# Multimodal Transportation Analysis in the NextGen Era : Challenges and Opportunities


Dr. Antonio Trani
vuela@vt.edu
540-231-4418

Nicolas Hinze
nhinze@vt.edu
540-231-2362

Air Transportation Systems Laboratory
http://www.atsl.cee.vt.edu

# Aviation Challenges and Opportunities

NextGen

Policies and Investments

1

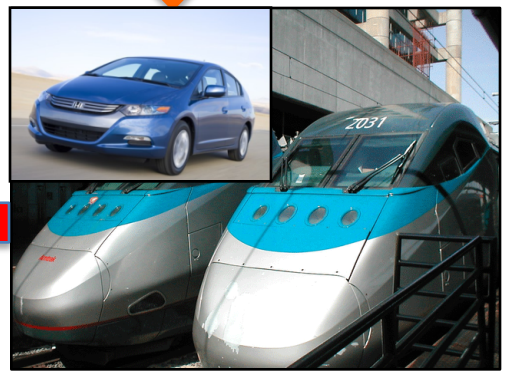
2

Intermodal Efficiency (LOS)

Airport/Airspace Capacity and Effciency

Aviation System Demand


Competing Modes



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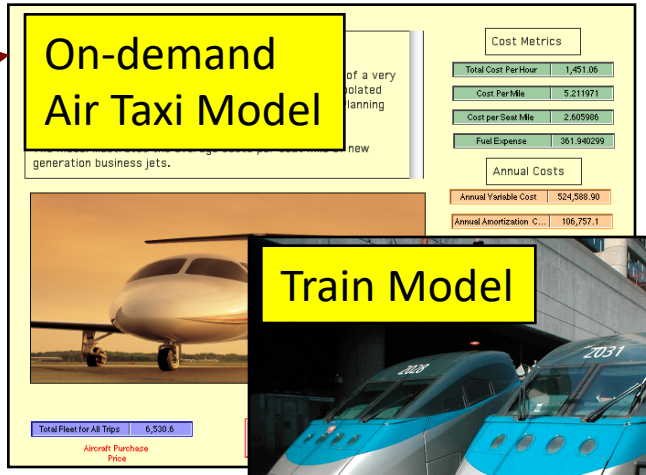
Exogenous Effects (cost factors, Socioeconomics)

# Multimodal modeling quantifies the utility of travel for various modes of transportation

On-demand Air Taxi Model

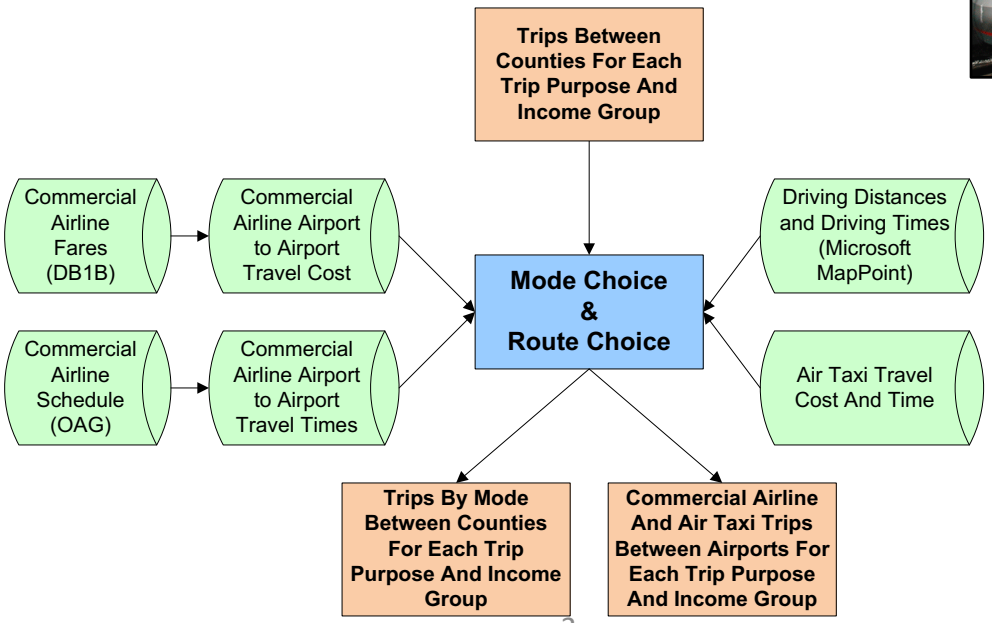



Train Model



Commercial Airline Model

Auto Model

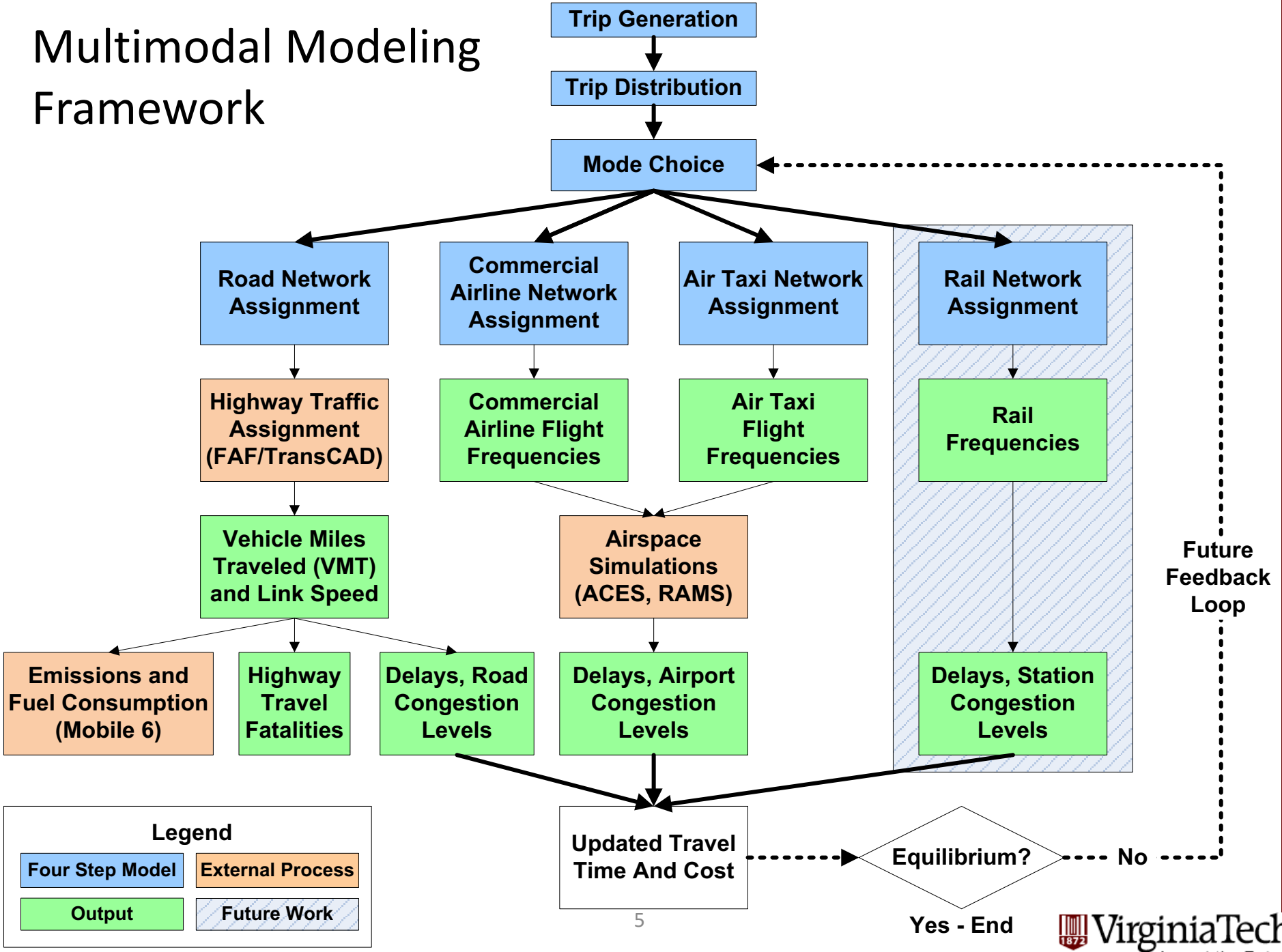



TSAM View

# TSAM is an effort to understand multimodal intercity travel

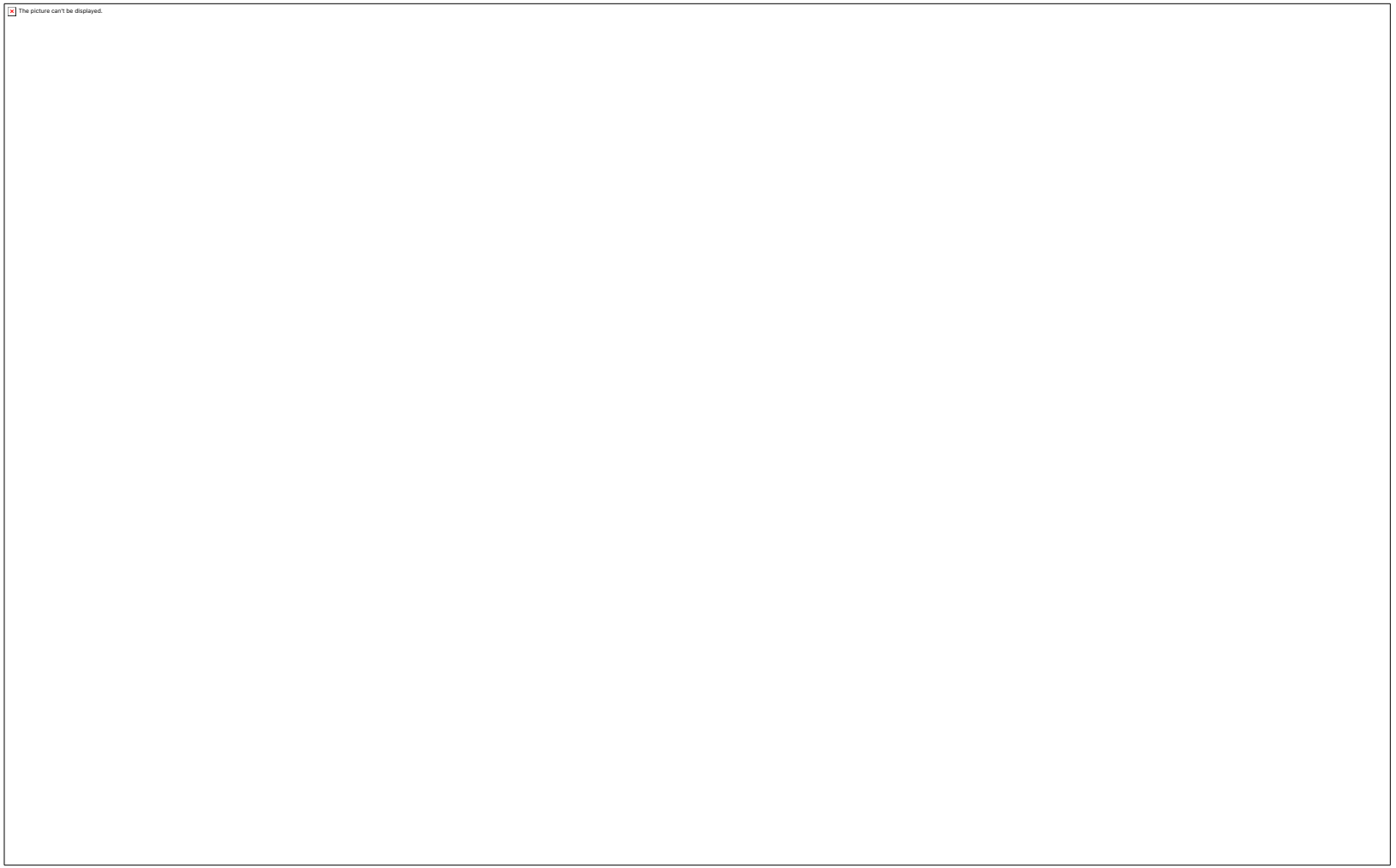
- 9 million county pairs (3,076 X 3,076 counties)
- Automobile, commercial air, and air taxi travel
- Trips greater than 100 miles
- Business and non-business trips
- 5 household income groups
- 3 types of metropolitan statistical areas
- Four steps process: trip generation, trip distribution, mode choice, network assignment
- Standalone software: GIS framework and MATLAB computation

# Multimodal Modeling Framework

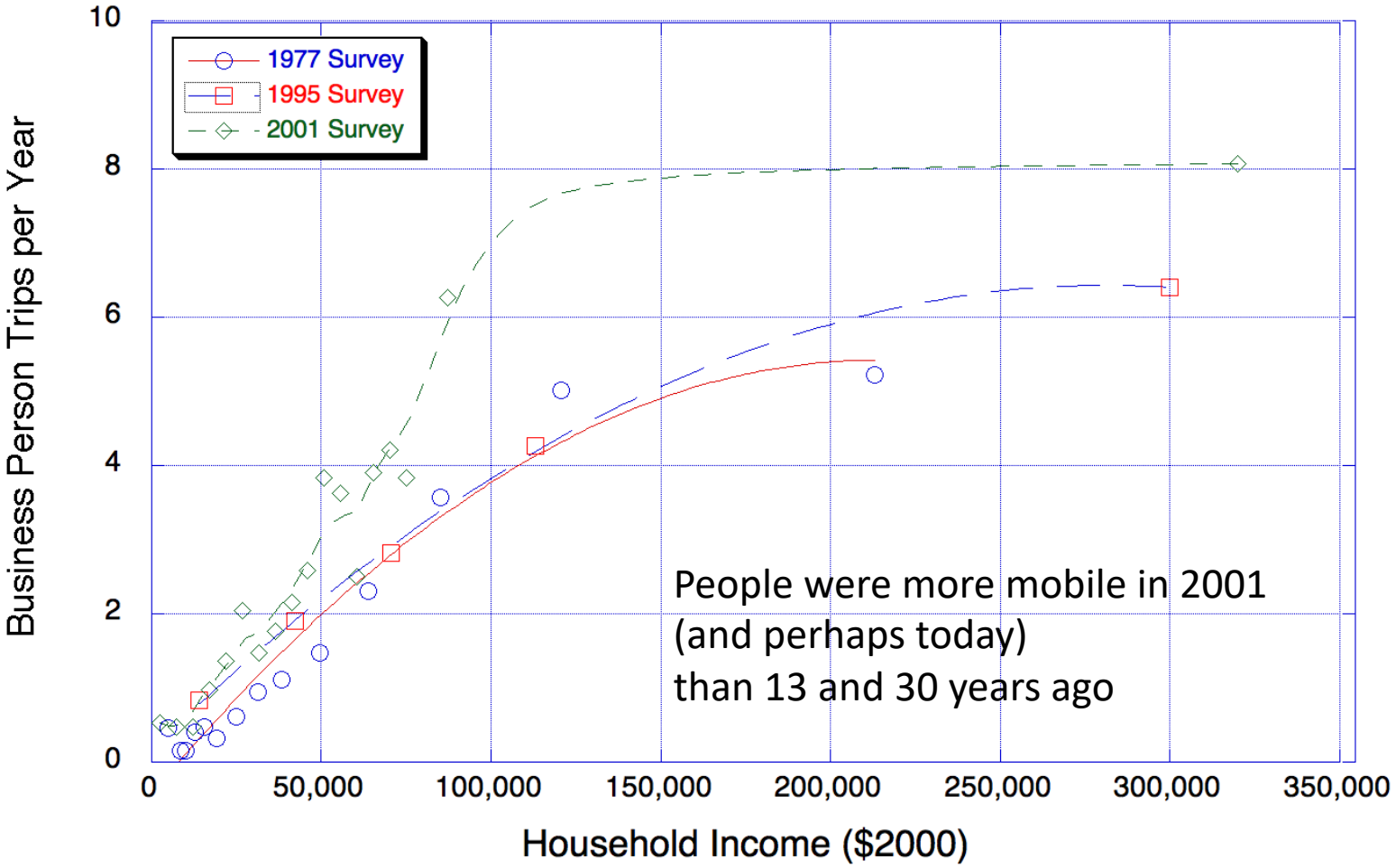


# Old Benchmarks for Multimodal Validation

- ATS 1995 is the only survey that provides a nationwide standard of mode choice behavior for intercity travel



# Trip Rate Changes with Time

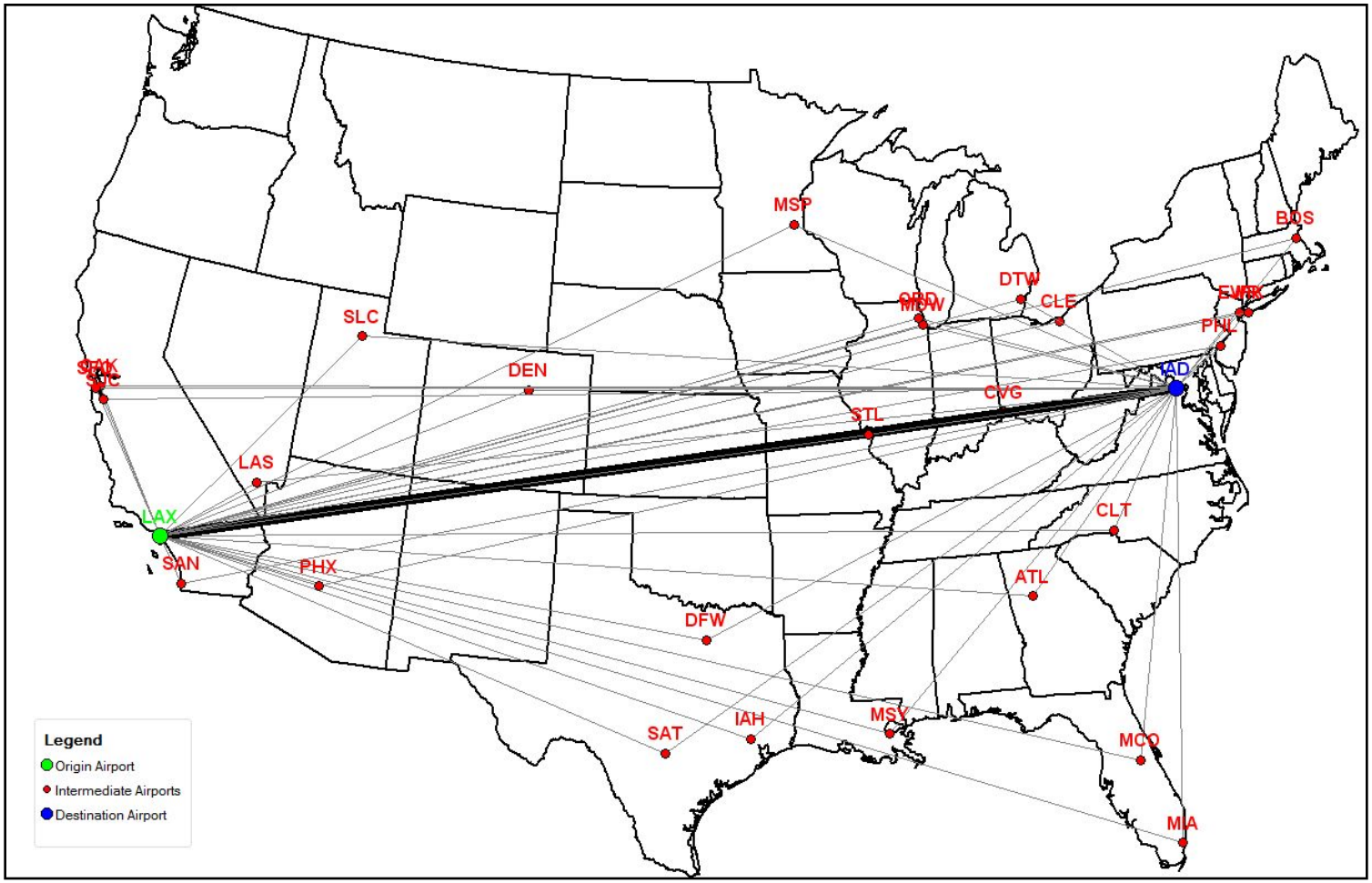



Source of data: Bureau of Transportation Statistics

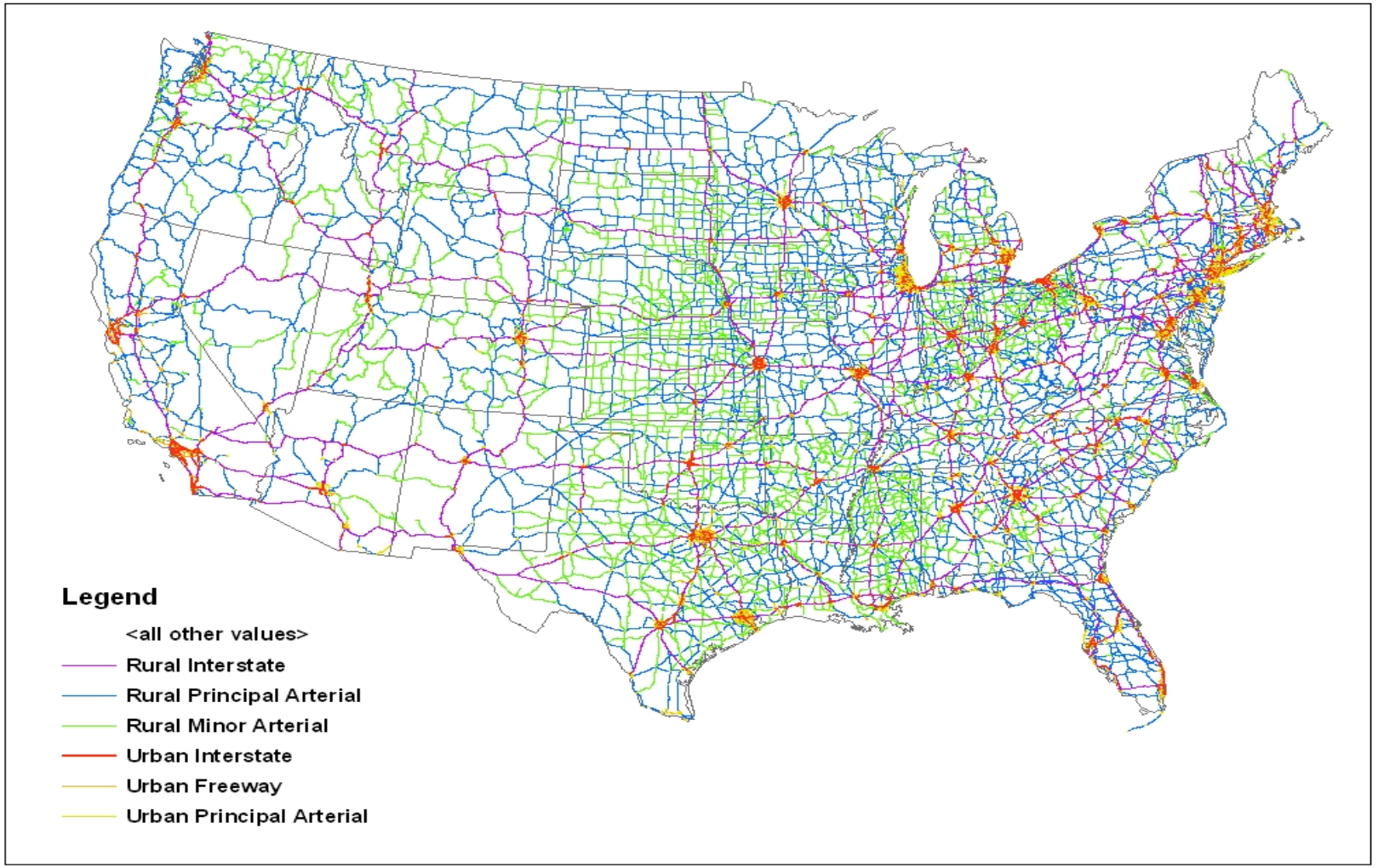
Analysis by Virginia Tech Air Transportation Lab (Henderson and Trani, 2006)

# Network assignment loads the commercial airline and air taxi demand onto the network

- Trip Generation
- Trip Distribution
- Mode Choice
- **Network Assignment**



# The Freight Analysis Framework (FAF) is adapted for automobile intercity traffic assignment in TSAM



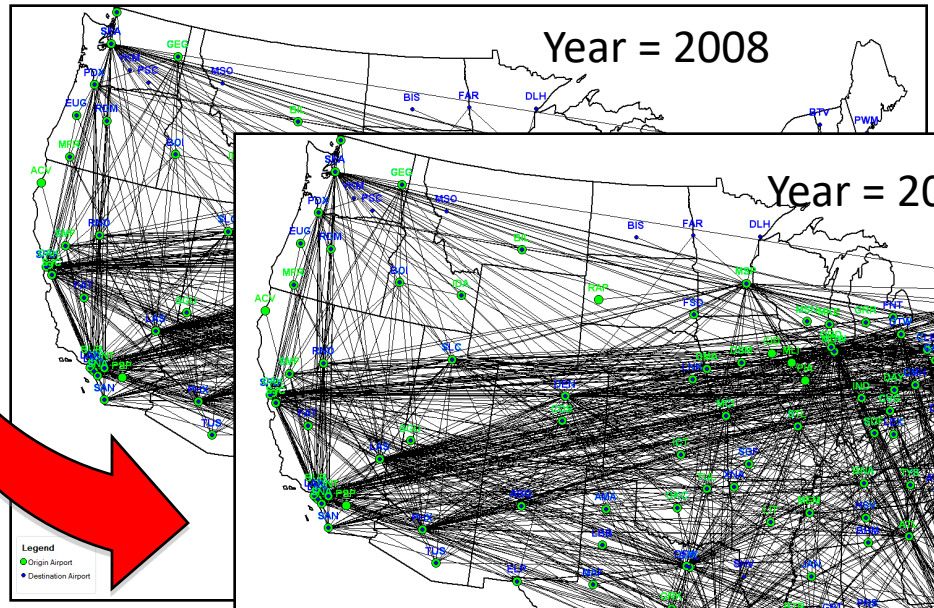
# Commercial airline network and schedule (supply) need to evolve based on future commercial airline demand

Evolution of the airline fleet

Policies

NextGen

Evolution of airline / airport network



# Modeling the NextGen System

- NextGen - Next Generation Air Transportation Systems
- Nextgen is associated with technical changes to the system allowing faster transit time at airports (i.e., faster screening and services)
- NextGen provides added airport/airspace capacity (values still debatable)
- Initial goal of NextGen was to reduce travel time by 30% for passenger in the year 2025 (very ambitious goal)
- This implies large reductions in transit time at airports (the speed of subsonic aircraft is not expected to change drastically in the next 20 years)

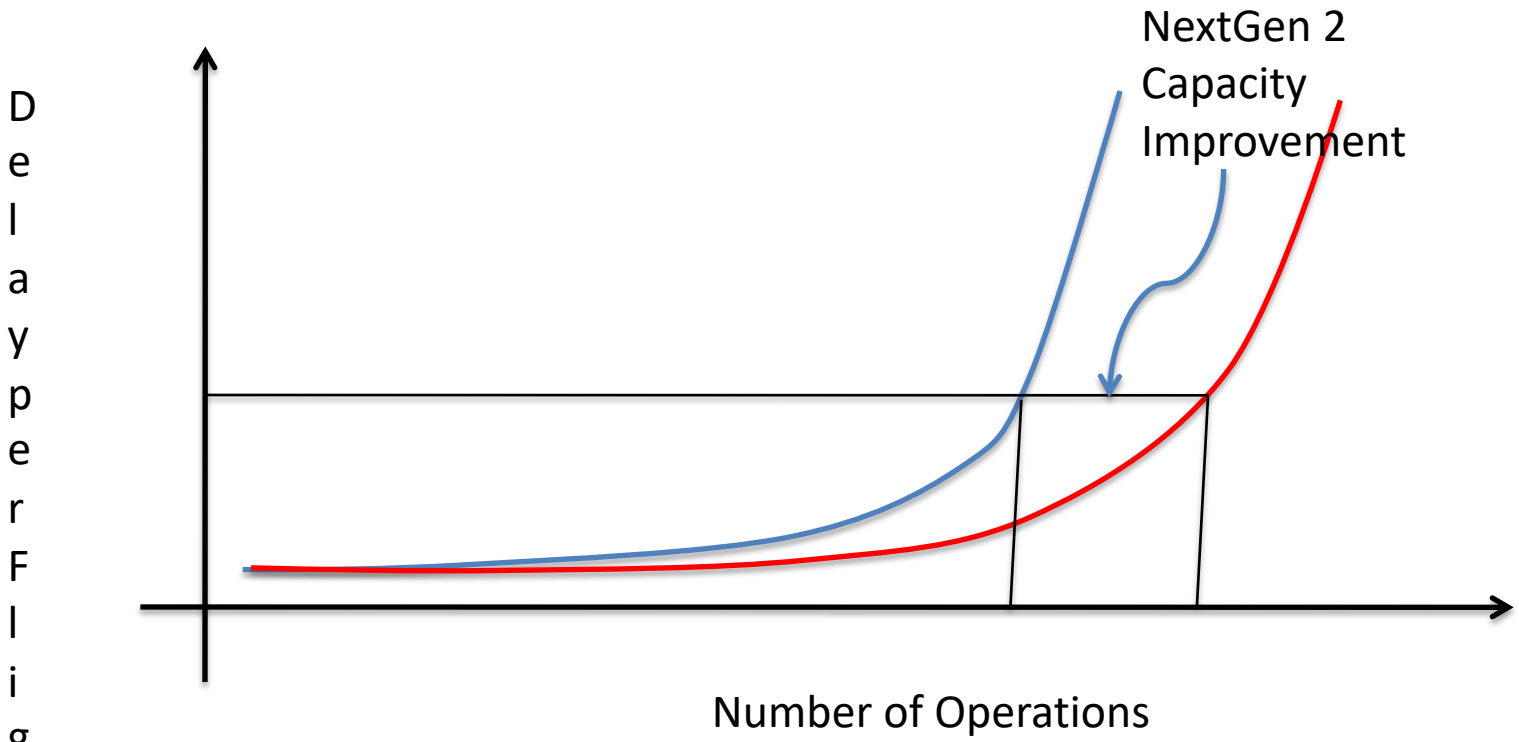
# NextGen Modeling Assumptions (year 2025)

| Scenario | Airport Processing + Slack Time (hrs) | Airline Scheduled Time and Fares | Airport egress time (hrs) |
|---|---|---|---|
| **Baseline Scenario** | 1.8 (Large hub)<br>1.5 (Medium hub)<br>1.0 (Small Hub) | 1X<br>AFF = 1 ($2000) | 0.75 Large hub<br>0.75 Medium hub<br>0.50 Small/Non hub |
| **NextGen 1**<br>Reduction in gate-to-gate time reduction goal | 0.9 (Large hub)<br>0.8 (Medium hub)<br>0.5 (Small/Non-hub) | 1.0 X ($2000)<br>AFF = 1.0 | 0.50 Large hub<br>0.50 Medium hub<br>0.30 Small/Non hub |
| **NextGen 2**<br>Reduction in gate-to-gate time reduction goal | 0.9 (Large hub)<br>0.8 (Medium hub)<br>0.5 (Small/Non-hub) | 0.95 X ($2000)<br>AFF = 1.0 | 0.50 Large hub<br>0.50 Medium hub<br>0.30 Small/Non hub |

- Reducing intermodal processing times at the airport along with a 5% reduction in scheduled airline time increases passenger enplanements by 15%
- Most flights added fall into the 150 to 700 statute miles distance range
- Average overall flight distance reduced approximately 62 miles with NextGen 2

# Assumption for NextGen

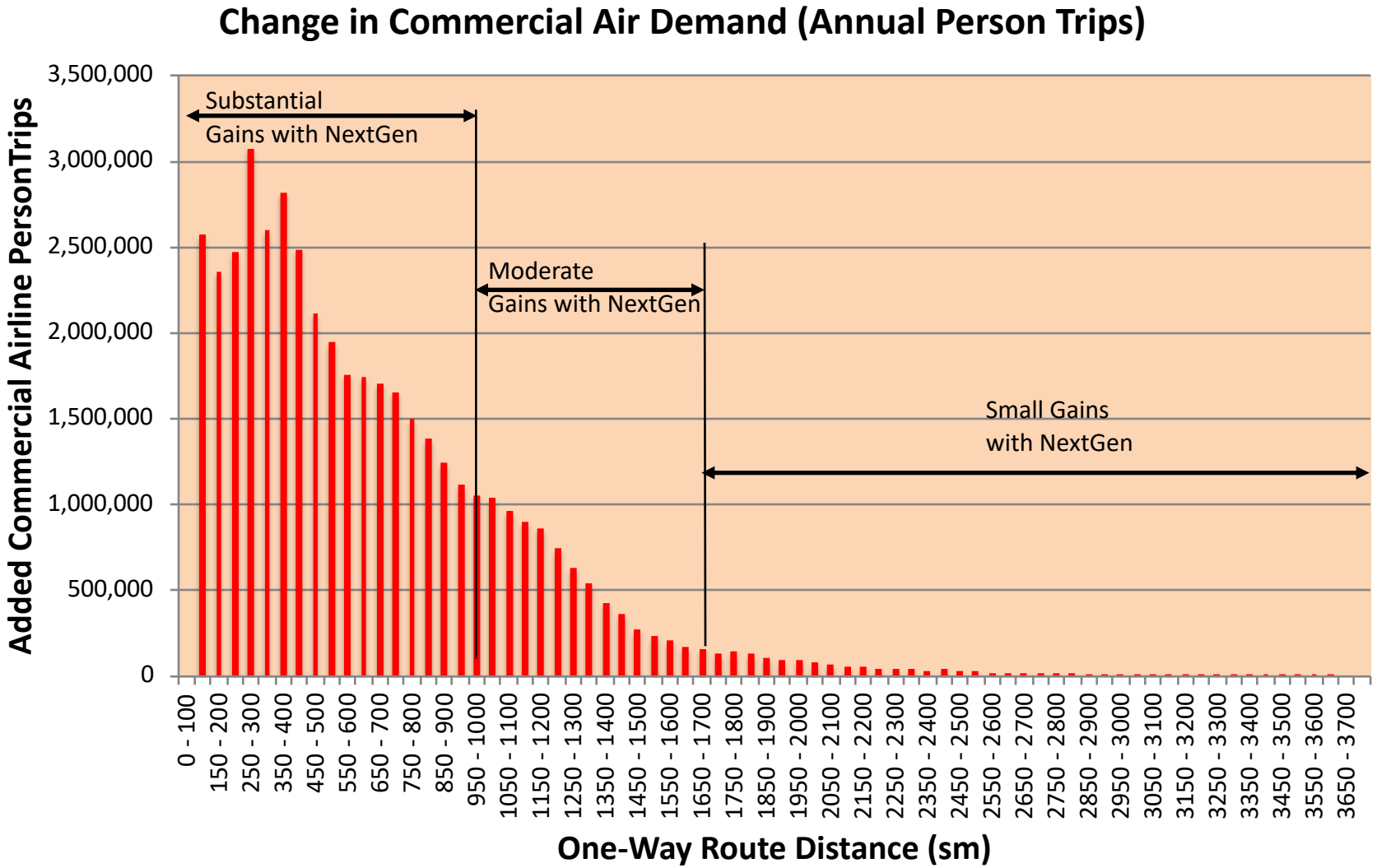
- Assume (for a moment) that added demand loads in the system produce similar average delay per flight of the baseline scenario



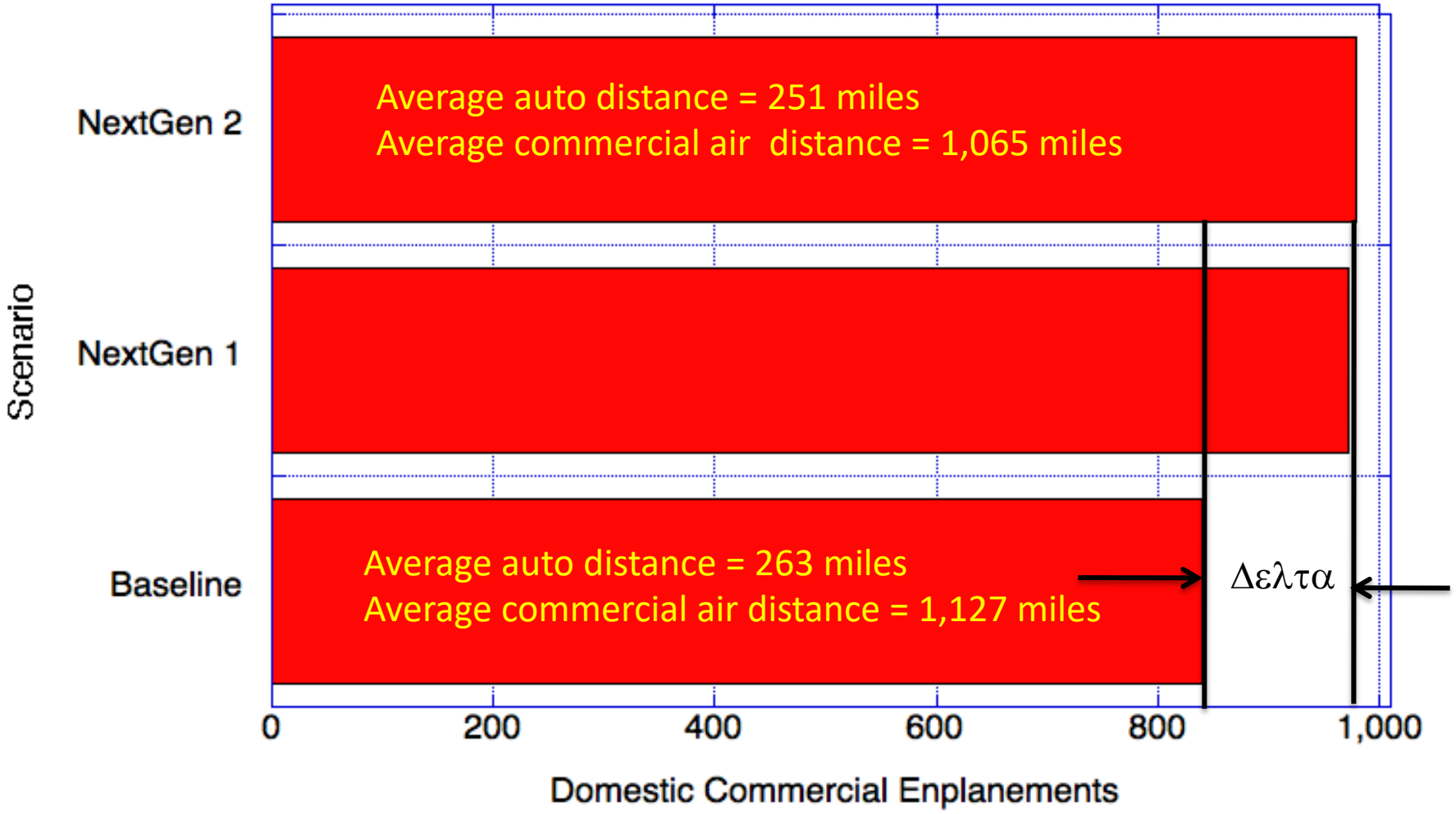
# NextGen 2 Airport Demand Map

# Auto Trips Produced (NextGen 2)

# With NextGen 2 in place, scheduled airline demand could increase by 15% (NextGen Scenario 2025)

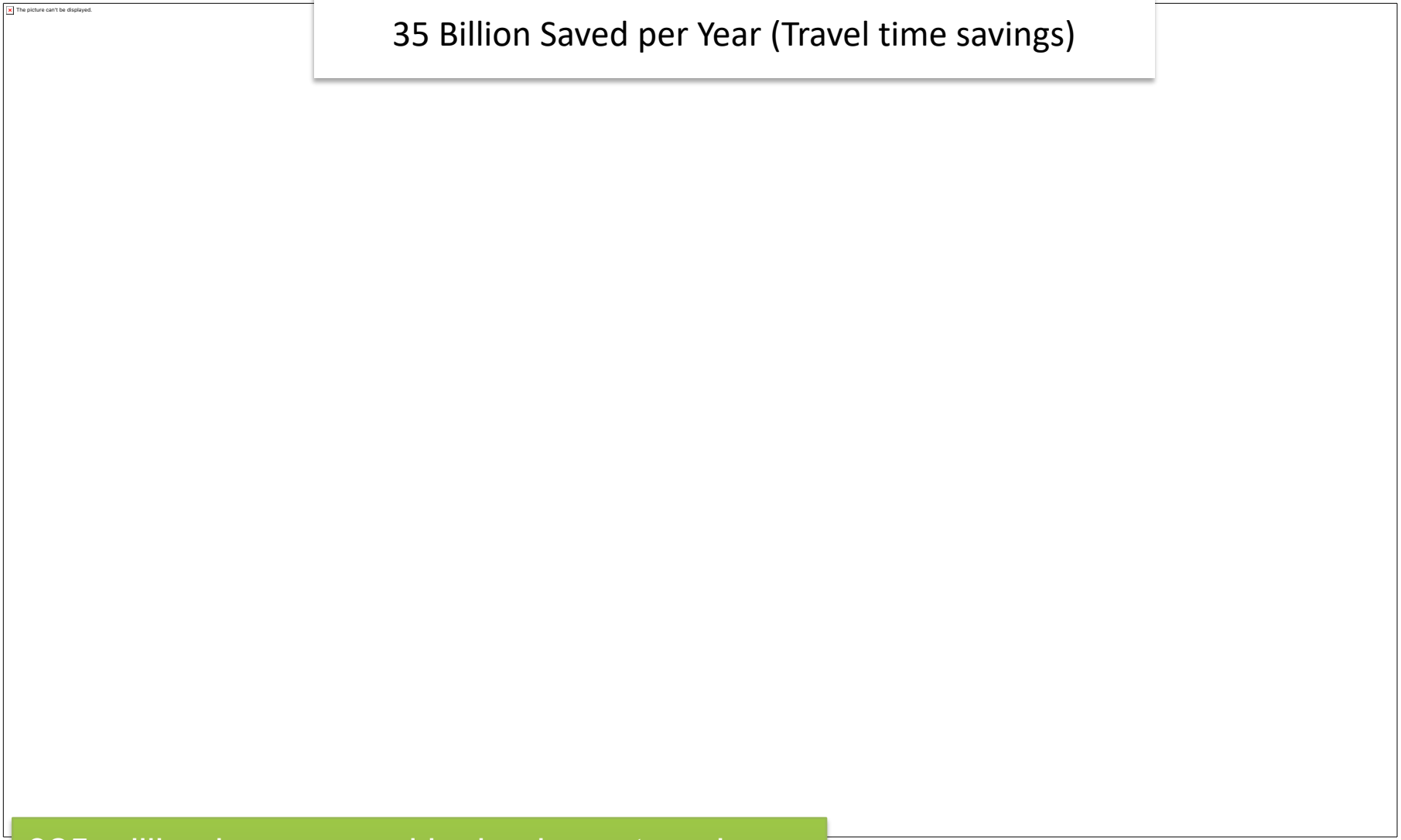


# NextGen 2 could induce another 130 million enplanements in 2025



# Spatial Distribution of Travel Time Savings under NetxGen (2025)

35 Billion Saved per Year (Travel time savings)



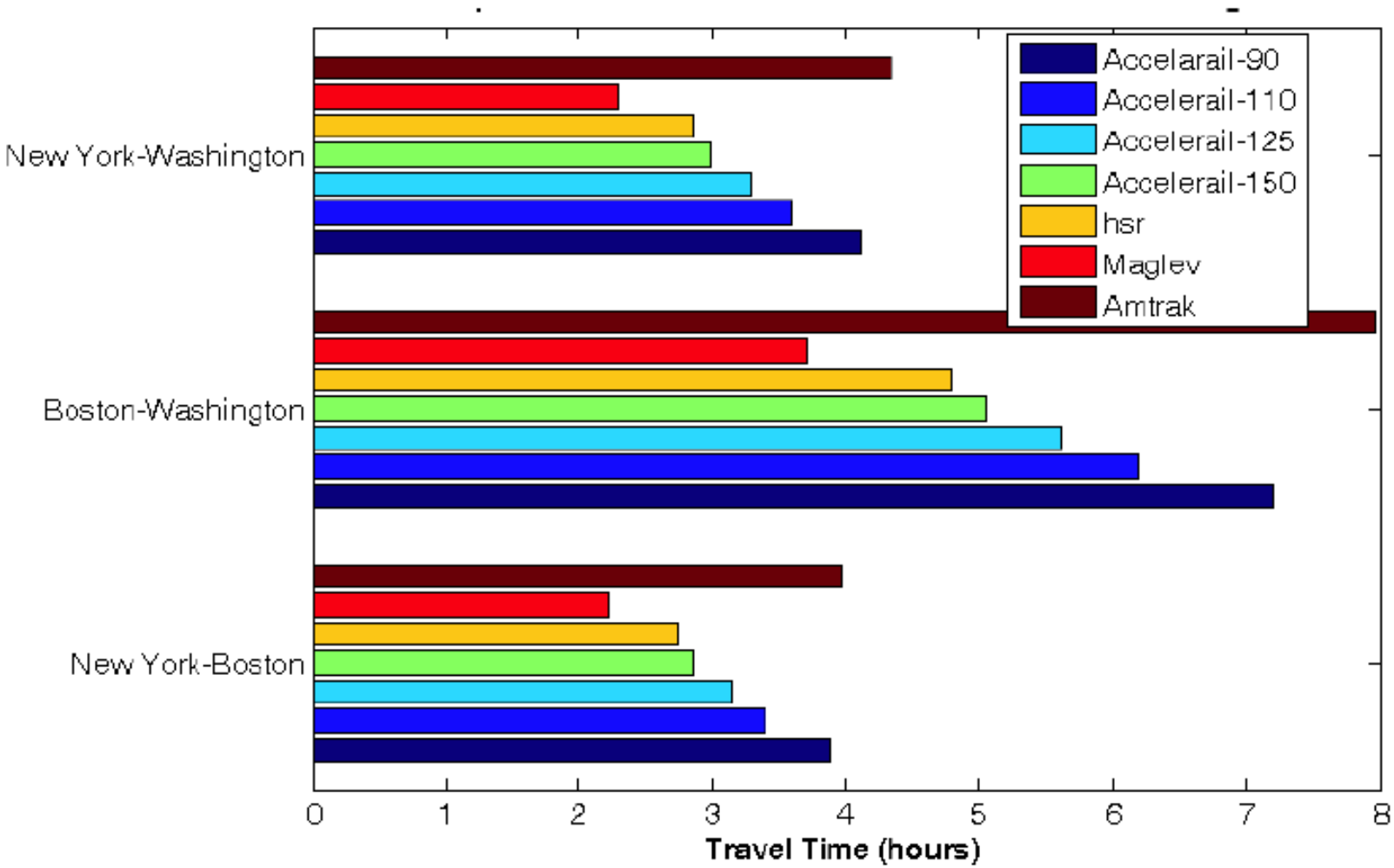
325 million hours saved by business travelers

713 million hours saved by personal travelers

# Multimodal Possibilities

- On-demand air taxi
- Limits of growth reached at some airports
- Shift to secondary airports
- Competing modes are developed and take some of the demand load
- Some corridors can be serviced by high-speed rail

# Comparative Travel Times for Different Rail Technologies in the Northeast Corridor



# Rail Trips Produced in 2025

# Can Rail Complement Commercial Air Transportation?

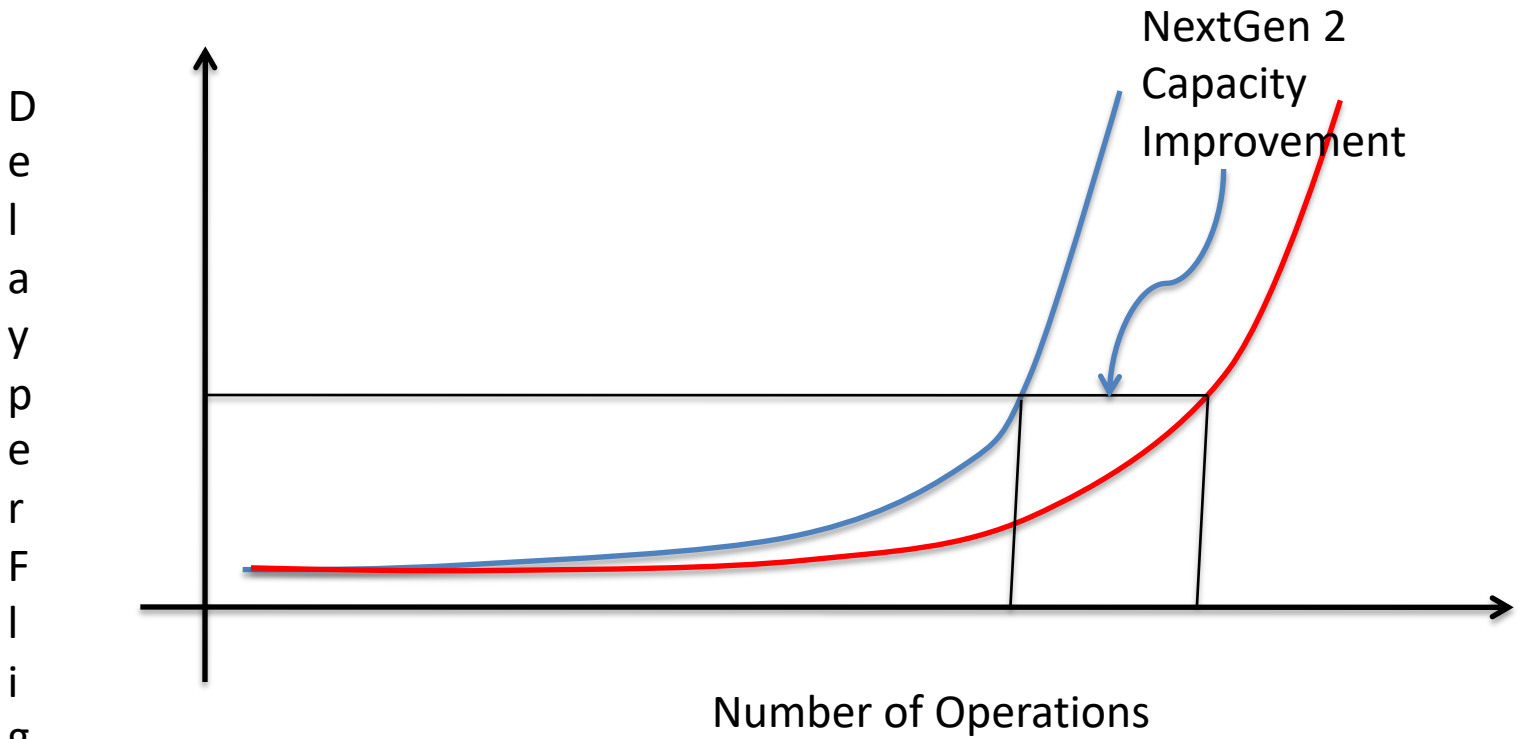
- Likely but limited to congested corridors (if the price is right)
  - Northeast corridor (Boston-Washington)
  - California (San Francisco- San Diego)
  - Northwest corridor (Seattle-Eugene)
  - Florida (Miami-Jacksonville)
  - Minneapolis-Chicago corridor
- Requires extensive work on track improvements and signal control infrastructure

# Study Findings

- Multi-modal transportation choice models are “modestly” capable of predicting air transportation demand changes due to NextGen investments and improvements
- NextGen is a multi-modal solution (access/egress times and processing times cannot be ignored)
- With improvements, other modes of transportation can play a role to complement aviation demand
- The optimistic assumptions made for gate-to-gate travel time in NextGen 2 could have a substantial effect in the demand for air transportation (15% increase in 2025 compared to the do-nothing alternative – baseline scenario)

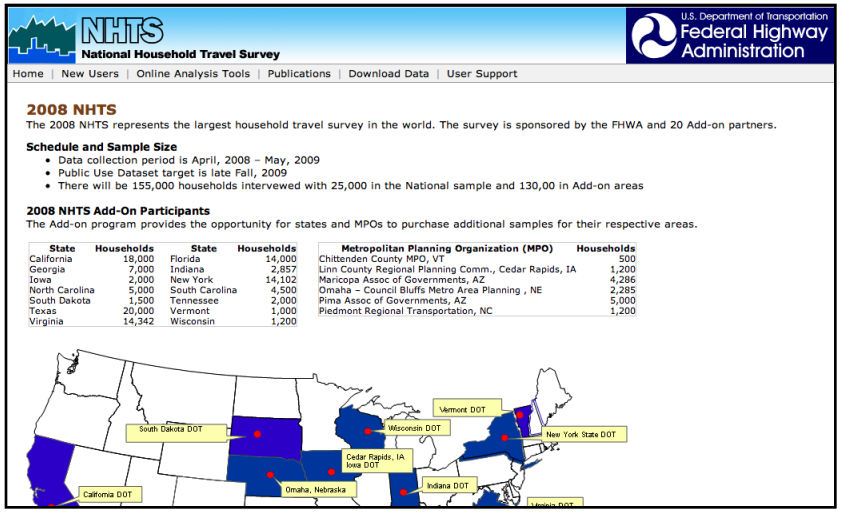
# Challenge for NextGen

- The delay function under Nextgen needs to be derived realistically to quantify door-to-door travel times



# Challenges (cont.)

- Travel survey data is old and incomplete
  - Mode choice calibration of TSAM would be greatly improved if zip code/county and airport/station information from the American Travel Survey (1995) data were publicly available
  - Future transportation surveys should collect and distribute zip code/county and airport/station information
- Some help is on the way (maybe)
  - NHTS 2008
  - ACRP survey guidebook



# Final Words (More Challenges)

- People behavior is difficult to predict with mathematical models using 2-6 variables
- Los Alamos Lab anecdote on TRANSIMS
  - "Easier to predict the behavior of atomic and sub-atomic particles than a person's daily commute from A-B-C"
- Airline behaviors (price and network evolution) are sometimes driven hard to predict

- We to keep trying to understand the complex dynamics of multimodal modeling