Trends Driving Demand for ODM Air Mobility in Thin Haul and Intra-Urban Markets

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Topics

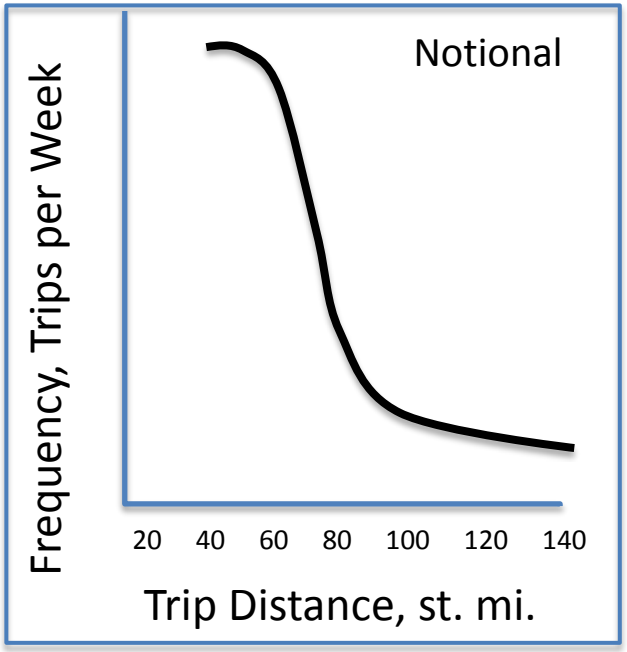
- Scope: Inter- and Intra-Urban Demand
- Definitions
- Strategic Trends Affecting Markets (The “Pull”)
- Emerging Technologies (The “push”)
- ODM / Thin Haul Strategic Innovation Premise

On-Demand Mobility (ODM) serves markets that are too thin
for financially sustainable scheduled air service,
and leverages technologies for sustainability, safety, affordability, and accessibility.

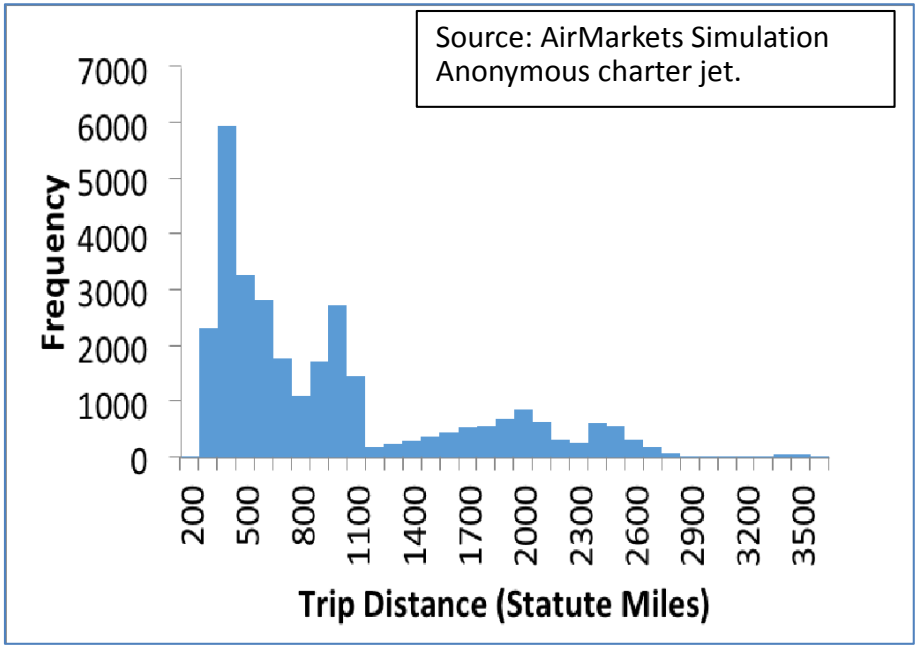
Distributions of Latent Demand for Intra- and Inter-Urban Air Mobility

Latent Demand

Intra-Urban ODM



Inter-Urban ODM

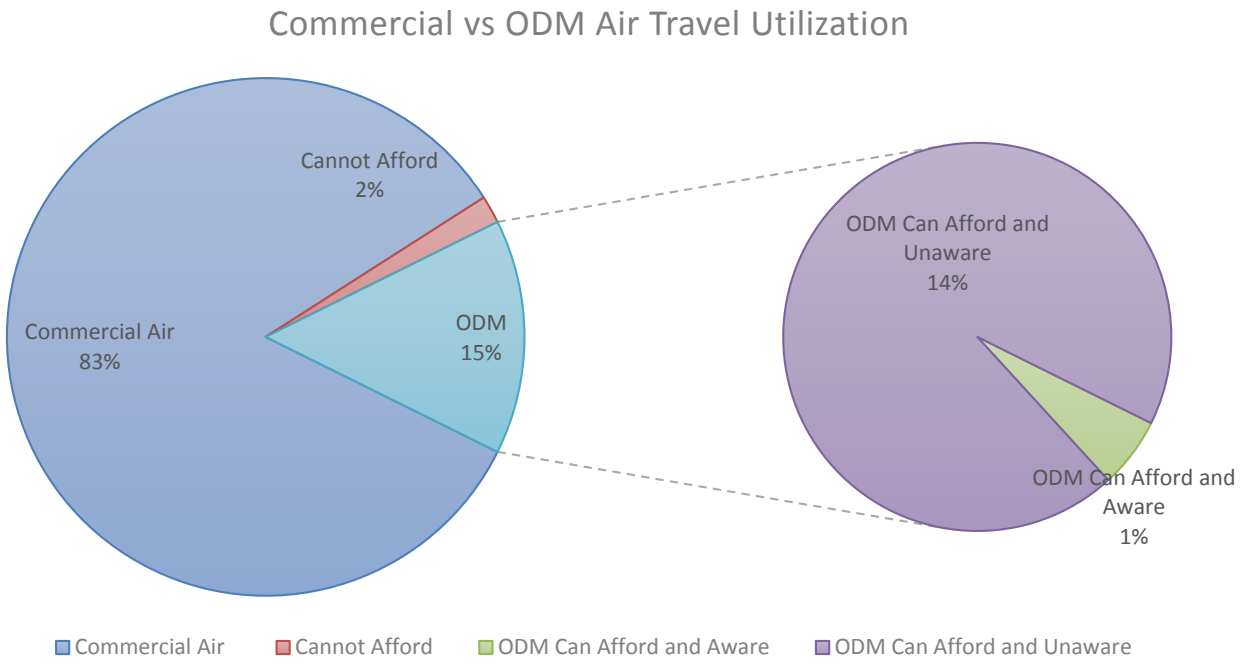


Supply

Factors affecting Supply-Side Satisfaction of Latent Orig – Dest Demand

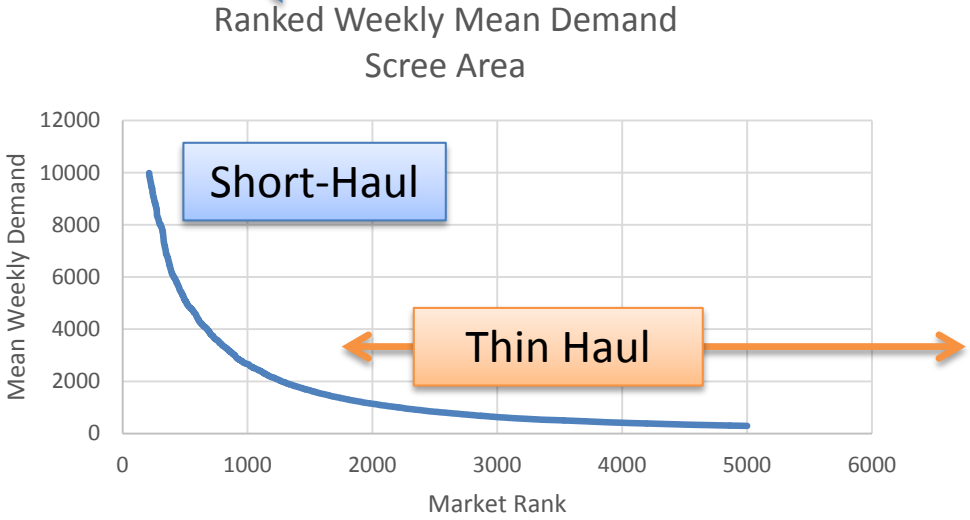
- Aircraft performance
- Fare (price)
- Geography
- Modal options
- Air- and Land-side Infrastructure adequacy
- Airspace services

Proposed "Thin Haul" Definition



- Thin Haul demand side consists of latent demand markets of sufficient density for economic service by specified aircraft at specified fares.
- Thin Haul supply side consists of specified aircraft and fares that economically satisfy latent demand.
- Filling the gap requires a system innovation: Aircraft, Airspace, Business Models, Airport Systems.

Thin-Haul Fills a Growing Void

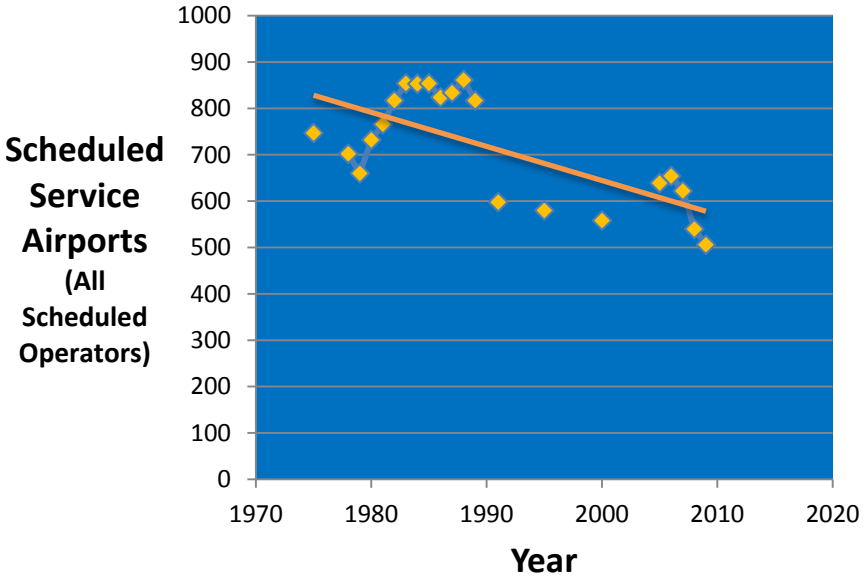


"Thin-Haul" market vacuum provokes innovation in business models and aircraft.

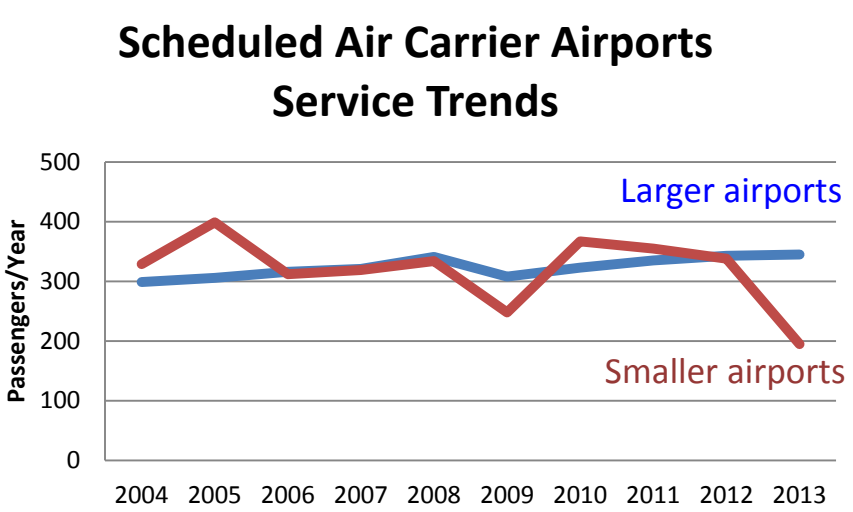
Global Trends in Commercial Air Service

As scheduled air carriers have consolidated to larger markets, larger aircraft, flying longer segments, the vacuum left behind in smaller markets frames and On-Demand opportunity.

U.S.

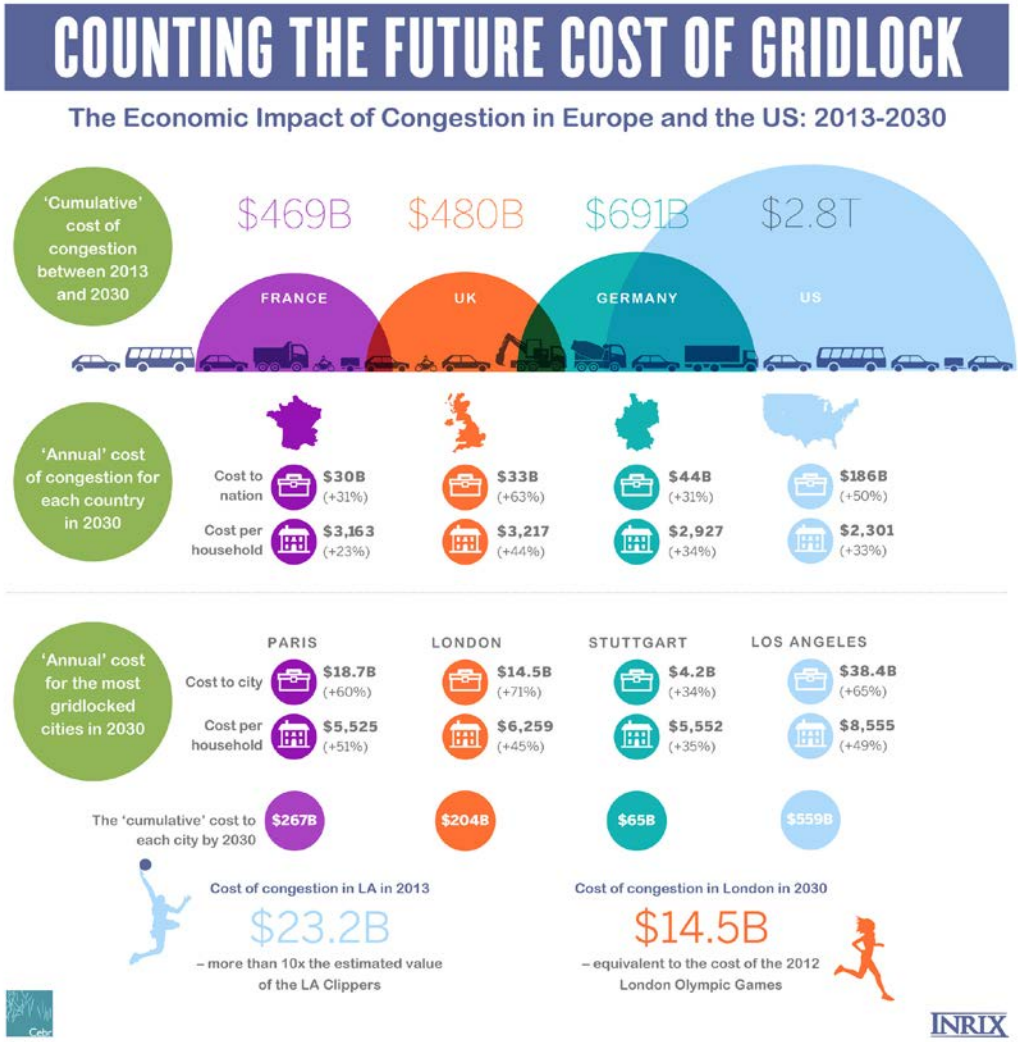


EU



Based on data from the US Department of Transportation, Bureau of Transportation Statistics.

Highways:
Creating the Intra-Urban Opportunity

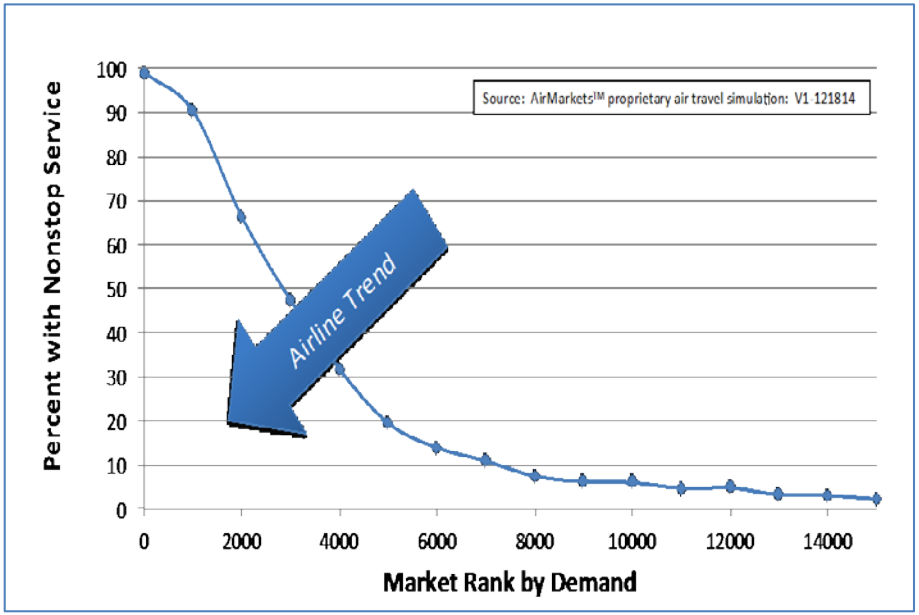


- In 2013, U.S. highway ***<u>congestion cost the U.S. economy $124 Billion</u>***
- Without significant action, this ***<u>cost accumulates to $2.8 Trillion by 2030</u>***.
- EU faces similar congestion costs.
- ODM Intra-Urban opportunity.

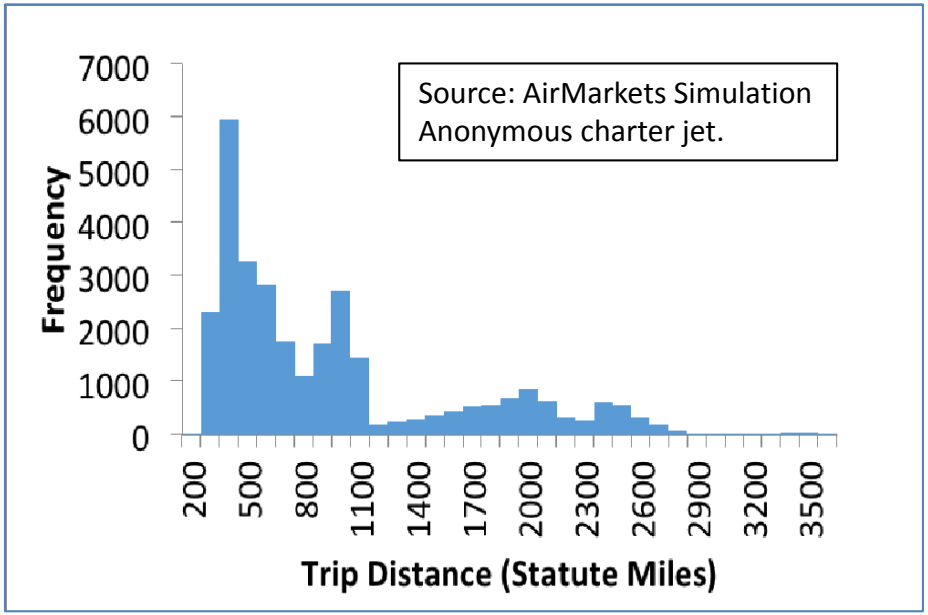
http://www.inrix.com/press/americans-will-waste-2-8-trillion-on-traffic-by-2030-if-gridlock-persists/

U.S. Nonstop Service Availability Shapes Thin Haul Demand Structures

Share of nonstop U.S. markets



Distribution of Trip Distances



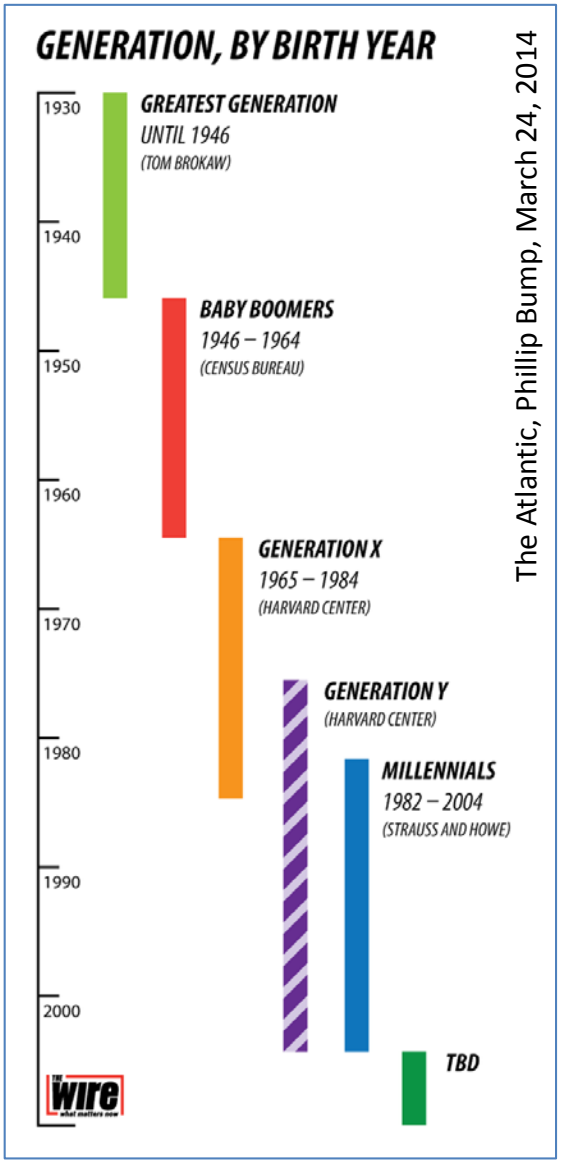
Less than 20% of 52,000 U.S. city-pair markets have nonstop airline service. Thin Haul gains an advantage as airline non-stops decrease.

Demographic Drivers Affecting ODM Demand

Generative methods for demand simulation are needed to capture these and other market dynamics.

- The over-55 market exhibits different consumption behaviors than younger consumers (time-rich, able to pay, hassle intolerant).

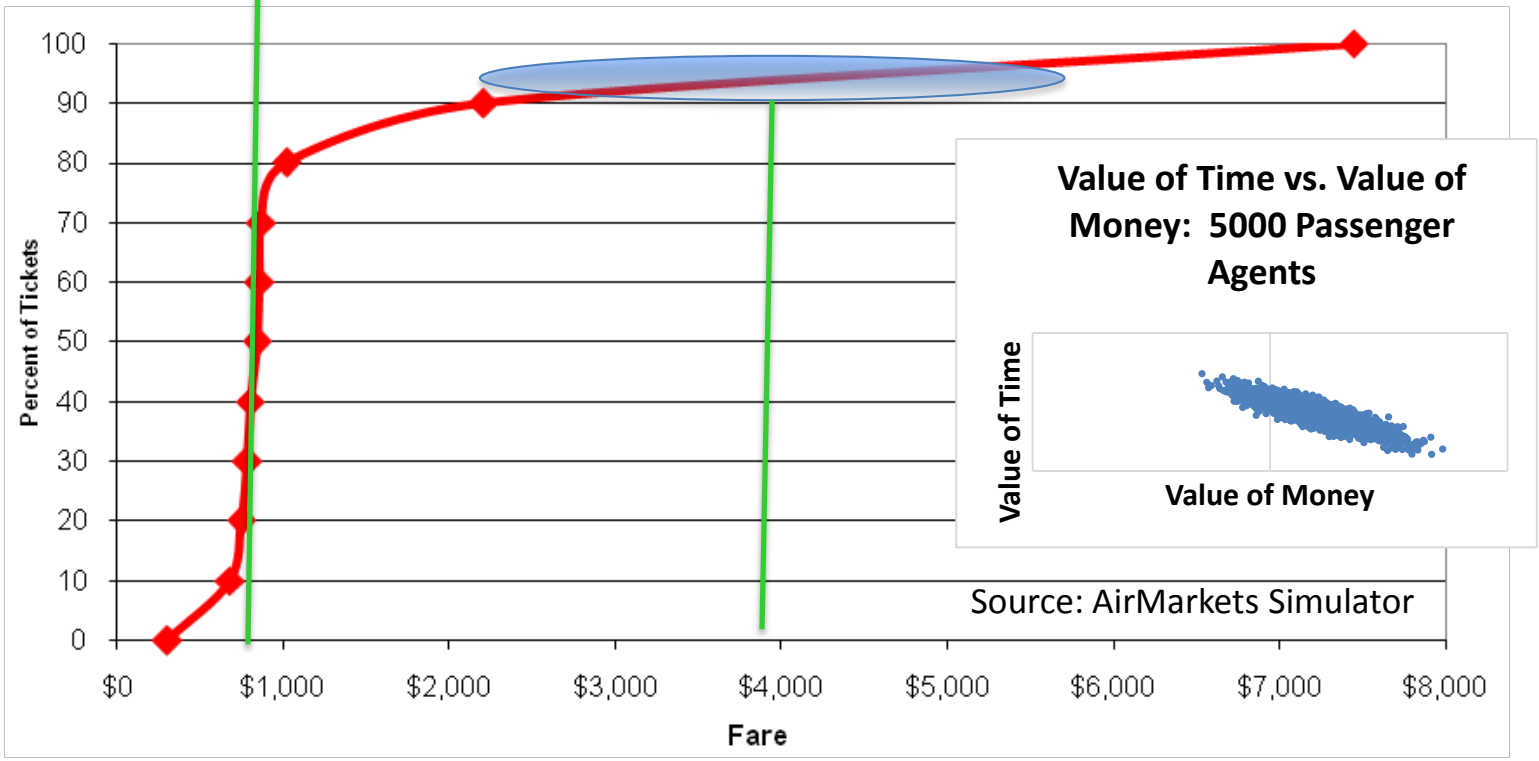
- The Millennials are creating the ”sharing economy” that re-shapes the ODM product design space (distributed costs, environmentally conscious).



Empirical Distribution of "Willingness to Pay"

Median Airline Price = $785

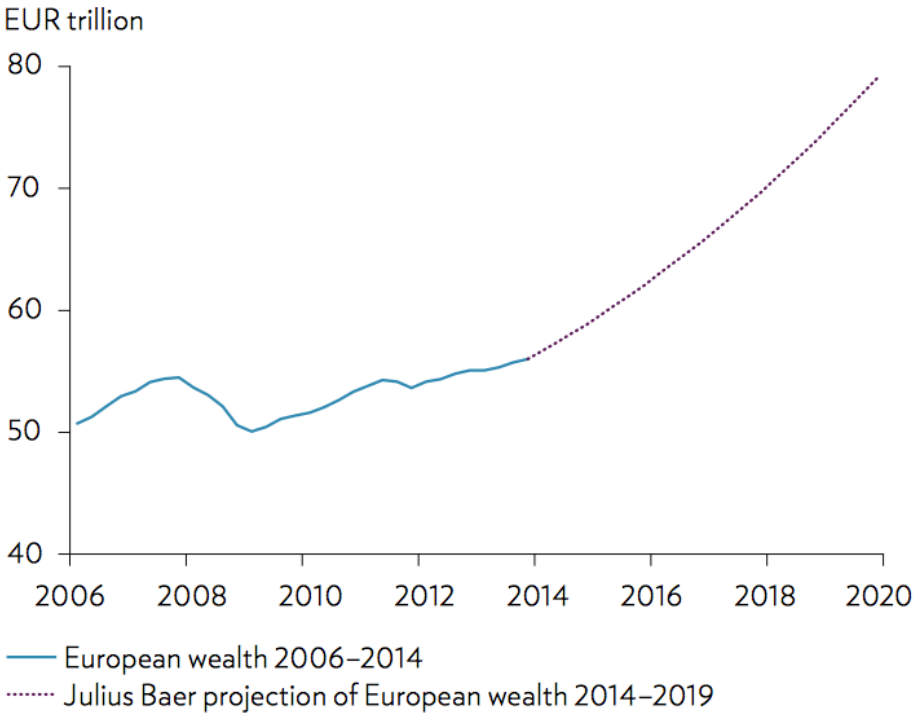
About 5 % of Consumers Will Pay
~4.5 x Median Airline Price



This curve is representative of the fare distribution across over 18,000 global markets. About 5% of travelers will pay about 4.5 times the median price, or more. About 10% of travelers will pay about 2 times premium airline fares.

Disposable Income Trending

Chart 8: European wealth set to rise by 40% by 2019



Source: Eurostat, ECB, IMF, national statistical agencies, OECD, Julius Baer

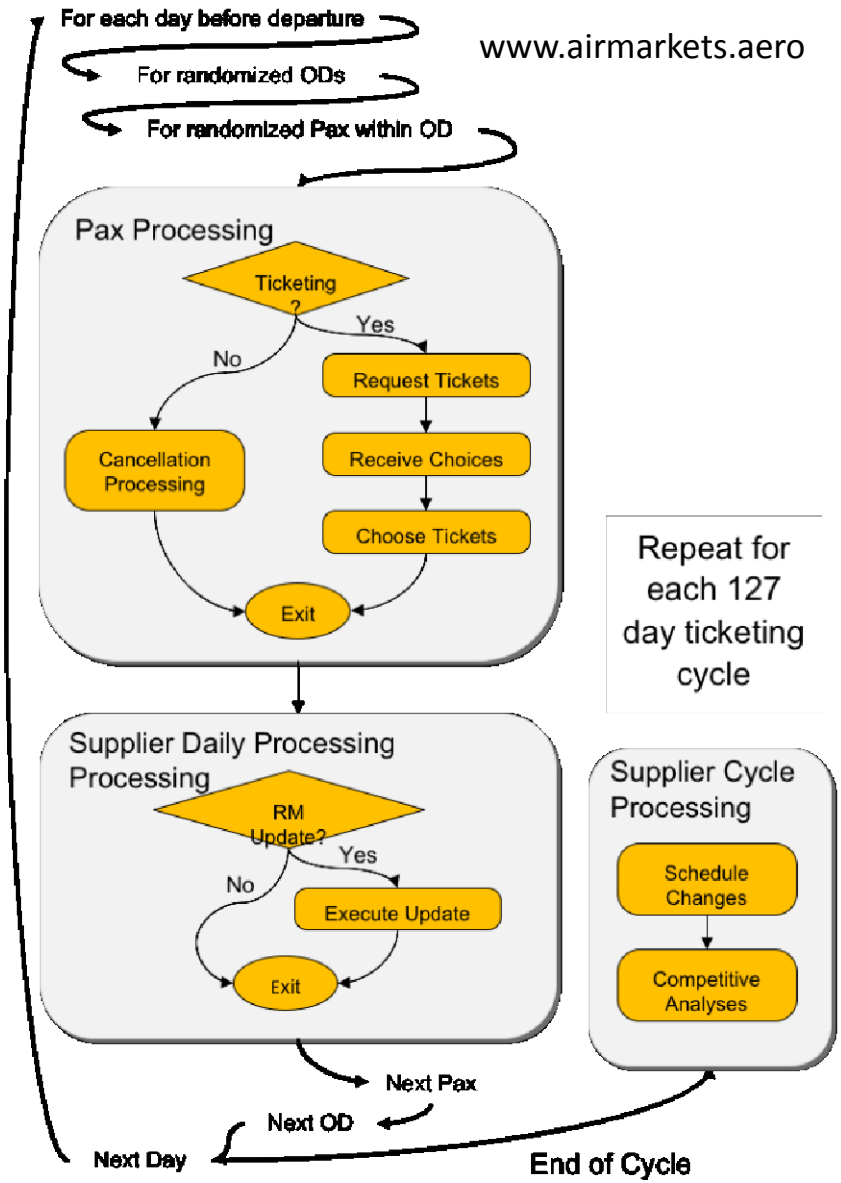
- A 40%+ rise in wealth translates into rise in demand for private aviation (in the context of worsening modal options)
- Much of this wealth will be in the hands of consumers with propensities to travel.
- Early adopters of ODM can fund the startup and evolution of the market.

Strategic Innovation Premise
for ODM in Thin Haul and Intra-Urban Markets

- A large and growing underserved market opportunity exists for on-demand air mobility (ODM).
- These markets span demographics and trip distance market domains.
- ODM is "strategic" or "blue ocean" in the sense that it stimulates new, previously unreachable demand.
- Key enabling technologies:
  - Connected aircraft
  - Some autonomy and automation
  - Propulsion revolution
  - Ubiquity of airspace services
- The solutions generate significant value for our nation's economy, environment, and quality of life.

Consumer Choice Simulation

- Agent-Based Modeling (ABM) represents consumer behaviors for all travelers in all origins and destination for all modes of travel around the world.
- An ABM produces probabilities of demand, market-by-market, mode-by-mode, with schedules and revenues, based on consumer behaviors and preferences.
- The results support decisions by aircraft OEMs, fleet operators, airport authorities, and investors



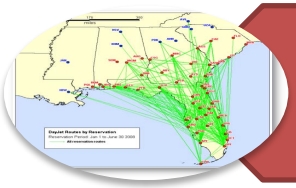
Enablers for Innovation in On-Demand Air Mobility Services

The "Right" Airplane

Purpose-designed aircraft for on-demand air mobility

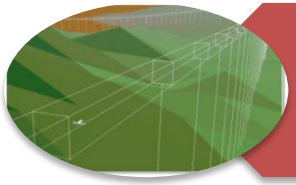
Real-time Logistics

Per-Seat and Per-Plane management



Small World Networks

Optimizing revenue management by designing the optimal networks



Airspace and Airports

More autonomy in aircraft.
More automation in airspace.

The technology push and the market pull are converging, for innovations in on-demand air mobility.

Factors Affecting Demand and Satisfaction for ODM Transportation

Demand-side (Consumer) Factors

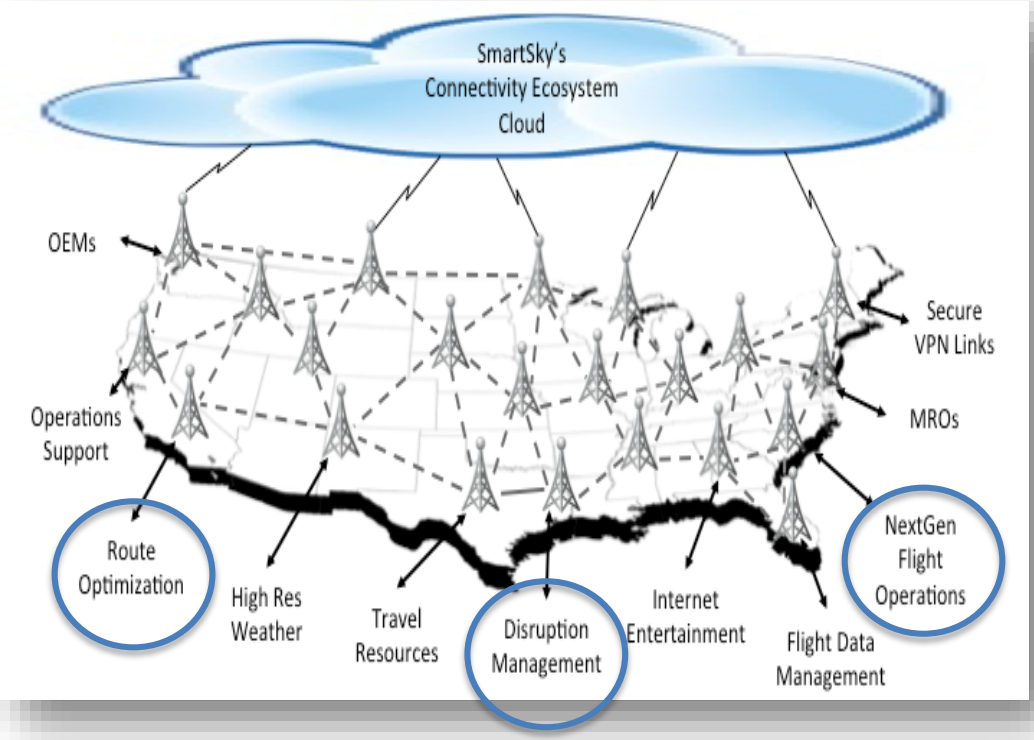
- Value of Money and of Time
- Total Cost of Travel
- Preferred Journey Duration
- Age-Dependent Factors
- Schedule Inefficiency
- Perceived Comfort
- Privacy
- Consumer Awareness

Supply-side (Provider) Factors

- Price (Fare)
- Aircraft Performance
- Airport Accessibility
- Aircraft Availability
- Aircraft Acceptability
- Modal Options
- Cabin Comfort
- Booking Ease

These are key factors in forecasting demand!

Key Enabling Technology: Connected Aircraft



- Aircraft as nodes on the Internet.
- A revolution in integrated Communications, Navigation, and Surveillance.
- More efficient flight paths everywhere.
- Connected passengers.
- Connected Pilots

"Connected Aircraft" enable asset management efficiencies not previously possible.

The Pioneers:
History in National Mobility Technology Strategy

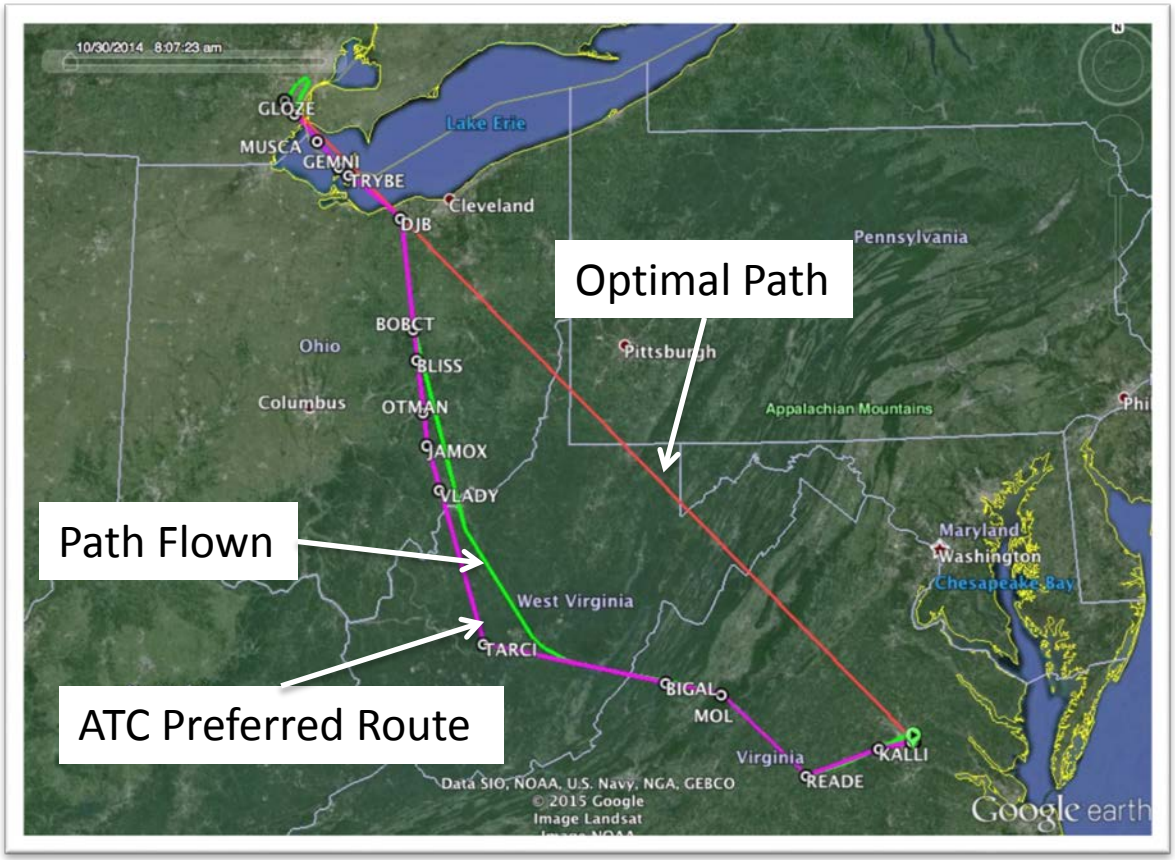
Between 1990 and 2005, NASA, the FAA, industry and academia partnered to advance technologies for aviation system innovations.

The Settlers:
U.S. On-Demand Business Model Innovators

Business Models
(Parts 91K, 125, 121, 135)

- Branded Charter
- Brokered Charter
- Fractional
- Subscription Transport
- Jet Card
- Equity-building Jet Card
- Leasing
- Networked Air Taxi, per-seat
- Prop Card
- Pure Charter
- Corporate Shuttle
- Ride Sharing

The Natives:
Our Legacy Airspace and Airport System



- Air Traffic Control manages airspace for safety, not for efficiency of time and cost.
- Current NextGen and SESAR beneficiaries are limited.
- New tools will give all airspace users more ways to improve performance.
- More widely distributed access and efficiency are needed.

Innovations in bandwidth-enabled apps for managing all aspects of flying will create new, previously unreachable benefits.

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