National Aeronautics and Space Administration

Unmanned Aircraft Systems Traffic Management (UTM)

SAFELY ENABLING UAS OPERATIONS IN LOW-ALTITUDE AIRSPACE

ICNS, April 2017

Outline

- Overview
- Approach and schedule
- FAA-NASA Research Transition Team deliverables
- Next Steps

Overview

Low Altitude UAS Operations

- Small UAS forecast – 7M total, 2.6M commercial by 2020
- Vehicles are automated and airspace integration is necessary
- New entrants desire access and flexibility for operations
- Current users want to ensure safety and continued access
- Regulators need a way to put structures as needed
- Operational concept being developed to address beyond visual line of sight UAS operations under 400 ft AGL in uncontrolled airspace using UTM construct

What is UTM?

- UTM is an “air traffic management” ecosystem for uncontrolled airspace
- UTM is a separate, but complementary system to the Air Traffic Management (ATM) system
- UTM utilizes industry’s ability to supply services under FAA’s regulatory authority where these services do not exist
- UTM development will ultimately identify services, roles/responsibilities, information architecture, data exchange protocols, software functions, infrastructure, and performance requirements for enabling the management of low-altitude uncontrolled UAS operations

How to enable multiple BVLOS operations in low-altitude airspace?
UTM addresses critical gaps associated with lack of support for uncontrolled operations

Key Operational Assumptions

- FAA maintains regulatory *AND* operational authority for airspace and traffic operations
- UTM is used by FAA to issue directives, constraints, and airspace configurations
- Air traffic controllers **are not required** to actively "control" every UAS in uncontrolled airspace or uncontrolled operations inside controlled airspace
- FAA has on-demand access to airspace users and can maintain situation awareness through UTM
- UTM roles/responsibilities: Regulator, UAS Operator, and UAS Service Supplier (USS)
- FAA Air Traffic can institute operational constraints for safety reasons anytime

Key principle is safely integrate UAS in uncontrolled airspace without burdening current ATM

UTM Principles and Services

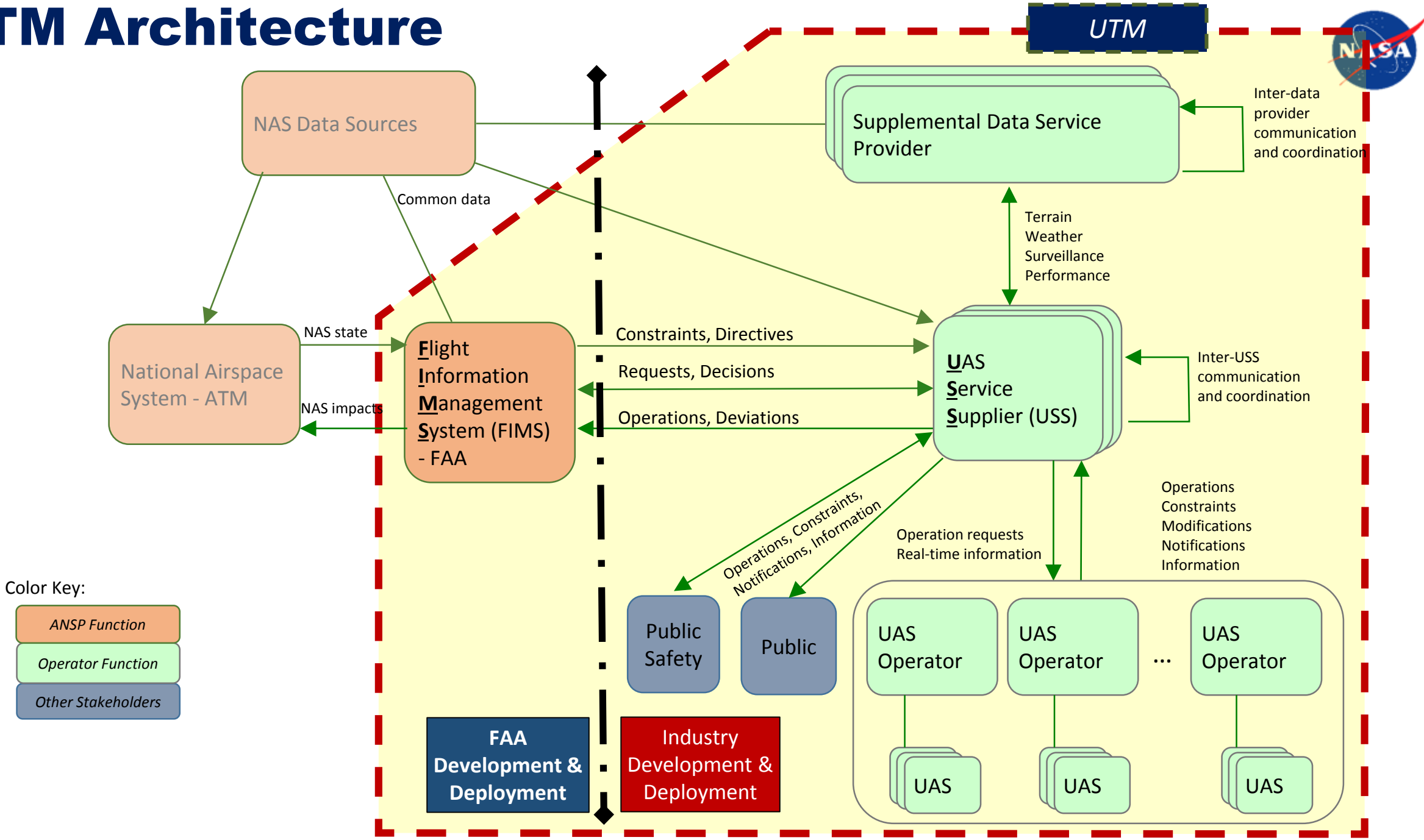
Principles

- ❑ Users operate in airspace volumes as specified in authorizations
- ❑ Authorizations are issued based on type of operation and operator/vehicle performance
- ❑ UAS stay clear of each other
- ❑ UAS and manned aircraft stay clear of each other
- ❑ UAS operator has complete awareness of airspace and other constraints
- ❑ Public safety UAS have priority over other UAS

Key UAS-related services

- ❑ Authentication
- ❑ Airspace configuration and static and dynamic geo-fence definitions
- ❑ Track and locate
- ❑ Communications and control (spectrum)
- ❑ Weather and wind prediction and sensing
- ❑ Conflict avoidance (e.g., airspace notification)
- ❑ Demand/capacity management
- ❑ Large-scale contingency management (e.g., GPS or cell outage)

UTM Architecture



Value of UTM

- Higher density UAS operations
- Beyond visual light of sight (BVLOS) UAS operations
- Manned and unmanned vehicle operations coordination
- Unmanned vehicle operations coordination through agreed upon data/information exchanges about each others' operations and with FAA NAS systems
- Exceptions handling
- Beyond Part 107 operations– e.g. entry into controlled airspace

UTM Approach and Schedule

UTM Progression

Goal:

Safely enabling large scale visual and beyond visual line of sight operations in the low altitude airspace

Risk-based approach along four distinct Technical Capability Levels (TCL)

UTM Progression

TCL1: *multiple VLOS*

→ API-based networked ops

→ Info sharing

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TCL3: *multiple BVLOS, near airports, suburban*

→ Routine BVLOS

→ Airborne DAA, V2V

→ Avoid static obstacles

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TCL3: *multiple BVLOS, near airports, suburban*

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TCL4: *complex urban BVLOS*

→ BVLOS to doorstep

→ Track and locate

→ Avoid dynamic obstacles

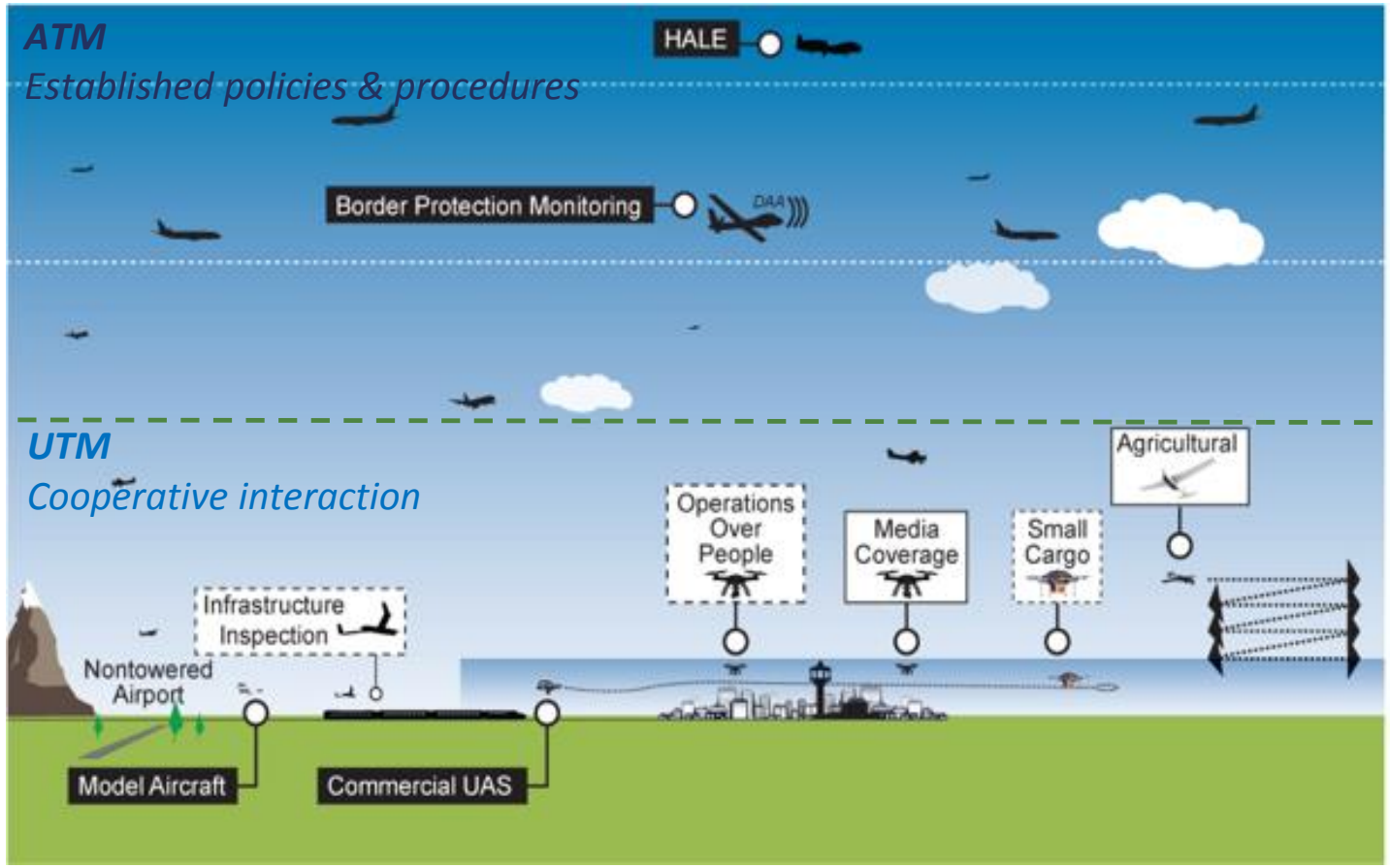
→ Large scale contingencies

FAA-NASA Research Transition Team (RTT) Deliverables

UTM RTT *Scope*

UTM focuses on a self-managed environment:
Uncontrolled airspace & uncontrolled operations inside controlled airspace

- Entry point - small UAS (Part 107 < 55lbs) – although weight is not a factor for UTM
- Beyond visual line of sight (BVLOS) of the operator - expanded operations
- Airspace where the FAA does not interact directly (e.g., no controller clearances to each vehicle)
- Low altitudes – *initial focus is at or below 400 ft AGL* – potentially scales to other airspace
- All airspace classes (B, C, D, E, & G) except Class A - *initial focus is Class G, uncontrolled airspace*



RTT Plan & Key Deliverables

- **Near-term priorities**
  - Joint UTM Project Plan (JUMP) – December 2016 (Completed)
  - RTT Research plan – January 2017
  - UTM Pilot project – April 2017-2019
- **Execution**
  - March 2016 – December 2020

- **Key RTT Deliverables (FAA needs)**
  - Tech transfer - to FAA and industry
    - Concepts and requirements for data exchange and architecture, communication/navigation and detect/sense and avoid
      - Cloud-based architecture and Conops
      - Multiple, coordinated UAS BVLOS operations
      - Multiple BVLOS UAS and manned operations
      - Multiple operations in urban airspace
  - Tech transfer to FAA
    - Flight Information Management System prototype (software prototype, application protocol interface description, algorithms, functional requirements)

- **FAA-NASA Key RTT Deliverable**
  - Joint FAA-NASA UTM Pilot Program

RTT will culminate into key technical transfers to FAA and joint pilot program plan and execution

Communications and Navigation (C&N) Working Group

- Develop C&N guidance to industry for ensuring that
  - Unmanned Aircraft (UA) are under operational control of the pilot
  - UA remain within a defined area
- Three main topics
  - Command and control
  - Navigation
  - Data collection and compliance
- Strong industry participation
- Currently developing guidance for low risk operations, followed by guidances to moderate and high risk operations

Lessons learned from TCL2 demo

- Awareness of nearby operations and airspace constraints
- Consistent measurement and reporting of vehicle altitude
- Consistent operational plans between UTM, GCS, and UA

Next Planned Evaluations

- Additional TCL2 multiple BVLOS tests at all FAA test sites in May/June 2017

  – Task orders to all test sites issued. Strong industry participation (many operators, multiple USS, many use cases)

  – Focus Areas:
    - UAS Service Supplier technologies and procedures
    - Geofencing technologies/conformance monitoring,
    - Ground-based surveillance/sense and avoid,
    - Airborne sense and avoid
    - Communication, navigation, surveillance
    - Human factors related to UTM data creation and display

- TCL3 preparations ongoing, testing period end FY17/FY18

QUESTIONS?

Embracing innovation in aviation while respecting its safety tradition