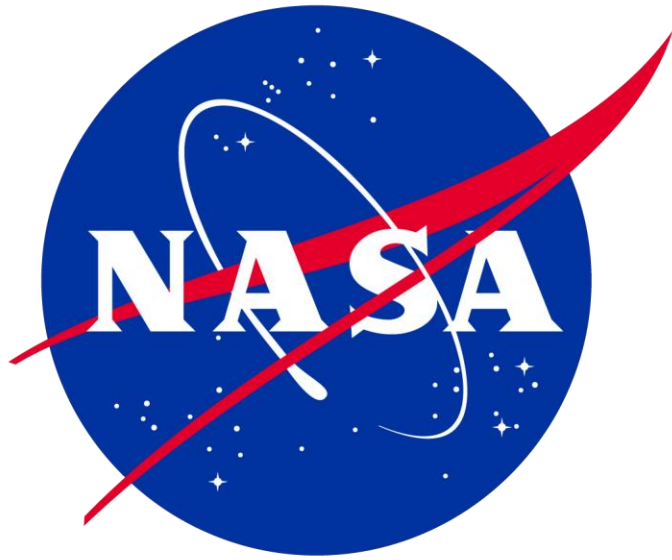


UTM

UAS TRAFFIC MANAGEMENT

NASA/Bay Area Public Operators UAS Engagement

Oct 29, 2024



Introductions

Time	Topic	Presenter	Room
10:00	Introductions	Assoc. Center Director - Amir Deylami	100
10:15	UTM BVLOS Project: <ul style="list-style-type: none"> Background UTM Key Site Operational Evaluation Bay Area Key Site Expansion 	Joey Rios Al Capps Abhay Borade	100
11:00	Public Operations Representation	Gita Hodell	100
11:20	Key Issues for Public Operations: <ul style="list-style-type: none"> Prioritization of Public Safety Planning Intent with Uncertainty Sensitive Operational Data 	Gita Hodell Abhay Borade	100
12:00	Lunch (on your own)		
13:00	Q&A	Gita Hodell	100
13:30	UTM demo	Airspace Operations Lab	214
14:30	Debrief	Gita Hodell	100
15:00	Next Steps & Wrap-up	Gita Hodell	100

Lunch Options – Pre-Order Available

On-site:

The Space Bar (can be pre-ordered for pickup)

Off-site (close 5 min drive):

Specialty's Café & Bakery (can be pre-ordered for pickup)

Wagon-Wheel BBQ

Las Adelitas



UTM project:

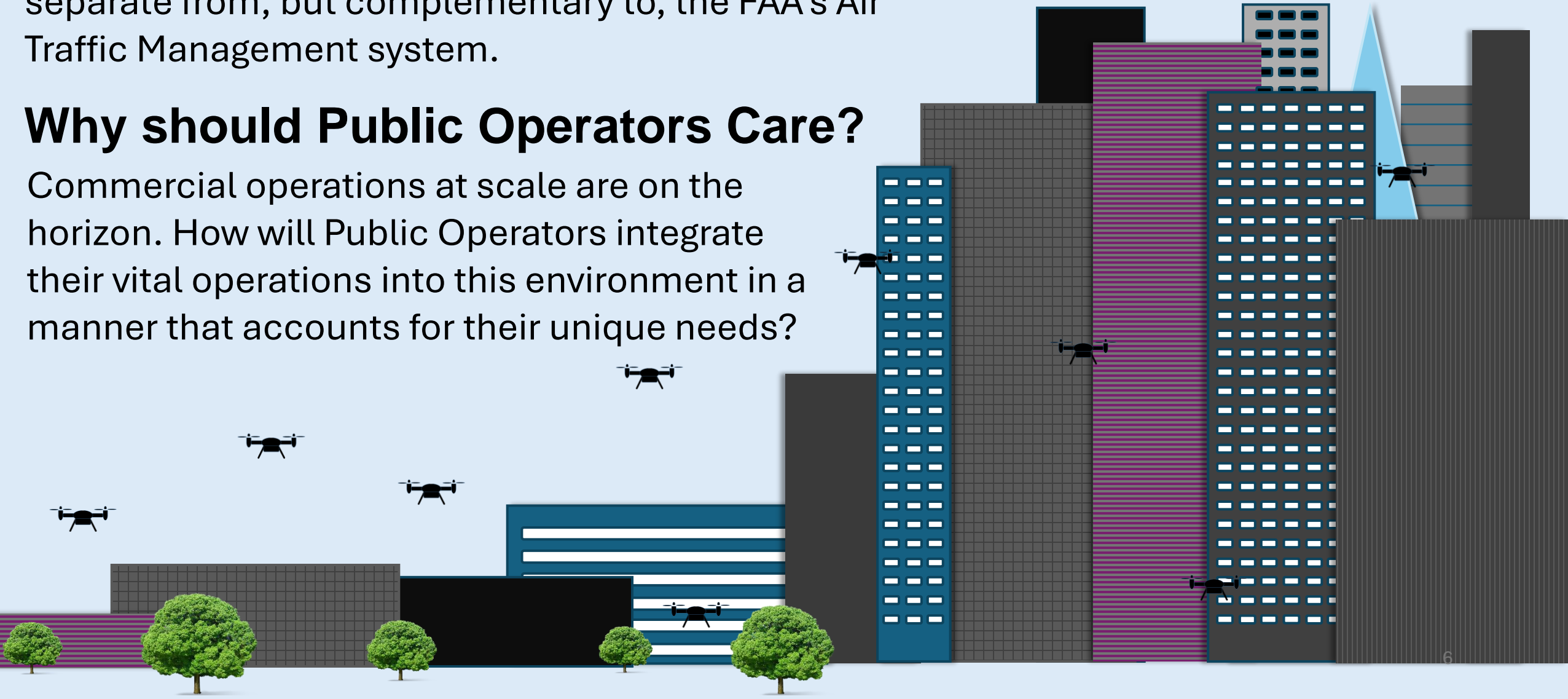
Background (2014-2020)

What is UTM?

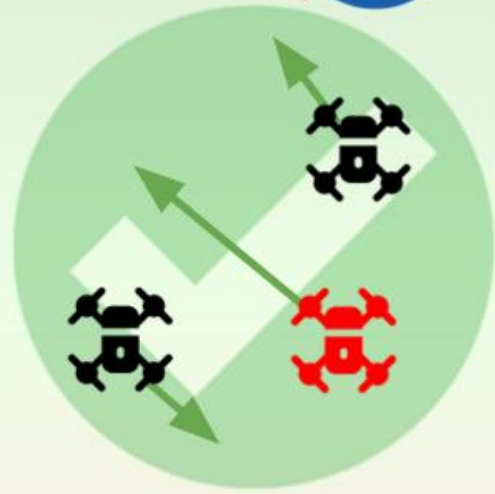
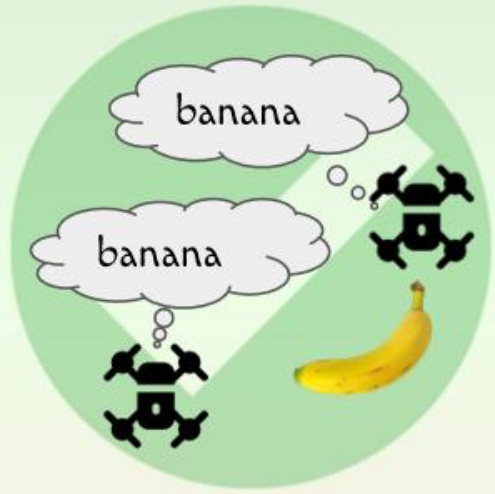
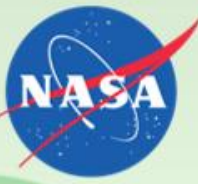
Unmanned Aircraft System Traffic Management (UTM) is a community-based, cooperative ecosystem that is separate from, but complementary to, the FAA's Air Traffic Management system.

Why should Public Operators Care?

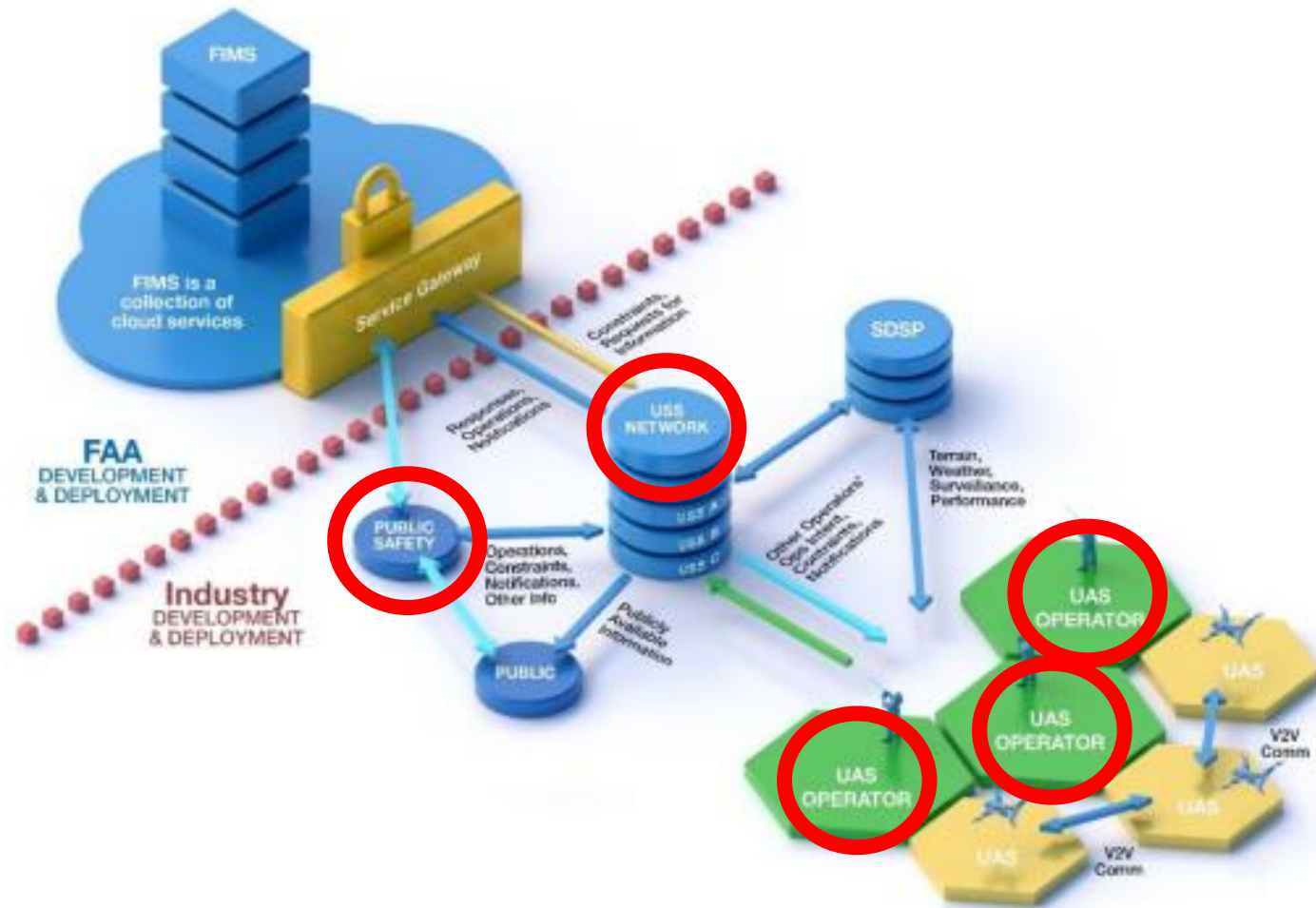
Commercial operations at scale are on the horizon. How will Public Operators integrate their vital operations into this environment in a manner that accounts for their unique needs?



UTM core operating principles



Envisioned UTM Architecture



- Operators and Service Suppliers leverage a distributed information centric USS Network for safe operations
- USS Network enables services to mitigate operational risks and increase efficiency
 - Operator-to-Operator, Vehicle-to-Vehicle, and Operator-to-FAA
- Regulator (FAA) has on-demand access to UTM operational information, when needed

- NASA's prior UTM testing conducted across 4 progressively complex phases
- Worked closely with local governments and public safety organization participants throughout
- Focus was not only on operations but on procedures and situation awareness for relevant stakeholders

Technical Capability Levels (TCL)

Risk-based development and test approach along four distinct TCL



TCL 1

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 Testing



TCL 1

What: Demonstrated concept for management of airspace in lower risk environments and multiple visual line-of-sight (VLOS) UAS operations
Where: Crows Landing, CA and six FAA UAS Test Sites
Who: 19 Industry Partners
When: Aug 2015, May 2016
Outcomes: Validation of cloud-based service oriented architecture



TCL 2

What: Demonstrated complexity of multiple beyond visual line of sight (BVLOS) UAS Operations in lower risk environments
Where: Reno-Stead, NV and six FAA UAS Sites
Who: 42 Industry Partners
When: October 2016, June 2017
Outcomes: Demonstrated information sharing between operators, supplemental services and established federated 3rd party service model



TCL Testing (cont)



TCL 3

What: Demonstrated technology enablers to address challenges multiple BVLOS UAS Operations over populated areas and near airports
Where: six FAA UAS Test Sites
Who: 34 Industry Participants
When: March-June 2018
Outcomes: Demonstrated enabling technologies for detect and avoid, communication and navigation, and data exchange between service providers

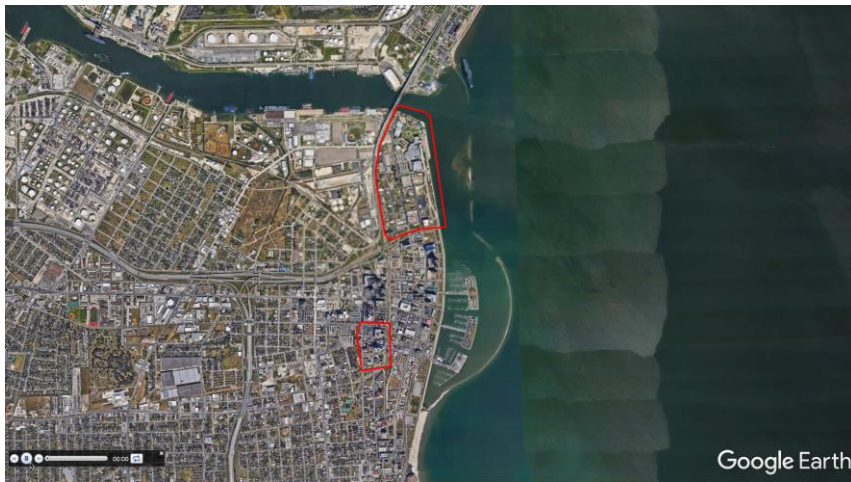


TCL 4

What: Demonstrate complex operations in urban environment and large-scale contingency management
Where: Downtown Reno, NV and Downtown Corpus Christi, TX
Who: 38 Industry Participants
When: Summer 2019
Outcomes: Understanding the operational concept, vehicle technologies, and data exchanges for nominal and contingency operations to safely fly under challenges of large structures and highly populated areas



UTM TCL4, Public Safety Flight Testing, Corpus Christi, TX





The UTM Key Site Operational Evaluation:

(2023 – present)

What is the UTM Key Site Operational Evaluation?

UTM Operational Evaluation Overview

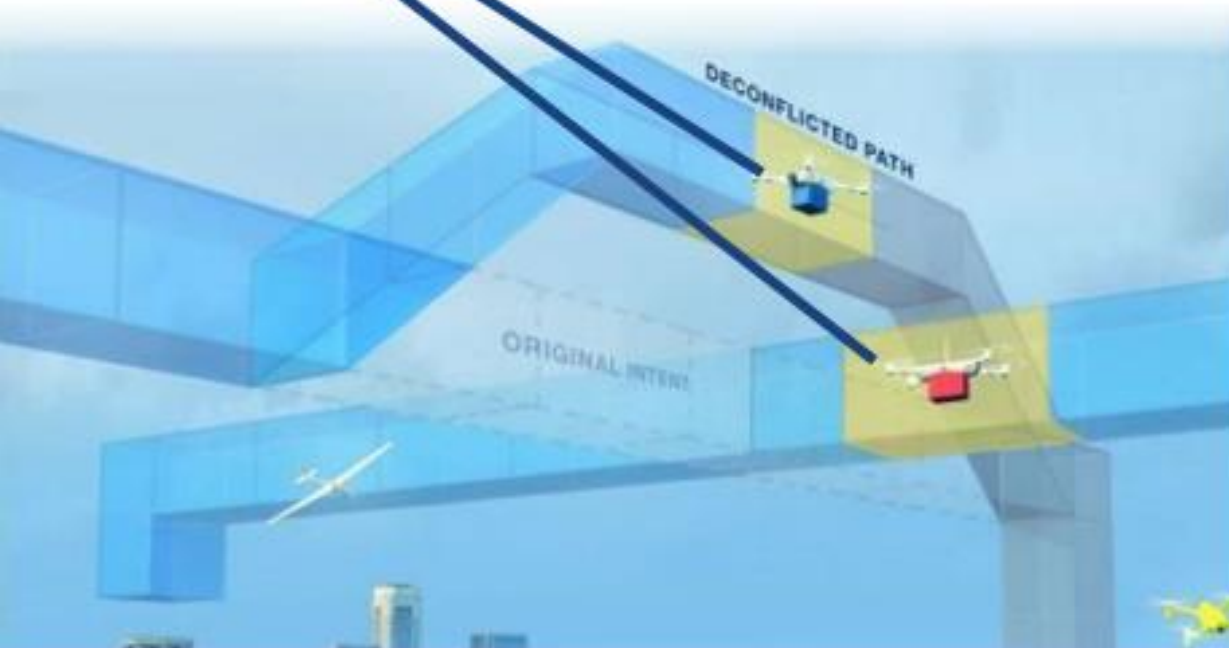
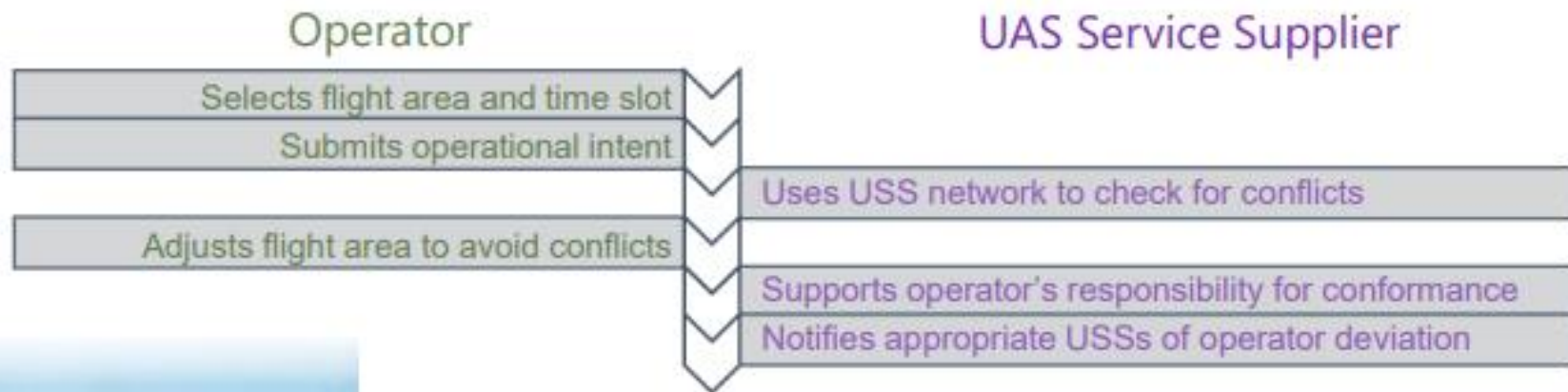


- Consortium of industry operators convened to facilitate preparations and execution of overlapping BVLOS operations in the Dallas-Fort Worth, Texas area
- Precedent-setting exemptions for BVLOS, where operators can leverage UTM services as operational risk mitigators
- UTM services leverage USS interoperability standards to manage and mitigate UA-to-UA conflicts
- Deployed ecosystem will be the basis for routine operations in Dallas-Fort Worth
- Evaluation will define common requirements to enable routine BVLOS operations in other locations



UTM UA-to-UA Deconfliction

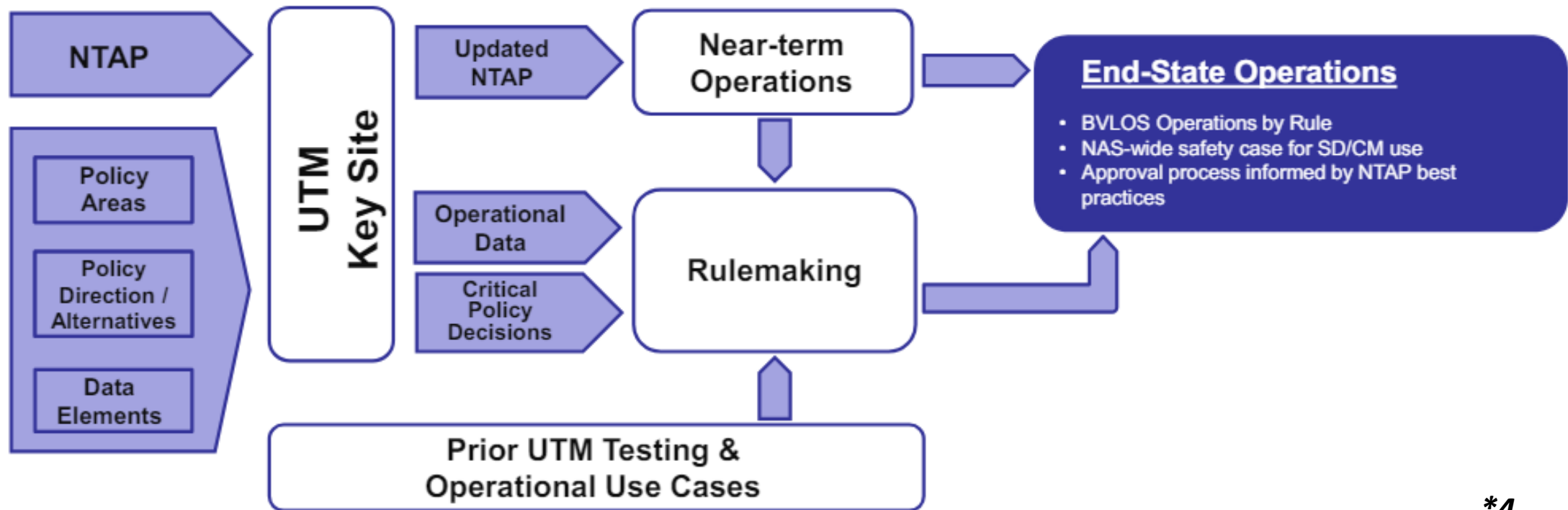
Operators may use different UAS Service Suppliers (USSs)



- Multiple operators coexist in one area, each using a different UAS Service Supplier to share flight intent
- A common framework/capability is needed

Relationship of Key Site to Policy Informing End State Operations

Background – Policy



*4

UTM Key Site Expects to Inform Critical Policy Decisions

Governance Agreement Overview | Governance Committees

The two Governance Committees manage the relationships between the industry participants, including onboarding, technical roadmaps, and escalations when issues arise.

Operations Committee

- Manage onboarding/offboarding
- Monitor/resolve conformance issues
- Publish operational reports
- Implement technical roadmap
- Facilitate operational learnings
- Oversee sourcing and provisioning of technical infrastructure

Technical Committee

- Owns and is responsible for Service Description Documents (“SDD”)
- SDD Management (rollout schedule, updates)
- Establish technical roadmap and accepted automated testing baseline
- Resolves issues concerning technical standards (e.g., ASTM)

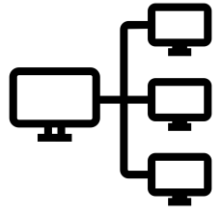
Governance Committee meetings have FAA participation and other stakeholders as observers at the invitation of a Governance Committee.



Public Safety Objectives of UTM Key Site



- Enable direct self-representation of NTX public safety in key site operator and technical committees



- Enable a leave-behind capability establishing data sharing & governance that benefits public safety missions



- Identify & prioritize the future roadmap of required capability to support public safety operators needs



- Establish and share lessons learned on public safety UAS operations that benefit all communities

Key Site Is an Opportunity for Public Safety Input Ahead of FAA BVLOS Ruling



The Bay Area Key Site Expansion (2025)



Key Site Expansion



What's the big picture?

To replicate BVLOS organic operations in the Bay Area with NASA, Commercial entities, and Public operations



Why?

It's a key milestone "Establish Operations Beyond UTM Key Site" [ATMX.2.UBV.20.06]



What does success look like?

At least 1 Service and Operator each: Federal, Public, and Commercial entities operating in the ecosystem (ie NASA, Cal Trans, Fremont PD, Matternet)



Power
Power Line Inspections



Rail or Road Inspection



USCG Crewed or UAS SAR

PAPD

PAFD-3

Stanford Life Flight

Stanford Hospital Heliport

8cfff2ef-8ea8-448b-ac49-a789da7adb8e

PAFD-6-Stanford

PAFD-4

Wing

MVFD-5

NASA Ames Research Center

Smart Mobility

PAFD-2

MVFD-3

Rail

Medical Delivery

MVPD

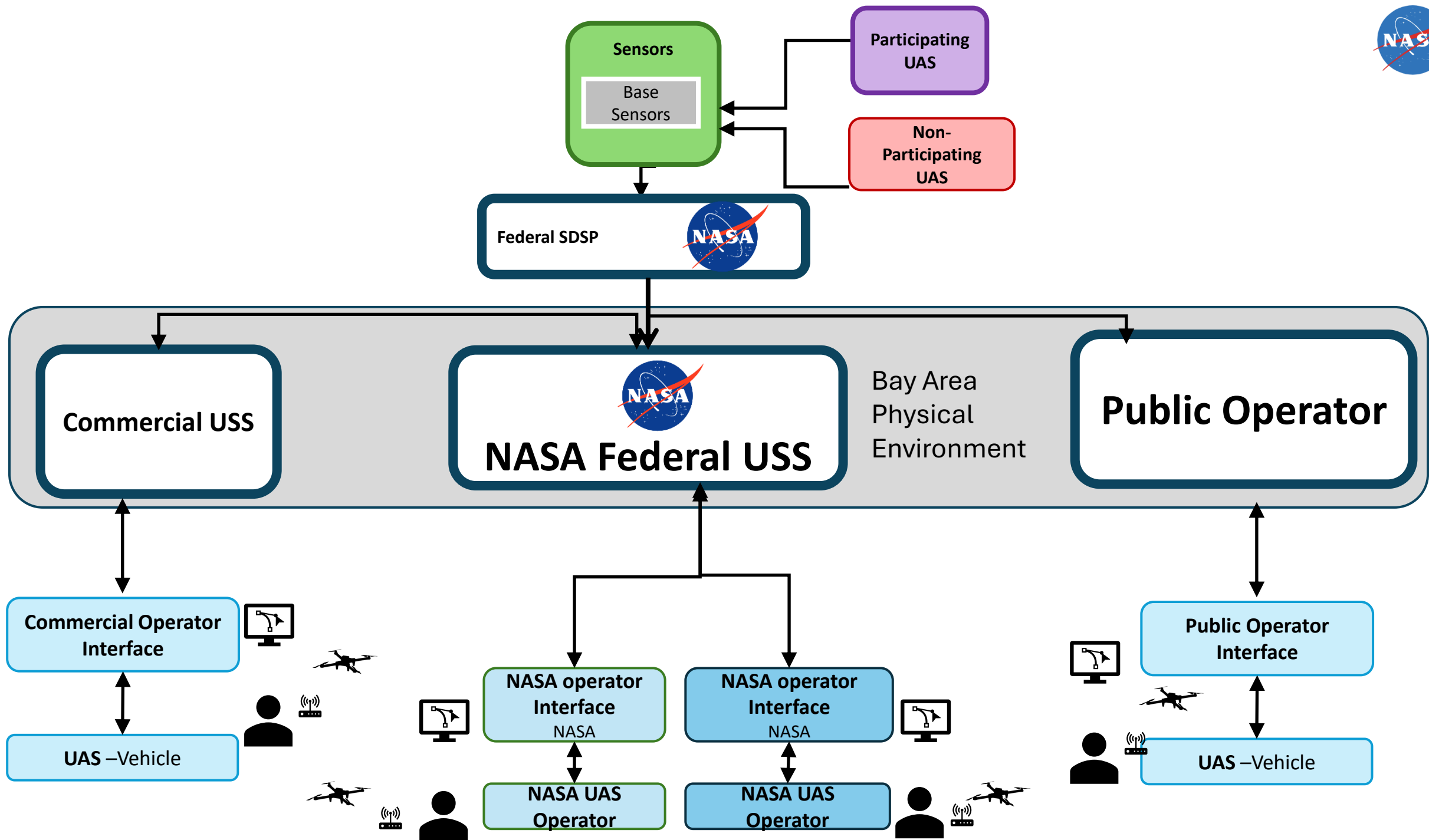
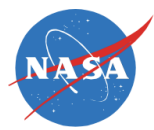
MVFD-1

MVFD-4



MVFD-2

PAMI-MV





UTM BVLOS:

Public Operations Representation (2023-present)

UTM and Public Operators



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



UTM Public Operations

Goals:

- Integrate public operations
- Roadmap capabilities
- Inform the community



Service Suppliers



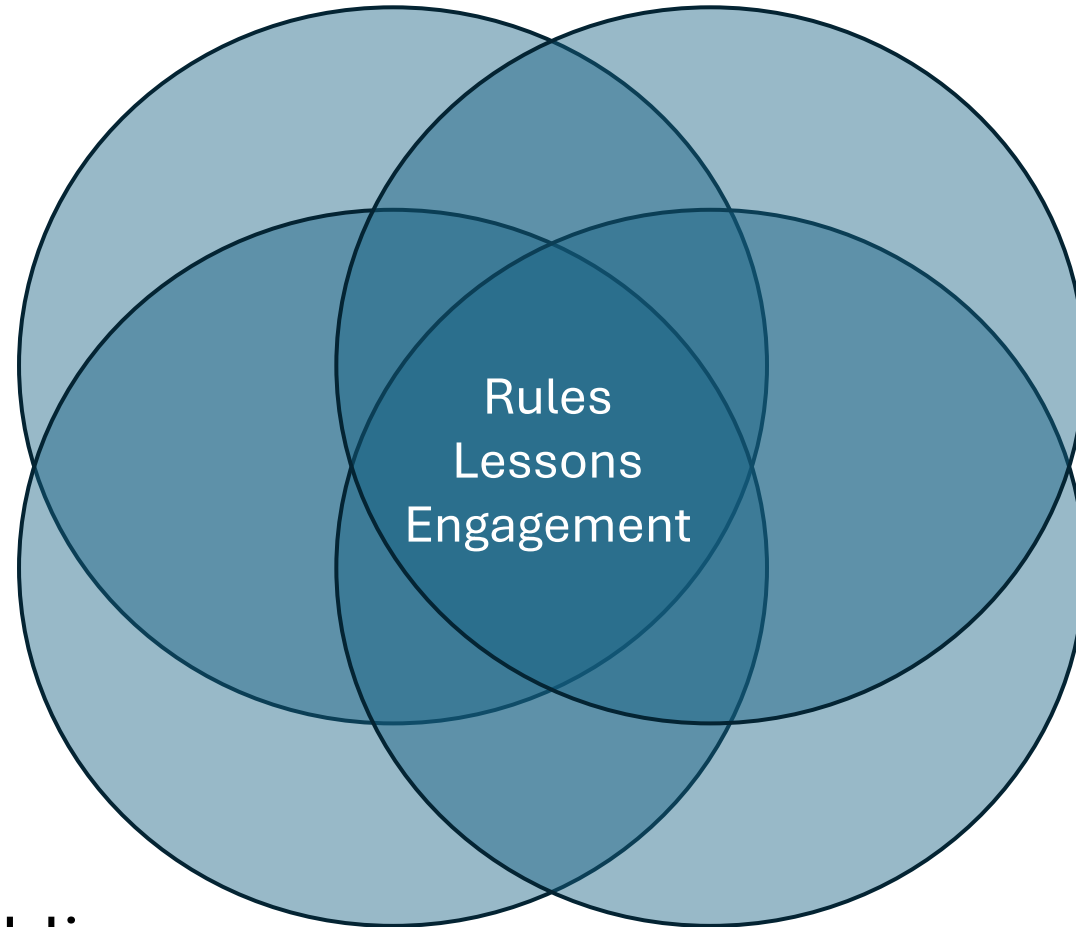
Public Operators





Police

Fire

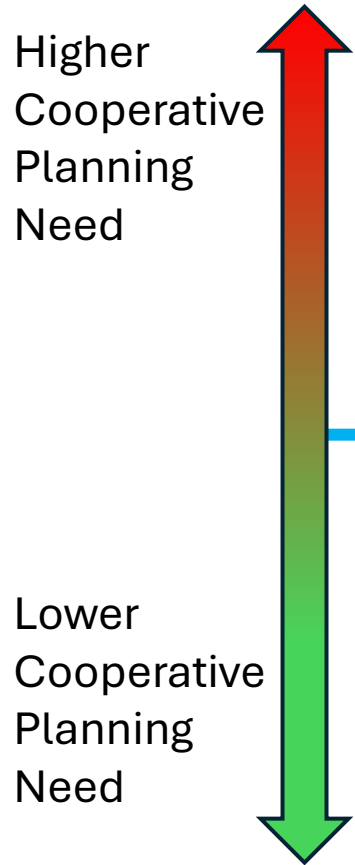


Public
Works

Medical



Data Sharing Need by Public Safety Mission Type



- Drone as First Responder (DFR) remotely deployed Vehicle
- Large Planned Event support (with and without TFR)
- Multiple-Vehicle deployment to single location
- Special Government Interest (SGI) request

- Tactical Officer Deployment of Single Vehicle On Site (VLOS)
- SWAT response with indoor deployed Vehicle

More complex missions will receive greatest benefit from intent sharing

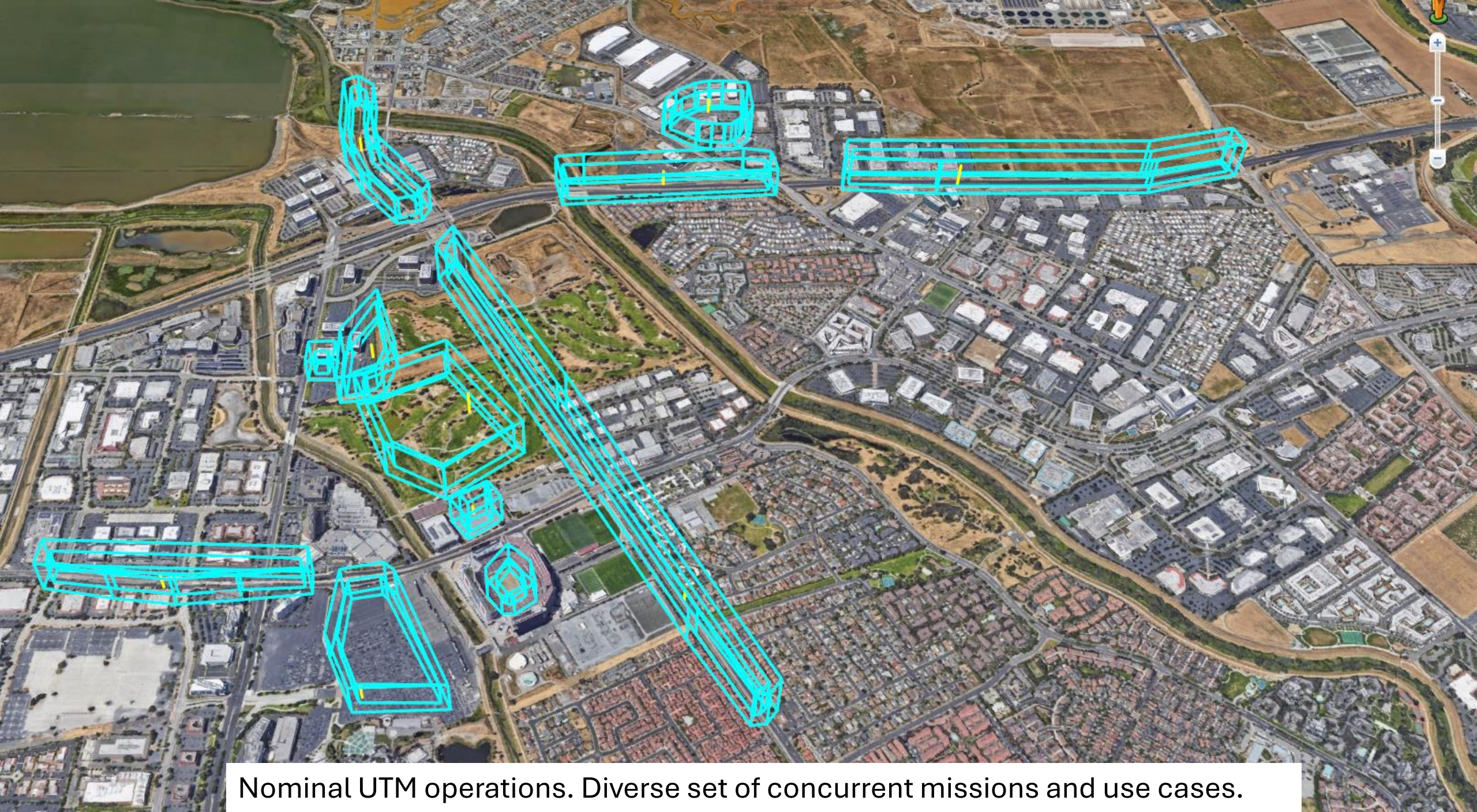


Prioritization of Public Safety

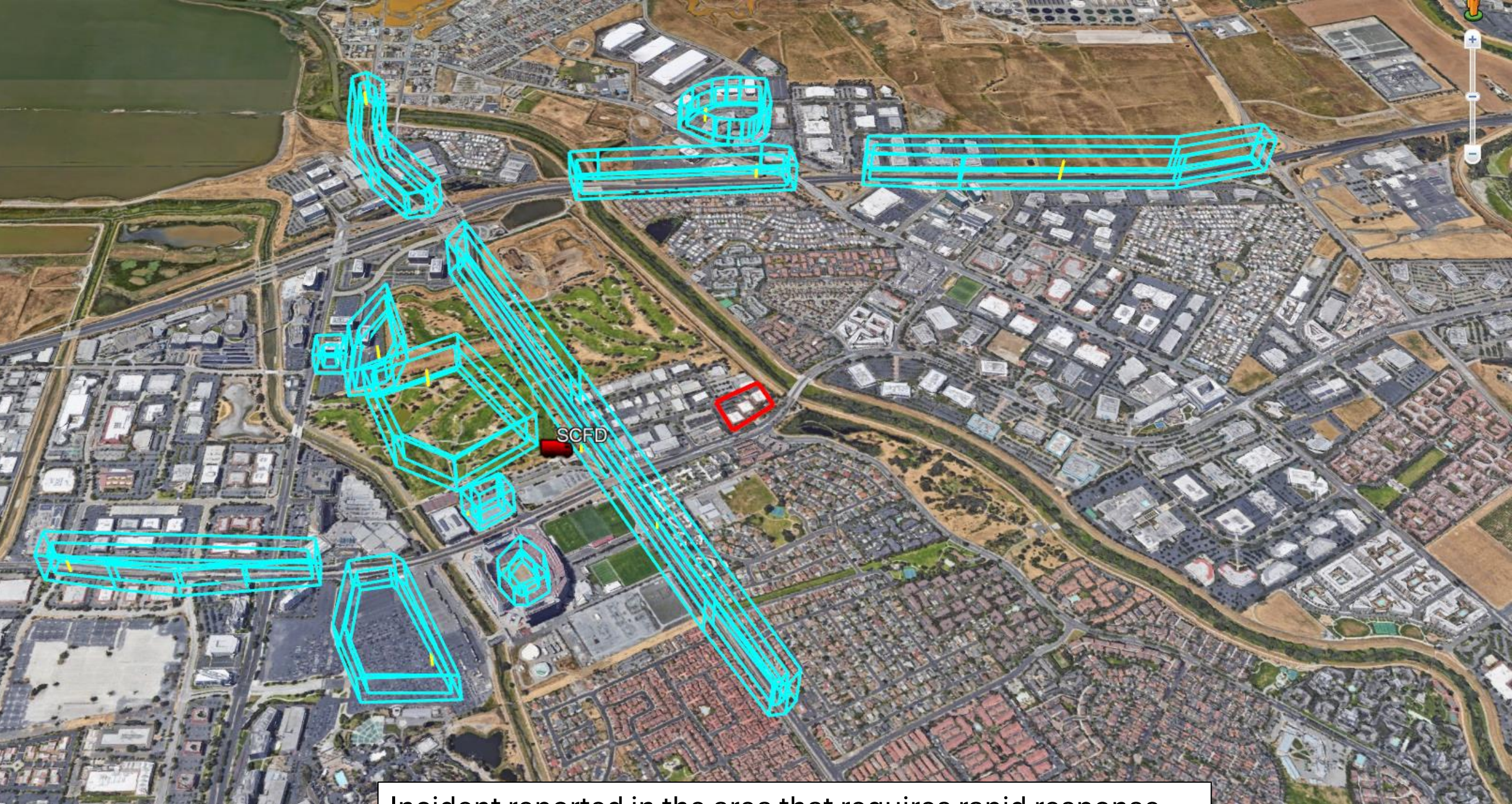
Current State of Priority

- Current standards make allowances for priority operations, but take no official position on implementation
- A prioritization task force has recently been initialized for key site operations.

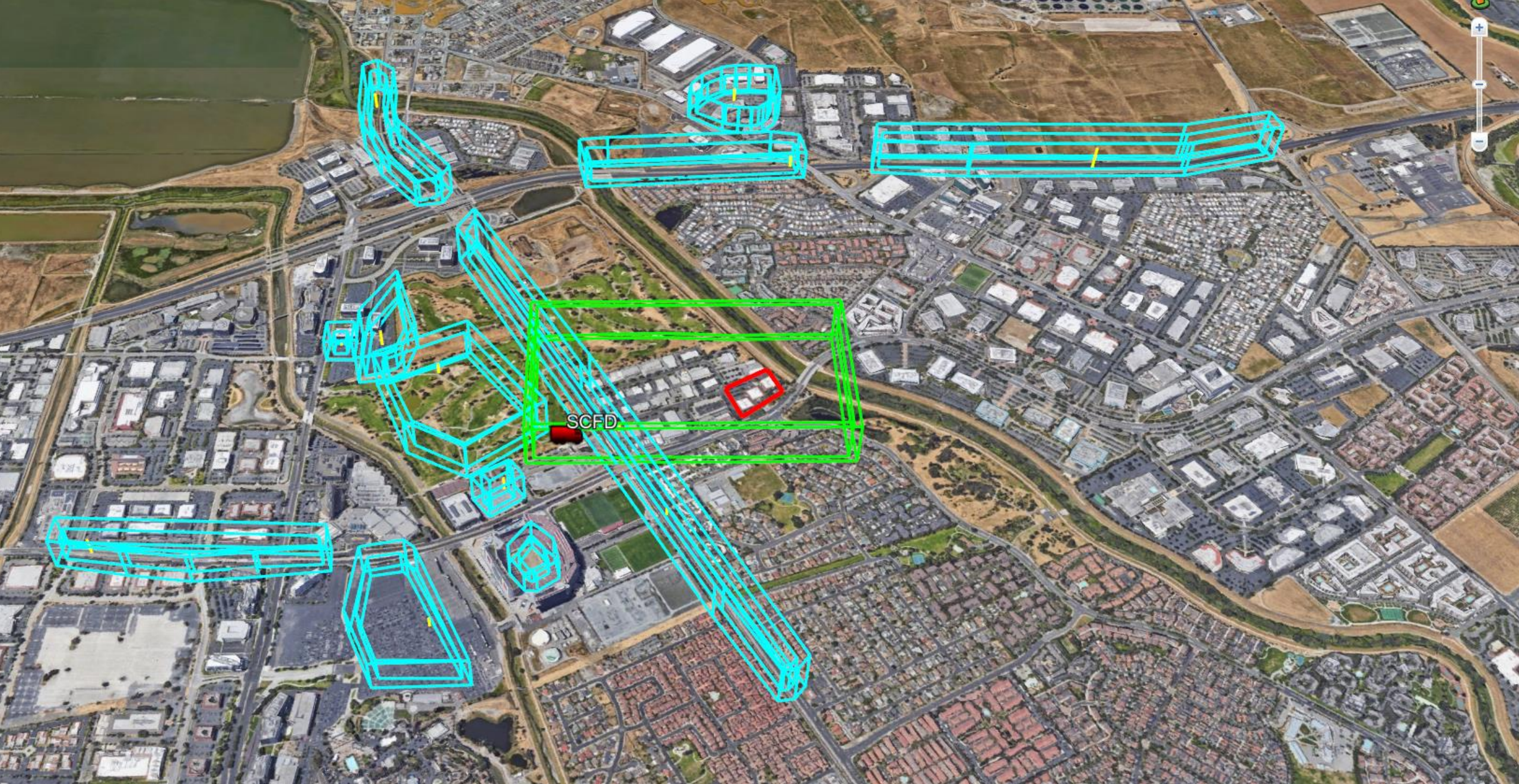
Priority	Types of Ops
3	<p>UAS <u>civil</u> and <u>public</u> aircraft operations:</p> <ul style="list-style-type: none"> •Transporting needed medical materials where safety of human life is dependent on immediate response •Directly supporting emergency response or public safety, where public safety includes fire, accident, and disaster response <p><i>Note – Disaster response includes both natural and man-made disasters (unintentional and intentional)</i></p> <ul style="list-style-type: none"> •Performing a search and locate mission where safety of human life is dependent on timely response
2	<p>UAS <u>civil</u> and <u>public</u> aircraft operations:</p> <ul style="list-style-type: none"> •Directly supporting disaster recovery •Performing inspections of publicly-owned critical infrastructure for public benefit •Other active federal, state, local, tribal, or territorial government missions and government-sponsored/supported missions not captured under Priority Level 3
1	<p>UAS <u>civil</u> aircraft operations:</p> <ul style="list-style-type: none"> •Performing inspections of privately-owned critical infrastructure for public benefit
0	<p>UAS <u>civil</u> and <u>public</u> aircraft operations:</p> <ul style="list-style-type: none"> •Conducting all other operations not covered under Priority Levels 1-3



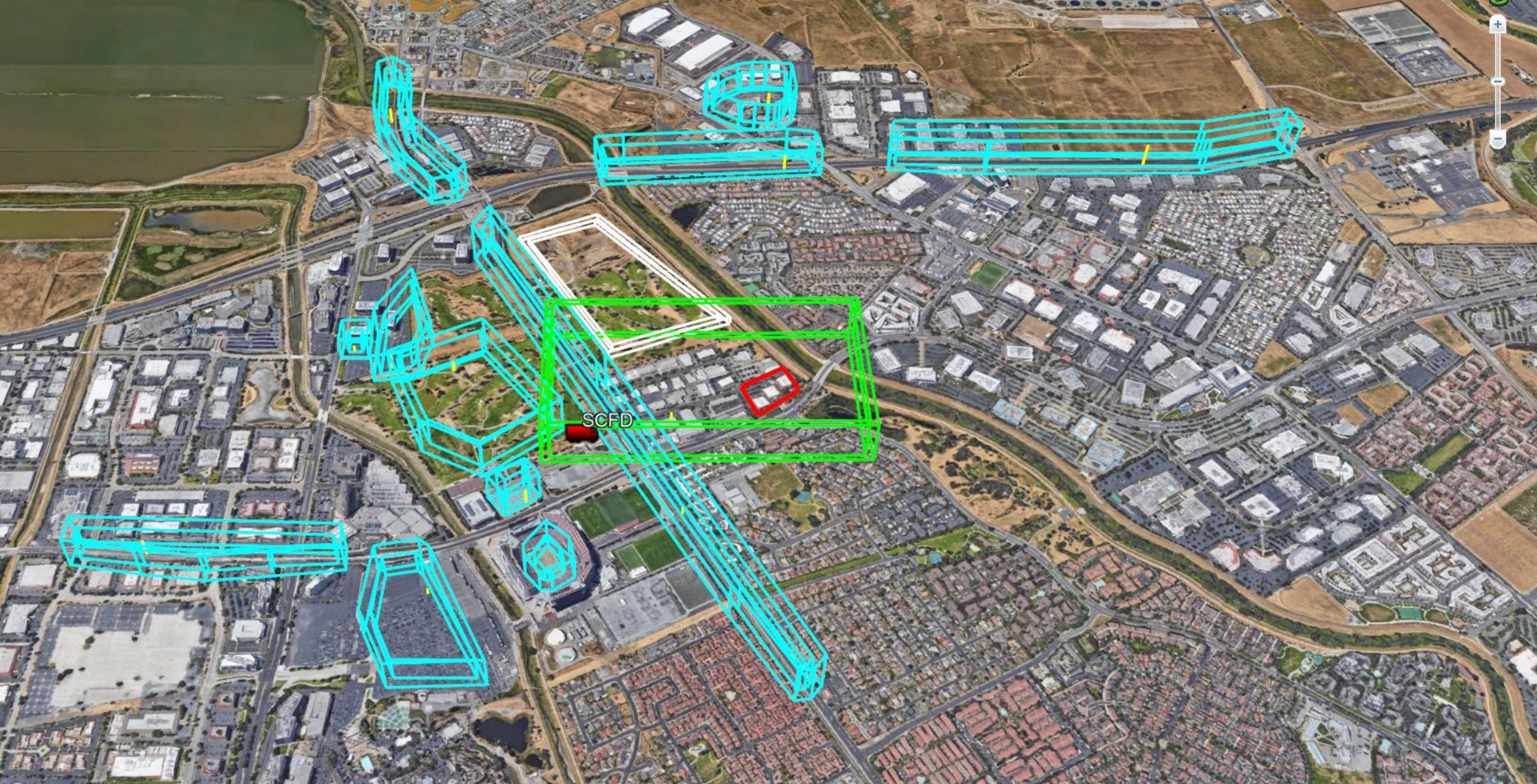
Nominal UTM operations. Diverse set of concurrent missions and use cases.



Incident reported in the area that requires rapid response.



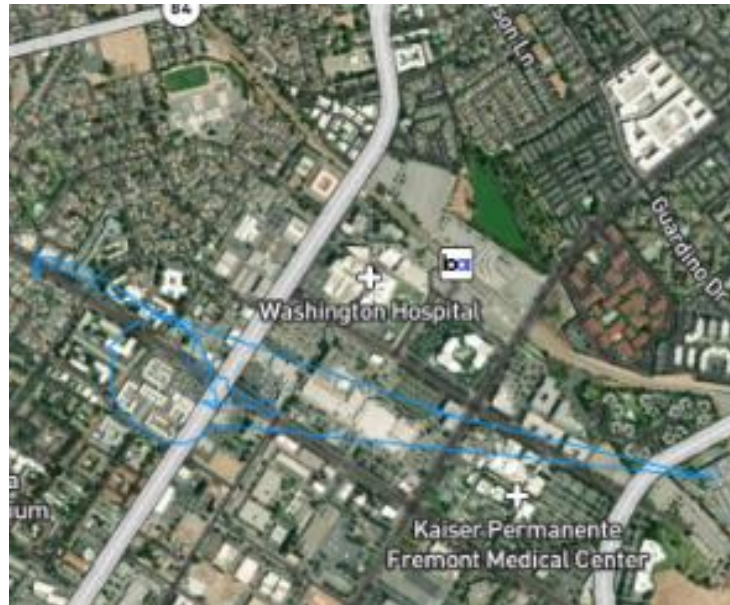
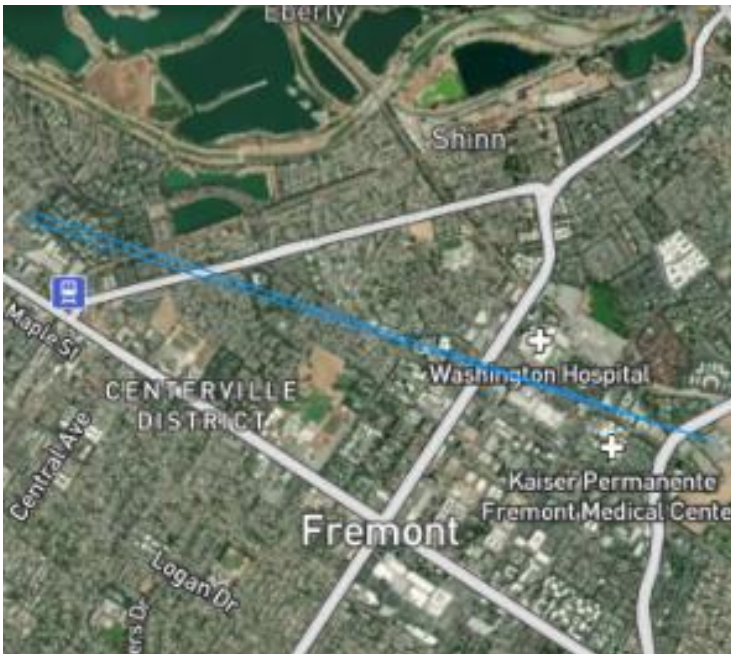
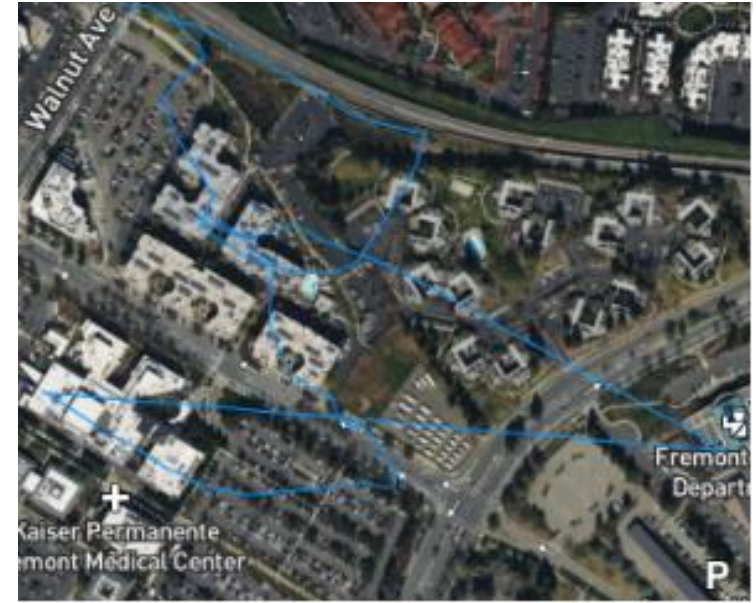
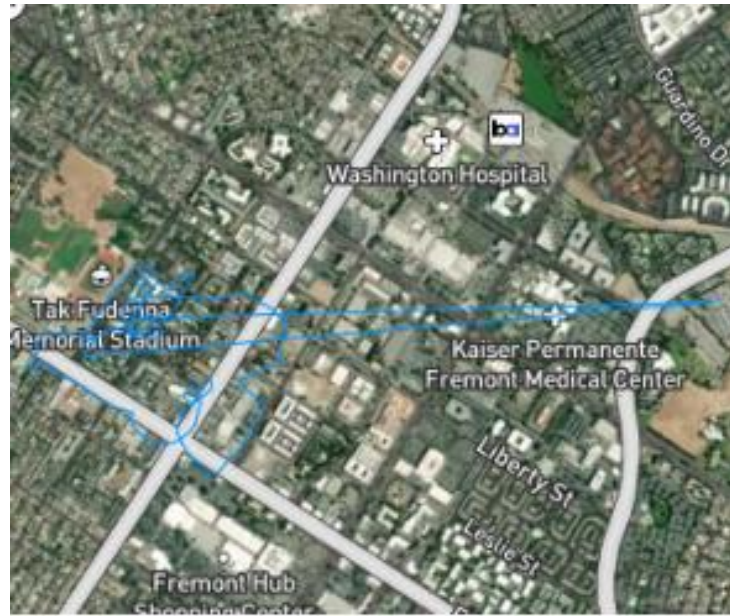
Fire department quickly plans and communicates intent for its UAS response to the network.

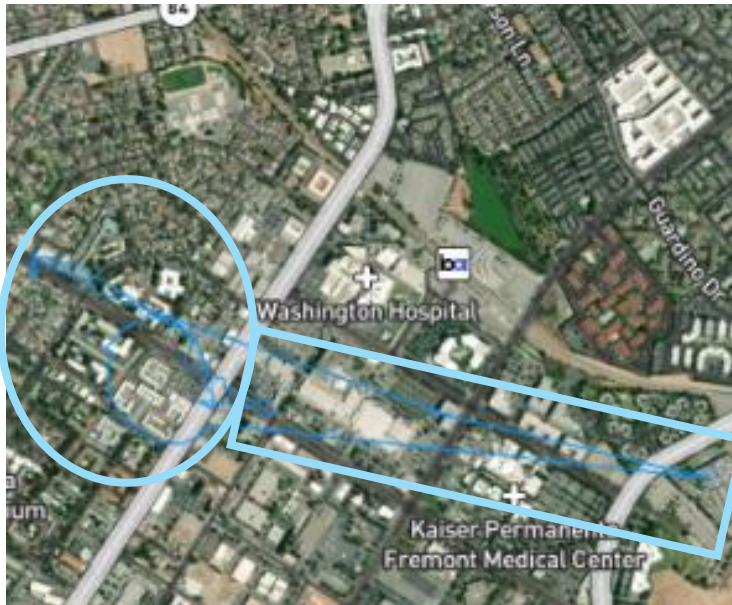
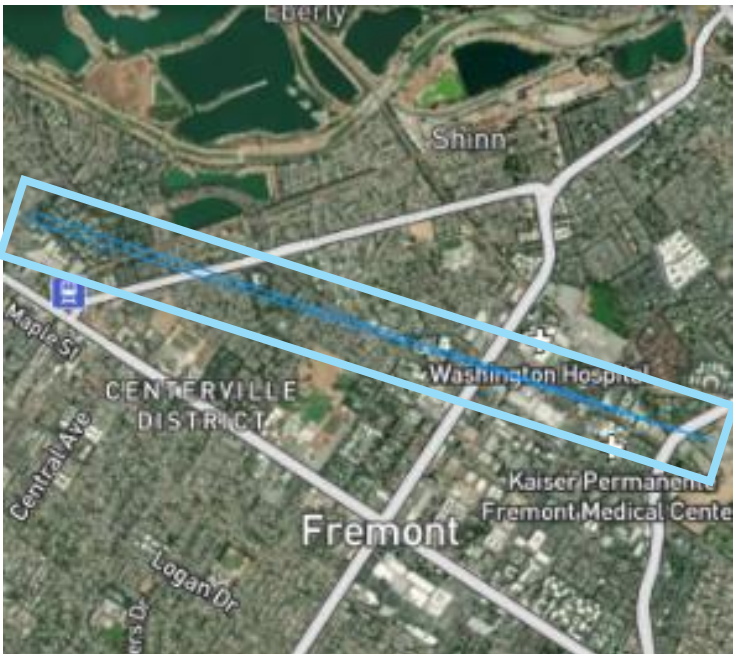
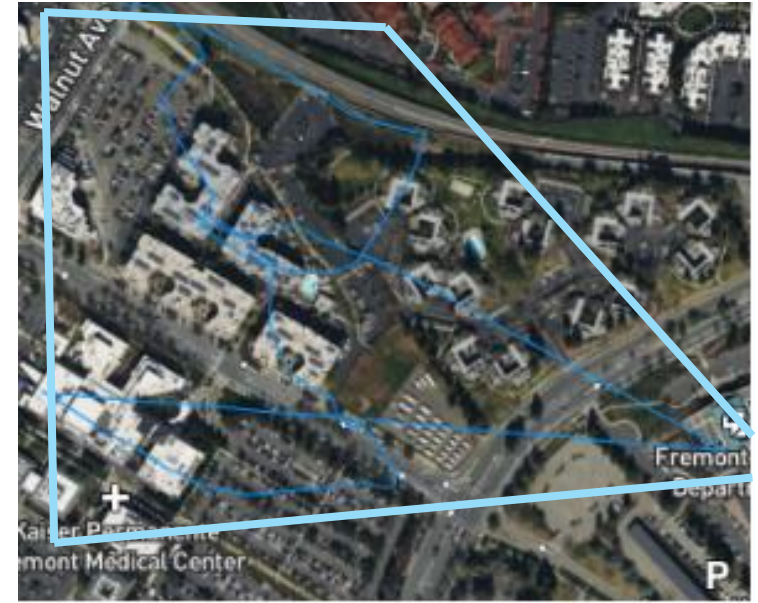
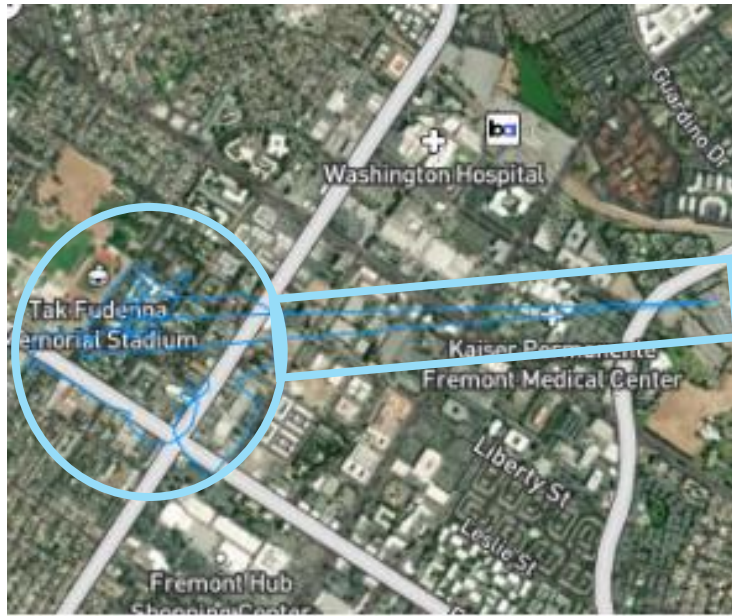


Affected operations are notified of the need for priority access to the airspace.



Conformance Under High Uncertainty

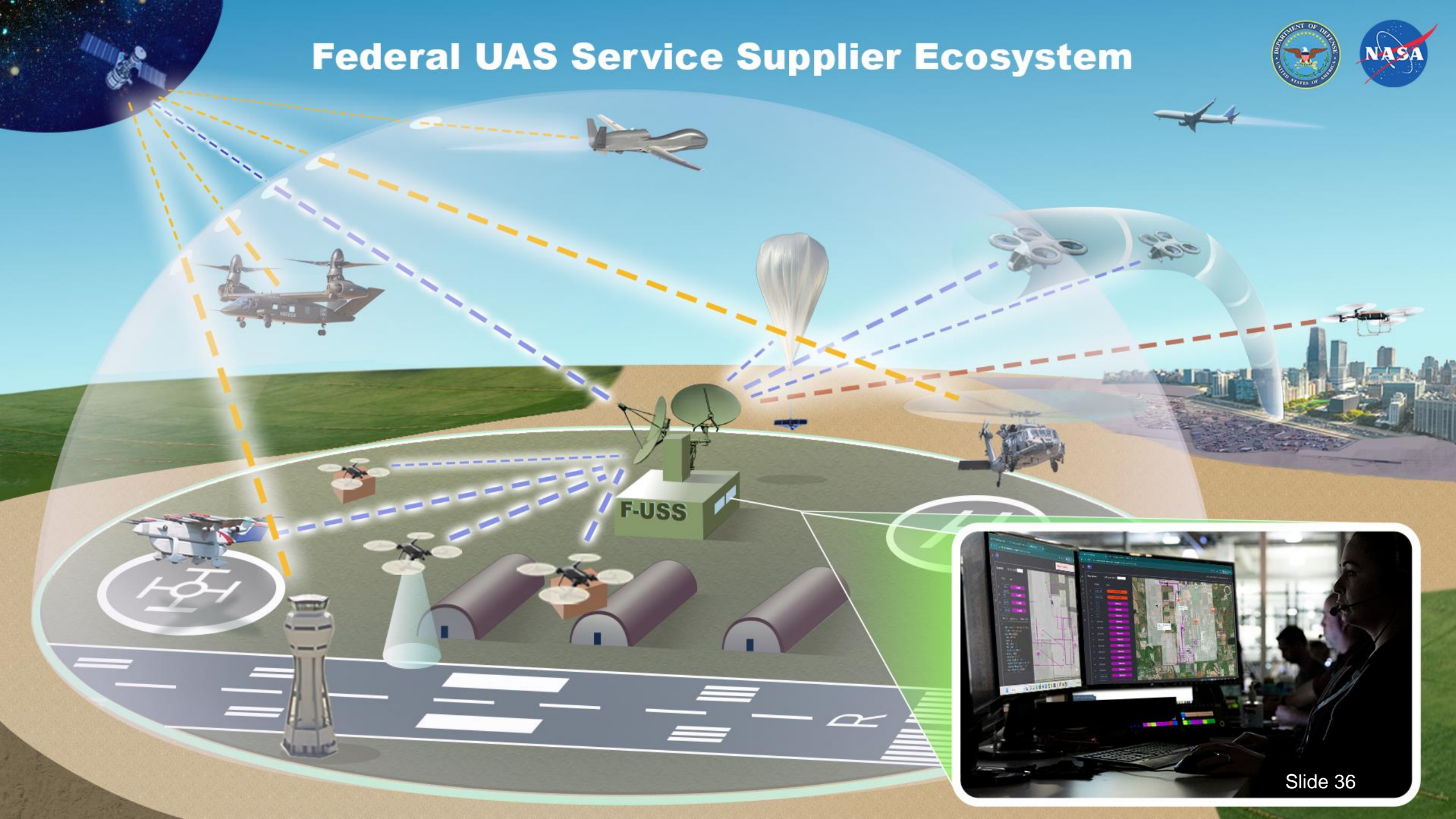


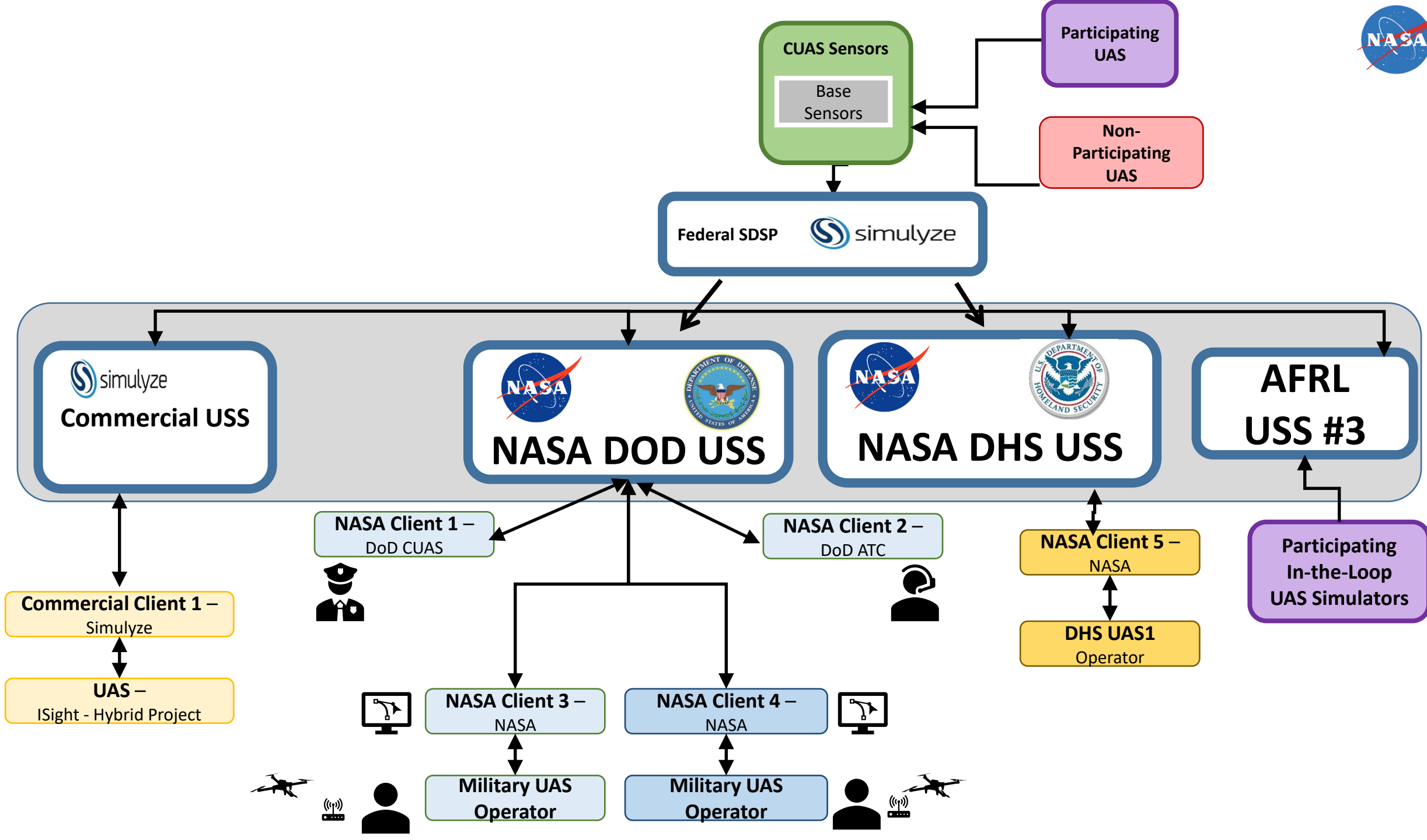




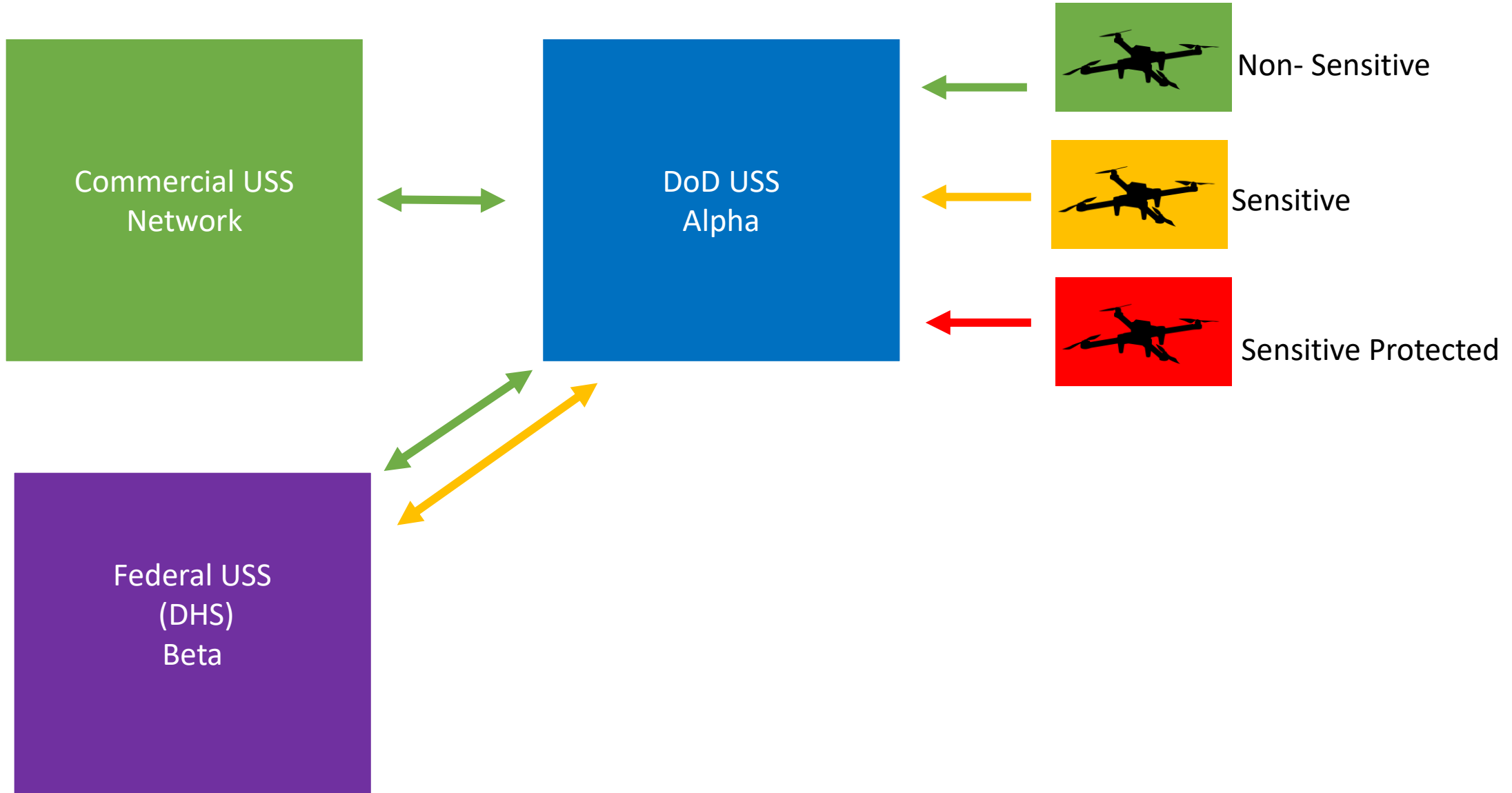
Sensitive Operational Data

Federal UAS Service Supplier Ecosystem





Information Exchange Based on type of Mission



Information Exchange Based on type of Mission

The image displays a screenshot of the Simulzye WebCOP interface, divided into three vertical panels representing different types of Conflict of Priority (COP) scenarios: ATC COP, CUAS COP, and Commercial COP.

- ATC COP (Left Panel):** Shows a map of Grand Forks AFB with several aircraft icons and their associated flight paths. A yellow callout bubble labeled "Sensitive" points to a specific area on the map.
- CUAS COP (Middle Panel):** Shows a similar map view with a yellow callout bubble labeled "Sensitive" and a green callout bubble labeled "Non-Sensitive" pointing to different areas.
- Commercial COP (Right Panel):** Shows a detailed map view with various mission tracks and icons. A yellow arrow points from the "Sensitive" callout in the CUAS COP panel to this panel, and a green arrow points from the "Non-Sensitive" callout in the CUAS COP panel to this panel.

Mission Info Panel (Visible in CUAS COP):

```
SIM_MV55
Sim4 TC2 0.0
SIMM_COM_4
Sim4 TC3 0.0
SIMM_COM_4
Sim3 TC2 0.0
SIMM_COM_3
Sim3 TC3 0.0
SIMM_COM_3
Sim2 TC2 0.0
SIMM_COM_2
Sim2 TC3 0.0
SIMM_COM_2
SV TC1 no overlap 1.1
6a65 V SuperVolo
```

Mission Info Panel (Visible in Commercial COP):

```
Mission Info
Name: SV TC1 no overlap 1.1
GURI: 6a65
State: ACTIVATED
Takeoff: 2021-07-20
```

Results

ASTM Standard USS-to-USS communication

Prototype Federal USS

Role-based Access

Interoperability messaging between operators and Agencies

Situational awareness for operators

Develop a Common Operating Picture



Lunch (1 hour)

On-site:

The Space Bar (Google: NASA Ames Space Bar)

Off-site (close 5 min drive):

Specialty's Café & Bakery

Wagon-Wheel BBQ

Las Adelitas



Questions for the room:

1. What are your goals for BVLOS operations?
2. What are your primary challenges?
3. So far, are the use cases we've talked about valid?
4. What are some areas of concern that were not covered?
5. What is your first impression on the shared airspace idea? Is there a need in the region for intent sharing?
6. What is your level of interest in using deconfliction services for your own operations?



Potential Next Steps

Follow-on Discussion Topics

Public UAS Operator Survey

Please take the NASA survey

Public Safety at the Key Site

Solicit interest in operating as active participants in the Key Site Expansion

Working Group

Discuss the potential of standing up a working group focused on the integration of public operations in a UTM environment



Potential Next Steps

Follow-on Discussion Topics: Operations

Public Safety priority operations

Priority response operations in the same airspace as routine commercial BVLOS operations

Public Safety constraint management

Authorized public entities injecting constraints into the UTM system (per standards) in support of response operations

Public Safety situational awareness

Situational awareness needs with consideration of information availability and display capabilities regarding the UTM environment



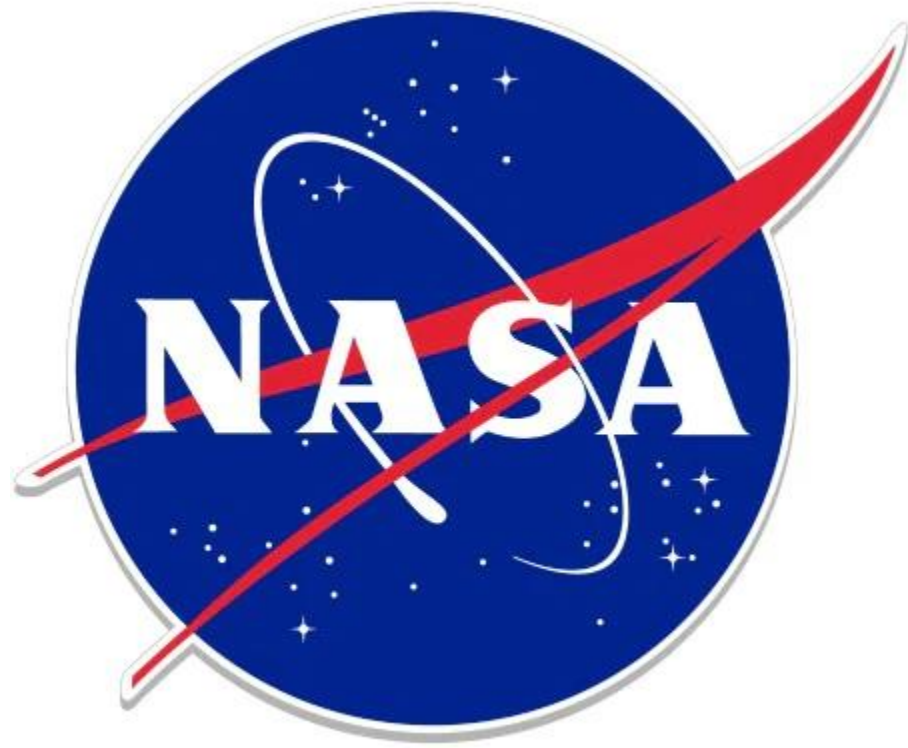


Contact NASA

Gita Hodell (UTM Public Ops) | gita.s.hodell@nasa.gov

Please take the
Public UAS
Operators survey!

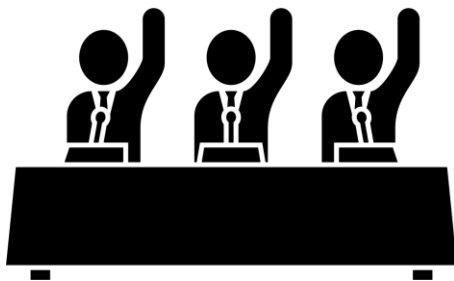




Governance Committees

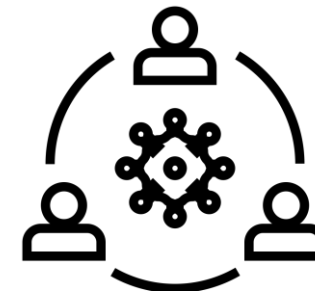
Operations Committee

- General oversight committee which manages the onboarding & offboarding of Service Providers & Operators
- Monitors & resolves conformance issues
- Implements the technical roadmap
- Promote best practices related to safety reporting & sizing of operational intents
- Oversees sourcing & provisioning of technical infrastructure & shared costs

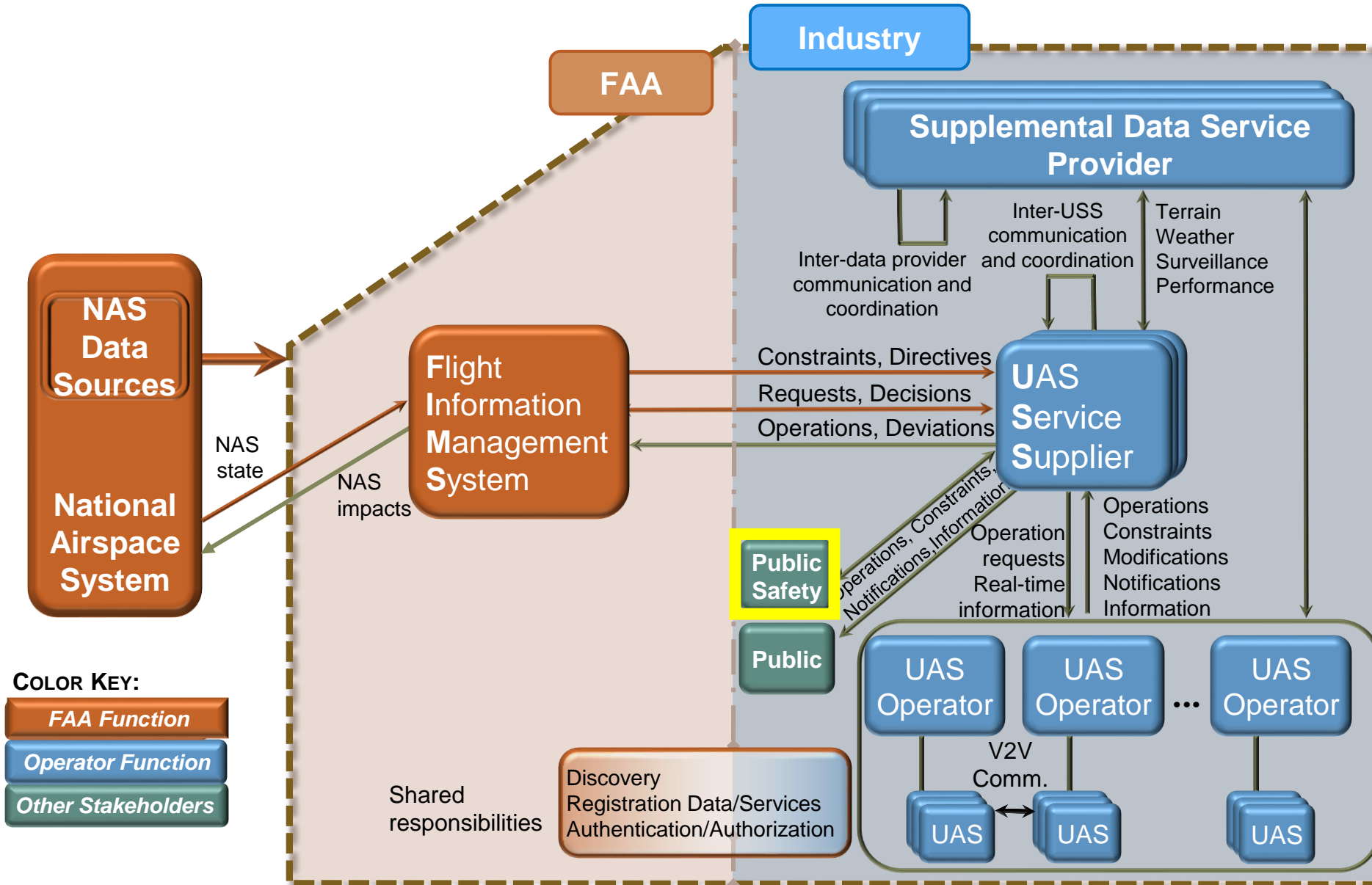


Technical Committee

- Owns and is responsible for the Service Description Documents, including their rollout and schedules
- Establishes a technical roadmap and automated testing baseline
- Manage any issues concerning technical standards
- Promotes best practices related to automated testing



UTM Service-Based Architecture



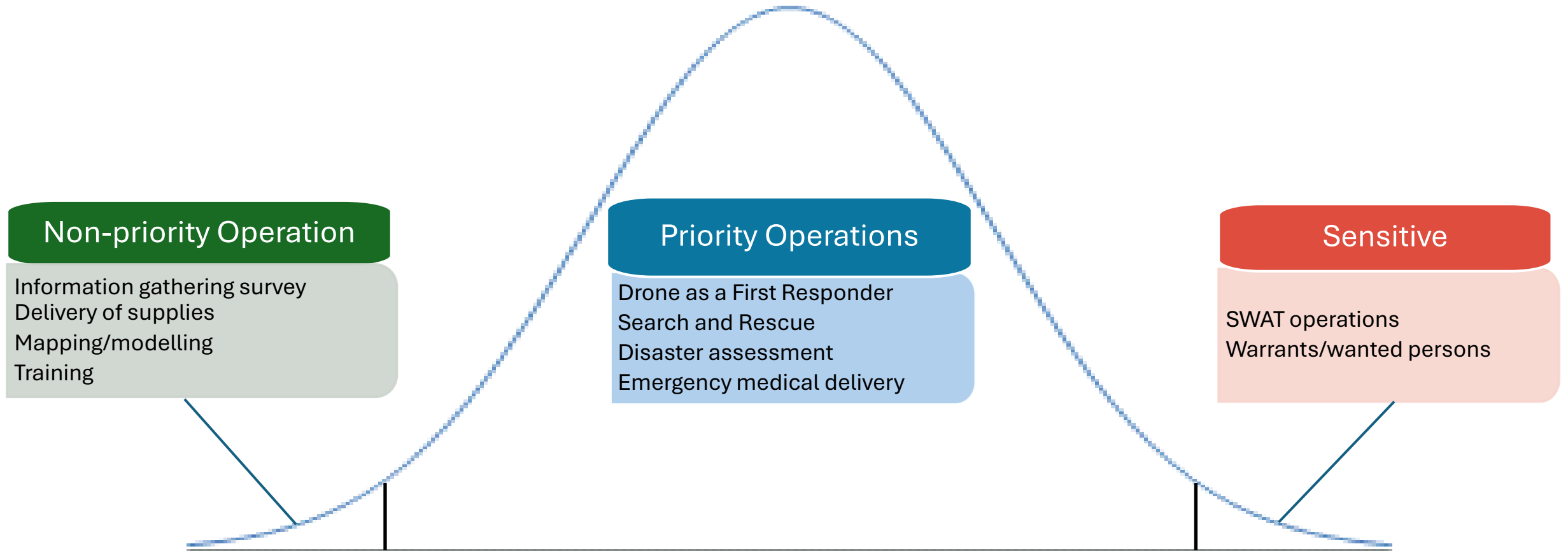
COLOR KEY:

- FAA Function
- Operator Function
- Other Stakeholders

- Flight Information Management System**
 - Enables airspace controls
 - Facilitates requests
 - Supports response in emergencies impacting NAS
- UAS Service Supplier**
 - Federated Structure
 - Cloud-based system
 - Automated System
 - Supports UAS with services (e.g. separation, weather, flight planning, contingency management, etc.)
- Supplemental Data Service Provider**
 - Supplies supplemental data to USS and UAS Operator to support operations
- UAS / UAS Operator**
 - Individual Operator
 - Fleet Management
 - On-board capabilities to support safe operations



Data Sharing Categories, Examples, Frequency*



The overwhelming majority of public safety missions are priority

* For illustration purposes, not real data

Background on “North Texas Shared Airspace Implementation”

- “...seven operators engaged in a project to operationalize strategic conflict detection in the Dallas-Fort Worth area, including DroneUp, Flytrex, Manna, Prime Air, UPS Flight Forward, Wing, and Zipline, with ANRA Technologies as a service provider.”
- “Companies have reached consensus on governance and data sharing and have signed and implemented agreements that are publicly available. This is known as the North Texas Shared Airspace Implementation.”



Governance Agreement from NTX Key site

UTM SERVICE PROVIDER DATA SHARING AND GOVERNANCE AGREEMENT IN THE UNITED STATES

This UTM Service Provider Data Sharing and Governance Agreement (this "Agreement") is entered into by and among the undersigned Service Providers to establish the terms and conditions under which Service Providers and Operators will share data and govern operations in shared airspace to manage conflicts between unmanned aircraft in the United States. Each of the undersigned is referred to individually as a "Party" or collectively as the "Parties." The effective date of this Agreement is April 22, 2024 (the "Effective Date").

WHEREAS the UAS industry establishes this Agreement in support of FAA Order 8040.6A and complex operations

WHEREAS the UAS industry establishes this Agreement based on cooperative operating principles to enable the efficient use of shared airspace where safety is the highest and foremost priority; (see throughout the Agreement)

WHEREAS the UAS industry aspires to enable safe and efficient UAS operations in shared airspace across the United States through this Agreement; (see Section 2 (Purpose))

WHEREAS the establishment of shared cooperative operating environments are based on agreed criteria for performance, security, privacy, and quality based on industry consensus standards; (see Section 4 (Service Description Document))

WHEREAS all providers of UTM Services, including private and public entities and organizations, are eligible and encouraged to join this Agreement in furtherance of the adoption of industry consensus standards to enable safe and efficient UAS operations in shared airspace (see Annex C (Governance) Section 4 (Onboarding))

WHEREAS the UTM Services described herein will evolve and adapt services based on operational learnings and operational needs; (see Annex C, Section 3 (Committees and Members) and Section 6 (Voting))

WHEREAS the Service Providers and Operators proactively monitor and manage conformance . . .

“Service Providers and Operators will share data and govern operations in shared airspace to manage conflicts between unmanned aircraft in the United States.”

“...all providers of UTM Services, including private and public entities and organizations are eligible and encouraged to join this Agreement... (see Annex C)”