

# NASA FAA Upper Class E Traffic Management (ETM)

## ETM Project History and Overview

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FL600

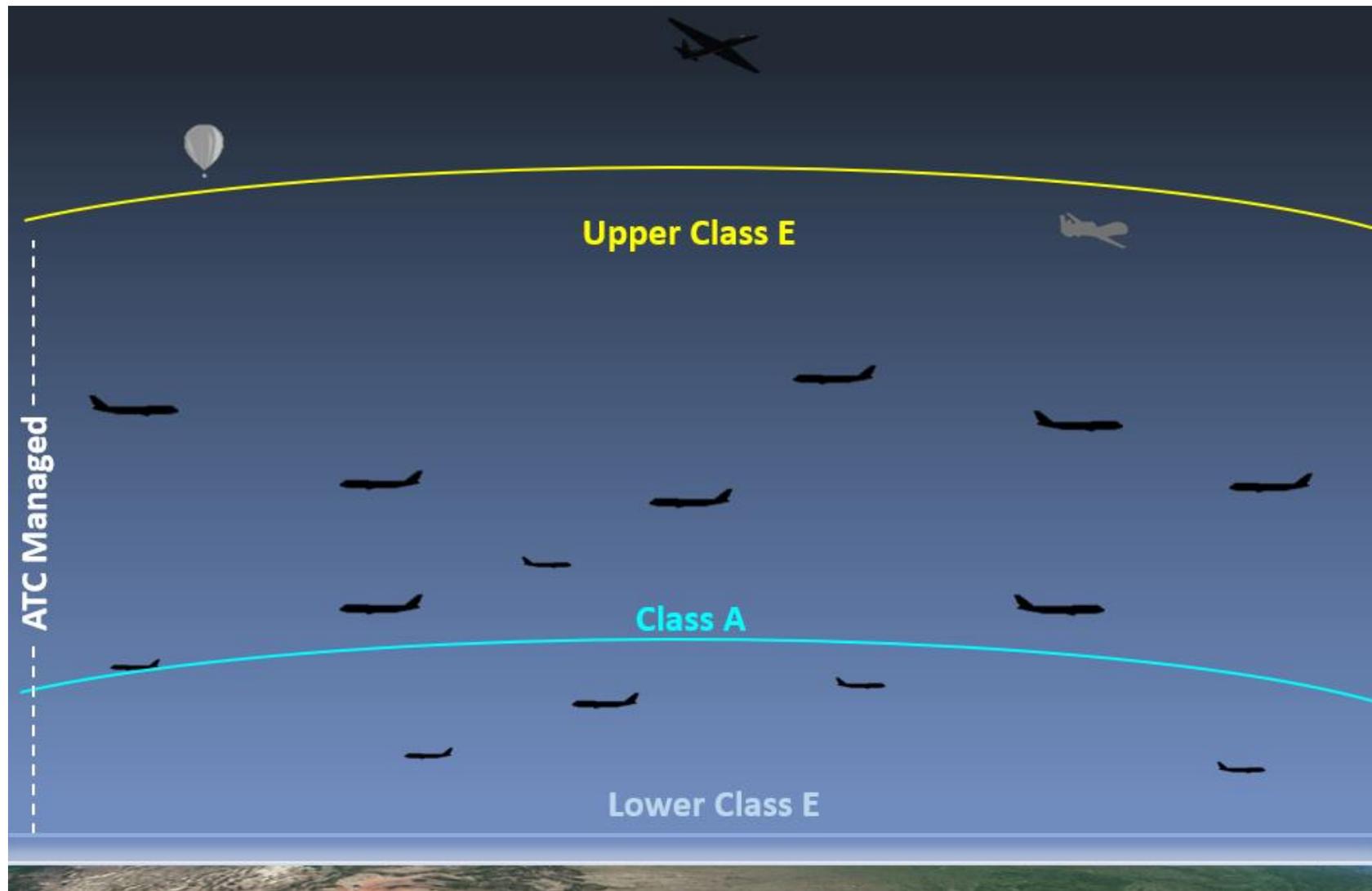
FL180



# Background



- Operations in Upper Class E airspace have traditionally been relatively few in number
- Security and science missions have contributed to much of the presence at high altitudes
- Managed services in Upper Class E have historically not been provisioned for civil aircraft operations





# Growth in Upper Class E Opportunities



Security & Science Communications

Persistent Monitoring

Supersonic  
Transport

Commercial  
Space  
Launch

Hypersonics



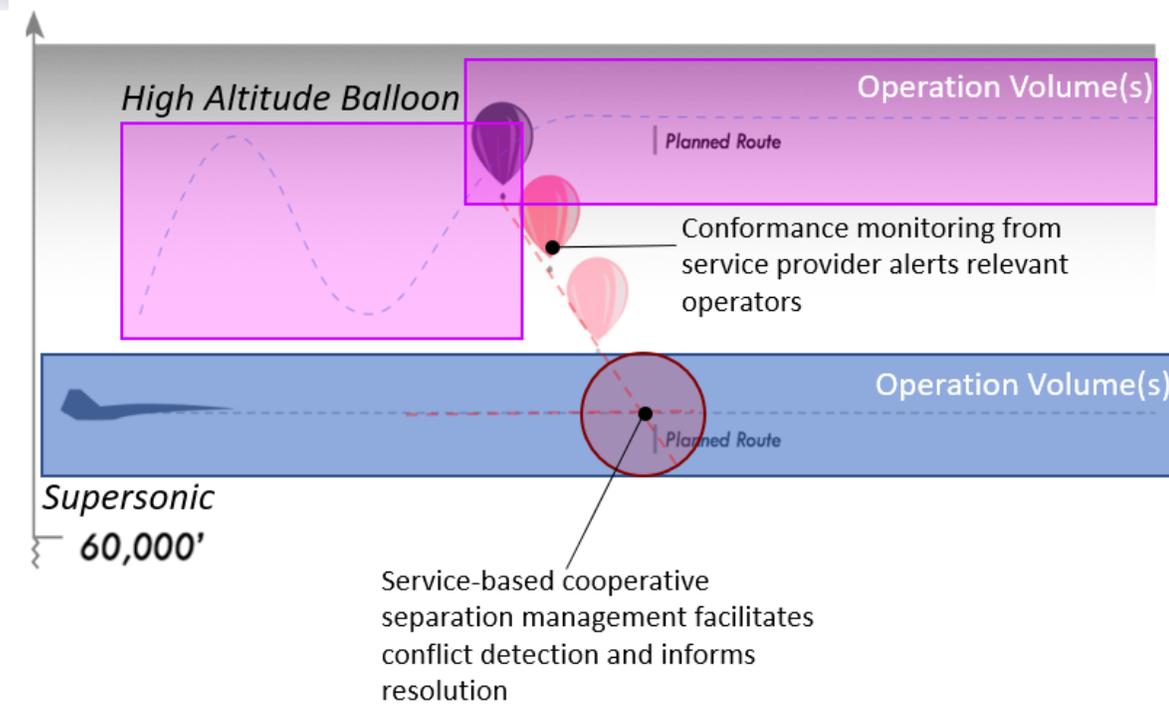
# Upper Class E Traffic Management (ETM)

- What is ETM?

- A cooperative approach to airspace integration and management that is safe, scalable, efficient, and fair that accommodates all missions and use cases

- Why is ETM needed?

- New entrants are emerging
- Existing users need continued safety and access
- Demand for Upper Class E airspace use is projected to increase
- A diverse set of vehicle and operation types are expected
- In the US, ATC services are limited or not provided in Upper E, which will impact the ability for industry to scale

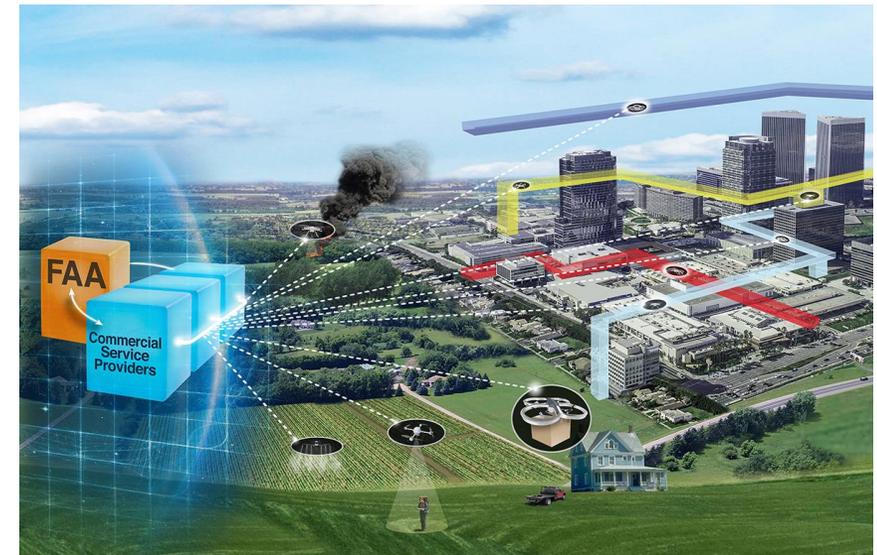
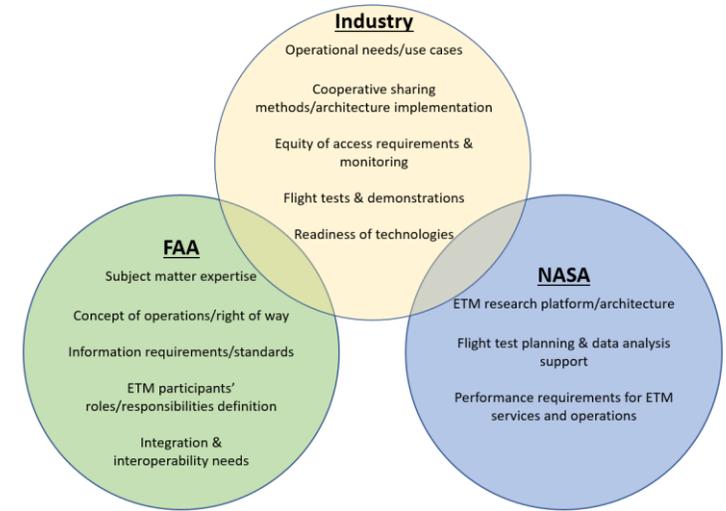




# ETM Development



- Development of ETM was understood to require close collaboration with multiple stakeholders
  - Industry
  - FAA
  - Other regulatory agencies and organizations
  - DoD and other federal agencies
- In developing ETM, the early approach was to build upon the foundations established in NASA's and FAA's UAS Traffic Management (UTM) research





## NASA Ames Research Center April 18, 2019

### Participants

**Standards**  
Int'l. Civil Aviation Org.

**Defense & Security**  
Dept. of Defense (DOD)   
Dept. of Homeland Security (DHS)

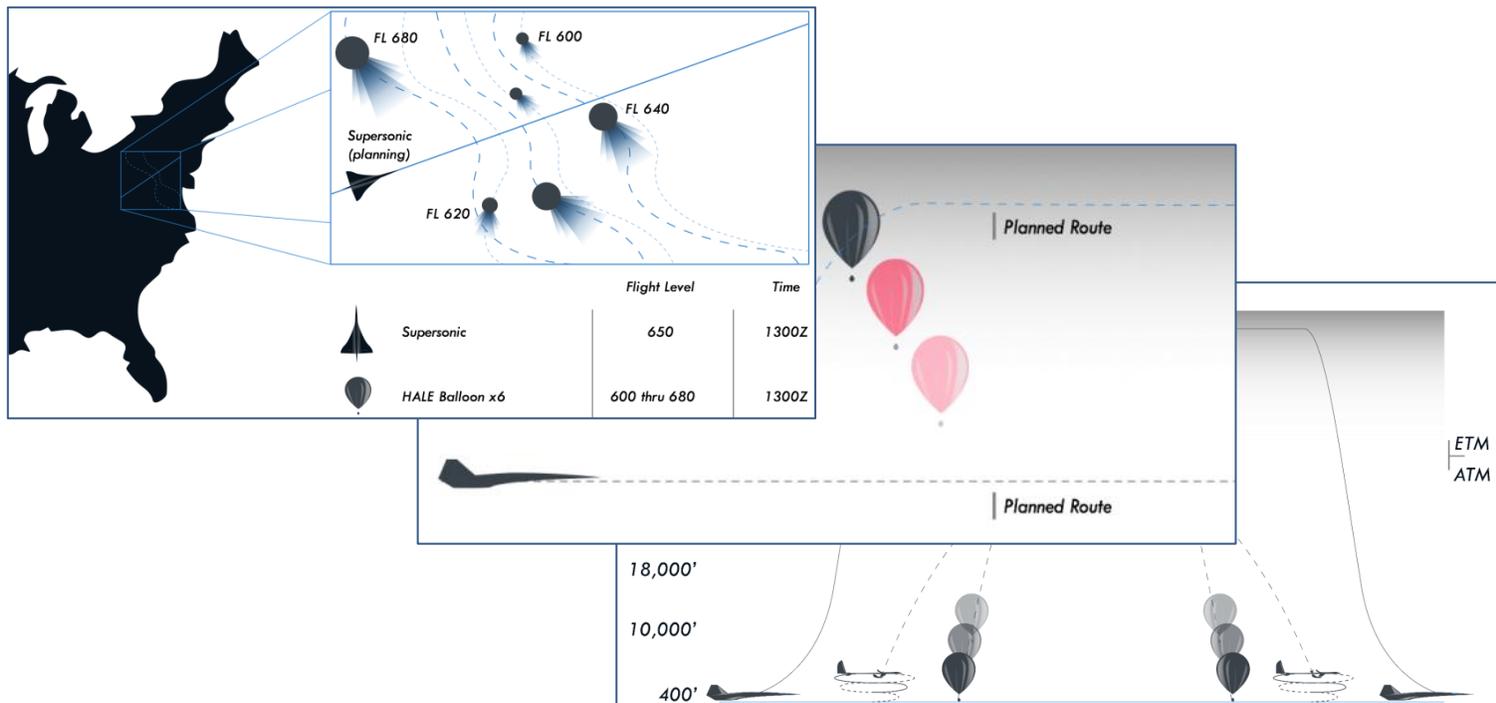
**Industry**

**NASA**  
Ames Research Center

**FAA**  
NextGen (ANG)   
Aviation Safety (AVS)  
Air Traffic Organization (ATO)  
UAS Integration Office (AUS)  
National Air Traffic Controllers Association (NATCA)

### Scenarios

- 1) Transition into ETM
- 2) Strategic Deconfliction between Operations (Pre-Flight)
- 3) Deconfliction between Pre-Flight and Active Operations
- 4) Planned Overlapping Areas of Supersonic & HALE Operations
- 5) Tactical Deconfliction
- 6) Off-Nominal Event





# Tabletop Meetings with Industry & Government Stakeholders: Tabletop 2

## NASA Ames Research Center December 12, 2019

### Participants

**NASA**  
Ames Research Center



**Defense & Security**  
Dept. of Defense (DOD)




**FAA**  
NextGen (ANG)  
Aviation Safety (AVS)  
Air Traffic Organization (ATO)  
National Air Traffic Controllers Association (NATCA)  
UAS Integration Office (AUS)



**Industry**












### Ascent to Operating Altitude Airspace Management and Procedures

*Aerion AS2 (Super/Subsonic)*

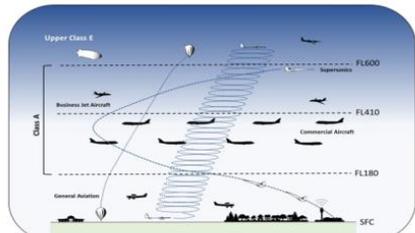
Ascent	Manned Fixed Wing
Ascent Pattern	
Speed	270-280 accelerating to 380 knots
Rate of Ascent	6200 FT/min initially
Time to reach altitude	Approximately 10 minutes
Ability to move laterally and horizontally	Yes
Ability to maintain position (hold altitude)	Able to level off at any portion of the flight

Equipment	Manned Fixed Wing
Surveillance	Planned Secondary Surveillance Radar (SSR) and ADS-B
Communications	Controller Pilot Data Link Communication (CPDLC) and traditional Push-to-Talk (PTT)
Navigation	Global Navigation Satellite System (GNSS), GPS, Inertial Reference System (IRS)

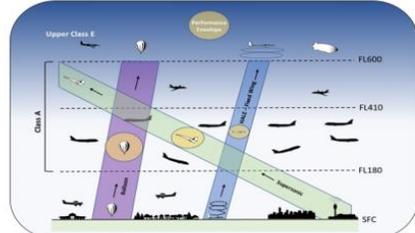
- Ascent procedures
  - ATC services/coordination
- Operating altitude procedures
  - ATC services/coordination
- Operational Issues
  - FAA identified
  - Industry identified



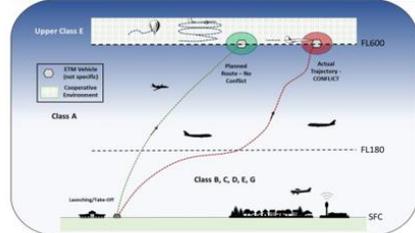




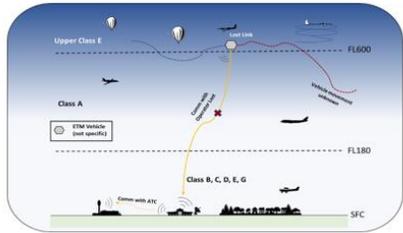
Take-off/launch and transit to Upper Class E airspace



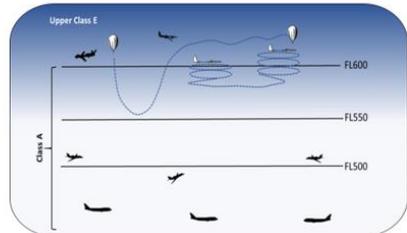
Ascent/Descent to/from operating altitude



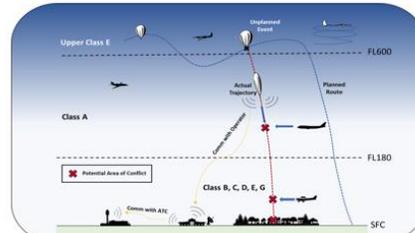
Class E entry point change



Lost link



Operations straddling ETM and provided separation



Uncontrolled descent



# Post-Tabletop Engagement

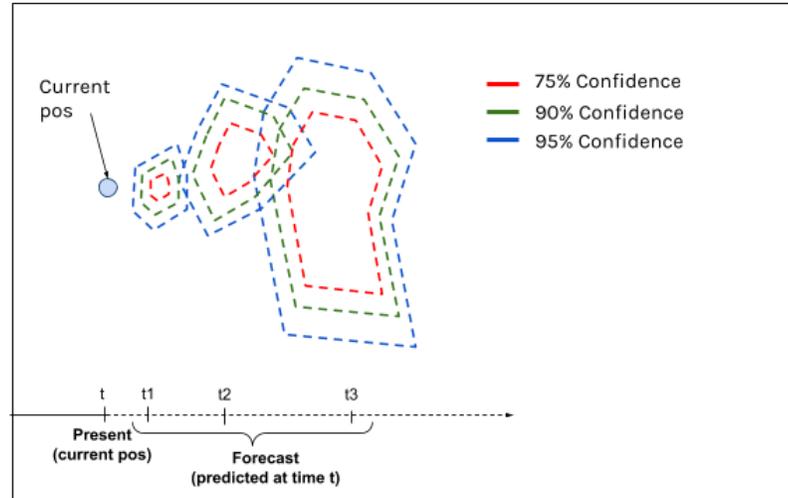
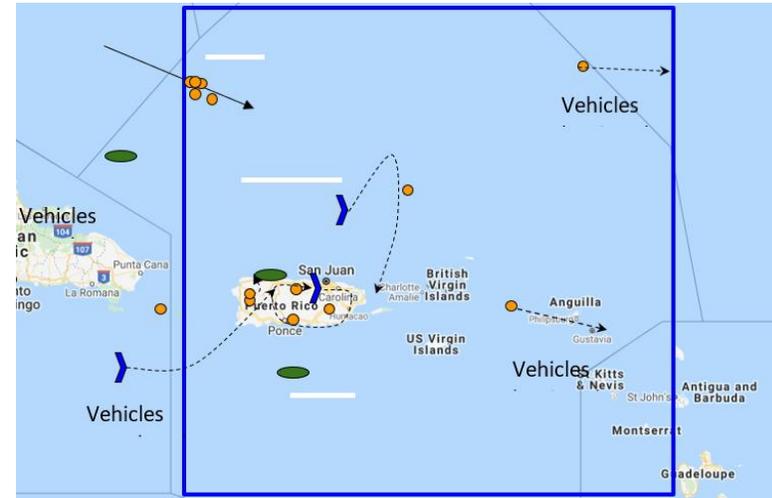


- Need was identified for greater interaction among ETM stakeholders
- Regular meeting schedule developed with Industry, FAA, and other stakeholders
- Interim AIA-mediated meetings for Industry consensus



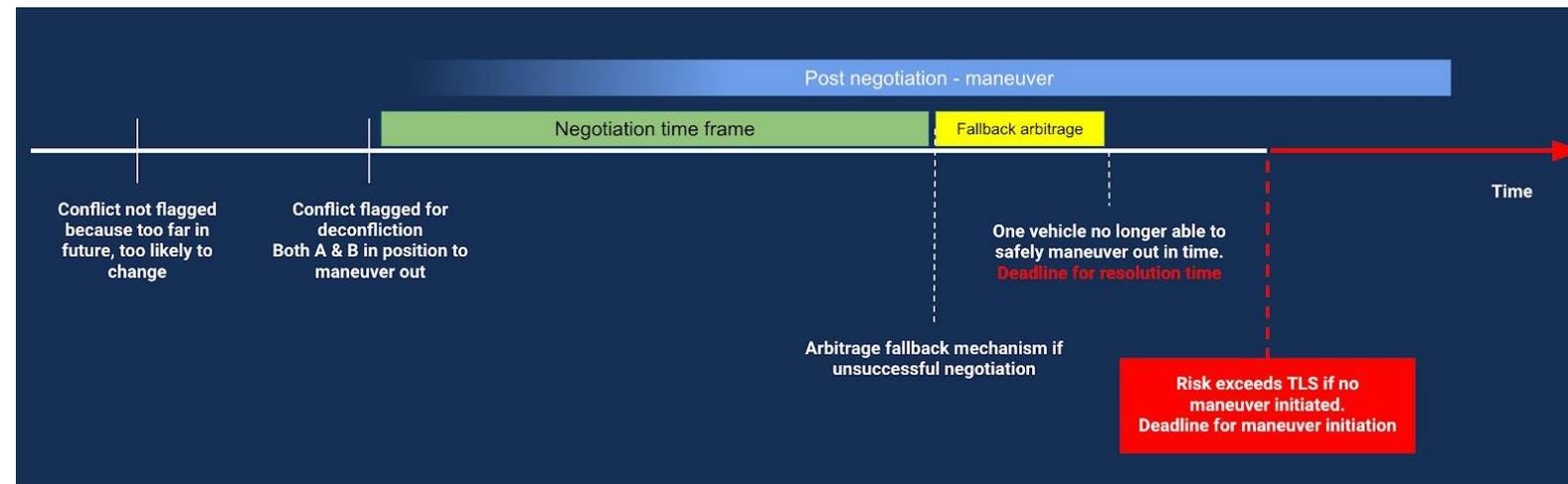
Swift Engineering Inc.





Multiple topics presented and discussed as part of regular engagement between stakeholders:

- Proposed use cases
- Concept of intent sharing
- Conflict identification
- Cooperative conflict resolution process and negotiation
- Rules of the road for operators
- Characterization of ETM environments
- *many more...*





# NextGen ETM ConOps

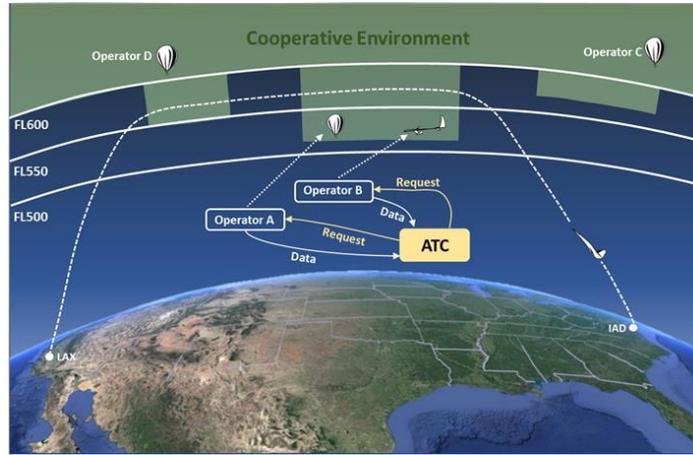


**Concept of Operations**

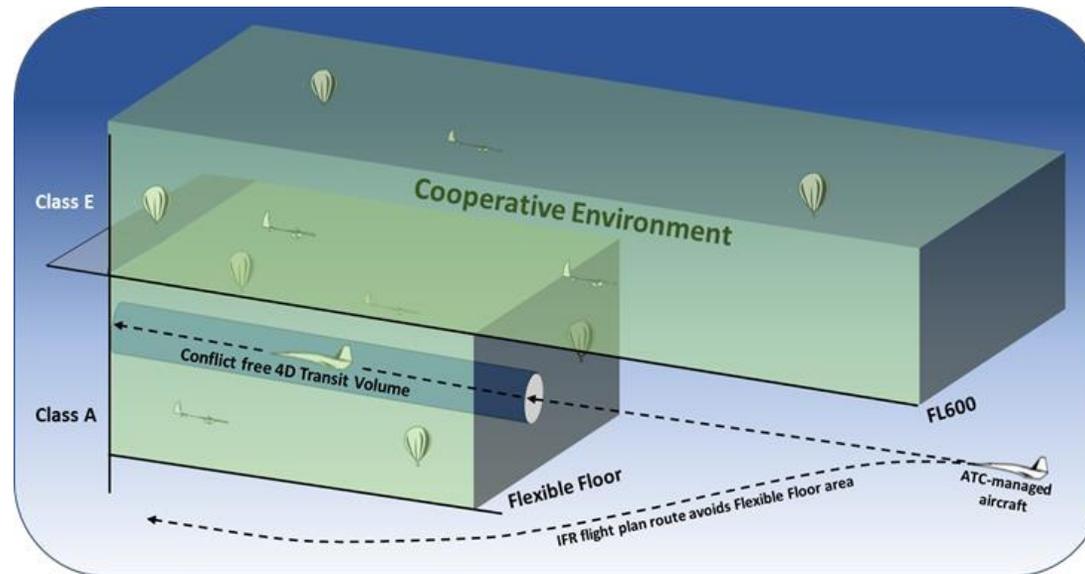
**v1.0**

- Foundational Principles
- Roles and Responsibilities
- Scenarios and Operational Threads

**Upper Class E Traffic Management (ETM)**



- Operations
  - Pre-Flight and Transition to Upper Class E Airspace
  - Operating Altitude WITHIN Upper Class E Airspace
  - Operating Altitude BELOW Upper Class E Airspace: Flexible Floor of Cooperative Environment
  - Descent from Upper Class E Airspace to Landing (into/through Class A airspace)
  - Contingency Management
- Equity of Airspace Usage
- Security
- ETM Implementation

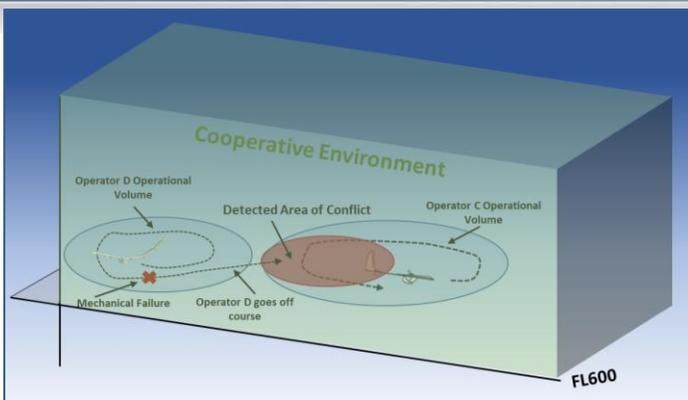
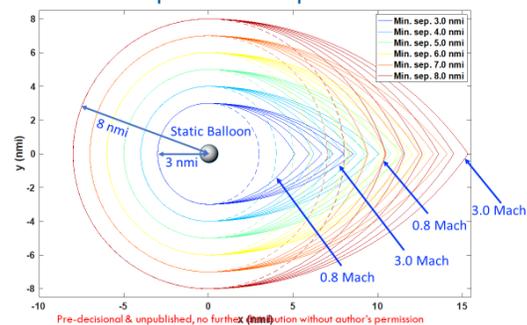




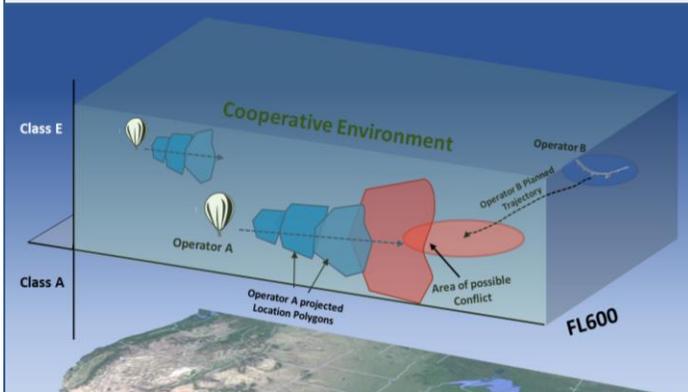
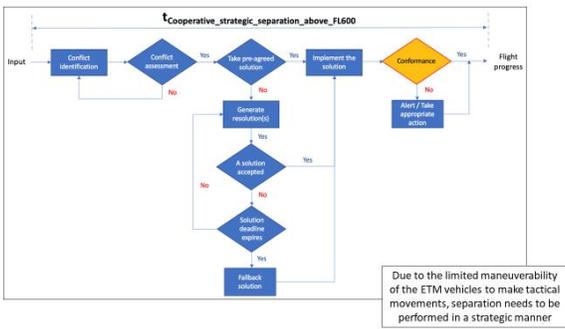
# Early Work



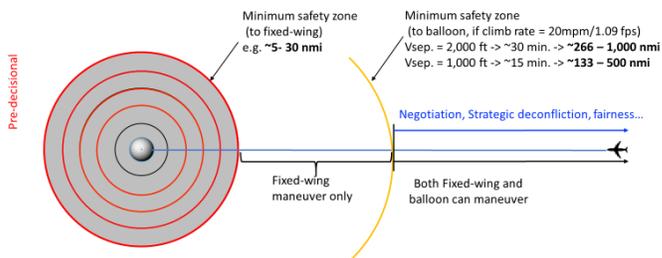
### Minimum safety zone for different minimum separations & speeds



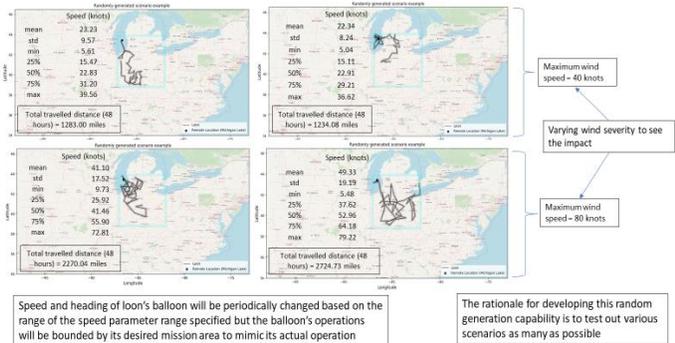
### National cooperative separation management service processes within Upper Class E Airspace (Above FL 600)



### Conflict Resolution Phases for Balloon and Fixed wing



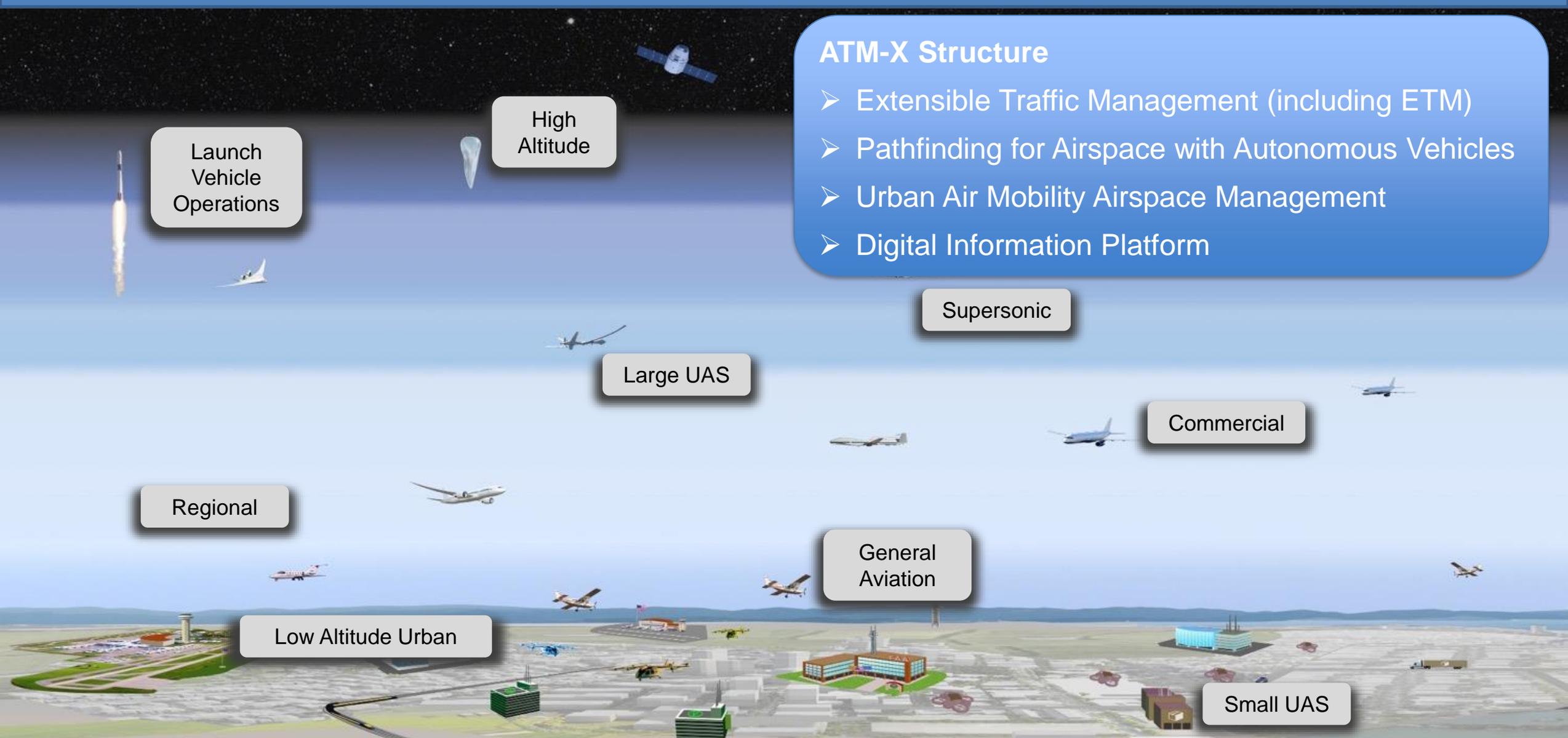
### Random scenario generation for Loon's balloon (examples)



- Stakeholder engagement and outreach
- Use case development and discussions
- Concept development
- Simulation planning and initial platform development
- Architecture and services exploration



# ETM as Part of NASA Air Traffic Management eXploration (ATM-X) Project



Launch Vehicle Operations

High Altitude

- ### ATM-X Structure
- Extensible Traffic Management (including ETM)
  - Pathfinding for Airspace with Autonomous Vehicles
  - Urban Air Mobility Airspace Management
  - Digital Information Platform

Supersonic

Large UAS

Commercial

Regional

General Aviation

Low Altitude Urban

Small UAS



## Research Transition Team (RTT)



- The early collaboration between ETM participants provided the foundations for formal structure to be applied to the research and development effort
- Building upon that structure, NASA and FAA formally established a Research Transition Team in 2021 with a path forward to progressing the ETM concept in close coordination with each other and the other community stakeholders