The Future of Air Transport & What it Means for Energy and the Environment

Megan S. Ryerson
Department of City & Regional Planning
Department of Electrical & Systems Engineering
University of Pennsylvania
Emissions from aircraft overwhelm savings potentials from other modes

Philadelphia: Reduce VMT by 596 million per year

1 year of daily flights between Philadelphia-Doha

Boston: Hubway Bicycle Program saved 350 tons of CO₂ from 2011-2014

Between 2014-2015, Boston’s new international flight to Beijing, China emitted 58,530 tons of CO₂

In the past year, U.S. aircraft emitted

- 11 percent of GHG emissions from the transportation sector in the U.S.
- 3 percent of total U.S. GHG emissions
- 29 percent of GHG emissions from all aircraft globally
- 0.5 percent of total global GHG emissions
System growth and system contraction

Economic development

Technology, procedures, and regulations
Damage Cost for One Flight by Airport

Nahlik, M., Chester, M., Ryerson, M.S. Spatial Differences And Local Costs Of Air Pollution Damages Across U.S. Airports. In review, submitted August 2015.
Airlines Create Rush Hours, Crowds and Full Flights
American Is Bunching Up Flights in Miami to Create Peaks and Lulls

Congestion

Peaks

Unpredictability
Airline Contingency Planning

• 4.48% of the fuel consumed by a single flight is due to carrying unused fuel

• 1.04% of the fuel consumed by a single flight is due to carrying additional contingency fuel above a reasonable buffer

• Reducing contingency planning across the entire U.S. domestic aviation industry would reduce as much CO$_2$ as removing 1-2% of California VMT

Open Skies, Joint Ventures, and Gulf Carriers
New Travelers and Travel Patterns

Traveling with Millennials

It makes sense to travel now, instead of saving travel for a future that is in no way guaranteed.
- System growth and system contraction
- Economic development
- Technology, procedures, and regulations
Major U.S. airports are routinely expanded with the justification of economic development.

Airport funded airline incentive programs

Massport is Focusing on These Top International Opportunities

400,000 tons CO₂

❖ System growth and system contraction

❖ Economic development

❖ Technology, procedures, and regulations
New Airframes, New Engines, New Fuels, New Procedures

“Aircraft remain the single largest GHG-emitting transportation source not yet subject to GHG standards in the U.S.”
Greener Skies

New NextGen satellite procedures over Elliott Bay in Seattle are saving airlines money and fuel, and getting passengers on the ground quicker.

NextGen Route: 4 minutes

Current Radar: 8 minutes

Save: 0.06 minutes per flight

154 flights per day

112,420 barrels annually

Annual Savings Potential: $13,490,400

Alaska Airlines

www.faa.gov/nextgen
Figure 1. The Aviation Industry’s Long-term Targets

Aviation’s emissions recuction road map

- Business-as-usual emissions
- Known technology, operations, and infrastructure measures
- Biofuels and additional technology
- Carbon-neutral growth from 2020
- Gross emissions trajectory
- Economic Measures

Source: Air Transport Action Group (ATAG).
Megan S. Ryerson, Ph.D.
Assistant Professor
Department of City and Regional Planning
Department of Electrical and Systems Engineering
University of Pennsylvania
mryerson@design.upenn.edu
Daily Airport Traffic and Annual Damages Summarized by Emission

15 of the top 16 airports are airline hubs
Is there pushback to growing major airline hubs?
The FAA has a number of interrelated statutory requirements related to capacity, safety, and demand management.

From U.S. Code §47101, it is the policy of the United States—

1. that the safe operation of the airport and airway system is the highest aviation priority;
2. that airport construction and improvement projects that increase the capacity of facilities to accommodate passenger and cargo traffic be undertaken to the maximum feasible extent so that safety and efficiency increase and delays decrease;
3. that artificial restrictions on airport capacity
   - (A) are not in the public interest;
   - (B) should be imposed to alleviate air traffic delays only after other reasonably available and less burdensome alternatives have been tried; and
   - (C) should not discriminate unjustly between categories and classes of aircraft;
How do aircraft stack up against different modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Passengers</th>
<th>Fuel Efficiency</th>
</tr>
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<tbody>
<tr>
<td>55 mpg sedan</td>
<td>20, 5 Pax</td>
<td>100, 1 Pax</td>
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<tr>
<td>35 mpg sedan</td>
<td>25, 5 Pax</td>
<td>125, 1 Pax</td>
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<tr>
<td>Boeing 737 Legacy</td>
<td>75, 85% LF</td>
<td>130, 50% LF</td>
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<tr>
<td>Boeing 737-800</td>
<td>40, 85% LF</td>
<td>70, 50% LF</td>
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</tbody>
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Source: Chester M and Horvath A 2012 High-speed rail with emerging automobiles and aircraft can reduce environmental impacts in California’s future Environ. Res. Lett. 7 034012