An Introduction To On-Demand Mobility & Challenges To Its Implementation

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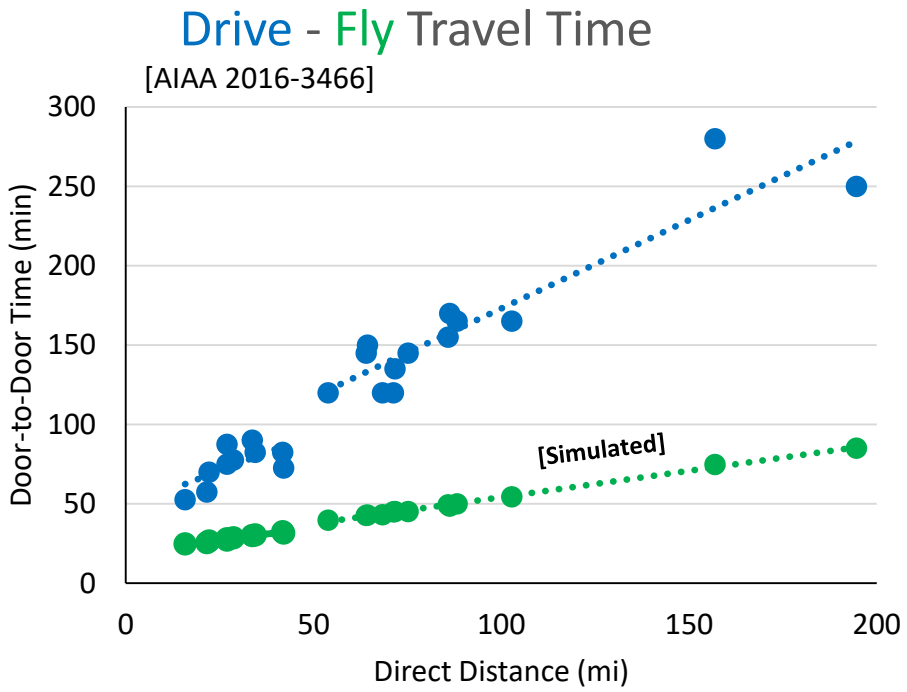
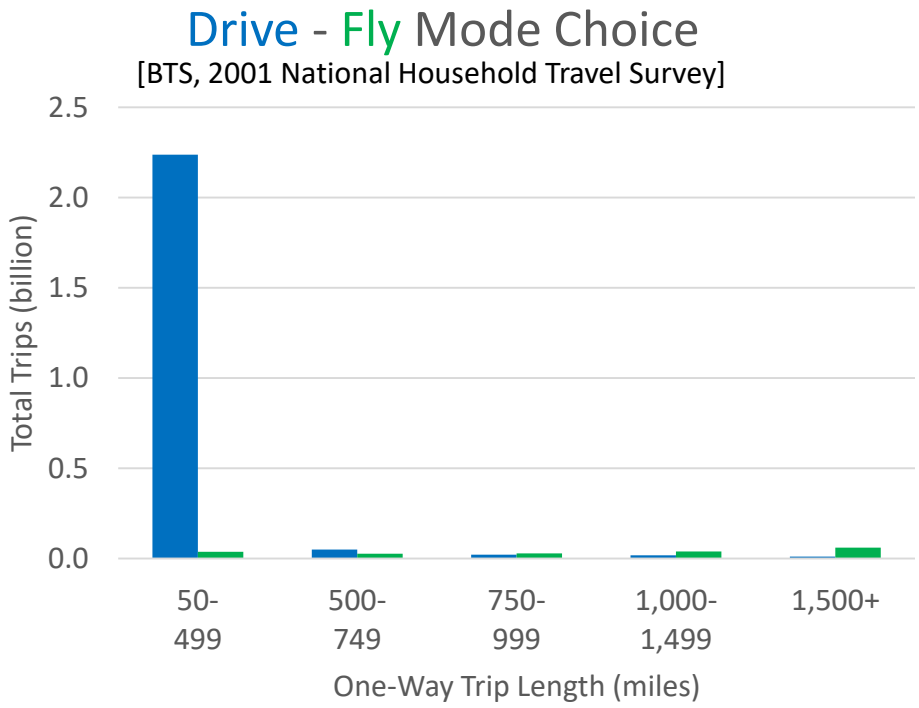
What is On-Demand Mobility (ODM)?

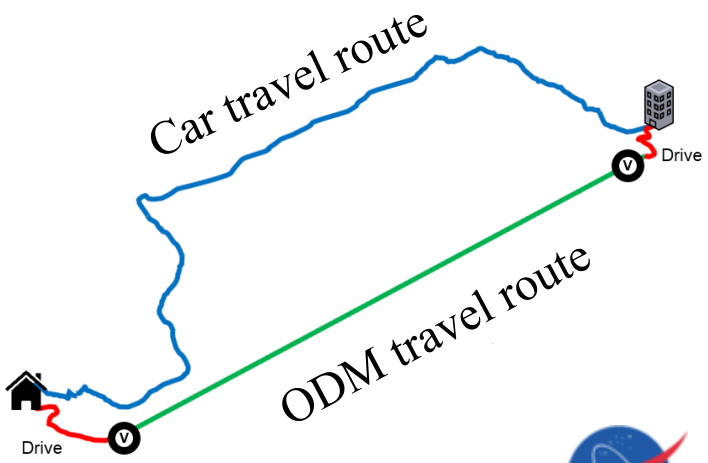
- Immediate and flexible air transportation
  - Users dictate trip origin, destination, and timing
  - 1-9 passengers or up to 2000 lb payload
- ~2-3x faster than cars & hub-and-spoke over ~10-500 mile range





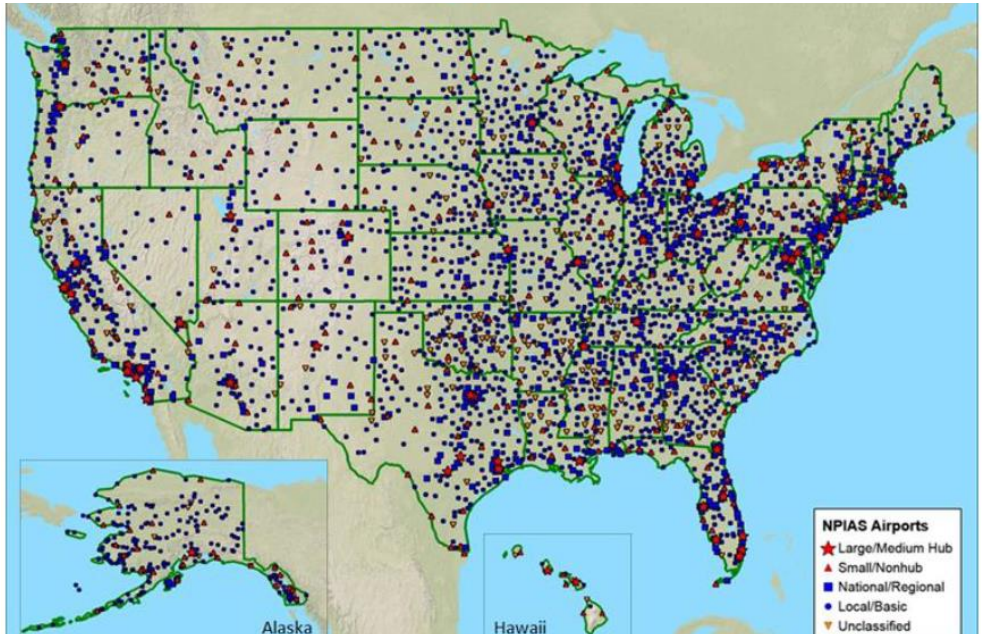
What is On-Demand Mobility (ODM)?

- A range of missions, aircraft types, & operations
  - Enable trips that were not time/cost effective with current transport (e.g., conventional takeoff and landing commuter)
  - Alternative to car travel to avoid/alleviate city congestion (e.g., vertical takeoff and landing air taxi, “urban air mobility”)
  - New, more rapid methods of cargo distribution (e.g., sUAS package delivery)
- May be enabled by the convergence of technologies including electric propulsion, increasing autonomy, and advanced NAS operations



Conventional Takeoff and Landing (CTOL) Mission

- Concept of operations
  - Trips of approximately 50 to 500 mi
  - Operate from 5,000+ public-use airports
  - Enable point-to-point travel and/or improve connectivity to hub-and-spoke
  - Single pilot, autonomous, or remote operator



Locations of 3,331 airports in the FAA's National Plan of Integrated Airport Systems

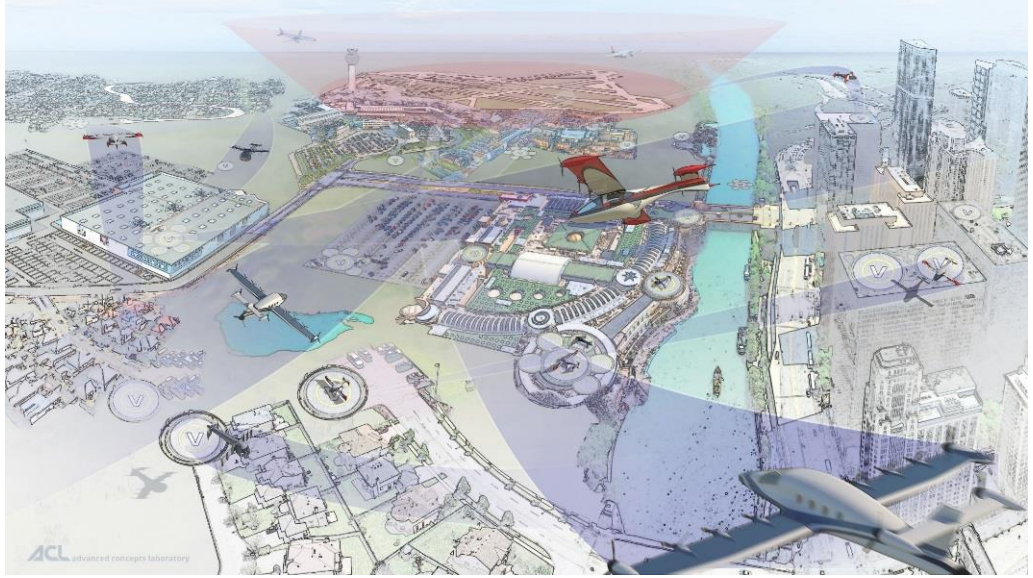
NASA X-57 Maxwell

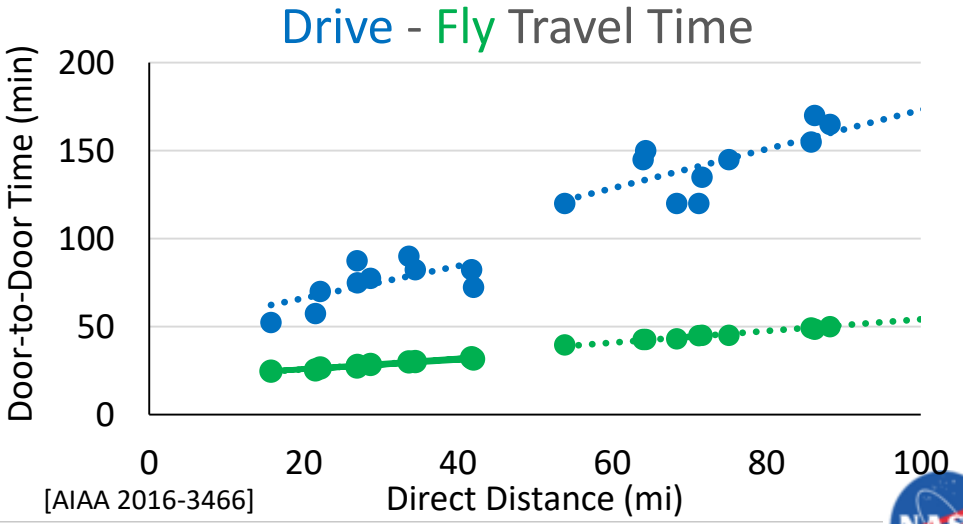
Cirrus SR-22

Cessna 402

Vertical Takeoff and Landing (VTOL) Mission "Urban Air Mobility"

- Concept of operations
  - Trips of approximately 10 to 100 mi
  - Operate from new "vertiport" infrastructure and/or existing heliports
    - Barges, roof tops, parking garages, …
  - Enable point-to-point (daily) commutes and/or package delivery
  - Single pilot, autonomous, or remote operator





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Prioritized Barriers to Successful ODM System Implementation from ODM Roadmapping Workshops

1. Ease of Certification	**2. Affordability**	**3. Safety**	**4. Ease of Use**	**5. Door-to-Door Trip Speed**
6. Average Trip Delay	**7. Community Noise**	**8. Ride Quality**	**9. Efficiency**	**10. Lifecycle Emissions**

Prioritized order, but any barrier can limit feasibility, utility, growth

Panelists

- Mr. Kenneth Goodrich
  - Senior Research Engineer, NASA Langley Research Center
- Dr. Brian German
  - Langley Associate Professor, School of Aerospace Engineering, Georgia Institute of Technology
- Mr. Andrew Gibson
  - President, Empirical Systems Aerospace (ESAero)
- Dr. Stephen Rizzi
  - Senior Technologist for Aeroacoustics, NASA Langley Research Center
- Dr. Danette Allen
  - Senior Technologist for Intelligent Flight Systems, NASA Langley Research Center

QUESTIONS?

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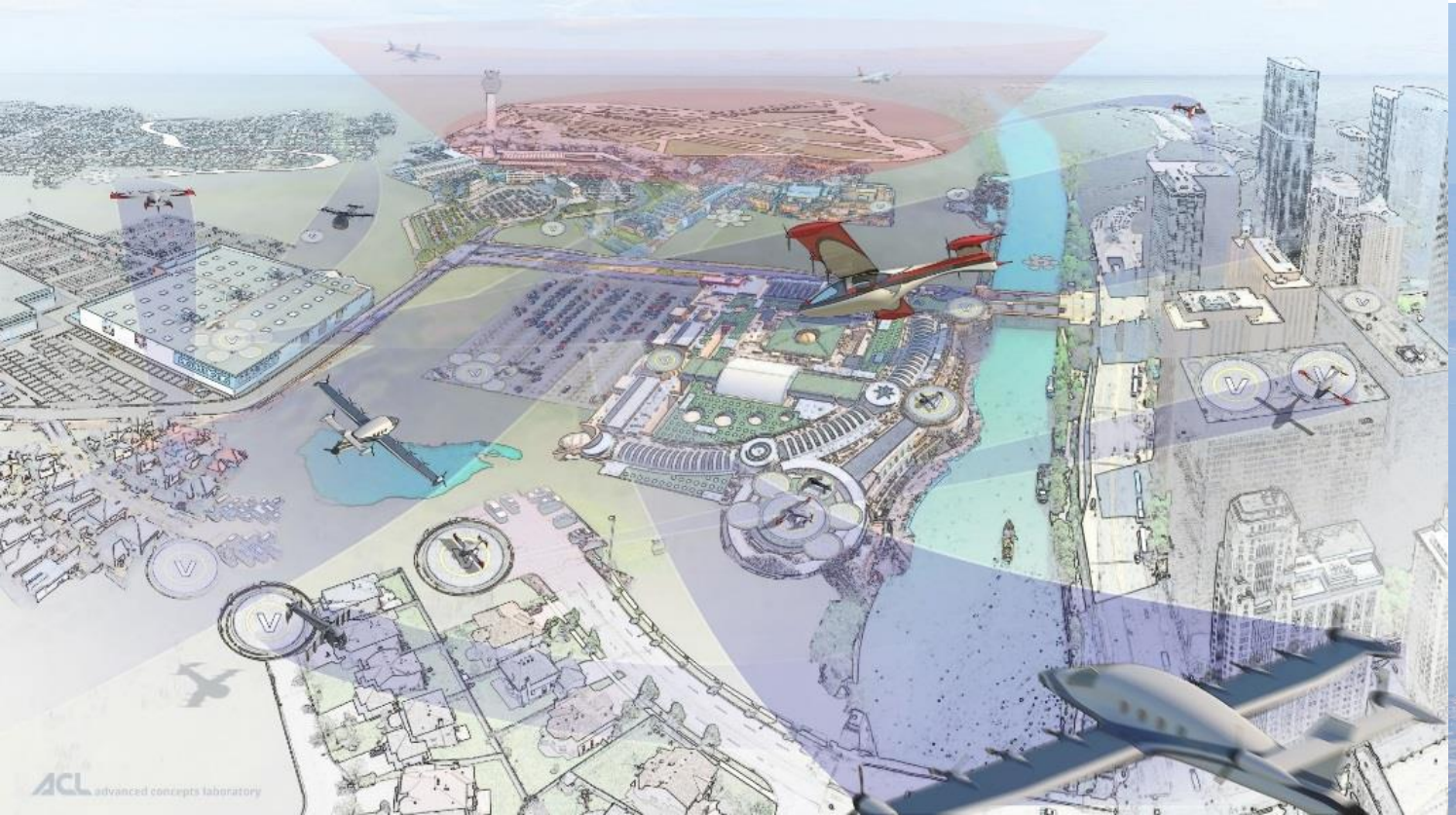
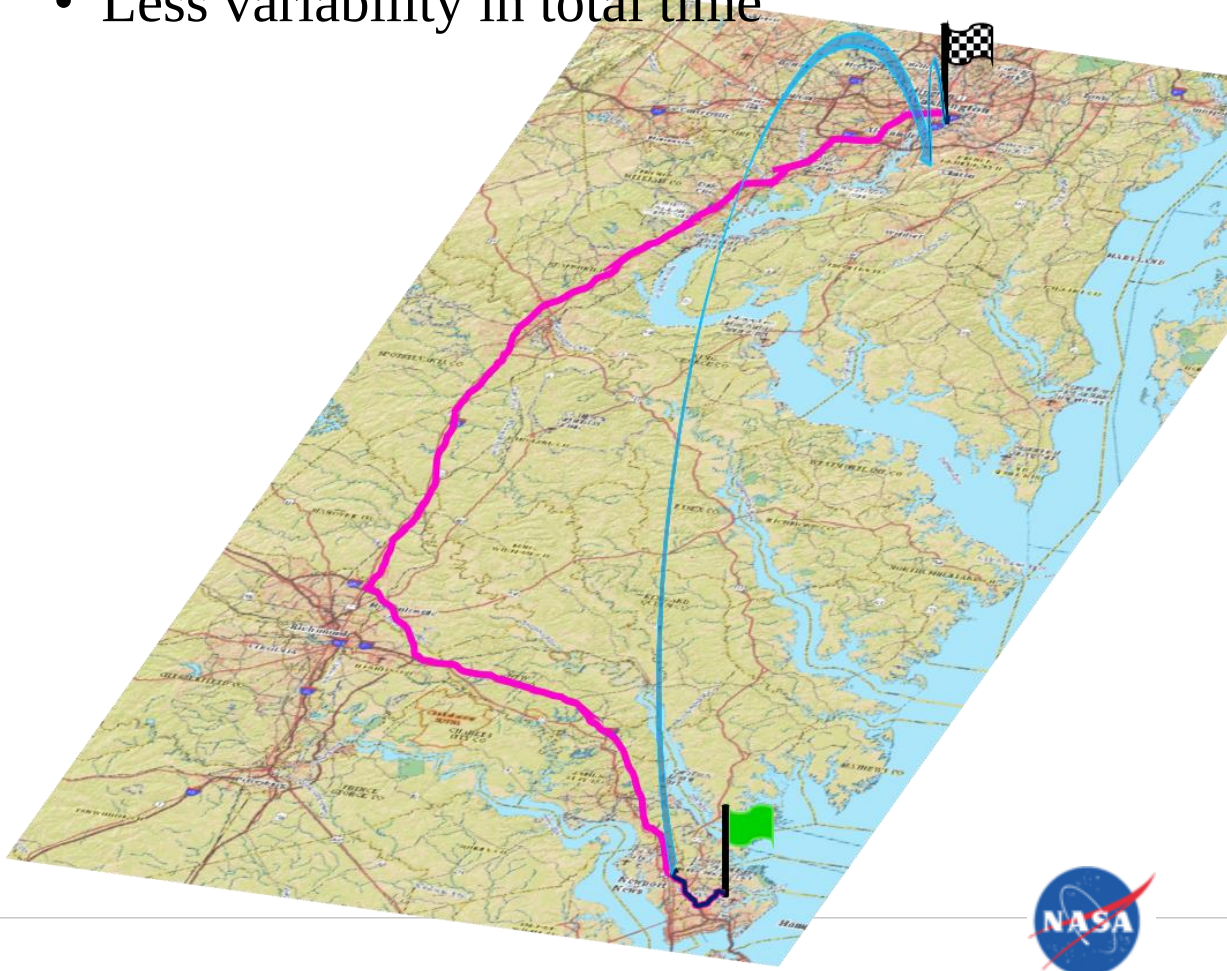


Combined Mission Example: NASA LaRC to DOT HQ

	Drive		ODM	
	Min	Max	Min	Max
Drive/Taxi	2h 40m	4h 20m	18m	40m
Parking	5m	10m	-	-
Mode Switch	-	-	5m	15m
CTOL Flight	-	-	45m	55m
Mode Switch	-	-	5m	10m
VTOL Flight	-	-	5m	10m
Mode Switch	-	-	2m	3m
Walk	-	-	6m	8m
Total	2h 45m	4h 30m	1h 26m	2h 21m
Nominal Total	**~3h**		**~1h 35m**	

- Combined ODM travel:
  - Saves ~1h 25m (~47%)
  - Less variability in total time