



# Unmanned Aircraft Systems Traffic Management (UTM)

## SAFELY ENABLING UAS OPERATIONS IN LOW-ALTITUDE AIRSPACE

NEXTGEN

ICNS, April 2017





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



# Overview

# Low Altitude UAS Operations

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- 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?

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- 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

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- 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

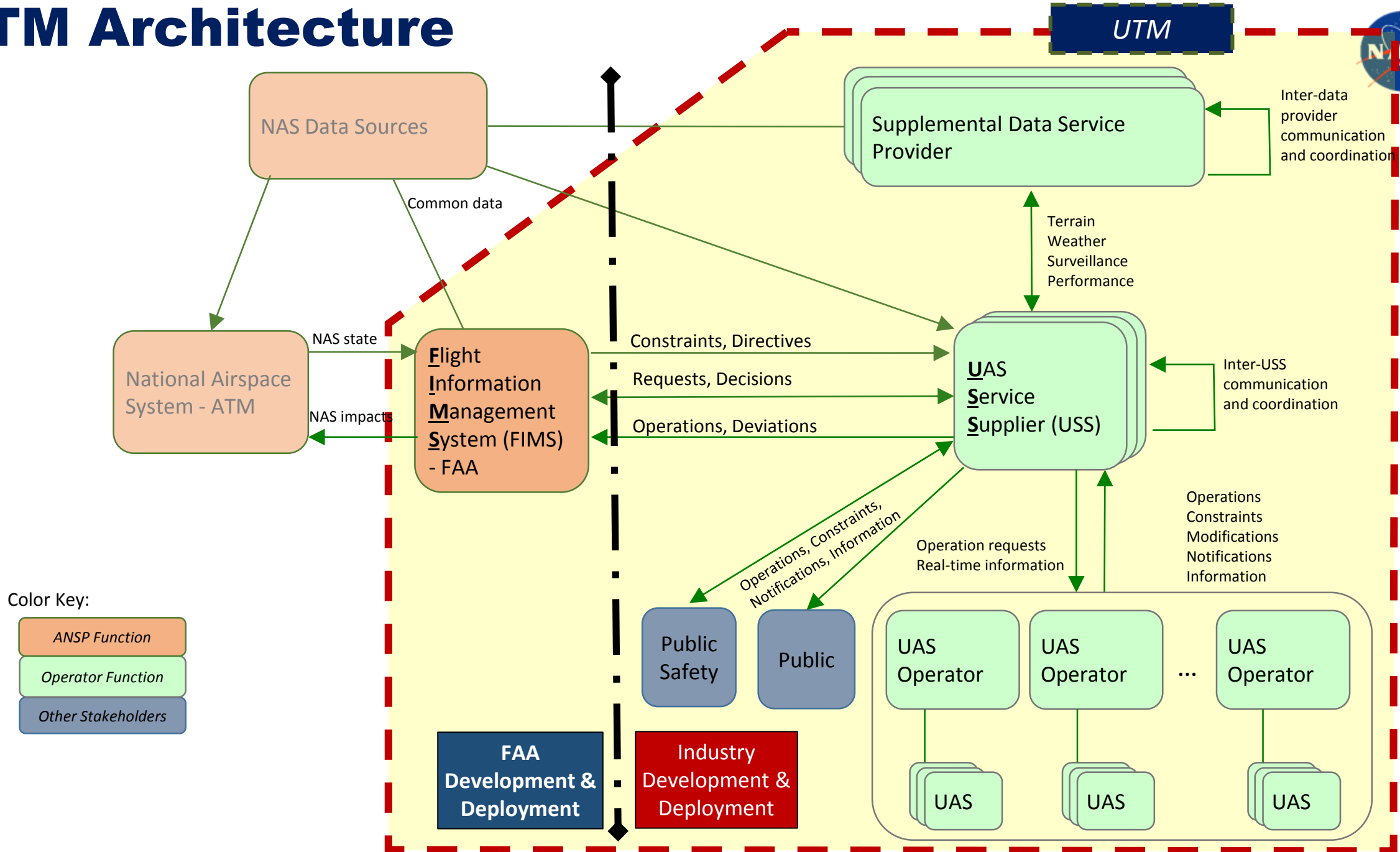
## Principles

- 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



Color Key:

- ANSP Function
- Operator Function
- Other Stakeholders

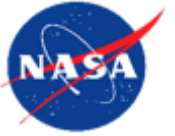


# Value of UTM

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- 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

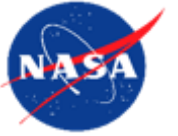


## TCL1: *multiple VLOS*

- API-based networked ops
- Info sharing



# UTM Progression



## **TCL1: *multiple VLOS***

- API-based networked ops
- Info sharing

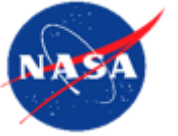
## **TCL2: *multiple BVLOS, rural***

- Initial BVLOS
- Intent sharing
- Geo-fenced ops

## **TCL3: *multiple BVLOS, near airports, suburban***

- Routine BVLOS
- Airborne DAA, V2V
- Avoid static obstacles

# UTM Progression



## **TCL1: *multiple VLOS***

- API-based networked ops
- Info sharing

## **TCL2: *multiple BVLOS, rural***

- Initial BVLOS
- Intent sharing
- Geo-fenced ops

## **TCL3: *multiple BVLOS, near airports, suburban***

- Routine BVLOS
- Airborne DAA, V2V
- Avoid static obstacles

## **TCL4: *complex urban BVLOS***

- BVLOS to doorstep
- Track and locate
- Avoid dynamic obstacles
- Large scale contingencies

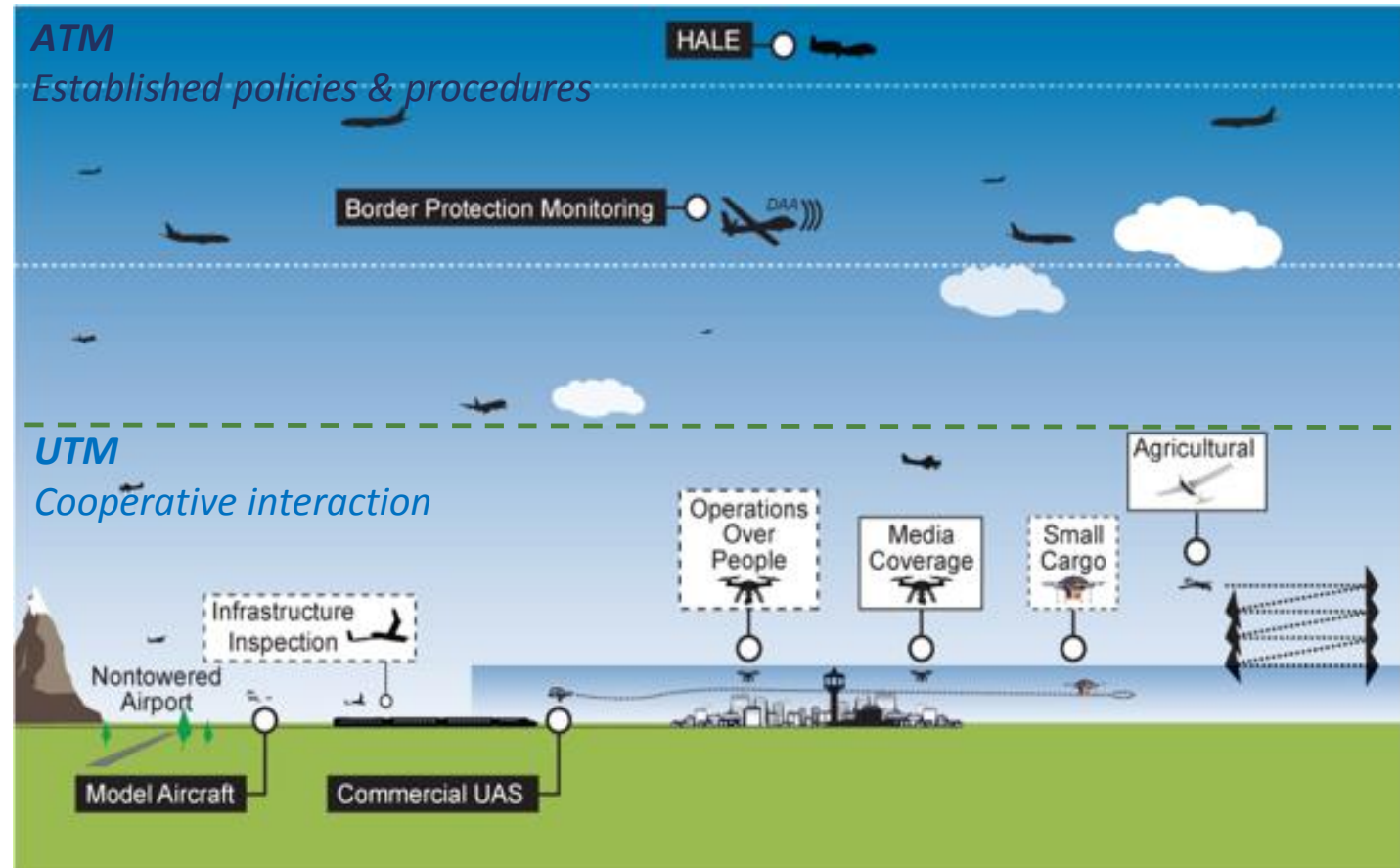


# FAA-NASA Research Transition Team (RTT) Deliverables

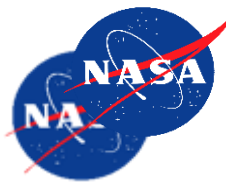


## UTM focuses on a self-managed environment: Uncontrolled airspace & uncontrolled operations inside controlled airspace

- 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

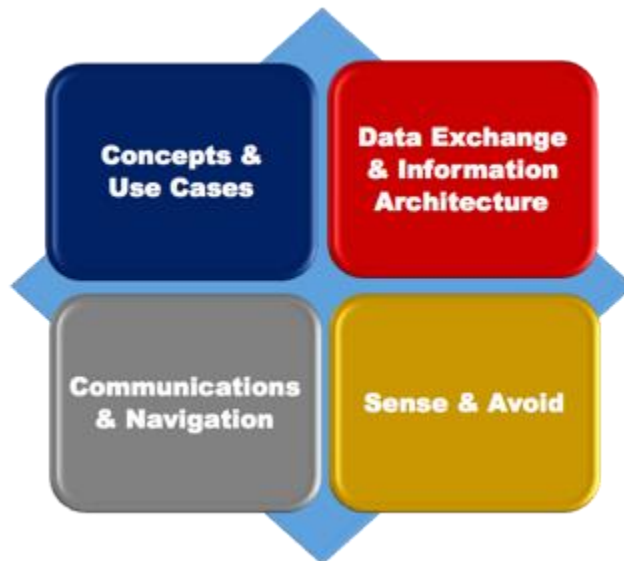


- **Near-term priorities**

- 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)

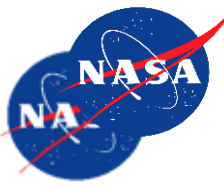
- **FAA-NASA Key RTT Deliverable**

- 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

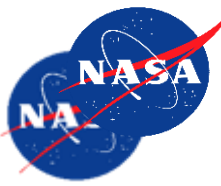
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- Develop C&N guidance to industry for ensuring that
  - Unmanned Aircraft (UA) are under operational control of the pilot
  - UA remain within a defined area
- Three main topics
  - Command and control
  - Navigation
  - Data collection and compliance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

# Lessons learned from TCL2 demo

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- 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

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- 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?

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*Embracing innovation in aviation while respecting its safety tradition*