Operational Aspects of Aircraft-Based On-Demand Mobility

R. John Hansman
Parker D. Vascik

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Aircraft-Based ODM

• Intra-City, Aircraft-Based On-Demand Mobility (ODM)
  − Multi-modal, point to point transit within a city
  − Enabled by advancements in electric aircraft and autonomy
  − Overcomes highway or transit infrastructure limitations and congestion
  − Expands the mobility reach of economic basins
  − Diversifies mobility options available to residents

• Key Challenges Facing Intra-City ODM
  1. Airspace Integration
  2. Air Traffic Interaction
  3. Ground Infrastructure Availability
  4. Noise Management
  5. Operations and Certification
Aircraft-Based ODM

Joby Aviation

ZeeAero

NASA GL-10

UberCHOPPER

Carter Aviation Technologies

Are proposed CONOPS for On-Demand Mobility consistent with airspace integration, regulation, and operational constraints, both today and in the future?
MIT ODM CONOPS Study

- MIT Study on ODM Airspace Operations and Integration
  - Began collaboration in February, 2016
  - Goal is to determine the range of reasonable concept of operations (CONOPS) for intra-metropolitan air transportation
  - Consider airspace, regulatory and infrastructure constraints
  - Collect extensive stakeholder and subject matter expert input
  - Focus on Los Angeles county as preliminary case study

Phase 1: Short-Term Implementation
- Operation within existing airspace definitions, regulations and constraints
- Human piloted 1-2 PAX personal air vehicles and 2-4 passenger ODM vehicles

Phase 2: Longer-Term Architecting
- Investigate airspace, regulation or constraint changes to enhance ODM operations
- Additionally consider package delivery UAS, automated manned vehicles and 4-9 passenger thin-haul aircraft
Preliminary LA Airspace Review

• Characterize Existing LA Airspace
  - Controlled airspace
  - VFR helicopter routes
  - Current air traffic density (fixed wing and rotorcraft) in potential ODM flight envelope
  - NOTAMs and Temporary Flight Restrictions (TFRs)
  - Minimum altitude and speed constraints

• Influence of Airspace on ODM CONOPS
  - Route planning
  - Aircraft equipage and pilot training
  - Vehicle flight envelope requirements
LA Basin Airspace Constraints
LA Basin Airspace Constraints

VFR Helicopter Route Chart
LA Basin Airspace Constraints

VFR Helicopter Route Chart
Existing LA ODM Aircraft Ground Infrastructure

- 15 public use airports
- 11 private use airports
- 138 private use FAA registered heliports
- A large number of Emergency Helicopter Landing Facilities (EHLF) on high-rise buildings
• **Los Angeles Municipal Code 57.4705.4**
  - All buildings over 75 ft constructed since 1974 in LA County must have an Emergency Helicopter Landing Facility (EHLF) or heliport
  - Dimensions of pad must be at least 50 x 50 ft
  - EHLF facilities are not certified by the FAA for commercial use
  - LA Fire Policy 10 released buildings from this requirement beginning in 2014

• **California Public Utilities Code § 21662.5**
  - No helicopter may land or depart within 1,000ft of a public or private K-12 school unless the location is a permitted, permanent heliport
Existing LA Ground Infrastructure Constraints

• While helipads are numerous in LA, their utilization for ODM operations faces numerous challenges
  – Uneven distribution and the existence of unserved areas
  – No public heliport facilities
  – Certification and transition of emergency landing pads to usable commercial facilities
  – Airport facilities are limited and posses little ability to expand to accommodate high volume ODM operations

• The development of new facilities or the use of alternative landing locations may be investigated
  – Heliport design: AC 150/5390-2
  – Vertiport design: AC 150/5390-3 (cancelled 2010)
Central Business Districts have numerous private heliports and EHLFs
Existing LA Ground Infrastructure Constraints

Preliminary heliport identification through HAI database and visual identification
- Emergency Helicopter Landing Facility
- Private Heliport
- Government Heliport
- Medical Heliport

Existing heliport infrastructure quickly drops off outside of central business districts
Polycentric nature of Los Angeles is apparent through clumping of existing heliport infrastructure

EHLFs must be updated and certified by the FAA for use beyond emergency situations

Additional ODM landing facilities may be necessary to support operations outside central business districts
Existing LA Ground Infrastructure Constraints

Existing Helicopter Infrastructure

Population Density

Google Earth

reconnectingamerica.org
Developing vertiports in traffic interchange “clover leafs” has been proposed, as well as over interstates

- Land is generally already utilized in LA county if space is sufficient
- Approach and departure path clearances and ground vehicle access requires further exploration
Noise Constraints

• One of the most significant constraints for intra-city ODM operations will be noise

• The FAA has released multiple studies on the subject, including the 2013 *Los Angeles Helicopter Noise Initiative*
  – Identified noise “hot spots” in LA
  – Led to the development of three new helicopter routes
  – Created the LA Automated Complaint System (ACS) for noise

• A majority of complaints originate from:
  – Low altitude flights over neighborhoods
  – Extended hovering over tourist sites or news events
  – Flights over recreation areas and large, public events
  – The high concentration of flights near airports
  – Training and test flights near Robinson Helicopters
Noise Constraints

- Tourism and flight over parks
- Low flights and hovering
- LAX Plane Spotting
- Robinson Helicopter

ACS: hell-noise-la.com
Noise Constraints
Numerous operations and certification questions create significant uncertainty in the design of CONOPS for ODM vehicles

- Certification as helicopters or fixed wing vehicles?
- 0, 1, 2 pilots?
- What are the significant demand patterns?
  - Flight to or from residential areas
  - Flight to or from airports
  - Flight to or from central business districts
A preliminary review of the Federal Aviation Regulations provides initial insights into potential ODM operation constraints

- § 91.117: Aircraft speed limitations
- § 91.119: Minimum safe altitudes
  - Helicopters exempt if causing no hazard
- § 91.151: Reserve fuel requirements for VFR conditions
- § 93.95: Special air traffic rules for flight in vicinity of LAX
  - Basic VFR weather minimums in effect
  - Class B equipage required
  - Airspeed shall not exceed 140 knots
- § 135.4: Pilot requirements for eligible on-demand operations
  - Must have a two-pilot crew
  - Pilots must have instrument ratings
- § 135.203: VFR Minimum Altitudes
Summary

- ODM aircraft intra-city operations present fundamentally new opportunities and challenges
- Our approach is to identify constraints, review the existing FARs, and develop CONOPS for near short and long-term operations

We welcome feedback from this group about our approach and their ideas for ODM CONOPS development
Thank You

Parker Vascik – pvascik@mit.edu
John Hansman - rjhans@mit.edu