



**Unmanned Aircraft System Traffic Management (UTM) Project**

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# UTM Project Summary

- Objective
  - Develop and validate airspace operations and integration requirements to enable safe, large-scale UAS operations in low-altitude airspace.
- Approach
  - Partner with FAA and industry to design and test prototype UTM system
  - Develop Concept of Operations and software development for system components
  - Field test UTM system and vehicle/ground technologies for validation
  - Conduct real-time and fast-time simulations; system hazard analysis
- Outcomes
  - Tech transfer to FAA and industry
  - Inform regulators
  - Guidance to industry
  - International harmonization
- Schedule
  - FY15 - FY20

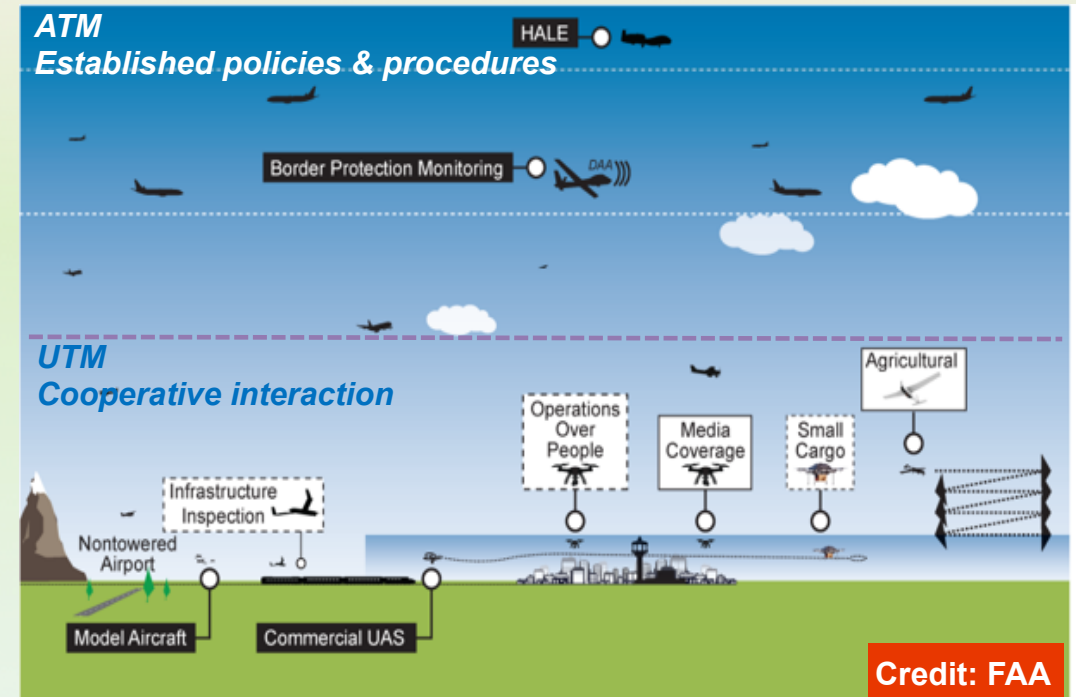
# Why is UTM Needed?

- FAA small UAS forecast – 7 million total, 2.6 million commercial by 2020
  - Many use cases: package delivery, news collection, precision agriculture, infrastructure inspections, public safety, disaster response, etc.
- New entrants desire access and flexibility for operations
- Current users want to ensure safety and continued access
- Regulators need a way to put structure as needed
  - Current approach for air traffic control of manned aircraft won't scale up for small UAS operations
  - Need to assure safe integration into the National Airspace



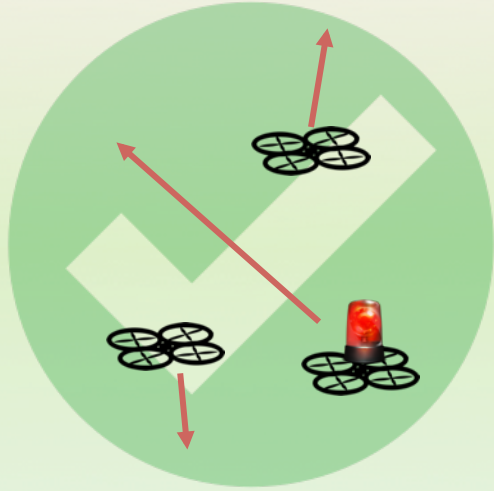
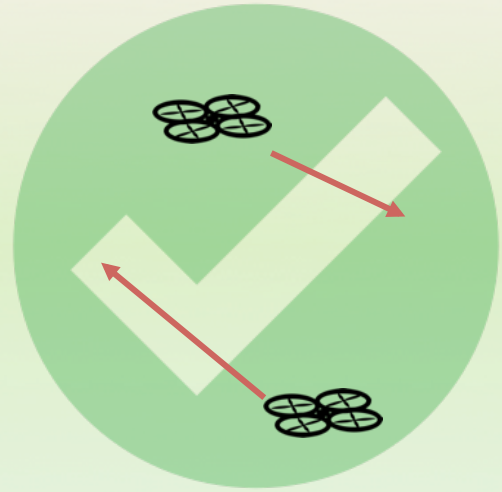
# What is UTM?

- UTM is an “air traffic management” ecosystem for uncontrolled airspace
- UTM utilizes industry’s ability to supply services under FAA’s regulatory authority where these services do not exist
- UTM development will ultimately enable the management of large scale, low-altitude UAS operations
  - Operational concept will address beyond visual line of sight UAS operations under 400 ft. AGL, Class G airspace
  - Roles/responsibilities of FAA and operators
  - Information architecture, data exchange protocols, software functions
  - Performance requirements

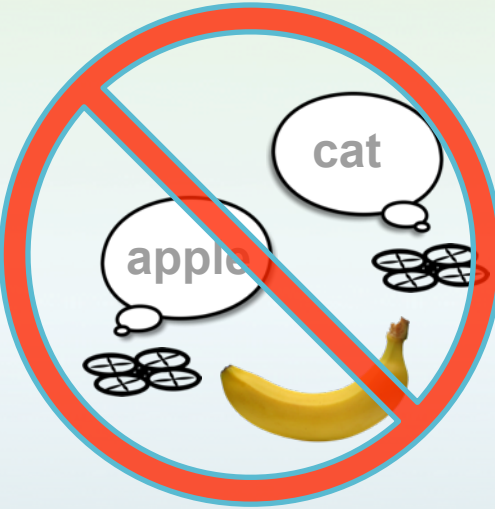




# UTM Principles (Things That UTM Will Help With)



VS





# Key Operational Assumptions

- FAA maintains regulatory *AND* operational authority for airspace and traffic operations
- UTM is used by FAA to issue directives, constraints, and airspace configurations
- Air traffic controllers **are not required** to actively “control” every UAS in uncontrolled airspace or uncontrolled operations inside controlled airspace
- FAA has on-demand access to airspace users and can maintain situation awareness through UTM
- UTM roles/responsibilities: Regulator, UAS Operator, and UAS Service Supplier (USS)
- FAA Air Traffic can institute operational constraints for safety reasons anytime

**Key principle is safely integrate UAS in uncontrolled airspace without burdening current ATM**



# Technical Capability Levels (TCL)



Risk-based development and test approach along four distinct TCL



## TCL1

Remote Population  
Low Traffic Density  
Rural Applications  
Multiple VLOS  
Operations  
Notification-based  
Operations

## TCL 2

Sparse Population  
Low-Mod Traffic Density  
Rural / Industrial  
Applications  
Multiple BVLOS  
Operations  
Tracking and  
Operational Procedures

## TCL 3

Moderate Population  
Moderate Traffic Density  
Suburban Applications  
Mixed Operations  
Vehicle to Vehicle  
Communication  
Public Safety Operations

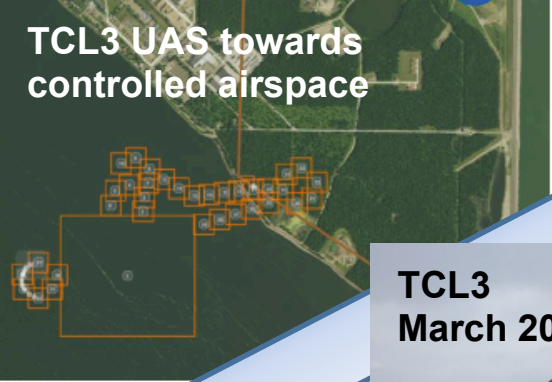
## TCL 4

Dense Population  
High Traffic Density  
Urban Applications  
Dense BVLOS Operations  
Large Scale Contingency  
Management

# TCL 1, 2 and 3 (in progress)



TCL3 UAS towards controlled airspace



TCL3  
March 2018



TCL 3

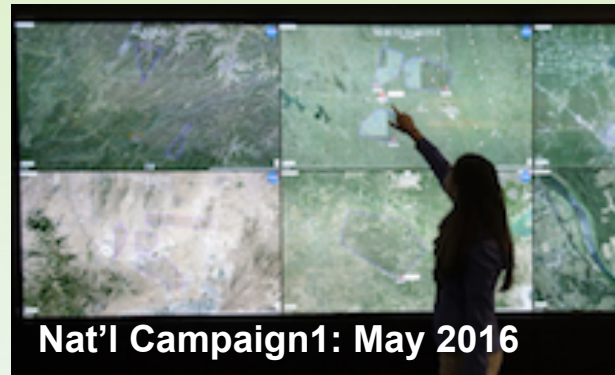
Nat'l Campaign 2:  
May 2017



TCL3 First Responders



Nat'l Campaign 1: May 2016



TCL 2



Nat'l Campaign 2

TCL 1 demo:  
August 2015



TCL 1

**Operational Area**

UAS Range  
Elevation: 5050 feet  
Desert Terrain  
Missions up to 500 ft  
Operations at 5 Locations

State of Nevada Test Site  
Reno-Stead Airport

Reno

SRHawk Radar  
Used to detect small UAS

Weather Equipment  
30 ft tower used to collect weather data

LSI  
Used to detect manned aircraft

Reno-Stead Airport

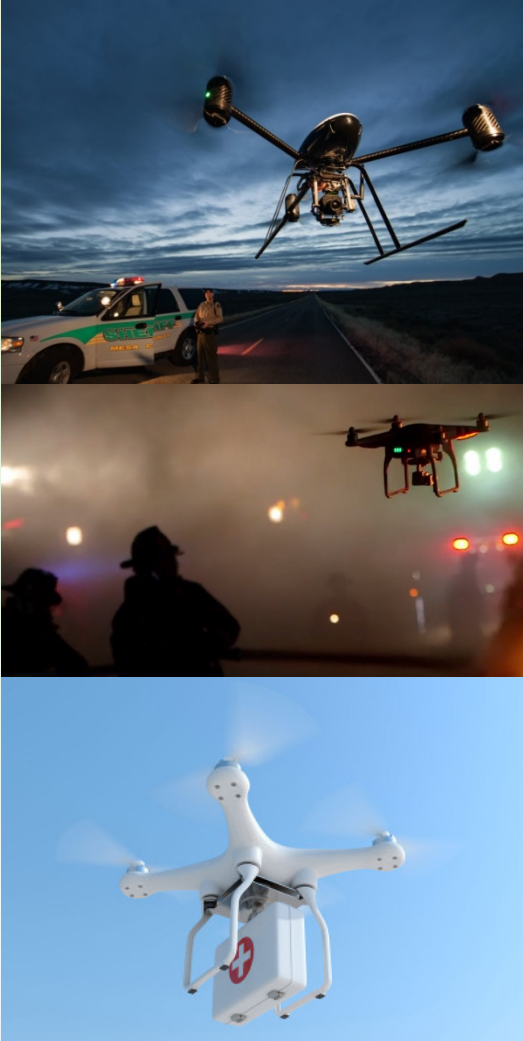
**TCL 2 demo:  
Oct 2016**

## Participating Orgs

TCL 1	19
TCL 2	42
TCL 3	35



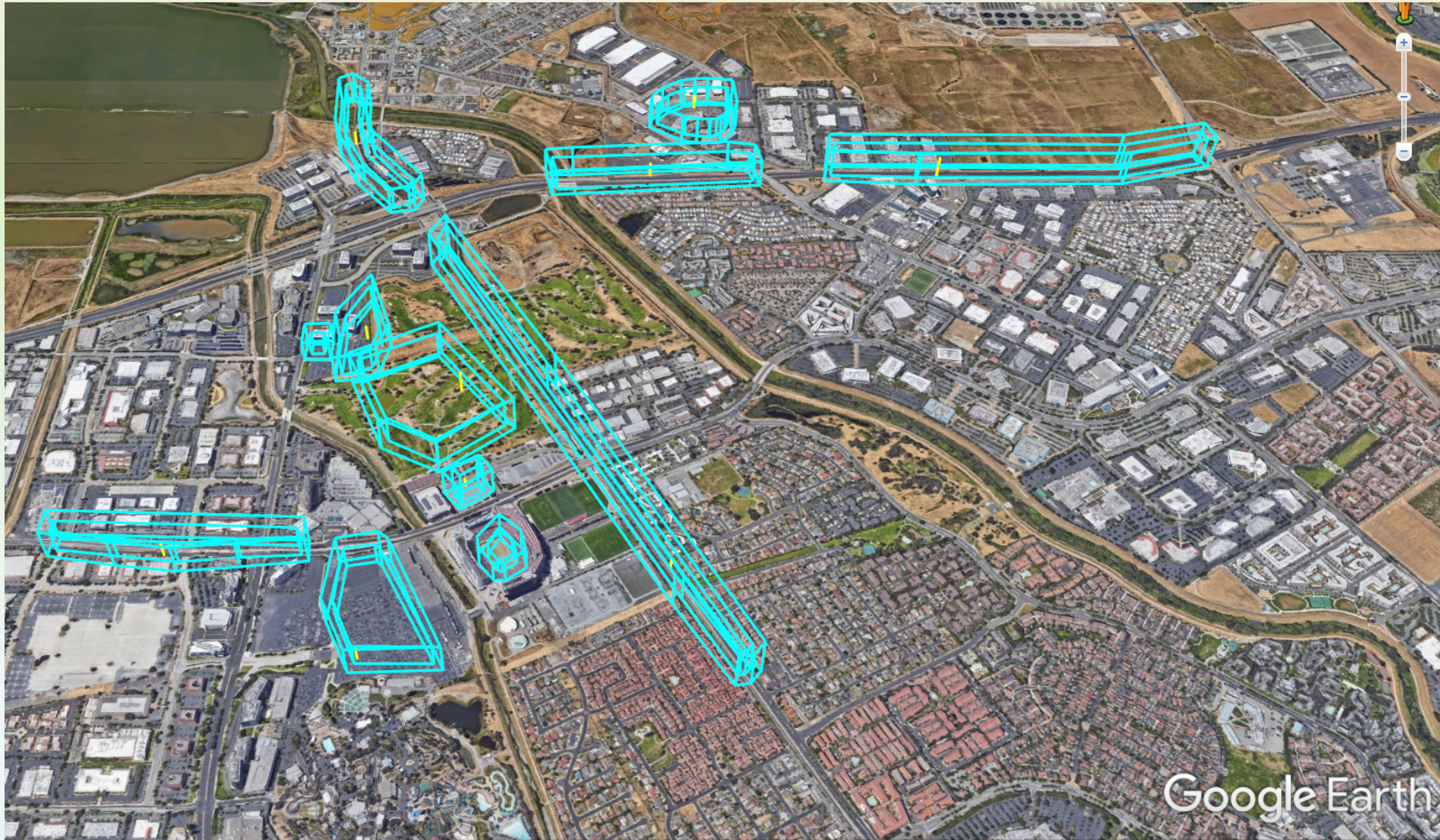
# UTM and Public Safety



- Public safety operations using small UAS are becoming increasingly common
- Gaining perspective from the public safety community is important in understanding how UTM can best support operational needs
- Commercial and public safety operations need to be safely integrated
- UTM Principle: Provide priority access for public safety operations



# UTM Public Safety Example



Nominal UTM operations. Diverse set of concurrent missions and use cases.



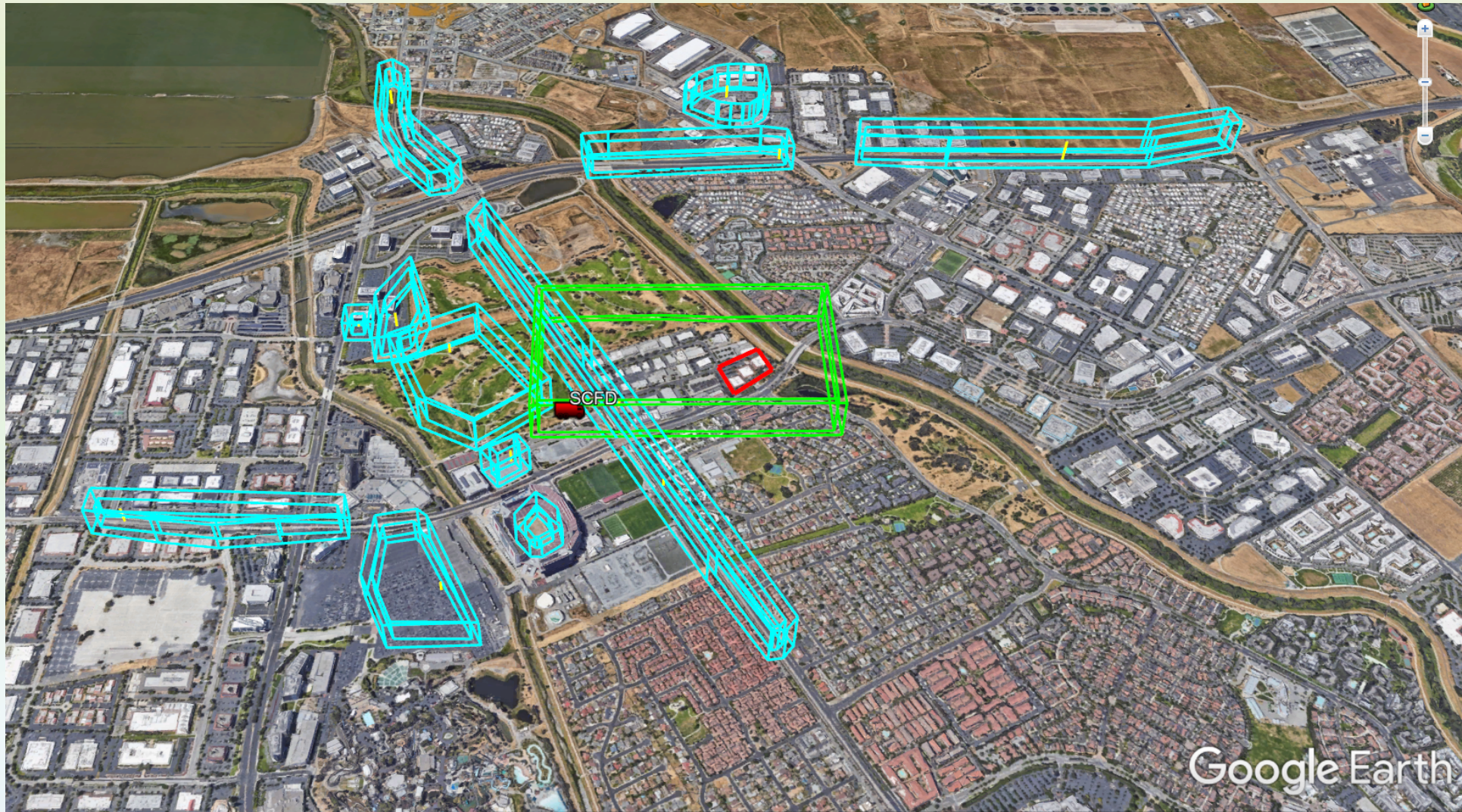
# UTM Public Safety Example



Incident reported in the area that requires rapid response.



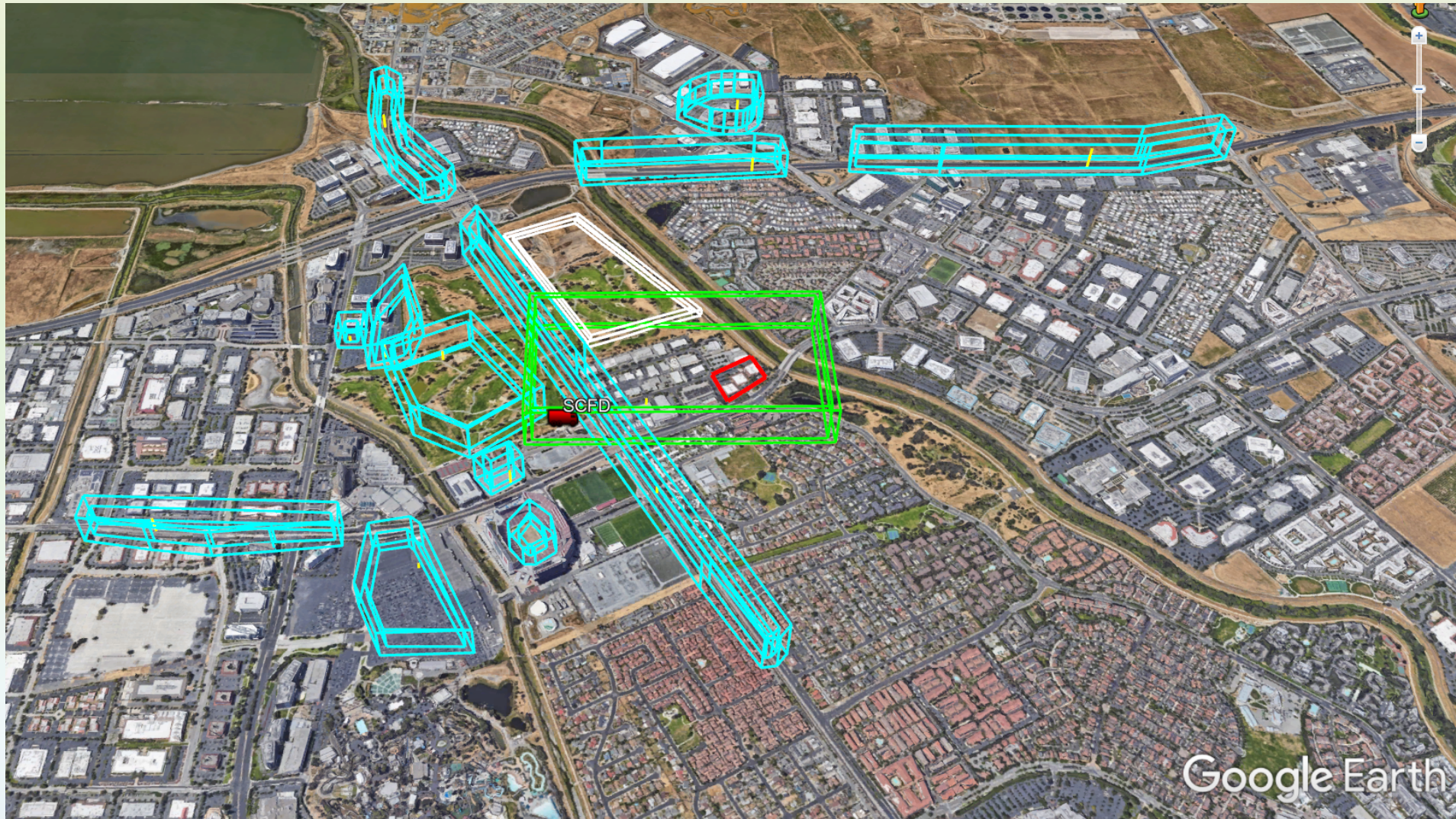
# UTM Public Safety Example



Fire department quickly plans and communicates intent for its UAS response to the network.



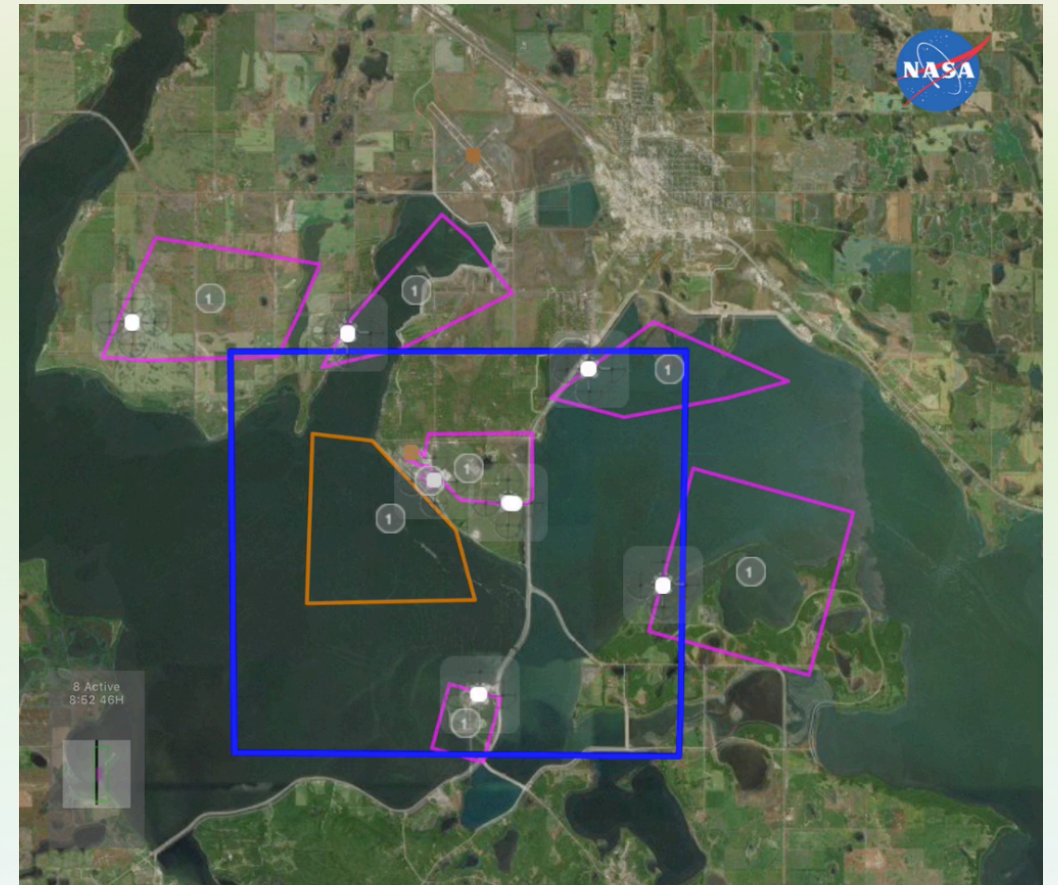
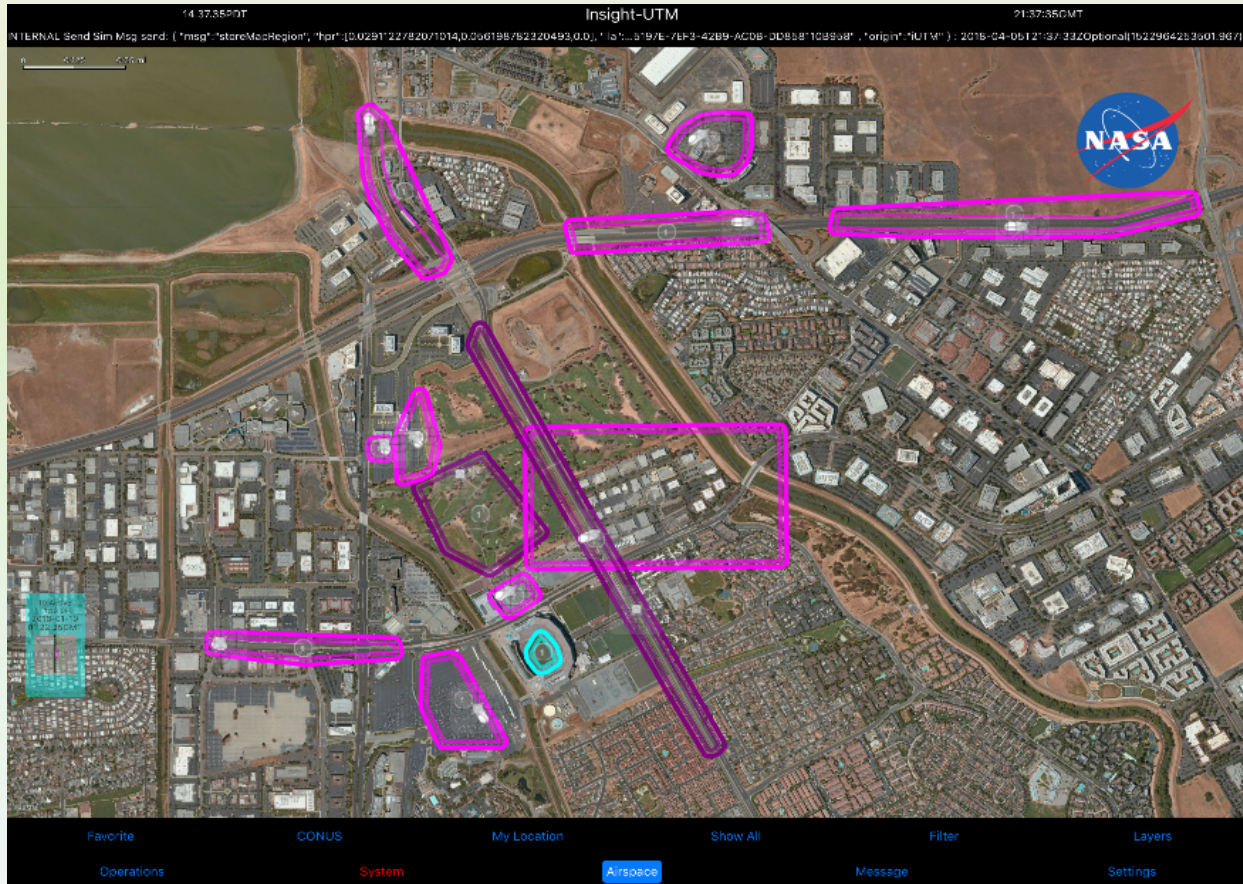
# UTM Public Safety Example



Affected operations are notified of the need for priority access to the airspace.



# Simulation and Testing



- Public safety use cases and concept exploration are taking place in simulation and live flight demonstrations
- TCL 2 and 3 flight demonstrations included elements of public safety and plans are in progress for further incorporation in the TCL 4 demonstration





# Summary

- **UTM is successfully developing the framework** for large scale, small UAS traffic management. See UTM website for publications: <https://utm.arc.nasa.gov/documents>
- **TCL Demonstrations include many testing organizations, industry, and academia partners** that are crucial to validating requirements and investigating technology solutions
- **NASA and the FAA are closely collaborating** to ensure appropriate regulatory and operational requirements are included and that technology transfers support the development of future operational systems
- **Ensuring that UTM supports public safety applications of small UAS** is a principle and active area of collaborative research