

UTM: Update to Partners

13 Oct 2015

Outline

- General updates
- Software status
- Build 1 Demonstration Review
- Near future steps
- Questions

UTM Status

- Entering our 2nd year!
- Accomplishments in 1st year
 - Initial ConOps document developed, partially reviewed externally
 - Prototype of UTM System available to outside users
 - Live demonstration of initial concept with multiple partners
 - Implementation of simulation environment
 - Cataloging of vehicle and performance data
 - UTM Convention bringing together stakeholders
 - Established partnerships with industry, academia, government, and the FAA

Rough Calendar

- Dec 2015: Build 1 Closeout
- Early 2016: Full draft of ConOps available for review
- Spring 2016: National Campaign with Test Sites
- Summer 2016: Initial Testing for Build 2 Demo
- Oct 2016: Build 2 Demonstration

Software Prototype Update

- Version 15.9 pushed to tmiserver last month
- Expect more regular updates with announcements on mailing list
- Currently implements most of our Build 1 concept
 - Airspace volume reservation
 - Workflow for operators (nominal: submit, activate, submit positions, close)
 - Constraint checking (airspace class, national park, manager-defined)
 - Notifications pushed to users
 - Framework for independent development of clients and manager systems
- UTM Client ICD version 1.0 available to developers.
 - 1.1 coming soon
 - Working on approvals to make this document more easily distributable
- Email daniel.g.mulfinger@nasa.gov if you are interested in developing a UTM Client to obtain credentials and documentation
 - Available to those with an RFI response on file and/or a Space Act Agreement

Mailing List

- Would like to make this a reasonable tool for communication
- Encourage partners to post general, non-proprietary questions there
- NASA will make UTM announcements there
 - Calls for participation
 - Software releases
 - Discussion topics
 - General updates

UAS Traffic Management Build 1 Flight Demonstration: Overview

NASA Ames Research Center

10/13/2015

Partnerships



Equipment

- Ground Equipment
 - Air Traffic Surveillance
 - (ADS-B, ASDE-X, air traffic radar)
 - Radar Station
 - SRHawk 2D low altitude radar
 - 1 ADS-B Ground Relay Station
 - Sound Microphone Sensors
 - Weather Station
 - 100 ft Weather Tower
 - Radiosonde System
 - Microwave Profiler
 - 2 Octocopters
 - Fixed Wing : 2
 - Range in size, weight, endurance, and capabilities
 - 1 ADS equipped aircraft
 - 1 vehicle equipped to be tracked over cellular network
 - UTM Connection via LAN
 - UTM Manager displays
- Vehicles:
 - Multi-rotors:
 - 5 QuadCopters
 - 1 Hexacopter



Test Objectives

- **Objective 1:** Demonstrate UTM Capabilities
 - Show connection of a variety of vehicles to the UTM system
- **Objective 2:** Collect Data on UAS Navigation Performance Error
 - Collect data on a vehicles ability to track a flight plan and maintain a geo-fenced boundary
- **Objective 3:** Collect Data on Aircraft Tracking Performance
 - Collect data on the ability and performance of a independent surveillance source to track the UAS
- **Objective 4:** Collect Weather Observations for Forecasting Models
 - Collect localized weather information and compare them to forecasting models and support the development of vehicle performance models
- **Objective 5:** Collect Data on Noise Signature of UAS Vehicles
 - Collect data on the decibel levels and frequencies at which UAS operating at different altitudes will produce in an operational environment.



Flight Plan

Altitudes:

- Launches will occur at local airfield elevation (approx. 166 ft. MSL)
- Maximum flight altitudes up to 400 ft. AGL

Range:

- Flights to remain within MOA airspace constraints & site layout operational area (see next slide).
- Flights will be staged over terrain which consists of the airfield runways & unpopulated farm land.

Duration:

- Eight (8) to thirty (30) minutes on average, not to exceed safe battery limits.

Modes:

- Single aircraft launch & recovery
- Dual aircraft launch & recovery



Crow's Landing

08/24/2015-09/02/2015



Grid Pattern

Only two aircraft will operate simultaneously and will operate in separate flight areas

Operation Area 2

Operation Area 1

Legend

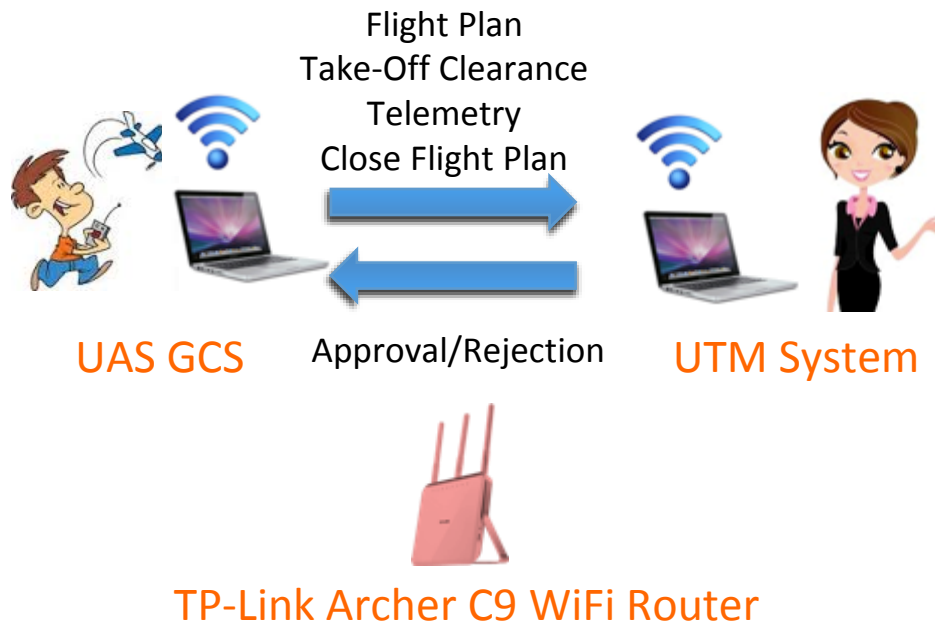
- 5 ADS-B Relay Station
- B Field Operations Canopy
- C Ground Control Station #1
- A Ground Control Station #2
- Latrines
- 4 Microphone
- P Parking
- E Rest Area
- D UTM Canopy
- Video Station

Google earth

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Portable UTM System

- Communication between GCS & UTM system is over ad-hoc WiFi network (5.0GHz router)
 - Telemetry information is read-only from GCS
 - GCS can submit a flight plan to the UTM system & UTM system can respond with an approval or rejection message to the GCS.



UTM Manager Display

The screenshot displays the UTM Manager interface, which is divided into several sections:

- Map View (Left):** Shows a satellite map of an airport area with a geofence boundary. A drone icon is positioned within the geofence, and a label 'AKA01 Status: Activated' is visible.
- Table View (Top Center):** A table with columns for STATUS, CLIENT, and GEOFENCE. The data row shows 'Activated', 'guest', and 'AKA01'. Below the table, a card displays 'AKA01' with a 'TO: MIT' label, speed 'Spd: 0.0', altitude 'Alt: 33.0', and a 'CLOSE' button.
- Timeline (Top Right):** A horizontal timeline with markers for '08:53:51', '09:00', and '10:00'. A green vertical line is positioned at '08:53:51', and a green box labeled 'Activated' is shown below it.
- System Messages (Bottom Left):** A panel titled 'System Messages' containing a warning: 'Warning Type: Decision Warning. Warning Message: DB error upon registration check, probably due to data input - does your registration contain valid UUID?'.
- Broadcast Messages (Bottom Right):** A panel titled 'Broadcast Messages' which is currently empty.

Results

- General Statistics:
 - 108 flights over 8 days
 - ~18 hours of flight time
 - Flights averaged about 11 minutes (ranging from 2- 38 minutes)
- Critique forms were located on-site to assess deployment and capture lessons learned
- Ongoing data analysis is being conducted with respect to the 5 outlined test objectives



Near Future Steps

- UTM Build 1 completion
 - NASA requirements checkout at Moffett Field: Nov/2015
 - Software release to test sites: Dec/2015
- National UAS Integration Campaign
 - All UAS test sites operate integrated with UTM: Mar/Apr 2016
- UTM build 2 development
 - software complete: Jul 2016
- UTM build 2 testing
 - field demo: Oct 2016

Near Future Steps: UTM Build 2

Objective

- Support beyond visual line of sight (BVLOS) UAS operations over sparsely populated areas by ensuring that
- UAS operations are safely managed
- UAS operations are contained in defined low-risk areas and by
- information about UAS operations is provided to other airspace users and people on the ground

ConOps highlights

- UTM services separate UAS operations temporally and spatially through geo-fences, and altitude stratification of flight segments.
- UTM services use vehicle, weather, terrain, obstacle, and surveillance information to approve, reject, cancel or abort operations based on risk assessment.
- Nominal operations and certain contingencies are handled by the UTM services and the UAS operators alone.
- A UTM manager can provide support and directions to the UTM system and operations and is expected to handle certain contingencies

UTM Build 2:

Services to support Beyond Visual Line of Sight

External data services

- Terrain
- Obstacles
- Weather
- Vehicle registration and performance
- Surveillance

New UTM services

- System Health Monitoring
- Flight Monitoring (conformance, rogue and intruder aircraft)
- New user authentication
- Constraint checking against weather, obstacles, terrain
- Multi-segment airspace reservation
- Altitude separation
- Performance-based buffers

UTM Build 2:

Advanced Procedures and Apps

Procedures

Integrated procedures with automated operator notifications for

- Nominal Operations
- Alert handling
- Contingencies

Apps

- Enhanced mobile apps for visualizing the status of operations, airspace and systems
- Enhanced UTM Manager App to oversee and manage operations, airspace and systems harmonized with mobile apps

UTM Build 2:

Testing and Evaluation

Simulations

- Simulations throughout the year
- Full build 2 type operations
 - infrastructure monitoring
 - oceanographic observations,
 - support for first responders, such as wildfire inspections
 - imaging applications
- Nominal ops and contingencies
- Generation of 24/7 simulation platform

Partners are encouraged to connect to simulation platforms once available

Field Trials

- Field demonstration of build 2 technologies and operations (Aug - Oct 2016)
- limited geographical area
 - Up to four simultaneous ops
 - At least one BVLOS ops included in multi ops demo
 - Altitude separation
 - Flight monitoring and automated alerting of UAS operators
 - All land contingencies

Near Future Steps

Concept of Operations

- Finalize build 2 Con-Ops
- Further develop UTM long-term Con-Ops

Technologies:

- Integrate external services, develop UTM technologies

Demonstration

- Determine Scenario and Technology requirements
- Select Field Site
- Identify build 2 partners