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
• 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
## 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

- National Airspace System - ATM
- Flight Information Management System (FIMS) - FAA
- NAS Data Sources
- Supplemental Data Service Provider
  - Terrain Weather Surveillance Performance
  - Inter-USS communication and coordination
  - Inter-data provider communication and coordination
- UAS Service Supplier (USS)
  - Operations, Constraints
  - Requests, Decisions
  - Operations, Deviations
  - Operation requests
  - Real-time information
- Public Safety
- Public
- FAA Operator
- UAS Operator
- Other Stakeholders
- ANSP Function
- Operator Function
- Industry Development & Deployment
- FAA Development & Deployment
- UTM

*Color Key:*
- FAA Operator
- UAS Operator
- UAS
- Normal Font
- Orange
- Green
- Blue
- Gray

*UTM Architecture Diagram*

*UTM Architecture Diagram Description*

- UAS Service Supplier (USS) interacts with the FAA, providing real-time information and operation requests.
- Public Safety and Public receive constraints, directives, and requests.
- The NAS Data Sources feed into the UAS Service Supplier, enabling coordination and communication.
- The FAA, ANSP, and other stakeholders interact through the UTM Architecture diagram, facilitating information flow and coordination.
• 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
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
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 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:
    o UAS Service Supplier technologies and procedures
    o Geofencing technologies/conformance monitoring,
    o Ground-based surveillance/sense and avoid,
    o Airborne sense and avoid
    o Communication, navigation, surveillance
    o 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