Unmanned Aerial Systems Traffic Management (UTM)

SAFELY ENABLING UAS OPERATIONS IN LOW-ALTITUDE AIRSPACE

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Unmanned Aerial System Traffic Management (UTM)

Near-term Goal: Safely enable initial low-altitude UAS as early as possible

Long-term Goal: Accommodate increased demand with highest safety, efficiency, and capacity
UTM: Balancing Multiple Needs

**NATIONAL AND REGIONAL SECURITY**
Protecting key assets

**SAFE AIRSPACE INTEGRATION**
Flexibility where possible and structure where needed
Geographical needs, application, and performance-based airspace operations

**SCALABLE OPERATIONS FOR ECONOMIC GROWTH**
Ever-increasing applications of UAS: Commercial, Agricultural, and Personal
UTM Design Functionality: Cloud-based

Self-driving car does not eliminate lanes and rules for efficient and safe operations

**DIGITAL, VIRTUAL, & FLEXIBLE RISK-BASED APPROACH AND SERVICE INFRASTRUCTURE**

- Safe low-altitude UAS operations with
  - Airspace management and geofencing
  - Weather and severe wind integration
  - Predict and manage congestion
  - Terrain and man-made objects: database and avoidance
  - Maintain safe separation (Airspace reservation, V2V, & V2UTM)
  - Allow only authenticated operations
UTM Functions

**AIRSPACE OPERATIONS & MANAGEMENT**
- ~500 ft. and below
- Geographical needs and applications
- Rules of the airspace: performance-based
- Geofences: dynamic and static
UTM Functions

**Wind & Weather Integration**
- Actual and predicted winds/weather

**Congestion Management**
- Demand/capacity imbalance
- Only if needed – corridors, altitude for direction, etc.
**UTM Functions**

**Separation Management**
- Airspace reservation
- V2V and V2UTM
- Tracking: ADS-B, cellphone, & satellite based

**Contingency Management**
- Large-scale GPS or cell outage
- 9-11 like situations
<table>
<thead>
<tr>
<th>Build</th>
<th>Date</th>
<th>Description</th>
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<tbody>
<tr>
<td>Build 1</td>
<td>August 2015</td>
<td>- Reservation of airspace volume &lt;br&gt;- Over unpopulated land or water &lt;br&gt;- Minimal general aviation traffic in area &lt;br&gt;- Contingencies handled by UAS pilot &lt;br&gt;- Enable agriculture, firefighting, infrastructure monitoring</td>
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<td>Build 2</td>
<td>October 2016</td>
<td>- Beyond visual line-of-sight &lt;br&gt;- Tracking and low density operations &lt;br&gt;- Sparsely populated areas &lt;br&gt;- Procedures and “rules-of-the road” &lt;br&gt;- Longer range applications</td>
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<td>Build 3</td>
<td>January 2018</td>
<td>- Beyond visual line-of-sight &lt;br&gt;- Over moderately populated land &lt;br&gt;- Some interaction with manned aircraft &lt;br&gt;- Tracking, V2V, V2UTM and internet connected &lt;br&gt;- Public safety, limited package delivery</td>
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<td>Build 4</td>
<td>March 2019</td>
<td>- Beyond visual line-of-sight &lt;br&gt;- Urban environments, higher density &lt;br&gt;- Autonomous V2V, internet connected &lt;br&gt;- Large-scale contingencies mitigation &lt;br&gt;- News gathering, deliveries, personal use</td>
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Each build is independent and deployable.
Multiple providers could offer some UTM services

Tailoring operational services based on geographical area needs

Vehicle performance could be different
Regulator has a key role in certifying UTM system and operations. All UTM systems must interoperate.
Progress

- Research Transition Team with FAA, DHS, and DoD
- 125+ industry and academia collaborators and increasing
- Initial UTM Concept of Operations: Industry, academia, and government
- Client interface allows to connect partners to the UTM
- **Build 1 tests** with 12 partners were successfully completed – data is being analyzed
  - Included NASA and partner vehicles, ADS-B, cell-based communications, and low-altitude radar for non-cooperative targets
  - Data: Trajectory conformance accuracy, geo-fencing conformance reliability, UTM usability
- International interest
• NASA and FAA will work together to institute RTCA committee
• Terms of reference are being finalized
• Close coordination between NASA and FAA will be maintained for one government voice for move forward strategy
• UTM construct may be adapted based on FAA and industry inputs, as well as UTM field tests
Next Steps

• UTM Build 1 testing in August
• Development, simulations, and testing of UTM Builds 2-4
• Safety analysis

• NASA will continue to work with industry, academia, and government groups
  – Refine operational requirements, system architecture(s), prototype, and conduct tests – Continue until safe airspace integration is proven!

• National initial safe UAS integration campaign: coordinated effort for data collection and demonstrations
  – Through FAA test sites and other approved locations

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