LOW-EMISSION AIRCRAFT STUDY
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OBJECTIVE

To develop a framework that enables the systematic assessment of cost and emissions impacts of future aircraft technologies designed to reduce greenhouse gas emissions

- respond to questions posed in a global, multiple transport mode context
- a means for value and assumption articulation
- enable rational choices to be made among options for aviation technology development

TRENDS IN TECHNOLOGY, COST, AND EMISSIONS

Historically, growth has outpaced efficiency improvement = increased emissions

1971-1998 U.S. fleet
- $E_I$ reduced > 60% or ~3.3% per year
- RPK grew by ~330% or 5.5% per year

A semi-empirical model for aircraft energy intensity($E_I$):

$$E_I = \frac{Q \cdot W_f}{\text{#Seats} \cdot \alpha \cdot \text{SL} \cdot \eta_f}$$

Reduced energy intensity helps reduce airline costs

1959 to 1995 U.S. fleet
- 65% reduction in overall DOC/RPK as newer aircraft models introduced
- maintenance, crew, and capital related DOC/RPK accounted for ~75% of reduction, fuel ~25%

Breakdown of $E_I$ reduction:
- 57% engine efficiency
- 22% aerodynamic efficiency
- 17% capacity efficiency
- 4% other incl. increased a/c size

Airlines willing to pay higher acquisition cost if they can gain from savings in DOC

1959 to 1995 U.S. fleet
- short-range $/seat rose ~50%
- long-range $/seat rose ~130%