Advanced Air Mobility (AAM) Update, February 2024

Presentation to the San Francisco Airport (SFO) Community Roundtable

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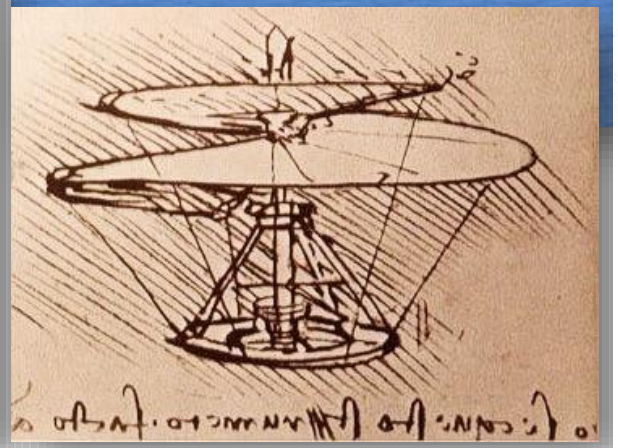
February 7, 2024

Agenda

- Introduction
- Definitions
- Vehicle Types
- Use Cases
- Infrastructure Considerations
- Noise, Airspace, & Operational Considerations
- Challenges, or Opportunities?

Source: https://newatlas.com/aircraft/joby-manned-evtol-tests/

"History doesn't repeat itself, but it often rhymes."

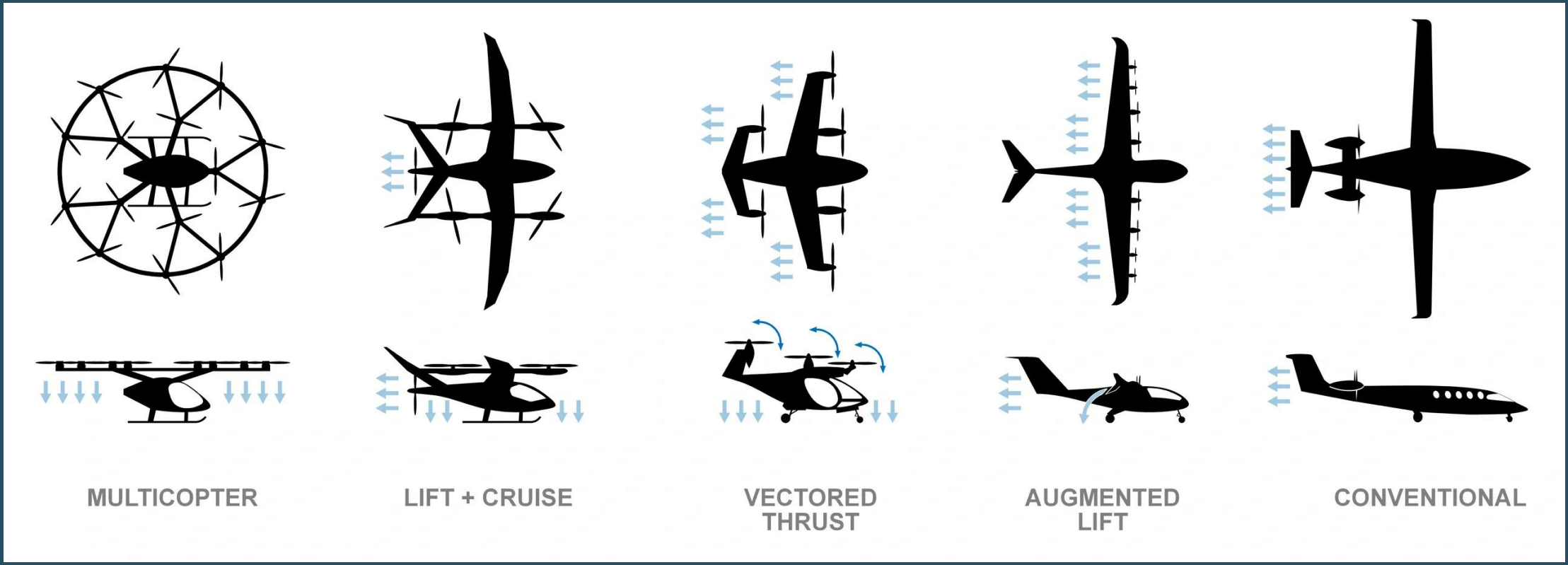


Definitions

- AAM – Advanced Air Mobility
  - As defined in the AAM Coordination and Leadership Act (P.L. 117-203, 136 Stat. 2227), October 17, 2022: *AAM is a transportation system that moves people and property by air between two points in the United States (U.S.) using aircraft with advanced technologies, including electric aircraft, or electric vertical takeoff and landing (eVTOL) aircraft, in both controlled and uncontrolled airspace.*
- RAM – Regional Air Mobility
  - *Air travel connecting suburbs, villages, towns, and rural areas to urban city centers and airports; or intra-city air travel*
- UAM – Urban Air Mobility
  - *Inter-city air travel*
- Drone – *Generic term for any aircraft without a pilot*
- UAS – *Uncrewed Aircraft Systems; technical term for Drones*
  - Small UAS – 14 CFR Part 107, Under 55 Pounds
  - Large UAS – 55 Pounds or More
- bVLOS – Beyond Visual Line Of Sight
- eVTOL – Electric Vertical Take-Off and Landing
- STOL – Short Take-Off and Landing
- CTOL – Conventional Take-Off and Landing

Image Source: FAA Innovate28:
https://www.faa.gov/air-taxis/implementation-plan

Vehicle Types



Source: SMG Consulting, https://aamrealityindex.com/aam-reality-index

Vehicle Types

Source: https://flagshipinc.com/manage-elroy-airs-transition-facility/

Use Cases

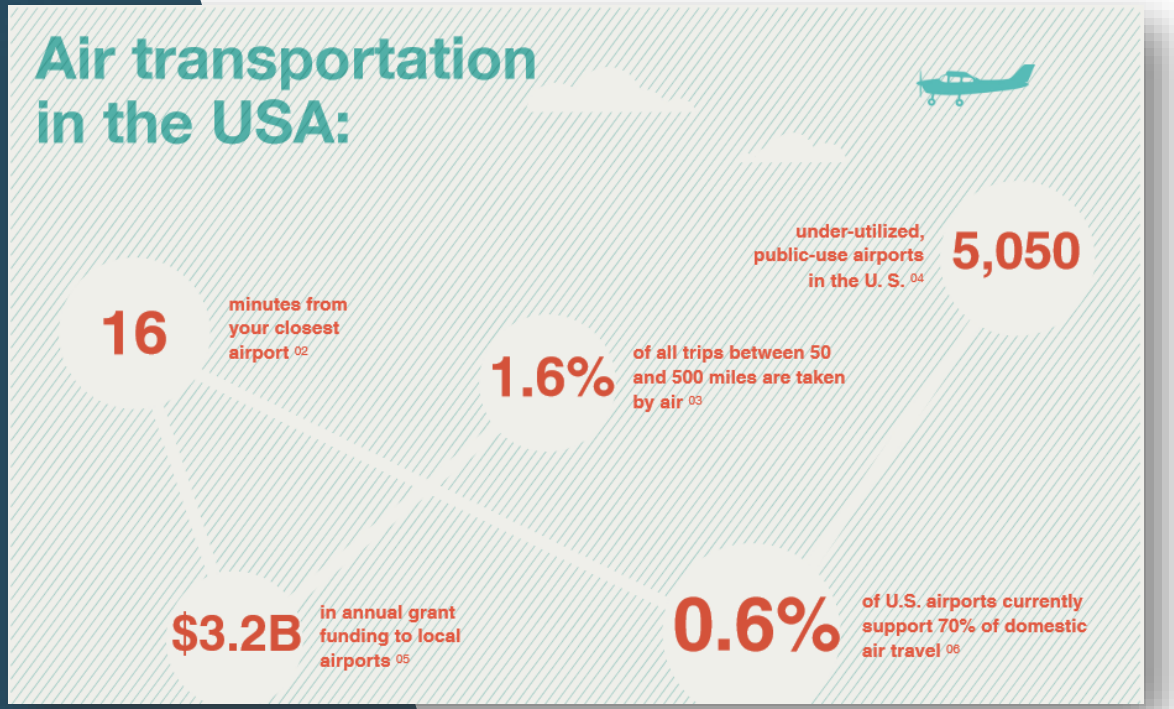
- Cargo
  - Last mile (UAS)
  - Airport to warehouse (AAM)
  - Airport to vertiport; airport to airport
- Medical
  - Patients
  - Organs, blood, supplies
- Passengers
  - Inter and intra city travel
  - On-demand air taxis
  - Scheduled service

Sources: Archer Aviation inc. (top) and courtesy of Joby Aviation. ©Joby Aero, inc. (bottom).

Source: https://www.reuters.com/business/aerospace-defense/us-faa-shifts-gears-certifying-future-flying-taxi-pilots-2022-05-10/

Infrastructure Considerations

- RAM operations look to increase utilization of existing airport infrastructure
- AAM and UAM operations look to **also** build new infrastructure, such as vertiports
- FAA vertiport guidance
  - Engineering brief No. 105, Vertiport Design
  - https://www.faa.gov/airports/engineering/engineering_briefs/engineering_brief_105_vertiport_design
- High real-estate prices: UAM/AAM utilization potential exists in dense congested urban areas where real estate is limited and costly
- Limited space: rooftops are not equipped for aircraft, charging, and emergency response, and parking garages are quite low in height
- Vehicle cost: on-demand services require significantly more carriers than scheduled ones
- Airspace integration: airspace is usually most congested in the cities
- Other challenges like certification cost, operations in inclement weather, passenger rooftop access, etc.



Source: NASA's Regional Air Mobility Report (https://sacd.larc.nasa.gov/ram/)

Interim Vertiport Design Guidance

FAA is preparing interim guidance for the design of vertiports and vertistops considering eVTOL vehicles.

- FAA plans to use transport helicopter criteria for VTOL vehicles. The rationale for increased size is enhanced safety
- Flight Approach and Take Off Zone (FATO) needs to be two times of the controlling dimension i.e., 50 feet long eVTOL would require 100 ft X 100 ft load-bearing surface.
- This larger size would be a problem for retrofitting rooftop style parking garage vertiports

Joby S4 Wingspan (WS): 45 ft
Airbus CityAirbus WS: 52 ft
Archer Maker: 10.4 ft
Supernal S-A1: 56 ft

DRAFT

Federal Aviation Administration

Memorandum

Date: June XX, 2022

To: All Airports Regional Division Managers

From: Michael A.P. Meyers, P.E.
Manager, Airport Engineering Division, AAS-100

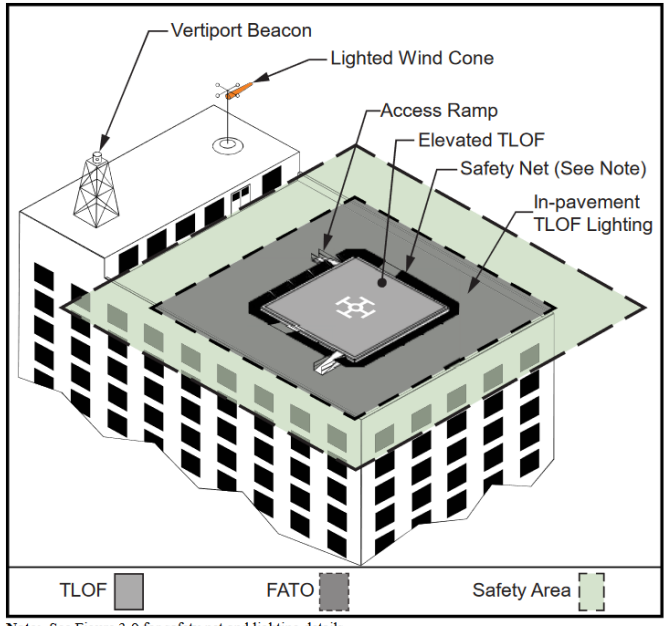
Prepared by:

Subject: Engineering Brief No. 105, Vertiport Design

This Engineering Brief provides interim guidance to airport owner operators and their support staff for the design of vertiports for vertical takeoff and landing (VTOL) operations. Note that this interim guidance will be subject to updates as data, analysis, and VTOL aircraft and operations develop in the future.

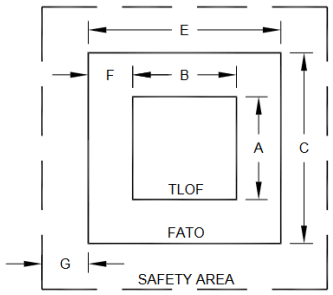
Attachment

Figure 3-8: Elevated Vertiport Configuration



Note: See Figure 3-9 for safety net and lighting details.

Helicopter



DIM	ITEM	VALUE	NOTES
A	Minimum TLOF Length	1 RD	
B	Minimum TLOF Width	1 RD	
C	Minimum FATO Length	1 ½ D	See Paragraph 207.a.(1) and Figure 2-5 for adjustments of elevations above 1000'
E	Minimum FATO Width	1 ½ D	
F	Minimum Separation Between the Perimeters of the TLOF and FATO	¾ D - ½ RD	
G	Minimum Safety Area Width	See Table 2-1	

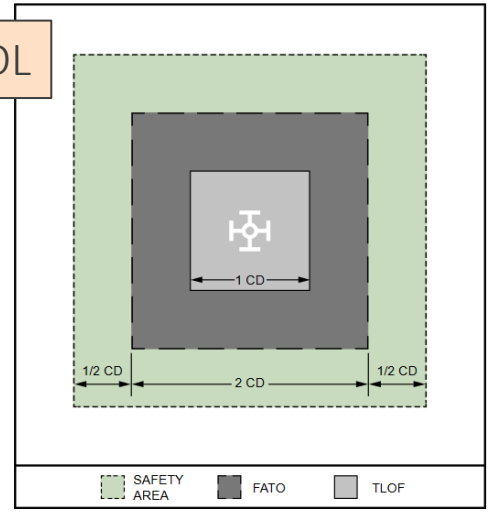
Note: For a circular TLOF and FATO, dimensions A, B, C and E refer to diameters.

Table 2-1: Landing Area Dimensions

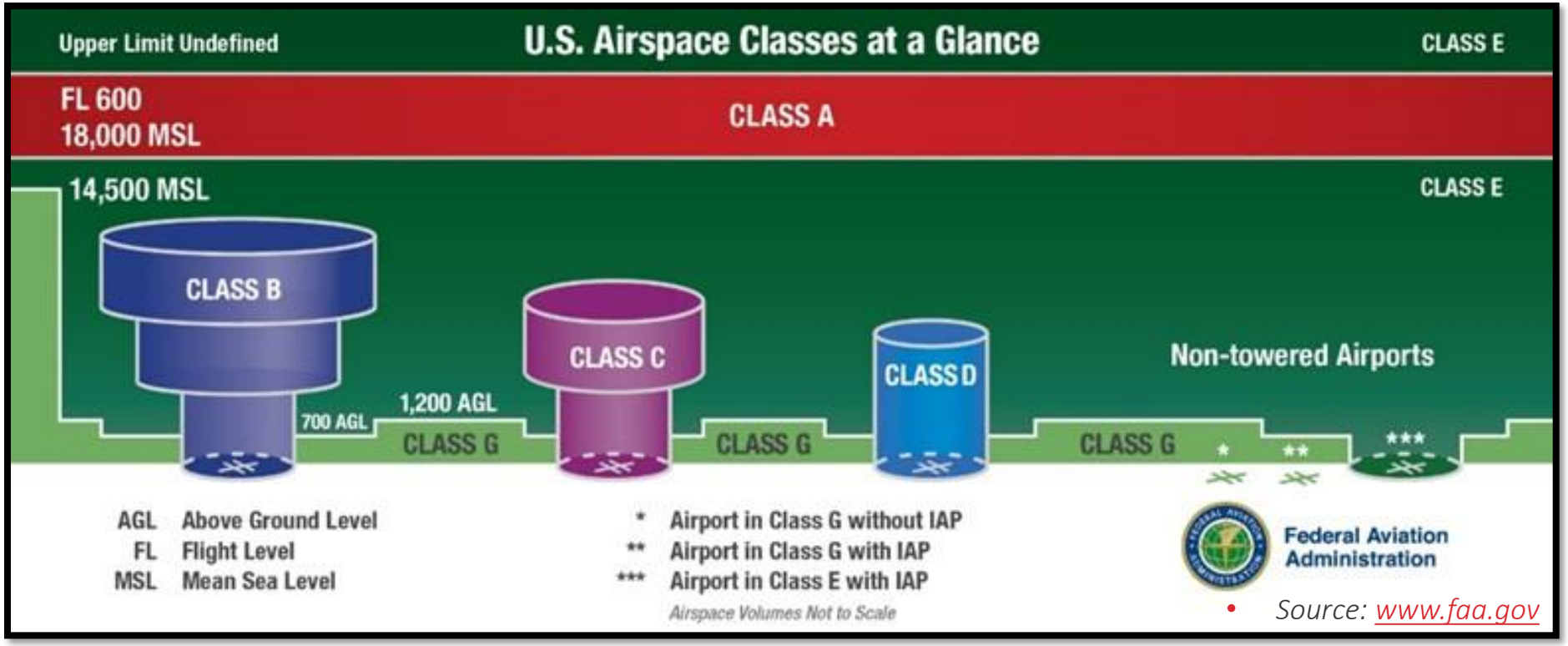
Element	Dimension
TLOF	1CD
FATO	2CD
Safety Area	3CD (½ CD added to edge of FATO)

Figure 2-1: Relationship and Dimensions of TLOF, FATO, and Safety Area

VTOL



Noise, Operational, and Airspace Considerations

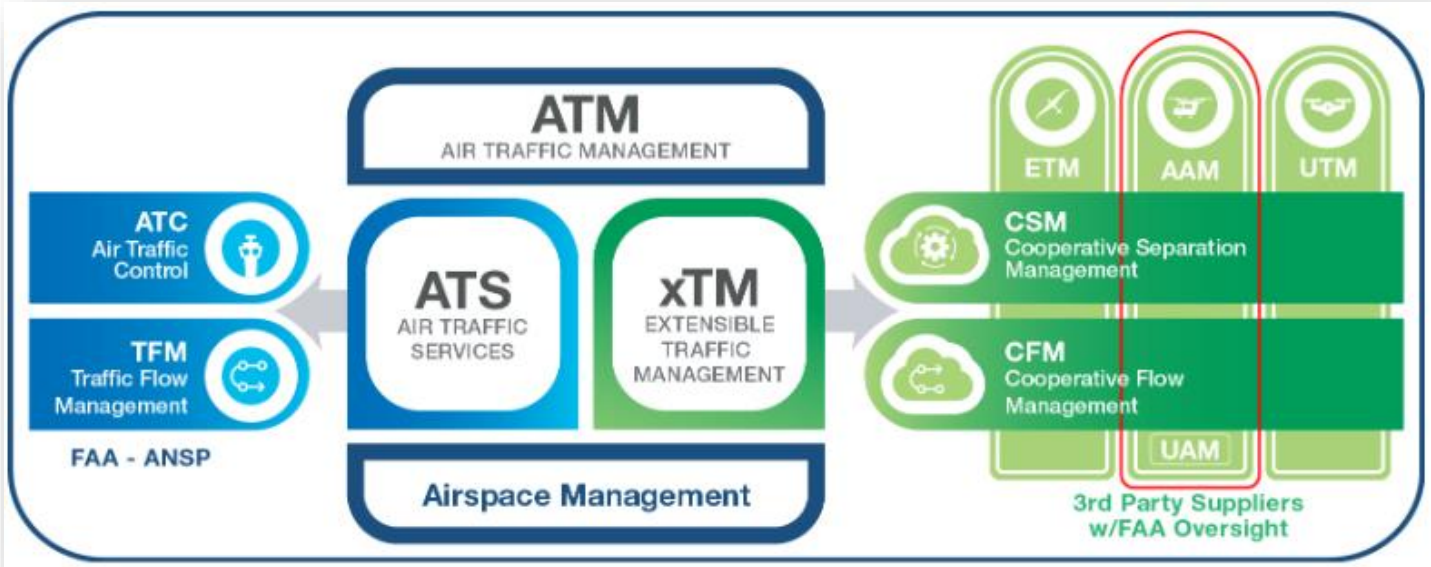


- Source: www.faa.gov

- *The FAA is the federal authority over aircraft operations in all airspace and the regulatory and oversight authority for civil operations in the NAS. The FAA maintains an operating environment that ensures airspace users have access to the resources needed to meet specific operational objectives and that shared use of the airspace can be achieved safely and equitably. The FAA develops or modifies regulations to support UAM operations. The FAA will approve COPs to ensure that the FAA authority is maintained (e.g., NAS safety, equal access to airspace, security). The FAA will define, maintain, and make publicly available UAM Corridor definitions (e.g., routes and altitudes) and manage the performance requirements of UAM Corridors. – **FAA UAM Concept of Operations (CONOPS) 2.0***
  https://www.faa.gov/sites/faa.gov/files/Urban%20Air%20Mobility%20%28UAM%29%20Concept%20of%20Operations%202.0_1.pdf

Noise, Operational, and Airspace Considerations

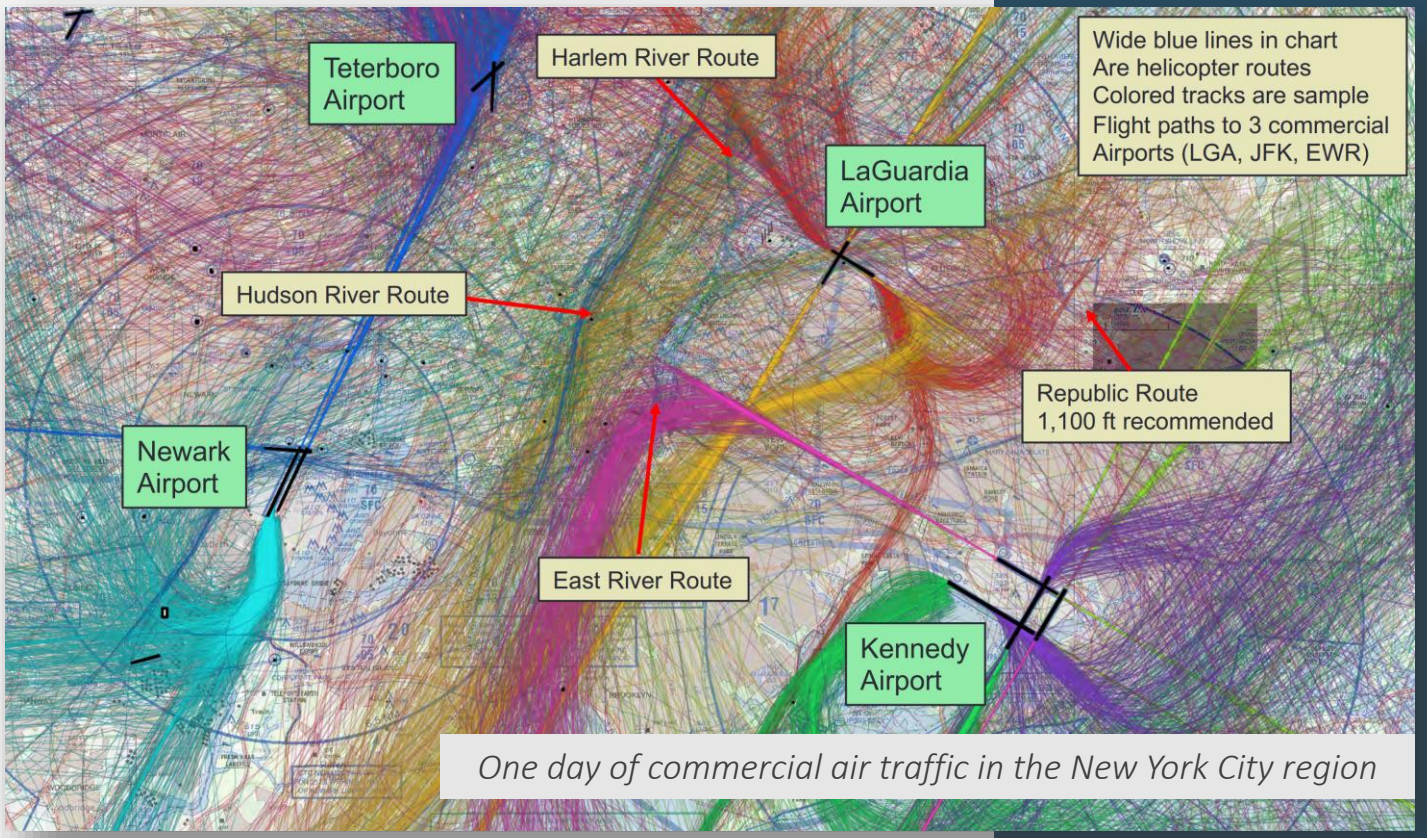
- Integrating AAM/UAM into National Airspace System (NAS) is complex
- Involvement of ATC in AAM/UAM traffic management could incur delay and put a burden on already saturated ATC
- FAA has developed a Concept of Operations (CONOPS) framework



- *Source: FAA UAM CONOPS 2.0 https://www.faa.gov/air-taxis/uam_blueprint*

Noise, Operational, and Airspace Considerations

- NASA & FAA working with manufacturers to gather data to be used for certification and policy decision making
- Elements of sound include pitch, tone, harmony, etc.
- Noise metrics for Environmental and Land Use planning defined in FAA Order 1050.1F
- Community annoyance to noise of aircraft operations has changed over time; FAA has acknowledged:
  - FAA Neighborhood Environmental Survey
  - FAA Noise Policy Review
- Manufacturers are designing 'low-noise' aircraft
  - Rotor speed, location, airframe interaction, angle of flight all influence the 'quality' of the noise



One day of commercial air traffic in the New York City region

Advanced Air Mobility – Community Integration Platform AAM-CIP

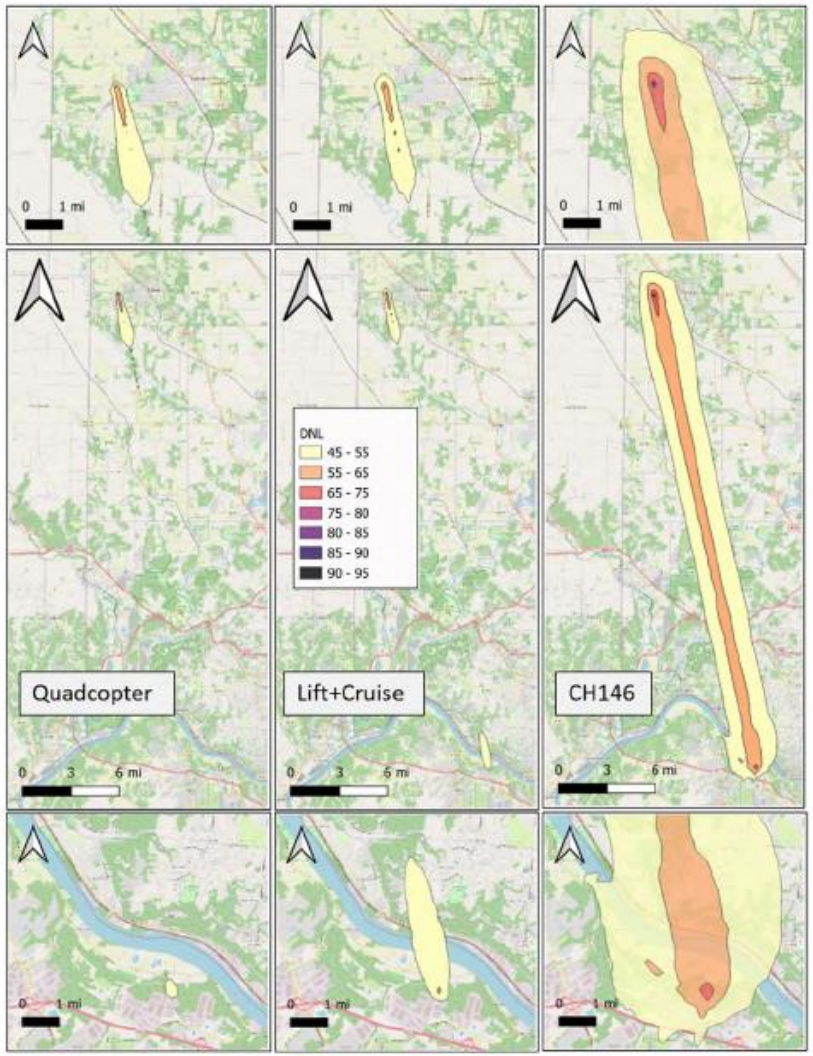


Figure 4. DNL Bands for AAM vehicles (Quadrotor and L+C), compared to Bell CH-146 Griffon Helicopter. The top and bottom panels zoom-in on Descent and Climb phase, respectively. The middle panels capture the entire flight's noise exposure.

- A noise estimation framework for AAM vehicles has been built for the AAM CIP tool.
- The framework leverages the credible computing capabilities of the Advanced Acoustics Model, which allows for proper acoustic characterization of AAM vehicles as sound sources via sets of spectral hemispheres.
- The framework allows for the estimation of noise exposure from AAM operations

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Noise Estimation Framework for Advanced Air Mobility

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Examples of State & Federal Plans

- Ohio Air Mobility Framework
  - https://drive.ohio.gov/about-driveohio/news/ohio-aam-framework
- Florida
  - https://www.fdot.gov/aviation/advanced-air-mobility
    - City of Orlando https://www.orlando.gov/Our-Government/Orlando-plans-for-a-future-ready-city/Advanced-Air-Mobility
- North Carolina
  - https://www.ncdot.gov/divisions/aviation/advance-mobility/Pages/advanced-air-mobility.aspx
- California
  - SB 800, https://atrn.assembly.ca.gov/sites/atrn.assembly.ca.gov/files/SB%20800%20%28Caballero%29.pdf
- US DOT, Interagency Working Group
  - https://www.transportation.gov/aamiwg

Image Source: https://www.greencarcongress.com/2021/07/20210716-aam.html

Challenges, or Opportunities?

- Balancing operational considerations with noise abatement
  - Flight paths optimized for efficiency of power (i.e., slower battery drain), are not conducive to noise abatement paths (i.e., up and out quick)
- Development of noise abatement flight routes within existing airspace guidance
  - FAA Innovate28; https://www.faa.gov/air-taxis/implementation-plan
  - *FAA Could Improve Outreach through Enhanced Noise Metrics, Communication, and Support to Communities*
    - GAO Report: https://www.gao.gov/assets/gao-21-103933.pdf

Thank You.

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