On-Demand Mobility (ODM)

Overview

Mark Moore, ODM Senior Advisor

Ken Goodrich, ODM Senior Advisor

NASA Langley Research Center

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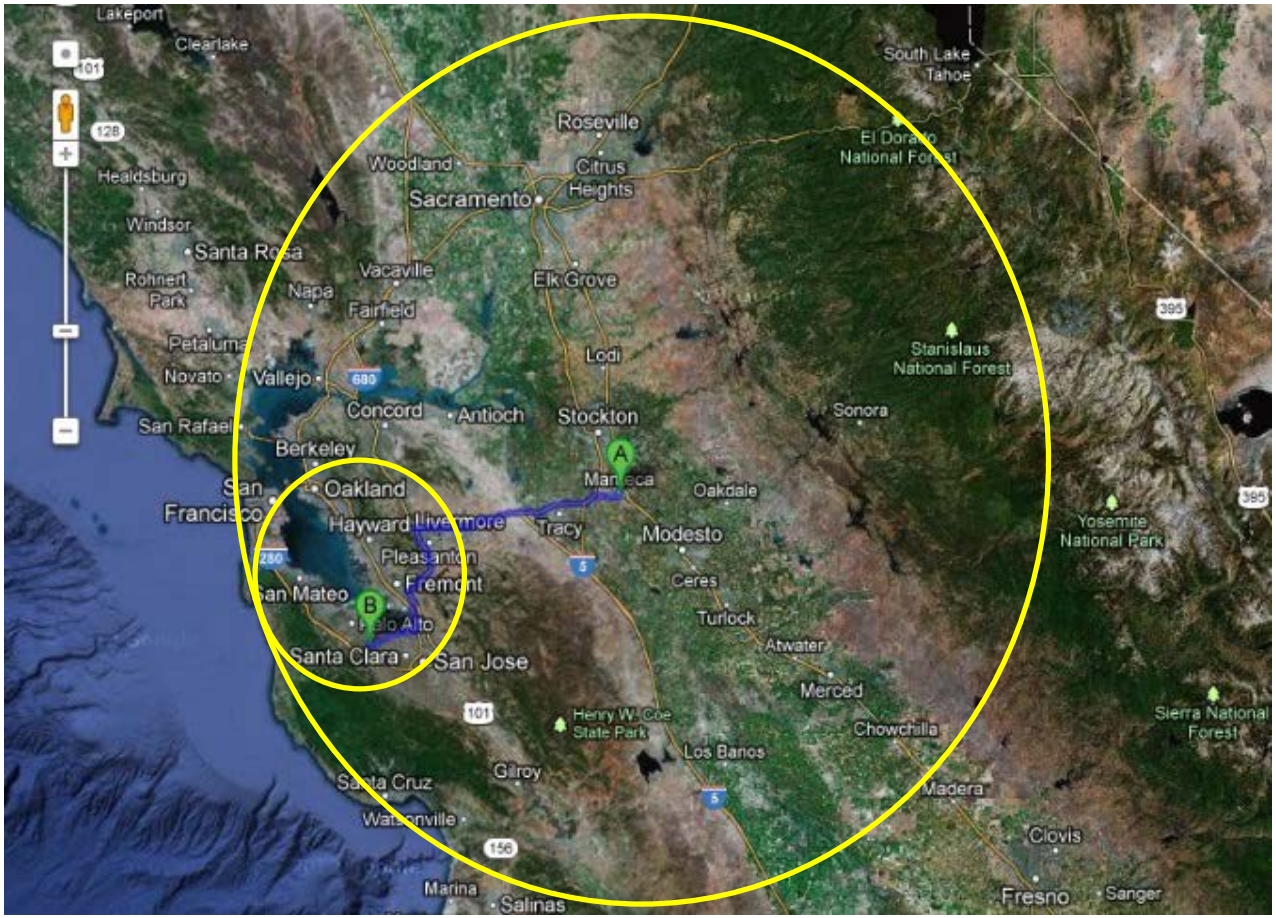
On-Demand Mobility Definition

On-Demand Mobility (ODM) *combines the* ***immediate and flexible*** *travel access of automobiles with* ***aviation's speed*** *and ability to travel in a* ***distributed fashion****, independent of ground terrain and route infrastructure pathways. ODM is a new transportation choice that achieves* ***greater regional productivity through high speed travel*** *wherever and whenever users desire, with* ***vehicles*** *that offer levels of* ***safety, efficiency, environmental and community friendliness, as well as affordability that is competitive to existing transportation*** *solutions.*

On-Demand Mobility Goal

Enable Greater Regional Mobility Reach



San Francisco Bay Area Daily and Regional Reach

Enable rapid, accessible personal mobility 'reach' for people and goods.

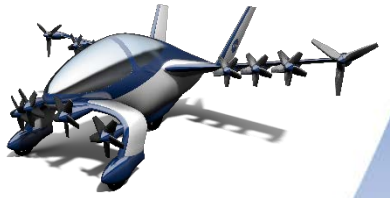
- Provide ~4x increase in door to door speed compared to ground-based solutions.
- Overcome ground traffic congestion and geographic constraints.
- Increase regional productivity and transportation accessibility.
- Provide synergy with telecommunication technologies to expand economic opportunity areas.

Convergent Technology Opportunity

ODM Missions *fit across several categories of vehicles that vary in size, performance features, and how they interact with society.*

Small UAS Missions: *Package delivery, govt services, etc*

Transformative Vertical Flight: *Short range urban commuters that can achieve high productivity and utilization (with dramatically lower noise for acceptable helipad operations) to achieve competitive economics and unrivaled door to door speeds.*



Next Generation General Aviation: *Enhanced capabilities across safety, ease of use, operating and acquisition costs*

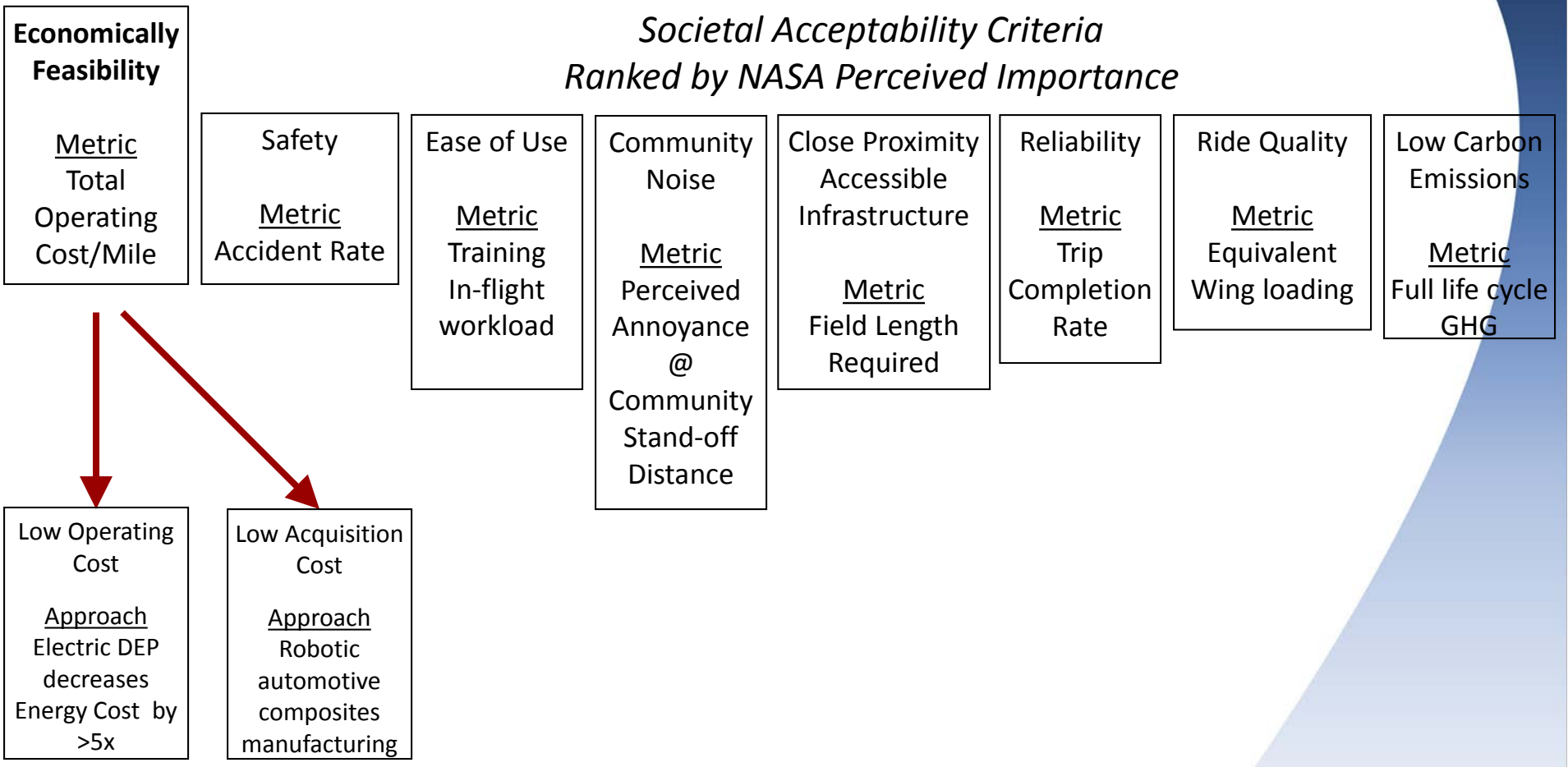
Thin Haul Commuters: *Up to 9 pax aircraft providing regional connectivity (i.e. Cape Air, Surf Air, Beacon, SATSAir, etc)*

ODM Technology Challenges / Market Barriers

Current General Aviation (GA) Aircraft compared to Commercial Airliners

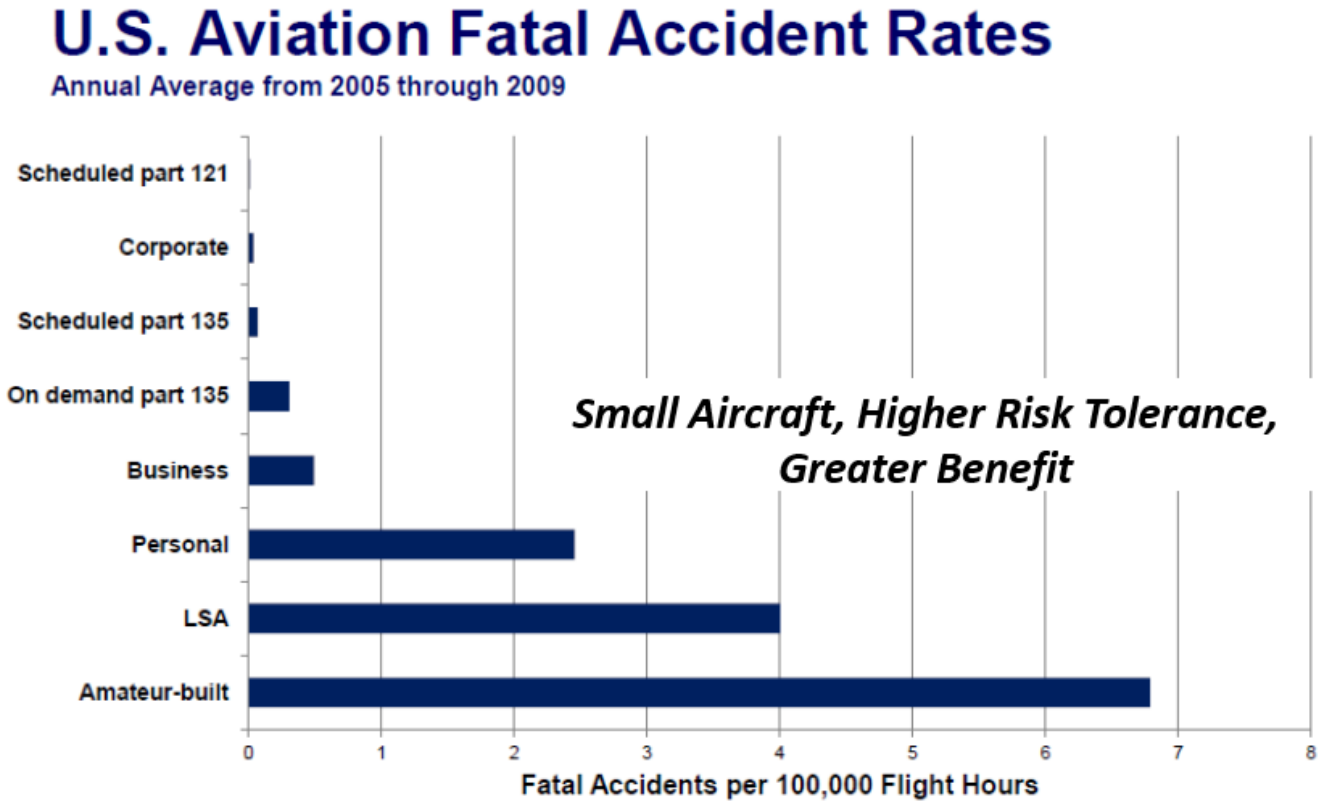
- **Poor Aerodynamic and Propulsive Efficiencies**
  - Aerodynamic efficiency measured as Lift/Drag ratio is 9-11 compared to 17-20.
  - (Thermal) x (propulsive efficiency) of 20-24% compared to 36-40%.
- **Poor Emissions**
  - High Hydrocarbon, Green House Gas emissions, particulates and lead pollution.
- **Poor Community Noise**
  - Similar levels and certification compliance with few improvements for the past 50 years.
- **Poor Comparative Safety**
  - **Accident rate 56x worse than airlines, 15x worse than autos per 100 million vehicle miles traveled**.
- **Poor Ride Quality**
  - Low wing loading leads to bumpy ride along with gust sensitivity. (Note, technology needed for SVO also applicable to active gust alleviation)
- **Poor Dispatch Reliability Rate**
  - Maintenance and weather sensitivity result in <70% rate for trip completion.
- **Substantially Higher Operating Costs**
  - Compared to all other transportation options (car, airline, train).
- **Onerous Training Requirements**
  - Currently only 0.18% of the U.S. population is capable of flying GA aircraft compared to 69% who have a driver's license.

ODM Technical Challenge Decomposition



Safety Key Goal for Society Acceptance

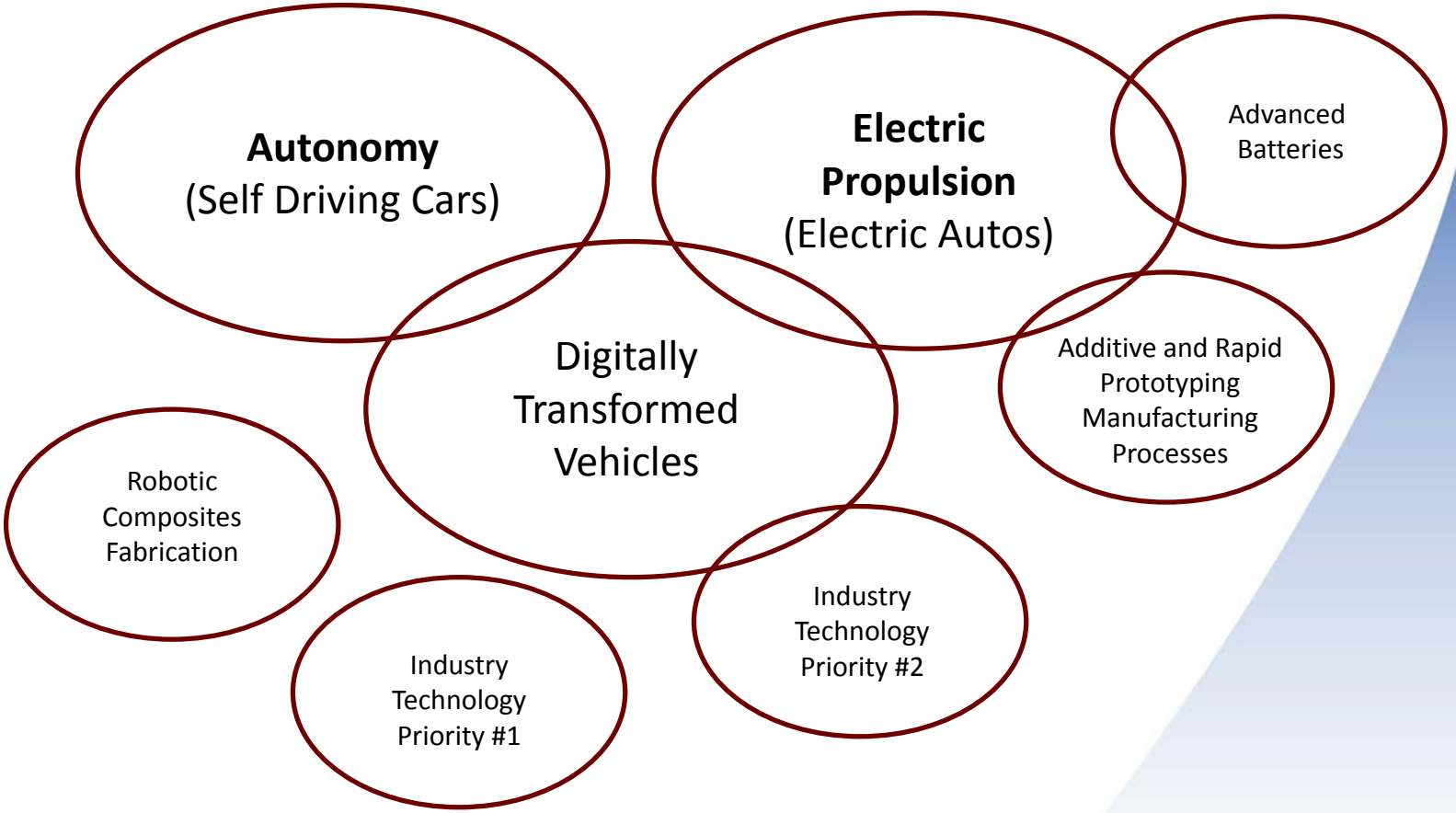
Autonomy offers the greatest benefit to small aircraft, while also providing the opportunity to build FAA statistical proof of it's effectiveness.



Wes Ryan, FAA Small Aircraft Directorate, "General Aviation Automation"

Convergent Technology Opportunity

Several technologies frontiers offer unique opportunities to fundamentally push back the market barriers in dramatic fashion, with other industries (such as the automotive world) making large investments which could be leveraged.



NASA On-Demand Mobility Perspective

Community Vision

- Potential to leverage rapidly developing convergent technologies to
  - Transform shorter-range transportation
  - Develop vibrant aviation markets
  - Dramatically increase regional productivity

Technical Barriers

- Solve challenges in safety, cost, efficiency, noise, accessibility
- Pioneer the certification standards

NASA Opportunities

- Enable solutions to technical barriers
  - *E.g.: Distributed Electric Propulsion*
- Develop technologies at smaller scale, lower cost, more rapid cycles
- Establish industry collaboration and cost sharing of technology investments
- Leverage ODM as early adopter of transformational technologies
- Incubation of new certification standards with minimum consequence
- Establish applicability to larger-scale commercial transportation