UAS Remote Identification (RID)

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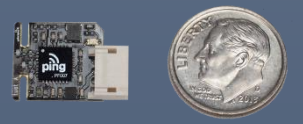
- Enabling Airborne Awareness
- Communications, Navigation, & Surveillance (CNS)
- Low Size, Weight, & Power (SWaP)
- All Airspace Users



All Airspace Users need a way to be aware of one another:

- Manned Aircraft
- Air Traffic Control
- On the Airport Surface

New Stakeholders:

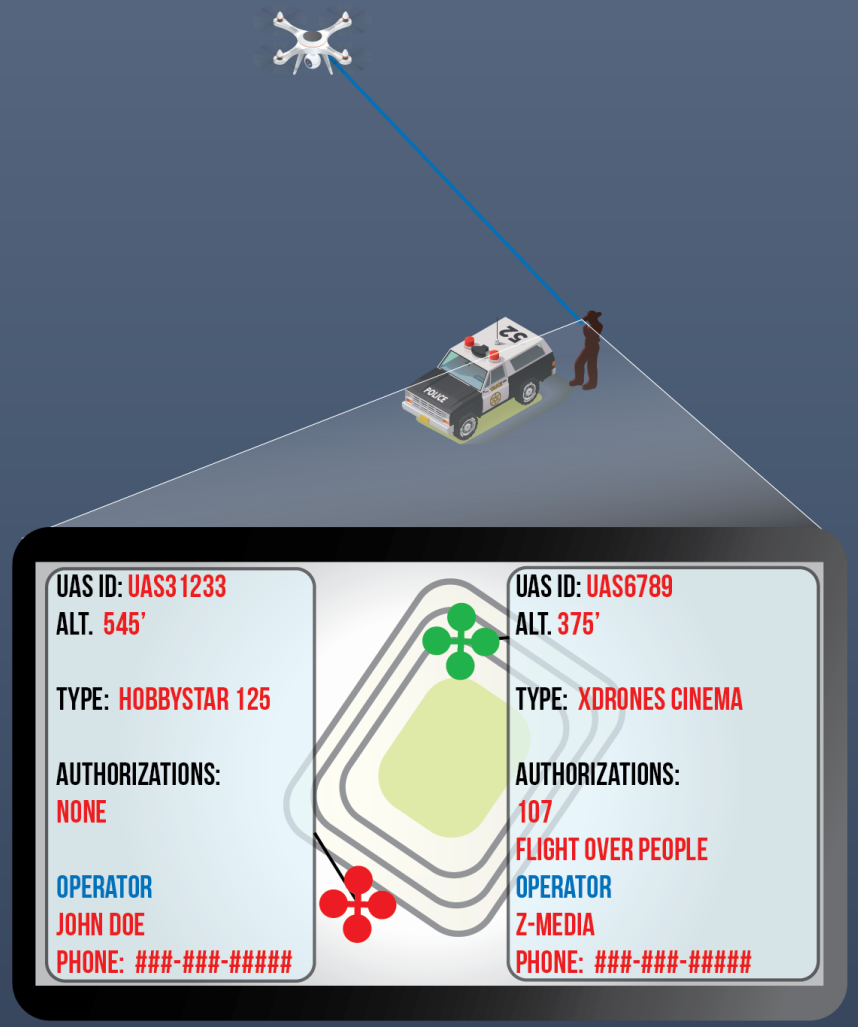
- UAS Operators
- Unmanned Traffic Management (UTM) Systems
- Law Enforcement & Security
- Public

RID Requirements Assumptions

1. Primary Purpose – Security
2. Digital License Plate
3. Spectrum
4. “Micro” SWaP
5. Anti-Spoofing
6. Cost
7. Installation Options
8. Flexible Ground Infrastructure

Operational Concept Key Points

1. Works with or without networks
2. Anti-Spoofing validation
3. Built upon existing technology



ADS-B vs. ADS-B “Like”

ADS-B

ADS-B “Like”

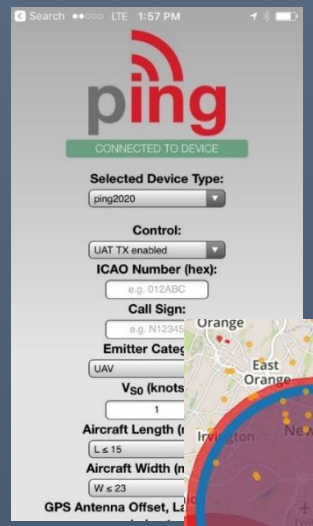
V2V / V2X

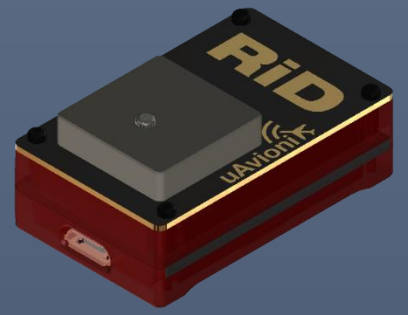
Remote Identification

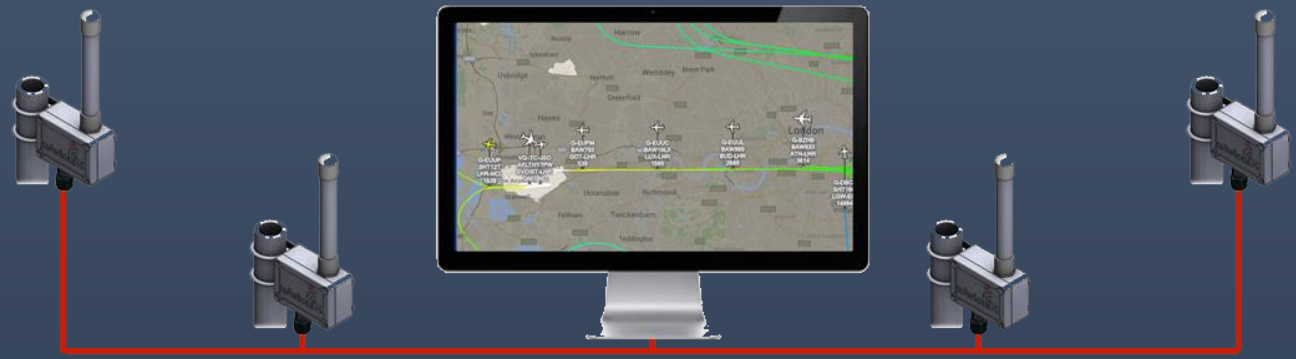
UID

Components

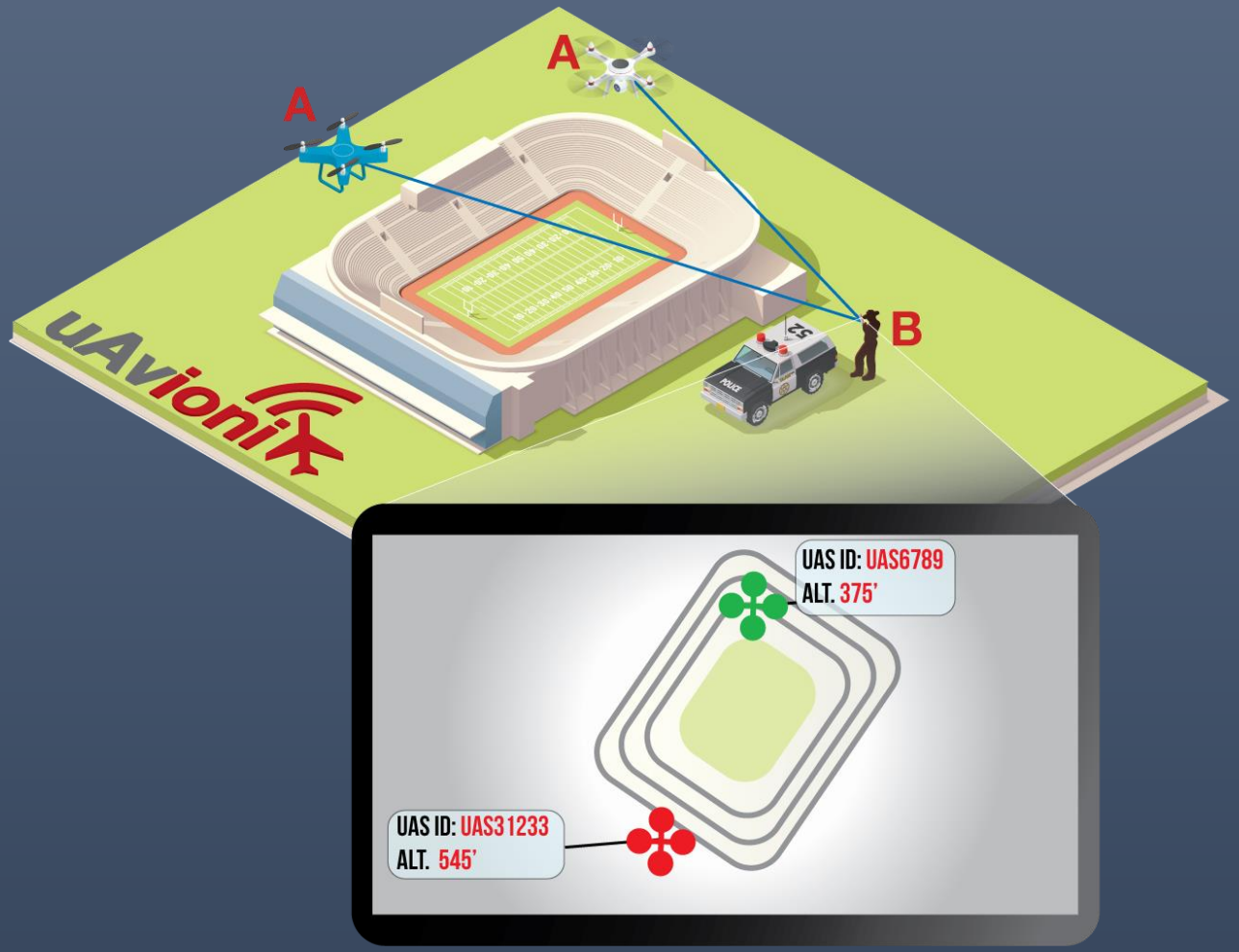
- Airborne Transmitters
  - Retrofit and OEM
- Ground Receivers
  - Mobile and Fixed
- Mobile Apps
  - Configuration
  - Display
  - Provides Network Bridge







Example – Without LTE/Internet



A. sUAS equipped with RID transmitters

B. Law Enforcement with mobile receiver paired to a smartphone

Example – with LTE/Internet

A. sUAS equipped with RID transmitters

B. Law Enforcement with mobile receiver paired to a smartphone

C. pingStation networkable receivers

D. 3G/4G Cellular Network

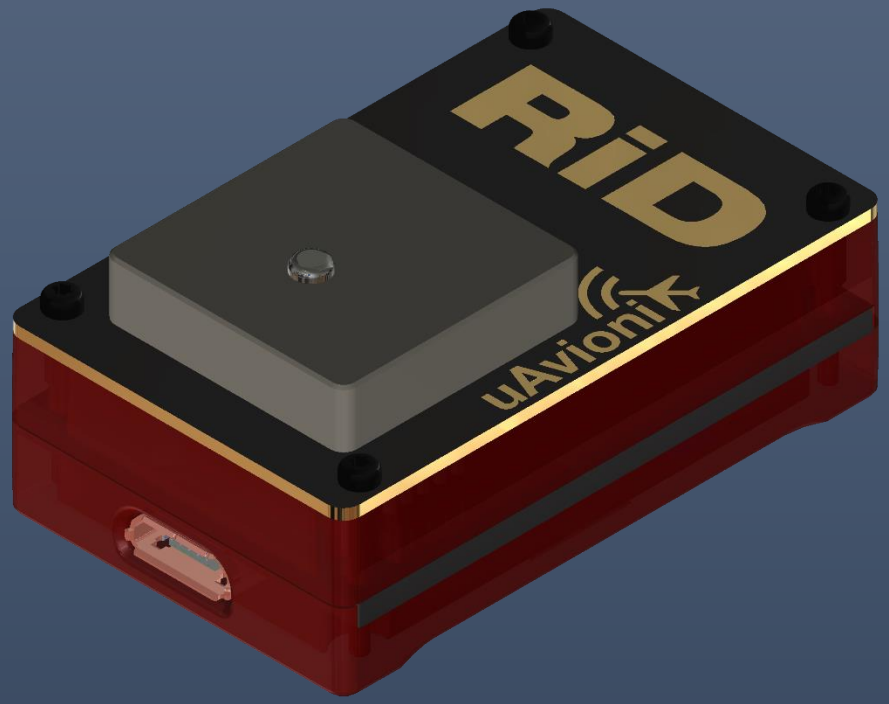
E. FAA Registration Database

F. UTM Providers

G. AirMap Drone ID Certificate Database

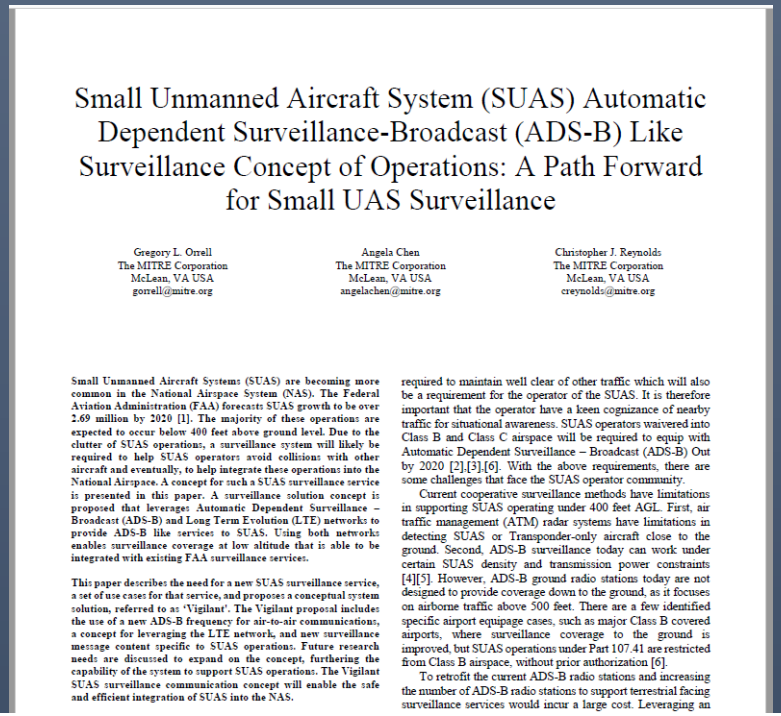
pingRID

- UID Protocol Transmitter
  - 916.5MHz
  - 1W = 2 miles line of sight
  - Integrated GPS
  - Integrated 2hour battery
  - Wi-Fi configuration
  - No host integration required
  - TLS/SSL Certificate Validation
  - <20grams
  - 42mm x 12mm x 25mm
- Q1 2018 - $50-$75 target
- Receivers
- Product Roadmap
- Initial Market – Security
- Retrofit and OEM Solutions



Unmanned ID Protocol (UID) – "ADS-B Like"

- Non-Proprietary
- Largely based on ADS-B UAT
  - Address Expansion (ICAO Limitation)
  - DroneID Verification
  - Content expansion
- Open Published Protocol with PingRID Launch
- Evolution expected
- MITRE Report: A Path Forward



Small Unmanned Aircraft System (SUAS) Automatic Dependent Surveillance-Broadcast (ADS-B) Like Surveillance Concept of Operations: A Path Forward for Small UAS Surveillance

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Small Unmanned Aircraft Systems (SUAS) are becoming more common in the National Airspace System (NAS). The Federal Aviation Administration (FAA) forecasts SUAS growth to be over 2.69 million by 2020 [1]. The majority of these operations are expected to occur below 400 feet above ground level. Due to the clutter of SUAS operations, a surveillance system will likely be required to help SUAS operators avoid collisions with other aircraft and eventually, to help integrate these operations into the National Airspace. A concept for such a SUAS surveillance service is presented in this paper. A surveillance solution concept is proposed that leverages Automatic Dependent Surveillance – Broadcast (ADS-B) and Long Term Evolution (LTE) networks to provide ADS-B like services to SUAS. Using both networks enables surveillance coverage at low altitude that is able to be integrated with existing FAA surveillance services.

This paper describes the need for a new SUAS surveillance service, a set of use cases for that service, and proposes a conceptual system solution, referred to as 'Vigilant'. The Vigilant proposal includes the use of a new ADS-B frequency for air-to-air communications, a concept for leveraging the LTE network, and new surveillance message content specific to SUAS operations. Future research needs are discussed to expand on the concept, furthering the capability of the system to support SUAS operations. The Vigilant SUAS surveillance communication concept will enable the safe and efficient integration of SUAS into the NAS.

required to maintain well clear of other traffic which will also be a requirement for the operator of the SUAS. It is therefore important that the operator have a keen cognizance of nearby traffic for situational awareness. SUAS operators waivered into Class B and Class C airspace will be required to equip with Automatic Dependent Surveillance – Broadcast (ADS-B) Out by 2020 [2],[3],[6]. With the above requirements, there are some challenges that face the SUAS operator community.

Current cooperative surveillance methods have limitations in supporting SUAS operating under 400 feet AGL. First, air traffic management (ATM) radar systems have limitations in detecting SUAS or Transponder-only aircraft close to the ground. Second, ADS-B surveillance today can work under certain SUAS density and transmission power constraints [4][5]. However, ADS-B ground radio stations today are not designed to provide coverage down to the ground, as it focuses on airborne traffic above 500 feet. There are a few identified specific airport equipage cases, such as major Class B covered airports, where surveillance coverage to the ground is improved, but SUAS operations under Part 107.41 are restricted from Class B airspace, without prior authorization [6].

To retrofit the current ADS-B radio stations and increasing the number of ADS-B radio stations to support terrestrial facing surveillance services would incur a large cost. Leveraging an

Short Message Structure

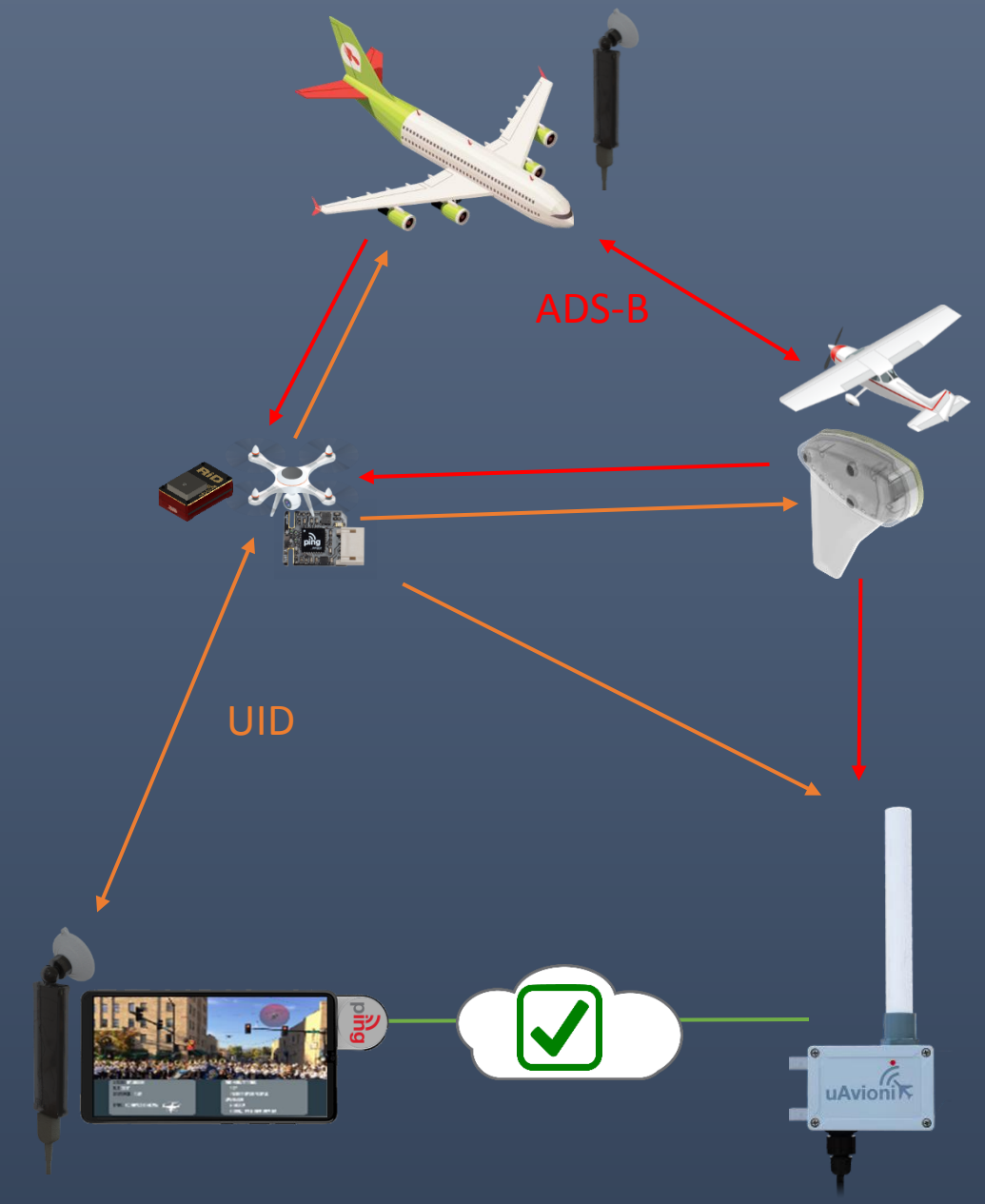
HEADER	STATE VECTOR

Long Message Structure

HEADER	STATE VECTOR	INTENT DATA/GCS INFO/WX

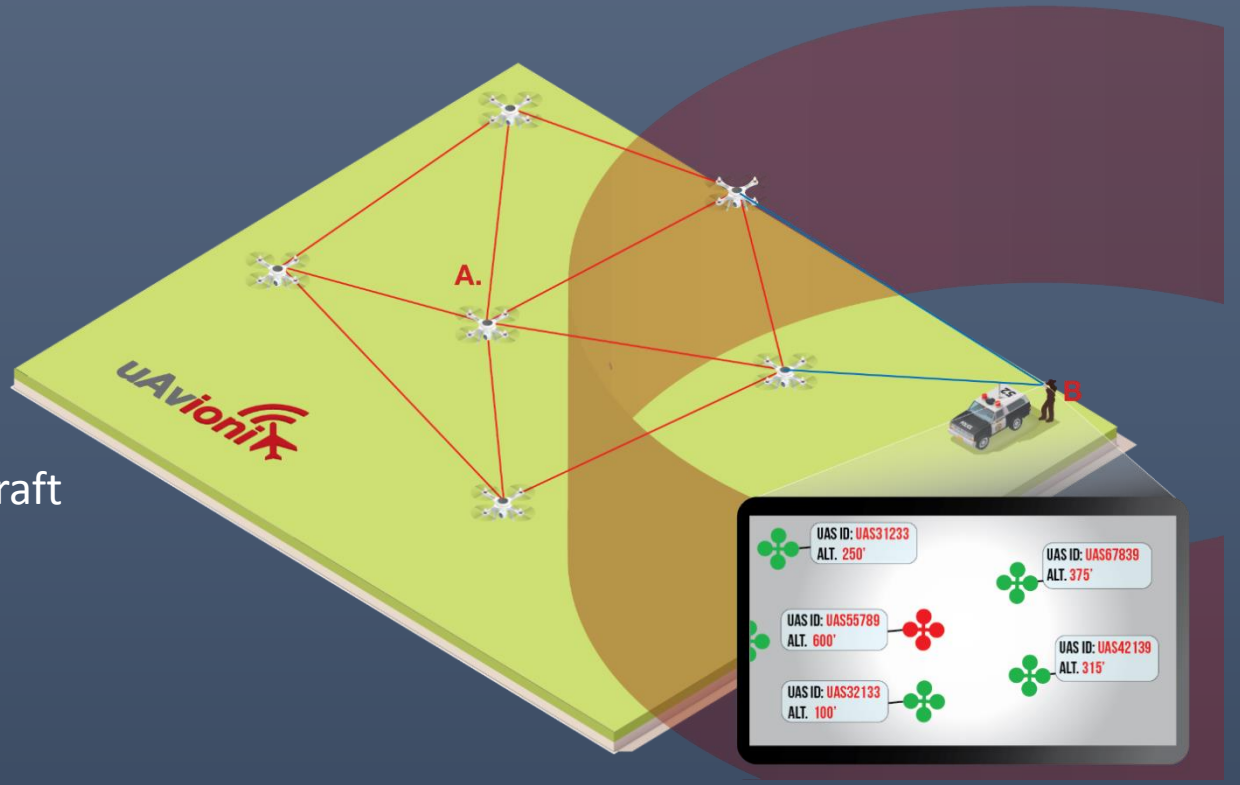
Integrating the Airspace

- In the Air
  - ADS-B Tx & Rx
  - UID transceivers
  - Combination devices
- On the Ground
  - Mobile and Fixed Receiver Networks
  - ID Validation
  - Display Apps



Roadmap Considerations

- 2 way communications/commands
  - Land Now
  - RTH
  - Hover Orbit
  - Proceed to GPS Coords
  - Kill Switch
- Low Power ADS-B Inert and Alert
  - Listens (only) for nearby ADS-B aircraft
  - If detected, broadcast ADS-B to alert manned aircraft
- Mesh Network to Extend Range
  - Rebroadcast other signals to extend range
- Black Box Data Recorder
  - Onboard storage of ownship and received data
  - Accident investigation aid



Thank You!

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