Automation for Accommodating Fuel-Efficient Descents in Constrained Airspace

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Example of Problem: Vertical Flight Profiles

Boeing 777 arrivals into San Francisco (SFO) over a two-week period
Example of Problem:
Lateral Flight Profiles
Towards a Solution: Efficient Descent Advisor

Trajectory-based, strategic arrival clearances:

• Allow a gliding, continuous descent at low engine power
• Maximize arrival throughput
• Avoid traffic conflicts
• Can be issued by voice or data-link
• Integrate with existing avionics for precision guidance and control
EDA Development

Human-in-the Loop Simulation

Flight Testing
Simulation Results
Comparison of Vertical Trajectories

Without EDA

With EDA
Using EDA for "Tailored Arrivals"
Potential Benefits
Fuel and Emissions Reduction from Tailored Arrivals

<table>
<thead>
<tr>
<th>Traffic Conditions</th>
<th>Fuel Savings (lbs)</th>
<th>CO₂ Savings (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>227</td>
<td>715</td>
</tr>
<tr>
<td>Med</td>
<td>358</td>
<td>1,128</td>
</tr>
<tr>
<td>Heavy</td>
<td>1,760</td>
<td>5,544</td>
</tr>
</tbody>
</table>

For Boeing 777 Operations into San Francisco
Potential Benefits
Noise Reduction from Tailored Arrivals

Before

After
Summary

- Potential environmental benefits of low-power descents are greatest during busy traffic conditions
- Trajectory-based automation and procedures are key to realizing these benefits
- NASA is working closely with FAA and industry to develop the required technology