The Role of Airspace Management

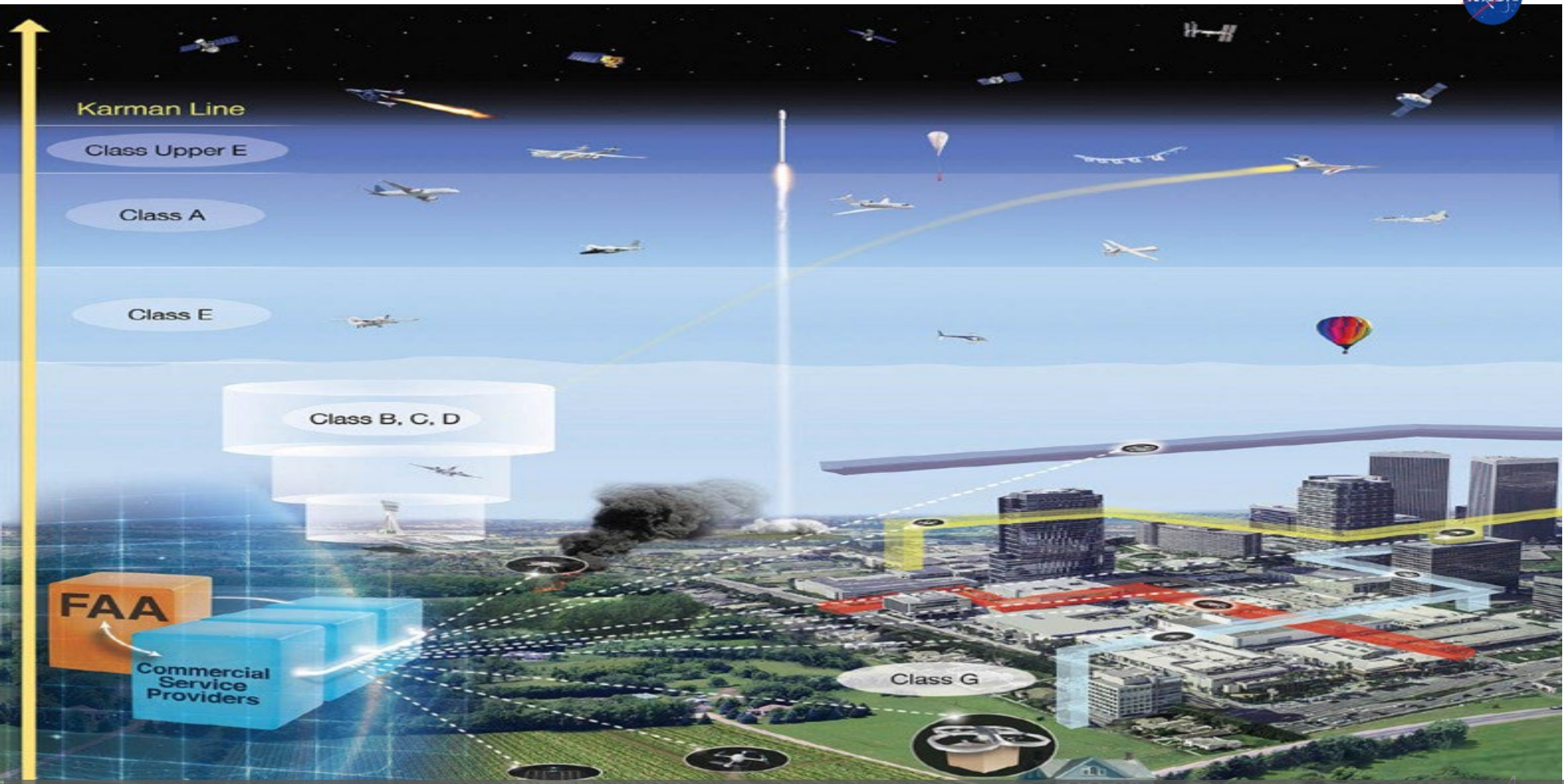
New Entrants need quicker and sustained airspace access

New Entrants need quicker and sustained airspace access

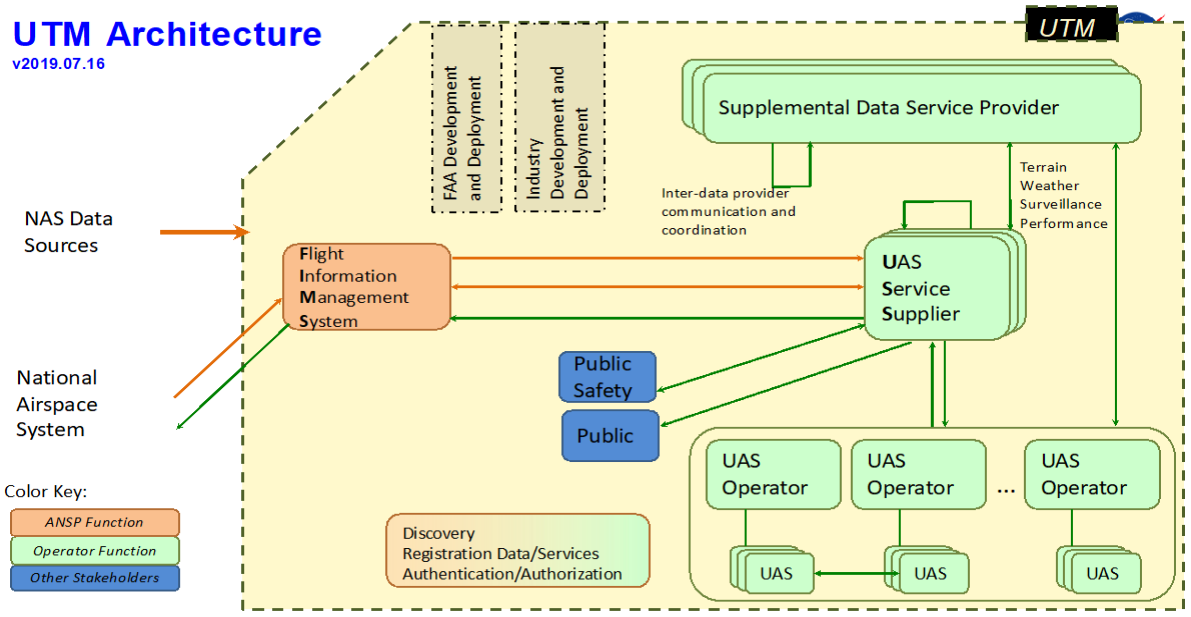
Airspace system needs to be ready when the vehicles are ready

Airspace “System” Should be Ready when Vehicles are Ready

Need


Karman Line
Class Upper E
Class A
Class E
Class B, C, D
FAA
Commercial Service Providers
Class G

Lessons Learned from Successful Unmanned Aircraft System Traffic Management



- Cooperative (share and care)
- Intent-sharing
- Digital: data exchanges among operators
- Standardized application protocol interfaces
- Air/ground integrated
- Service-oriented architecture
- Role for third-parties
- Management by exception

Recent Success: Global Impact

Scaled operations without burdening current air traffic system

Unmanned Aircraft System Traffic Management (UTM)

- Service-oriented architecture
- Cooperative
- Digital
- Intent-sharing
- Third-party services
- Managed by exception

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 operations (upper E)	✓
Conventional Manned Aviation (Class A, B, C, D, E)	✗
Urban/Advanced Air Mobility	✓
Low-altitude small UAS	✓

Current NASA AOSP partial focus is shown by ✓

Evolution of Airspace Operations and Safety

S-curves

Safety

Procedural

Estimate the current and planned a/c positions

+Density

Radar

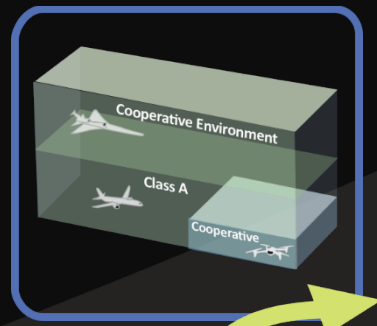
Know the current and **estimate** planned a/c positions

+ Efficiency and proactive planning

Trajectory

Know & exchange current and planned a/c positions

+ Service oriented architecture for tailored mission oriented services



Collaborative

Connected, performance-based, collaborative ATM

Introduces 3rd-party service providers

+ Complexity, scalability, and dynamic adaptation

Highly-Automated

ML/AI – based dynamic, robust performance and safety

Machine-to-machine interactions and humans collaborate

Digital Transformation of ATM

Human-centered safety monitoring, assessment and mitigation

Automated in-time safety monitoring and alerting services

Integrated predictive risk mitigation across domains

Automatically-assured adaptive in-time safety threat management

Epoch 1

Epoch 2

Epoch 3

Epoch 4 (~2035)

Epoch 5 (~2045)

Transition to UTM-inspired Airspace Traffic Management

Current ATM	UTM-inspired-ATM
All services are provided by FAA	Services are provided FAA and third-parties
Human address off-nominal situations and contingencies to ensure safety	Automation addressed off-nominal situations and contingencies to ensure scalability while maintaining safety
Very little interaction among users and third parties	Users collaborate/cooperate for efficiency, preferences for flights into constraints resources
• Human at the epi-center of information integration • Every data for every vehicle moves through FAA systems • Management by clearances • Each change is focused on domain-specific FAA system	• Automation at the epi-center of information integration • New paradigm: Digital, connected ecosystems, outside applications • Movement towards management by exceptions • Each change is focused on trajectory optimization

Research Needed: Architecture, data exchanges, service allocation/roles/responsibilities, rules of engagement, performance requirements for aircraft and airspace system technologies, automation for contingency management and disruption handling, machine learning environment and algorithms for continuous improvement, safety assurance/certification/acceptance approaches, and technology transfers.


Simultaneous Total System Performance
Management by Exception
Airspace Simplification
Disruption Management

Embracing Innovation in Aviation while Respecting its Safety Tradition

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