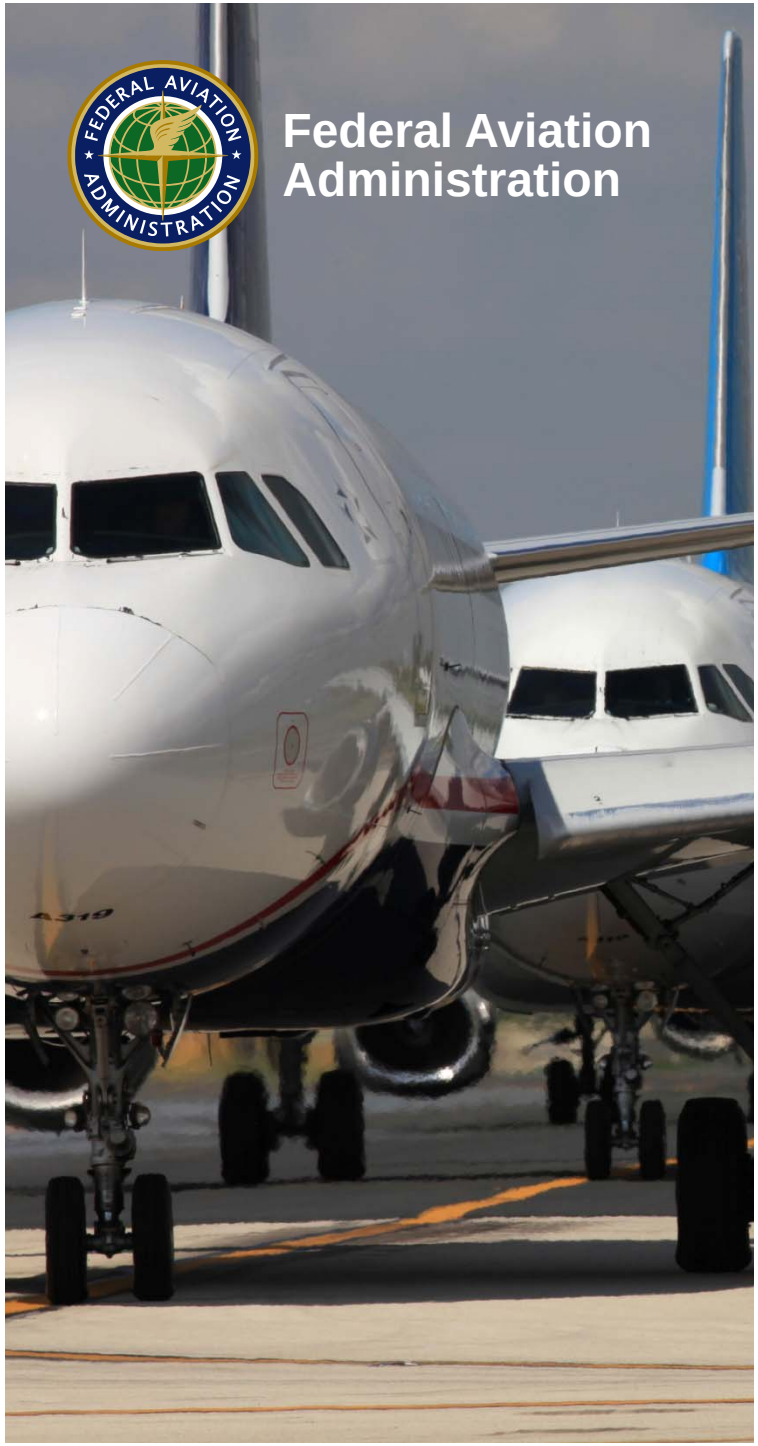
NextGen Environmental Management System

Goals and Targets Analysis Status Update



Presented to: Spring 2014 REDAC

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Date: March 25, 2014

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Goals and Targets Background

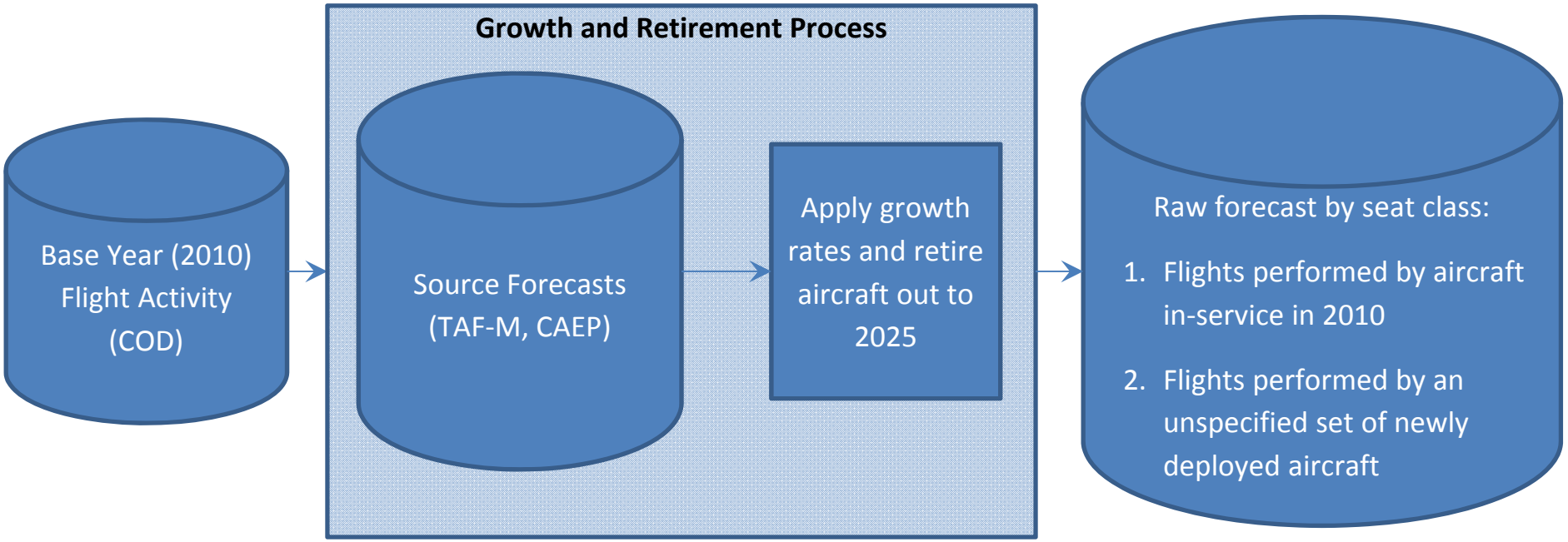
- **Aviation Environmental and Energy (E&E) Goals**
  - U.S. Climate Action Plan, E&E Policy Statement
  - Noise, air quality, climate, and energy
- **"Goals and Targets Analysis"**
  - Forecasting progress against FAA performance goals
  - NextGen EMS: "Check" phase
  - "System Improvements" scenario considers improvements from operations, technology, and alternative fuels

FAA Goal Category	FAA Performance Metric*
Climate	Carbon neutral growth, starting in 2020, relative to the 2005 emissions level
Energy: Alternative Fuels	1 billion gallons of renewable jet fuel used by aviation by 2018
Energy: Energy-Efficiency	Annual reduction of 2% (of year 2000 level and starting in 2010 – as expressed collectively in the FAA business plan and portfolio of goals)
Noise	Less than 300,000 people exposed to "significant aircraft noise" by 2018
Air Quality	50% reduction, starting in 2018,relative to 2005 level

* Goals are subject to revision based on Administrator's strategic priorities

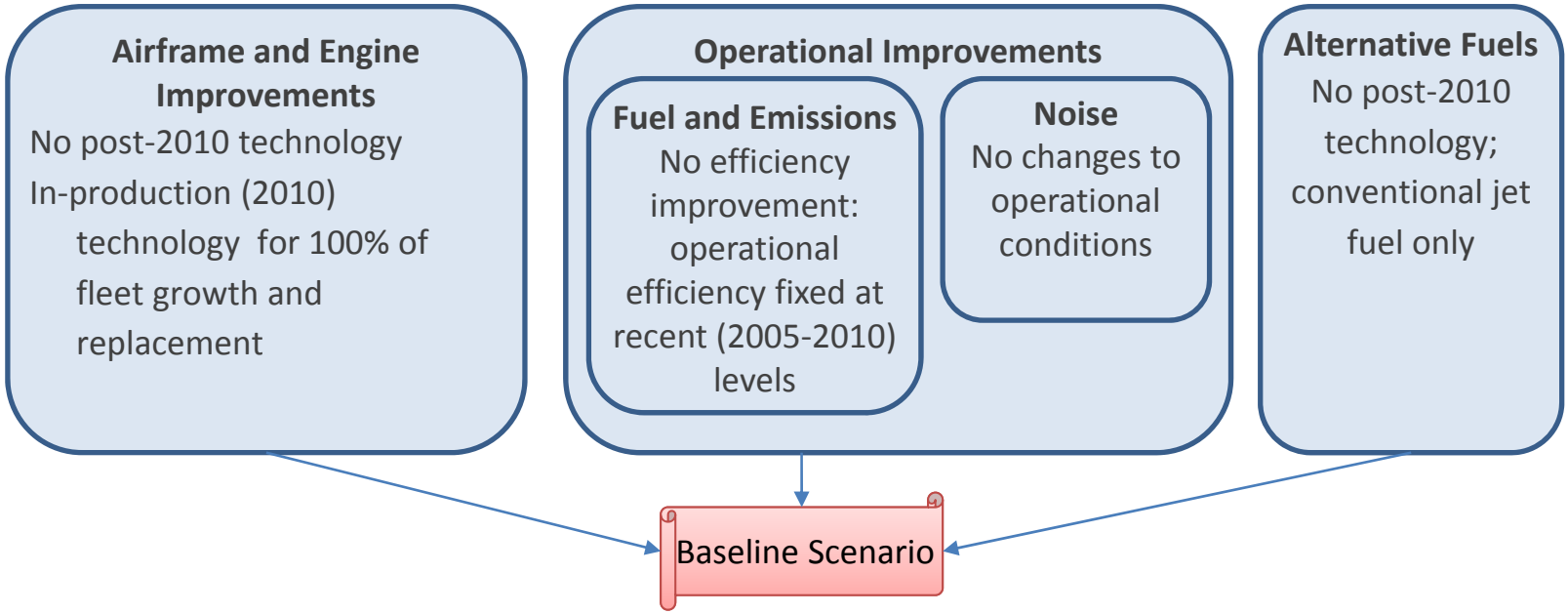
Approach: Forecast

- **Base year activity: Common Operations Database (COD), a radar-derived record of flight activity in 2010**
  - Derived from Traffic Flow Management System (TFMS) archives
- **Future year activity out to 2025: research-only version of 2011 FAA Terminal Area Forecast (TAF-M), FAA's official forecast, which is updated annually**



Approach: Modeling

- Re-packaged version of Aviation Environmental Design Tool (AEDT Noise and Emissions Analysis Toolkit (NEAT)) used to generate baseline scenario noise and emissions inventories
- Inventories were post-processed to account for benefits from airframe and engine improvements, operational improvements, and alternative jet fuels



Improvement Scenarios

Airframe and Engine Improvements

In-production technology plus, when available, future technologies for 100% of fleet growth and replacement on major passenger flights.

The future technologies include:

- 2012 CLEEN Program technology
- Market-driven technologies similar to those of the Boeing 787 and Airbus A350

Operational Improvements

Fuel and Emissions
Unimpeded, laterally-direct travel

Noise
Assumption of zero net effect

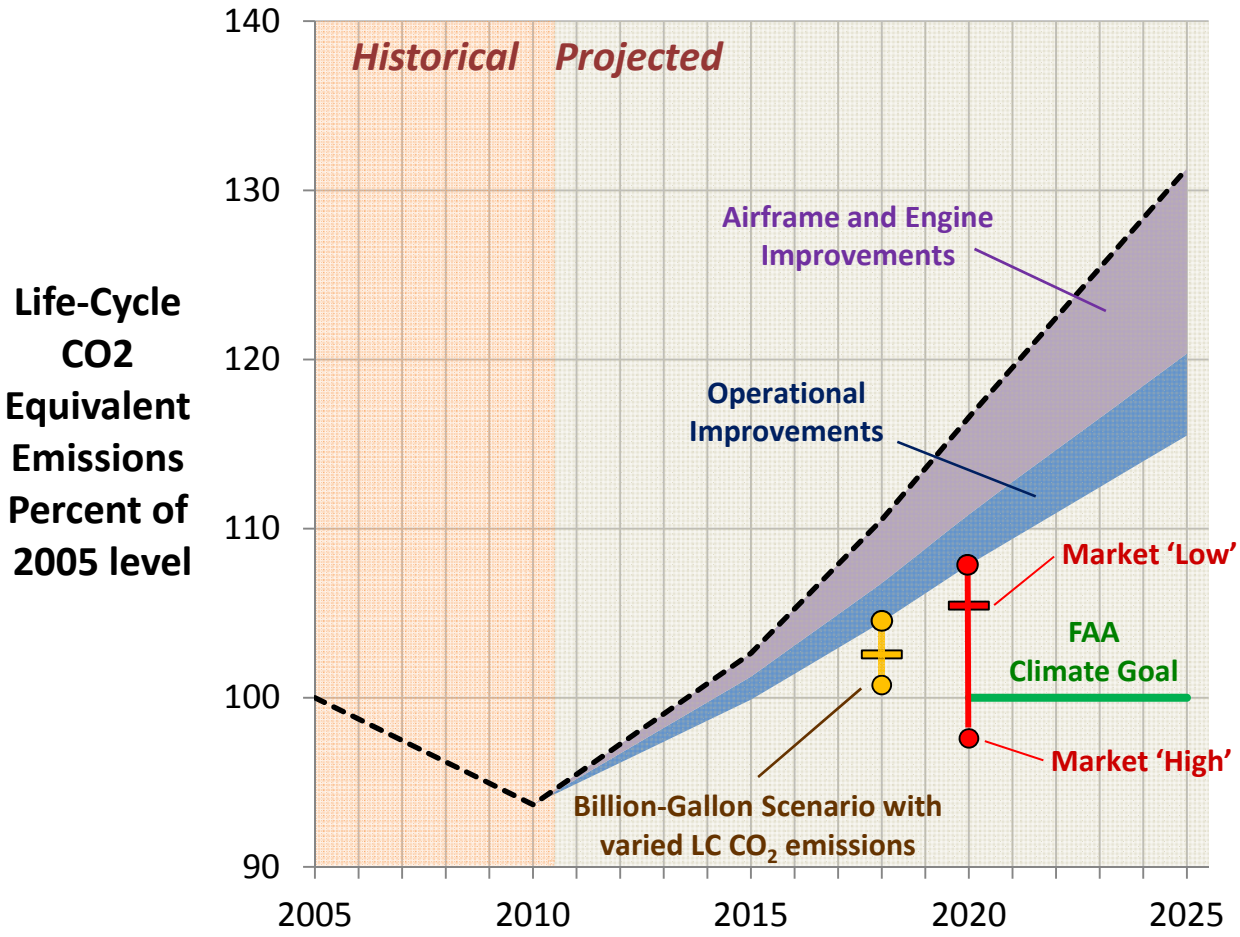
Alternative Fuels
Alternative fuels scenario assumptions detailed on next slide.

Core Improvement (CORE/HIGH-MKT-SVY)

Sensitivity Analyses

- LOW-MKT-SVY
- BLN-50%
- BLN-0%
- ZERO-ALT-FUEL
- CO2-NTRL

Example Results – Climate



Highlights

- Substantial progress in alt fuels and / or some sort of MBM measure required as a "gap filler"
- Need to refine analysis to better understand feasibility of meeting 2020 goal

Alternative Fuel Consumption
(Volume in millions of gallons)

Year	Market 'Low'	Market 'High'	Billion-Gallon
2018	n/a	n/a	1,000
2020	2,854	8,032	n/a

- In 2018, quantity of fuel is held constant at 1bn gallons, while emissions content of fuel is varied
- In 2020, quantity of fuel is varied while emissions content is held constant at 66% of Jet-A LC CO_2

Analysis provides a 'first cut' at possible impacts of improvements considered

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Rerun Improvements (1)

- **Transition from AEDT NEAT to AEDT 2b**
  - Using analysis to assist AEDT2b assessment
  - Provides runtime performance improvement; BADA4
  - Using Beta 7 release
- **Updated TAF-M**
  - Latest release from APO
  - More granular data (further potential for calculating fuel efficiency metrics)
  - International traffic (compare to CAEP Trends Assessment)
- **Extend analysis timeframe**
  - Can run baseline out to duration of TAF-M (2040)
  - Considering longer timeframes

Rerun Improvements (2)

- **Update Technology Assumptions**
  - Georgia Tech updating EDS Assessment of CLEEN Technologies (PARTNER Project 36) in April
  - Integrate CLEEN and non-CLEEN (e.g., NASA) technologies into future aircraft
  - Accounting for performance (fuel, NOx, and noise) and Entry Into Service
  - Low-to-high (e.g., realistic, optimistic) scenarios
- **Operations assumptions**
  - Leverage existing Nextgen system-wide modeling as a scenario
  - Side task: bottom-up estimation of benefits of operational improvements (see next slide)
- **Assess air quality health impacts**

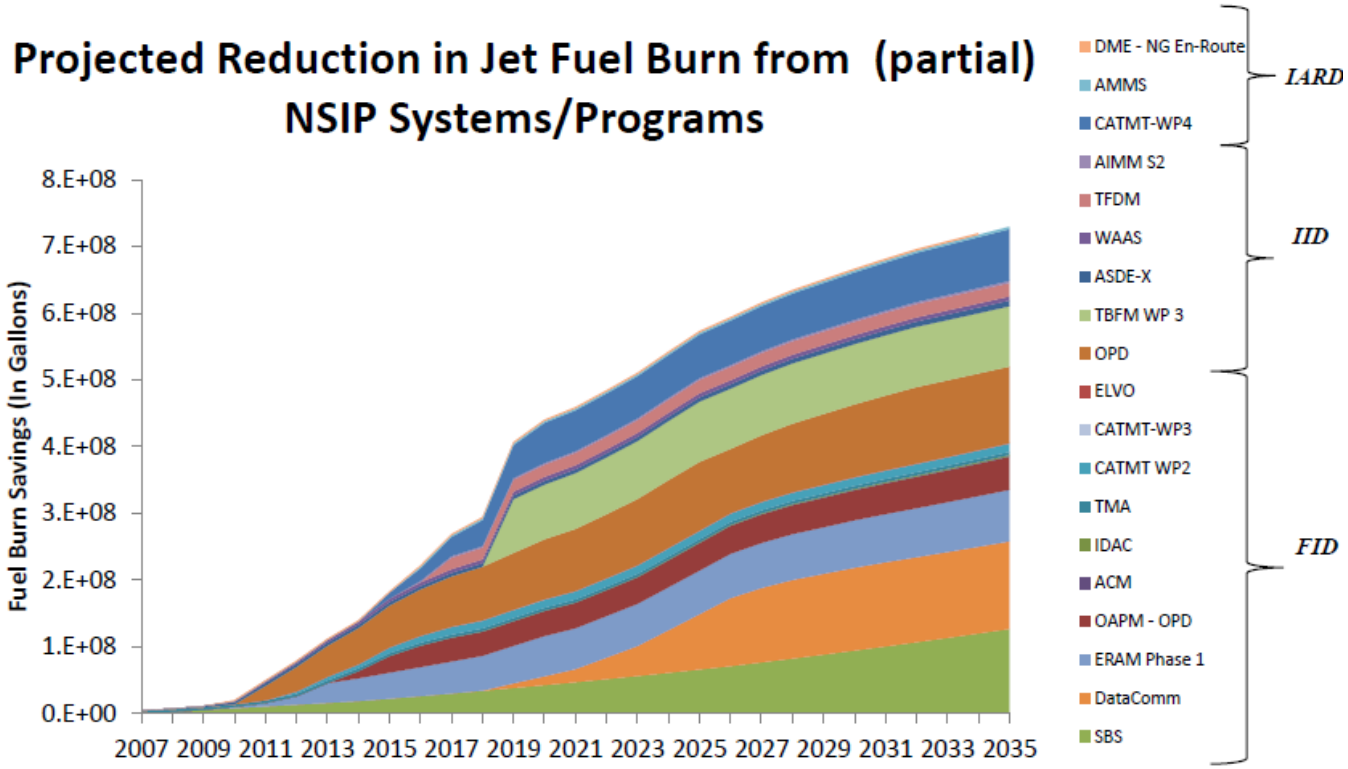
Rerun Improvements (3)

Note: This on-going analysis has not yet fully accounted for the following factors:

- *Completeness of set of increments (a number of OIs/Increments have not yet been included)*
- *Latest (most accurate) projection of implementation scheduled of NextGen systems and capabilities*

Preliminary Observations / Conclusions

- *NSIP Capabilities/Programs (from partial set) with highest potential system wide benefits include;*
  - *OPD/CDAs*
  - *SBS*
  - *DataComm*
  - *CATMT-WP4*
  - *ERAM Phase1*
  - *TBFM WP3*



Note:

1. **The fuel burn savings have been standardized based on 2010 ADOC**
2. **The fuel savings projections to year 2035 have been scaled proportional to 2010 TAF projection, unless otherwise specified in the BCAR**
3. **Evaluated energy savings (i.e. in gallons of jet fuel). Results can be scaled to CO2 savings w/ □ 9.8 kg CO2 / gallon jet fuel**

Current Progress

- Reboot forecasting process
- End-to-end AEDT 2b testing (exercise all pieces of model we need)
- Scrutinize TAF-M update
- Execute AEDT2b run (baseline; chorded for Air Quality, normally “modal”)
- Scrutinize baseline results
- Apply system improvements (first take critical look at CLEEN data)
- Scrutinize improvement scenario results (analysis, comparisons, etc.)
- Assess Air Quality impacts
- Documentation

We are here

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Future Analysis Improvements

- **Extend analysis timeframe**
  - 2040 at a minimum, ideally 2050 – examining TAF extension to 2050
  - Explore connection to APMT-E for AC retirements
- **Expand improvement scenarios**
  - New aircraft configurations out to 2050 – leverage work of NASA
  - Mission specification changes (i.e., PARTNER Project 43 led by Stanford)
- **Operational Improvement changes:**
  - Automate derivation of efficiency factor
  - Radar-based modeling path → incorporate advanced operations research (e.g., Cruise Altitude/Speed Optimization)
- **Comparison to CAEP Trends Assessment (TAF-M int'l. vs. CAEP at a "route-group" level)**
- **Use ANG-5 SWAC outputs to inform delay growth**
- **General Aviation / military noise sensitivity**
- **Leverage alt fuels work (e.g., Alternative Fuels Transportation Analysis Tool)**
- **Align with 2015 US Climate Action Plan needs (i.e., shape analysis to meet requirements, e.g., int'l. focus, 2050, etc.)**

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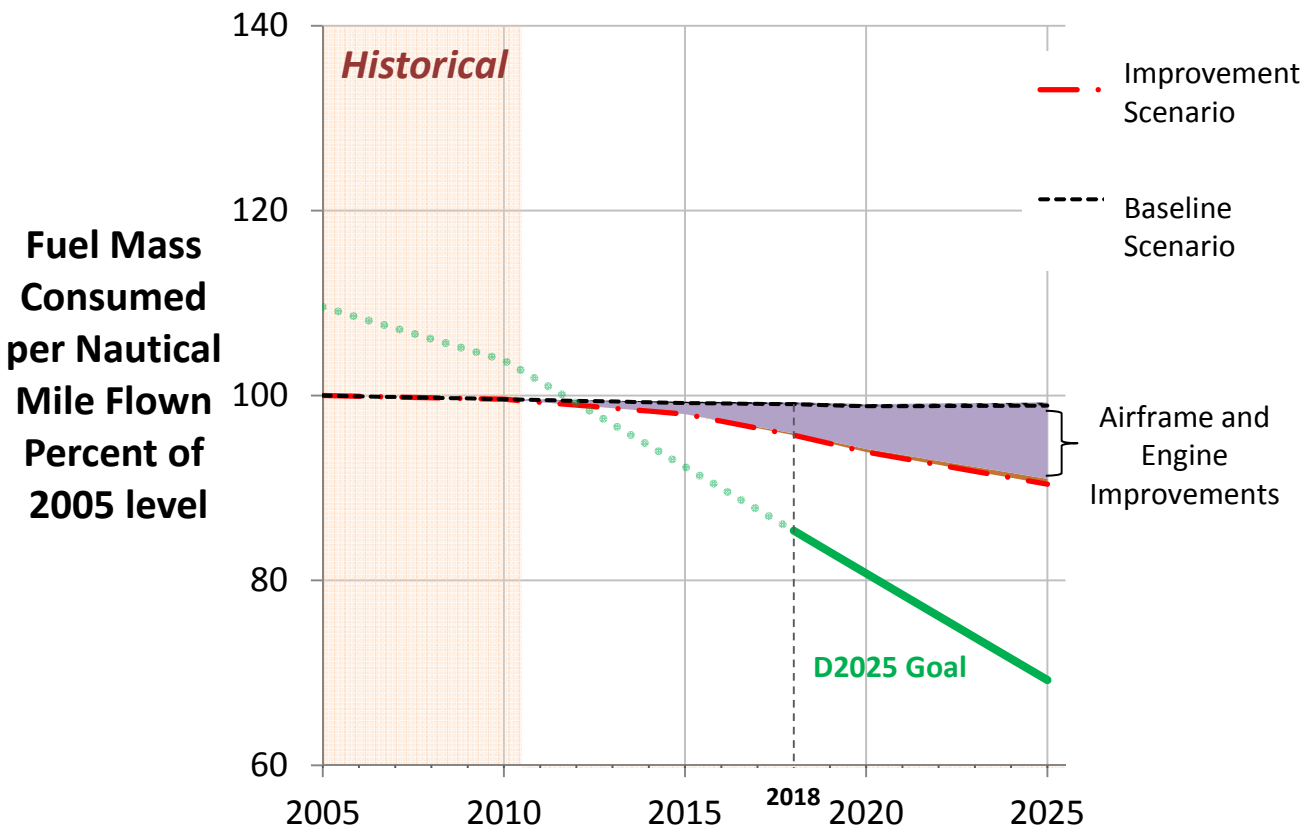
Backup Slides

Results – Energy-Efficiency



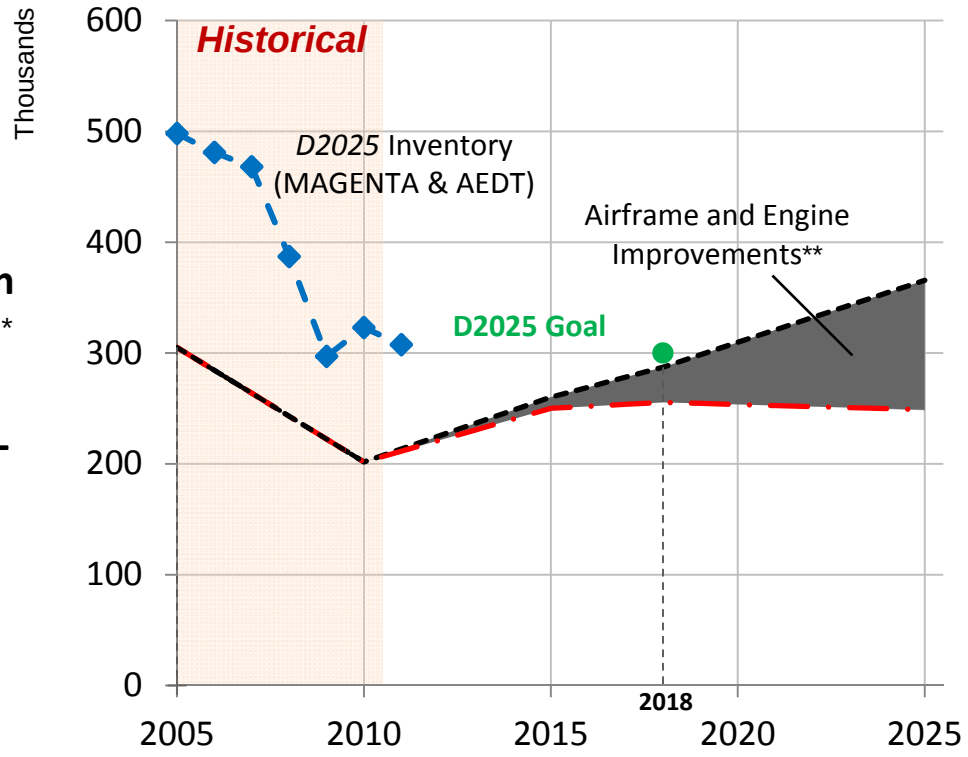
Highlights

- Initial analysis suggests goal requires additional measures beyond those considered here
- Savings associated with Alt Fuels and Operational Improvements too small to be visible
- Study suggests normalizing by available seat-miles as a better measure of productivity; results in performance 13% higher (worse) than D2025 goal, rather than 21% (as shown in figure)

Analysis provides a 'first cut' at possible impacts of considered improvements

Results – Noise

Population exposure* to 65 dB DNL



Highlights

- Initial analysis indicates that the 2018 goal is achievable
- Differences between Destination 2025 Inventory and Baseline Scenario:
  1. Use of 2010 Census
  2. Operations counts
  3. Improved tracks and usage rate data
- Analysis assumes constant population density based on 2010 census
- Changes in operational conditions, such as new runway infrastructure, are not considered and these could reduce exposure

* Exposure reflects 2010 Census population densities throughout the analysis period
** Operational improvements were assumed to have zero net effect, and the effect of alternative fuels was assumed to be negligible
Note: The nearly constant exposure level of the Core Improvement Scenario (2018-2025) is a derived result rather than an assumption of the Study methodology

Analysis provides a 'first cut' at possible impacts of improvements considered