# Creating an Urban Airspace Design: The Future Regulatory Landscape

Jason T. Lorenzon
*Kent State University*, jloren10@kent.edu

# Urban Air Mobility: Creating an Urban Airspace Regulatory

**Jason Lorenzon, JD, ATP**

**NTAS #1538**
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**Embry-Riddle University**
**Daytona Beach, Florida**

# Definitions

- **14 CFR 1.1**
  - ***Aircraft*** means a device that is used or intended to be used for flight in the air.
  - ***Small unmanned aircraft*** means an unmanned aircraft weighing less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft.
  - ***Small unmanned aircraft system (small UAS)*** means a small unmanned aircraft and its associated elements (including communication links and the components that control the small unmanned aircraft) that are required for the safe and efficient operation of the small unmanned aircraft in the national airspace system.

Confluence of Defense and Civil Stakeholders  2006-2010

# Definitions Continued II

- Other Classifications come from US DoD “unofficial” group classifications
  - Characteristics and functionality
  - Group I — UAS 20 lbs or less — operated below 1,200 feet AGL
  - Group II — UAS 21-55 lbs — operated below 3,500 feet AGL
  - Group III — UAS less than 1,320 lbs — operate below 18,000 feet MSL
  - Group IV — UAS more than 1,320 lbs — operate below 18,000 MSL
  - Group V — UAS more than 1,320 lbs — operate above 18,000 MSL

    - *US Air Force, Army, and Navy/Marines have their own classification

# Definitions Continued III

## Industry and Regulatory

- COTS- “Commercial Off the Shelf”
  - Hobby; purpose is recreation
  - sUAS
  - MAV- Micro Aerial Vehicle

## Popular Culture

- Drone-  anything that flies without human intervention on board

# AAM and UAM

- **Advanced Air Mobility**

  - NASA, FAA and Industry Initiative
    1. Develop and Air Transportation System
    2. Moves People and Cargo between
    3. Local, Regional and urban places previously not served or underserved by aviation
    4. Using REVOLUTIONARY AIRCRAFT

    ***AAM Supports a wide range of passenger, cargo, and other operations within and between urban and rural environments***

    ***Traffic and commute times are increasing on the ground thereby creating a need for alternative modes of transportation***

    ***Cost of air platforms such as a traditional helicopter were expensive; introduction of UAS, technology and electronic propulsion decrease the cost of entry and operations***

- **Urban Air Mobility**

An electric air taxi under development by U.S. startup Joby Aviation | TOYOTA MOTOR CORP. / VIA KYODO

  - Focuses on the transition from the traditional management of air traffic management to the future passenger or cargo-carrying air transportation services within an urban environment

# Definitions and Acronyms

**Aircraft Automation**

- Human within the Loop (HWTL)
- Human on the Loop (HOTL)
- Human over the Loop (HOVTL)

**Location of the PIC**

- PIC onboard the UAM
- Remote PIC

**CON OPS**

- Con Ops 1.0 Operational Tempo: Low: PIC on board
- Mature: HOVTL

UAM will operate within a regulatory, operational and technical environment that is incorporated within the NAS

DCM- Demand Capacity Balancing

Operational Tempo- density frequency and complexity of UAM operations

UAM CBRs- Community Based Regulations- right now LOA

UTM- Unmanned Traffic Management

ATM- Air Traffic Management

PSU- Providers of Services for UAM

USS- Unmanned Service Supplier

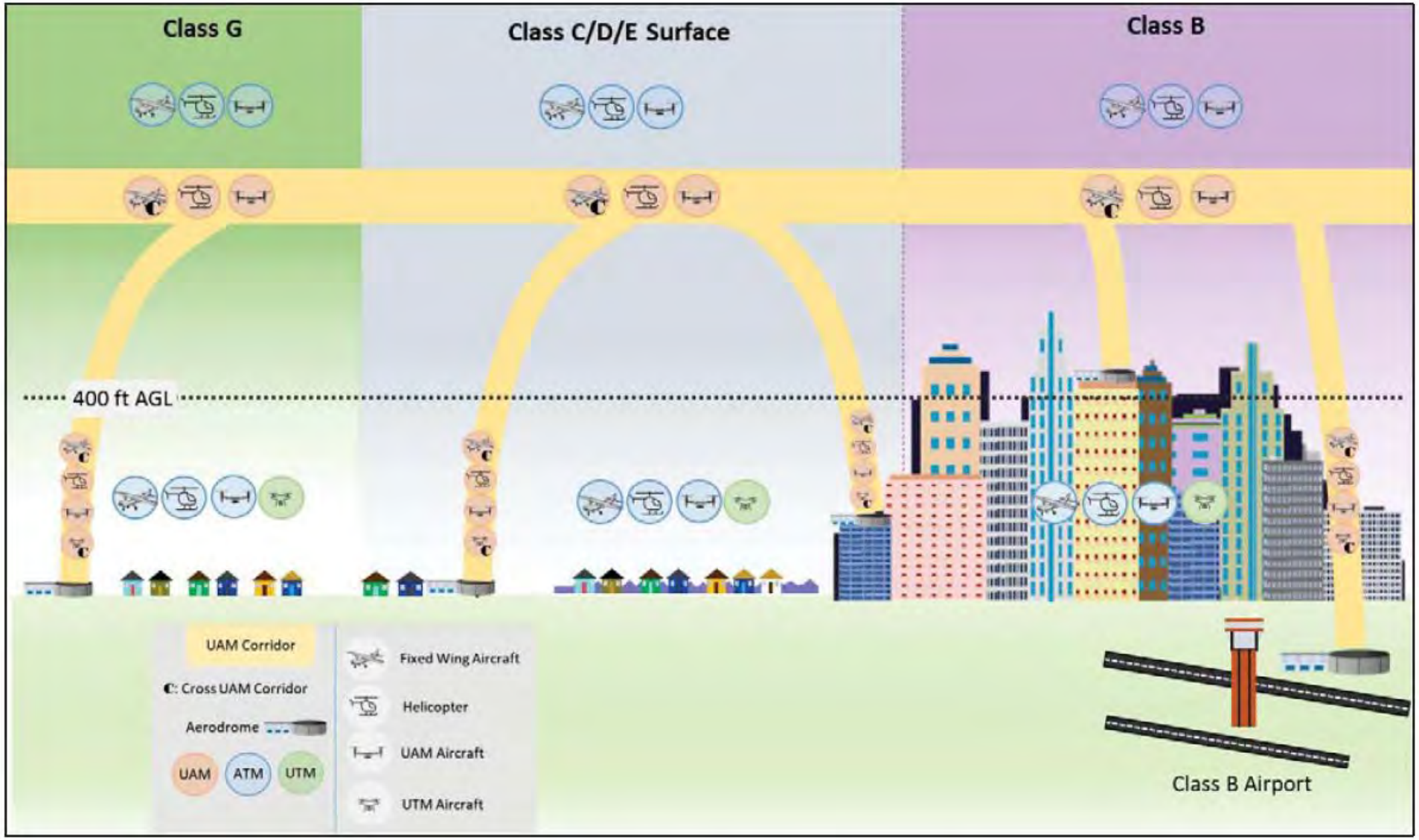



**Figure 1-2: UAM, UTM, and ATM Operating Environments**

# UAM Corridors- Aerodromes

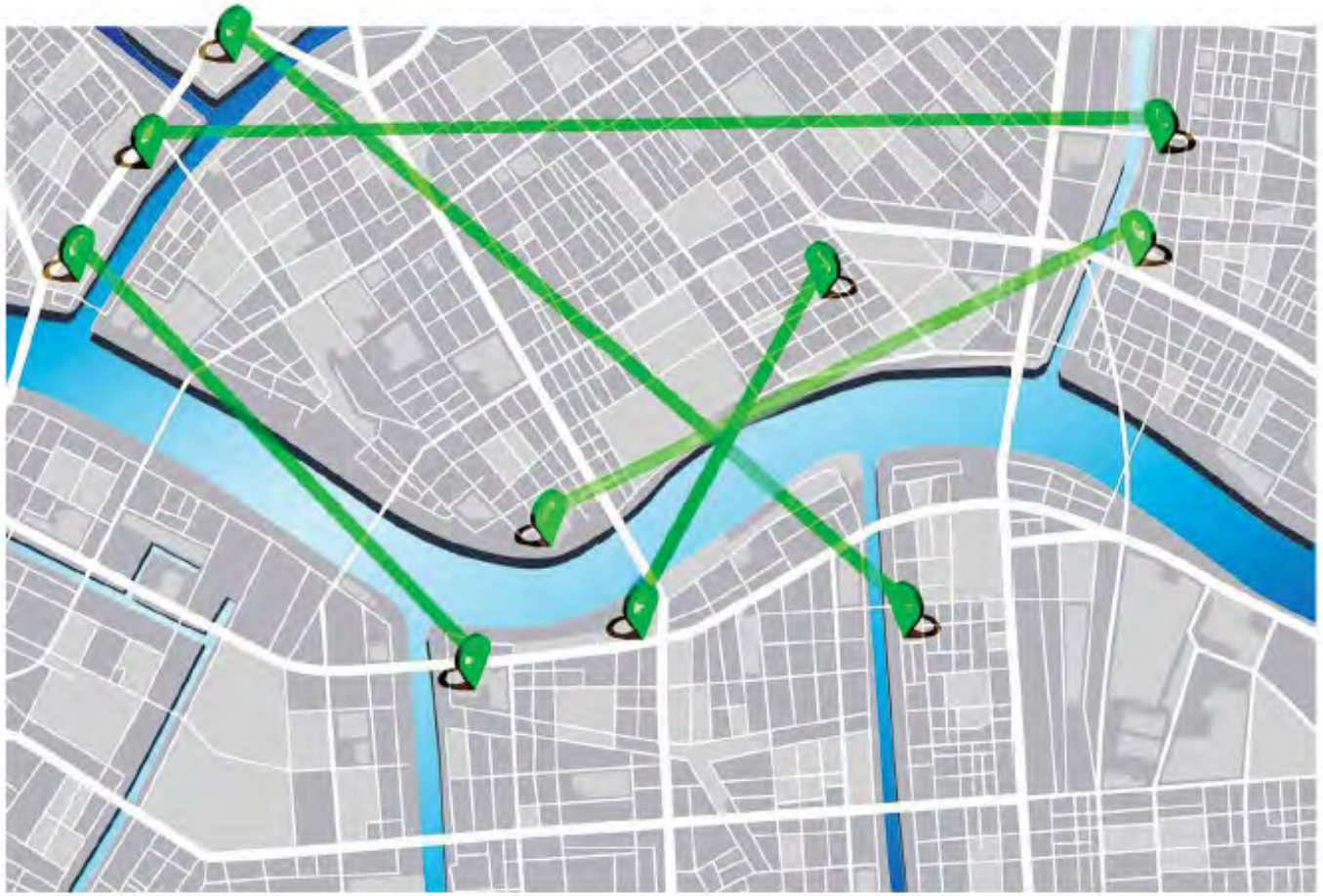


Figure 4-1: Multiple UAM Corridors

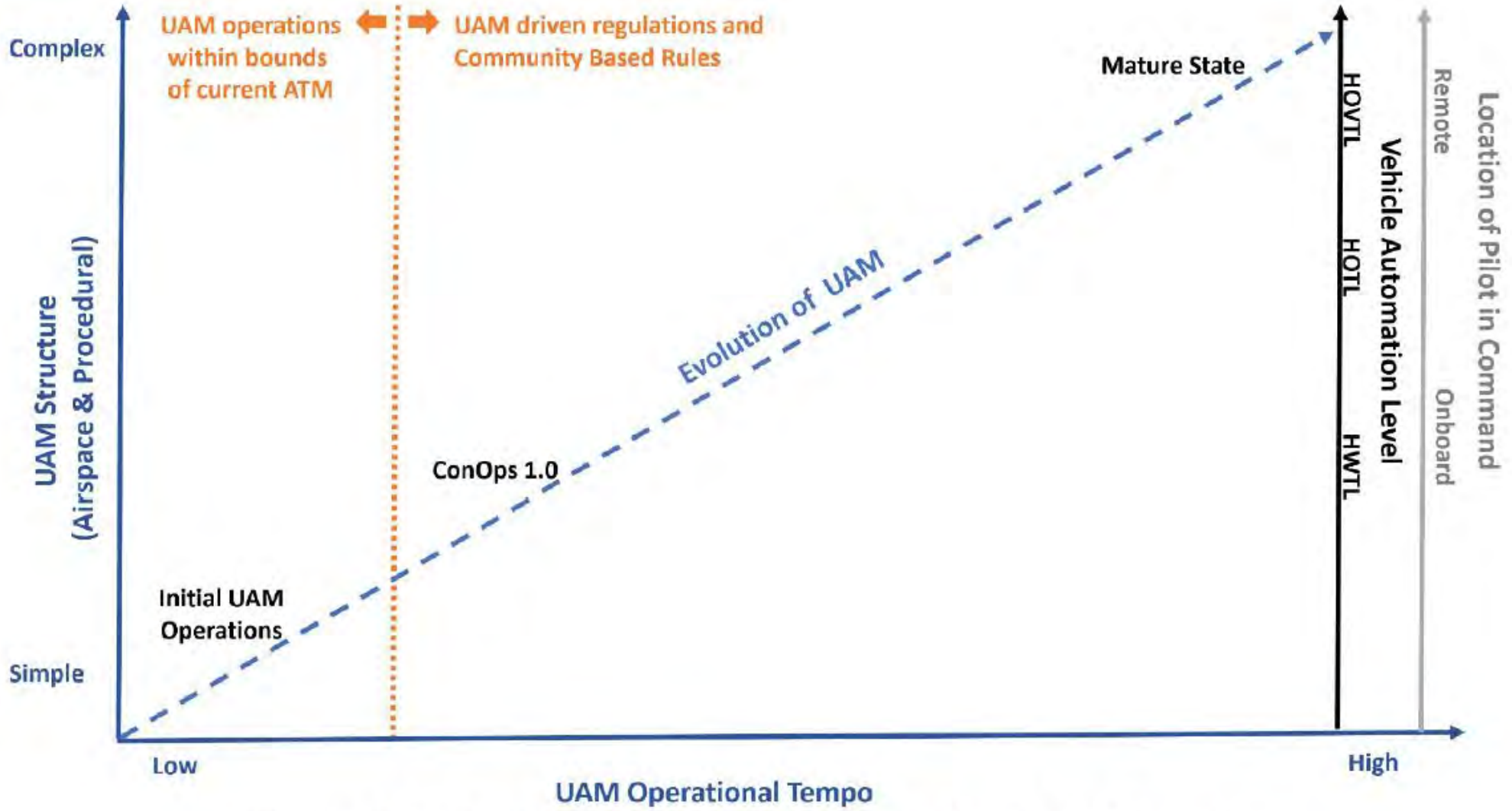



**Figure 3-1: Evolution of the UAM Operational Environment**

# UAS Corridors with Tracks

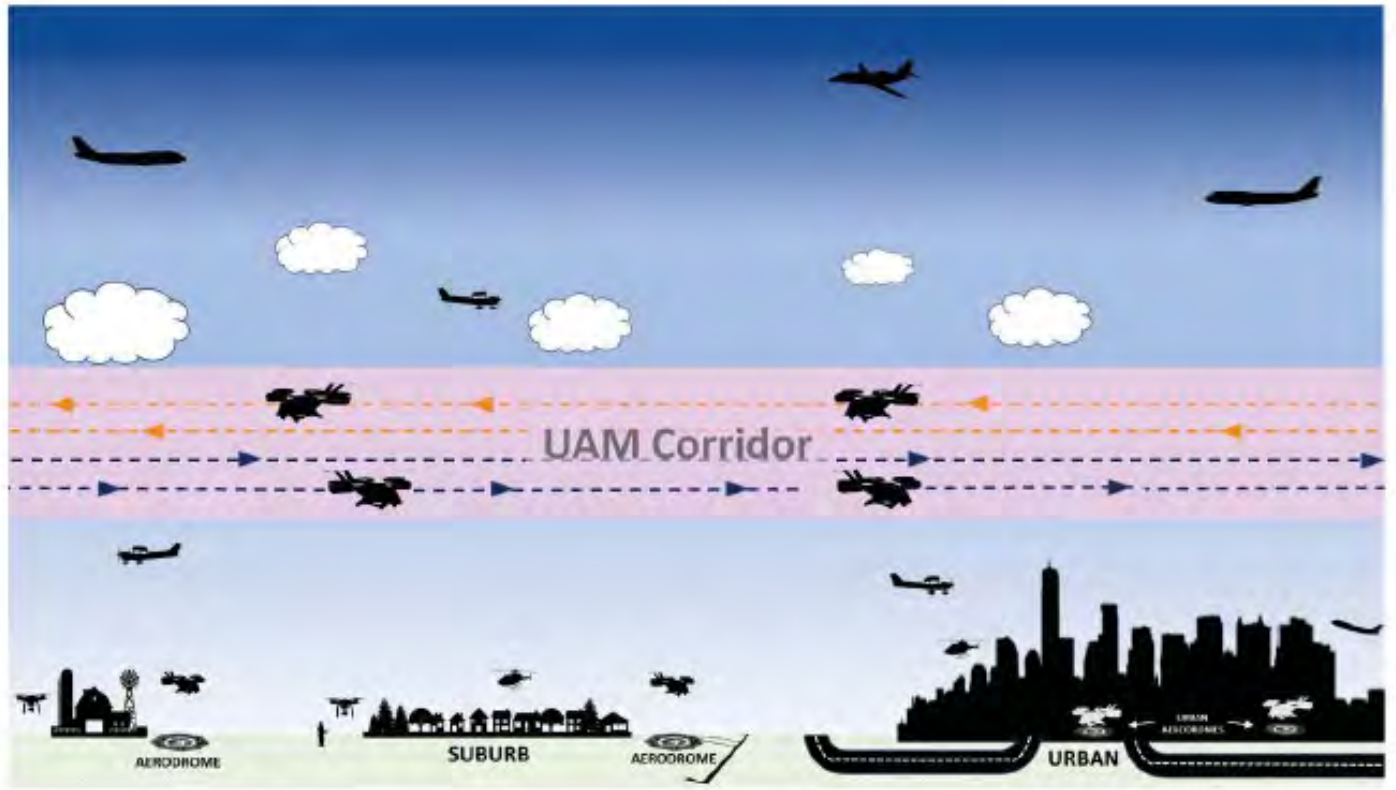



Figure 4-2: UAM Corridor with "Tracks"

# Engineering, Pilots, Industry and Government

## Industry

- **Venture Capital;**
- **OPM; Risk and Reward**
- **Vehicle Certification**
- **Public Acceptance**
- **Silicon Valley v. Washington**
- **Issue of Common Carriage**
  - A commercial enterprise that contracts to transport passengers or goods for a fee
- **GENERAL PUBLIC**

### Goals of Industry

- **Eliminate Pilot- high cost**
- **Build public confidence in a very high-risk environment**
- **UAM and AAM**
- **Commercial Space**
- **Certification of Aircraft/Pilots 49 USC 44703**
- **Licensure 14 CFR 460**
- **Regulatory Road-Blocks**

# Engineering Pilots, Industry and Government

## Research

- **Engineering**
- **Grants/Federal Grants**
- **Research Universities**
- **Amazon**
- **UPS, Fedex**
- **Vertiports- Form 7480-1**
- **Agricultural Use**
- **COVID-19 Use**
- **Disjunct and not organized**
- **Rapidly Changing Technologies**
- **Inventors, Engineers and pilots…**

## Government

- **Use the Courts in an activist way- *Pirker***
- ***Acts of Congress…how long does it take the FAA to implement?***
- Certification- 2 years
- 333 Exemptions- regulations.gov
- Industry starts to consolidate
- Electronic Propulsion- Chemistry needs to change- look to hybrid options in the short term
- Look to US Patents
- Emergency Use Authorization
  - Immediate, imperative to save lives and needs approval

# Drone Regulations Landscape

- **Flight Over People**
    - Integration into the NAS
    - Advancement of Technology
    - Can operate safely
    - Flexibility and Demand for sUAS
    - Four Categories
- The ability to fly over people varies depending on the level of risk that a small UAS operation presents to people on the ground. Operations over people are permitted subject to the following requirements:
- Category 1 small unmanned aircraft are permitted to operate over people, provided the small unmanned aircraft:
    - Weigh 0.55 pounds or less, including everything that is on board or otherwise attached to the aircraft at the time of takeoff and throughout the duration of each operation.
    - Contain no exposed rotating parts that would cause lacerations.
- In addition, for Category 1 operations, no remote pilot in command may operate a small unmanned aircraft in sustained flight over open-air assemblies unless the operation is compliant with REMOTE ID See 14 CFR Part 81.

# Operations over People
# 14 CFR 107.115

- Category 2 and Category 3 provide performance-based eligibility and operating requirements when conducting operations over people using unmanned aircraft that weigh more than .55 pounds but do not have an airworthiness certificate under part 21.

- In addition, for Category 2 operations, no remote pilot in command may operate a small unmanned aircraft in sustained flight over open-air assemblies unless the operation is compliant with Remote ID.
- Label the UAV as eligible for Category 2 Operations
- 11 foot-pound of kinetic energy and no exposed rotating parts that would lacerate human skin 14 CFR 107.120

# Operations over People
# 14 CFR 107.125

- Category 3 small UAS have further operating restrictions. A remote pilot in command may not operate a small unmanned aircraft over open-air assemblies of human beings. Additionally, a remote pilot in command may only operate a small unmanned aircraft over people if:
  - The operation is within or over a closed- or restricted-access site and all people on site are on notice that a small UAS may fly over them; or
  - The small unmanned aircraft does not maintain sustained flight over any person unless that person is participating directly in the operation or located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling small unmanned aircraft.
  - UAV has to be labelled as eligible for Category 3 Operations
  - Transfer of 25 foot-pounds of kinetic energy 14 CFR 107.130

# Operations over People
# 14 CFR 107.140

- Category 4 operations is an addition from the NPRM. This category allows small unmanned aircraft issued an airworthiness certificate under part 21 to operate over people, so long as the operating limitations specified in the approved Flight Manual or as otherwise specified by the Administrator, do not prohibit operations over people. Additionally, no remote pilot in command may operate a small unmanned aircraft in sustained flight over open-air assemblies unless the operation is compliant with Remote ID. To preserve the continued airworthiness of the small unmanned aircraft and continue to meet a level of reliability that the FAA finds acceptable for operating over people in accordance with Category 4, additional requirements apply. Part 21, Part 43, Part 91

- Note: Sustained flight over an open-air assembly includes hovering above the heads of persons gathered in an open-air assembly, flying back and forth over an open-air assembly, or circling above the assembly in such a way that the small unmanned aircraft remains above some part the assembly. ‘Sustained flight’ over an open-air assembly of people in a Category 1, 2, or 4 operation does not include a brief, one-time transiting over a portion of the assembled gathering, where the transit is merely incidental to a point-to-point operation unrelated to the assembly.

# Remote ID 14 CFR Part 81

## 3 WAYS DRONE PILOTS CAN MEET REMOTE ID RULE

### Drone Remote Identification

**Standard Remote ID Drones**


- Remote ID capability is built into the drone
- From takeoff to shutdown, drone broadcasts:
  - Drone ID
  - Drone location and altitude
  - Drone velocity
  - Control station location and elevation
  - Time mark
  - Emergency status

### Drone Remote Identification

**Drones With Remote ID Broadcast Module**


- Remote ID capability through module attached to drone
- Limited to visual line of sight operations
- From takeoff to shutdown, drone broadcasts:
  - Drone ID
  - Drone location and altitude
  - Drone velocity
  - Takeoff location and elevation
  - Time mark

### FAA-Recognized Identification Area (FRIA)

**Drones Without Remote ID**

- Drones without Remote ID can operate without broadcasting
- Drones without Remote ID must operate within visual line of sight and within the FRIA
- Anyone can fly there, but FRIAs can only be requested by community-based organizations and educational institutions

# Remote ID 14 CFR Part 89

## Compliance Dates

- Almost all of the final rule on remote ID becomes effective April 21, 2021. The subpart covering the process for FRIA applications from community-based organizations and educational institutions becomes effective September 16, 2022.

- September 16, 2022:
  - Drone manufacturers must comply with the final rule's requirements for them.
- September 16, 2023:
  - All drone pilots must meet the operating requirements of part 89. For most operators this will mean flying a Standard Remote ID Drone, equipping with a broadcast module, or flying at a FRIA.

  - Prohibition against use of ADS-B unless authorized by the administrator see 14 CFR Parts 107.52 and 107.53

# Operations over Vehicles
# 14 CFR 107.145

In a change from the NPRM, the final rule permits operations over moving vehicles, provided the small unmanned aircraft operation meets the requirements of Category 1, 2 or 3 **and** either:

- The small unmanned aircraft must remain within or over a closed- or restricted-access site, and all people inside a moving vehicle within the closed- or restricted-access site must be on notice that a small unmanned aircraft may fly over them; or
- The small unmanned aircraft does not maintain sustained flight over moving vehicles.
- A remote pilot may also conduct operations over moving vehicles with a small unmanned aircraft eligible for Category 4 operations as long as the applicable operating limitations in the approved Flight Manual or as otherwise specified by the Administrator do not prohibit such operation.

# Night Operations 14 CFR 107.29

1. The remote pilot in command must complete an updated initial knowledge test or online recurrent training; and
2. The small unmanned aircraft must have lighted anti-collision lighting visible for at least three (3) statute miles that has a flash rate sufficient to avoid a collision.

# Initial and Recurrency Testing/Training

There are multiple training options, depending on your current status:

If you do not hold a Part 107 Remote Pilot Certificate you must:

Take the UAS Initial Aeronautical Knowledge Test

Current Part 61 certificate holders:

Take the Part 107 Small Unmanned Aircraft Systems Initial (ALC-451) online course

Part 107 remote pilots who are also certificated and current under Part 61:

Take the Part 107 Small Unmanned Aircraft Systems Recurrent (ALC -515) online course

All individuals who hold a Part 107 remote pilot certificate (regardless of currency):

Take the Part 107 Small UAS Recurrent Non-Part 61 Pilots (ALC-677) online course

# Recreational Flyers

**What is a recreational flyer?**

A recreational flyer  is someone who operates their drone for fun or personal enjoyment purposes only.

**How to fly a drone recreationally:**

1. Pass TRUST (“The Recreational UAS Safety Test”)
2. If your drone weighs more than .55 lbs, register your drone through the FAA's DroneZone
3. Follow safety guidelines on the FAA website or of an existing aeromodelling organization

# Where does Private Property Start?

## Trespass

**“One is subject of liability to another for trespass, irrespective of whether he thereby causes harm to any legally protected interest of the other, if he intentionally enters land in the possession of the other, or causes a thing or a third person to do so, or Remains on the land, or fails to remove from the land a thing which he is under a duty to remove”**

**Restatement (Second) of Torts 158 (1965)**

# Where Does Private Property End?

**American Bar Association and the American Law Institute**
**Restatement of Torts (1934)**

(Draft) Trespass- A Trespass on land may be committed by entering or remaining:

(a) On the surface of the earth, or
(b) Beneath the surface thereof, or
(c) Above the surface thereof

# Where does Private Property End and the National Airspace Begin?

**Restatement (Second) of Torts**

"Flight by an aircraft in the air space above the land of another is a trespass if, but only if,

(a) it enters into the immediate reaches of the air space next to the land, and
(b) it interferes substantially with the other's use and enjoyment of his land."

**(RESTATEMENT (SECOND) OF TORTS 159(2)).**

# Private Property vs National Airspace System (NAS)

**National Conference of Commissioners on Uniform State Law (2018)**
**Tort Law Relating to Drones Act**

Aspirational hopes of a ”uniform per se aerial trespass law”
“The Intrusion Rule”: Presumption of Intrusion

(1) Drones are operated below a certain height; and
(2) Within a certain distance of the property line

See FAA Reauthorization Act of 2018, P.L. 115-254
also see Certification based upon Industry Standards

# Local and State Law and Private Property

## FAA has increasingly asserted exclusive jurisdiction over all airspace “above the grass”

Where does Local Authority end and Federal Authority begin?

Resolution:

(1)By Legislation

(2)By Litigation

# Private Property vs National Airspace

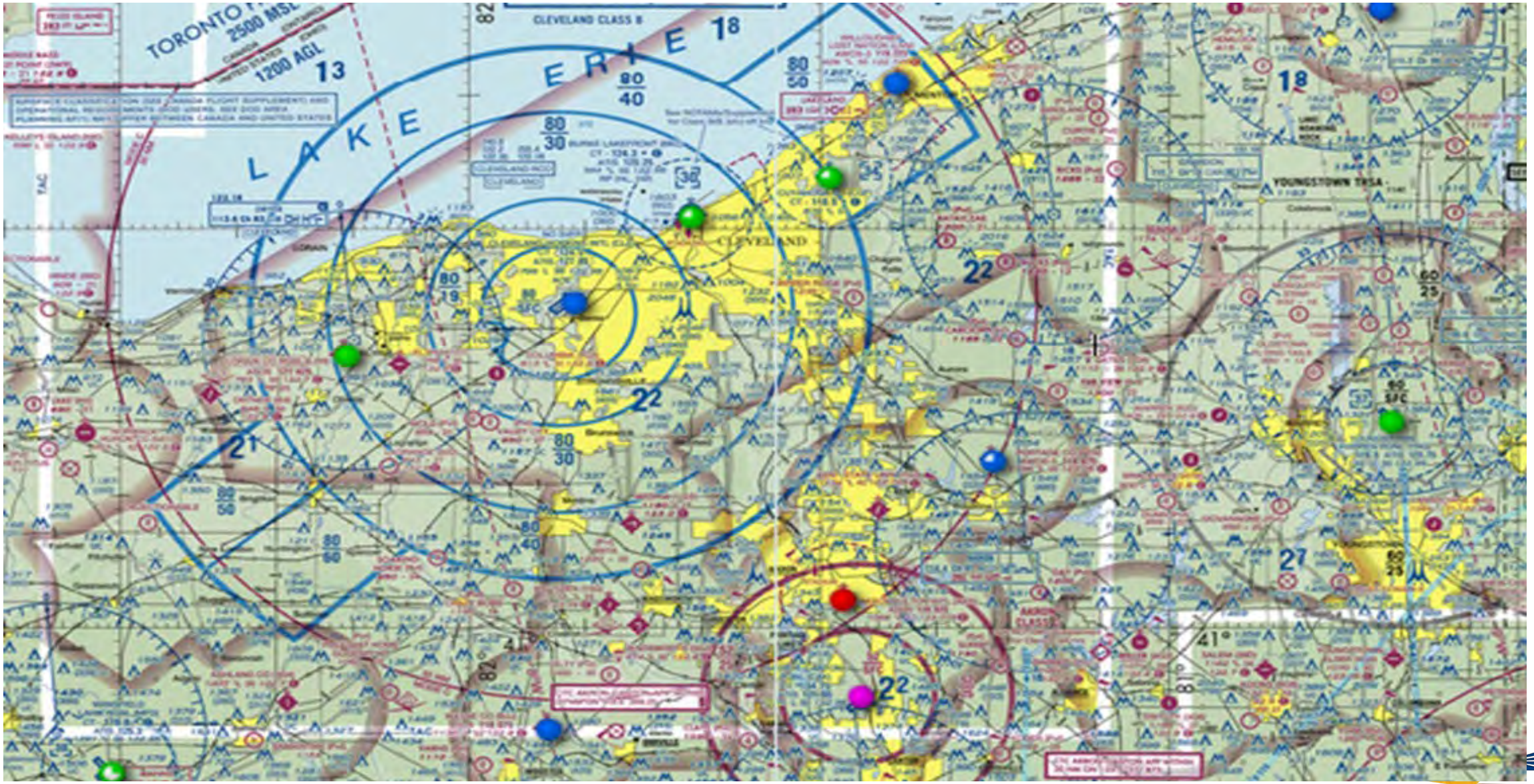
**National Conference of Commissioners on Uniform State Law (2019)**
**Tort Law Relating to Drones Act**

**SECTION 5. AERIAL TRESPASS BY UNMANNED AIRCRAFT**

(a) A person is liable for aerial trespass if the person intentionally and without the consent of the land possessor operates an unmanned aircraft in the airspace over the land possessor's real property and causes substantial interference with the use and enjoyment of the property.

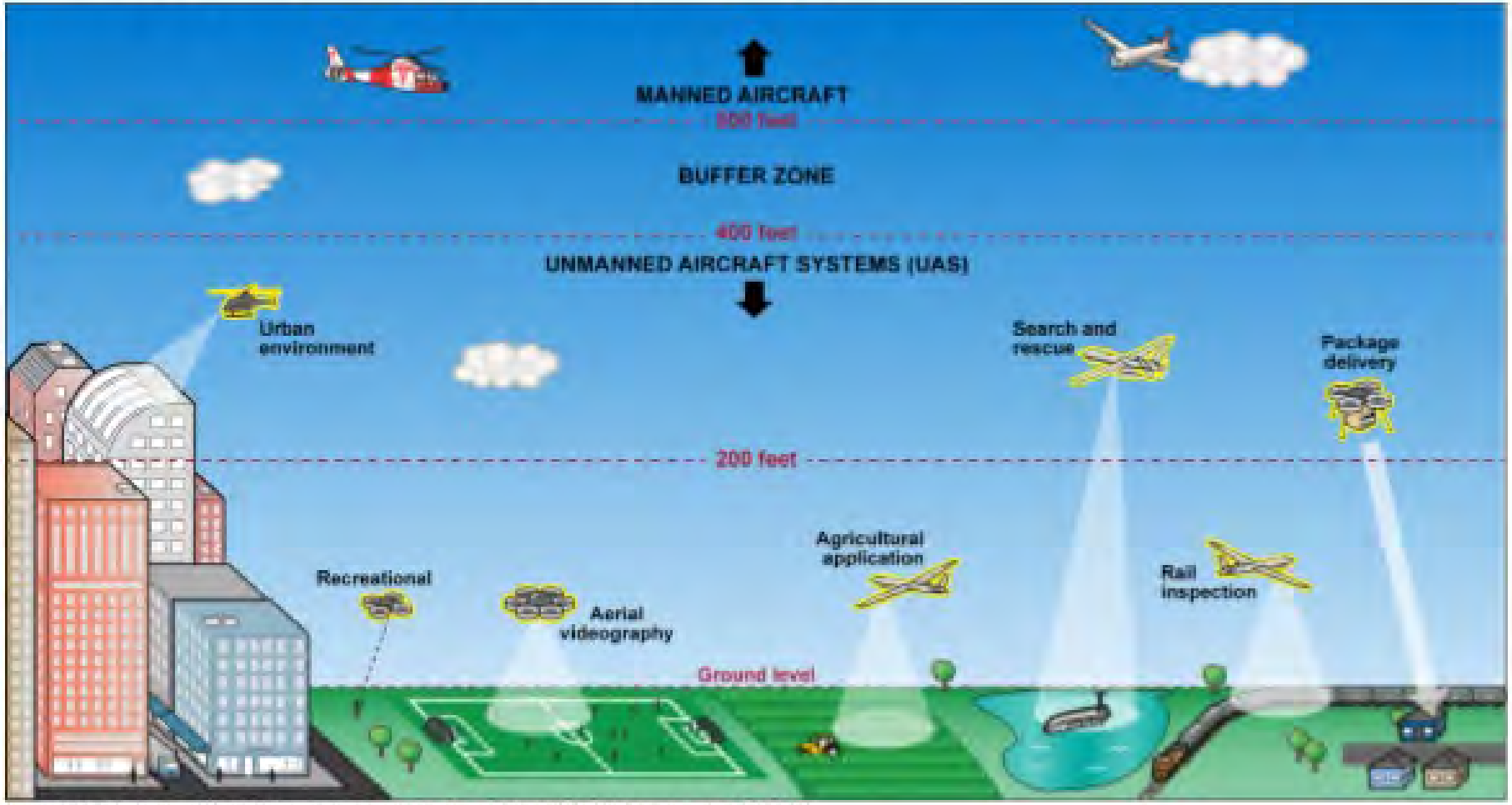
# Do not forget…..

- **U.S v. Causby, 328 US 256 (1946);**
- **Griggs v. Allegheny County, 369 US 84 (1962);**
- **Nuisance and Trespass**
- Long Lake Twp. v. Maxon**, 2019 Mich. App. LEXIS 1819 (Mich. Ct. App. March 18, 2021)**
  - Reasonable Expectations of Privacy- Drones are more intrusive
  - Regulatory Violation not necessarily a 4th Amendment Violation
  - Kyllo- infrared- 4th Right Amendment Violation
  - Ciraolo, Florida v. Riley- Human Operated Aircraft
    - Drone surveillance intrudes into person's reasonable expectations of privacy


LAKE ERIE
CLEVELAND CLASS B
TORONTO
2500 MSL
1200 AGL
CLEVELAND
YOUNGSTOWN
13
18
22
21
27
41°

# Where does the National Airspace Start?

Figure 6: Illustration of a Potential Model for the National Aeronautics and Space Administration's (NASA) Concept of Operations for the Unmanned Aircraft System Traffic Management System




Source: GAO illustration of National Aeronautics and Space Administration (NASA) information. | GAO-18-110

# Advanced Air Mobility | Ecosystem

# Aerial Corridors


# UAS Low Level Surveillance Systems Considerations

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- Low Level surveillance would be conducted under subscription services much similar to the Ohio Turnpike operates everyday.
- This system would operate the very same way as the Turnpike works where transportation of people, property, and cargo would be conducted but via Unmanned Aircraft.
- For Business Operators;  point to point or door to door operations?
- Much of the revenue from the Ohio Turnpike is used for upkeep of roads and facilities. However, under UAS operations, the State Constitution has the power to derive a fee on the Unmanned Aircraft

# AAM/UAM

- **Who owns the airspace?**
- **Who has jurisdiction under 400 feet?**
- **Certification of the Aerial Vehicle?**
  - Look to Industry (FAA Appropriations Bill of 2018)
- **BVLOS ARC**
  - "The UAS BVLOS ARC will provide recommendations to the FAA for performance-based regulatory requirements to normalize safe, scalable, economically viable, and environmentally advantageous UAS BVLOS operations that are not under positive air traffic control (ATC)."

- **Concept of Operations AAM/UTM V 1.0**
- **Concept of Operations UAM V 1.0**
- **Concept of Operations UTM V. 2.0**

Designation as an ***FAA-UAS-CTI*** March 2021

B.S. Degree with a Concentration in UAS Operations
UAS Minor
Aviation Law and Policy Minor

In Development
M.S. Airspace Ecosystems

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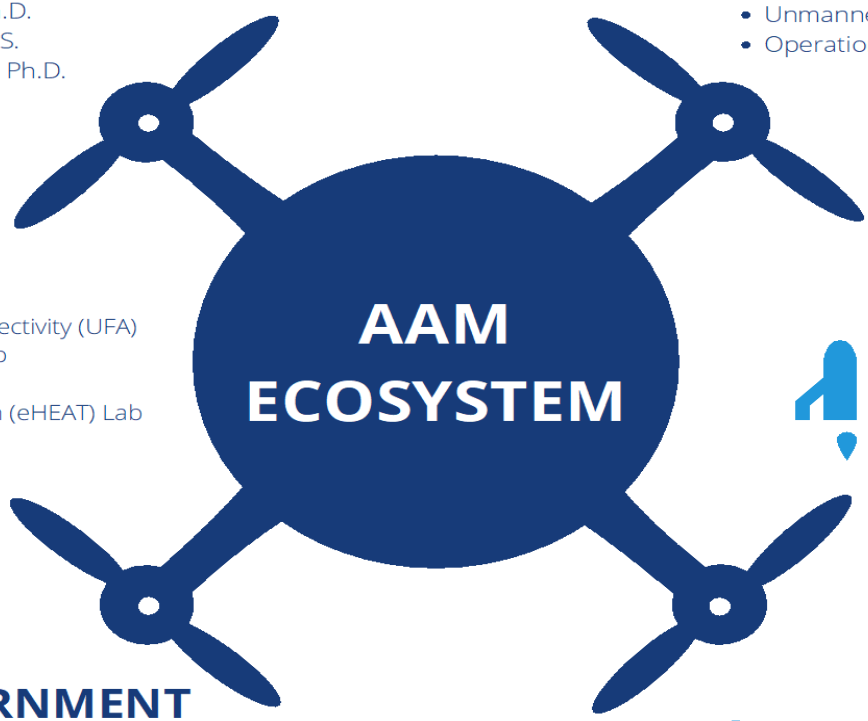
# ADVANCED AIR MOBILITY ACTIVITIES

## PROGRAMS AND WORKFORCE DEVELOPMENT

- Aeronautics, B.S.
- Aerospace Engineering: B.S., M.S., Ph.D.
- Aviation Management & Logistics, M.S.
- Mechatronics Engineering: B.S., M.S., Ph.D.
- Unmanned Aircraft Systems, B.S.
- UAS Part 107 Certification

## FACILITIES AND CAPABILITIES

- Kent State University Airport (1G3)
- Air Traffic Control Simulator with external connectivity (UFA)
- Control, Automation, & Mechatronics (CAM) Lab
- Cognitive Research & AI (CRAI)
- eVTOL Hybrid-Electric Aero-Thermal Propulsion (eHEAT) Lab
- Fuel Cell Research Lab
- Cyber Security Lab
- Extended Reality (XR) Lab
- Visual Flight Simulators (Alsim)
- UAS Fleet




## OPERATIONS, SYSTEMS, AND SECURITY

- AAM Operations - JL, RN, SS
- Unmanned Traffic Management (UTM) Infrastructure - BK, JL, BS, SS
- Operational Security - TC, SS

## POLICY

- Aviation Law - JL
- Aviation Policy - JL
- Policy Considerations for AAM Low-Level Surveillance - JL, SS

## PROPULSION AND POWER

- Hybrid Propulsion Systems - YD, RL, BS
- Laboratory Demonstration - YD, BS
- Materials - AA, MF
- eVTOL Propulsion Thermal Modeling - AA, BS

## GOVERNMENT PROFESIONAL SERVICE

- Air Force Office of Scientific Research (AFOSR) - JH
- Army Research Laboratory (ARL) - BS
- National Academy of Science - Transportation Research Board- RN
- National Aeronautics & Space Administration (NASA) - JH, BS
- National Science Foundation (NSF) - CB, JH
- Ohio Aviation Bar, Florida Aviation Bar - JL
- Faculty, Visiting Faculty , U.S. Air Force Academy, U.S. Military Academy - BS

## ROBOTICS, AUTONOMY, AND HUMAN FACTORS

- Artificial Intelligence / Teaming - TC, RL
- Health Care Robotic Applications - HM, TS
- Robotic Systems for UAS Applications - TS
- Control Applications - HM
- Extended Reality (XR) Applications in Technology & Workforce Development - SF, BK

**Legend**

AA - Ali Aziz, Associate Professor
CB - Christina Bloebaum, Dean and Professor
TC - Xuhui (Tracy) Chen, Assistant Professor
YD - Yanhai Du, Professor
MF - Michael Fisch, Associate Professor
SF - Stephanie Fussel, Assistant Professor
JH - Joycelyn Harrison, Associate Dean of Research & Faculty Affairs
BK - Benjamin Kwasa, Assistant Professor
RL - Rui Liu, Assistant Professor
JL - Jason Lorenson, Assistant Professor
HM - Hossein Mirinejad, Assistant Professor
RN - Richmond Nettey, Professor
BS - Blake Stringer, Associate Professor
SS - Syed Shihab, Assistant Professor
TS - Tao Shen, Assistant Professor

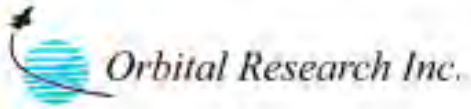
# NEO Center for Advanced Air Mobility Initiatives - Collaborators

**Manufacturers**
Collins Aerospace
Eternium
Orbital Research Inc
SIC Drones
Theiss UAV
Event 38 Unmanned Systems

**Regional Assets**
Ashtabula County Airport
Baldwin Wallace University
Kent State University
Geauga County Airport

**Resource Organizations**
Aerozone Alliance
Manufacturing Works
Ohio Aerospace Institute
Ohio Federal Research Network
Team NEO
Youngstown Business Incubator

**Industry Advocates**
Cuyahoga County
Fly Ohio
Heil Consulting
Michael Best Consulting
Regionerate LLC














# Ohio AAM and NEO Initiatives

## CAAM-I NEXT STEPS

### Regional Ecosystem

- Engage Team NEO/JO for Regional roadmap of infrastructure and use cases
- Direct funding opportunities from County, ARPA, SBIR, etc. to drive AAM advancement
- Maximize impact of regional assets (Universities, incubators, non-profs)

### Tech & Infrastructure Network

- Expand Regional Test Flight Facilities
- Air Traffic and Database Systems
- Secure Investment and Engagement for Initiatives

### Lab to Commercialization

- Technology connected to marketplace
- Technology scale up to commercialization
- Connecting businesses to OEM, Military, NASA, etc. resources

### Policy

- Forums to facilitate UAS Flight campaigns
- Pathway to inform policy
- Define FAA in support

### Talent

- Owner level – hiring, growing, investing
- Skills development – apprenticeship, supervisors
- Technology development – university partnership, AI and Virtual Reality

### Supply Chain

- Connecting needs to solutions.
- Supporting production scale
- Create mentoring connections
- Leverage JO funding support for regional initiatives

# CAAMI – Tasks, Challenges, Objectives

1. Create a roadmap based on a needs and solutions assessment to attract commercial interests in locating to Northeast Ohio for Maintenance, Repair, Overhaul, Manufacturing and Corporate Headquarters.
2. Plan a Center of Advanced Air Mobility with Kent State University to build on their existing engineering and aeronautical expertise, pilot programs, research & development and physical assets at their airport.
3. Engage stakeholders in an AAM Consortium to help define the roadmap, investment, supply chain and use case scenarios.
4. Define and use the regional airport assets across the State of Ohio is pursuing ‘nodes’ of development, assets and expertise.
5. Align cargo, logistics, and flight options around Lake Erie.
6. Build the Flight Information Exchange as a connected tissue to every county in NEO.
7. Encourage Army & National Guard to expand alignment with roadmap efforts and incorporate military and defense sustainment and logistic planning.
8. Build Ohio’s strength and leverage existing efforts with Springfields COE to align attraction efforts.
9. Supplement supply chain efforts with membership organizations to create a state-wide, multi-state commercial network.
10. Create a transformational commitment to racial equity through inclusion by leveraging, influencing and leading mentoring, apprenticeship, trades and creating pathways for non-traditional employees to enter the workforce.

# Maintenance Operations, Academic, and Advanced Air Mobility Center (MOAAAC)



The MOAC will support CAE A&P certification program, the 2-year A&P program offered out of Ashtabula campus, CAE's 4-year BS in Aviation Maintenance Management, the maintenance of our own fleet of 34 aircraft, and the FAA certified repair station. Also facilities for the CAAM – including supporting infrastructure.

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CW
CW


CW
CW


TARANIS
UNMANNED AIRCRAFT SYSTEMS
DRONE PILOT STAND CLEAR

# Thank You.


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**QUESTIONS?**

**jloren10@kent.edu**