Enabling Airspace Integration of Advanced Air Mobility as Operations Scale

Kurt Swieringa – ATM-X Deputy Project Manager for Technology

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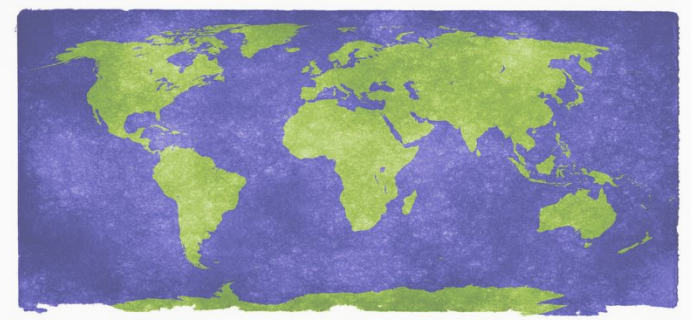
ATM-X
Air Traffic Management eXploration

The Rapid Transformation of Aviation

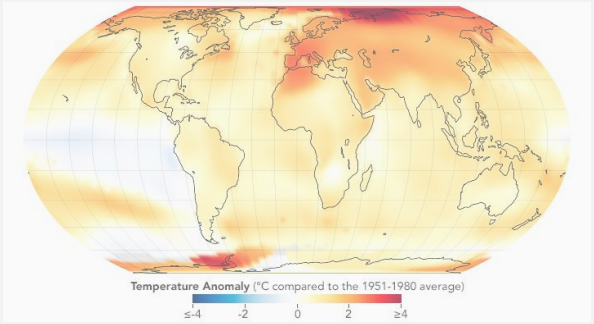
Drivers for the Future Aviation Ecosystem

Economic Growth



- *Global competition*
- Leadership ~$9T UAM market by 2050[1]

Sustainability

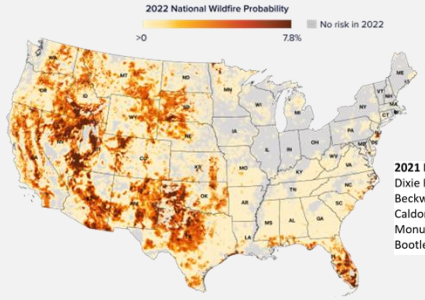


- *Climate change*
- Meet Net Zero 2050 Goals

Greater Mobility

- *Slow pace in meeting market demand*
- Diverse, scalable mobility solutions

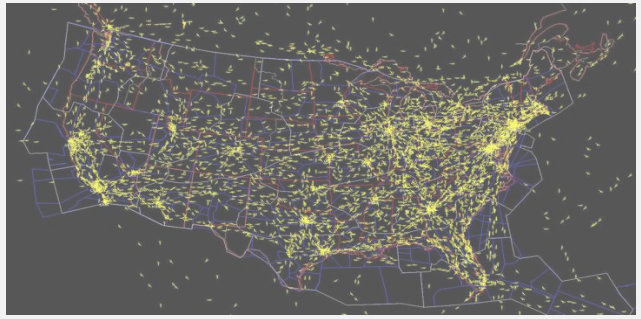
Public Benefit



2021 Estimated Costs and Duration	
Dixie Fire:	$637M (over 3 months)
Beckwourth Complex:	$542M (over 2 months)
Caldor Fire:	$271M (over 2 months)
Monument:	$163M (over 2 months)
Bootleg:	$100M (over 1 month)

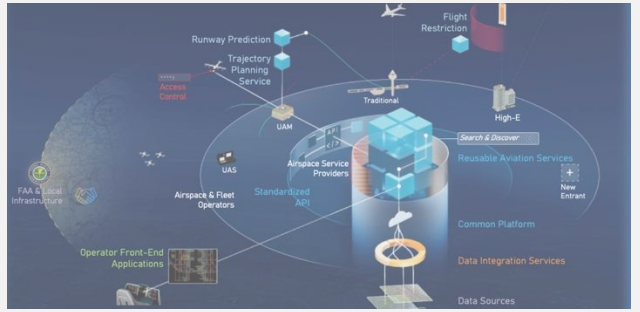
- *Inability to leverage aviation capabilities*
- Unleash new humanitarian solutions

Maintain Safety



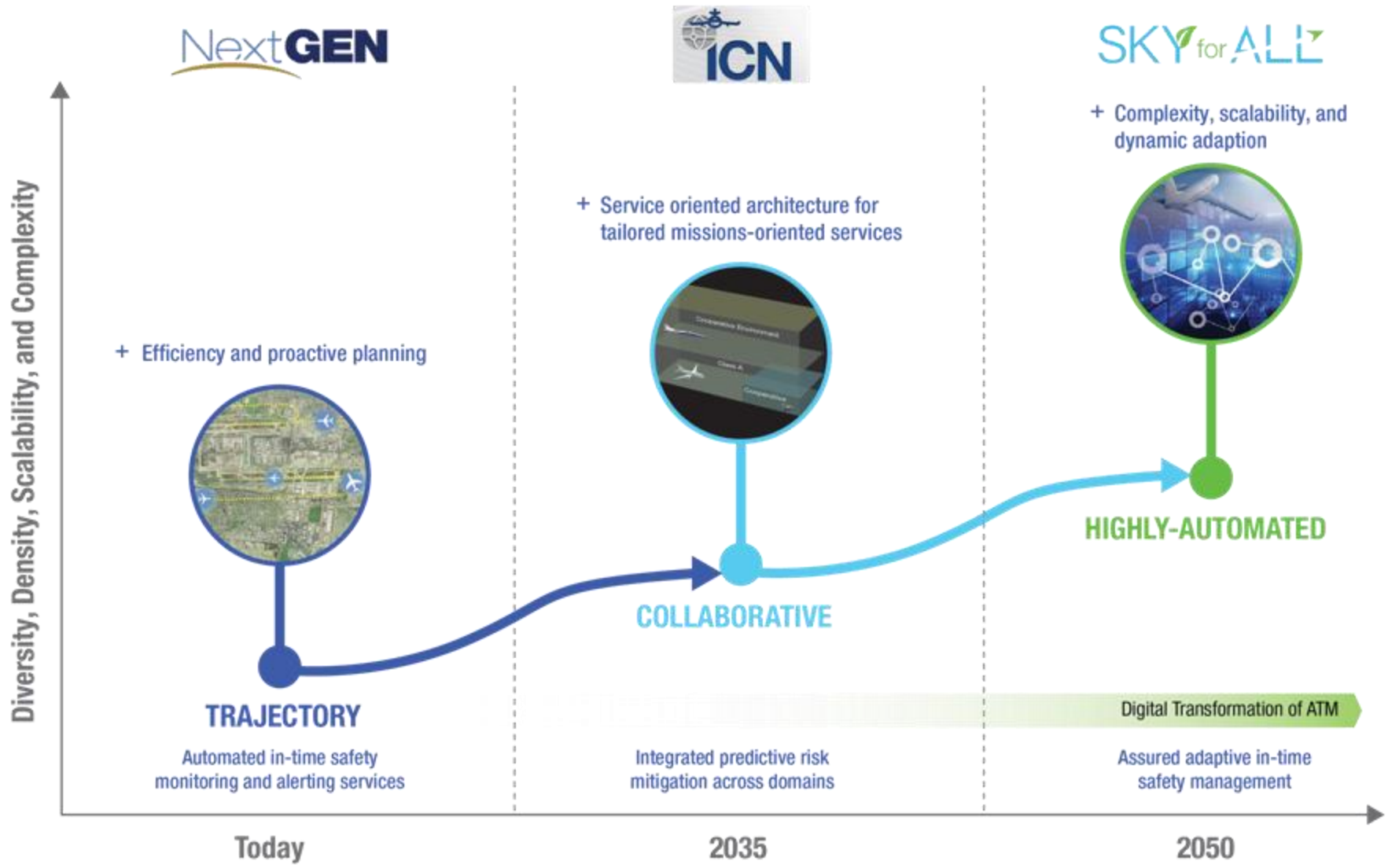
- *Growing complexity threatens safety*
- Develop next generation of safety

Emerging Innovation



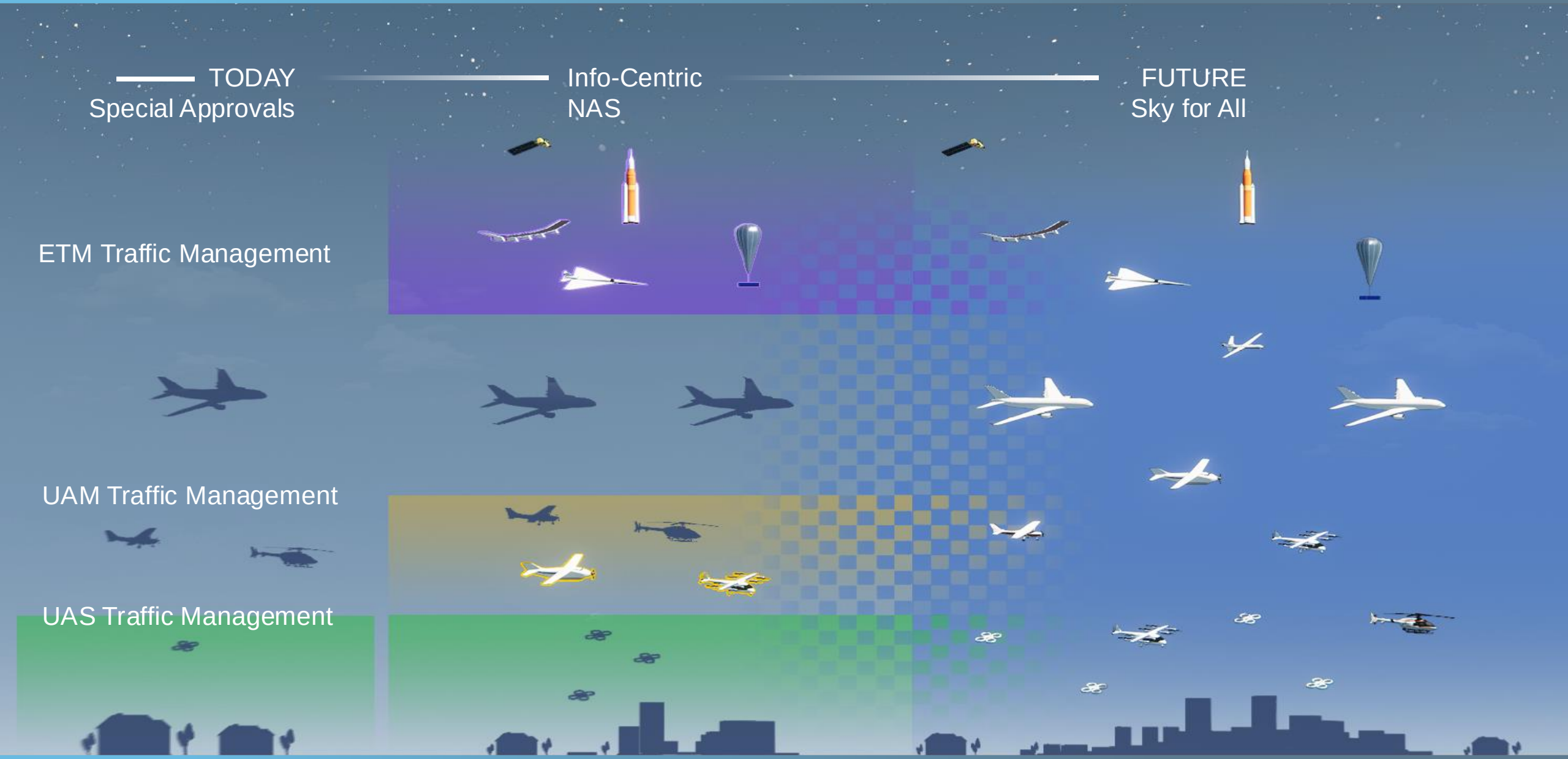
- *Integration complexity delays benefits*
- Adapt at the pace of innovation

The Path to a Sky for All



xTM is a New Air Traffic Management Paradigm

Enabling Integration of New Operations



Small Uncrewed Aircraft Systems (sUAS)

- Allied Market Research predicted that the global sUAS package delivery market will grow to $32.1 billion by 2031
- sUAS will support other missions such as infrastructure inspection and agriculture
- sUAS will also be used for public safety services

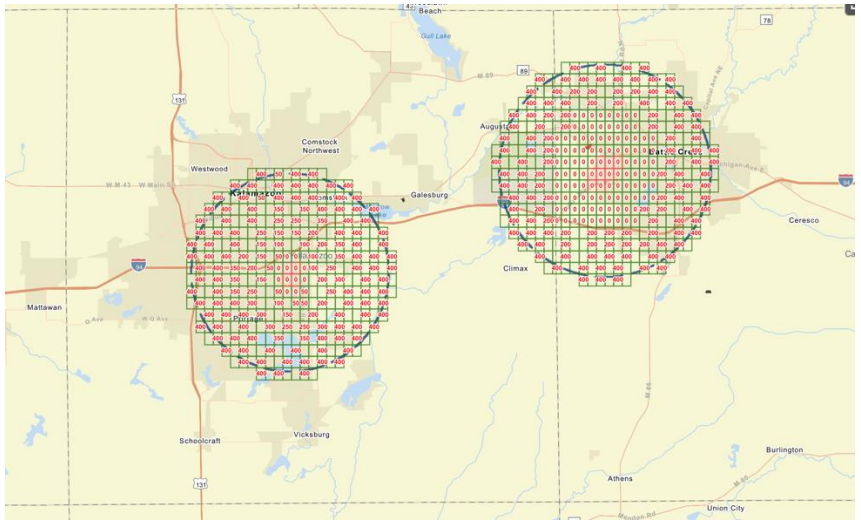
Current State of Small UAS Operations

Part 107

- Operations within visual line of sight
- Less than 55 pounds
- Below 400 feet above ground level
- Cannot operate above non-participants
- Must yield right of way to other aircraft

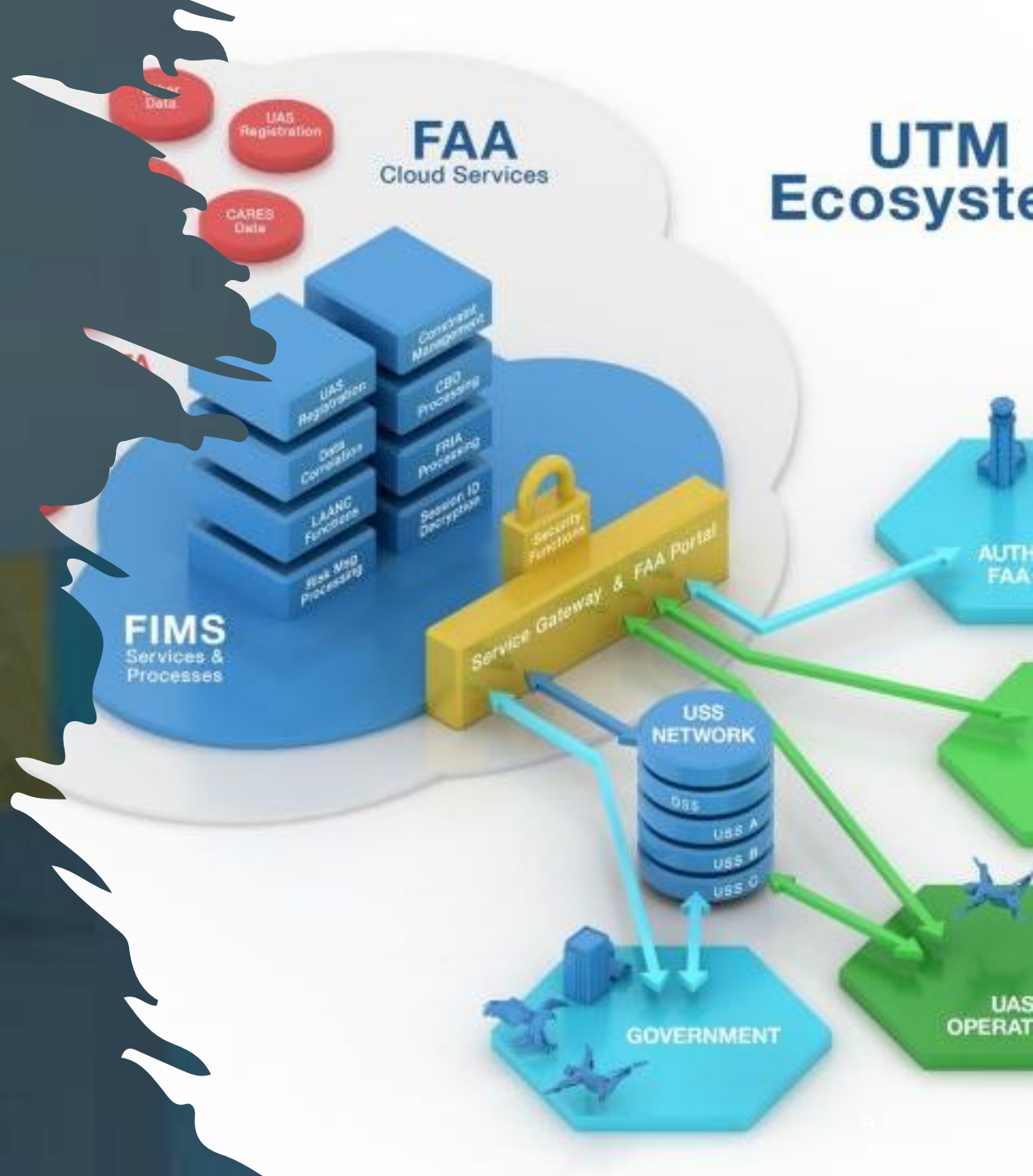
Low Altitude Authorization and Notification Capability (LAANC)

- Coordinates access to controlled airspace near airports
- Automated process for near-real time approvals



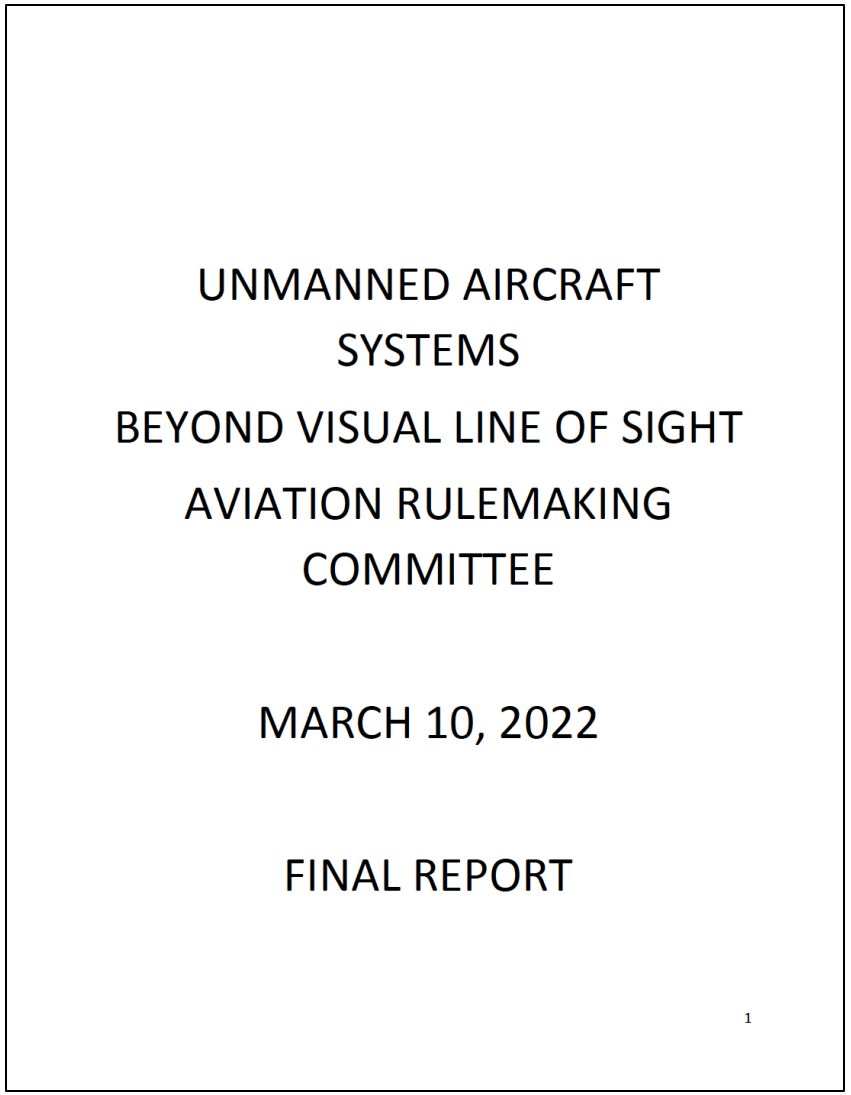
UAS Traffic Management (UTM)

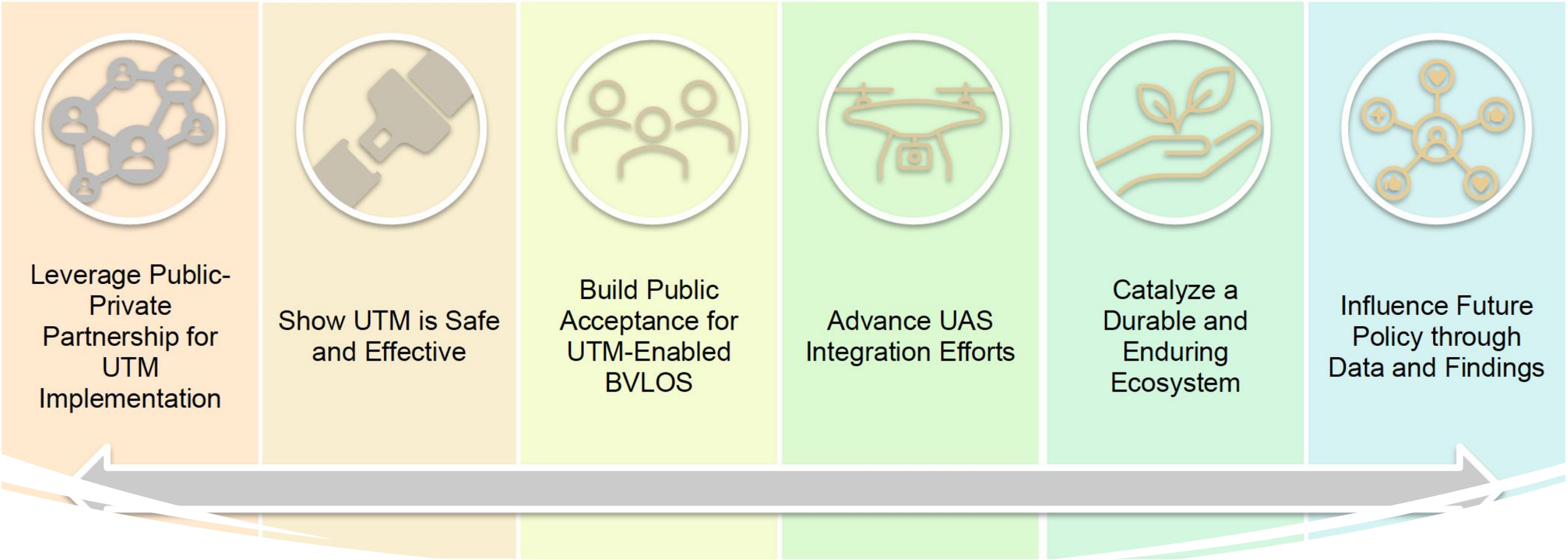
- UTM was designed by NASA to provide strategic deconfliction between sUAS
- UTM uses a service-based architecture that is a paradigm shift from the conventional air traffic management system



Rulemaking for BVLOS Operations

- UAS BVLOS ARC published in March 2022 provides recommendations for rulemaking
- FAA released a request for comments on different conflict management approaches in May 2023
- The May 2024 FAA reauthorization act requires a proposed Beyond visual Line of Sight (BVLOS) rule within 4 months and a final rule withing 16 months of publishing the proposed rule
- The UAS BVLOS ARC recommend a risk-based approach consistent with the kinetic energy of light sport aircraft





FAA UTM Key Site in North Texas

- Multiple operators conducting sUAS operations at scale in shared airspace
- Demonstrate the use of UTM for strategic deconfliction
- Exercise approval process for services

Urban Air Mobility

- Allied Market Research predicted that the global urban air mobility (UAM) market will reach $30.7 billion by 2031
- Expected to provide an alternate method of transportation across urban areas
- Will use new eclectic vertical takeoff and landing aircraft

Electric Vertical Takeoff and Landing Aircraft

- Alaka'i

- Beta — Flown

- Bell

- Elroy Air — Flown

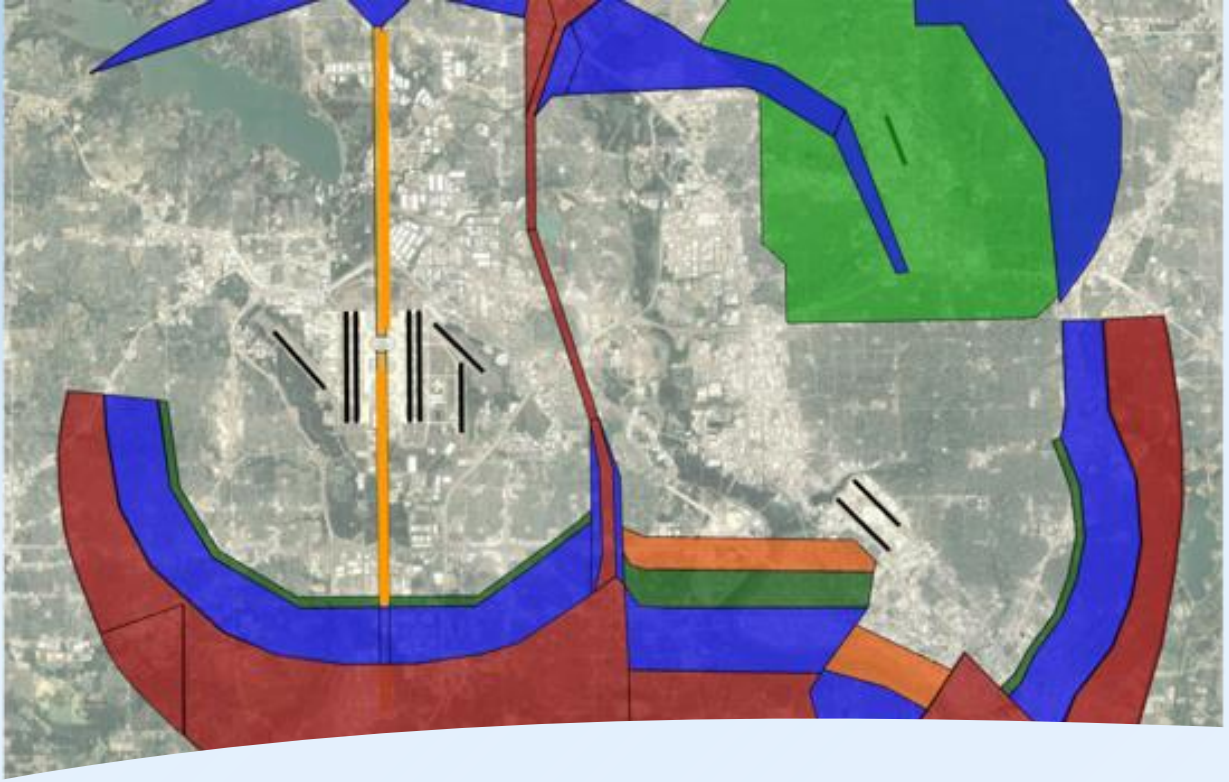
- Joby — Flown

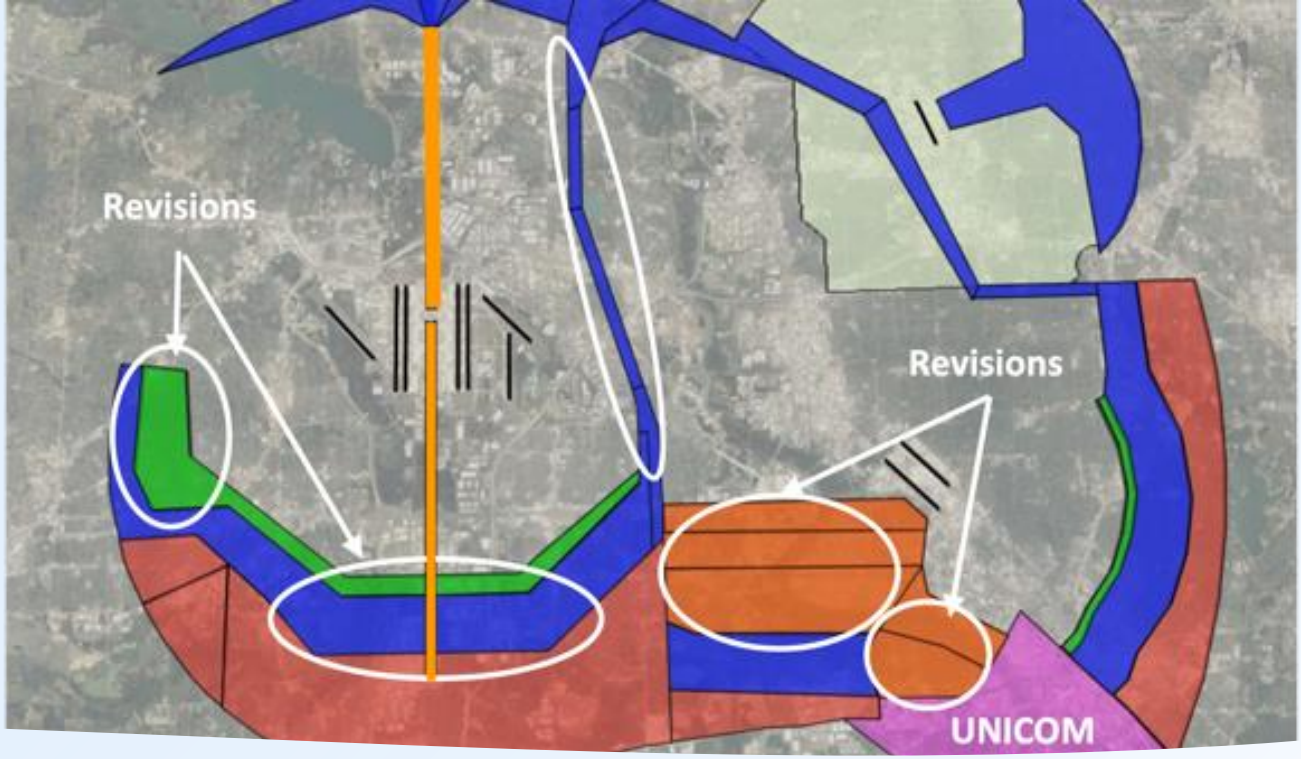
- Jaunt Air Mobility

- Kitty Hawk — Flown

- Wisk — Flown

- Workhorse/Moog — Flown





Airspace Integration for Urban Air Mobility

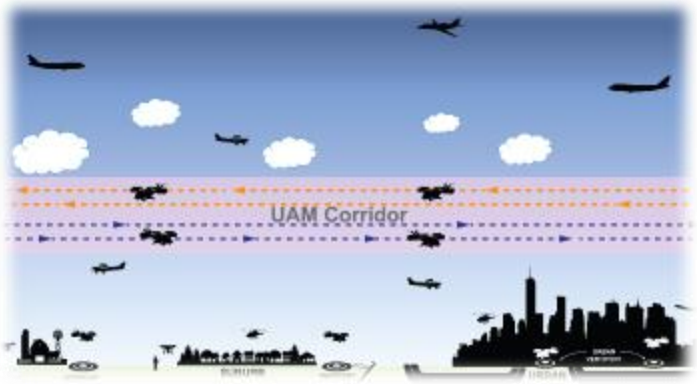
- Minimalize disruption of current aviation operations
- Avoid excessive noise above neighborhoods
- Maintain acceptable Air Traffic Controller workload
- Routes that enable economic viability

Major Needs and Barriers

Near Term

- Lower density initial operations
- Visual Flight Rules
- Visual Meteorological Conditions
- Defined routes

Mid-Term



- Consistent with FAA UAM ConOps
- Medium density
- Instrument meteorological conditions
- UAM corridors
- Reduced separation

Far-Term

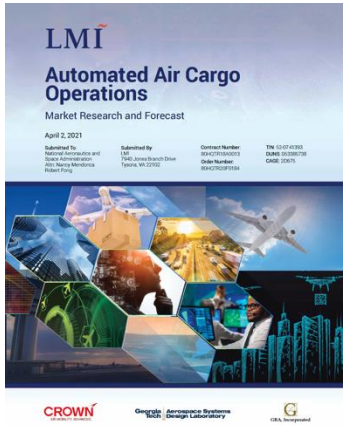
- High density
- Instrument meteorological conditions
- Separation provided by services and automation

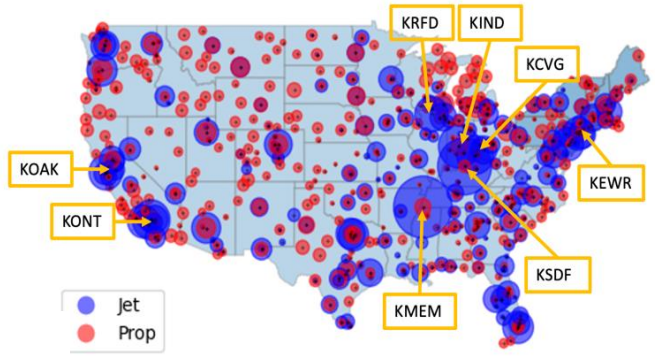
Large Remotely Piloted Aircraft Systems

Opportunity for Regional Air Mobility

"*increase the safety, accessibility, and affordability of regional travel while building on the extensive and underutilized federal, state, and local investment in our nation's local airports*"

Regional Cargo is an Initial Use Case





A 2021 market study indicated:

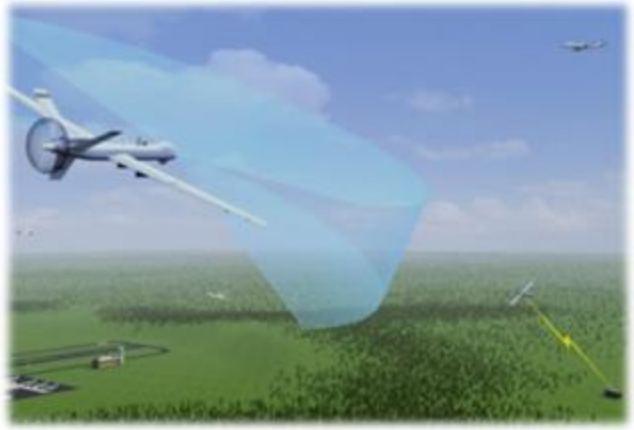
- Most promising use case was regional cargo distribution
- There are benefits to remotely piloted operations
- The strongest business case was remotely supervised

Industry is Developing Increasingly Automated Aircraft for Regional Cargo

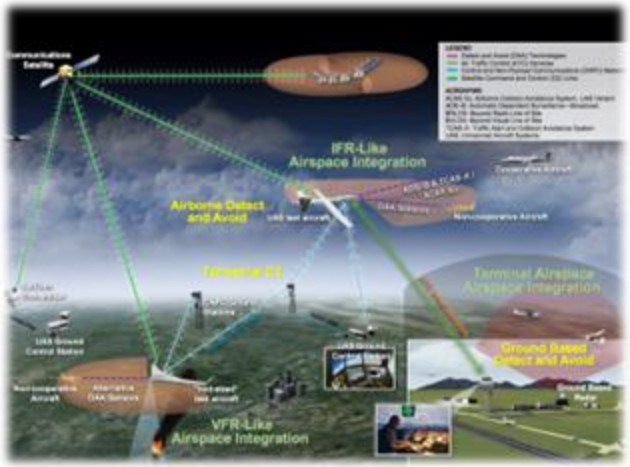
Desire to quickly progress from remotely piloted to remotely supervised (e.g., m:N)

Operations using existing airports require airspace integration with IFR and VFR traffic

Major Needs and Barriers

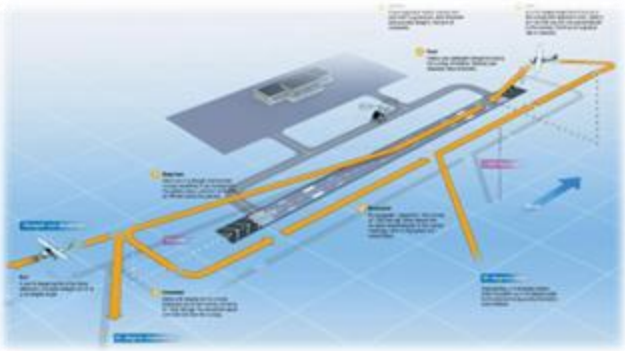


Detect and Avoid (DAA)



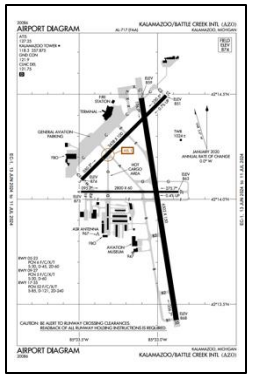
Command and Control (C2)

Standardized Lost C2 Link Procedures



Traffic Pattern Integration at non-towered airports

Automated landing without CAT III ILS



Automated surface operations

Community Benefits

Acceleration of NAS Modernization

Cooperative service-based architecture to facilitate industry innovation

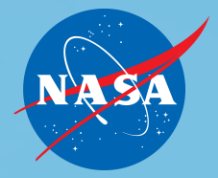
Improved Use of NAS Data

Data and advanced algorithms to increase efficiency and environmental sustainability

Integration of Diverse Aircraft and Missions

Concepts, requirements, and reference implementations to enable airspace integration of diverse aircraft and missions

National Aeronautics and Space Administration



Q&A

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Contact Us: Kurt Swieringa, kurt.a.Swieringa@nasa.gov

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Aviation Ecosystem Transformation