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VIGILANT AEROSPACE SYSTEMS™

INTEGRATION OF MULTI-SENSOR ACTIVE DETECT-AND-AVOID SYSTEMS WITH UTM TOWARDS A COMPREHENSIVE SAFETY SYSTEM ENABLING UAM / AAM

XPONENTIAL™

Background

- Vigilant Aerospace Systems & FlightHorizon
- Focused on developing detect-and-avoid and airspace management systems
- FlightHorizon based on two NASA patents, projects with NASA, FAA, UAS test sites, and multiple USAF and civilian programs
- Fully-integrated multi-sensor systems for both ground and onboard use
- Use of both local sensors and online data sources and can be used online/offline

Agenda

1. Key elements for AAM safety
2. Technical requirements
3. FAA UTM ConOp 2.0
4. Technical Requirements & Technical Standards
5. Process to Design Safe System
6. Components – Example Implementation
7. User interface and UTM functions
8. Example Projects
9. Summary and Questions

Key Elements for AAM Safety

- AAM safety will require **interlocking** technologies to create **multiple** layers of **safety** and **coordination.**
- **Safety**
  - Strategic
    - Certification, choice of where/how to fly and what to fly
  - Operational
    - Flight rules, coordination, flight authorization, procedures
  - Tactical
    - Air traffic surveillance, situational awareness, automatic avoidance

FAA UAM ConOp 2.0 – April 26, 2023

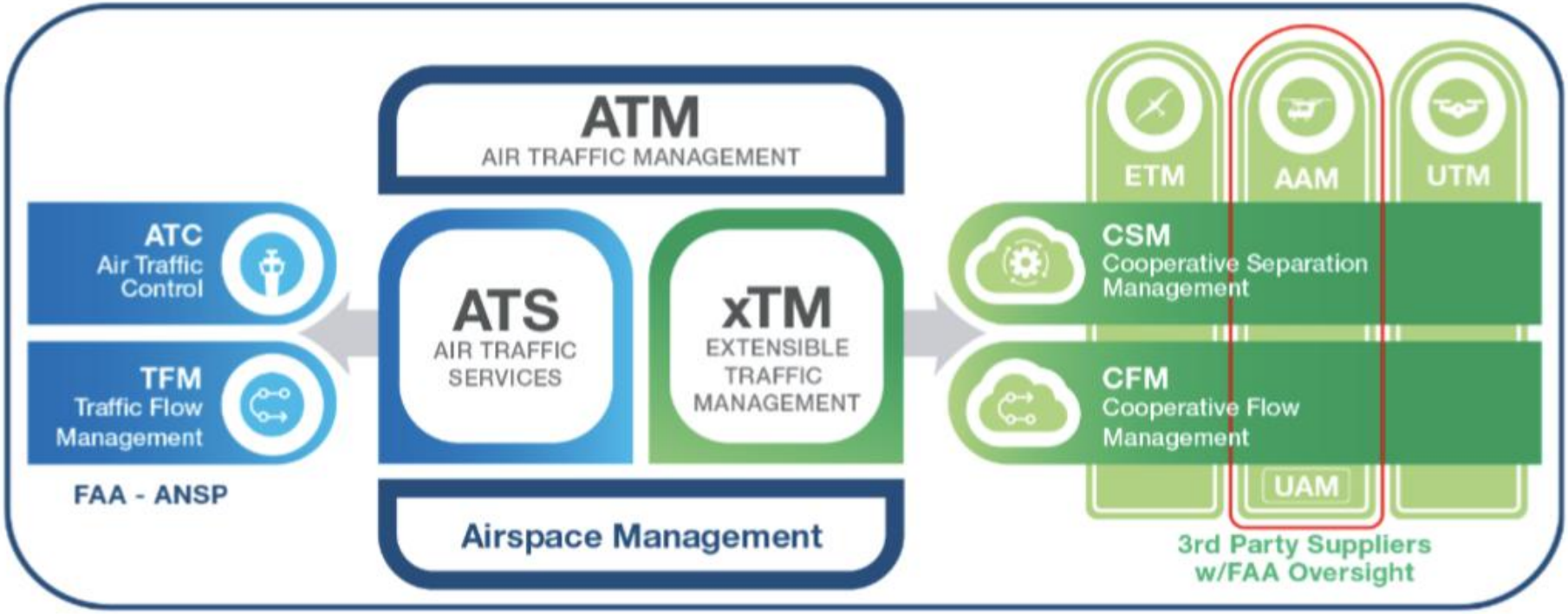


Figure 1: Notional Overview of Future Complementary Service Environments

Technical Requirements

NASA airspace managers using FlightHorizon for sonic boom testing.

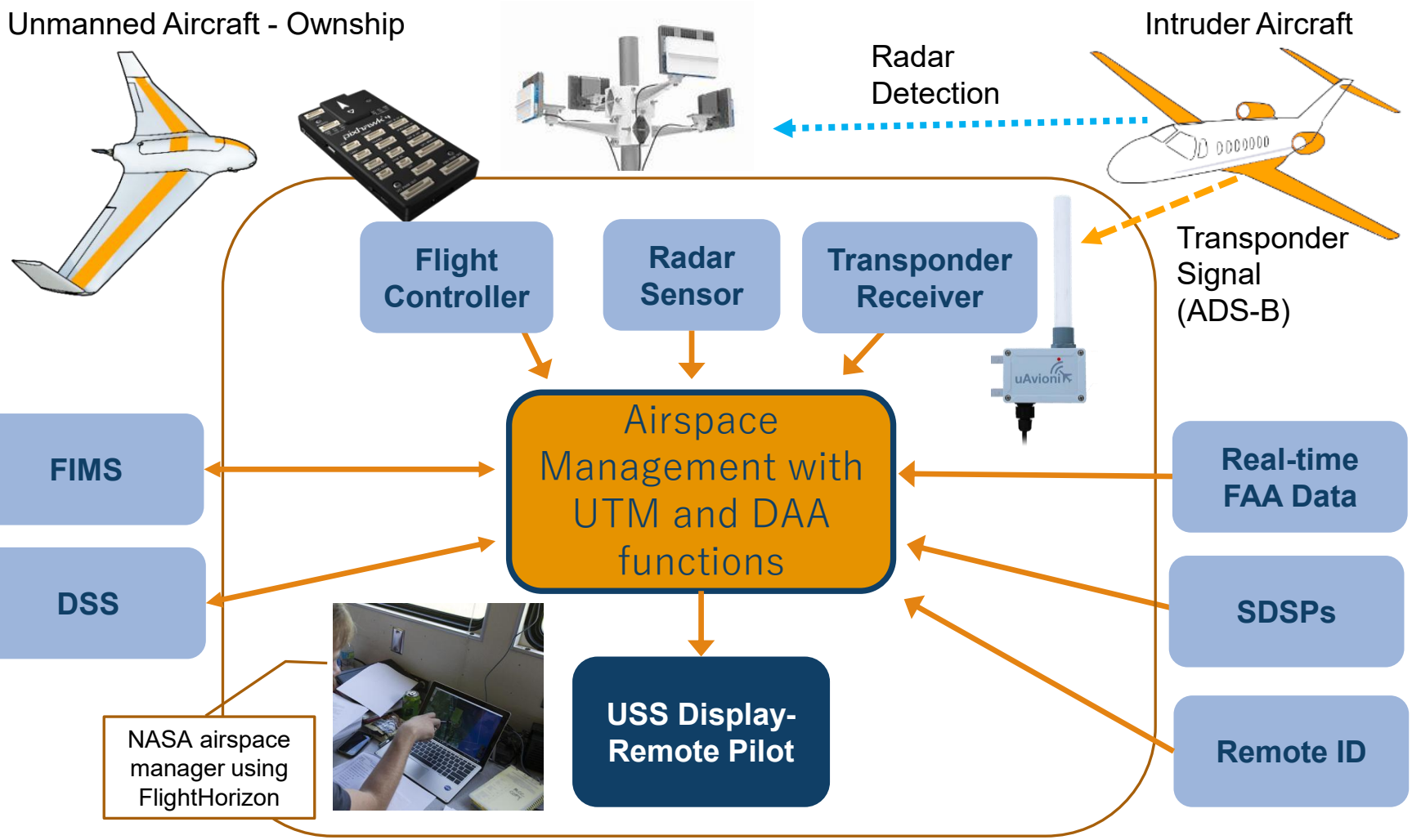
- Cooperative and non-cooperative air traffic
- Private sensors – take-off, landing, facilities, infrastructure
- Coordination of both onboard and ground-based surveillance
- Distribution of shared surveillance data (SDSP model)
- Distribution of coordination data (UTM / xTM - reservations)
- Low-altitude coordination for drone-to-drone and drone-to-aircraft

Technical Standards

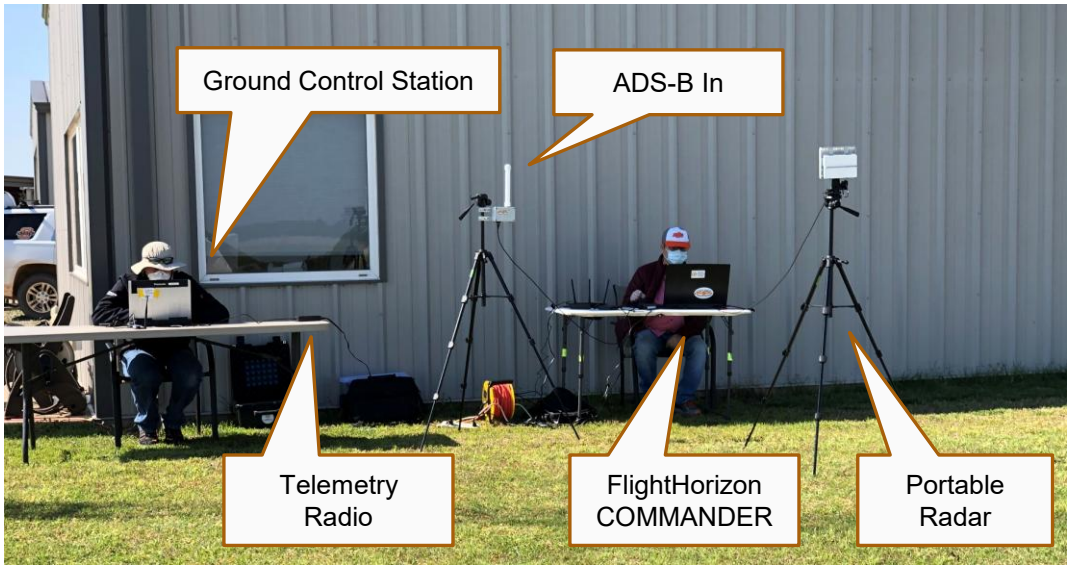
- Why use standards?
  - Consensus industry standards create agreement, certainty and technical targets
  - Support investment and development
- Relevant Standards
  - ASTM F3442/F3442M-20 – Detect and Avoid System
  - RTCA DO-365b – ACAS sXu via NASA DAIDALUS II: Minimum Operational Performance Standards for Detect and Avoid Systems
  - FAA AC 20-172b – ADS-B In Systems
  - RTCA DO-178c – Software Verification

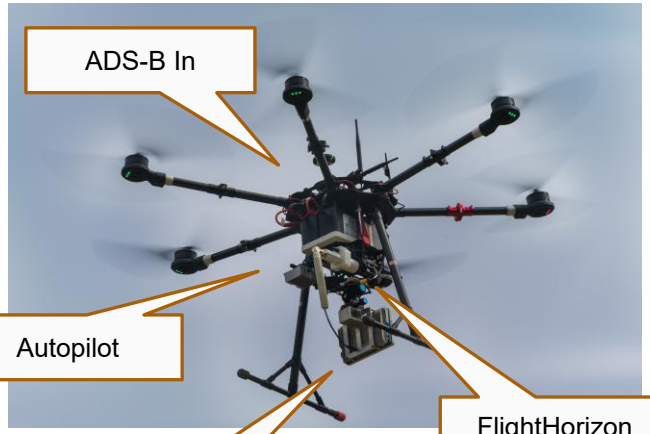
Approach to Safety

System Implementation

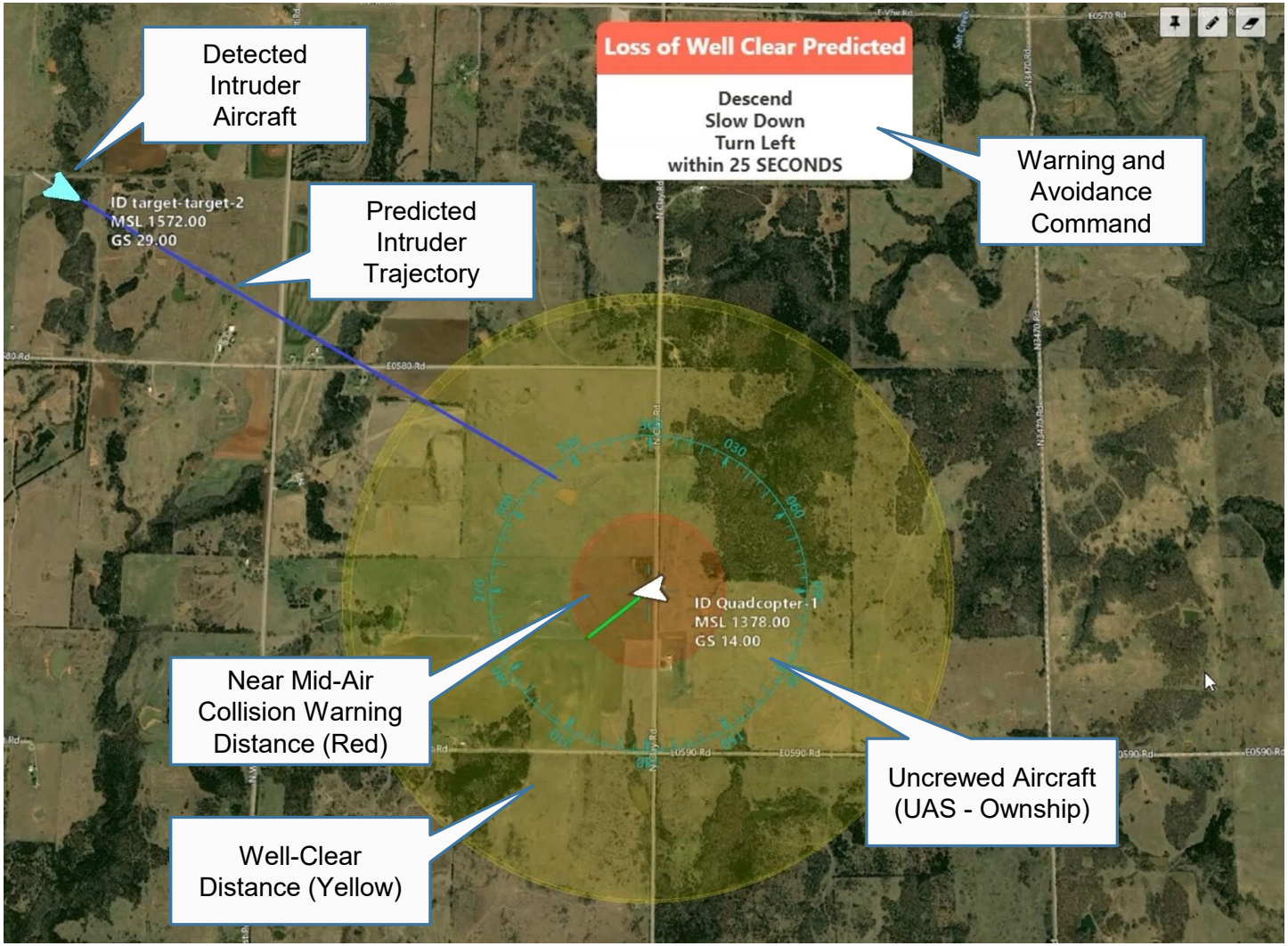


System Implementations

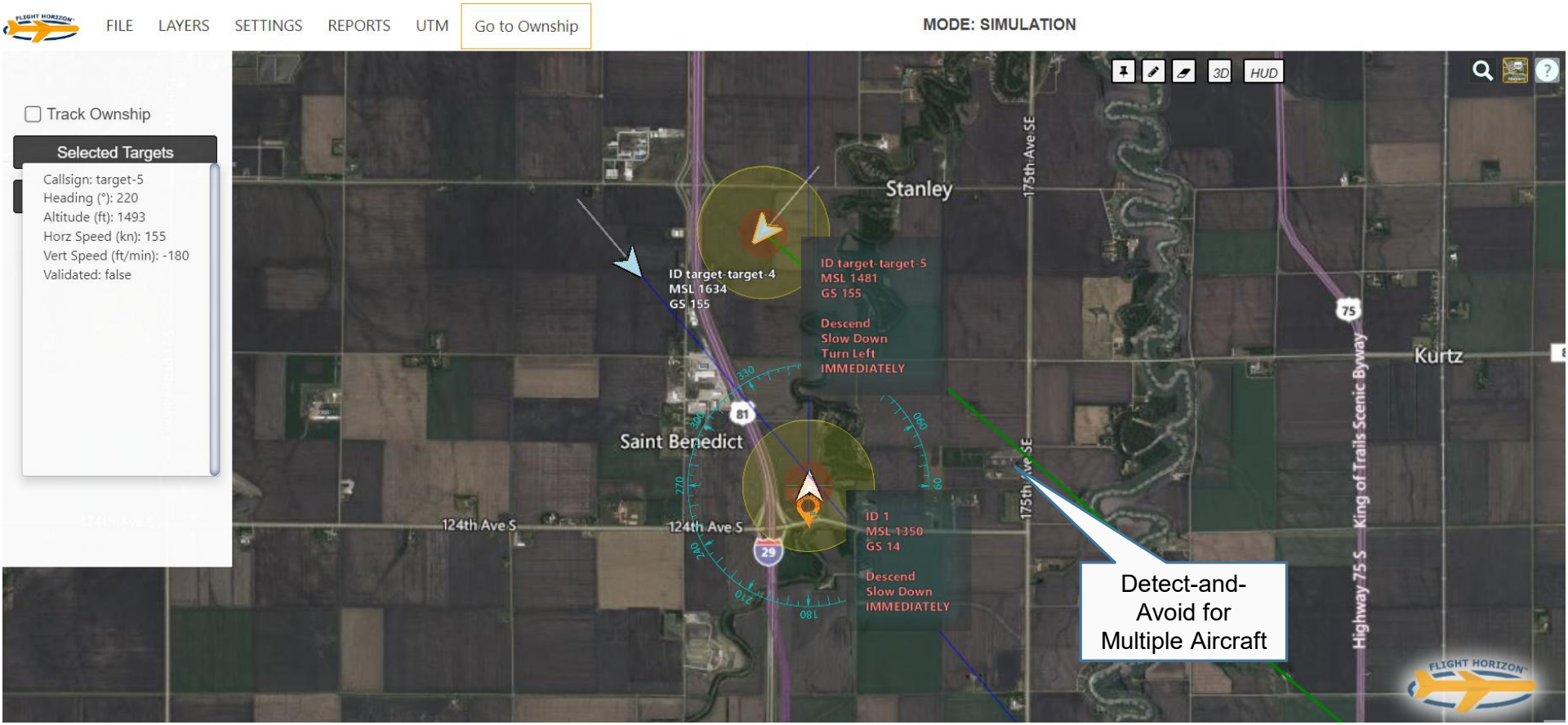




Detect-and-Avoid User Interface

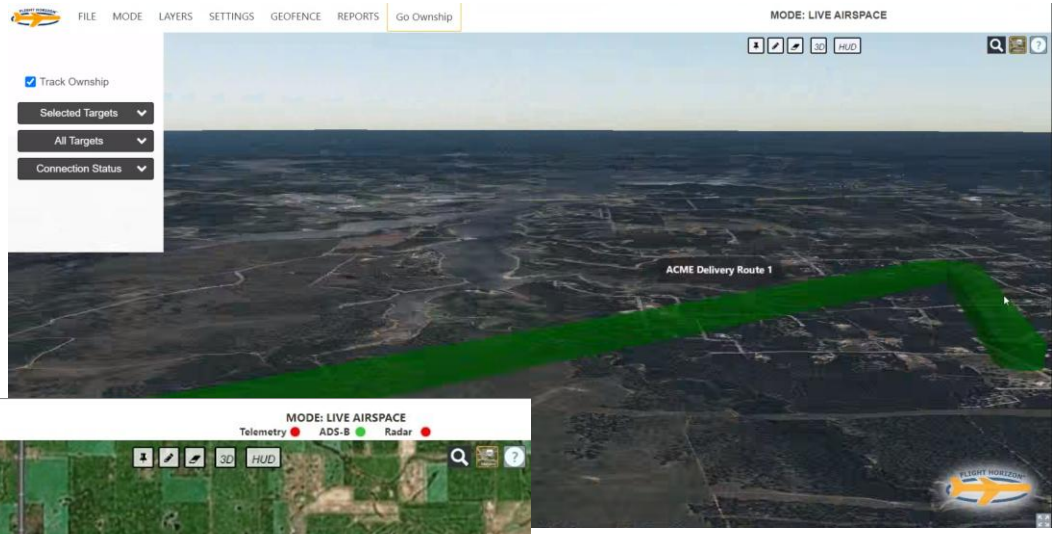


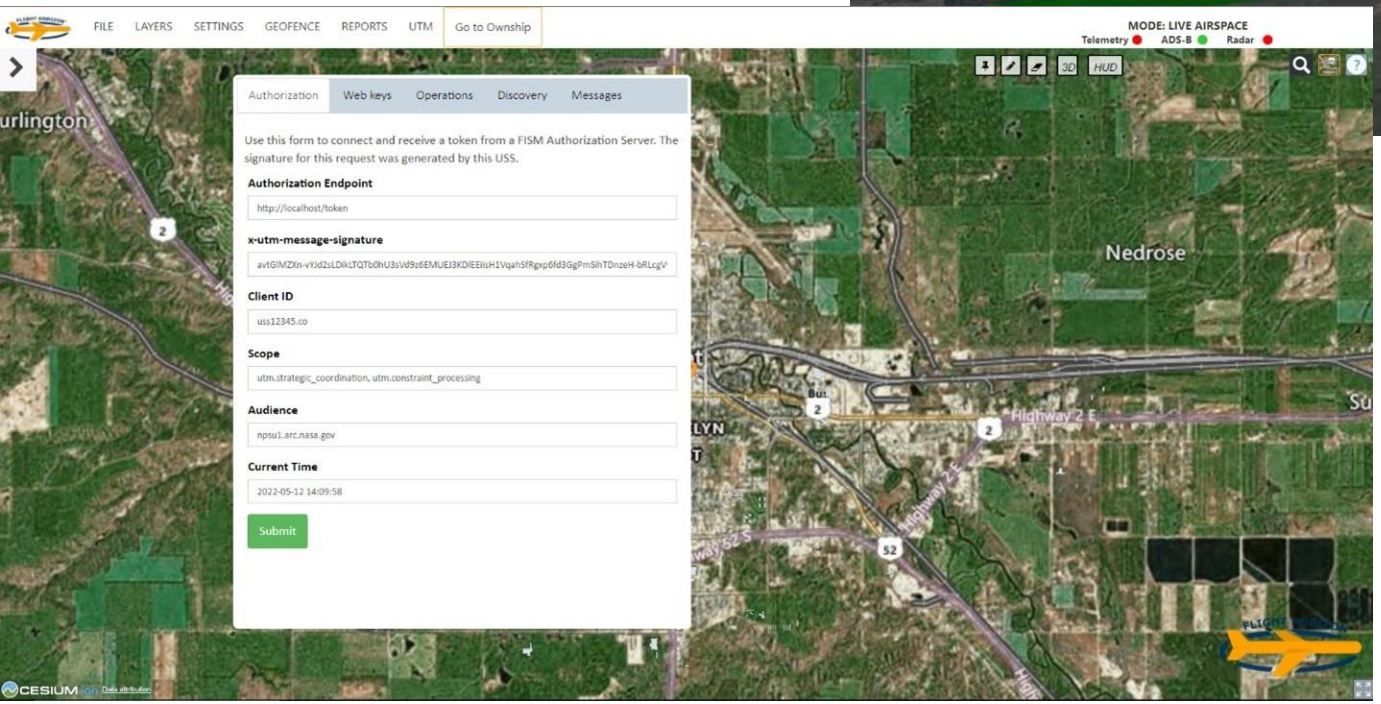
Multi-Aircraft DAA

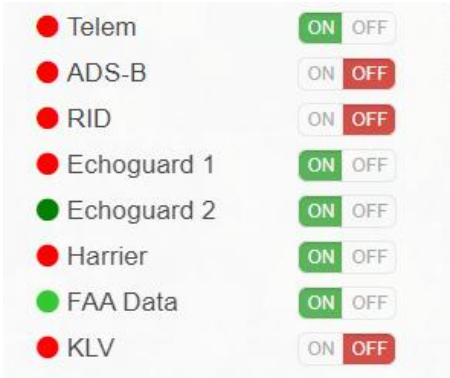


Multi-Aircraft Airspace Management with Collision Avoidance

UTM Functions







BVLOS Flights in Alaska - 2021

Small UAS Ops – 2018 - Present

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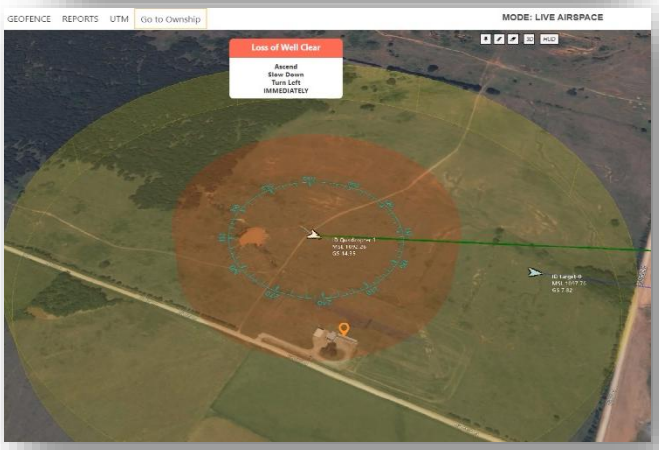
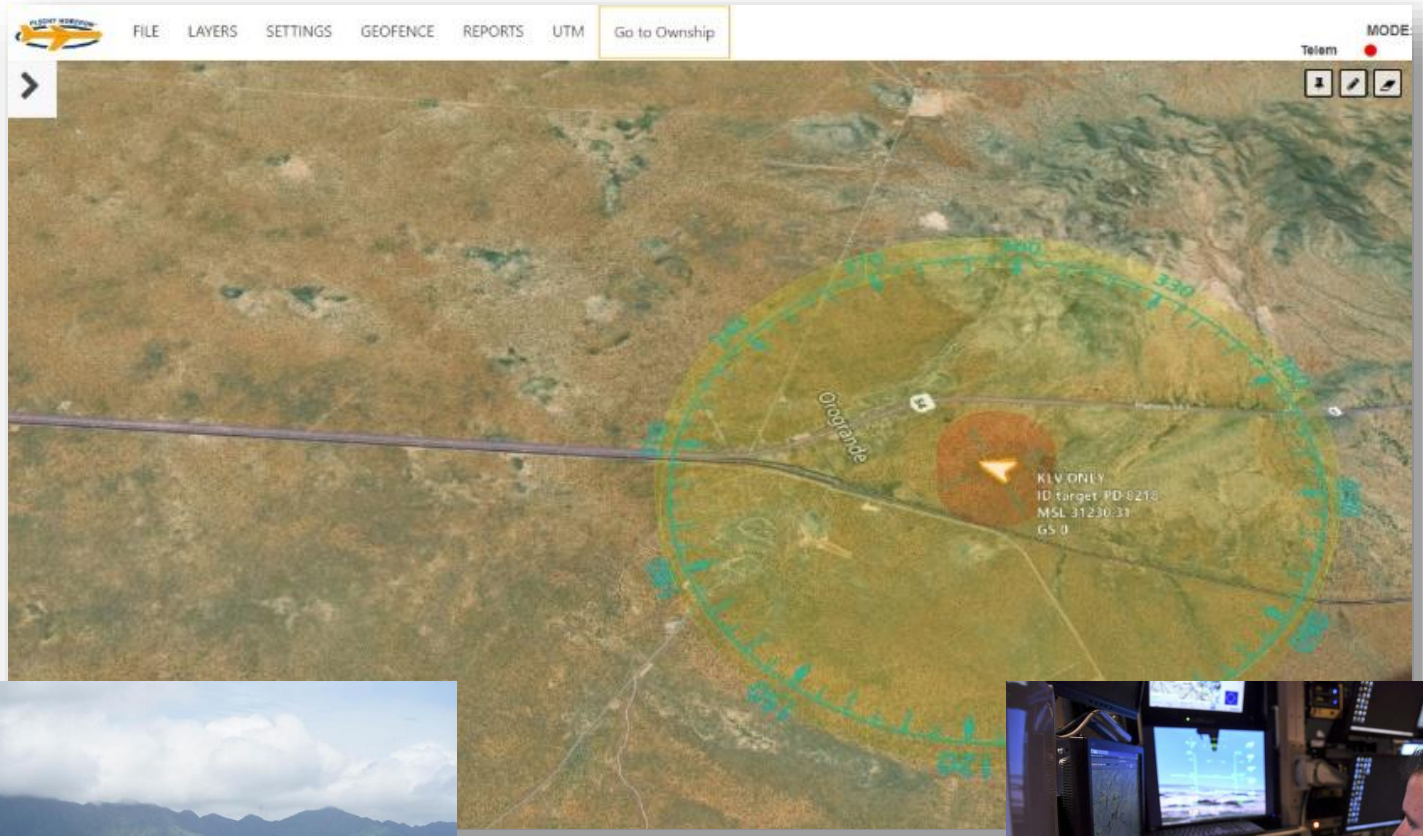


US Air Force Pilot Project - Ongoing



Summary

- Safe AAM will require coordination of multiple data sources
- UTM and associated elements provide a framework for delivery of services to end-user organizations
- Standards create certainty and ensure interoperability
- Scalability will require integration and automation
- Active DAA requires consideration of air and ground risks, appropriate sensors and surveillance
- Active DAA using multiple data sources and correlation can improve baseline safety in UTM

Questions?