

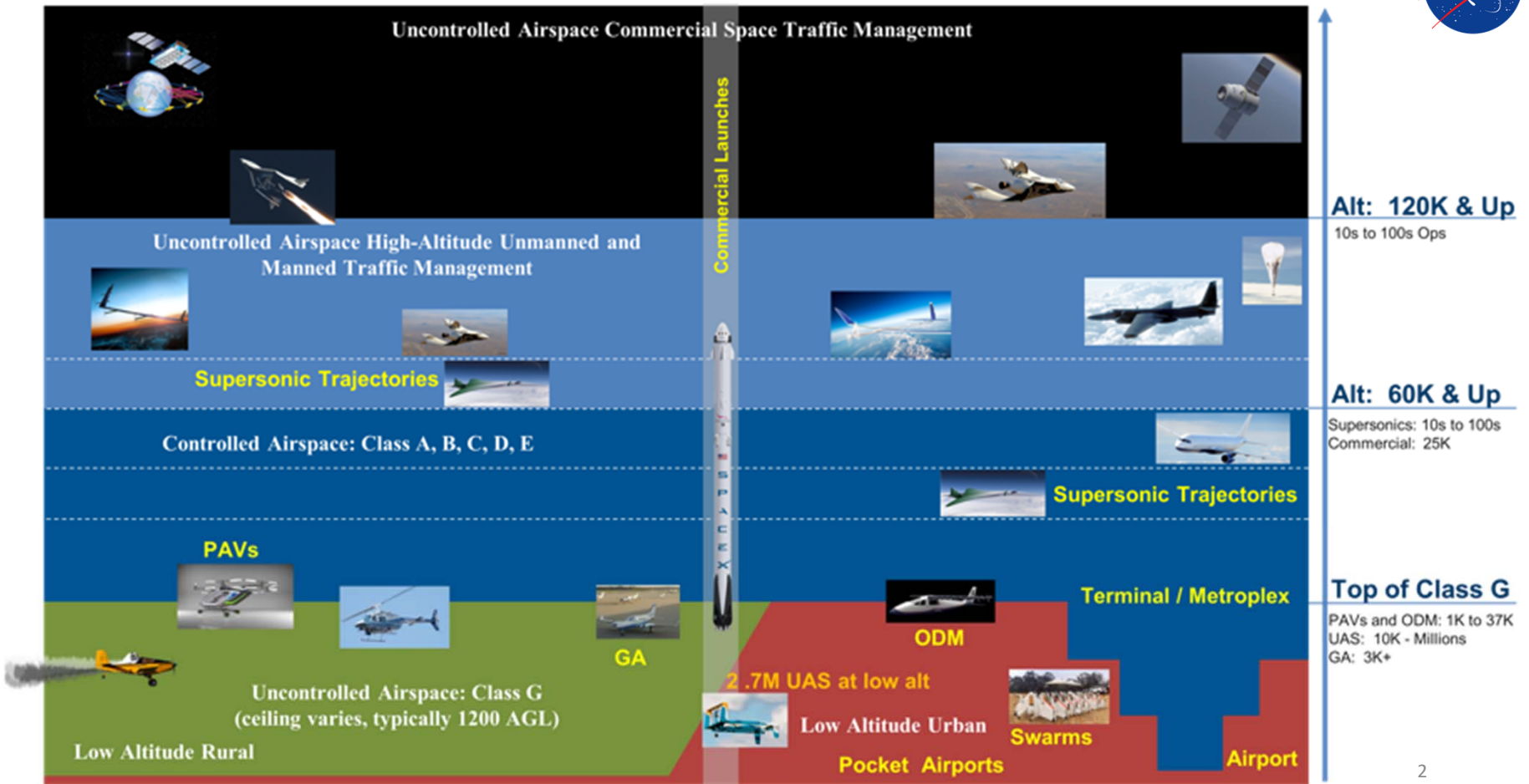


Embracing Innovation in Aviation While Respecting Its Safety Tradition

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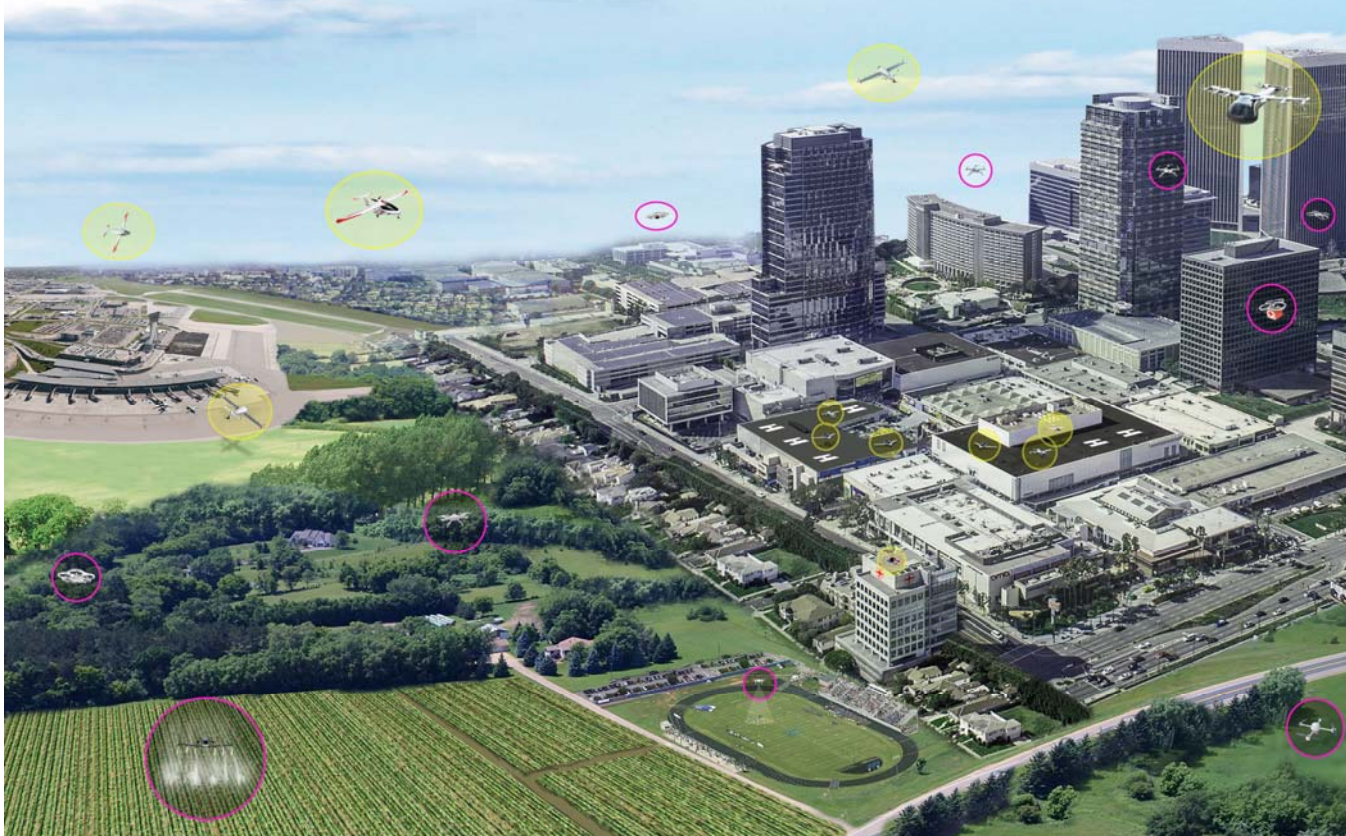
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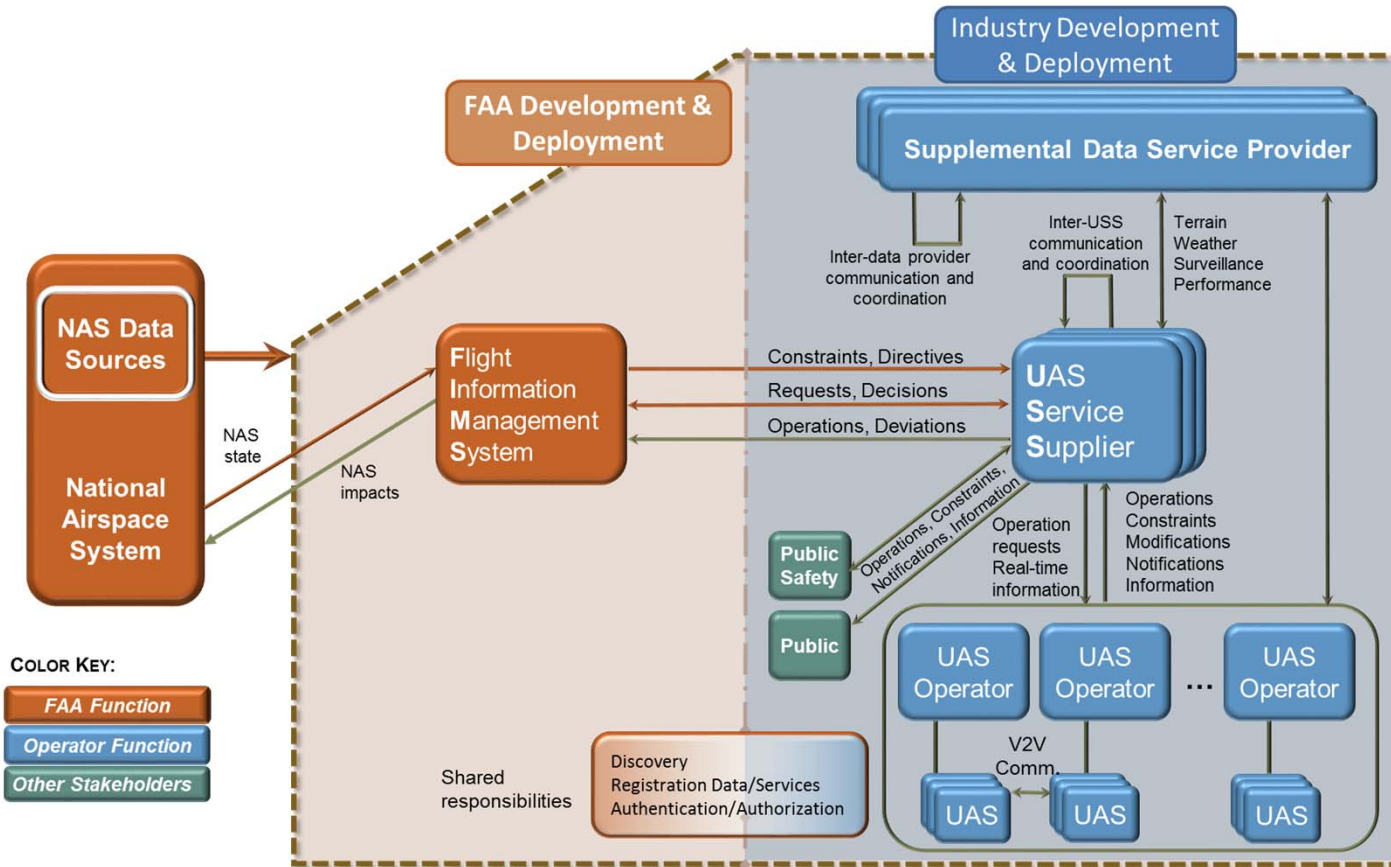
SMALL UNMANNED AIRCRAFT SYSTEMS



URBAN AIR MOBILITY: SMALL DRONES TO LARGER PASSENGER CARRYING VTOLS



UAS TRAFFIC MANAGEMENT ARCHITECTURE



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

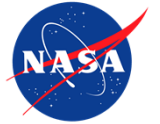
- Individual Operator
- Fleet Management
- On-board capabilities to support safe operations

COLOR KEY:

- FAA Function
- Operator Function
- Other Stakeholders

*Connections & communications are internet-based & built on industry standards & protocols

UTM-LIKE-ATM AIRSPACE OPERATIONS ENVIRONMENT



- Cooperative
- Intent-sharing
- Digital: data exchanges among operators
- Standardized application protocol interfaces
- Air/ground integrated
- Service-oriented architecture
- Role for third parties

Space Traffic Management

High Altitude UTM (Upper E)

**Conventional Manned Aviation
(Class A, B, C, D, E)**

Urban Air Mobility

Low-altitude small UAS

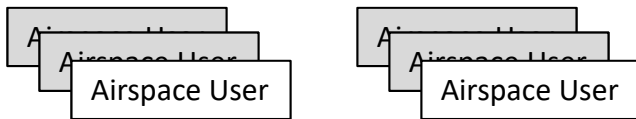
Current ATM

All services are provided by the FAA

- Traffic flow management
- Airspace directives/constraints
- Scheduling, sequencing, and spacing
- Separation management
- Off-nominal management
- Every vehicle interaction in real-time.

FAA Systems

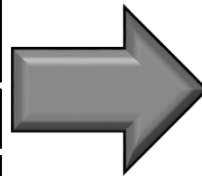
Humans address off-nominal and contingencies



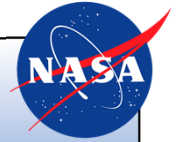
Very little interaction among users and third-party services.

- Human in the epi-center of information integration
- Every data moves through FAA systems for every vehicle
- Each change focused on domain-specific FAA system.

NASA's unique role: architecture, data exchange, service allocation/roles/responsibilities, rules of engagement, service performance requirements, automation for contingency management and disruption handling, machine learning environment and algorithms for continuous improvement, safety assurance, certification/acceptance approaches and technology transition.



UTM-inspired ATM



Some services are provided by the FAA

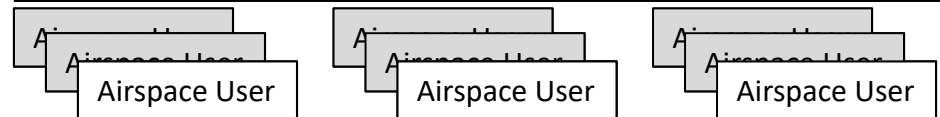
- Airspace directives/constraints
- Resource availability and changes to resources (e.g., arrival/departure rates, resource schedules)
- Separation.

FAA Systems

User or third-party services

- Flow management
- Sequencing and spacing
- User participation strategic Separation (e.g., oceanic).

Automation addresses off-nominal and contingencies



Users collaborate/cooperate for efficiency, intra-user preferences for flights into constrained resources.

- Automation in the epi-center of information integration
- New paradigm: digital and connected ecosystems—outside apps, scalability.



CONCLUDING REMARKS

- Need for change is real, current systems are not sustainable
- Sense of urgency due to emerging markets and diversity of operations
- Build-a-little-test-a-little and deploy
- International harmonization – many areas
- Highly scaled operations that are affordable and safe

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