



Commercial Airplanes

Noise of the Future

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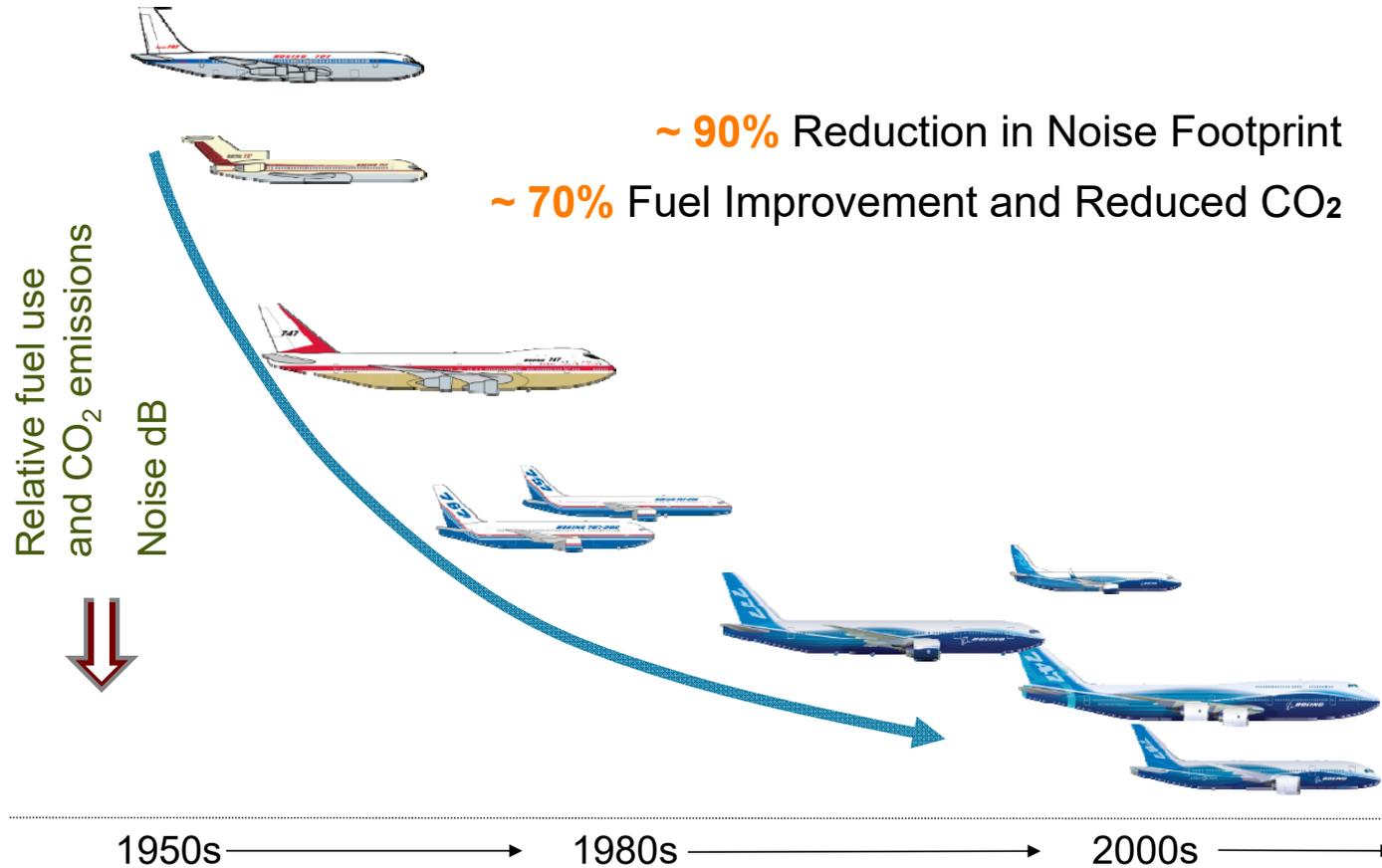
Boeing Commercial Airplanes

Senior Manager – Noise, Vibration and Emissions

October 2018

Aviation Working Together

A Strong Track Record



More Efficient, Quieter Family of New Airplanes

777X

12% Reduction in fuel and CO₂
Substantially smaller noise footprint

**than the A350-1000

787

20% Reduction in fuel and CO₂
60% Smaller noise footprint

*than the model it replaces



Less fuel, lower operating costs, lower CO₂ emissions

737 MAX

14% Reduction in fuel and CO₂
40% Smaller noise footprint

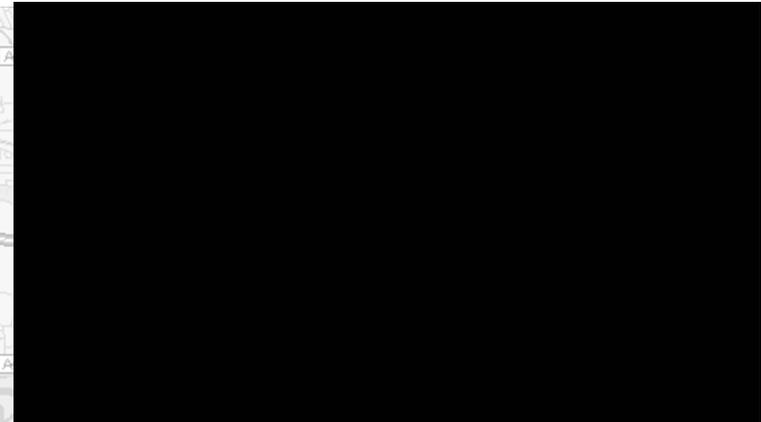
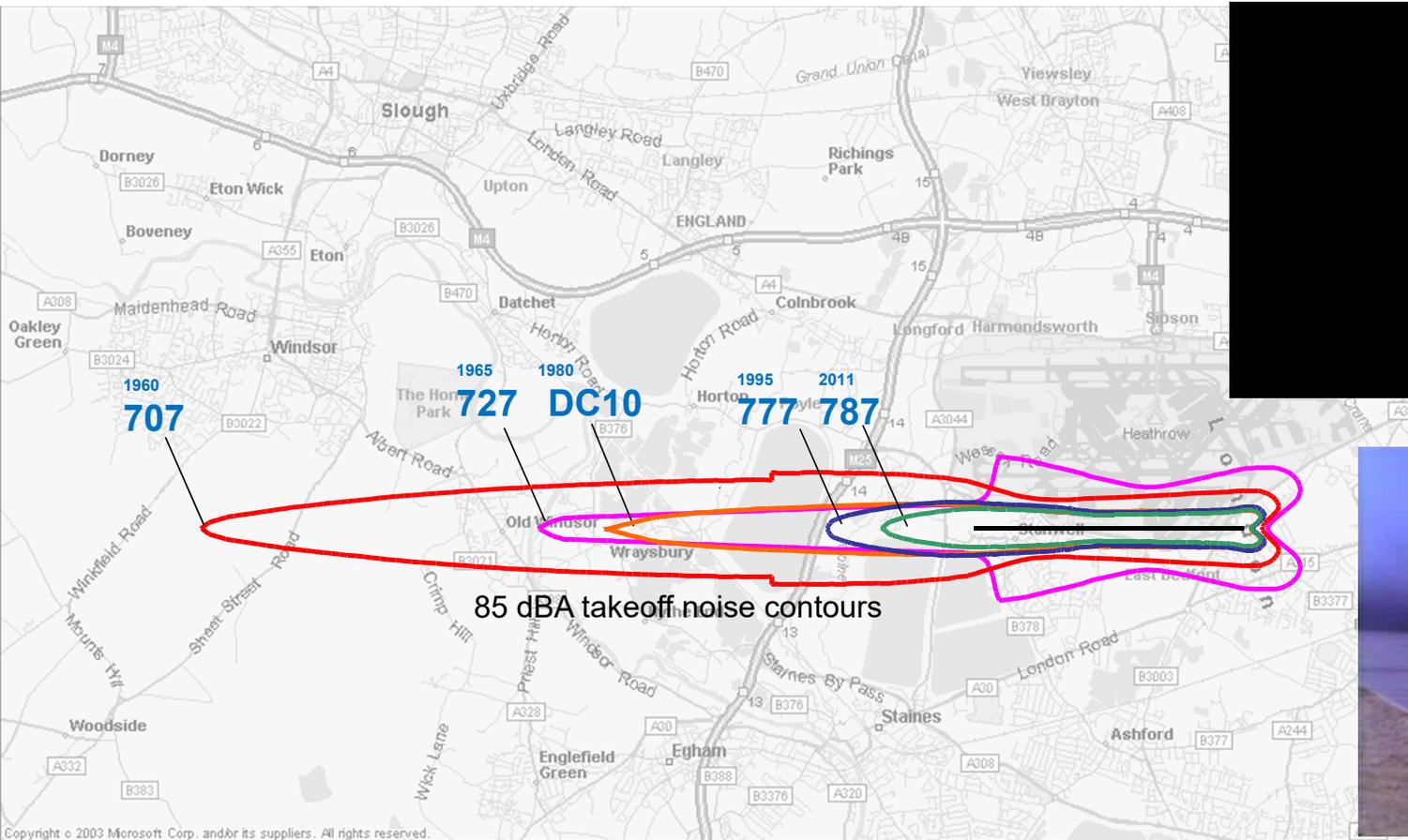
*than the model it replaces

747-8

16% Reduction in fuel and CO₂
30% Smaller noise footprint

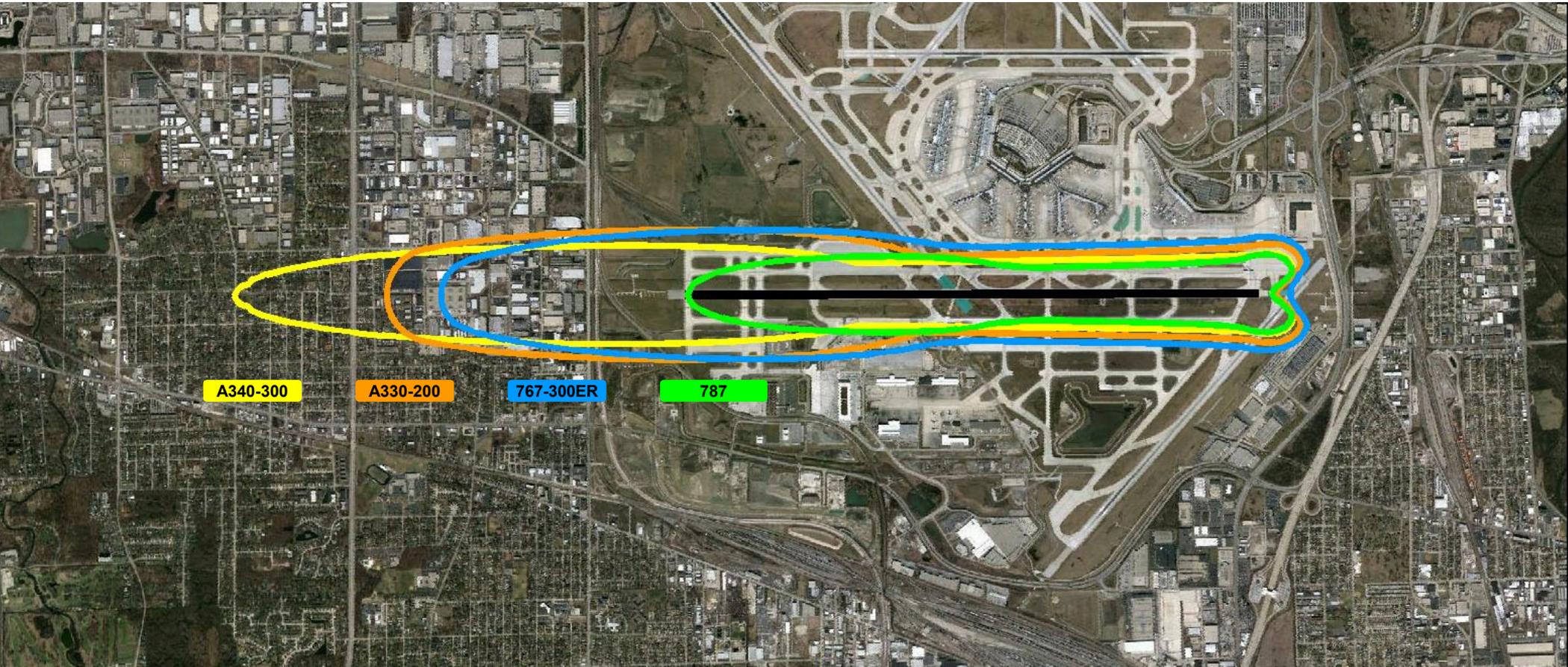
*than the model it replaces

Significant Reduction in Community Noise London Heathrow International Airport



787 is Quieter for Communities

Chicago, O'Hare International Airport



■ Chicago-O'Hare International Airport RWY 28
■ 85-dBA noise contours

Takeoff noise contours
■ 6000-nmi mission

Pioneers on the Frontier of Innovation

Technologies For Quieter and Efficient Airplanes

All Composite Fuselage



Modern High Lift Devices



Chevrons



Operational Procedures



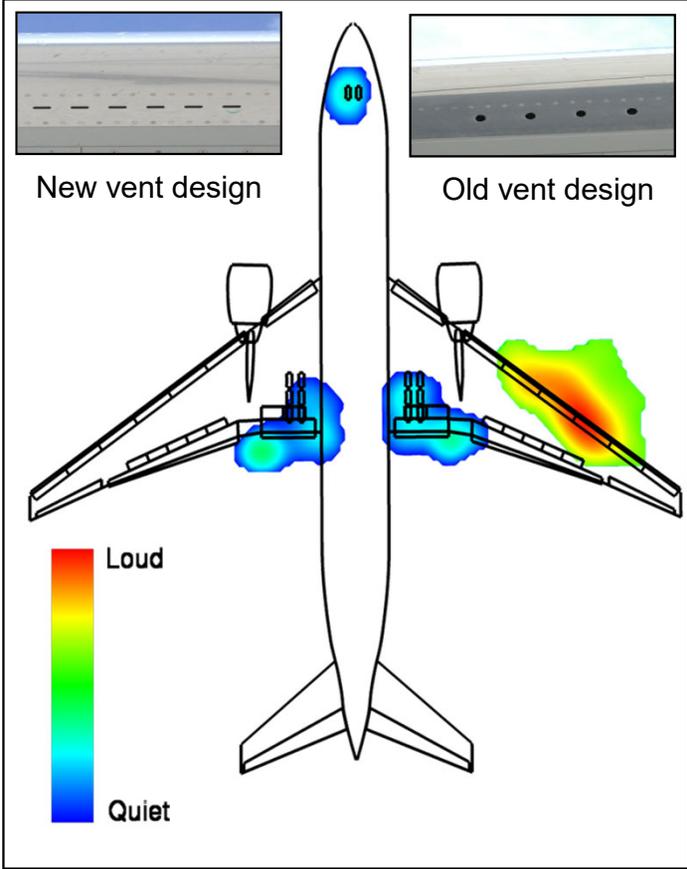
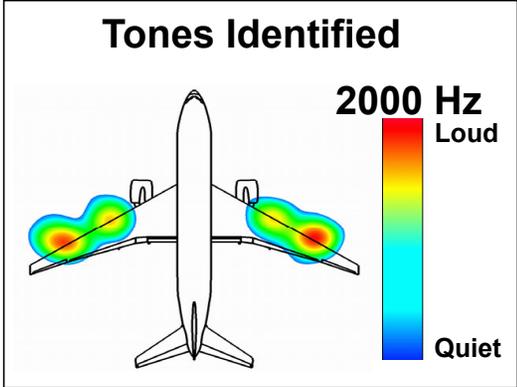
Higher Bypass Ratio Engines



Finding Noise and Fixing It

Advanced Test Techniques:

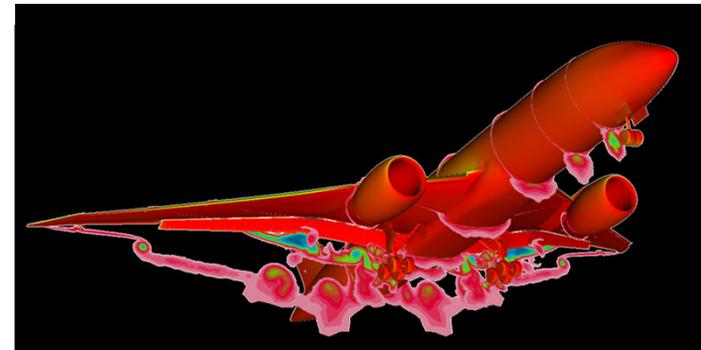
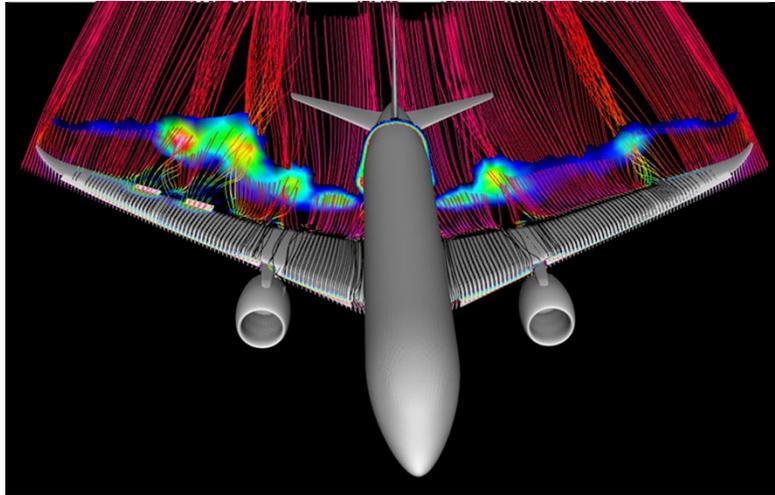
- Identify opportunities for source noise reduction
- Distinguishes between engine and airframe sources



Advanced Aeroacoustic Tools for Efficient Wing Design

State of the art computational tools

- Complex due to geometry, grid size, flow physics, (or all three!)
- Simply not possible on past programs
- Grid size on the order of 100 million cells
- Runs using hundreds of processors

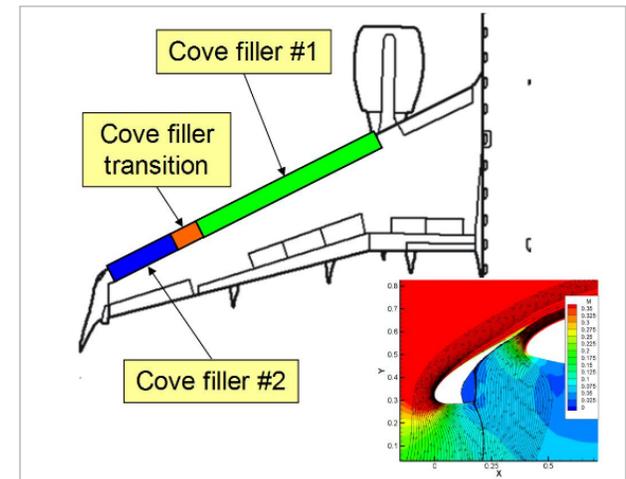


Smooth wing design

- Laminar flow technologies
- **Advanced wing tip designs**
- **State-of-the-art high lift systems**
- Composite structure allows high aspect ratio

2016 ecoDemonstrator

Slat Noise Cove Filler



Landing Gear Fairing

- Examined on QTD 2
- Showed Noise Reduction Promise
- Other issues –
 - Brake Cooling
 - Maintenance
- Looking and Next Generation Landing Gear Fairing on ecoDemonstrator



Advanced Concepts



Thanks

