

# Project U-SAFE

Drones will be everywhere very soon. Central New York's plan will make it safe for everyone.

CENTRAL NEW YORK  
REGIONAL ECONOMIC  
DEVELOPMENT COUNCIL

UPSTATE  
REVITALIZATION  
INITIATIVE



# Definitions

- **U-SAFE** : UAS Secure Autonomous Flight Environment
- **UTM**: UAS Traffic Management 
- **NUSTAR**: National UAS Standardized Test and Rating 

**U-SAFE**<sup>TM</sup>

# U-SAFE Award

- Dec 11, 2015
- Signature Initiative in Central New York's URI Submission
- \$250 million program over 5 years to help solve the challenges of safely integrating UAS into the NAS



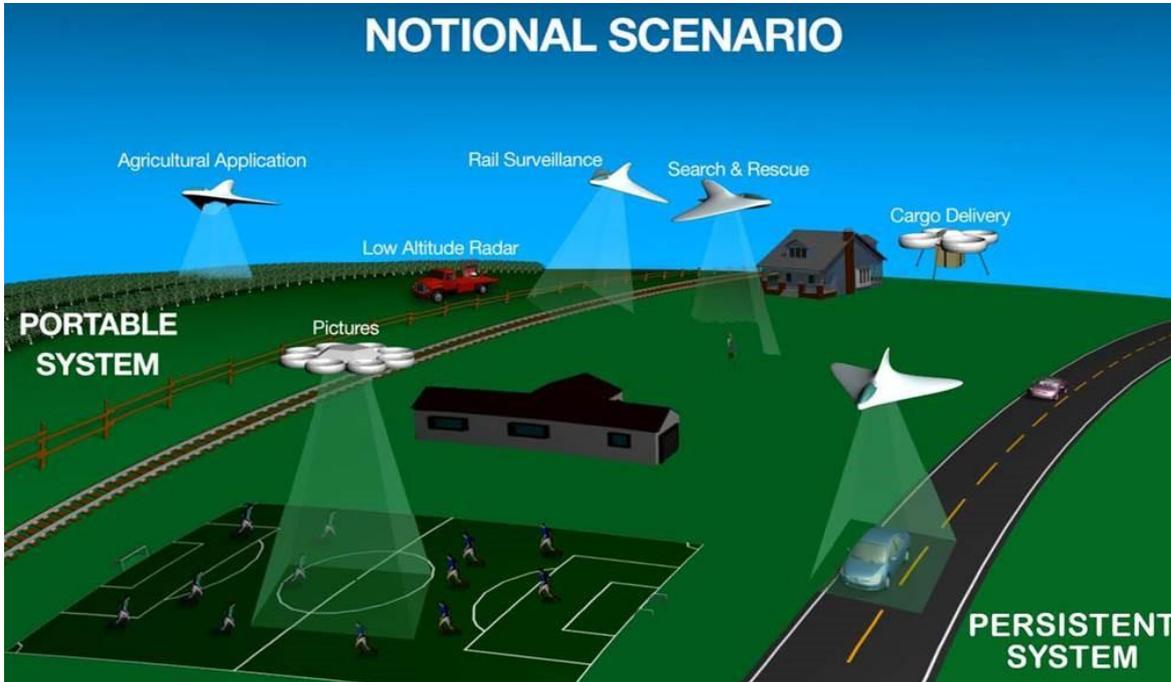
**U-SAFE™**



# project U-SAFE™

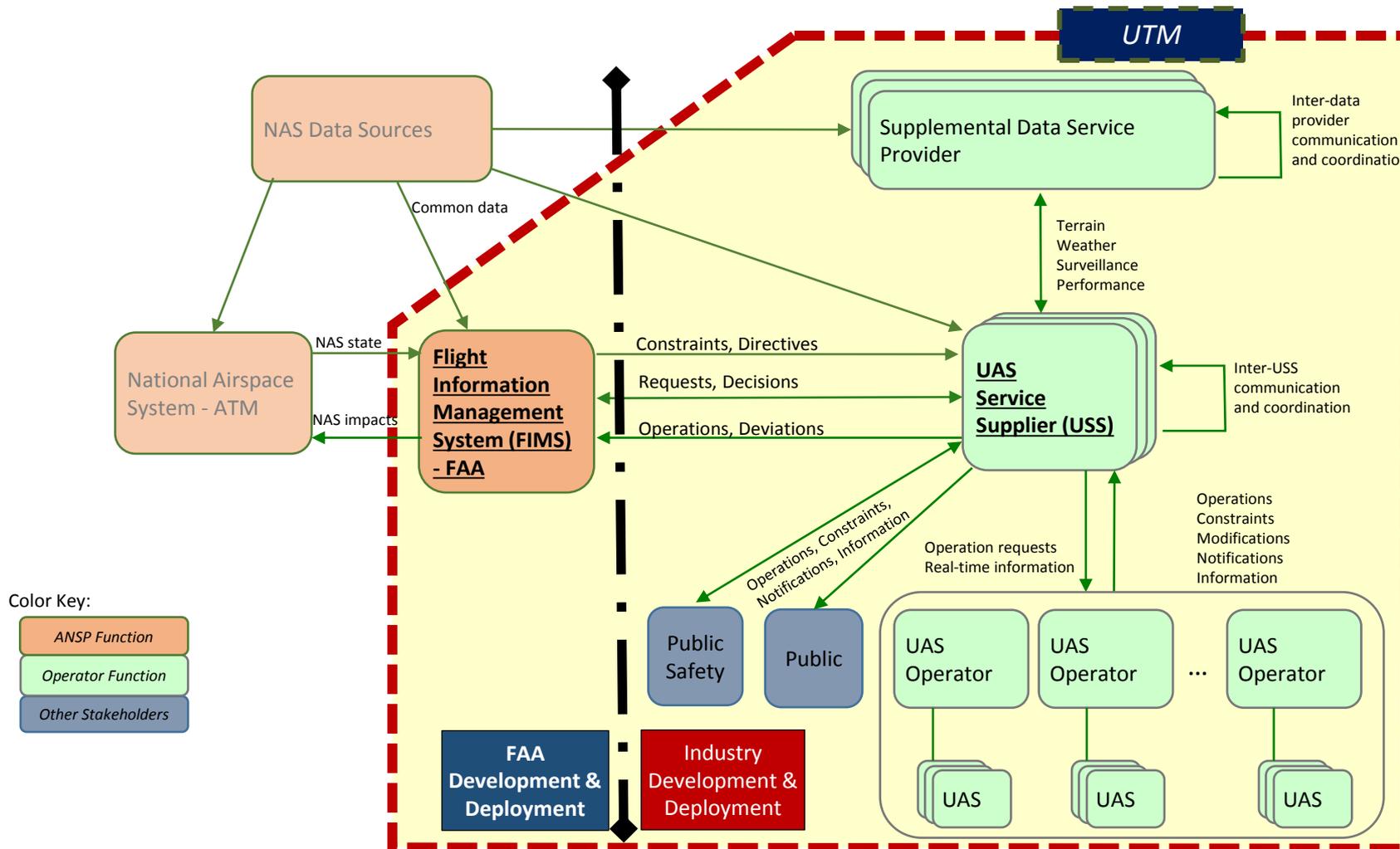


## NOTIONAL SCENARIO



- 50 mile “Validated” UTM (UAS Traffic Management) corridor
- BVLOS Commercial UAS Operations (Low altitude 500 ft, small UAS <55lbs)
- Critical Infrastructure Protection Applications
- NUSTAR (National UAS Standardized Testing and Rating) facility

# UTM Architecture



# UTM Technical Capability Levels (TCLs)



## CAPABILITY 1: DEMONSTRATED HOW TO ENABLE MULTIPLE OPERATIONS UNDER CONSTRAINTS

- Notification of area of operation
- Over unpopulated land or water
- Minimal general aviation traffic in area
- Contingencies handled by UAS pilot

**Product: Overall con ops, architecture, and roles**

## CAPABILITY 3: FOCUSES ON HOW TO ENABLE MULTIPLE HETEROGENEOUS OPERATIONS

- Beyond visual line of sight/expanded
- Over moderately populated land
- Some interaction with manned aircraft
- Tracking, V2V, V2UTM and internet connected

**Product: Requirements for heterogeneous operations**

## CAPABILITY 2: DEMONSTRATED HOW TO ENABLE EXPANDED MULTIPLE OPERATIONS

- Beyond visual line-of-sight
- Tracking and low density operations
- Sparsely populated areas
- Procedures and “rules-of-the road”
- Longer range applications

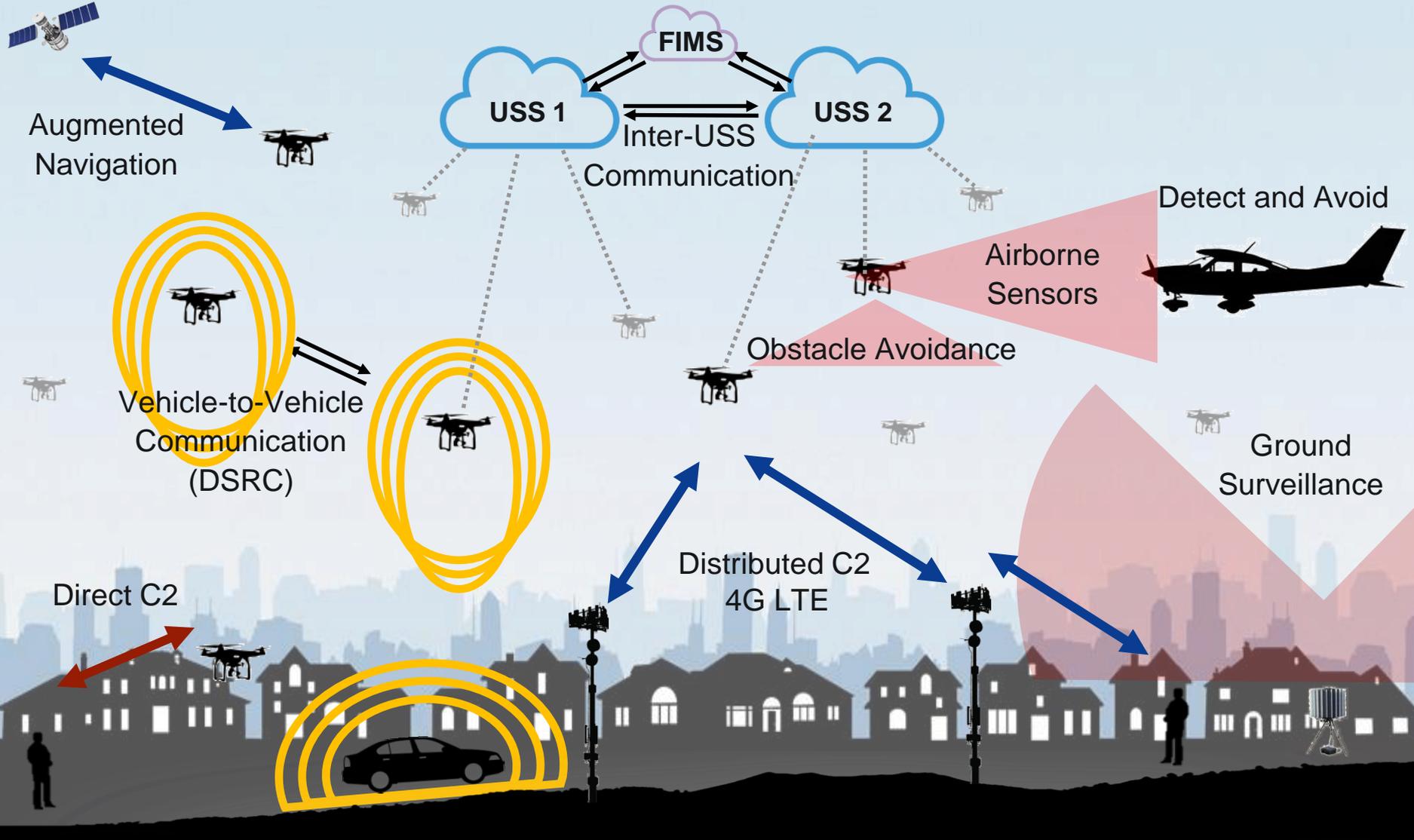
**Product: Requirements for multiple BVLOS operations including off-nominal dynamic changes**

## CAPABILITY 4: FOCUSES ON ENABLING MULTIPLE HETEROGENEOUS HIGH DENSITY URBAN OPERATIONS

- Beyond visual line of sight
- Urban environments, higher density
- Autonomous V2V, internet connected
- Large-scale contingencies mitigation
- Urban use cases

**Product: Requirements to manage contingencies in high density, heterogeneous, and constrained operations**

**Risk-based approach: depends on application and geography**



# UAS Spectrum Needs

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## Separation

DSRC, ADS-B In (978/1090MHz),  
Radar (L to W Band). LIDAR

## Command and Control

Point to Point (ISM Band),  
4G LTE/5G, SATCOM

## Tracking

Point to Point (ISM Band), 4G  
LTE/5G, SATCOM

## Payload

Point to Point (ISM Band), 4G LTE/5G

## UAS Identification

DSRC, ADS-B, ISM Band, 4G LTE/5G



# U-SAFE Phase 1 (today)

## UTM

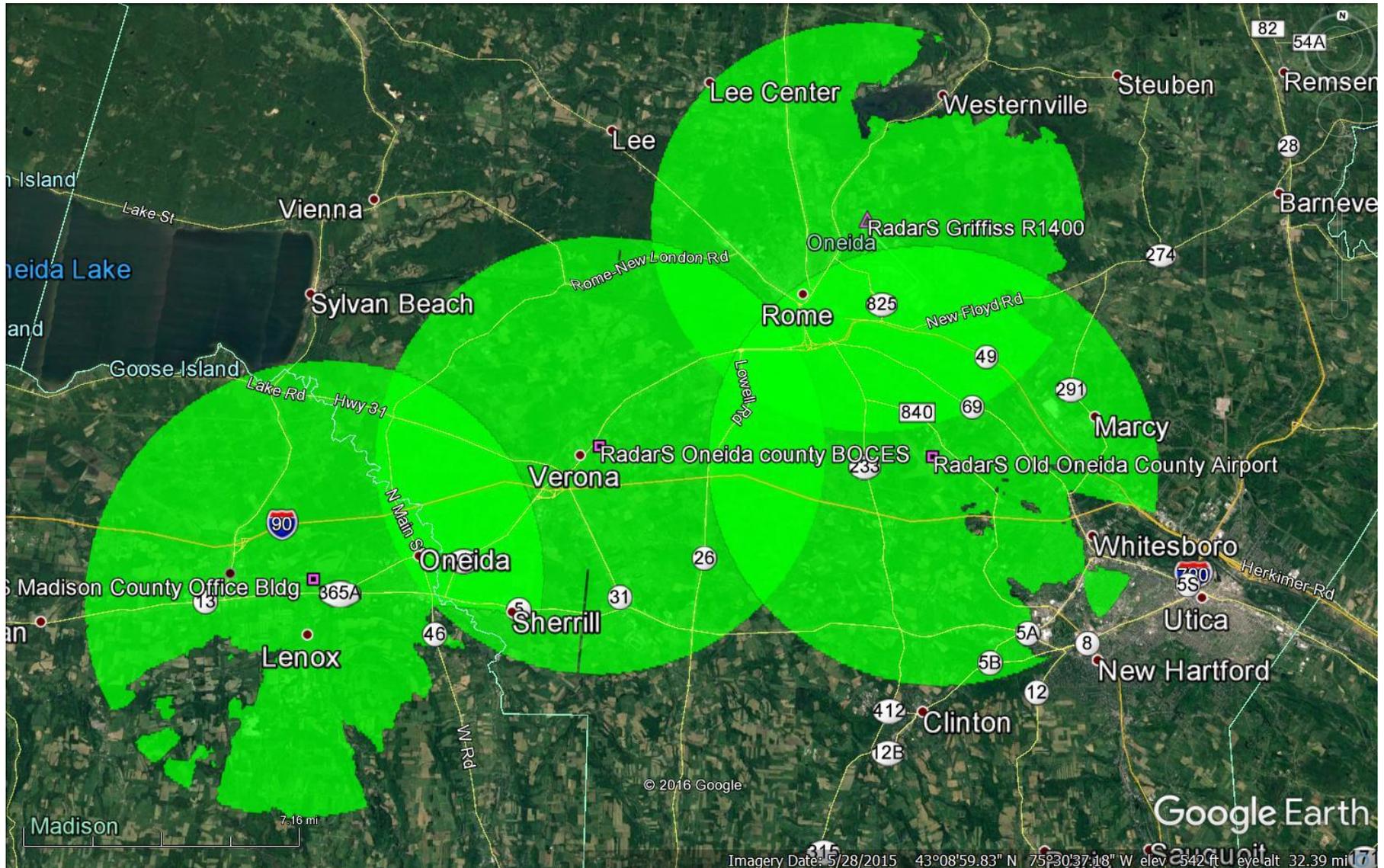
- Engineering Analysis and Siting for 50 mile corridor
- U-SAFE UTM Architecture
- Mobile UTM
- Initial Corridor Operational Sept 2017
- Critical Infrastructure Protection Capability

## NUSTAR

- Interim NUSTAR Capabilities
- NUSTAR Advisory committee
- RFI released



# Phase 1 Low Altitude Radar Coverage



# Mobile Skylight



- Mobile Drone Security and UAS Integration
- Sensors
  - R1400 radar
  - S1200 direction finding
  - EO/IR camera
  - ADS-B
  - Weather station
- Communications
  - VHF radio for FAA comms
  - Dual-band mesh network
    - 2.4 & 5.8GHz
    - FCC Part 15 compliant
  - Ka Band SATCOM
  - 4 SIM Cellular modem
  - Local TV Tuner
  - ICOM VHF Aircraft radio

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# Mobile UTM - Command Center



## External Features

- 35' masts with interchangeable sensor configurations
- FAA compliant & scene lighting
- 8kw Generator & shore power
- Spitzlift for equipment
- Auto-leveling (7 degree offset)
- Safety roof rack
- 360-degree security camera
- 4-wheel drive diesel
- Retractable Awning

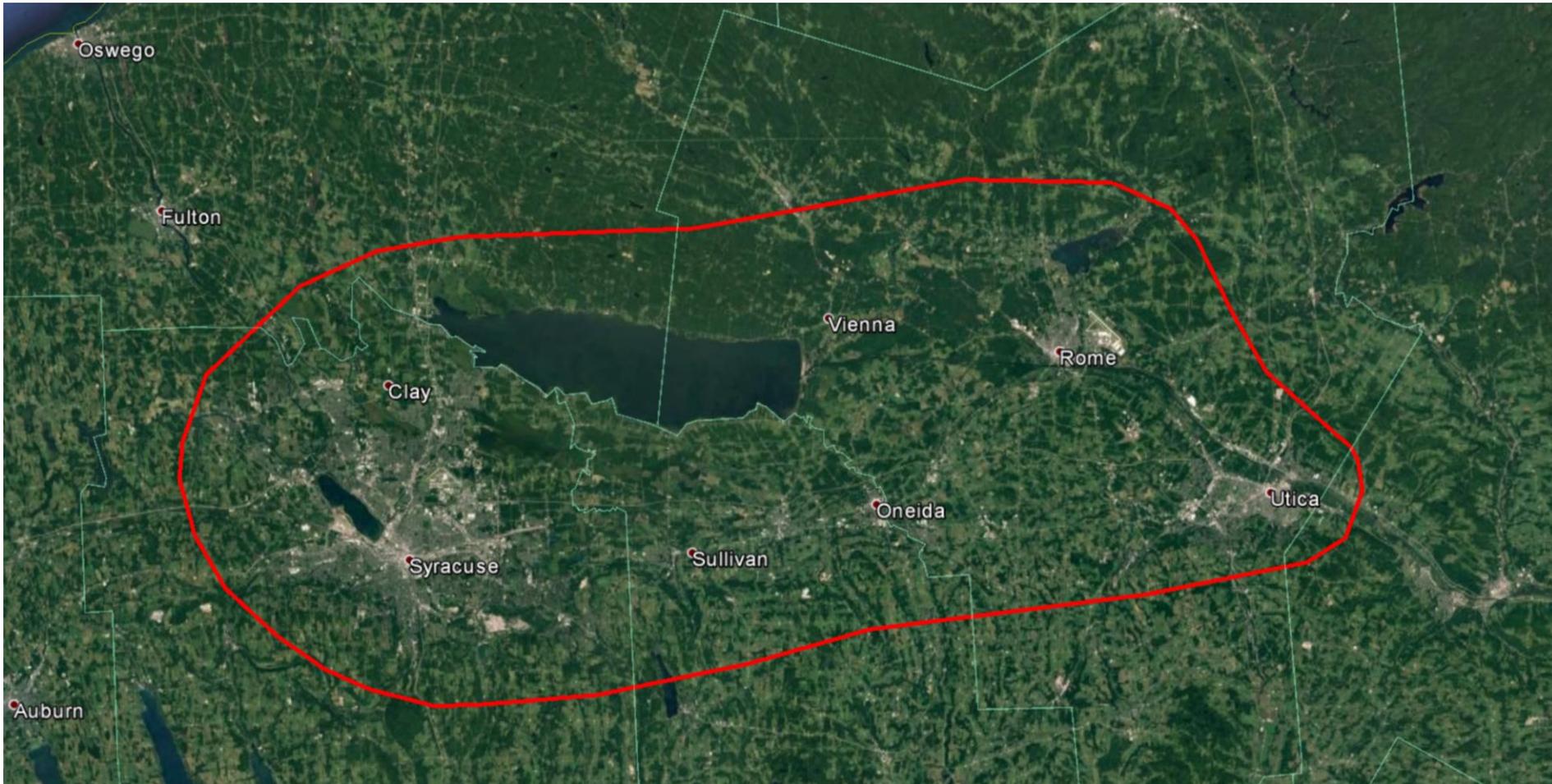
## Internal Features

- 3 air situation displays
- 360-degree fixed view security cameras and displays with DVR
- Streaming HDTV
- LED red & white lighting
- Desktop

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# UTM 2016 Convention





- Initial "BVLOS" operations begin at Griffiss Test Site in Phase 1 (Sept 2017)
- Fully instrumented 50 mile corridor between Syracuse and Griffiss for BVLOS operations (August 2018)
- 7 U-SAFE BVLOS UTM Use Cases Validated

# NUSTAR



# NUSTAR Market Demand

- Currently, standards are lacking for UAS airworthiness and certification
- Need for Cyber security performance benchmark testing of UAS
- <55 lbs. in weight – UTM commercial class
- BVLOS UTM flight operations
- FAA Micro UAS ARC
  - Operations over people



# NUSTAR GOALS

- Create standardized tests and scenarios that vehicles can be tested against
- Identify key performance parameters of all UAS and their standardized measurement strategy
- Develop standardized performance reporting methods to assist prospective buyers and insurance agencies



# NUSTAR GOALS (cont)

- Identify key performance metrics that could be used to assess the overall safety of the UAS and operations
- Compare the performance of individual UAS against the minimum requirement (e.g., detect and avoid detection time, cyber protection, stopping distance, etc.)



# Example Performance Testing

- **Wind**
  - Performance/function under varying conditions
  - Performance with and without payloads (where applicable)
- **Environmental**
  - Thermal
  - Ice/Rain/Fog/Dust/Sand/etc
- **EMI/EMC**
  - Susceptibility to ambient EMI (unintentional and other)
  - Spectrum occupancy and compliance
- **Physical/structural**
  - Drop/crash testing
- **Propulsion**
  - Propulsion/control testing

- **Cybersecurity/C2 requirements**
  - Controller reliability
  - Software/system reliability testing
  - OTA update security
  - Penetration vulnerability assessment
- **Autonomy**
  - Navigation/guidance systems testing
  - GPS systems
  - UTM compliance
  - BVLOS performance
- **Failure Mode and Effects Analysis (FMEA)**
- **Battery Life**
- **Noise**



# Interim NUSTAR Capability: Impact Test



Courtesy of  
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# Additional Capabilities: Forensics

- Learning from automobile and traditional aviation
- Forensics will be an important area
- Recreate incidences and accidents
  - Improving systems
  - Data and analysis for insurance, legal, and regulatory bodies
  - Policy decisions
- Create data-bank for anonymous incident reporting and analysis: learning



# NUSTAR Summary

- Test scenarios and variety of use cases
- Clear performance metrics and rating
- NUSTAR 1-5: 1- VLOS, 5-Autonomous to door step
- Considers subsystems as well as entire vehicle operation
  - Operational test conditions
  - Sub-system level performance: engine/propulsion, networking, battery, sensor systems, software systems, cyber-security, GPS denied operations, etc.
- Need to serve multiple stakeholders
  - Consumers, Manufactures, Insurance, Legal, Regulatory bodies
- Tentative Schedule:
  - Interim NUSTAR capability and Advisory committee: 2017
  - Standards and Testing development: 2017-2018
  - Construction: 2018 - 2019
  - Facility complete: August 2019



# NUSTAR Call for Action

- Funding is committed from the State for Project U-SAFE re: URI award
- National Advisory Committee working on development of this “National Asset”
- Public Private Partnership Opportunities

