Session 4: UAM: Urban Air Mobility
“What is it, and How Soon?”
Urban Air Mobility: What is it and how soon?

Simon Briceno
Georgia Airports Association
Annual Conference and Exposition
September 2019
Goal of current and future research at ASDL is to be an educational leader in advanced systems architecting, engineering, design, integration and operations, decision making, digital engineering, data and visual analytics.

**Transformative Aviation Concepts**
- Regional and Urban Air Mobility System of Systems Modeling
- Vehicle, Operations, and Infrastructure Integration

**System Safety and Certification**
- Vehicle Safety Analysis and Flight Simulation
- Certification-driven Systems Design

**Unmanned Aerial Systems Operations**
- 3D Path-Planning Optimization
- Deep Learning-based Imagery Analysis
Emergence of a New Mobility Option

- New mode of transportation that uses the “third dimension”
- Flying over road traffic at high speeds will shorten commutes
- UAM and similar regional aviation will connect communities
- UAM market projected to grow to $15B by 2030

**Societal Demands**
- Urbanization
- Connectivity
- Service Agility
- Productivity

**New Urban Mobility Services**
- 2010
- 2019
- 2030

**Technological Maturity**
- Battery Capacity
- Electric Motors
- Automation & Autonomy
- Communication Networks

**Georgia Tech Aerospace Systems Design Laboratory**
Urban Air Mobility already exists!

Conventional helicopters not an affordable solution for urban mobility
Urban Air Mobility Aircraft – The eVTOL

- Electric/hybrid vertical takeoff/landing
- Trip range: 10-60nm
- 4-6 passengers/vehicle
- 130-180 mph
- Piloted → Autonomous
- Significantly more efficient than conventional aircraft
- Many, many configurations...
Urban and Regional Air Mobility – Potential Markets

**Cargo Air Vehicles**
Autonomous delivery of small/large packages from local distribution hubs to dedicated receiving vessels using UAVs

**Air Metro**
Air shuttles along pre-determined and scheduled routes in high traffic areas with vehicles accommodating 4 to 6 passengers

**Air Taxi**
On-demand, door-to-door ridesharing operations using autonomous vehicles accommodating 4-6 passengers
Maximizing time savings for customers “When you want, where you want”

**Regional or “Thin Haul”**
Commuter operations from underserved airports with vehicles accommodating up to 9 passengers from facilities where demand is too thin to attract legacy carriers

Medical Delivery  Aerial Imaging  Surveying/Mapping  Precision Agriculture  Air Ambulance  Law Enforcement  Search & Rescue  Airport Shuttle  Disaster/Humanitarian

2030  2030-2040  2040+  2030
Urban Airport of the future - Vertiport

Operational considerations
• Customer experience
• Flight operations/support
• Final approach/takeoff procedures, safety areas
• Battery charging infrastructure
• High power charging/vehicle
  • 200KW – 600KW (2030)
  • 600KW – 3MW (2040)
UAM Challenges and Opportunities

Vehicle autonomy and conflict resolution
Maintenance, repair, overhaul
Spare parts
Vehicle noise
Cockpit automation
Cabin design and inflight experience
Data acquisition
Pilot training
Fleet operations management
Operations in IMC

Unmanned air traffic management (UTM)
Flight procedures
Reliable, secure, affordable CNS
Communication/Navigation/Surveillance
ATM infrastructure for scalable deployment of UAM
Aircraft operations management
Aircraft data exchange and coordination
Cybersecurity and communication

Vehicle safety
Airworthiness standards, operator certification
Software and system certification
Public acceptance/societal integration
Safety, privacy, jobs
Noise and visual disruption
Implementation roadmap

Consumer travel demand
Market identification – on-demand/scheduled
Integrated mobility solution
Affordable multi-mode transportation
Passenger/cargo operations

Fleet optimization
Vehicle manufacturing, ownership
Supply-chain
Unmanned logistics
Emergency use case applications

Airport/Vertiport energy infrastructure
Charging and service stations
Vertiport management
Urban planning, zoning, local ordinances
Public policy development
Ownership - public private partnerships

Infrastructure design, financing, maintenance
Telecom infrastructure
Aviation Connectivity – 5G communication
Data exchange - vehicles, operators, service providers, ATC
Intermodal transportation connectivity
Digital infrastructure – booking engine
Electric Flight is Already Here!

X-57 testbed provides wealth of knowledge in design, test, and certification of high-lift, electric aircraft to help overcome the barriers and enable new markets in UAM.
The Center for Urban and Regional Air Mobility (CURAM) is an interdisciplinary center that integrates existing capabilities and strengths of the faculty, students, and facilities from multiple schools, colleges, and research centers across Georgia Tech and the Georgia Tech Research Institute (GTRI). We aim to establish Atlanta and surrounding regions in Georgia as a living laboratory for urban and regional air mobility, complementing Atlanta’s existing smart city initiatives and city/regional master plans. Enabling urban air mobility requires the integration of expertise across the engineering disciplines and from experts in policy, economics, and business.

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https://airmobility.gatech.edu/
UAM and Smart Cities

Smart Cities and Future of Mobility

September, 2019
Future of Mobility | Population growth + infrastructure shortfalls = change

**Global Population Relative Urbanization (%)**

- 1950: 30%
- 2000: 46%
- 2050: 66%

**Cities with populations over 1 million now exist around the world**

- 500 cities

**Mega-cities with populations over 10 million are expected by 2030**

- 41 mega-cities

**Additional residents will be living in cities by the middle of the century**

- 3.4B

**Shortfalls in Global Infrastructure Investments**

- Annual (Average 2010-2030) ($T)
  - Demand: 3.7
  - Supply: 2.7
  - Gap: 1.0

**Shortfalls in Global Infrastructure Investments**

- $1.2T could be lost in GDP* by 2025 due to transportation infrastructure deficiencies

**Implications for Future Urban Areas in the US**

- City infrastructure is incapable of growing at a rate comparable to urban population growth
- Congestion will increase as new forms of transportation continue to develop and oversaturate existing infrastructure and capacity
- Economic growth and overall quality of life will decrease as the vitality and attractiveness of a city is compromised

**Aviation offers an exciting opportunity to add a 3rd dimension to localized transportation**

Source: “Smart City Challenge,” U.S. Department of Transportation; 2015 Urban Mobility Report, Texas A&M Transportation Institute; “Smart Cities Readiness Guide,” Smart Cities Council; TomTom Traffic Index; World Economic Forum, Strategic Infrastructure report; Deloitte Analysis

* Based on US data
Urban Air Mobility | **Aviation will be an option for the average citizen**
Growing Role of Aviation in Mobility – Increasing role of drones for first/last mile delivery and passenger urban air mobility, starting with helicopter services transitioning to EVTOLs

Open Vehicle Transportation Data – Connected and autonomous vehicles will be collecting a wealth of location-based information about traffic, road conditions, and safety for use by many stakeholders

Location-Enabled Vehicles – Companies like Uber, Audi, Daimler, and BMW are acquiring more and more geospatial assets to power cars of the future.

Big Location Data and Transportation Management - Government agencies are partnering with companies like Waze and thinking about other big location datasets to manage traffic and safety.
Significant Growth | **UAM expected to grow to trillion dollar market**

**Rapid UAM Industry Growth**

70+ Manufacturers Worldwide / $1B+ investment Since Sept 2018

- 5-seat eVTOL are more expensive than luxury ground ride share
- 2-seat eVTOL aircraft is comparable to current limo type services.
- Blade and Skyride charge ~$30 per passenger mile
- Voom charges ~$10/ passenger mile

- Multitrillion-dollar market – Robert Pierce, NASA Aeronautics Director
- Air Taxi Market estimated at 2.5 Billion in near Term – NASA Study (2018)
Data is the fuel of the future. **Mobility Operating System connects users, service providers, and infrastructure.**

**Mobility Platform**

**Cities**
- Facilitator
- Regulator
- Planner
- Policer

**Supply**
- Bicycles
- Public Transit
- Shared Cars
- Emergency Insurance
- Parking

**Demand**
- Residents
- Commuters
- Travelers
- Businesses
- Suppliers
- Consumers

**Nerve Center**
A system/mechanism for connectivity, seamless data sharing, and interoperability between all entities.
Future of Mobility | **Realizing the potential of technology’s driven mobility transformation**

**How Cities Are Planning to Capture the potential of UAM**

**Plan for the 3rd dimension of transportation (policy, funding, financing)**

**Build with aviation and UAM in mind (infrastructure, mobility operating systems)**

**Evaluate Potential**
- Assess the use cases for UAM based on city and regional characteristics

**Implement Agile Strategy**
- Plan for the 3rd dimension of transportation (policy, funding, financing)

**Take First Steps**
- Build with aviation and UAM in mind (infrastructure, mobility operating systems)

- Governance
- Enterprise Mobility Operating System
- Future Workforce
- Partnerships
- Community Buy-in
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Questions?