Unmanned Aircraft Systems (UAS) Traffic Management (UTM) Project

UTM Concepts and Use Cases

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UTM Technical Interchange Meeting
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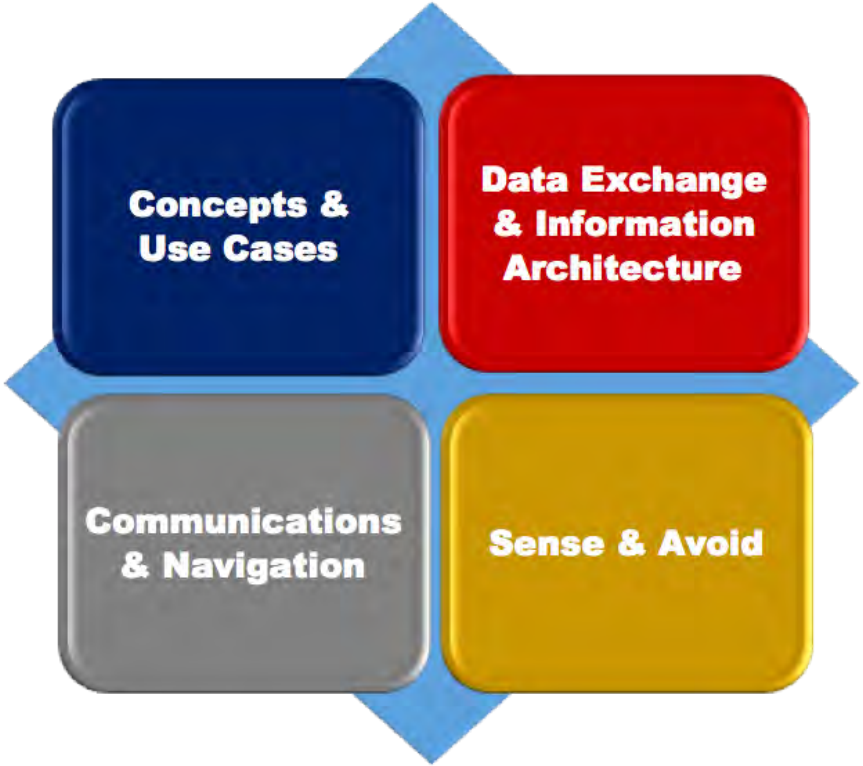
Outline

- UTM RTT Concepts and Use Cases Working Group (CWG) Overview
- Activities
- Publications
- Test Involvement
- Areas of Future Work
- Summary and Impact

UTM RTT Working Groups



- NASA-FAA UTM Research Transition Team (RTT) has been a joint undertaking for the development and eventual implementation of UTM
- UTM RTT initiated in 2016
- Four primary working groups
- Joint Management Plan (JMP) formulated with Research Transition Products for each group to deliver as part of RTT goals and objectives
- JMP signed in 2017

CWG Overview

- The CWG was chartered with collaboratively defining the UTM concept through the development of supporting use cases that will ultimately span the range of UTM operations and environments.
- Through this process, the CWG worked to identify information flows and exchanges, supporting architectures, and the roles and responsibilities of those entities interacting with the UTM ecosystem. The process and its output served as input to other programs and UTM RTT Working Groups.

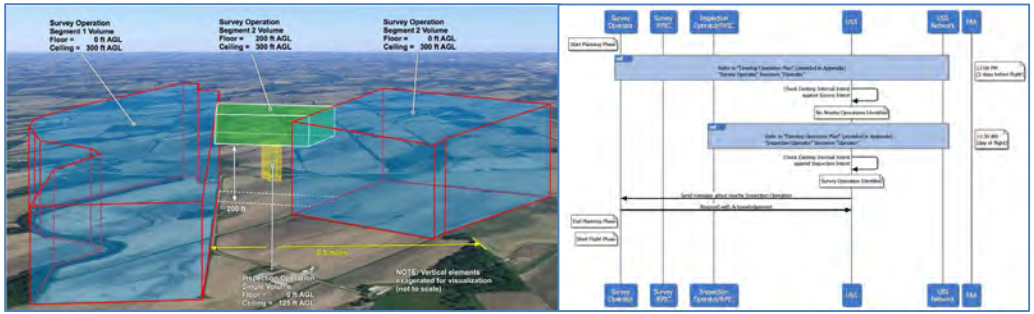
CWG Process

- The CWG was composed of a small core membership between NASA and the FAA
- Regular meetings were held for use case development and concept discussions. Number of attendees fluctuated depending on the focus of discussion.
- The majority of discussions centered around the development of use cases that highlighted concept elements that in turn clarified and refined the assumptions, stakeholder roles, and operational processes envisioned for the future UTM environment.
- Participation and coordination among all RTT leads in the CWG was an important part of the development process.

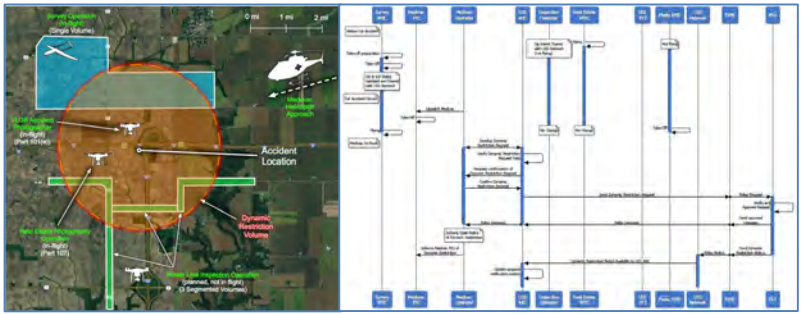
CWG Activities

- Each technical capability level had an associated Research Transition Product (RTP) in the form of a use case package
- Overarching Concept of Operations (ConOps) were also planned for publication to capture major elements and outputs of the ongoing RTT collaboration

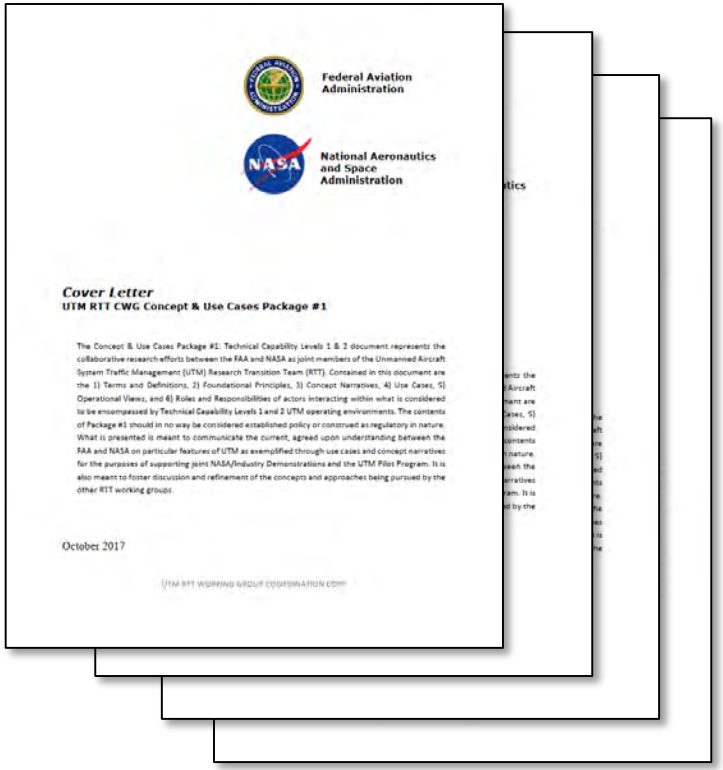
TCL 1 Example: VLOS Operation with Voluntary UTM Participation

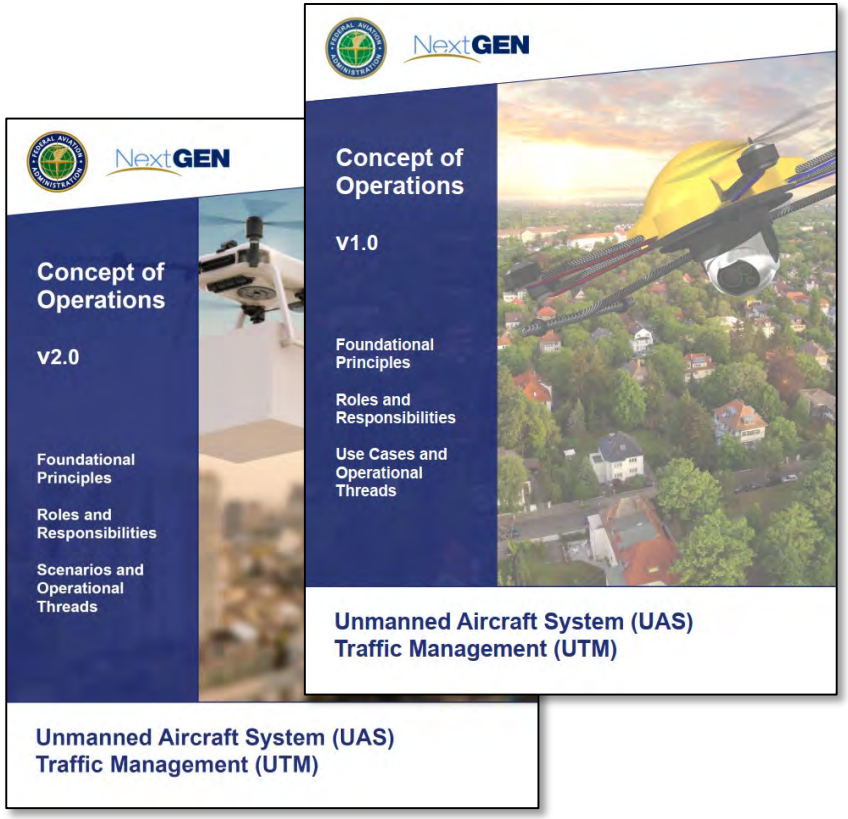


TCL 2 Example: Priority Operation in Uncontrolled Airspace



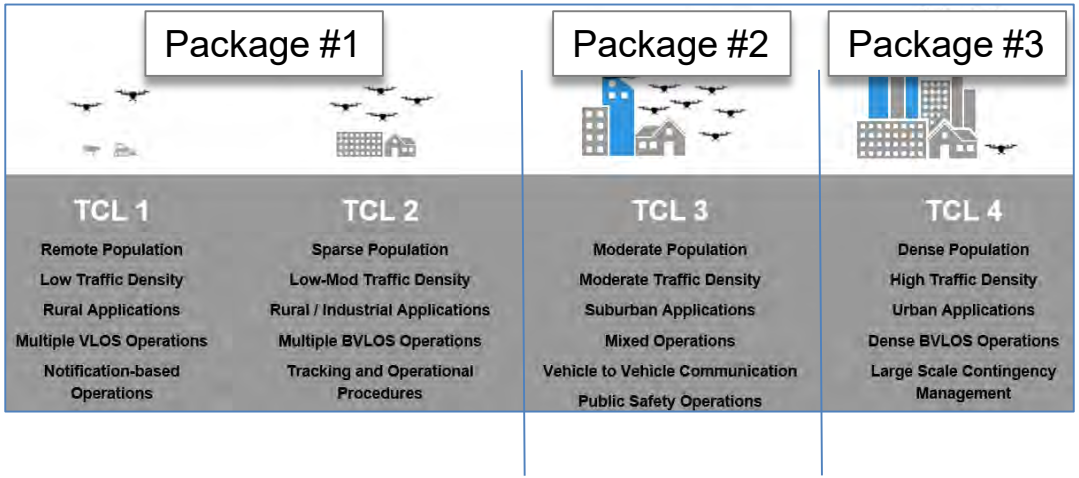
CWG Use Case Packages and ConOps





CWG Use Case Packages

- Three use case packages produced through the CWG as part of RTT deliverables
- Each package developed to encompass specific concept elements related to the UTM environment envisioned as part of a given Technical Capability Level (TCL)



CWG Use Case Package #1: TCLs 1 & 2

Federal Aviation Administration

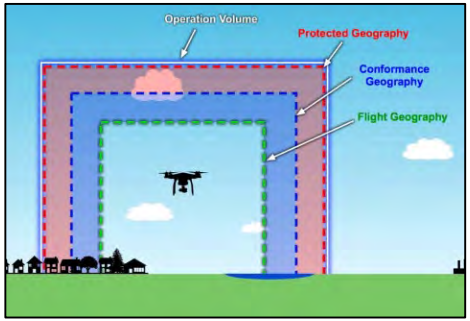
National Aeronautics and Space Administration

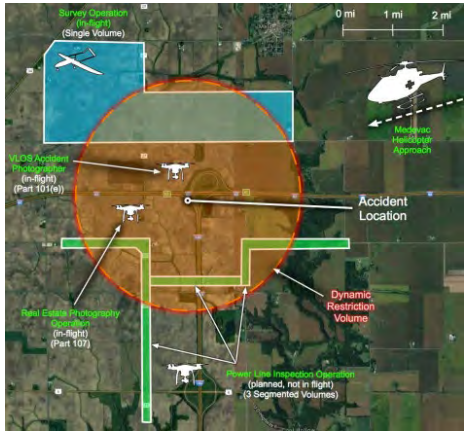
Cover Letter

UTM RTT CWG Concept & Use Cases Package #1

The Concept & Use Cases Package #1: Technical Capability Levels 1 & 2 document represents the collaborative research efforts between the FAA and NASA as joint members of the Unmanned Aircraft System Traffic Management (UTM) Research Transition Team (RTT). Contained in this document are the 1) Terms and Definitions, 2) Foundational Principles, 3) Concept Narratives, 4) Use Cases, 5) Operational Views, and 6) Roles and Responsibilities of actors interacting within what is considered to be encompassed by Technical Capability Levels 1 and 2 UTM operating environments. The contents of Package #1 should in no way be considered established policy or construed as regulatory in nature. What is presented is meant to communicate the current, agreed upon understanding between the FAA and NASA on particular features of UTM as exemplified through use cases and concept narratives for the purposes of supporting joint NASA/Industry Demonstrations and the UTM Pilots Program. It is also meant to foster discussion and refinement of the concepts and approaches being pursued by the other RTT working groups.

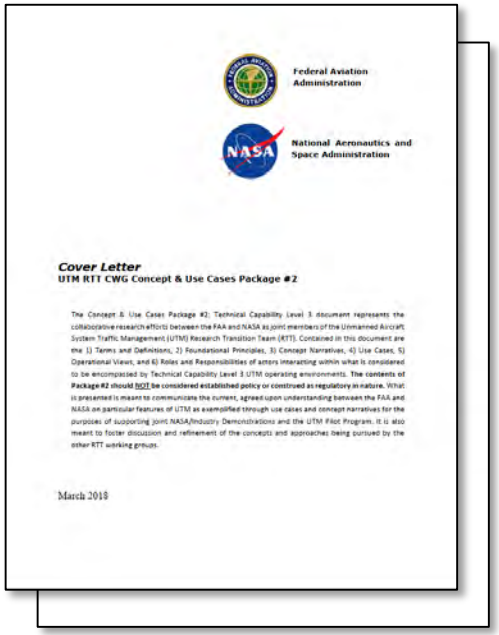
October 2017





- Published October 2017
- Basic elements introduced as part of TCL 1:
  - 1 use case: 2 VLOS operations
- Greater complexity included as part of TCL 2:
  - 4 use cases: 1 BVLOS 1 VLOS operation, 2 BVLOS near airport, Emergency medical priority, BVLOS conformance violation into Class D

CWG Use Case Package #2: TCL 3


Federal Aviation Administration

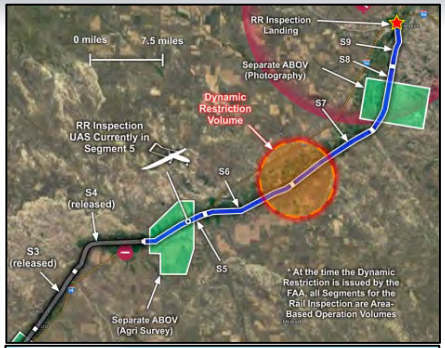
National Aeronautics and Space Administration

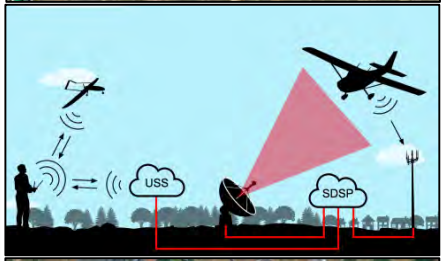
Cover Letter

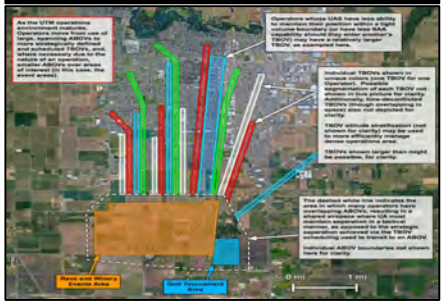
UTM RTT CWG Concept & Use Cases Package #2

The Concept & Use Cases Package #2: Technical Capability Level 3 document represents the collaborative research efforts between the FAA and NASA as joint members of the Unmanned Aircraft System Traffic Management (UTM) Research Transition Team (RTT). Contained in this document are the 1) Terms and Definitions, 2) Foundational Principles, 3) Concept Narratives, 4) Use Cases, 5) Operational Views, and 6) Roles and Responsibilities of actors interacting within what is considered to be encompassed by Technical Capability Level 3 UTM operating environments. **The contents of Package #2 should NOT be considered established policy or construed as regulatory in nature.** What is presented is meant to communicate the current, agreed upon understanding between the FAA and NASA on particular features of UTM as exemplified through use cases and concept narratives for the purposes of supporting joint NASA/Industry Demonstrations and the UTM Pilot Program. It is also meant to foster discussion and refinement of the concepts and approaches being pursued by the other RTT working groups.

March 2018

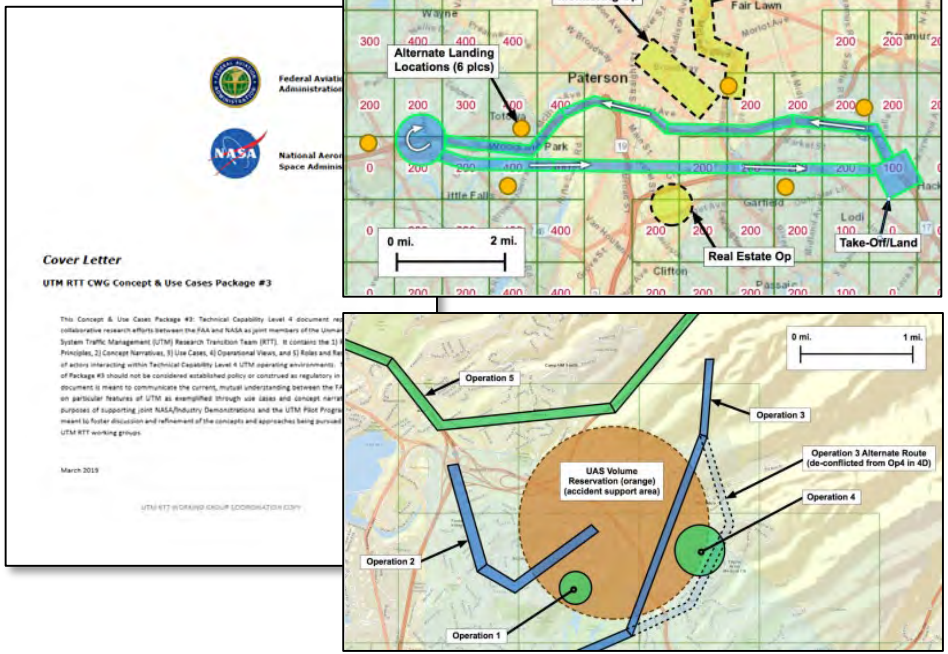






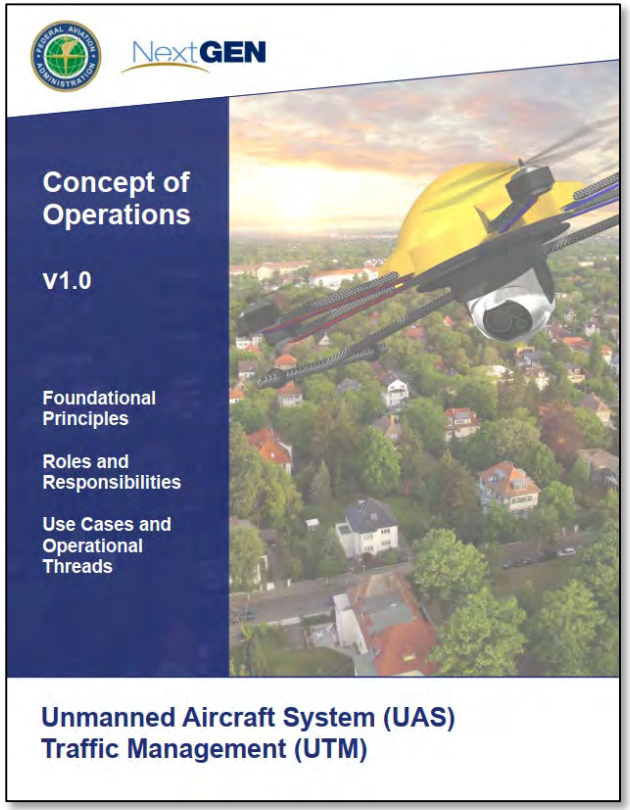
- Two publications in 2018
- Use cases and topics:
  - One-Way BVLOS Flight, Separate Landing/Take-Off Locations
  - Negotiation between Operators Due to Dynamic Restriction
  - UAS Interaction with Manned Aircraft
  - High Density UTM Operations
  - Last-Mile Rural Deliveries under Mode C Veil
  - sUAS Operator In-Flight Loss of Performance Capabilities

CWG Use Case Package #3: TCL 4



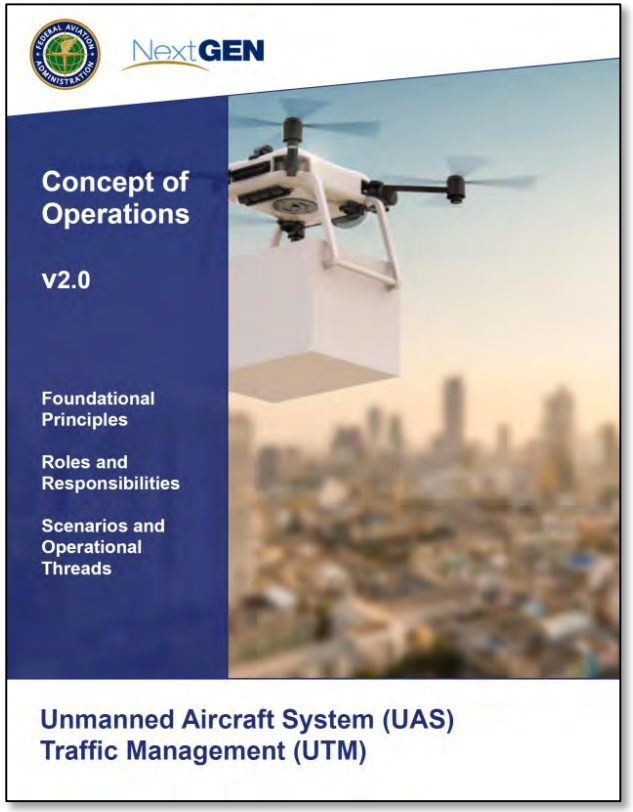
- Published March 2019
- Use cases and topics:
  - BVLOS UTM Operation within UAS Facility Maps
  - Historical UTM Information Queries by Authorized Entities
  - UAS Urgency/Distress Condition with Alternate Landing and UTM Coordination
  - UAS Volume Reservation in Controlled Airspace
  - Report to FAA due to UAS Flight Incident

UTM Concept of Operations



- Published May 2018
- First formal publication setting out the joint vision of UTM with broader input from multiple organizations and industry
- Established initial framework and definitions that included:
  - Notional architecture
  - Roles and Responsibilities of actors and entities
  - Airspace management philosophy with respect to safety, security, and equity
  - Eight illustrative use cases

UTM Concept of Operations



- Published March 2020
- Updated view of UTM concept informed by work of RTT and testing developments
- Addressed:
  - Operations of greater complexity in controlled and uncontrolled airspace
  - Expanded discussion of Performance and Airspace Authorizations
  - Introduction of Remote ID
  - Expanded discussion of Safety, Security, and Equity
  - Five illustrative use cases

CWG Test Involvement

- Flight demonstrations provided a means to test aspects of the UTM concept in real world environments
- TCL 3 involved dedicated tests as a distinct thrust under the concepts area
- TCL 4 scenario foundations provided by CWG
- Concept elements incorporated into FAA UTM Pilot Program (UPP) testing

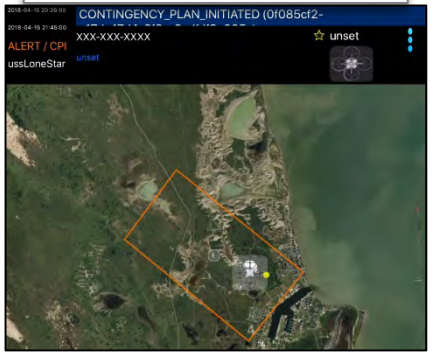
CWG: TCL 3 Demonstration

- Five distinct tests were included in the TCL 3 Statement of Work:
  - CON1: BVLOS Landing
  - CON2: Contingency Initiation
  - CON3: Public Portal
  - CON4: Multiple TCL 2/TCL 3 Operations for a Sustained Period
  - CON5: FIMS/USS Interaction When a Vehicle Heads Towards Controlled or Unauthorized Airspace
- A total of 17 CON tests were conducted across five test sites

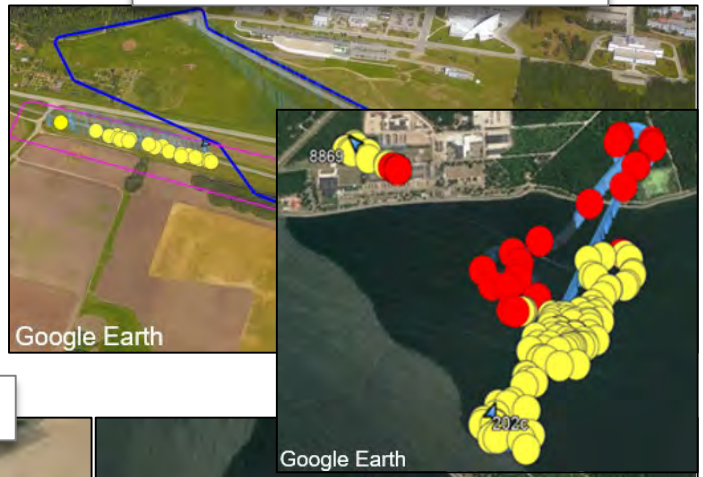
CWG: TCL 3 Demonstration

CON 1: BVLOS Landing

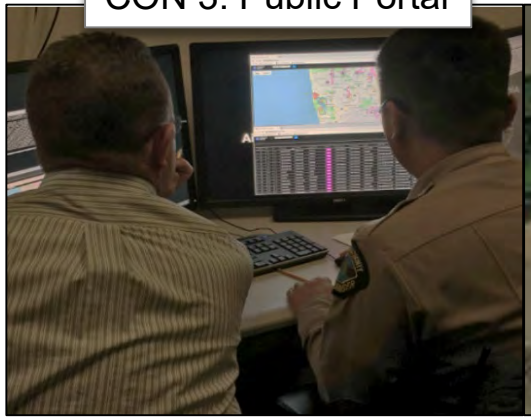
CON 2: Contingency



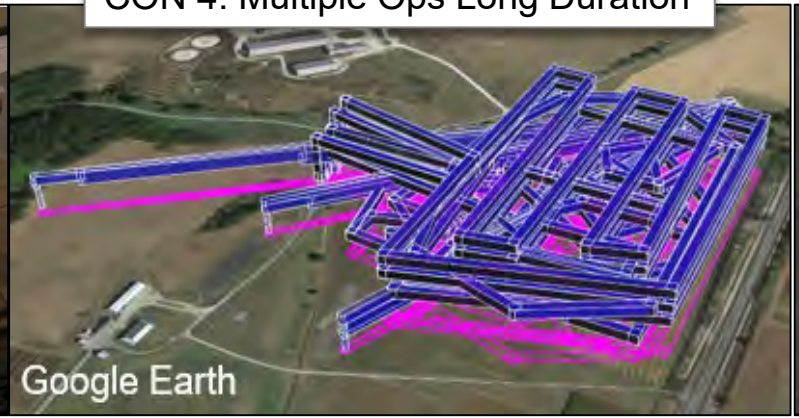
CON 5: Airspace Alerting



CON 3: Public Portal

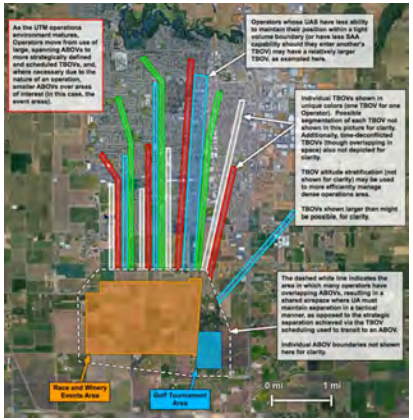


CON 4: Multiple Ops Long Duration



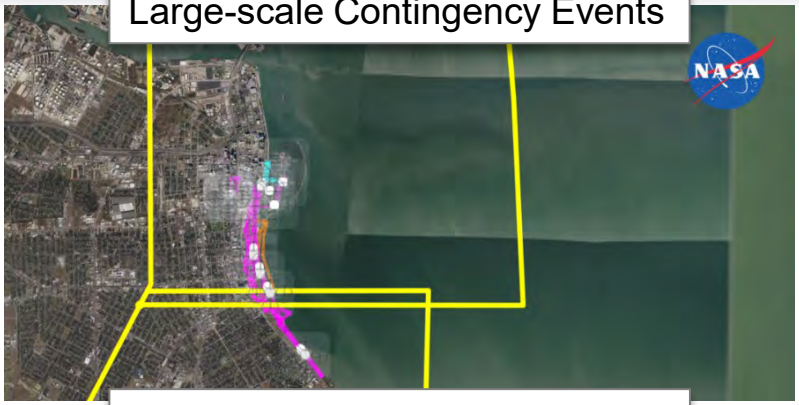
CWG: TCL 4 Demonstration

- Developed initial scenarios based on CWG and broader RTT discussions
- Five scenarios generated to examine a “day in the life” that addressed concept elements related to:
  - High density operations
  - Priority/Public Safety operations
  - UAS Volume Reservations in dense environments
  - Contingency Management
  - Remote ID



CWG: TCL 4 Demonstration

Large-scale Contingency Events



Public Safety Priority Operations

High Density Operations in Urban Environment

CWG Areas of Future Work

- Addressing comments related to ConOps v2.0
- UTM ConOps v3.0 in formulation stages
- Continued engagement between NASA and FAA on further development and refinement of the UTM concept and related areas covered through the RTT
- Additional areas of work and testing opportunities in discussion

CWG Summary and Impact

- Three use case packages and two formal concept of operations were published that defined the concept and laid the foundations for subsequent progress in the UTM domain
- CWG involvement in NASA and FAA testing ensured concept elements were explored and helped frame the targeted technical testing in other working group areas
- The work of CWG and its collaborative nature resulted in the development of strong working relationships across multiple teams and the open exchange of information and ideas that will continue to drive the UTM concept from its humble beginnings to the vision of its promising future reality