Unmanned Aerial Systems Traffic Management (UTM)

SAFELY ENABLING UAS OPERATIONS IN LOW-ALTITUDE AIRSPACE

NASA

http://www.utm.arc.nasa.gov

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Successful Initial UTM Tests at 6 FAA Test Sites

Breaking News: 23 UAS at a time, many with live and virtual traffic successfully managed in UTM research platform – API based. More research will continue.
UTM Goal and Characteristics

• Conduct research, development and testing to identify airspace operations requirements to enable large-scale visual and beyond visual line of sight UAS operations in the low-altitude airspace
  – Collaborate with FAA, DOD, DOI, and DHS through Research Transition Team
  – Collaborate and leverage industry capabilities and insights
  – Partner with FAA test sites for testing
  – Partner with FAA COE for key research needs

• UTM uses build-a-little-test-a-little strategy – remote areas to urban areas
  – Low density: No traffic management required but understanding of airspace constraints
  – Cooperative traffic management – Understanding of airspace constraints and other operations
  – Manned and unmanned traffic management – Scalable and heterogeneous operations

• UTM construct consistent with FAA’s risk-based strategy
• UTM research platform is used for simulations and tests
• UTM offers path towards scalability
Traffic Management Evolution

http://www.kcet.org/updaily/socal_focus/history/la-as-subject/7th-and-broadway.html
1920, Photo Collection, Los Angeles Public Library
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
Balancing Multiple Needs

**National and Regional Security**
Protecting key assets

**Safe Airspace Integration**
Mantra 1: Flexibility where possible and structure where needed

Mantra 2: Risk based- Geographical needs, application, and performance-based airspace operations

**Scalable Operations for Economic Growth**
Ever-increasing applications of UAS: Commercial, Agricultural, and Personal
Principles and Services for Safe Integration

• Principles
  – Authenticated users and UAS are allowed to operate in the airspace
  – 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 and stay clear of them
  – Public safety UAS have priority over other UAS

• Key UTM related services
  – Authentication
  – Airspace configuration and static and dynamic geo-fence definitions
  – Weather and wind prediction and sensing
  – Conflict avoidance (e.g., airspace notification, V2V)
  – Demand/capacity management
  – Large-scale contingency management – GPS outage, cell outage, etc.

• Research prototype is cloud-based

• UTM research identifies roles and responsibilities of operator, air navigation service provider, and UAS support service providers
Each capability is targeted to type of application, geographical area and uses risk-based approach.

**CAPABILITY 1 (AUGUST 2015)**
- Reservation of airspace volume
- Over unpopulated land or water
- Minimal general aviation traffic in area
- Contingencies handled by UAS pilot
- Enable agriculture, firefighting, infrastructure monitoring

**CAPABILITY 2 (OCTOBER 2016)**
- Beyond visual line-of-sight
- Tracking and low density operations
- Sparsely populated areas
- Procedures and “rules-of-the road”
- Longer range applications

**CAPABILITY 3 (JANUARY 2018)**
- Beyond visual line of sight
- Over moderately populated land
- Some interaction with manned aircraft
- Tracking, V2V, V2UTM and internet connected
- Public safety, limited package delivery

**CAPABILITY 4 (MARCH 2019)**
- Beyond visual line of sight
- Urban environments, higher density
- Autonomous V2V, internet connected
- Large-scale contingencies mitigation
- News gathering, deliveries, personal use
Opportunities: Research and Technology

- Airspace operations - Beyond visual line of sight autonomous operations
- Tracking and locating every vehicle: Cooperative and non-cooperative
  - Cell/wireless, Automatic Dependent Surveillance, Satellite, localized beacon based systems
- Sense and avoid
  - Other vehicles (V2V) as well as objects such as wires
- Command, control, and communications: cell phone, etc.
- Last/first 50 feet: sensors, hardware, and software for autonomous operations
- Security
Collaborative Research and Next Steps

- NASA works closely with many industry, academia, and government partners
- NASA and FAA have established Research Transition Team (RTT) to collaborate on UTM research – includes DOD, DHS, DOI
- NASA has over 200 collaborators and various work groups
- Test four technical capability levels
- Initial technical capability level 1 was tested, this week being further tested at the FAA test sites
- Capability level 2 will be tested in October
- Continue collaboration with all
Applications of Unmanned Aerial Systems

- Public Safety
- Deliveries
- Surveillance
- Weather Monitoring
- Agriculture
- Mapping
- Disaster Relief
- Entertainment