Limited to altitudes below 10,000 feet AFE (overflights below 10,000 feet MSL)
- Uses SAE-A21 AIR-1845/ECAC D_{POC} 29¹ methods for aircraft performance

- **Enroute**

- All altitudes greater than 10,000 feet AFE
- Uses BADA² airline procedures

1. Society of Automotive Engineers, Aircraft Noise Committee, Procedure for the Calculation of Airplane Noise in the Vicinity of Airports/European Civil Aviation Commission Report on Standard Method of Computing Noise Contours around Civil Airports
2. Base of Aircraft Data



Trajectory-based Performance Modeling

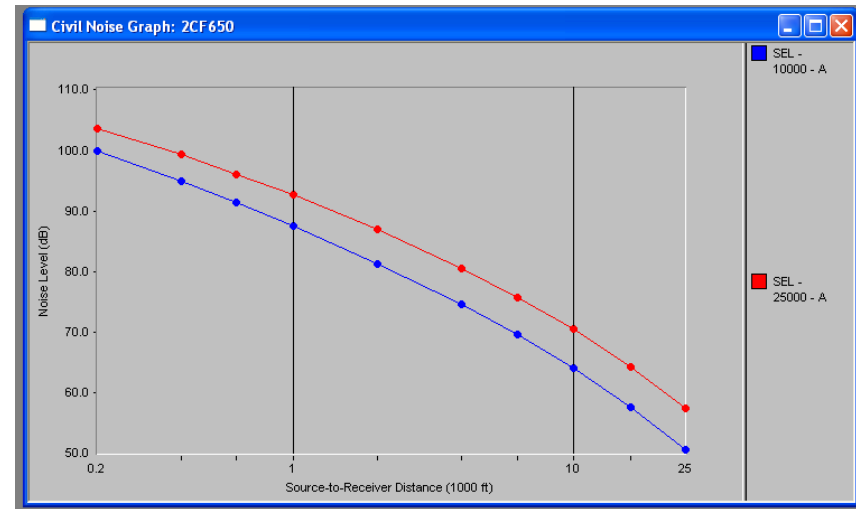
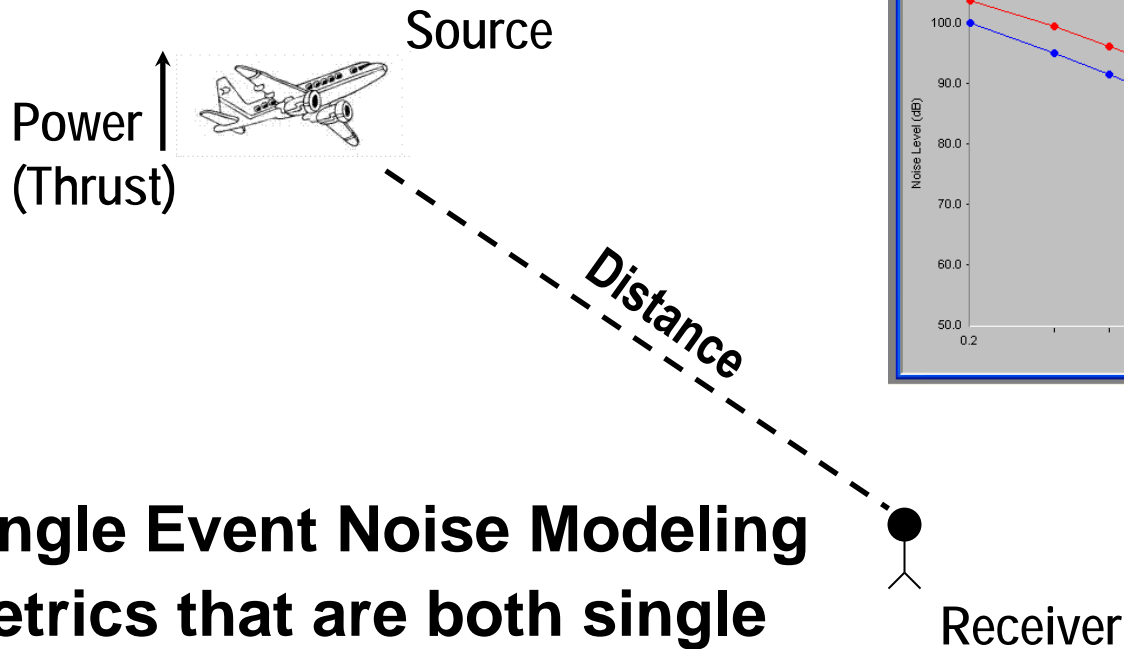
- **Scope (trajectory data defines extent)**
 - Terminal area
 - Regional (user-defined maximum altitude)
 - Runway-to-Runway (user-defined cruise altitude)
- **Altitude controls (At, At or Above, At or Below)**
- **Terminal Area**
 - Limited to altitudes below 10,000 feet AFE (overflights below 10,000 feet MSL)
 - Uses SAE-A21 AIR-1845/ECAC DOC 29¹ methods
 - Speeds derived from AEDT STANDARD procedures
- **Enroute**
 - All altitudes greater than 10,000 feet AFE
 - Uses BADA² airline procedures
 - Speeds derived from BADA Airline procedures

1. Society of Automotive Engineers, Aircraft Noise Committee, Procedure for the Calculation of Airplane Noise in the Vicinity of Airports/European Civil Aviation Commission Report on Standard Method of Computing Noise Contours around Civil Airports
2. Base of Aircraft Data



Noise Modeling

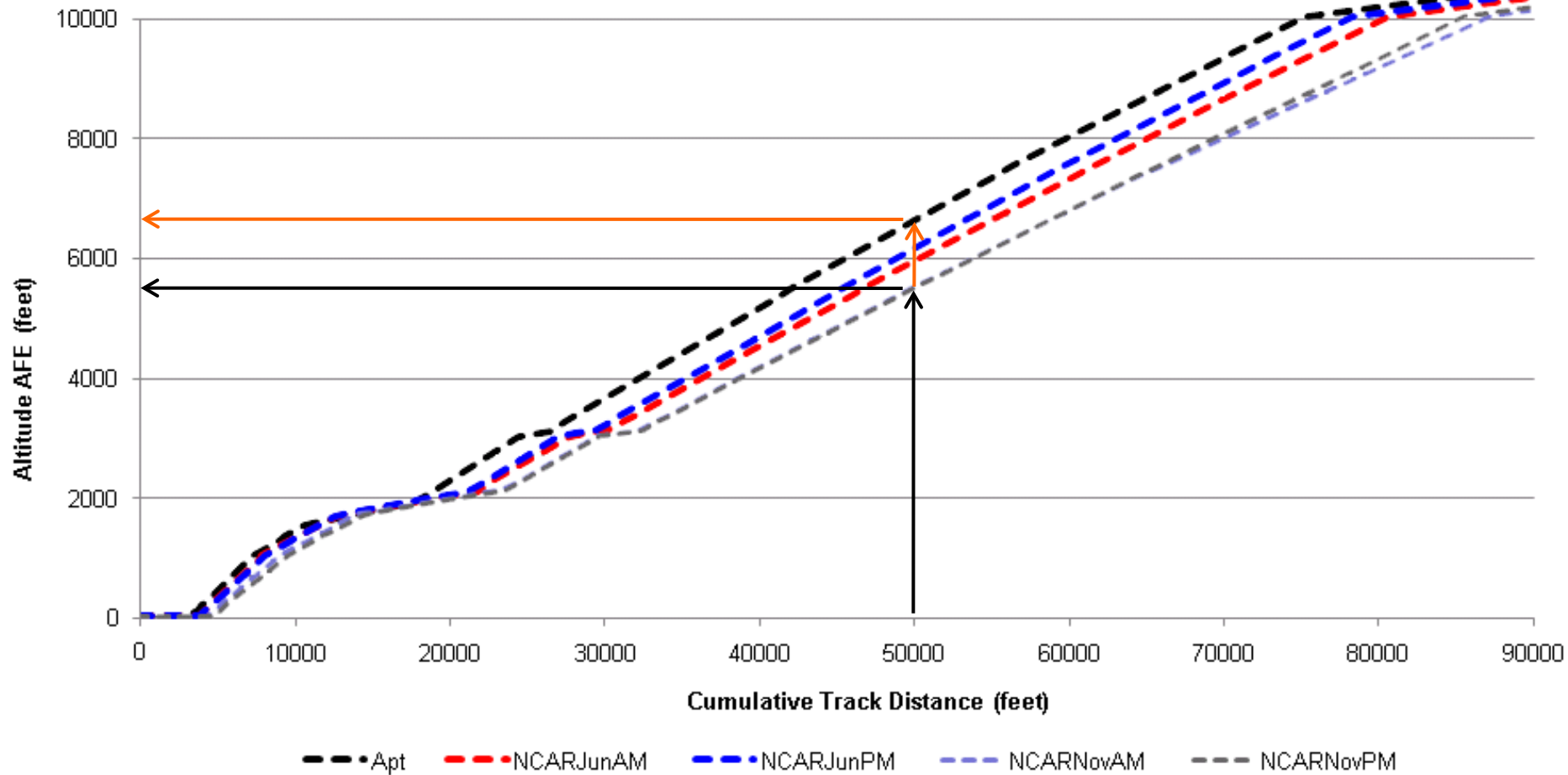
- Uses Noise-Power-Distance Curves



- Single Event Noise Modeling
- Metrics that are both single event and cumulative
- Produces both contours and noise at receptor points

AEDT: High Fidelity Weather

Cumulative Track Distance vs. Altitude AFE



B747-200 takeoff from Denver International Airport

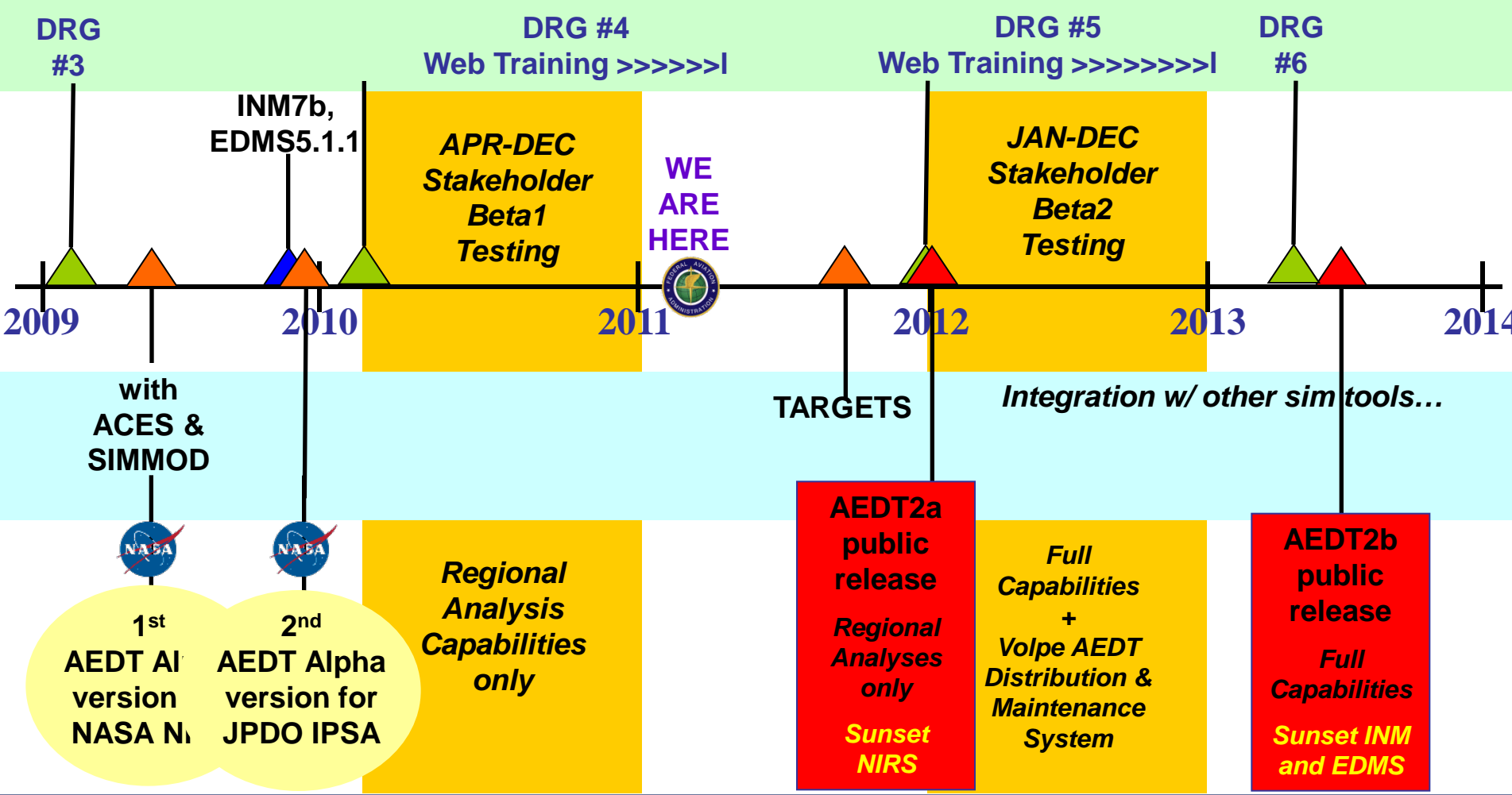


AEDT Timeline



AEDT Development Timeline

Design Review Group meetings



Uncertainty Quantification: Building Confidence

UQ Objectives

- Identify gaps in functionality that significantly impact the achievement of tool suite requirements, leading to the identification of high-priority areas for further development.
- Provide preliminary quantitative evaluation of the performance of AEDT relative to fidelity requirements for various analysis scenarios.
- Contribute to the development of external understanding of AEDT capabilities.
- Provide sensitivity analyses of output response to uncertainties in input parameters and assumptions.



Areas of Uncertainty Quantification

- **Verification and Validation (V&V)**
 - Captures accuracy of the model
- **Capability Demonstrations**
 - Establishes analysis methodologies
 - Identifies new functionalities
- **Parametric Uncertainty and Sensitivity Analysis**
 - Identifies key sensitivities of the model
 - Prioritizes which assumptions need to be addressed
 - Helps determine guidelines for use
- **Expert Review**
 - Establishes creditability of the models methodologies and use

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