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
- Vehicles:
  - Multi-rotors:
    - 5 QuadCopters
    - 1 Hexacopter
    - 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

Test Objectives

- **Objective 1:** Demonstrate UTM Capabilities
  - Show connection of a variety of vehicles to the UTM sytem
- **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.

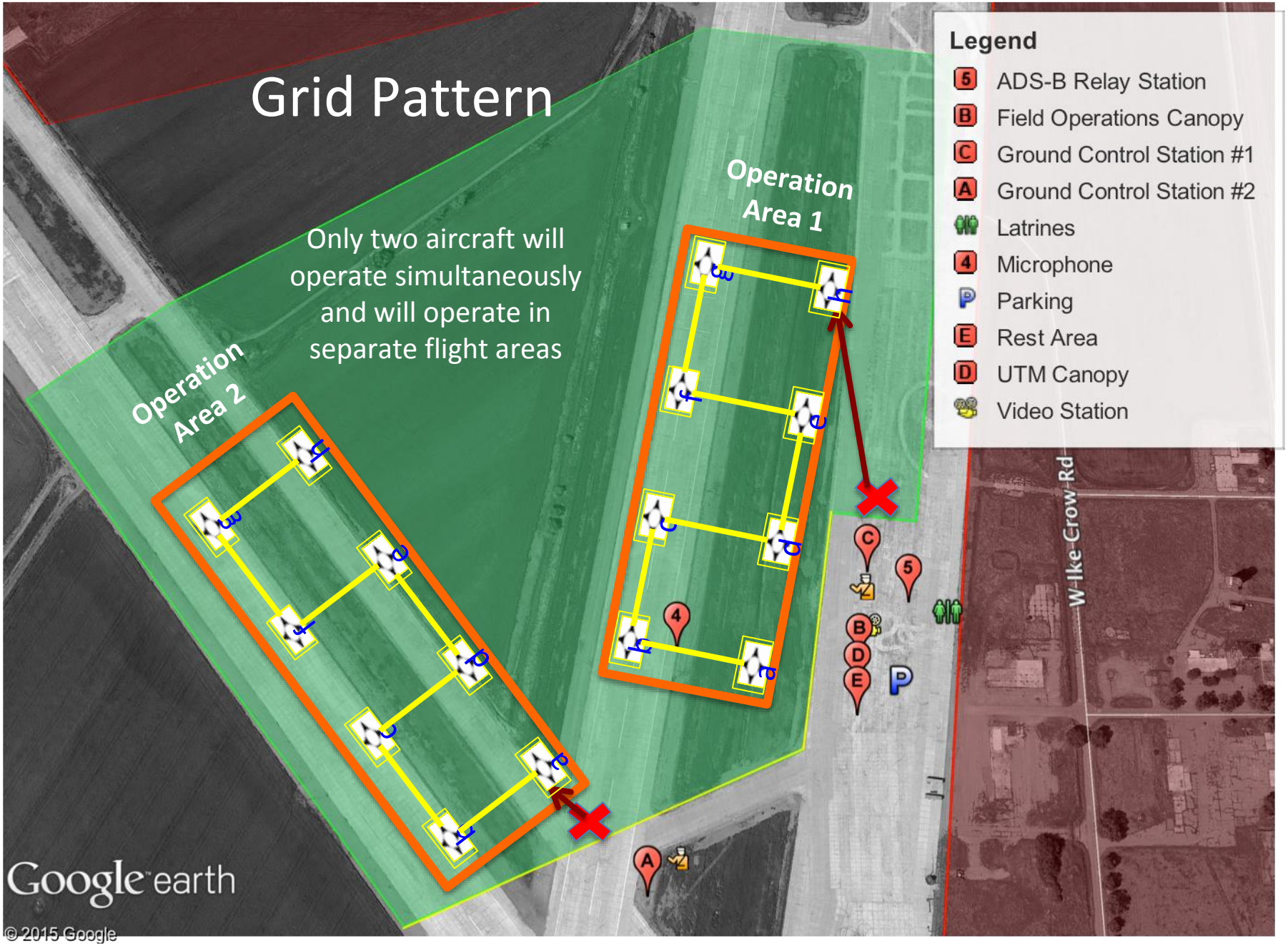
Duration:

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

Modes:

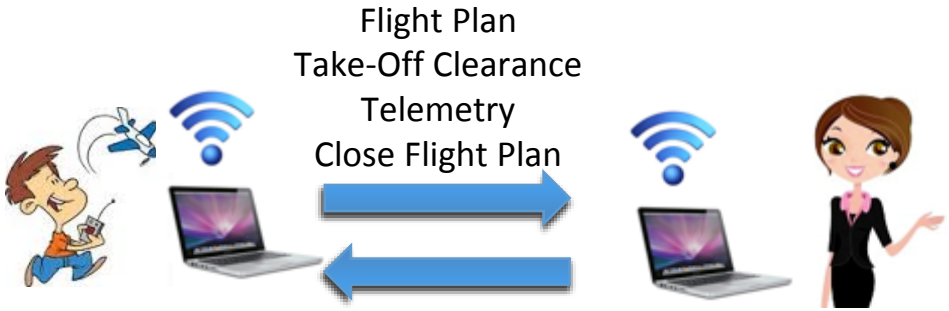
- Single aircraft launch & recovery
- Dual aircraft launch & recovery


Crow's Landing
08/24/2015-09/02/2015
Legend
ADS-B Relay Station
Field Operations Canopy
Ground Control Station #1
Ground Control Station #2
Latrines
LSTAR Radar
Microphone
Parking
Rest Area
SRHawk Radar
UTM Canopy
Video Station
Weather Equipment
Davis Rd
W Ike Crow Rd
Bell Rd
Google earth
N


Grid Pattern
Only two aircraft will operate simultaneously and will operate in separate flight areas
Operation Area 1
Operation Area 2
Legend
ADS-B Relay Station
Field Operations Canopy
Ground Control Station #1
Ground Control Station #2
Latrines
Microphone
Parking
Rest Area
UTM Canopy
Video Station
W Ike Crow Rd
Google earth
© 2015 Google

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.



TP-Link Archer C9 WiFi Router

UTM Manager Display

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