Office of Environment and Energy’s (AEE)  
Air Traffic Management Modernization / Operations Research Program Update

Presented to: REDAC E&E Subcommittee  
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Date: August 26, 2014
Air Traffic Management Modernizations (ATMM) Offer Important Potential E&E Improvements

AEE E&E ATMM Research Program Goals

1. Identify and accelerate the implementation of air traffic management concepts that will reduce aviation environmental impacts and/or improve energy efficiency
2. Investigate the E&E effects of operational changes implemented by the FAA.

Core Program Elements

• Research Process: Identifies, conducts, evaluates and transitions ATMM research for implementation
• Roadmap: Describes areas for ATMM Research near, medium, and long term.
• Portfolio Metrics: Assesses the portfolio’s balance with regard to addressing E&E issues and the maturity progression of research project.
Drivers of Research

1) Support AEE Vision and E&E goals

2) External pressures:
   – ANG-2 (NextGen Chief Scientist) direction:
     • Will be difficult to fund concepts that don’t have a near-term path to implementation
     • New operational concepts need to be either beneficial or neutral in terms of noise
   – General prominence of noise issues
   – Inconsistent/unpredictable funding, e.g., anticipated FY15 F&E funding cut expected to significantly reduce ops research budget
How are we aligning AEE Ops Research Program to conform to these pressures?

1) **Maturing promising near-term operational mitigations with the goal of transitioning to appropriate implementing organization (e.g., ATO, ANG)**

2) **Noise focus**
   - Noise-beneficial concepts
   - Enhancing noise analysis/modeling of operational concepts

3) **Developing improved environmental analysis capability**
   - Tools and processes
   - UAS

4) **Continuing and enhancing collaboration (within FAA and with external stakeholders)**

5) **Annual Roadmap assessment**
Maturing Promising Concepts

- Advance concept maturity to demonstrate environmental/operational benefits and identify potential implementation strategy
- Work collaboratively with implementing organization (e.g., ATO, ANG) with the goal of integration into NAS
- Concepts adequately funded in FY14 to minimize dependency on FY15 funding

<table>
<thead>
<tr>
<th>Project</th>
<th>FY14 Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cruise Alt. and Speed Optimization (CASO) /</td>
<td>$1M</td>
</tr>
<tr>
<td>Delayed Deceleration Approach (DDA)</td>
<td></td>
</tr>
<tr>
<td>N-Control</td>
<td>$170K</td>
</tr>
<tr>
<td>Optimized Profile Climb (OPC)</td>
<td>$150K</td>
</tr>
</tbody>
</table>
Maturing Promising Concepts

- Benefits fairly well-understood; critical path now is stakeholder collaboration and understanding operational barriers, implementation strategy
- Opportunities with Delta, OSU/NetJets
- Integration into NextGen concepts, e.g., RNAV speed targets
Maturing Promising Concepts

N-Control

- Airport Selection
- Airport Characterization
  - Site visits
  - Visualizations
  - Operational Data Analysis
- Algorithm Development
- Implementation Design
- Operational Testing & Performance Evaluation

Results

Refinement/Validation

- Focused on LGA demo and Surface Office coordination
- Complementary to NextGen Integration Working Group recommendation

OPC

- Refining benefits estimates
- Identifying barriers and targeted opportunities

Distribution in fuel and time savings

- N = 2177
- 55% fuel savings
- 5% fuel penalty
- 40% no level off

Graph showing distribution of time savings and fuel savings.
Noise Focus

- Noise-beneficial concepts:

<table>
<thead>
<tr>
<th>Project</th>
<th>Noise Impact</th>
<th>Research Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDA</td>
<td>Potential benefit from staying in “clean” configuration</td>
<td>Exploring noise measurement</td>
</tr>
<tr>
<td>OPC</td>
<td>Potential benefit from steeper profile</td>
<td>Exploring alternative metrics/modeling</td>
</tr>
<tr>
<td>Steeper glide slope</td>
<td>Potential benefit from steeper approach profile</td>
<td>Possible NAS-wide analysis (not currently funded)</td>
</tr>
</tbody>
</table>

- Enhanced analysis/modeling capabilities
  - ASCENT project focused on quantifying noise impacts of advanced operational procedures
Improved Environmental Analysis Capability

- **Goal** is to perform operations analysis that informs decision-making.

- **PBN Procedures Analysis objectives:**
  - Evaluate E&E impact of PBN procedures.
  - Develop generalized approach using AEDT to assess PBN procedures.
  - Assess noise and emissions trade-offs associated with Noise Abatement Departure Procedures (NADPs) and explore operationally viable alternatives.

- **In addition to E&E assessments,** analysis has resulted in development of tools/processes for advanced operations analyses with AEDT.
## Example NADP Analysis – LAX

### Baseline HOLTZ9 Runway 25R

### Baseline Preliminary DNL Noise Contours

#### Legend:
- 70 dB
- 60 dB
- 50 dB
- 40 dB

- Palos Verdes
- San Pedro

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### Baseline Preliminary Emissions and Noise Exposure Results

<table>
<thead>
<tr>
<th>Event</th>
<th># of Flights</th>
<th>Fuel (kg)</th>
<th>Distance (km)</th>
<th>Duration (min : sec)</th>
<th>CO (kg)</th>
<th>NOx (kg)</th>
<th>PM2.5 (kg)</th>
<th>DNL Contour Area (sq. km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline*</td>
<td>693**</td>
<td>2,035</td>
<td>255</td>
<td>23:02</td>
<td>2.3</td>
<td>42</td>
<td>1.9</td>
<td>806 185 21 3</td>
</tr>
</tbody>
</table>

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Federal Aviation Administration
Example NADP Analysis – LAX

- The scenarios were created to determine the environmental impact of different utilization rates of the Alternatives.
- Scenario LAX-a1 Creation:
  - 350 (50%) of the tracks from the baseline sample were used
  - 350 (50%) of the tracks from the baseline sample were ‘tagged’ onto Alternative 1
    - In TARGETS, control line was drawn across tracks to ‘tag’ to a procedure
  - Scenario LAX-a1 assumes the same percentages of Day/Evening/Night flights as the Baseline
    - Baseline Day: 231 (38% of total flights)  Alternative 1 Day: 231 (38% of total flights)
    - Baseline Evening: 36 (5% of total flights)  Alternative 1 Evening: 36 (5% of total flights)
    - Baseline Night: 83 (12% of total flights)  Alternative 1 Night: 83 (12% of total flights)
    - Scenario LAX-a1 Total: Day – 462 (66%), Evening – 72 (10%), Night – 166 (24%)
Example NADP Analysis – LAX

Key Take-Aways:
- Scenario LAX-a1 results in reductions in fuel, distance, duration, and emissions when compared to the baseline.
- The CNEL 60 dB contour areas increased in size, the 50 dB contour area decreased, and 70 dB contour area remained the same.

Scenario LAX-a1 Preliminary Emissions and Noise Exposure Results

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<th>NOx (kg)</th>
<th>PM2.5 (kg)</th>
<th>CENL Contour Area (sq. km)</th>
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<tr>
<td>Baseline*</td>
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<td>2,035</td>
<td>255</td>
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<td>2.3</td>
<td>42</td>
<td>1.9</td>
<td>185 21 3</td>
</tr>
<tr>
<td>Scenario LAX-a1** Δ</td>
<td>642</td>
<td>-53 (-2.6%)</td>
<td>-4.7 (-1.9%)</td>
<td>-0:35</td>
<td>-0.13 (-5.8%)</td>
<td>-1.43 (-3.4%)</td>
<td>-0.04 (-2.3%)</td>
<td>-38 (+7) (+33%) No change</td>
</tr>
</tbody>
</table>

Preliminary results; do not cite or quote
Improved Environmental Analysis Capability

Modeling Potential E&E Benefits/Impacts of UAS in the NAS

• On-going coordination with:
  • FAA UAS Integration Office
  • Volpe
  • TRB/ACRP

• Preliminary Findings on UAS Customization and Substitution in AEDT

<table>
<thead>
<tr>
<th>Level of Difficulty</th>
<th>Description of Customization</th>
<th>Data Needs</th>
<th>Data Availability</th>
<th>Updates to AEDT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Model UAS conversions as actual AEDT aircraft (e.g. G550 Conversion as a GV in AEDT)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>1</td>
<td>Model UAS with a substitute aircraft currently in AEDT</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>2</td>
<td>Select an airframe, engine alternative in AEDT</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>3</td>
<td>Select an airframe engine alternative with different BADA fuel specifications</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>4</td>
<td>Select an airframe engine alternative with a different NPD curve</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>5</td>
<td>Obtain new performance data for UAS vehicles and integrate into AEDT (Fuel Burn)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>6</td>
<td>Obtain new performance data for UAS vehicles and integrate into AEDT (Noise)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Preliminary results; do not cite or quote
Summary

• AEE Ops Research program is positioned to respond to external pressures now and in the future:
  1) Maturing promising mitigations
     • CASO, DDA, N-Control, OPC
  2) Addressing noise impacts
     • Noise-mitigating concepts
     • Enhanced noise modeling/analysis of operational concepts
  3) Improved environmental analysis capability
     • Procedure assessment
     • UAS
  4) Collaboration
  5) Annual Roadmap assessment