Advanced Concept Studies for Commercial Transports Entering Service in the 2030-35 Period

Subsonic Fixed Wing Perspective

Fundamental Aeronautics Pre-Proposal Conference
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Rich Wahls, Project Scientist
Description of SFW Project

• Objectives
  – Development of prediction and analysis tools for reduced uncertainty in design process
  – Development of concepts/technologies for enabling dramatic improvements in noise, emissions and performance characteristics of subsonic/transonic aircraft

• Relevance
  – Direct impact on future designs of a wide range of subsonic aircraft relevant to industry, DoD, and OGA
  – Direct impact on JPDO & NextGen operational and environmental goals and objectives
### System Level Metrics

**... technology for dramatically improving noise, emissions, & performance**

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<tbody>
<tr>
<td>Noise (cum below Stage 3)</td>
<td>-42 dB</td>
<td>-52 dB</td>
</tr>
<tr>
<td>LTO NOx Emissions (below CAEP 2)</td>
<td>-70%</td>
<td>-80%</td>
</tr>
<tr>
<td>Performance: Aircraft Fuel Burn</td>
<td>-33%***</td>
<td>-40%***</td>
</tr>
<tr>
<td>Performance: Field Length</td>
<td>-33%</td>
<td>-50%</td>
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**N+1 Conventional**

**N+2 Hybrid Wing/Body**

*** An additional reduction of 10 percent may be possible through improved operational capability

**Approach**

- Enable Major Changes in Engine Cycle/Airframe Configurations
- Reduce Uncertainty in Multi-Disciplinary Design and Analysis Tools and Processes
- Develop/Test/Analyze Advanced Multi-Discipline Based Concepts and Technologies
- Conduct Discipline-based Foundational Research
NextGen Vision
Provide environmental protection that allows sustained aviation growth

Key Factors
- Demand/Capacity
- Environment
- Energy

2% Shift to Micro Jets
- 2% shift to micro jets

Shift to smaller aircraft, more airports
- Smaller aircraft, more airports

Shift to more passengers / flight
flight (e.g., A380, reverse RJ trend, higher load factor)

Demand

Passengers 1.8-2.4X
Flights 1.4-3X
Increase 10+ pax/flight

Terminal Area Forecast (TAF) Growth Projection

TAF Growth Ratios, Higher Rate

TAF Growth Ratios, Lower Rate

Source: NextGen Integrated Plan, 2004
### Subsonic Fixed Wing Project – “N+3” Advanced Concepts Studies

*... technology for dramatically improving noise, emissions, & performance*

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<tr>
<td>Noise (cum below Stage 3)</td>
<td>-42 dB</td>
<td>-52 dB</td>
<td>better than -81 dB (55 LDN at average boundary)</td>
</tr>
<tr>
<td>LTO NOx Emissions (below CAEP 2)</td>
<td>-70%</td>
<td>-80%</td>
<td>better than -80% plus mitigate formation of contrails</td>
</tr>
<tr>
<td>Performance: Aircraft Fuel Burn</td>
<td>-33%***</td>
<td>-40%***</td>
<td>better than -70% plus non-fossil fuel sources</td>
</tr>
<tr>
<td>Performance: Field Length</td>
<td>-33%</td>
<td>-50%</td>
<td>exploit metro-plex concepts</td>
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Scope of Study

- Describe challenges that may be facing passenger- and package-carrying commercial aircraft operators in 2030 timeframe
- Identify vehicle concepts and enabling technologies to address these challenges and N+3 system level metrics
  - Perform design space trade studies as needed
  - Identify pros/cons of advanced vehicle concepts
  - Detailed system study to evaluate concepts on equal basis
  - Quantify noise, emissions and performance characteristics
  - Assess environmental, economic and mobility impacts (fleet level)
- Recommend and prioritize concepts and enabling technologies
- Define follow-on technology development roadmaps
- Provide Contractor Report for public release
Key Points

- Commercial, Entry into service 2030-35 timeframe
- Vehicle-centric study
  - In context of your view of operational challenges for commercial operators in 2030+
  - What will be the most prevalent vehicle beyond 2030?
  - Cursory assessment of impact of vehicle introduction into fleet
- Enabling Technologies and Roadmaps

- CLEAN SHEET of PAPER
  - THINK OUTSIDE THE BOX