Why is UTM Needed?

- FAA small UAS forecast – 3.9 million total, 0.7 million commercial by 2022
  - Many use cases: package delivery, news collection, precision agriculture, infrastructure inspections, public safety, disaster response, etc.
- New entrants desire access and flexibility for operations
- Current users want to ensure safety and continued access
- Regulators need a way to put structure as needed
  - Current approach for air traffic control of manned aircraft won’t scale up for small UAS operations
  - Need to assure safe integration into the National Airspace
What is the UTM System?

- UTM is an “air traffic management” ecosystem for small UAS in low-altitude airspace.
- UTM utilizes industry’s ability to supply services under FAA’s regulatory authority where these services do not exist.
- UTM development will enable the management of large scale, low-altitude UAS operations:
  - Address beyond visual line of sight UAS operations under 400 ft. AGL.
  - Define roles/responsibilities of FAA, operators, and other stakeholders.
  - Define information architecture, data exchange protocols, software functions.
  - Recommend performance requirements.
UTM Project Summary

Objective
- Develop and validate airspace operations and integration requirements to enable safe, large-scale UAS operations in low-altitude airspace.
- Provide prototype (software) UTM system for further FAA testing and development

Approach
- Partner with FAA, industry, and academia to design and develop prototype UTM system
- Develop Concept of Operations, Use Cases for anticipated operations and integration with ATM
- Field test UTM system and vehicle/ground technologies in progressively complex environments

Outcomes
- Validated system requirements and technology transfer to FAA and industry
- Inform regulators on beyond visual line of sight operations and operations over people to support future rulemaking
- Provide guidance to industry and standards organizations
- International promotion of UTM concepts and architecture
UTM Service-Based Architecture

- FAA Development & Deployment
- Supplemental Data Service Provider
- Industry Development & Deployment
- NAS Data Sources
- National Airspace System
- Flight Information Management System
- Inter-data provider communication and coordination
- Inter-UAS communication and coordination
- Terrain Weather Surveillance Performance
- Constraints, Directives
- Requests, Decisions
- Operations, Deviations
- Public Safety
- Public
- UAS Operator
- UAS
- V2V Comm
- Discovery Registration Data/Services Authentication/Authorization
- Shared responsibilities
- Color Key:
  - FAA Function
  - Operator Function
  - Other Stakeholders
Technical Capability Levels (TCL) Progression for System Development and Testing

<table>
<thead>
<tr>
<th>TCL1</th>
<th>TCL 2</th>
<th>TCL 3</th>
<th>TCL 4</th>
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<tbody>
<tr>
<td>Low Traffic Density</td>
<td>Low-Mod Traffic Density</td>
<td>Moderate Traffic Density</td>
<td>High Traffic Density</td>
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<tr>
<td>Rural Applications</td>
<td>Rural / Industrial Applications</td>
<td>Suburban Applications</td>
<td>Urban Applications</td>
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<td>Multiple VLOS</td>
<td>Multiple BVLOS Operations</td>
<td>Mixed Operations</td>
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<td>Operations</td>
<td>Tracking and Operational Procedures</td>
<td>Vehicle to Vehicle Communication</td>
<td>Large Scale Contingency Management</td>
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<td>Completed 2015</td>
<td>Completed 2017</td>
<td>Completed 2018</td>
<td>Planned 2019</td>
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TCL 3 Flight Demonstration Scope

- Demonstrate and evaluate the Concept of Operation, functional designs, and technology prototypes

- Test objectives
  - **Concept of Operation** for a range of applications
  - **Communication, Navigation, & Surveillance** where command signals and GPS services are impaired
  - **Sense and Avoid** other drones and manned aircraft
  - **Data Exchange** between system components in normal and contingency conditions.

- Tests conducted at six FAA designated UAS Test Sites from March-May 2018

- All sites connected to the UTM system and testing coordinated from the Airspace Operations Lab, ARC
UTM Project is successfully developing the framework for large scale, small UAS traffic management.

Completed TCL 1, 2, and 3 Demonstrations included many testing organizations, industry, and academia partners that are crucial to validating requirements and investigating technology solutions.

NASA and the FAA are closely collaborating to ensure appropriate regulatory and operational requirements are included and that technology transfers support the development of future operational systems.