NETC Advanced Air Mobility Regional Plan Topical Discussion

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Advanced Air Mobility: Planning a Clean, Green, and Equitable Aerial Future

Touchless Medical Supply Delivery

Emergency First Response

Critical Organ Supply

Dr. Jeff DeCarlo, Aeronautics Administrator
Massachusetts Department of Transportation
Commonwealth of Massachusetts UAS/AAM Lead

Feb 13, 2024

Objectives & Overview

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Objective of Topical Discussion

- Help New England states learn **where each agency is** as it relates to AAM, **the issues that need to be addressed**, and discuss **how the region might move forward together** with respect to a regional AAM plan.
- NETC AAM Regional Plan Topical Discussion – A Convening, potentially leading to future coordination, collaboration, and perhaps the formal development of a regional AAM plan.

NETC AAM Regional Plan

- Importance of an AAM Regional Plan
- Past New England Planning Efforts
- The Value Proposition

Massachusetts AAM Approach

- Collaboration
- AAM ITF

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Advanced Air Mobility Regional Plan

Examples of Previous NE Aviation Regional Planning

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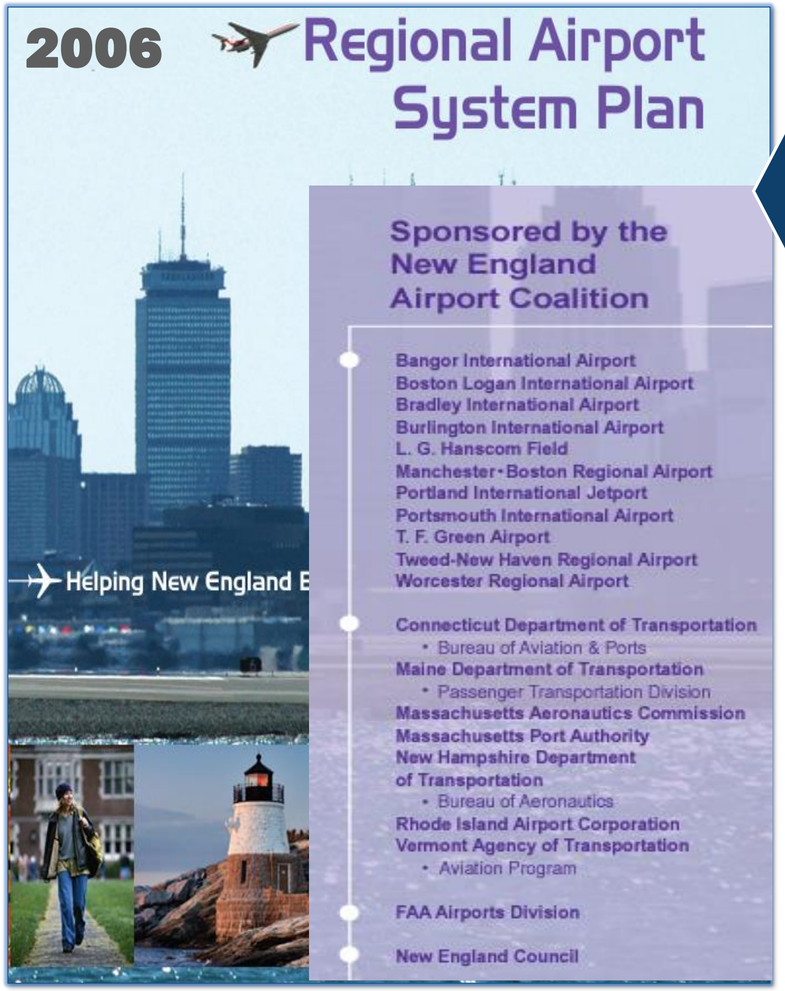
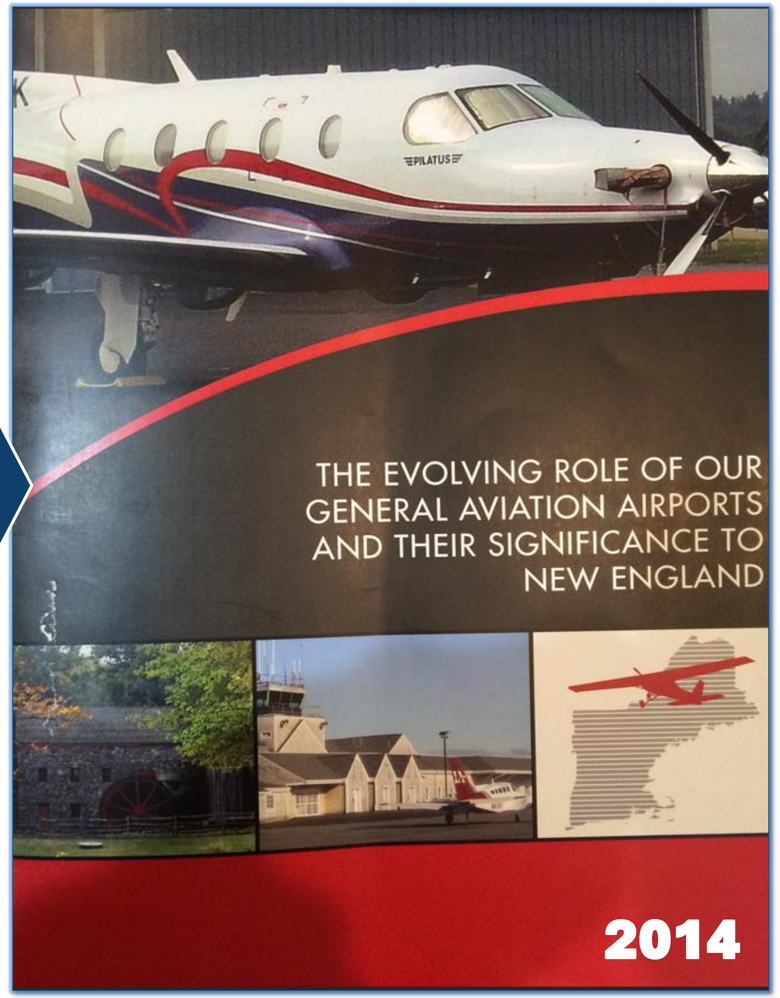
Regional Aviation Planning Examples



- **2006** - **Foundation for regional strategy** for air carrier airport system…support needs of air passengers thru 2020. Strategy was instrumental with informing investment and development of the primary commercial airport system in NE.
- **2014** – New England Regional Airport System Plan. The Evolving Role of our General Aviation Airports and their Significance to New England (Louis Berger)



NETC Advanced Aviation Study

2018 – 18-3 Integration of Unmanned Aircraft Systems (UAS) into Operations Conducted by State Departments of Transportation (Category – Other) Completed 3/31/2021 (WSP)

World Economic Forum & City of Los Angeles Release Principles for Making Inclusive Aerial Mobility a Reality in Cities (2019-20)

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- The Seven Principles of the Urban Sky identifies and outlines seven key components deemed critical for a scalable policy framework
- The WEF – Los Angeles consortia was an excellent collaborative construct
- Created a clear and usable model for community acceptance and integration

National and International Collaborative Forums: Successful Discussions and Exchanges

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- NASA – 1st Annex – AAM Community Integration 6/2021-2022
- NASA – 2nd Annex - AAM Public Good Use Cases & Conops 11/2022-5/2025
- UIC2 -UAM Initiative Cities Community of EU's CIVITAS
- WEF UAM/AAM Cities & Regions Coalition / WEF AVIATE
- Paris Conferences in Fall 2022 and Paris Airshow 6/2023 – Includes preparation for Paris 2024 Olympics
- South Korea – K-UAM Confex and GURS

Int'l: *EU's UAM Initiative Cities Coalition (UIC2) of Civitas*

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UIC2
Urban air mobility Initiative Cities Community
WALK.RIDE.DRIVE.FLY

Urban Air Mobility Initiative Cities Community
The voice of cities and regions in urban air mobility
DRIVING THE SUSTAINABLE & RESPONSIBLE TRANSITION OF URBAN MOBILITY TO THE 3RD DIMENSION

CIVITAS 2030
Sustainable and smart mobility for all

- The Urban-Air-Mobility Initiative Cities Community (UIC2), was established in October 2017 within EU's Smart Cities Marketplace, and transitioned to the EU's sustainable urban mobility and transport Initiative called CIVITAS.
- UIC2 is a city/region-centric and citizens' needs-driven community making the voice of the European urban/regional communities heard in the emerging sector of urban air mobility.
- UIC2 fosters collaboration across disciplines and sectors pertinent to UAM with the aim to jointly shape the future of UAM services.

UIC2

- The mission of UIC2 is to drive the sustainable and secure transition of urban mobility to the vertical dimension.

Int'l: *Paris and Paris Region Urban Transport of Passengers by eVTOL Conference (Paris Region)*

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Groupe ADP, RATP Group, with the support of the Paris Region, the DGAC (French Civil Aviation Authority), and the EASA (European Union Aviation Safety Agency) have teamed up to structure an ecosystem for Advanced Air Mobility in the Paris Region. They brought together leading industrials and international start-ups alongside major academic and research institutions to cover the entire AAM value chain and launch the first e-VTOL flights for the Olympic and Paralympic Games in 2024.

- Invited by UIC2 and the WEF
- Paris Summer Olympics Jul 26 – Aug 11, 2024 – eVTOL operations – Paris Region, Groupe ADP, Volocopter, Skyports, Hologarde
- Paris Transit Agency (RATP) working with Airport owners/operators (Groupe ADP) – Transit has bought in
- FAA Paris Attache' is the former FAA NE Regional Administrator working on Aeronautics and Space efforts
- EASA moving positively wrt AAM, reducing regulatory approval timeline by 80%

The AAM Interagency Working Group

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Air Traffic Federation

Infrastructure

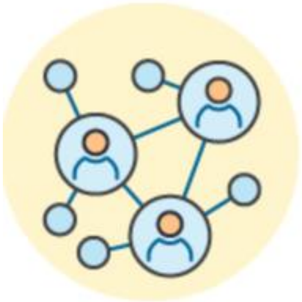
AAM IWG: AAM National Strategy - Report to Congress

- Upon mission-driven research and meetings, the AAM IWG will develop a national strategy that includes:
- Recommendations regarding the safety, operations, security, infrastructure, air traffic concepts, and other Federal investment or actions necessary to support the evolution of early AAM to higher levels of activity and societal benefit; and
- A comprehensive plan detailing the roles and responsibilities of each Federal department and agency, and of State, local, and Tribal governments, necessary to facilitate or implement the recommendations developed.

https://www.transportation.gov/aamiwg/report

Automation Strategy

Security Requirements



Community Roles

Interagency Working Group: AAM National Strategy an Opportunity to Leverage New Sources of Funding

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	Federal Agencies of the IWG		
1	Council of Economic Advisors	11	Department of State
2	Department of Agriculture	12	**Department of Transportation (incl. FAA)**
3	Department of Commerce	13	Department of Veterans Affairs
4	Department of Defense	14	Federal Communications Commission
5	Department of Education	15	National Aeronautics & Space Administration
6	Department of Energy	16	National Security Council
7	Department of Homeland Security	17	Office of Management and Budget
8	Department of the Interior	18	Office of the National Cyber Director
9	Department of Justice	19	Office of Science and Technology Policy
10	Department of Labor		

Beta Technologies & United Therapeutics Human Organ Delivery: Regional Planning Makes Sense

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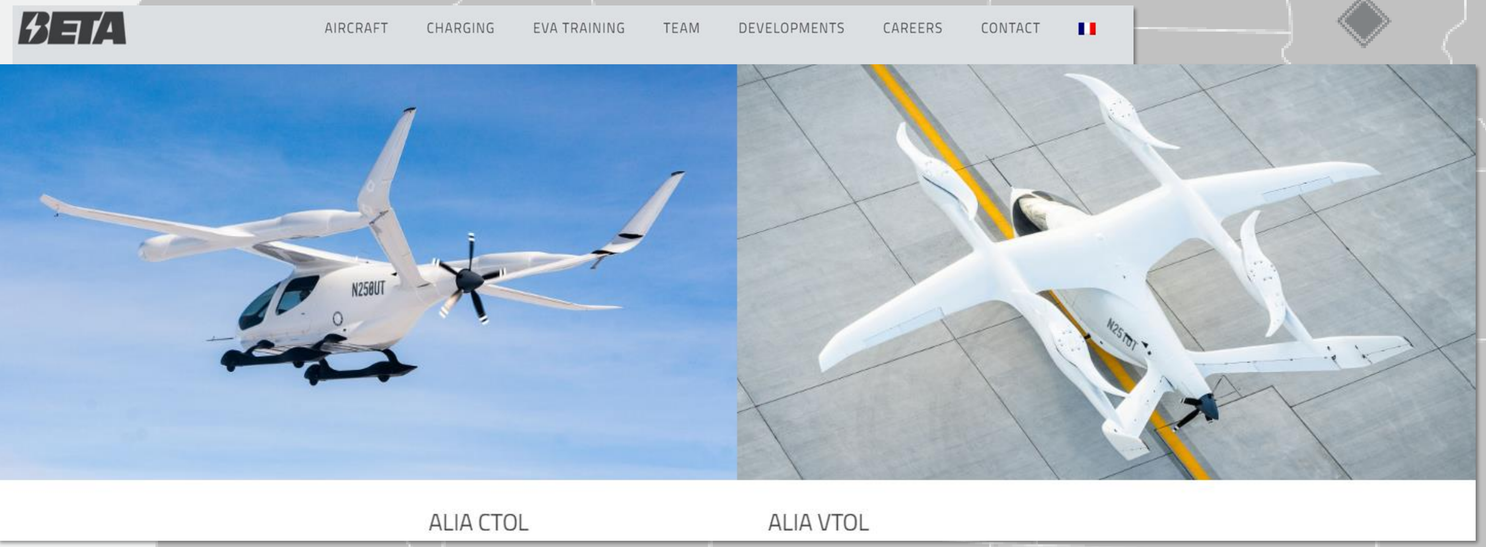

LUNG BIOENGINEERING
EVLP CENTER (LB-1)
Silver Spring, MD

LUNG BIOTECHNOLOGY

United Therapeutics CORPORATION

LBE TRANSPLANT CENTER
XVIVO TRANSPLANT CENTER
EVLP LBE CENTER
FUTURE LBE CENTER
Construction in progress

eVTOL: *electric Vertical Take-Off & Landing Aircraft*

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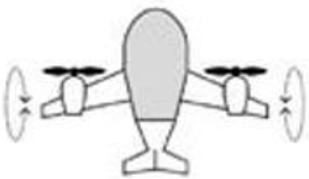
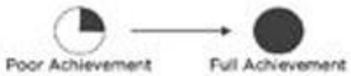
eVTOL Aircraft Mission Driven Architecture

Mission-Driven Architecture

ARCHITECTURE	VOLOCITY MULTI-ROTOR	LIFT & CRUISE	TILT-ROTOR OR TILT-WING	HELICOPTER
MISSION	Urban	Sub-Urban and Inter-City	Sub-Urban and Inter-City	Urban, Sub-Urban and Inter-City
CONCEPT DESIGNS				
HIGHEST SAFETY				
LOW COMPLEXITY				
LOW NOISE LEVEL			 [1]	
ENERGY EFFICIENCY & COSTS	Efficient urban & suburban city concept	Expanding range at similar efficiencies	High energy requirements in take-off and landing	Fossil fuel engine; High operational costs
RANGE (KM)	35-65[2]	50-120[2]	195-290 (?)[3]	400+
CRUISE SPEED (KM/H)	50-110	50-195	195-320 (?)[3]	210+



eVTOL: *LIFT Single-Person Multicopter*

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eVTOL Aircraft Mission Driven Architecture: Multi-Rotor

60 MINUTES: LIFT – HEXA, April 2022

- ULTRALIGHT CATEGORY
- DISTRIBUTED ELECTRIC PROPULSION
  - **Eighteen independent** electric motors
- AMPHIBIOUS
  - Capable of landing on both land and water, HEXA has four perimeter floats for buoyancy
- "LIFT is using technologies that have matured in the drone industry to democratize human flight – a natural progression that will soon provide a clean, exciting, and efficient alternative to sitting on congested roads burning fossil fuels."

https://www.youtube.com/watch?v=1YUv0AMq0x8
https://www.cbsnews.com/news/anderson-cooper-evtol-60-minutes-2022-04-17/

eVTOL: *Remotely Piloted Passenger Operations*

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eVTOL Aircraft Mission Driven Architecture: Suburban Lift & Cruise

Wisk Aero – Boeing, Kittyhawk (autonomous systems)

Pros/Cons of eVTOL Aircraft

The Echo Chamber

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Pros *(over traditional GA & helicopters)*

- Electric propulsion creates possibility of sustainable energy
- Quieter motors & quieter rotors
- Redundant by design = safer
- Small landing/take-off footprint
- Lower cost operations
- Autonomy and Simplified Vehicle Operations make pilot role easier and operations safer

Cons *(or challenges)*

- Initial Federal Administration Administration (FAA) certification still formative (exemptions, special conditions being used)
- Current battery technology marginal
- Ground charging may require substantial infrastructure investment
- Weather sensitivity
- Limited payload and range
- More pilots needed (both a challenge and a workforce development opportunity)

USAF Selects Electra for Up to $85M in Funding for eSTOL Development – 1/24/2023

eSTOL

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The U.S. Air Force's AFWERX program chose Electra for a Strategic Funding Increase award. This award secures up to $85 million for Electra to continue developing a full-scale pre-production prototype of its electric short take-off and landing (eSTOL) aircraft. (Photo: Electra)

- AFWERX, Agility Prime, electric short take-off and landing aircraft, eSTOL, NASA, U.S. Air Force
- Unique "Blown Wing Design"

https://www.aviationtoday.com/2023/01/26/electra-usaf-funding-estol/?oly_enc_id=3247B5883112I4W

Cape Air: *Electric Aircraft, Eviation Alice*

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eCTOL Aircraft Mission Driven Architecture: Essential Air Service (subsidized)

Cape Air has ordered dozens of the Eviation Alice Aircraft, an all-electric nine-passenger plane, for use on its short routes around the country.

COURTESY OF CAPE AIR

Posted Thursday, December 15, 2022 12:36 pm

General Characteristics

- Crew: 2
- Capacity: 9 passengers
- Length: 57 ft 1 in
- Wingspan: 63 ft 0 in
- Height: 12 ft 7 in
- Max takeoff weight: 18,400 lb
- Commuter payload: 2,500 lb
- Cargo payload: 2,600 lb
- Powerplant: 2 × magniX 650
- Elect Power Unit, 700 kW (940 hp) each

Performance

- Maximum speed: 300 mph, 260 knots
- Range: 290 mi VFR, 30 min. reserve
- Take-off field Length: 2,750 ft
- Landing distance: 2,040 ft

https://www.aviationtoday.com/2023/01/26/electra-usaf-funding-estol/?oly_enc_id=3247B5883112I4W

NE AAM Region Plan: Value Proposition

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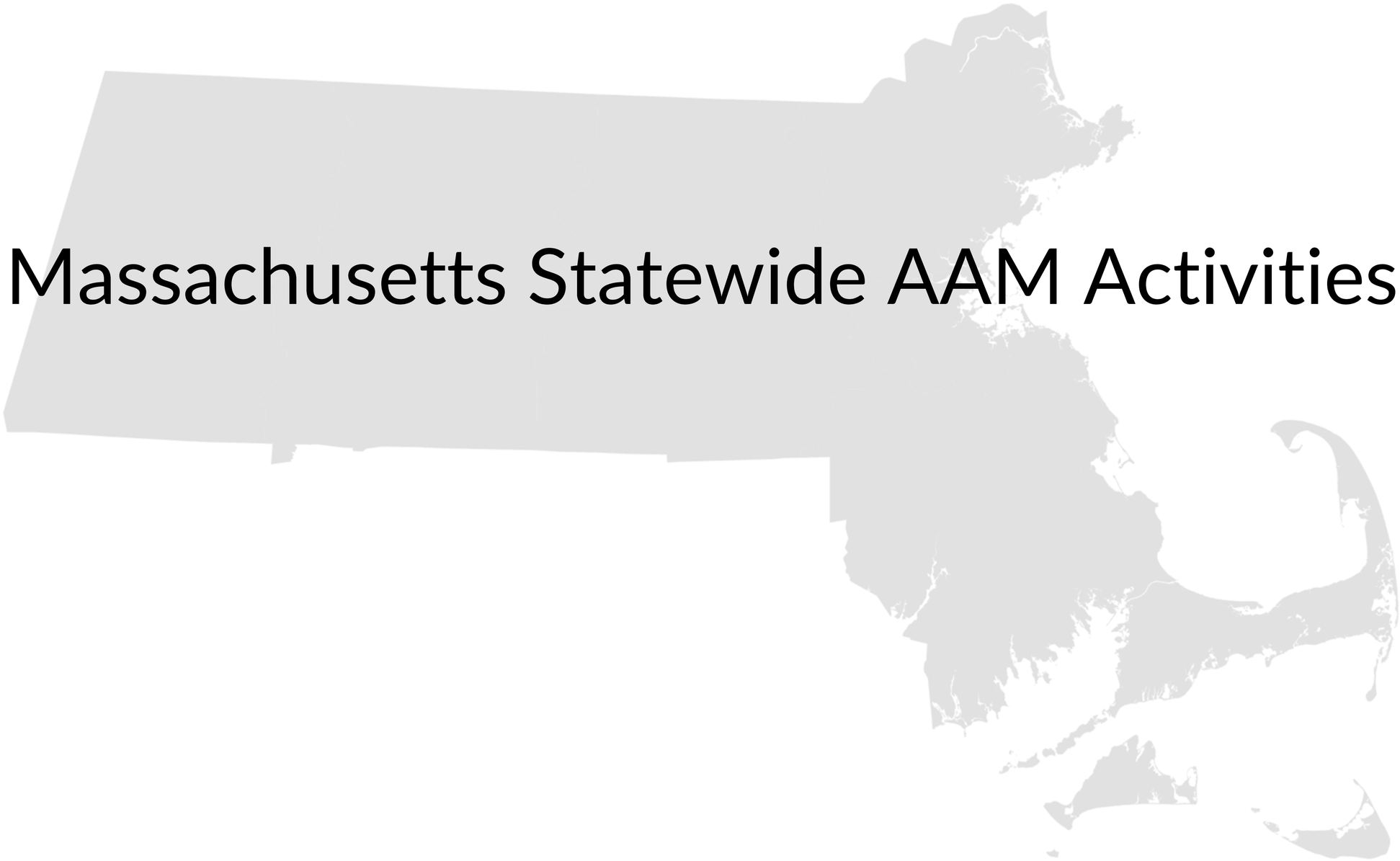
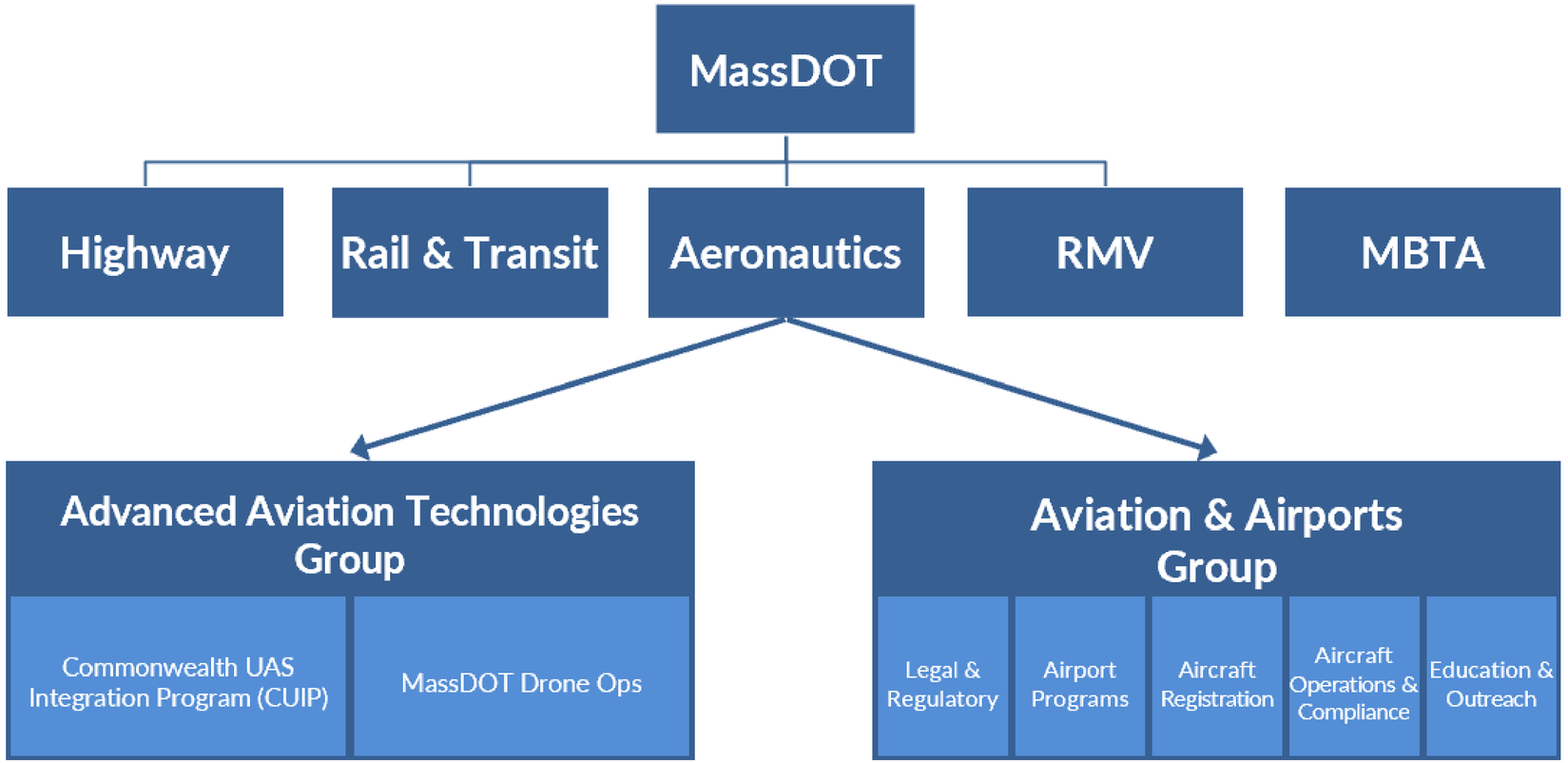
NE Region AAM Plan: A Unified Voice to Garner Support

- FAA New England Region
  - Regional Administrator: An AAM National Leader
  - Participating actively with AAM IWG
  - Oversees Airports Division
- AAM Use Cases: Flesh-out
  - Public Good
  - Commercial
- Planning
  - AAM Market & Roadmaps
  - Aviation System Plan
  - Long-Range Transportation Plan
    - Multimodal, MPO's, the 3rd Dimension
  - P3 – Public Private Partnerships
- Infrastructure
  - Electrification
  - Utilities
  - P3 – Public Private Partnerships
- Takeoff and Landing Sites
  - Leverage our Public Use Airports
  - PRLAs
  - New locations (P3)
  - Routings
- Green Fuels
  - SAF, Hydrogen
  - Federal & State Energy Agencies
  - Climate Initiatives

Massachusetts Statewide AAM Activities



Mission & Organization



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- Mission: *Promote aviation across the Commonwealth*
  - ✓ Establish an efficient integrated aviation and airport system
  - ✓ Enhance safety, customer service, economic development, and environmental stewardship
- Advanced Aviation Programs – development & operationalization
  - ✓ Shared service
  - ✓ R&D²
  - ✓ Economic development

Aviation & Airports Responsibilities

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Annual Airport Capital Investments

- **FAA: $30-50M**
- **State: $12-22M**

Annual Economic Impact

- Regulatory agency with oversight of Commonwealth aviation broadly, as well as the capital programs at 35 public-use airports.
- Aviation responsibilities include:
  - ✓ Safety & Security
  - ✓ Airport Development
  - ✓ Accident Investigation
  - ✓ Navigation Aids
  - ✓ Emergency Management
  - ✓ Planning
  - ✓ Licensing
  - ✓ Inspecting
  - ✓ Education & Outreach
  - ✓ **Lead & promote UAS & AAM research, development, deployment**

Massachusetts Emergency Management Agency (MEMA): *Air Operations Lead Coordinating Agency*

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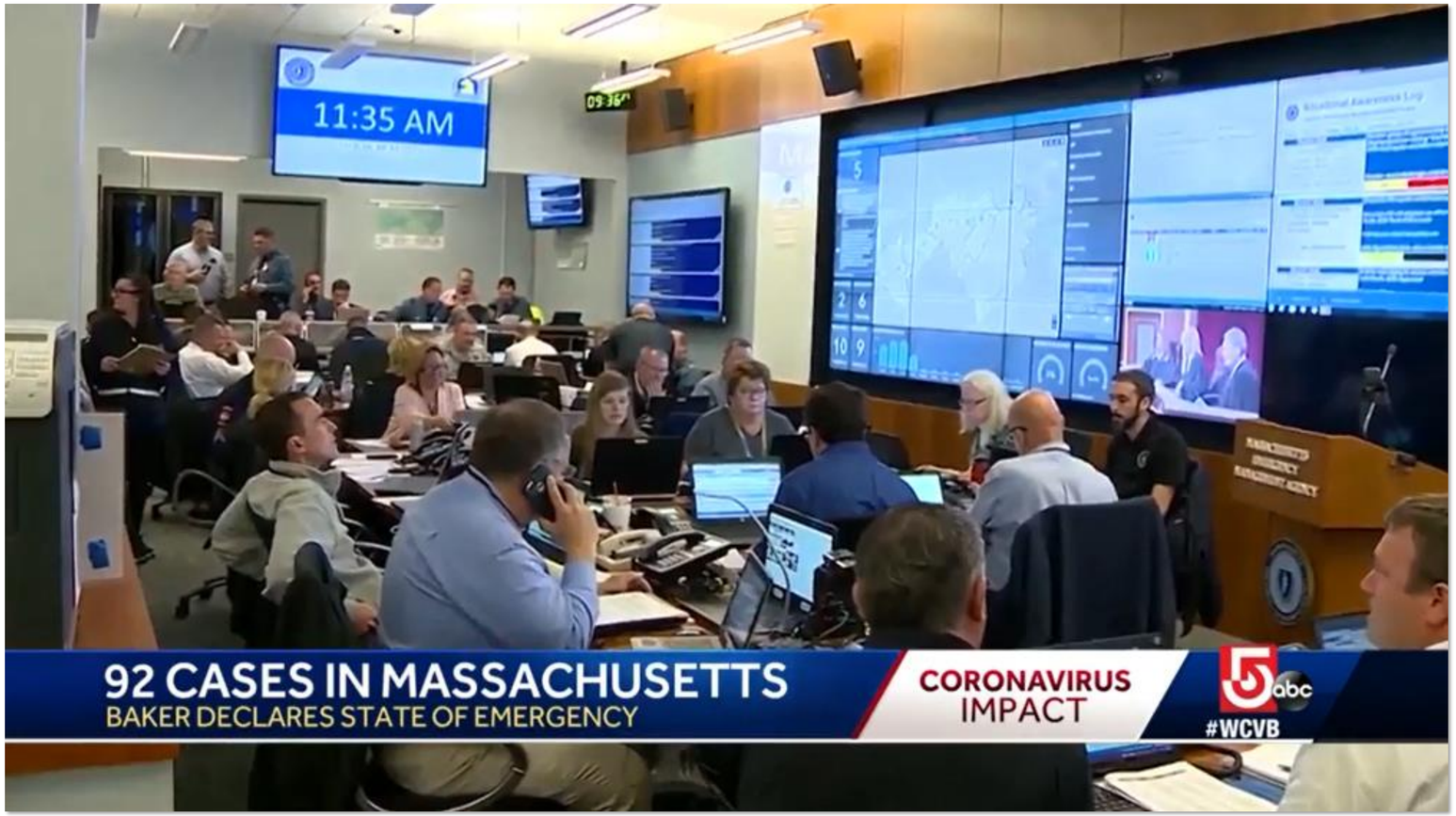
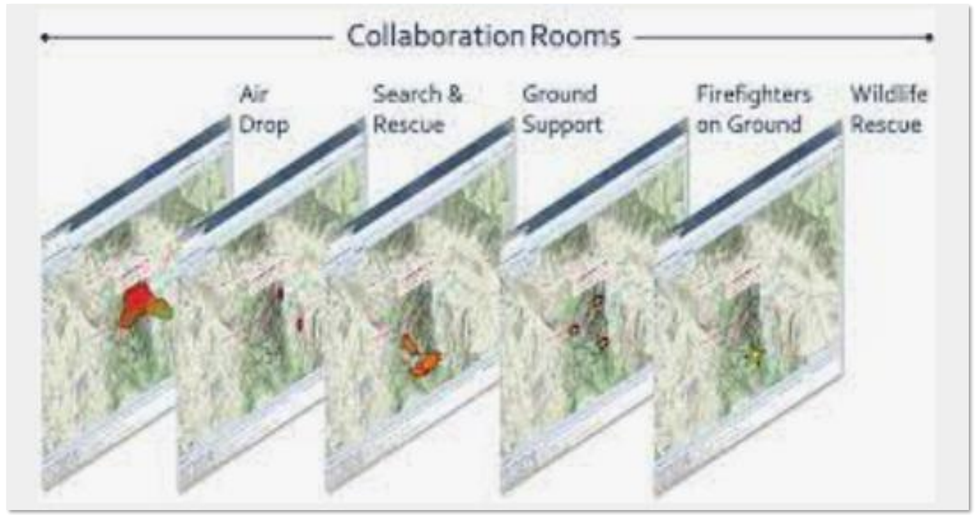


Massachusetts Emergency Management Agency



Supporting Growth of Advanced Air Mobility (AAM):

UAS Delivery & Advanced Aviation Package, Cargo & Passenger Operations including UAS, eVTOL eSTOL, eCTOL….and WIG… (incl. Hydrogen, Sustainable Aviation Fuels)

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Technology and the regulatory landscape advancing rapidly with multiple credible players in **goods delivery and passenger transportation** flight test

Massachusetts recognizes critical need for strong state role to help AAM services connect with existing transportation networks

Existing General Aviation approaches can be leveraged for the "crawl" phase of the industry, with evolution enabling the "walk" and "run" phases in the future

Safety
New forms of air transport must achieve levels of safety performance consistent with conventional aviation operations

Equity of access
There should be equitable access to mobility for disadvantaged communities

Sustainability
UAM must improve environmental outcomes and embrace innovation to achieve more sustainable behaviors

Multimodal connectivity
UAM should connect to existing, high-quality transport options, offering seamless travel

Low noise
Noise disturbances should be measured and mitigated by a community-first approach

Purpose-driven data sharing
Data sharing should help providers quickly respond to passenger need and market demand

Local workforce development
UAM is expected to increase jobs on the ground and in the air

Principles of the Urban Sky, Seven UAM Principles, World Economic Forum

eSTOL: Electric Short Take-Off and Landing
eVTOL: Electric Vertical Take-Off and Landing
WIG: Wing-in-Ground Effect

MassAutonomy

Integration accelerator harnessing disruptive technologies to advance state mobility systems

Industry created non-profit focused on deploying autonomy to all modes of mass transportation

Uniquely partnered with MassDOT Aeronautics in the air domain

Solves current transportation challenges

Nimble collaboration of government, industry and academia to increase the speed of innovation, while improving solution effectiveness

Drives economic development by advancing real-world technology solutions to operational problems

Focuses on the operationalization of Advanced aviation air systems and vehicles, while integrating with ground-based infrastructure

Commonwealth UAS Integration Program (CUIP):
Four Pillars & Data/Cybersecurity

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1

Advanced Air Mobility

Connecting Massachusetts to the Future

2

Enabling-UAS

Leveraging Air Technology Opportunities of the Future

3

Counter-UAS

Meeting Air Security Challenges of the Future

4

Test & Training Facilities

Enabling Change and a Workforce for the Future

Data and Cybersecurity

The AAM ITF TEAM

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Shaping the Air Integration of the Future

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MIT
International Center for
Air Transportation

TRANSCENDAIR

ENDICOTT
COLLEGE
1939

Raytheon
Technologies

BCG

REGENT *

BLADE

DRAPER®

Founding AAM ITF Participants: “In formation”

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AAM Integration Task Force

INITIATIVES

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Government, industry, and academia working together to support the infrastructure needs of an aviation system that is denser, more autonomous, and that requires more service, maintenance, and repair

Market Study

Develop building blocks for a communication plan

State Roadmap

Develop MA Roadmap for MassDOT Aeronautics and the Commonwealth of Massachusetts

Demos & Challenges

Evaluate, educate, and socialize innovative architectures

Pilot Infrastructure

Plan, design, and build facilities, infrastructure, and network traffic mgmt. system-of-systems architectures of the future; test and validate with e-aircraft

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Massachusetts AAM Market Study

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WHITE PAPER

Leading in Advanced Air Mobility

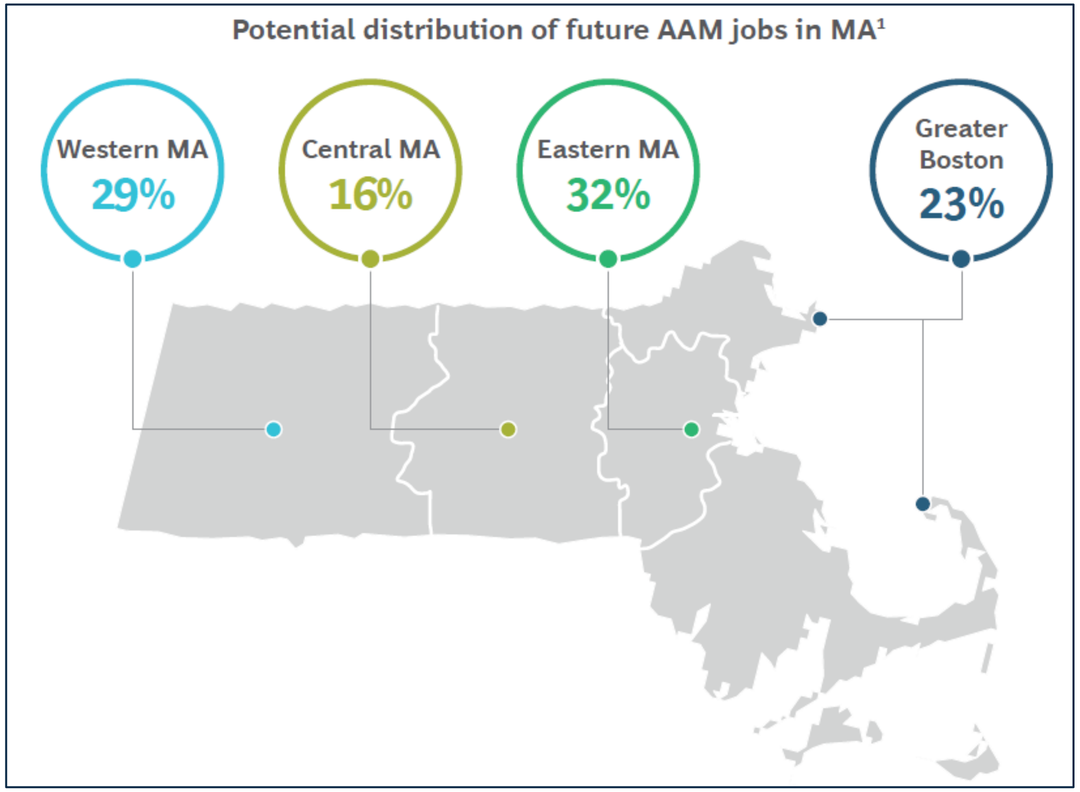
The Market Opportunity for Massachusetts

Passenger journeys:

1. Shuttle trips to Boston-Logan International Airport
2. On-demand air taxis
3. Regional airline replacements

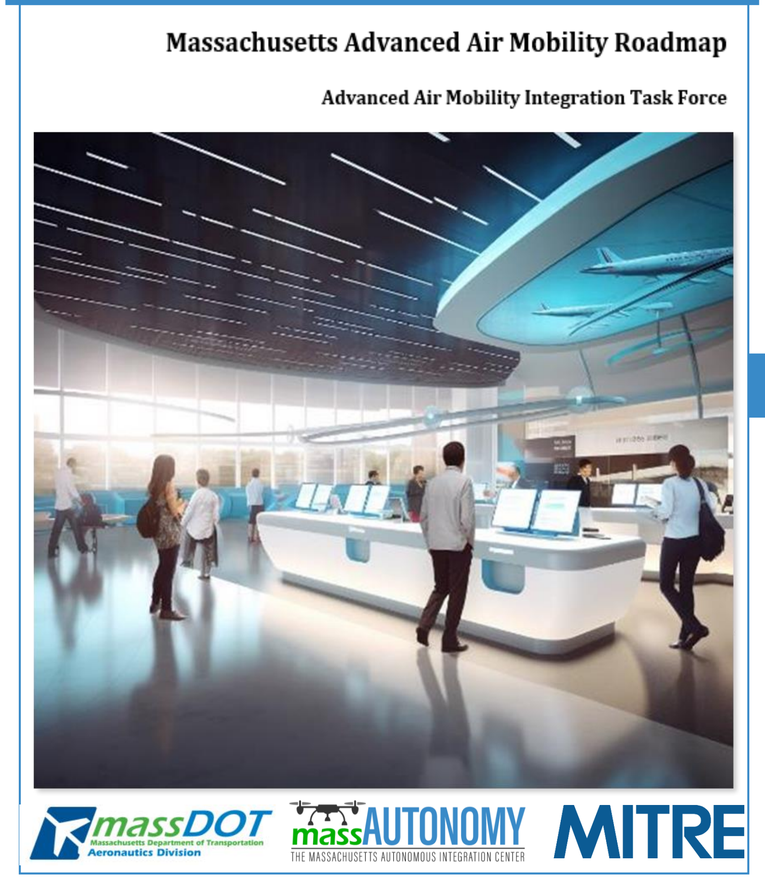
Cargo journeys:

4. Courier services
5. On-demand rapid deliveries: Drones and other AAM vehicles
6. Last-mile express deliveries: Drones

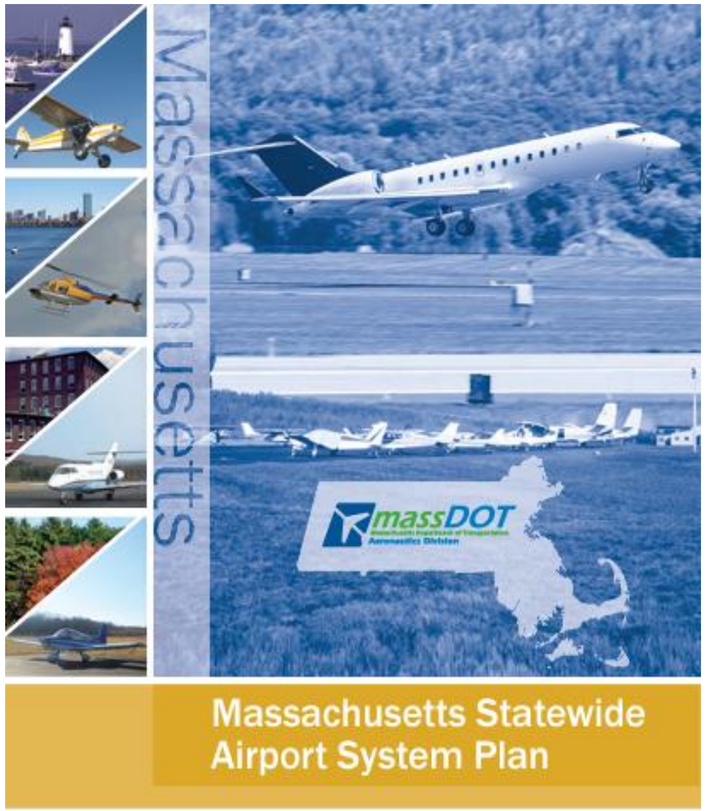


Massachusetts AAM Roadmap Informs Statewide Aviation System Plan & Long-Range Transportation Plan

AAM Roadmap



Aviation System Plan



Beyond Mobility 2050 Long Range Transportation Plan

Freight Plan | Rail Plan | Bike Plan | Trans Asset Mgmt Plan | Strategic Hwy Safety Plan

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Demos & Challenges

UAS Medical Supplies Delivery Demonstrations

December 2021 – Expanded Demos in 2023-24

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Skyports

MARITIME

WOODS HOLE OCEANOGRAPHIC INSTITUTION

Demonstrate emergency delivery to remote island communities

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Pilot Infrastructure

Marshfield Airport: *Electrification*

Infrastructure: Official Ribbon Cutting 10/13/2023

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Marshfield Municipal Airport, MA

George Harlow Field
KGHG

BETA Technologies

United Therapeutics CORPORATION

EVERSOURCE

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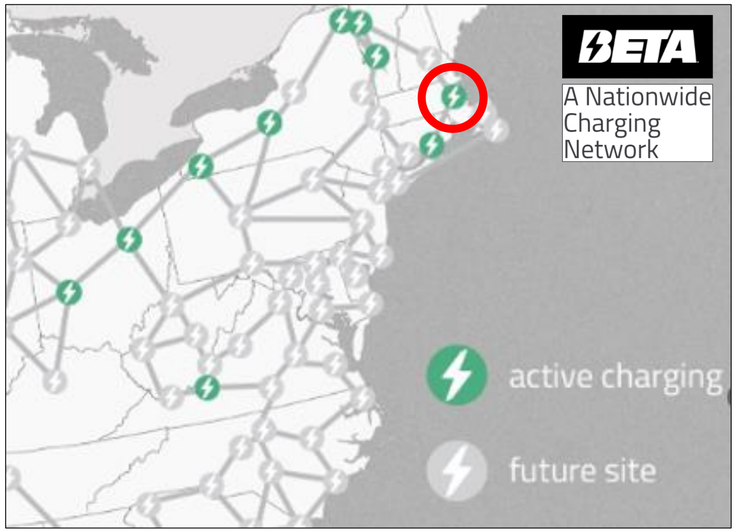

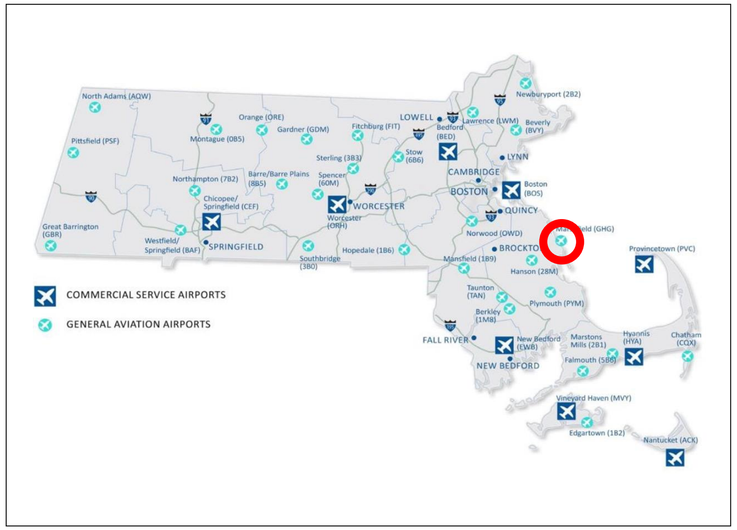

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SMART Grant: *Smart Microgrid Serving Commercial Airport and EJ Community*

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SMART

SmartGrid.gov

CHECK OUT THE NEW GRID TALK PODCAST

Pilot Infrastructure

U.S. DOT Grant Proposal to Partner with Cape Cod Gateway Airport & Cape Cod Regional Transit Authority

- The Massachusetts Department of Transportation, in partnership with Cape Cod Gateway Airport and Cape Cod Regional Transit Authority, proposes to build a smart microgrid at Cape Cod Gateway Airport in Hyannis, Massachusetts, an historically disadvantaged village in the town of Barnstable.
- By facilitating the electrification of ground vehicles, aircraft, and public transportation buses, regulating electrical load, and generating independent power through solar and possibly wind, this smart microgrid will reduce greenhouse gas emissions and provide reliable, cost-effective power, which the Airport and the underserved residents of Hyannis strongly depend on.

Over to MaineDOT
Alan Lambert