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**HYBRID EVENT**  
Torrance, CA, USA  
Jan 29 - Feb 1, 2022

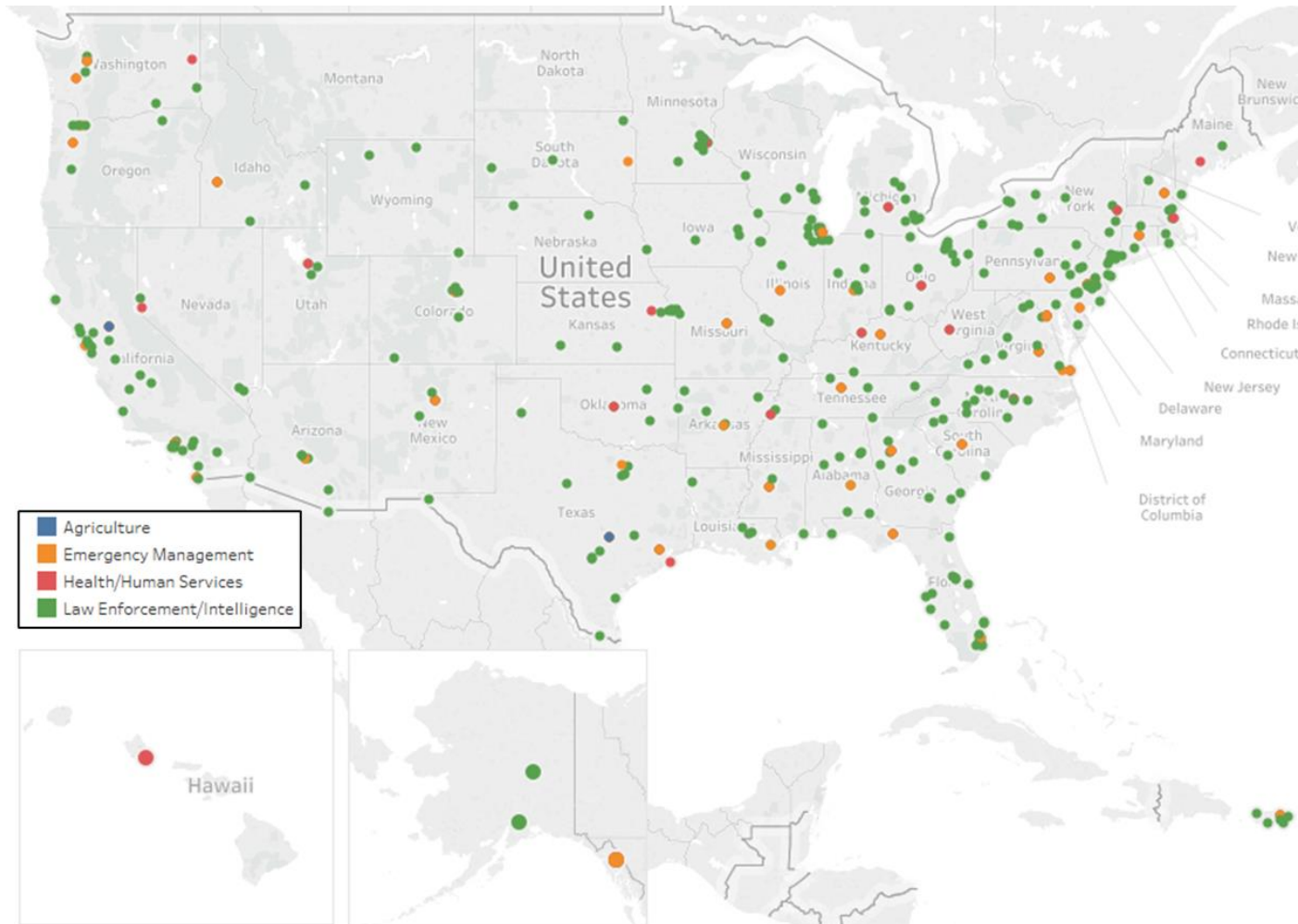
Premier Systems Engineering Workshop

# Exploring MBSE for UAS Applications

[www.incose.org/iw2022/](http://www.incose.org/iw2022/)



# CNA Corporation



- Non-profit corporation
- 75+ years dedicated to safety and security of the nation
- Dept of Navy FFRDC
- Direct work with over 580 federal, state, local partners
- Over 25 years supporting the FAA





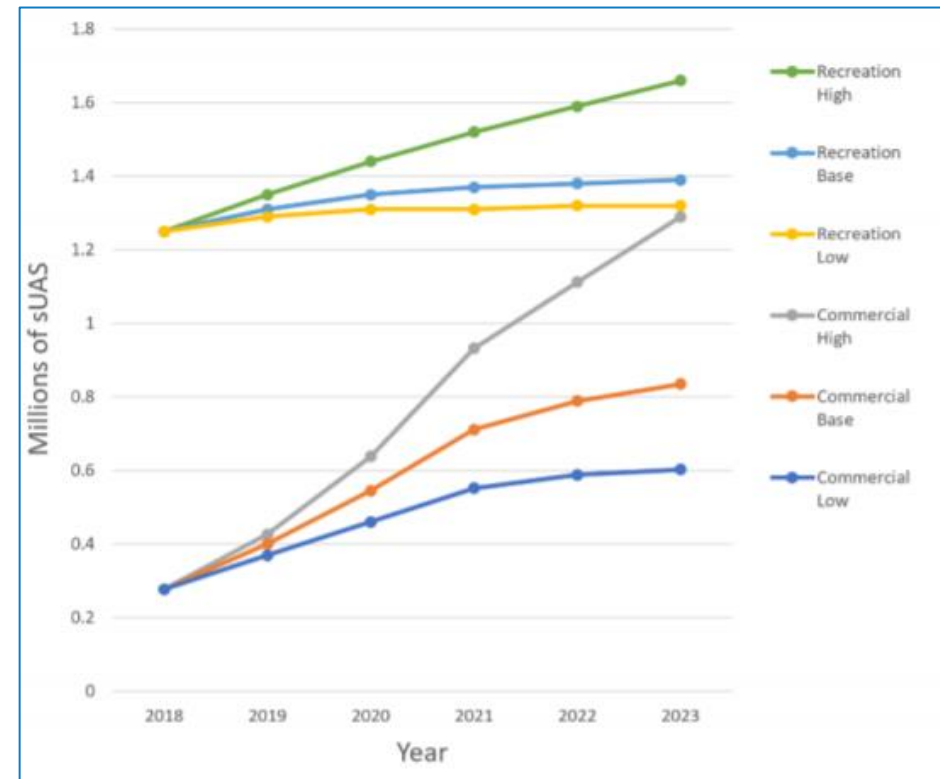
# Overview

- UAS Environment
- Model for State and Local UAS Applications
- Looking Forward
- Key Takeaways



# Uncrewed Aircraft Systems (UAS)

- Use of UAS has exploded in the past decade
- The combined recreation and commercial fleet is projected to reach 2 to 3 million by 2023
- UAS growth will have demand for Airspace Services



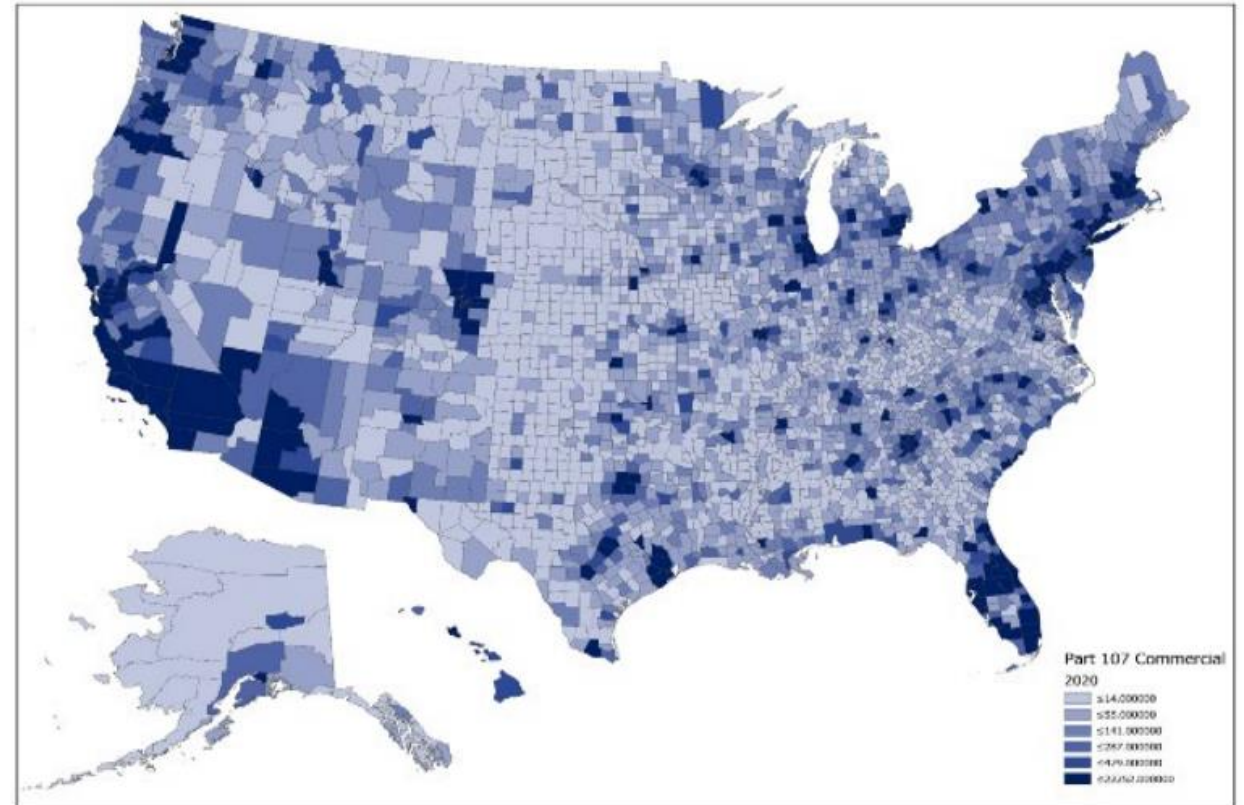
FAA UTM Conops v2.0 (2020)





# UAS Applications

- Type of Operations
  - Packaging Delivery
  - Precision Agriculture
  - Infrastructure Inspection
  - Public Safety
  - Surveillance
  - Shore to Ship deliveries



FAA Aerospace Forecasts FY21-41

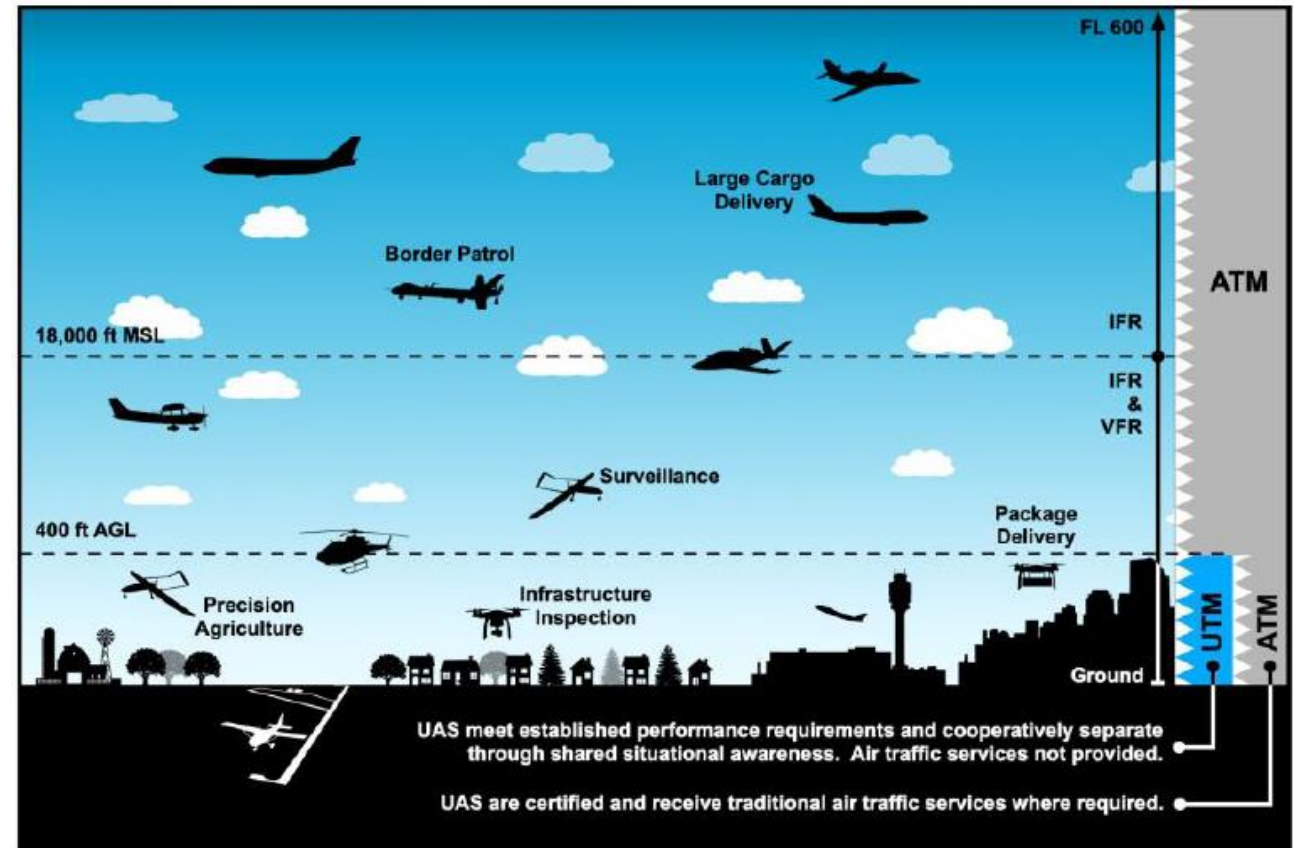






# UAS Integration into the NAS

- National Airspace System (NAS)
  - Network of US airspace and facilities
- Air Traffic Management (ATM)
  - Air and ground functions required to ensure safe and efficient movement of aircraft
- UAS Traffic Management (UTM)
  - Community-based, cooperative traffic management system where UAS operators are responsible



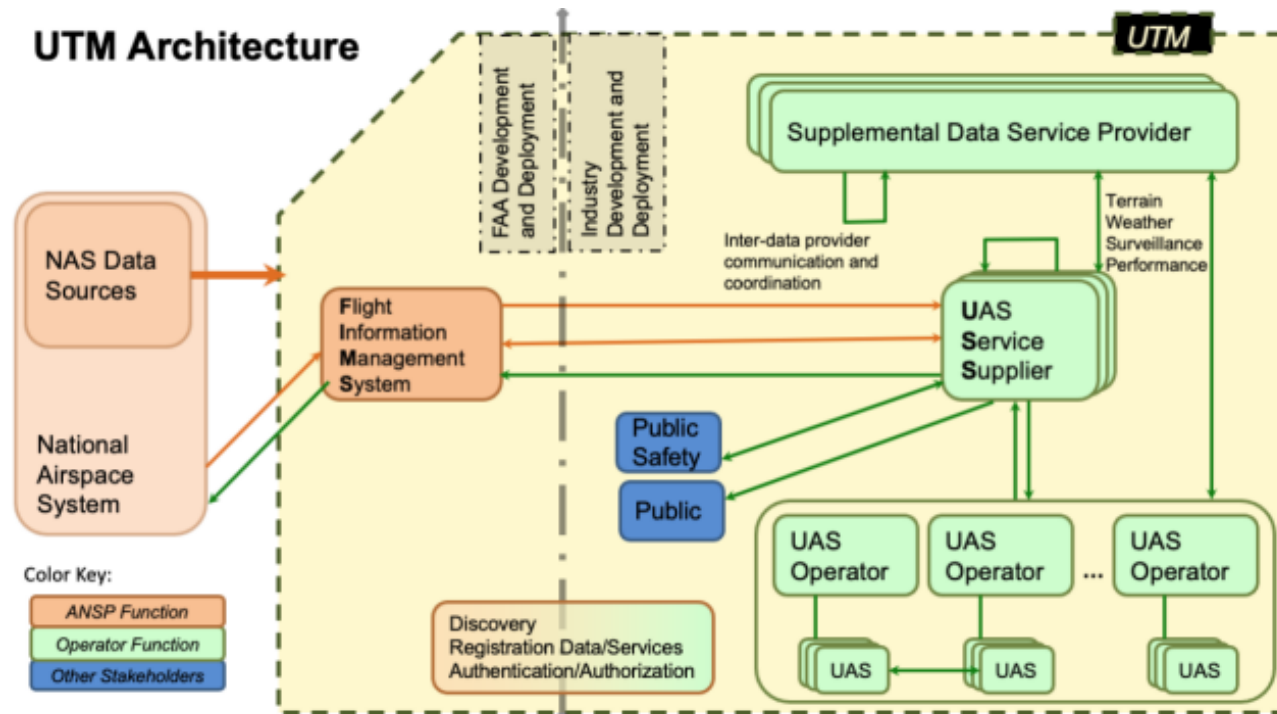
FAA UTM Conops v2.0 (2020)

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# UAS Traffic Management

- UTM architecture depicts how UAS operators and FAA interact
- Commercial UAS are required to register with FAA

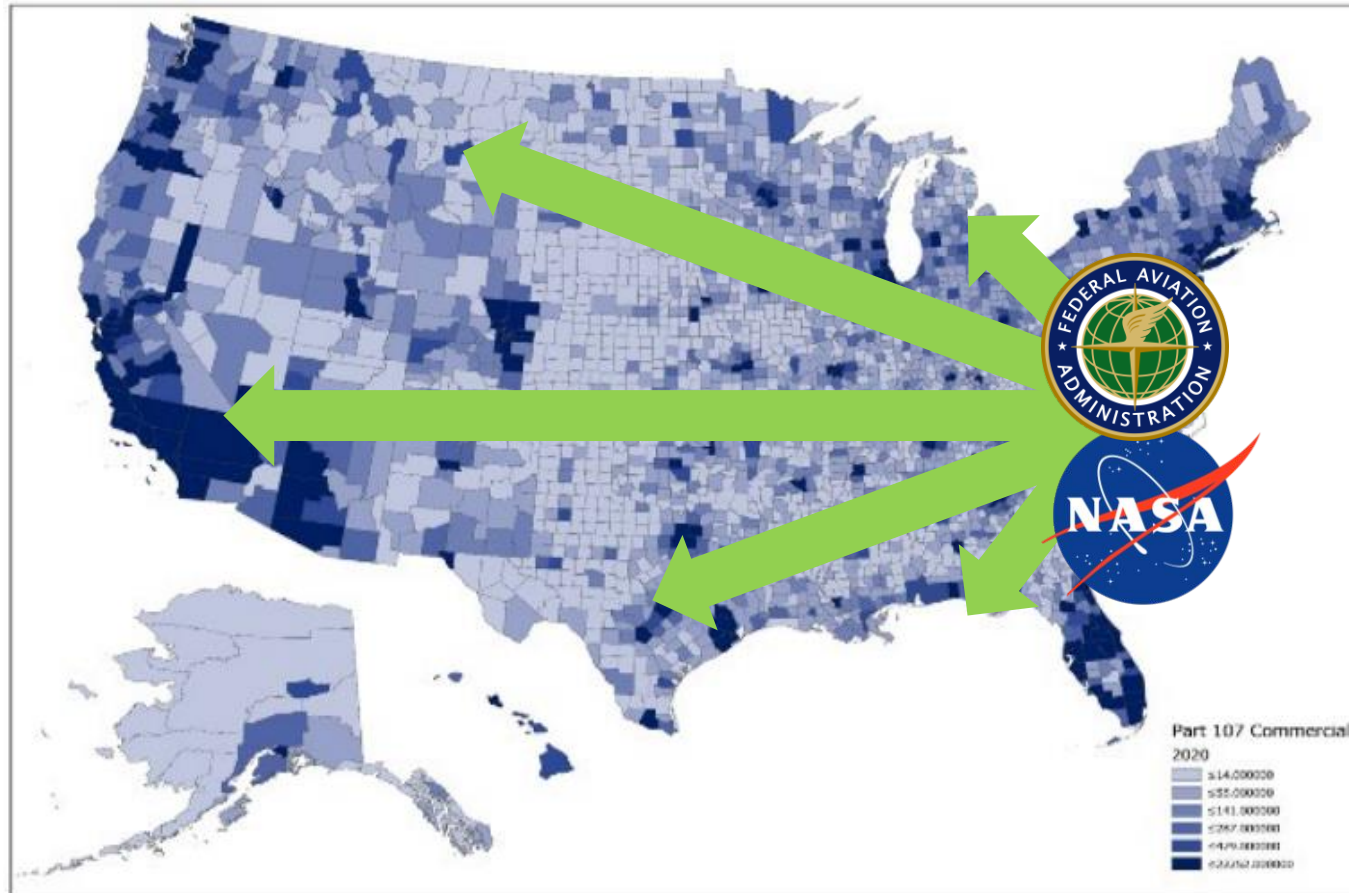


NASA xTM Research Paper (2021)





# Transition to State and Local Operators



- Need to transition UTM concepts and requirements to state and local use cases
- Ensure that local entities can readily access and apply requirements







# Public Safety UAS

- Public safety organizations are increasingly turning to UAS to enhance their missions
- But....



Guidehouse Insights Market Research (2020)





# Public Safety UAS

- ...many public safety organizations face challenges:
  - Technological constraints
  - Regulatory challenges
  - Lack of standards



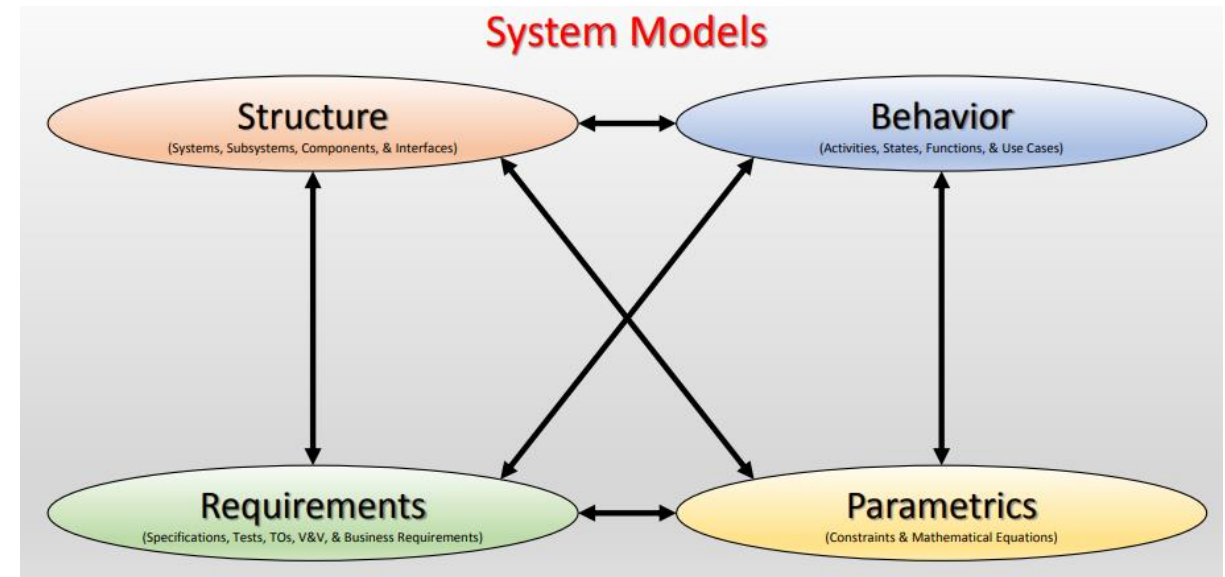
Guidehouse Insights Market Research (2020)





# MBSE Approach

- Leverage MBSE to model end-to-end processes for integration of key UAS use cases
- Benefits
  - Impact analysis from system changes
  - Traceability among system elements
  - Multiple views to facilitate stakeholder engagement

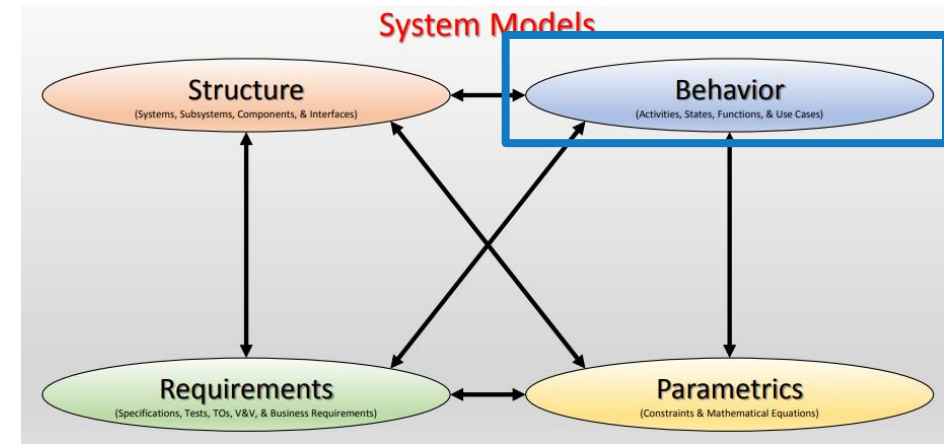


*INCOSE Welcome to SysML (2019)*



# Use Cases

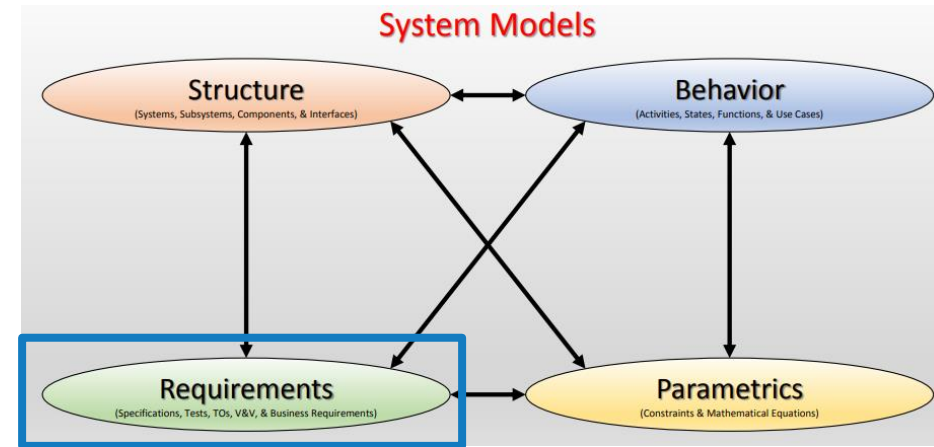
- First Responder
  - Respond to calls for service (i.e., 911)
  - Assess live situation
  - Gather intelligence
- Tactical Drone Deployment
  - Respond at the scene
  - May fly indoors
- Traffic Mapping
  - Accident investigations
  - SW needed for analysis of drone data





# Requirements

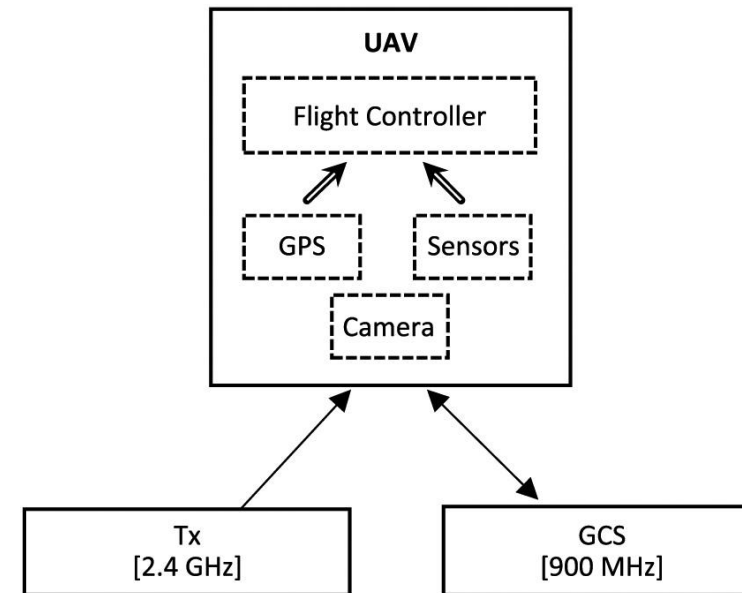
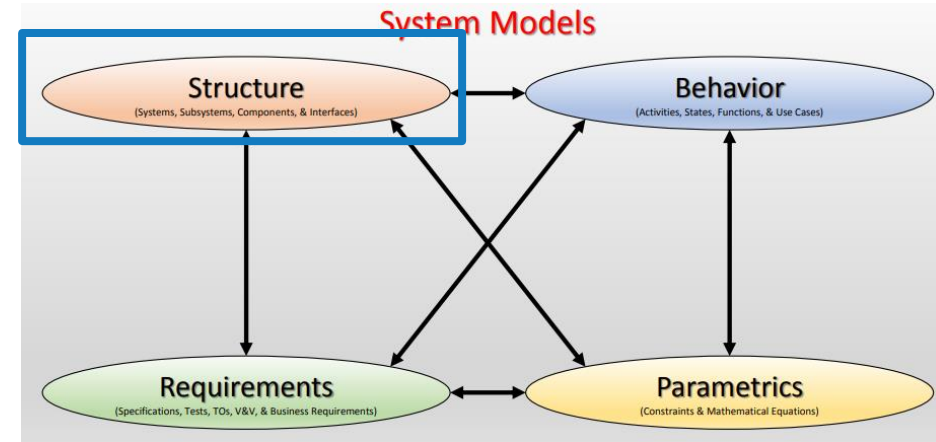
- Mission
  - Range
  - Flight Time
- Communication Interfaces
  - Command & Control
  - Among other UAS operators
- Operator Interfaces
  - Pilot
  - Officer





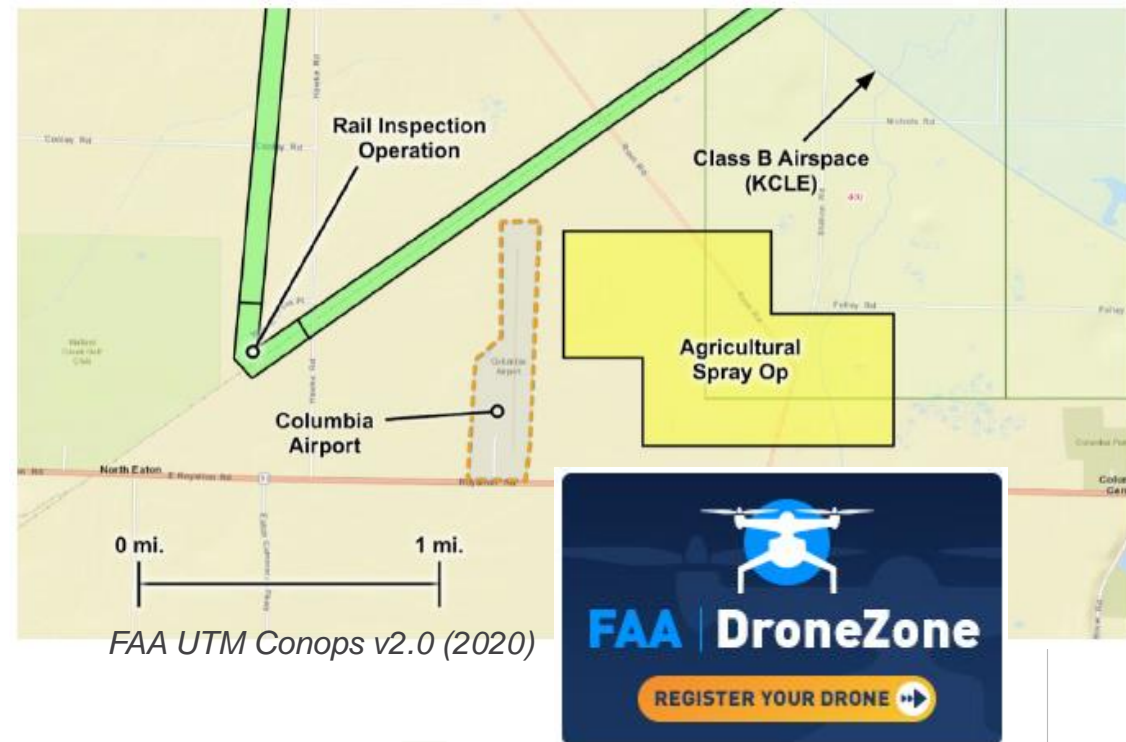
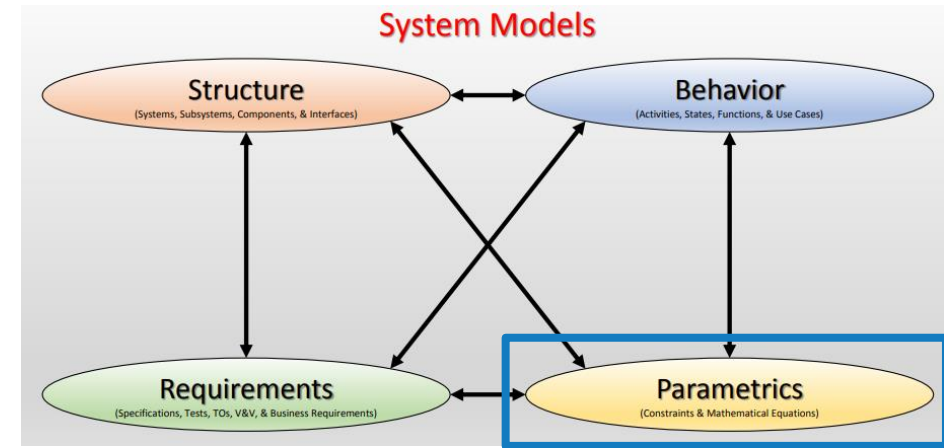
# System

- Aircraft Components
  - Telemetry radio
  - Sensors
  - Speaker
  - Payload
- Ground control station
  - Flight controller
  - Software platform



# Constraints

- Environment
  - Weather/Wind
  - Terrain
  - Obstacles
- Airspace
  - Restricted zones
- FAA Regulations
  - Part 107
  - Certificate of Authorization
  - BLVOS Waiver
- Local Regulations



# Looking Forward



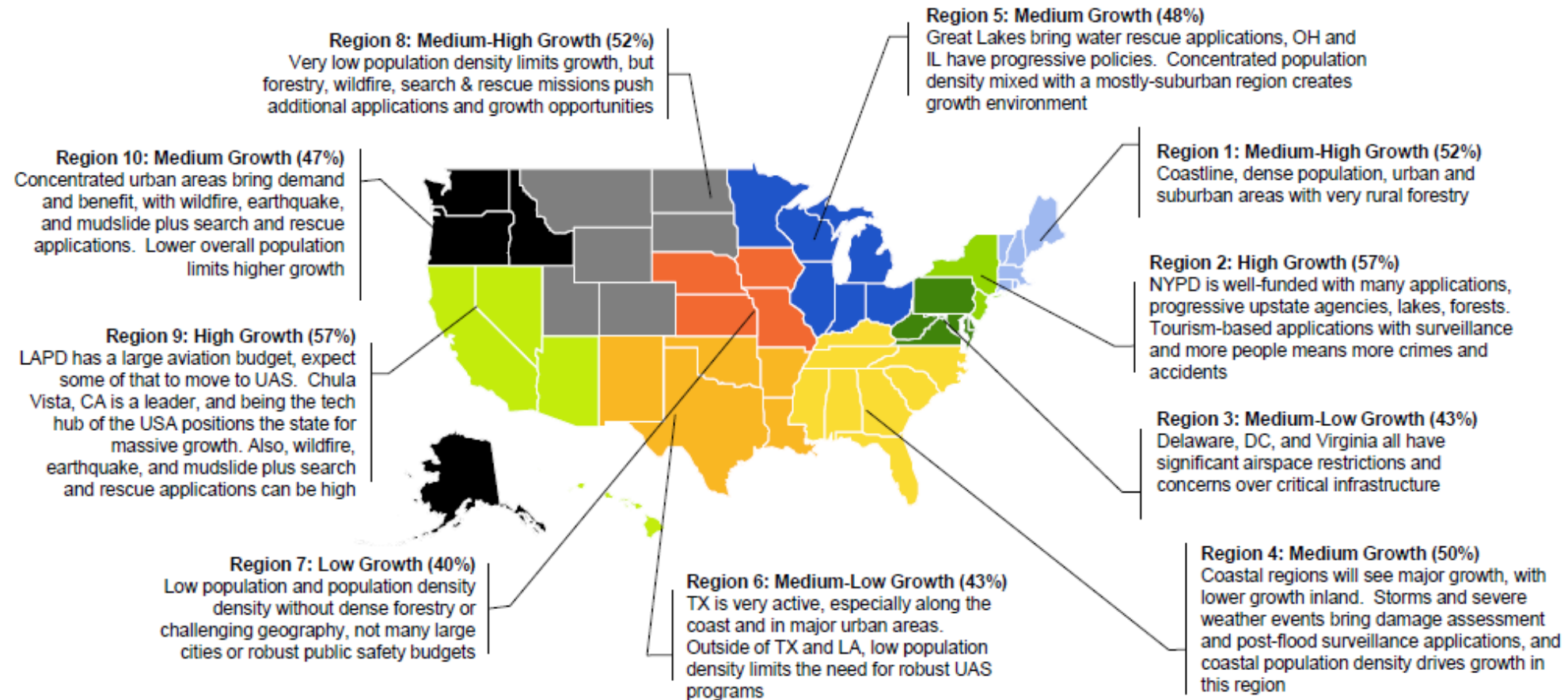
What's next?



# UAS Growth



## Regional Growth Factors for Public Safety UAS Programs: 2020-25



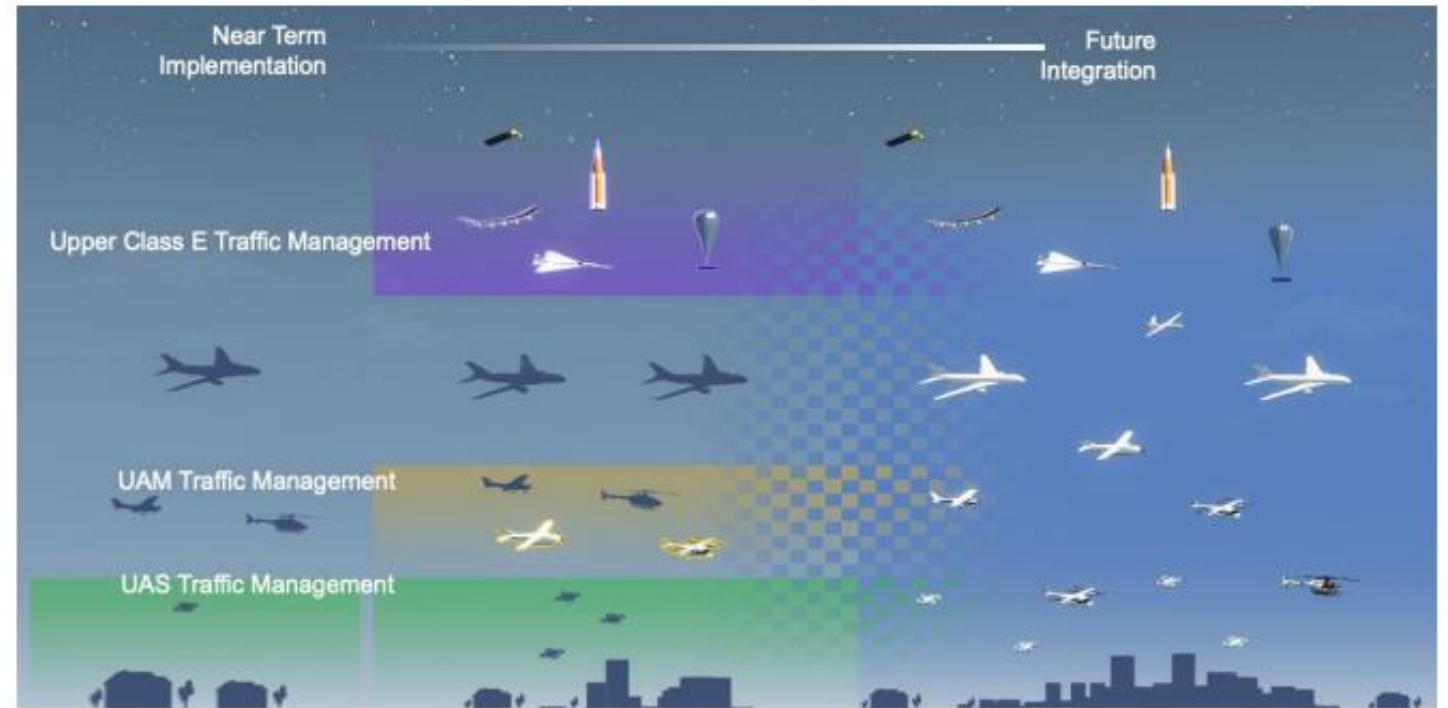
Guidehouse Insights Market Research (2020)





# New Entrants

- Future new entrants
  - Urban Air Mobility (UAM)
  - Advanced Air Mobility (AAM)
  - Upper Class E Traffic Mgmt (ETM)



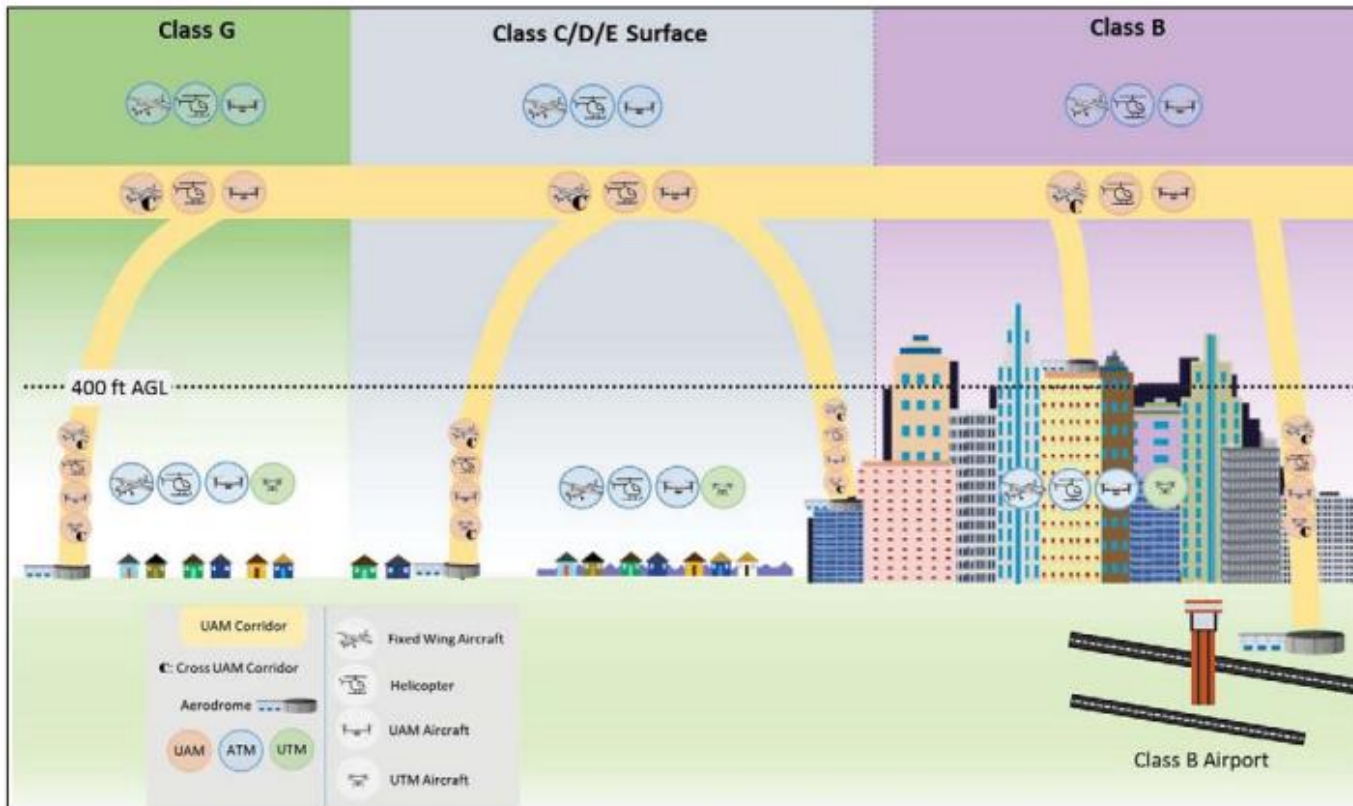
NASA xTM Research Paper (2021)

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# Integrated Regional Corridors



FAA UAM Conops v1.0 (2020)

- Multiple layers of crewed and uncrewed operations
- Increased system complexity
- Changes to the mission space





# Key Takeaways

- A model-based approach will facilitate **improved development and implementation** of public safety UAS programs
- Holistic review of use cases and requirements enable **shared UAS solutions** across regions and jurisdictions
- Integrated model allows jurisdictions to **more effectively respond** to changes in regulations and potential addition of new entrants



# Continue the Conversation!



<https://www.cna.org/centers/ipr/>

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[IPR's Guiding Principles](#)

**CNA**  
selected as a Stage 1 winner!  
First Responder UAS Triple Challenge 3.3:  
Shields Up! Securing UAS Navigation & Control  
**STAGE 1**  
winner

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