NASA Advanced Air Mobility (AAM) Overview

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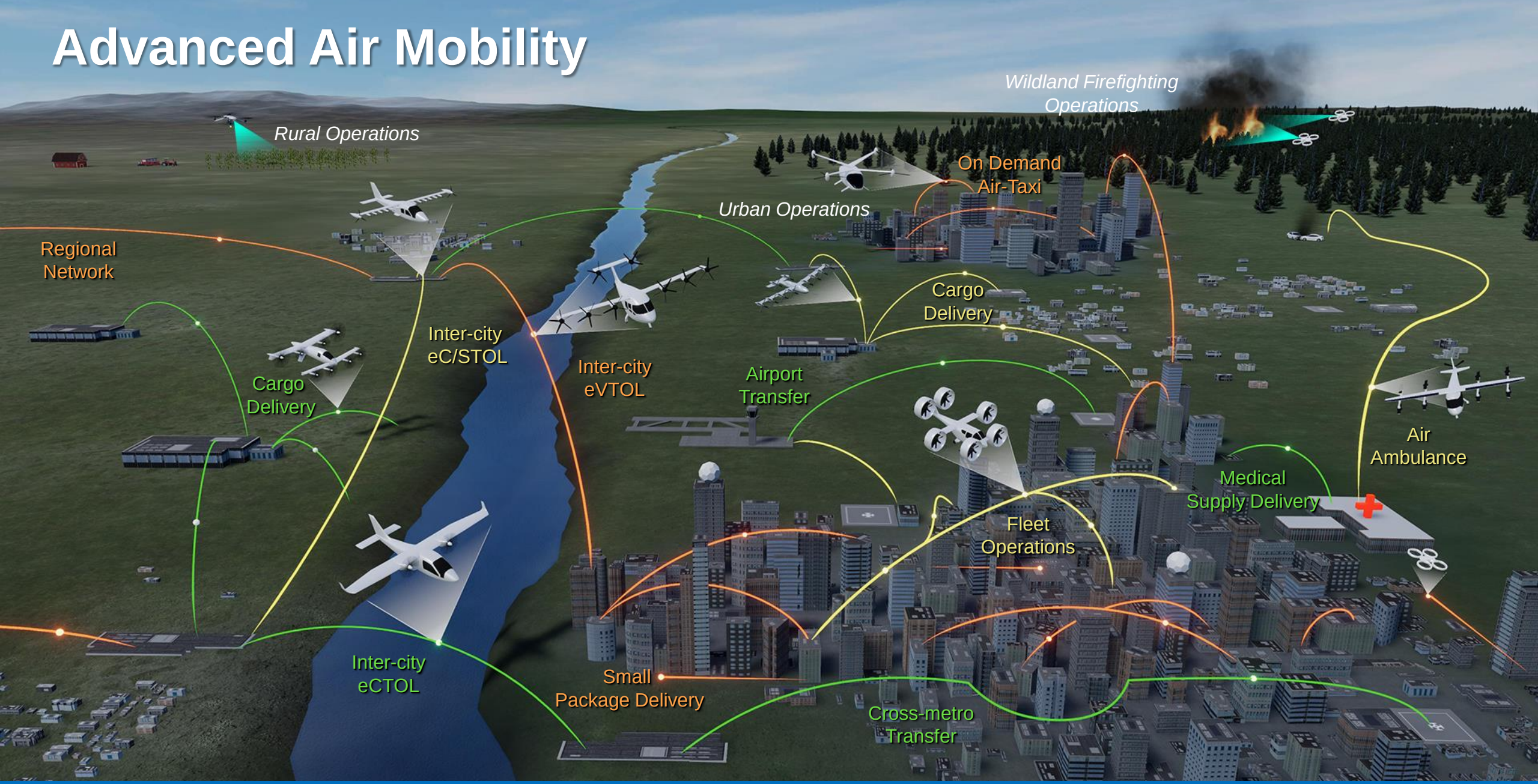
www.nasa.gov/aam

Four Aviation Transformations

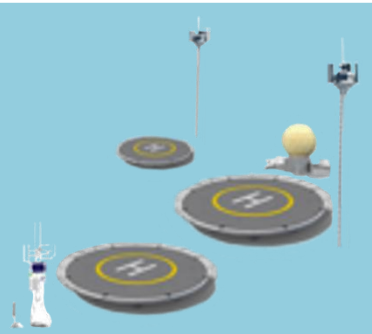
Advanced Air Mobility



Safe, sustainable, affordable, and accessible aviation for transformational local and intraregional missions

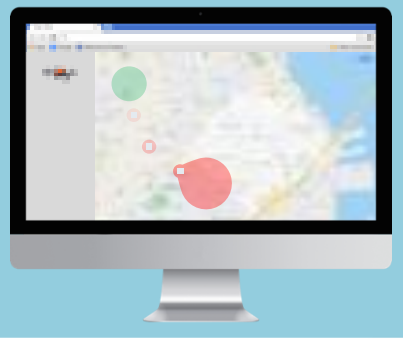
AAM Architecture System of Systems

Airspace Management

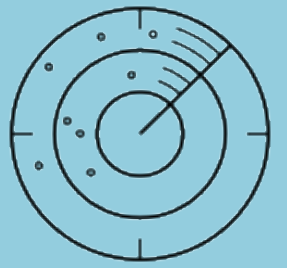


Vertiport/Airport Management

Aircraft Technologies and Automation

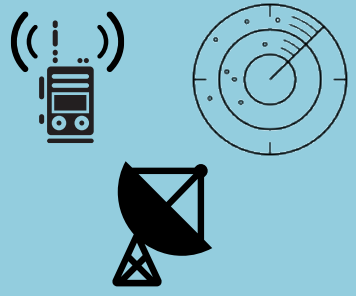


Fleet Management



FAA Aircraft Network Security Program

Infrastructure
Communication, Navigation, Surveillance, Weather



In-Time Aviation Safety Management Systems

AAM Research Areas

- Airspace
- Aircraft
- Community Integration

NASA Projects Supporting AAM

- Air Mobility Pathfinders (AMP)
- Airspace Traffic Management Exploration (ATM-X)
- System-Wide Safety (SWS)
- Advanced Capabilities Emergency Response Operations (ACERO)
- Revolutionary Vertical Lift Technology (RVLT)
- Flight Demonstrations & Capabilities (FDC)
- Transformational Tools & Technologies (T^3)
- Convergent Aeronautics Solutions (CAS)

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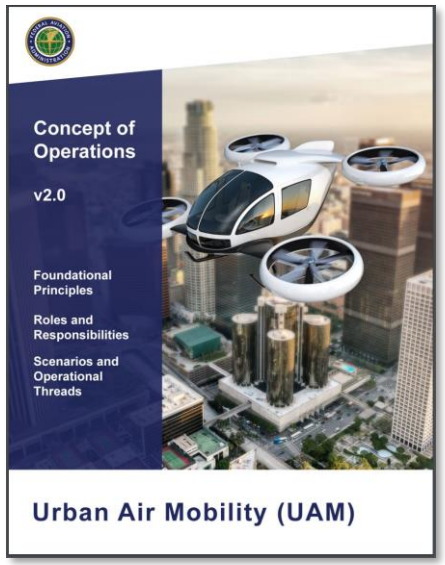
FAA's UAM Concept of Operations (ConOps)

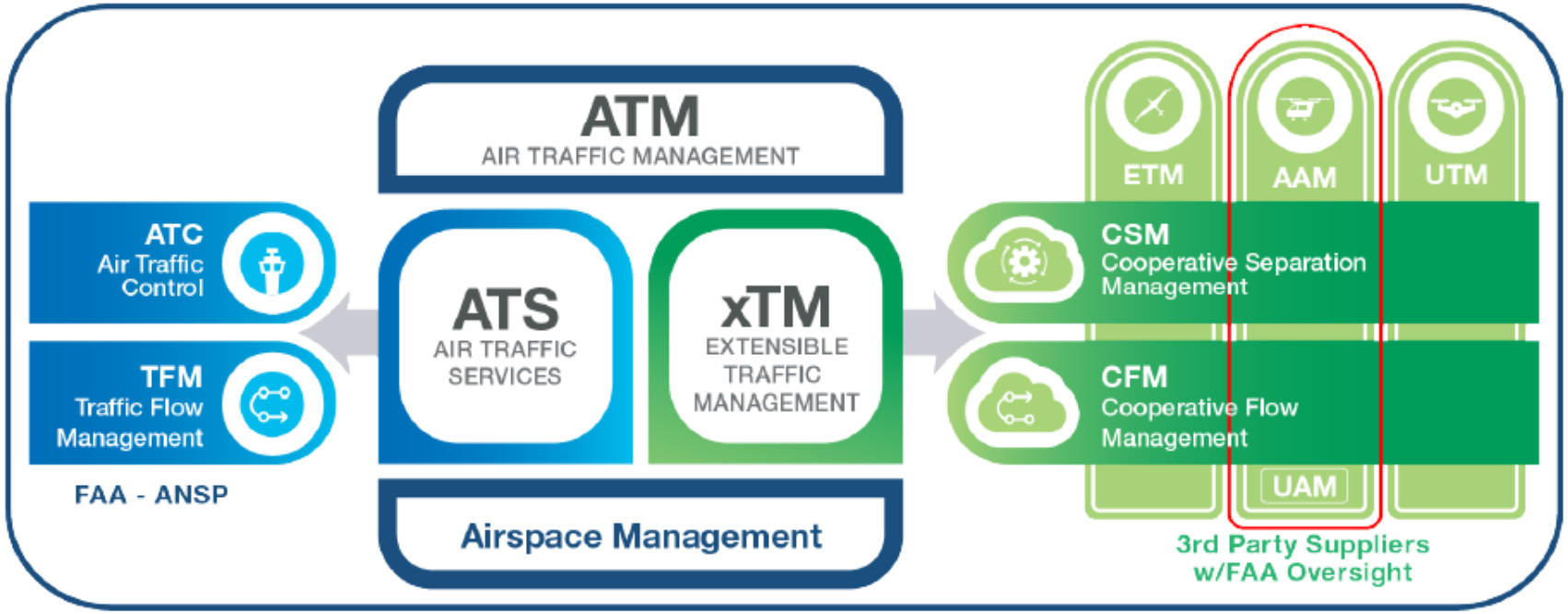


Operational evolutionary stages:

INITIAL → MIDTERM → MATURE

Increasing operational tempo, degrees of automation

Notional Cooperative Areas (UAM Corridors)



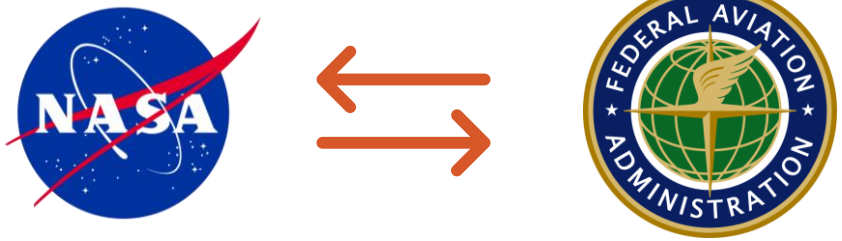
Anticipated Future Complementary Service Environments

[Images from the FAA's ConOps v2, accessible from https://www.faa.gov/air-taxis/uam_blueprint]

AMP: Focus on Midterm (with an Eye Toward Mature) UAM Operations

- Developing candidate/protype:
  - Reference functional architectures and interfaces
  - Traffic management system functionality
  - Cooperative Operating Practices (COPs)
  - Airspace structure recommendations
  - Cooperative separation management systems/procedures
- Three Technical Challenges, each culminating in Technical Capability Level (TCL) integrated evaluations:

AAM Research Transition Team



Strategic Planning & Deconfliction of Flights in Cooperative Areas → TCL-1 → Integration of Tactical Deconfliction → TCL-2 → Resilient Operations → TCL-3

ATM-X: Pathfinding for Airspace with Autonomous Vehicles

Enable scalable airspace integration of routine remotely piloted operations under Instrument Flight Rules

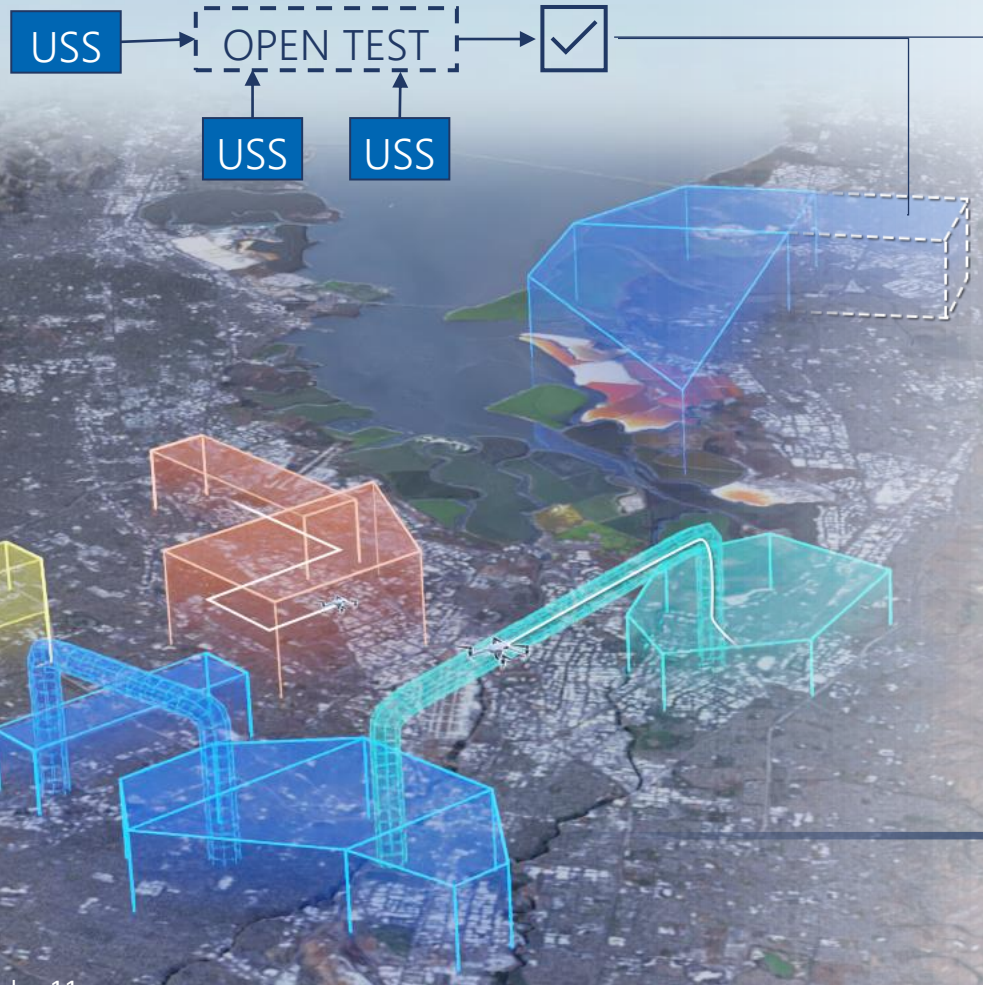
Integrated Concept of Use

Conflict and Contingency Management

Flight Test Ecosystem

ATM-X: UAS Traffic Management Beyond Visual Line of Sight

Enable routine, safe, extensible BVLOS operations in low altitude Class G airspace through the formalization and operationalization of ground-based services



UAS Service Supplier

Public Operations Integration

Validation Approach

Advanced Capabilities for Emergency Response Operations

SATELLITE

AIR TACTICAL GROUP SUPERVISOR

AERIAL COMMUNICATION

REMOTE SENSING

DAYTIME OPERATIONS

NIGHTTIME OPERATIONS

Develop, integrate, demonstrate, and transition to operations, NASA and industry aviation technologies to identify, monitor, and mitigate wildland fires and other emergencies, to enhance safety, improve efficiency of operations, and minimize economic loss.

TERRESTRIAL COMMUNICATIONS

TANKER

PILOTED HELICOPTER

REMOTELY PILOTED HELICOPTER

LOGISTICS

AIRCRAFT AUTONOMY

DECISION SUPPORT

AIRSPACE MANAGEMENT

SWS: In-Time Aviation Safety Management Systems

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T³: Select Automation Research

Multi-Vehicle (m:N) Operations

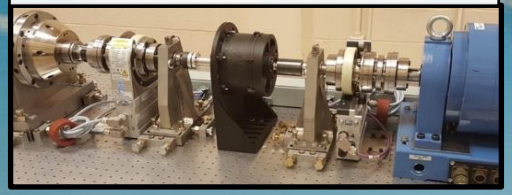
- m:N Working Group (WG): https://nari.arc.nasa.gov/ttt-ram/multi-vehicle
- Human-Autonomy Teaming
- Develop sensing and contingency management capabilities

AIRVUE: Airborne Instrumentation for Real-world Video of Urban Environments

- Large, open, dataset of vision data for computer vision algorithms
- Low-altitude flight in urban environments
- Initial data released: https://techport.nasa.gov/projects/147022

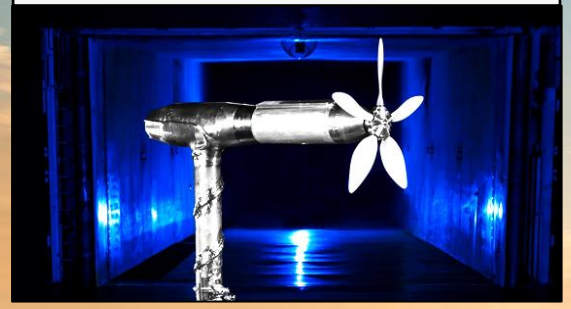
RVLT: Vehicle Safety and Noise Research

Reliable Electric Propulsion



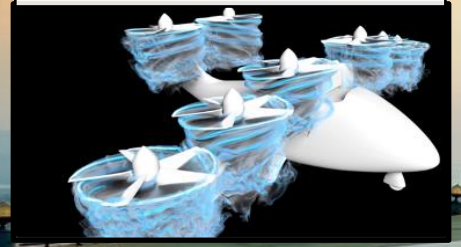
Piloted Handling Qualities Simulation

Performance and Acoustic Testing



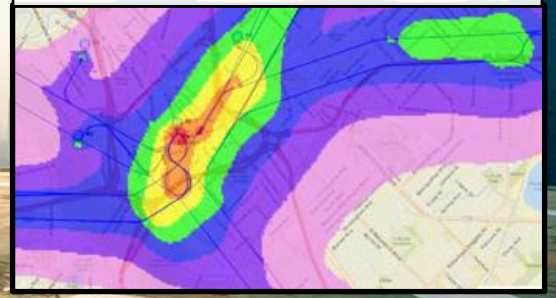
Passenger Ride Quality

High-Fidelity Simulation



Conceptual Design Tools

Noise and Annoyance Modeling



Crash Safety Testing and Modeling

Investing in the future of advanced vertical flight

Open Aircraft

RVLT: Reference Aircraft

- Vehicle model inputs and outputs publicly available
  - Discussions can be quantitative
  - Demonstration cases for training
  - Features representative of vehicles
  - Missions and design conditions
- sacd.larc.nasa.gov/uam/

- Focus and guide government research
  - Enable contracted work to be published
  - Assess technology payoff
  - Guide tool development
  - Scope validation tests
- No plan to build the vehicles, but they are not cartoons

FDC & T^3: Research Aircraft for eVTOL Enabling techNologies (RAVEN)

- Intended as open platform with public data for research
- ~1000-lb scale aircraft with subscale variants
- Subscale Wind tunnel and Flight Test aircraft (SWFT) tested in Langley 12-ft tunnel and undergoing flight testing
- Initial targets of flight controls and acoustics research
- sacd.larc.nasa.gov/raven/

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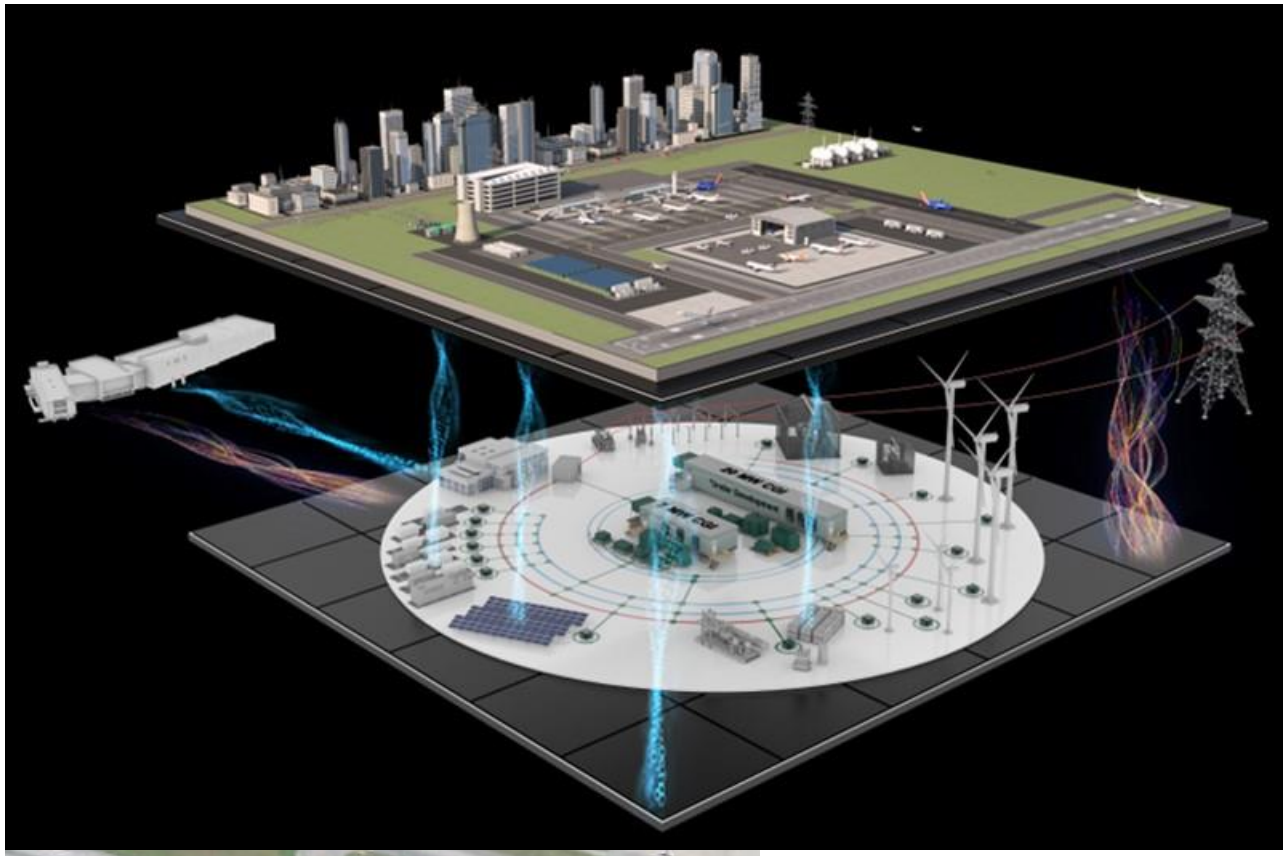
Community Integration Efforts

- City and State Partnerships
  - *Community Integration Considerations Playbook* jointly developed with five partners https://ntrs.nasa.gov/citations/20230010184
  - Exploring and modeling potential public good missions with four partners
- AAM Missions for Public Good
  - Previous report, https://ntrs.nasa.gov/citations/20230012505, identified 40+ potential use cases
  - Ongoing work exploring potential federal government provided public good missions
- AAM Playbook video series
  - https://www.nasa.gov/feature/nasa-is-creating-an-advanced-air-mobility-playbook/

CAS: Airports as Energy Nodes

- Make aviation part of the energy solution for communities
- Partnered with National Renewable Energy Laboratory (NREL), Tweed New Haven Airport (HVN), Winchester Regional Airport (OKV)
- Considering urban air mobility and regional air mobility demand
- Airport Modeling
  - Model HVN and OKV airports to estimate cost-optimal build out vs. various energy load futures and community energy integration strategies
  - Develop “energy virtual twin” of one airport site using NREL’s Advanced Research on Integrated Energy Systems (ARIES) facilities



↑ Energy Virtual Twin
Image from NREL

← Solar arrays at CHA
Imagery from NationalMap.gov

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AAM Ecosystem Working Groups (AEWG)

Exchange visions for AAM

Learn about NASA's research and planned transition paths

Discuss strategies for engaging the public on AAM

Collectively identify and investigate key hurdles and associated needs

Examine AAM system and architecture requirements

Support regulatory and standards development

https://nari.arc.nasa.gov/aam-portal/

Accelerate the development of safe and scalable AAM flight operations by bringing together the broad and diverse ecosystem

NASA's Advanced Air Mobility (AAM) research will help transform our communities by bringing the movement of people and goods off the ground and into the sky.