



AERONAUTICS
WITH YOU WHEN YOU FLY

Unmanned Aircraft System Traffic Management (UTM) Project

Jeffrey Homola, UTM Integration & Testing Lead



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

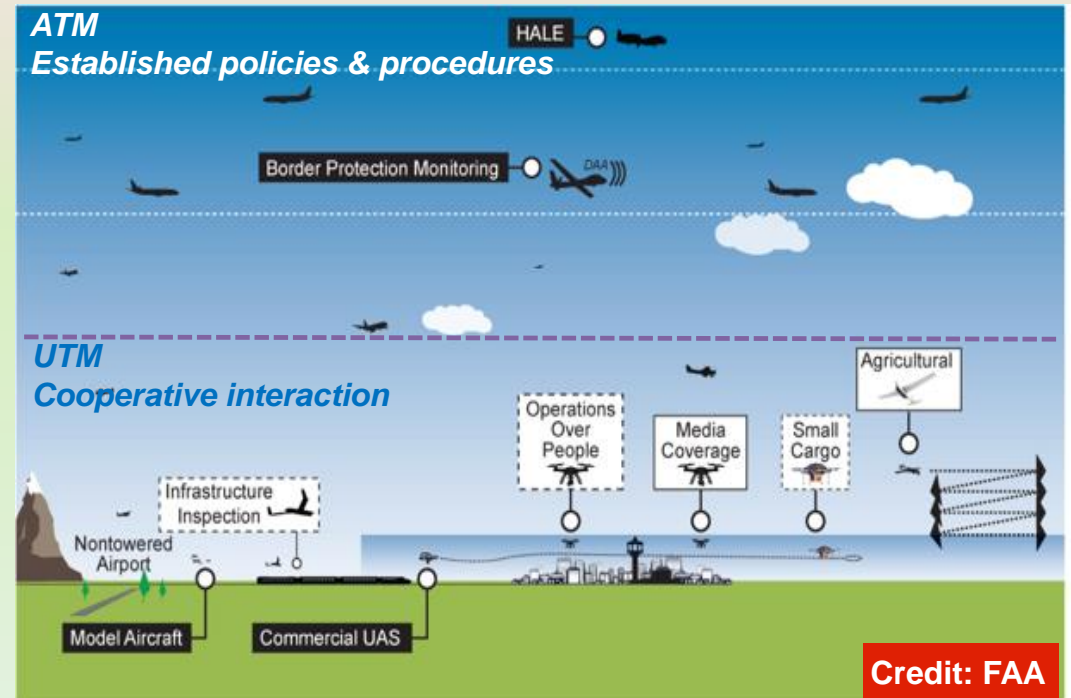
Why is UTM Needed?

- 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

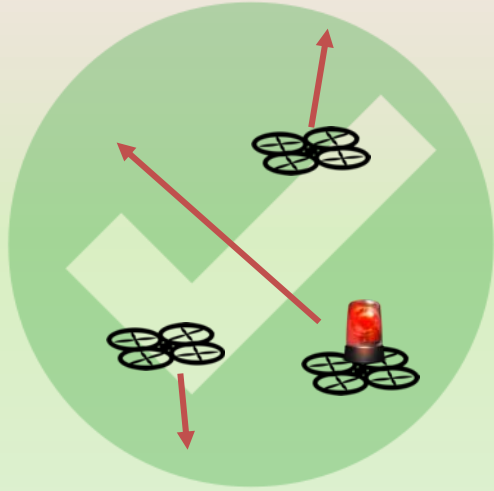
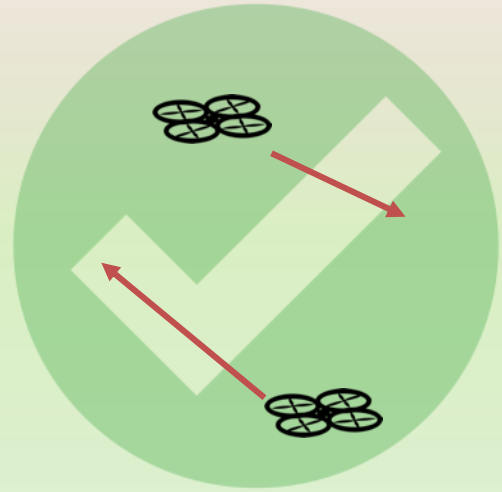


What is UTM?

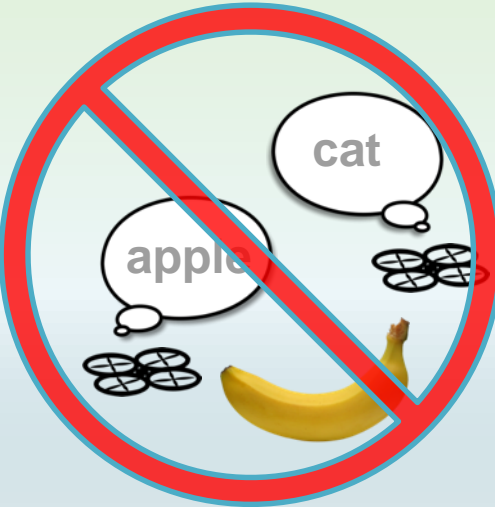
- UTM is an “air traffic management” ecosystem for uncontrolled airspace
- UTM utilizes industry’s ability to supply services under FAA’s regulatory authority where these services do not exist
- UTM development will ultimately enable the management of large scale, low-altitude UAS operations
 - Operational 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

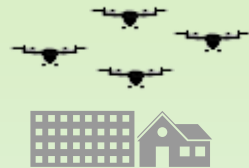
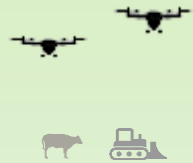
- FAA maintains regulatory *AND* operational authority for airspace and traffic operations
- UTM is used by FAA to issue directives, constraints, and airspace configurations
- Air traffic controllers **are not required** to actively “control” every UAS in uncontrolled airspace or uncontrolled operations 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

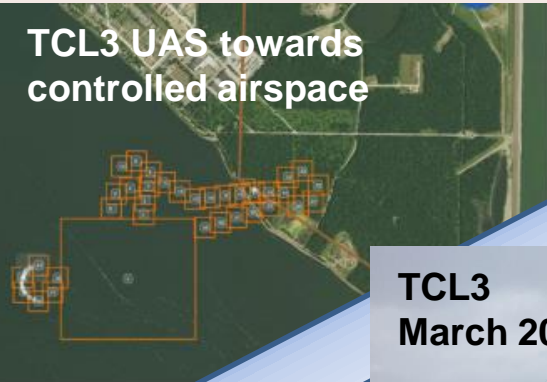
TCL 4

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

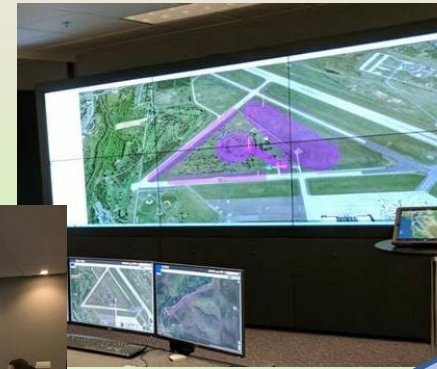


TCL 3

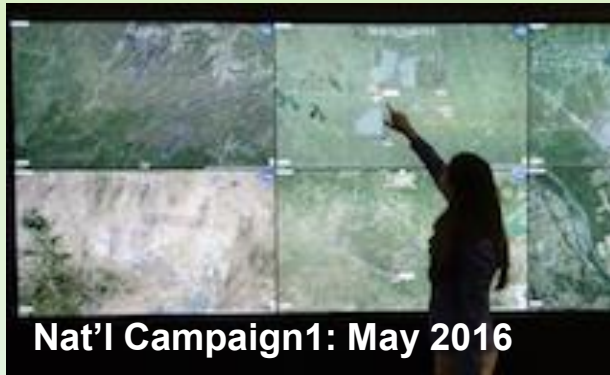
TCL3 First Responders



Nat'l Campaign 2:
May 2017



Nat'l Campaign 1: May 2016



TCL 2



Nat'l Campaign 2

TCL 1 demo:
August 2015



TCL 1

TCL 2 demo: Oct 2016

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

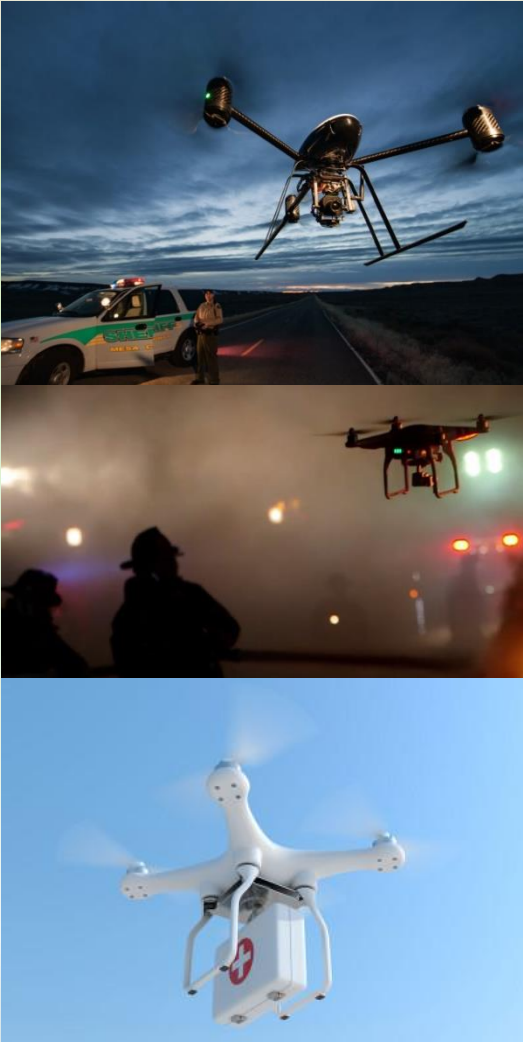
Weather Equipment
30 ft tower used to measure wind speed and direction at 10 ft layer

LST
Used to detect manned aircraft

Participating Orgs

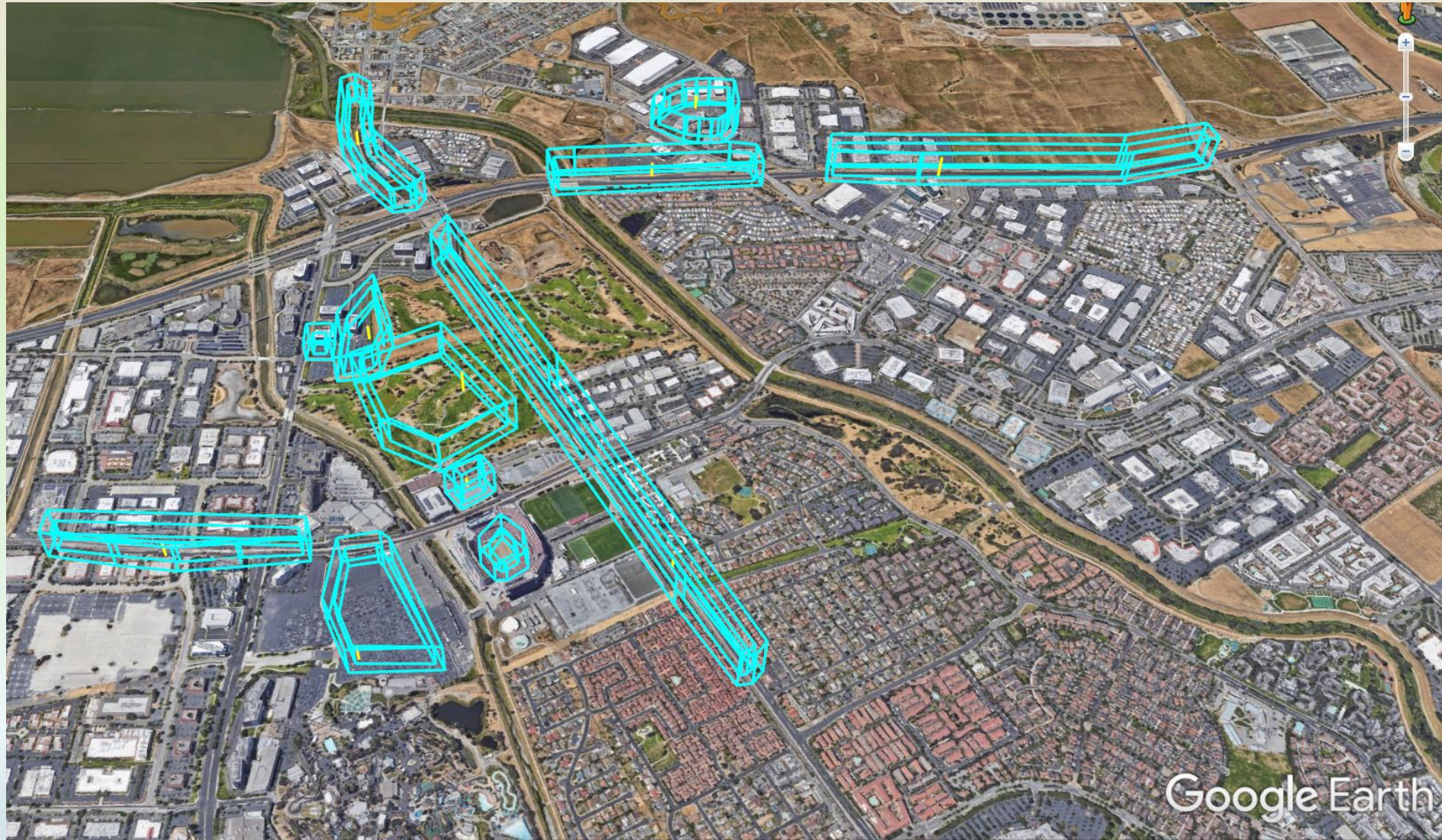
TCL 1	19
TCL 2	42
TCL 3	35

UTM and Public Safety



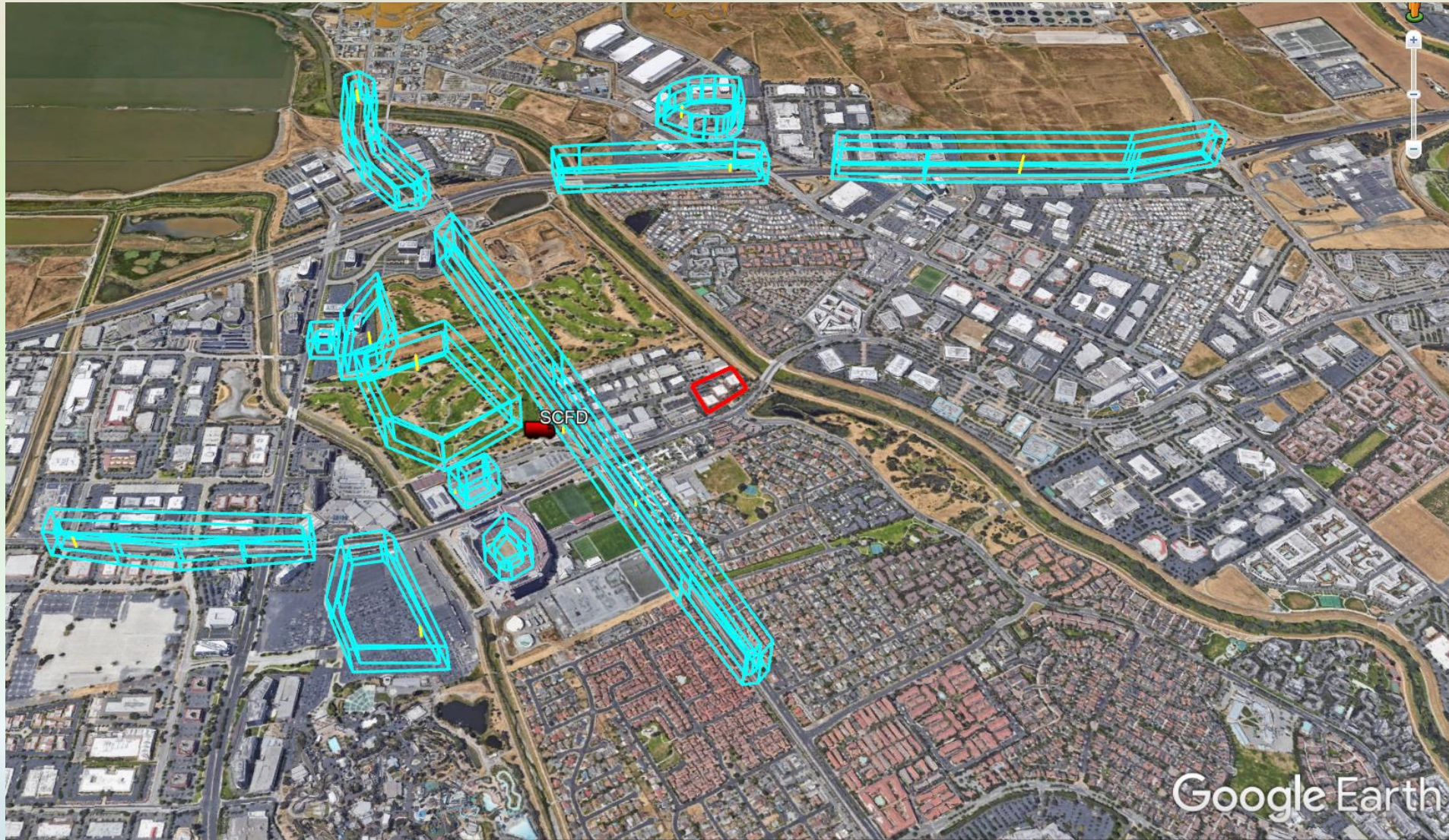
- Public safety operations using small UAS are becoming increasingly common
- Gaining perspective from the public safety community is important in understanding how UTM can best support operational needs
- Commercial and public safety operations need to be safely integrated
- UTM Principle: Provide priority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

UTM Public Safety Example



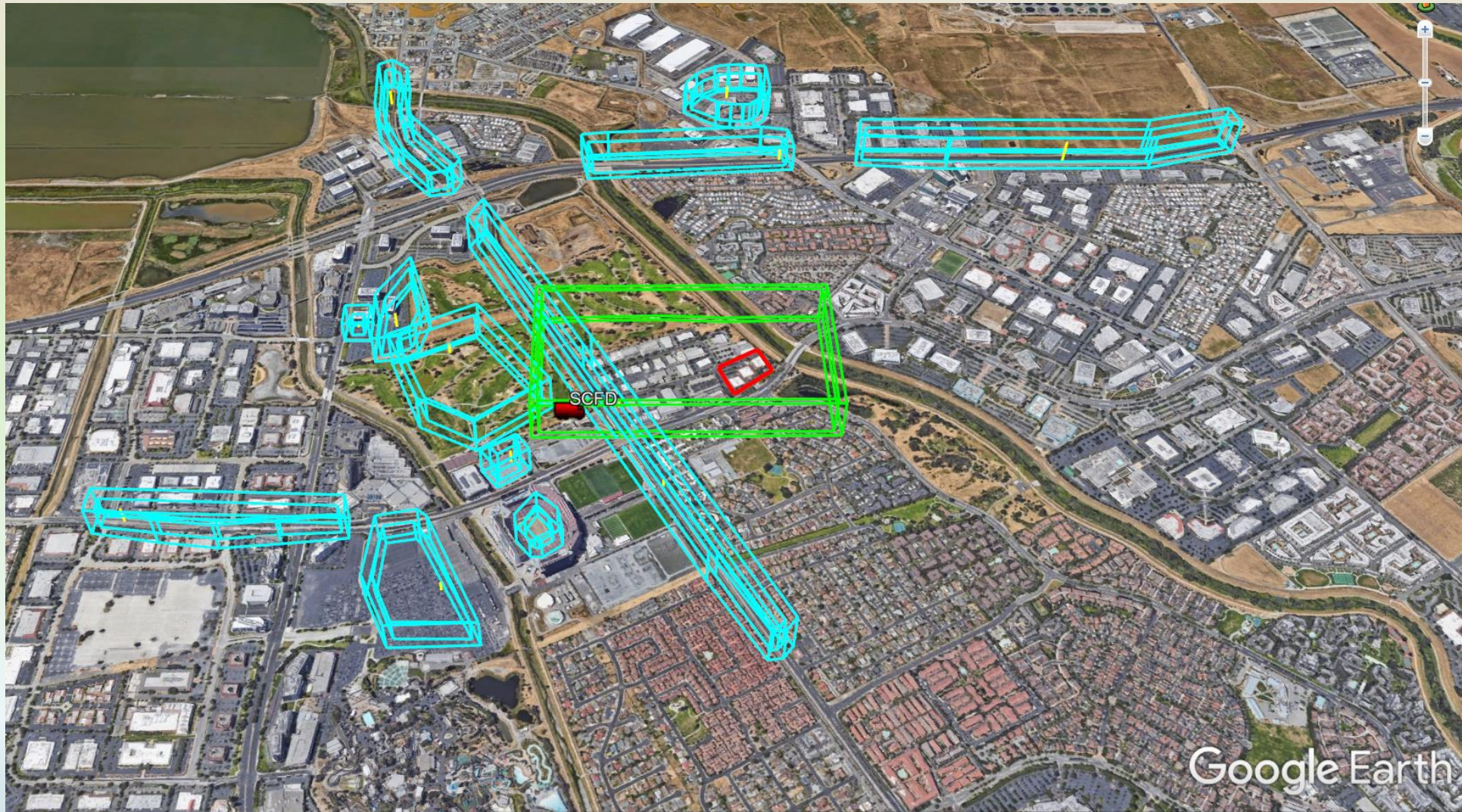
Nominal UTM operations. Diverse set of concurrent missions and use cases.

UTM Public Safety Example



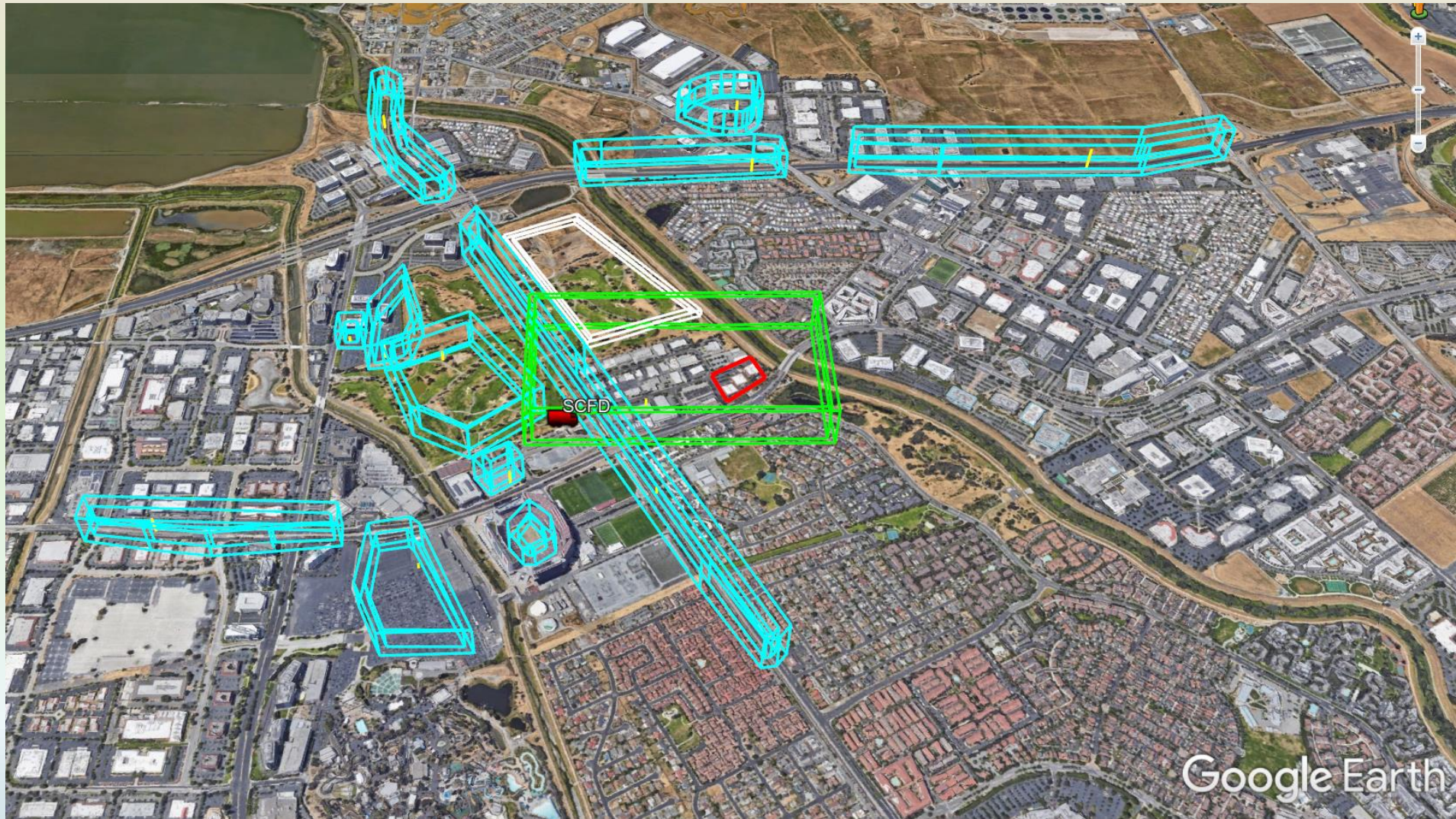
Incident reported in the area that requires rapid response.

UTM Public Safety Example



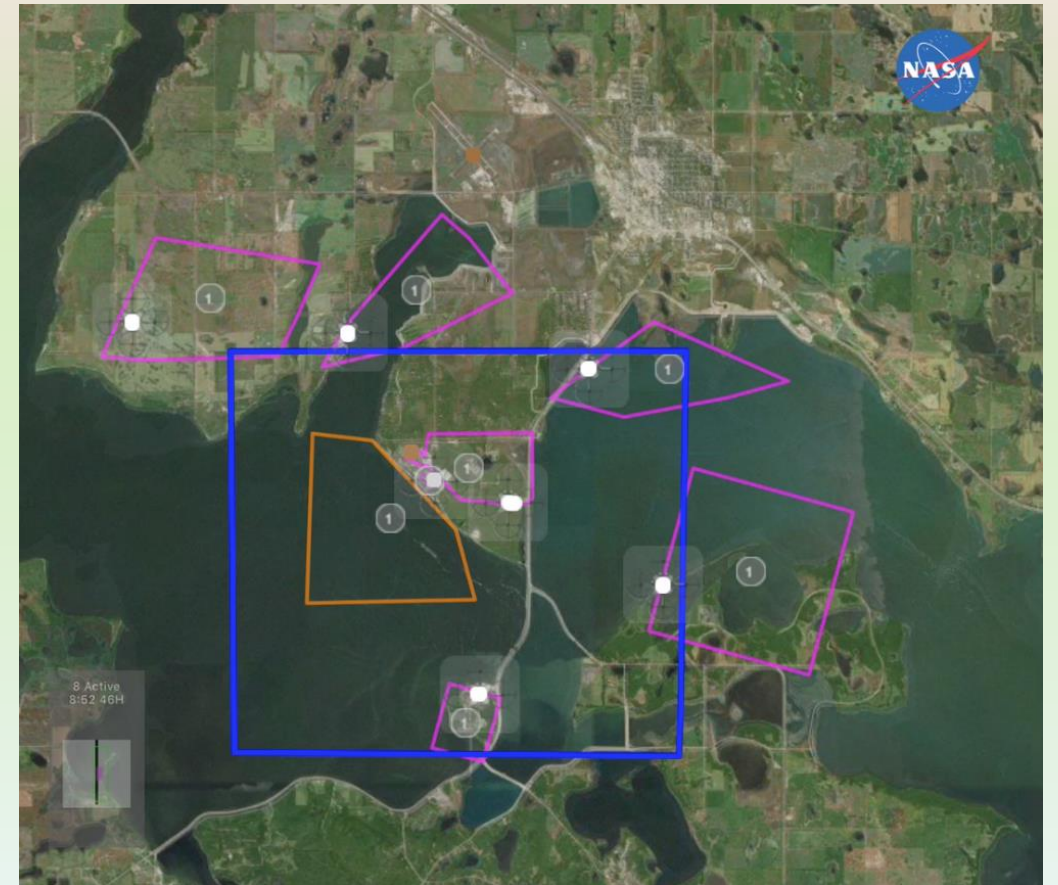
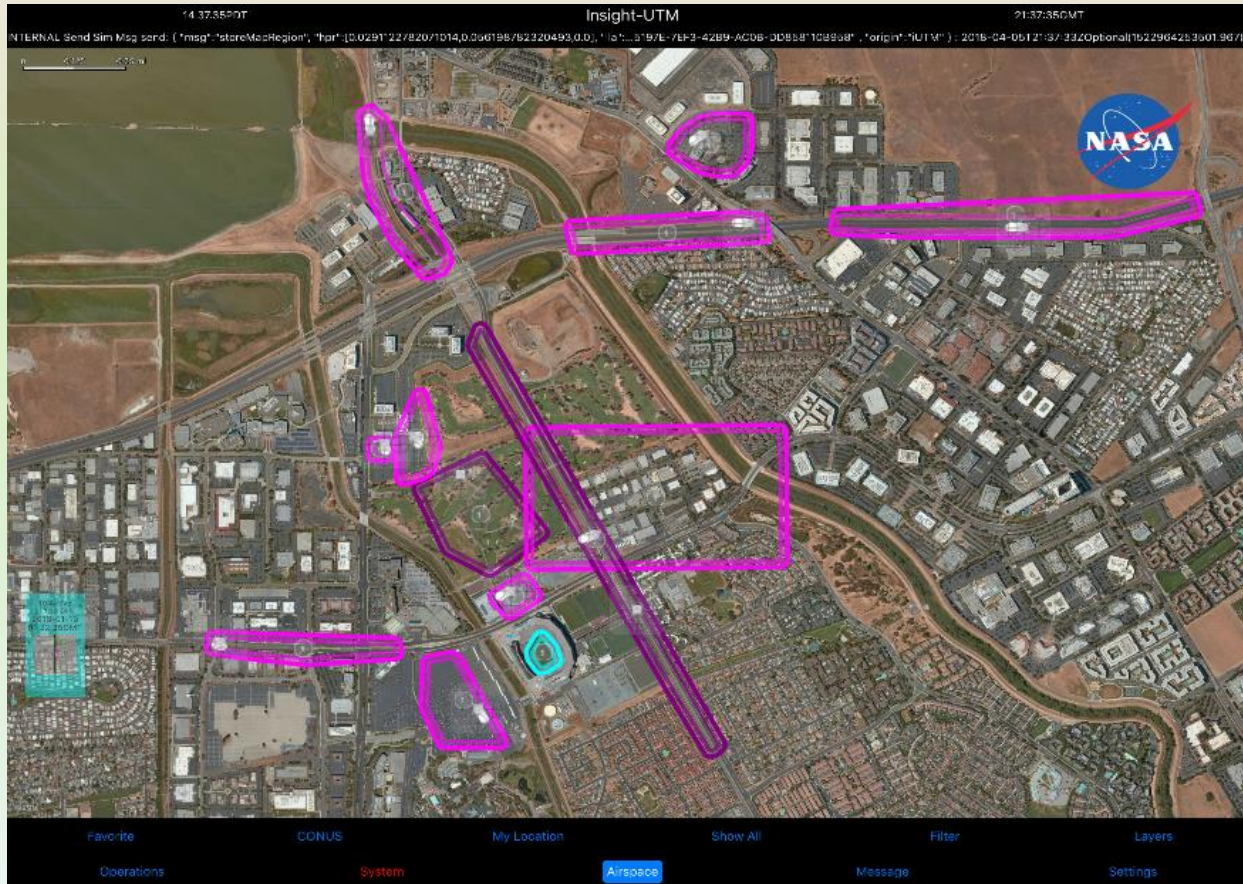
Fire department quickly plans and communicates intent for its UAS response to the network.

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