NASA Advanced Air Mobility (AAM) Mission

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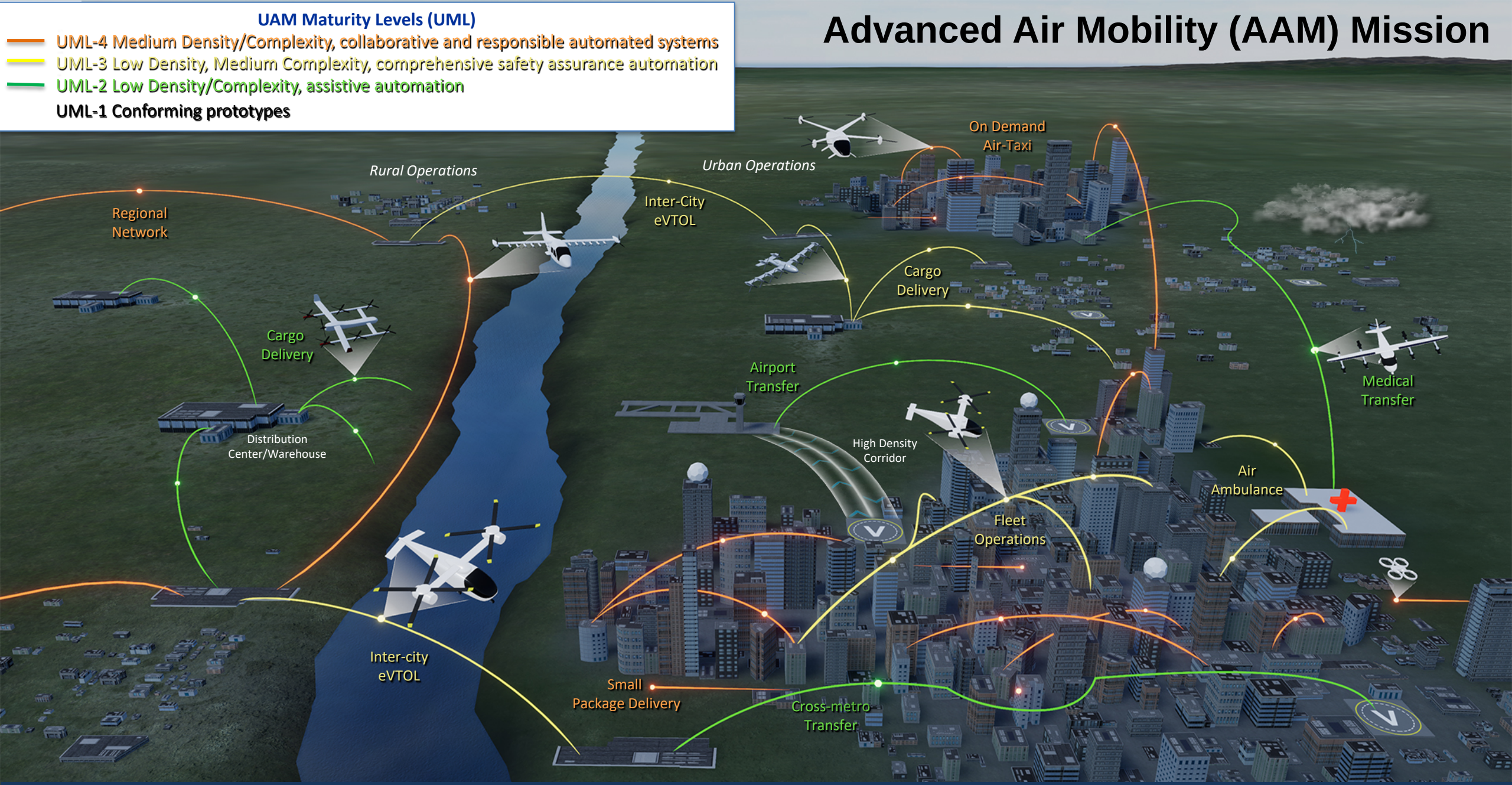
UAM Maturity Levels (UML)

- UML-4 Medium Density/Complexity, collaborative and responsible automated systems
- UML-3 Low Density, Medium Complexity, comprehensive safety assurance automation
- UML-2 Low Density/Complexity, assistive automation
- UML-1 Conforming prototypes



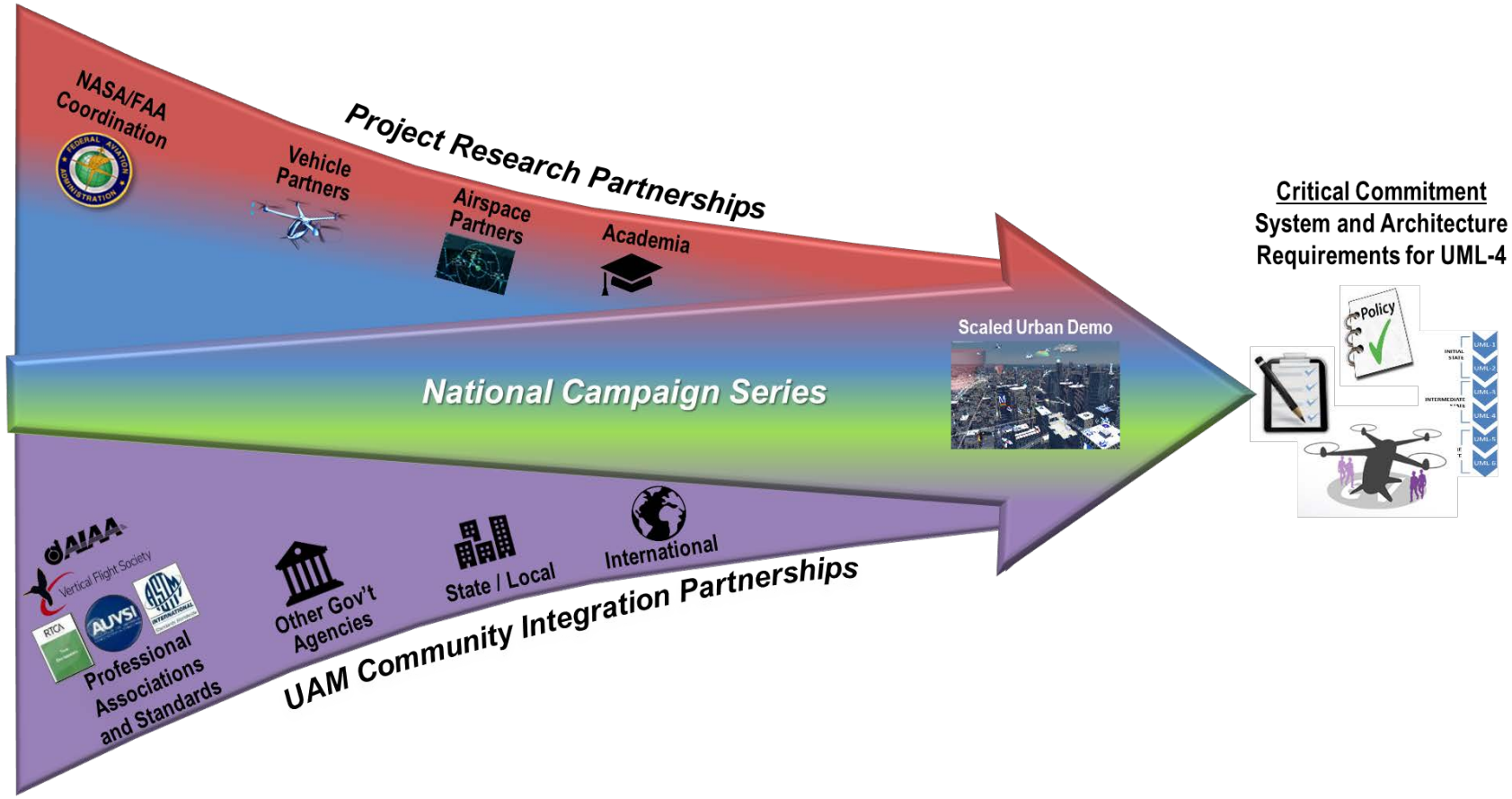
Safe, sustainable, affordable, and accessible aviation for transformational local and intraregional missions

NASA AAM Ecosystem Partnership Strategy

- Foundational research partnerships in existence and developing
- NASA/FAA AAM WGs are beginning formal execution

- Continue to Leverage NC as a centerpiece of the partnership strategy

- AAM Ecosystem Working Groups (AEWG) are providing a valuable opportunity space for localities, international, and standards organizations



FAA, AAM Ecosystem Working Groups (AEWG) and research partnerships are providing valuable input spanning vehicle, airspace, and community partners across the globe

AAM Mission Critical Commitment

Vehicle Development and Operations Develop concepts and technologies to define requirements and standards addressing key challenges such as safety, affordability, passenger acceptability, noise, automation, etc.

Airspace Design and Operations Develop UTM-inspired concepts and technologies to define requirements and standards addressing key challenges such as safety, access, scalability, efficiency, predictability, etc.

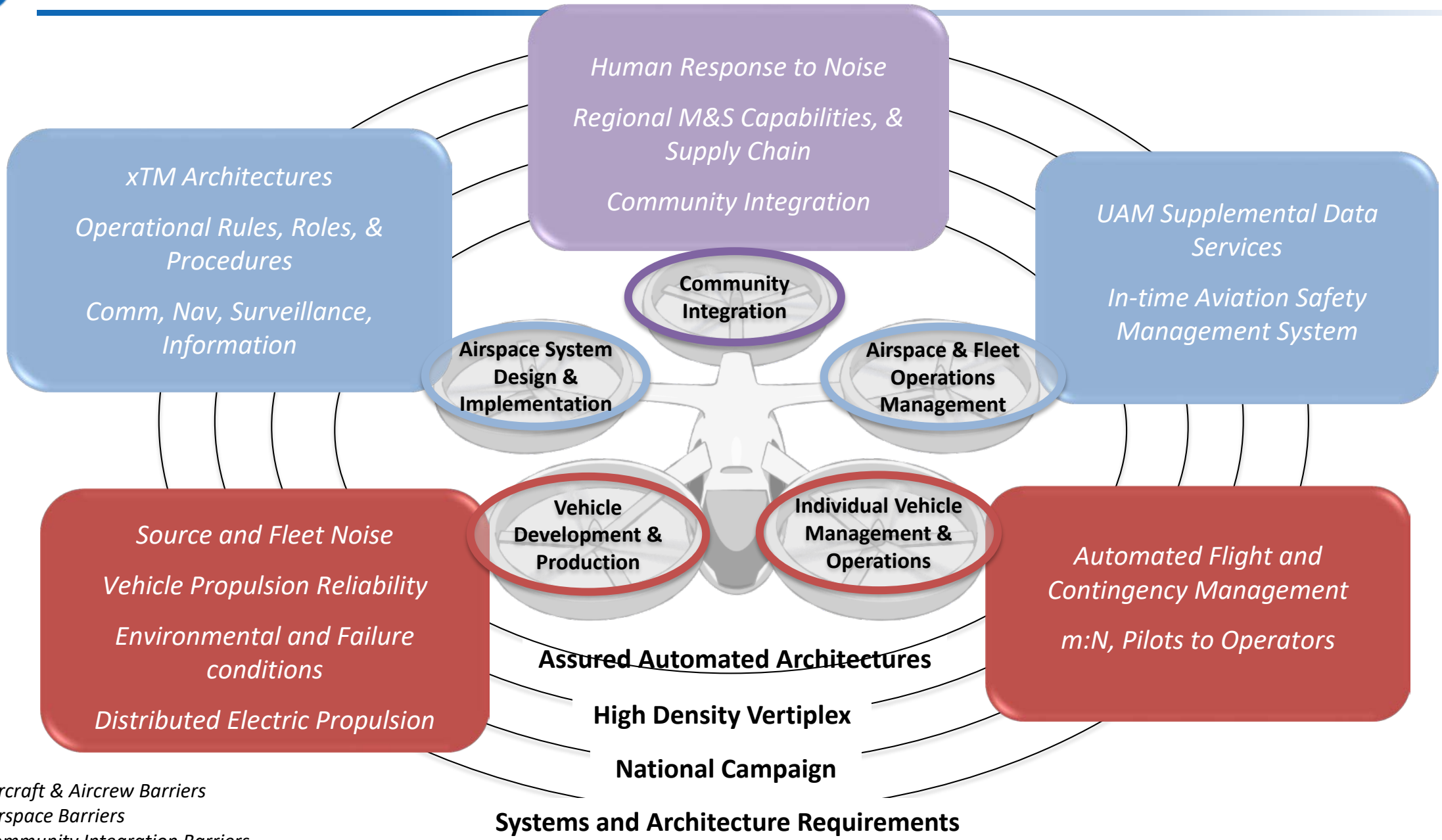
Community Integration Create robust implementation strategies that provide significant public benefits and catalyze public acceptance, local regulation, infrastructure development, insurance and legal frameworks, etc.

Critical Commitment:

Based on validated operational concepts, simulations, analyses, and results from National Campaign demonstrations, the AAM Mission will deliver aircraft, airspace, and infrastructure system and architecture requirements to enable sustainable and scalable medium density advanced air mobility operations

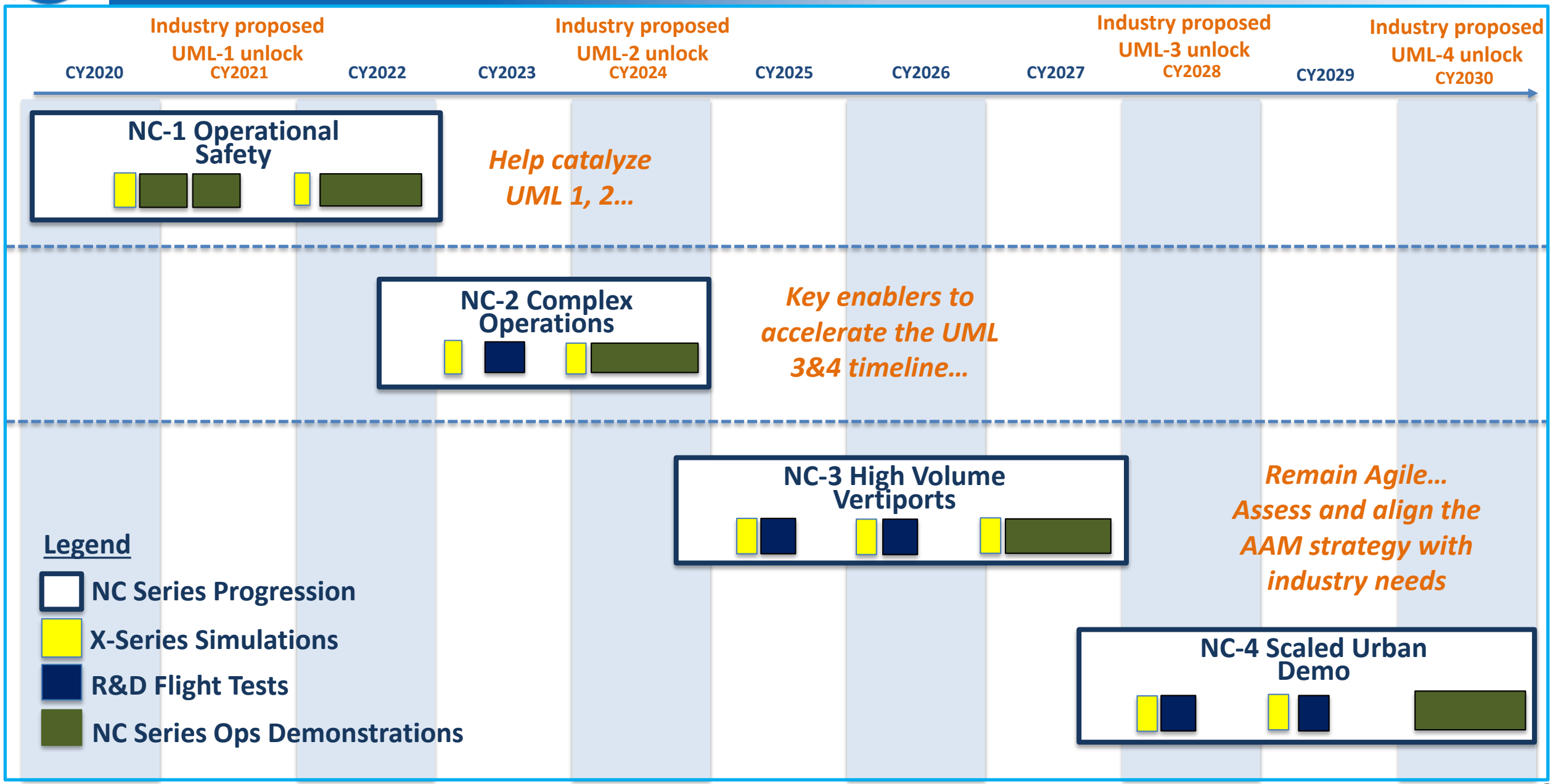
Achieving "systems and architecture requirements" will require *enabling activities* such as 1) the AAM National Campaign Series 2) a robust Ecosystem Partnership model and 3) NASA ARMD Portfolio Execution.

NASA AAM Mission Priorities



Aircraft & Aircrew Barriers
Airspace Barriers
Community Integration Barriers

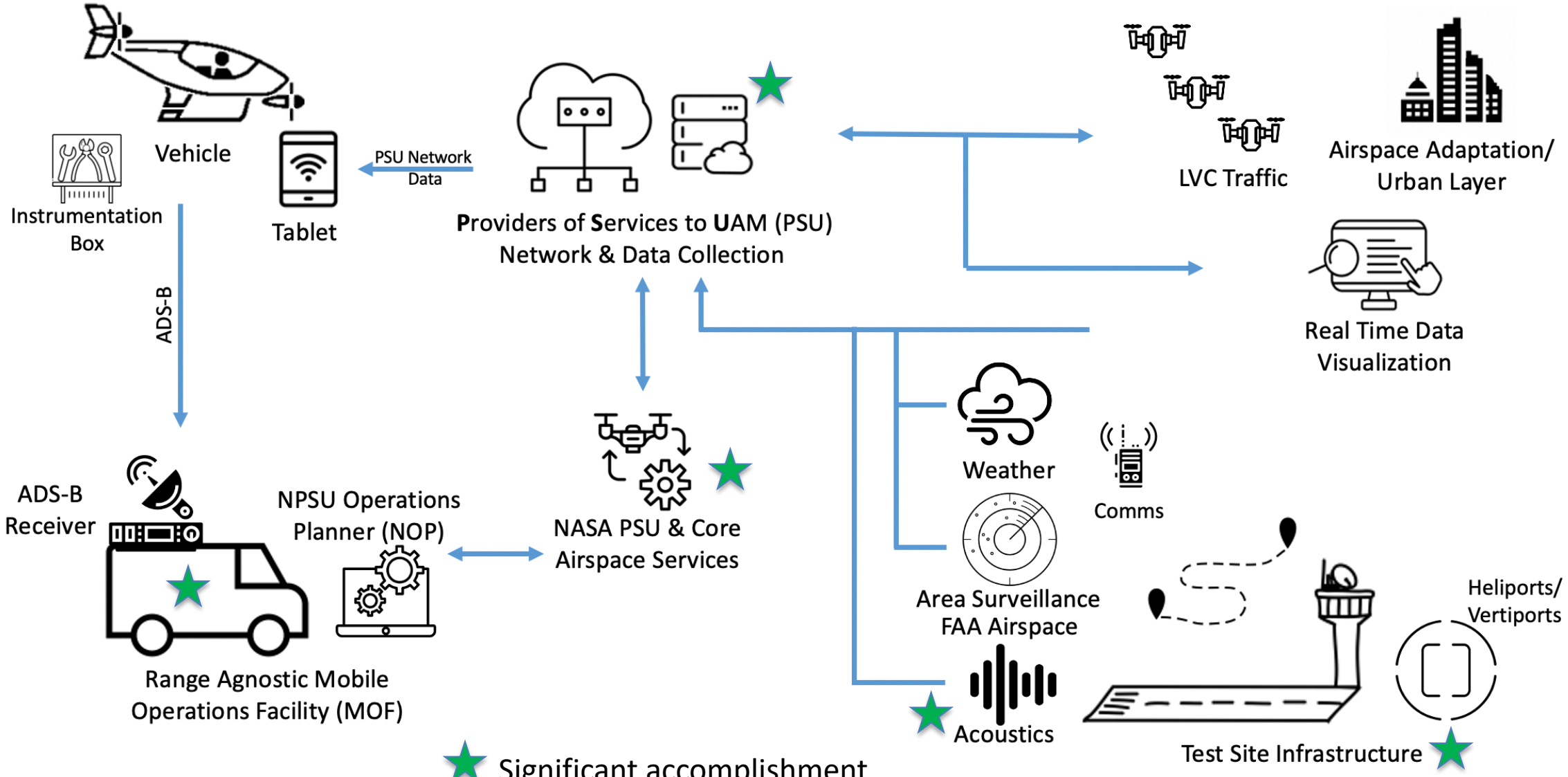
National Campaign Series support of the Industry Timeline



UML "unlocks" based on a range of publicly available industry projections and conversations with partners; not a consensus view

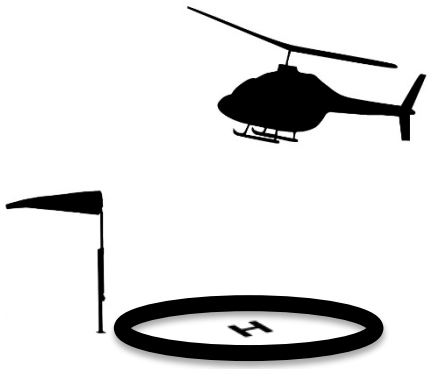
NC DT Joby Flight Test Interface Diagram

NC-DT Flights with Joby mirrors Dry Run, but with acoustic testing and flights at Partner Test Sites



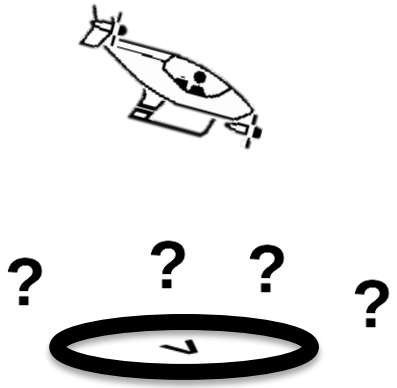
Industry Need for Vertiport Technology

HDV is developing technologies and requirements to support industry infrastructure and automation needs and FAA vertiport design guidance development



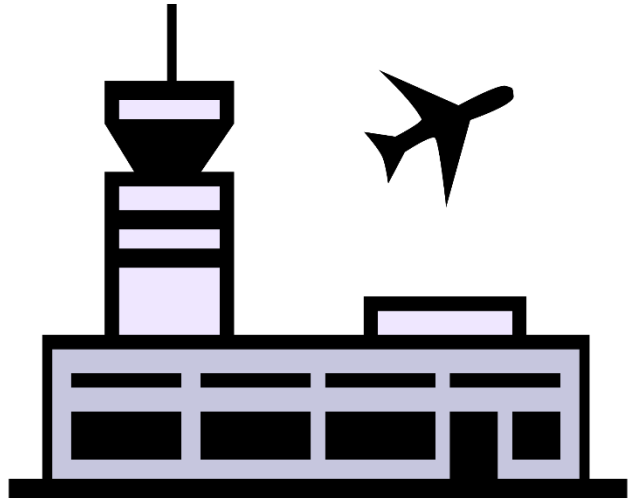
Heliports

- Low throughput operations
- No infrastructure
- FAA Guidance and State/Local Government Oversight
- Operations managed by aircraft Operators (one certified heliport)



Vertiports

- Moderate-High throughput operations
- Infrastructure and Automation Needed
- FAA Guidance and State/Local Government Oversight
- Operations intended to be managed by vertiport Operators, PSUs, aircraft/fleet operators aided by automation
- Interoperability with UAM, UTM, and ATM



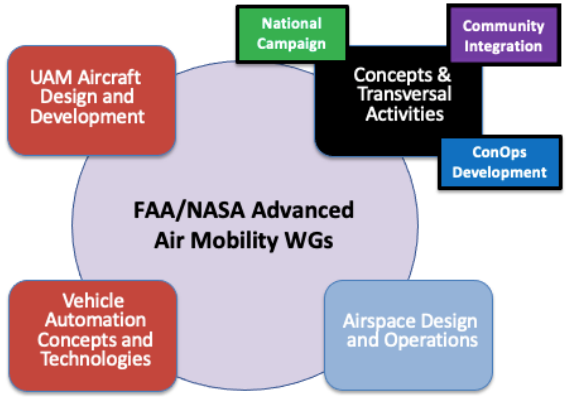
Airports

- High throughput operations
- Infrastructure and automation
- FAA Regulations and Oversight
- Operations managed by airport operator, ATC, procedures, and aided by automation
- Interoperability with ATM

Community Integration Status

- Successful “Community Integration” efforts will implement approaches that are ecosystem wide, but have a critical focus around education, “vertiports” and public acceptance.
- FAA and DOT, state and local governments, academia, community organizations and Standards Development Organizations are activity coordinating with NASA on research activities to break down community integration barriers.
- Challenges such as regulatory, noise acceptance, weather, and societal and economic factors make make community integration a significantly challenging barrier to Advanced Air Mobility.

AAM Ecosystem Working Groups



NASA/FAA AAM Executive Board and Working Groups

Standard Development Organizations (SDO’s)

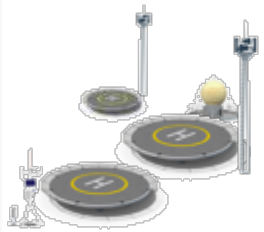
Community, Professional, & Industry Organizations

BACK UP

Vertiplex Automation System

Legend
- AOA
- SAO
- VO
- IAS-2.HDV

Vertiport Services



- Vertipad(s) Status
- Constraint Management
- Weather Conditions [SWS]
- Take off/Landing Clearance
- Vertiport Management Display
- Hazard Management [SWS]

Airspace Services

- Strategic Deconfliction [ATM-X]
- Conformance Monitoring [ATM-X]
- Conflict Management [ATM-X]
- Scheduling [ATM-X]

Aircraft Automation

- Automated Landing
- Battery Monitoring [SWS]
- Tactical Conflict Management [ATM-X]
- Merging and Spacing
- Health Monitoring [SWS]
- Contingency Decision Making

Ground Control Station / Fleet Management

- Operations Planning
- Automated Divert /Approach
- Risk Assessment [SWS]
- Multi aircraft control tools [TTT]

HDV serves as an integrator for key ARMD automation technologies to develop and test vertiplex environments.

Vertiport Automation Architecture

Airspace Services

Vertiport Services

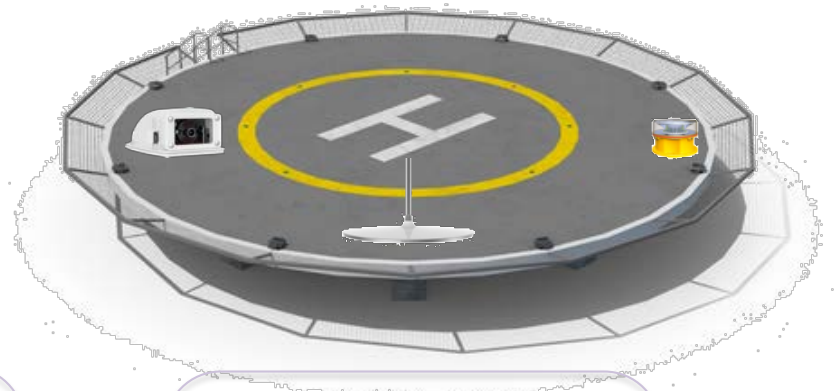
- Vertipad Status
- Weather Conditions
- Constraint Management
- Hazard Management
- Take off/Landing Clearance
- Slot Allocation Management
- Vertiport Management Display
- Surface Movement Management

UAS Automation

Additional Ground Support

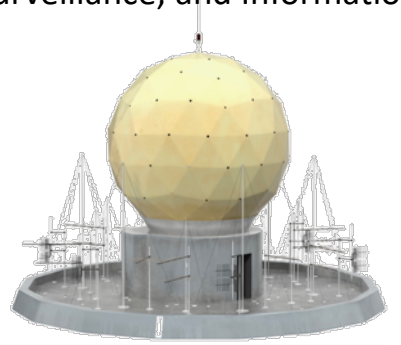
- Automated Weather Station
- Obstacle /Terrain Databases
- Approach / Departure Airspace Configuration
- Battery Charging Station

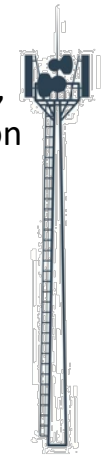
Instrumented Vertipad



- Pressure Sensing Vertipad
- Video Surveillance
- Microphone Array
- Obstruction Lighting, Beacons, Foam Dispensing, and Infrared Sensors

Communication, Navigation, Surveillance, and Information





- Radar
- ADS B Receiver
- Augmented Position, Navigation, and Timing
- RF Monitoring and Analysis
- Connectivity Fiber / 4G LTE
- V2x Radios

Legend

- AOA
- SAO
- VO
- Safety
- Not in Scope