Detect-and-Avoid System with ADS-B Avionics for Unmanned Aerial Systems

NASA Armstrong Flight Research Center

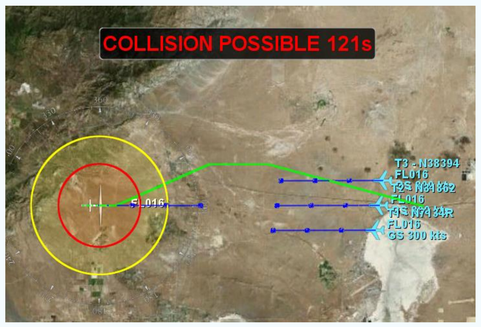
VIGILANT AEROSPACE SYSTEMS

What is Detect-and-Avoid System with ADS-B Avionics?

A unique **collision-avoidance algorithm** and **sophisticated display options** that exceeds FAA requirements for unmanned aerial systems (UAS) to fly in National Air Space (NAS)

ADS-B: 21st Century Radar
Uses GPS satellite signals and aircraft avionics to automatically determine and transmit position, speed, etc. Allows aircraft to be tracked by ground stations and by each other in the air.

ADS-B transponder from uAvionix
25 x 39 x 12 mm | 20 grams



Enhances UAS control and tracking
- Real-time updates of air traffic

Integrates components
- Communications
- Command-and-control operations
- Sense-and-avoid capabilities

Key Features

Crucial capabilities previously nonexistent for UAS

- Collision-avoidance algorithm keeps aircraft on a "well-clear" path with specific avoidance commands
- Provides unmanned pilots situational awareness and can provide autonomous avoidance for auto-pilots

Dramatically increases safety for the UAS itself, other aircraft in the airspace, and persons and property on the ground

Technology Transfer

Cost-Efficient Marketing

- NASA Armstrong TTO **developed an online listing** to broadly communicate technology during its development
- TTO **won an FLC Far West Outstanding Technology Development Award**, boosting the tech's credibility

Building Market Interest

- Inventor actively networked at the **FLC Far West meeting** and met director of Cimarron Capital Partners
- At Cimarron's invitation and with TTO support, inventor presented technology and its potential impact on the aviation industry at WBT **UAS Open Innovation Forum**

Launching a Startup

- Cimarron recruited a CEO and provided financial capital to launch **Vigilant Aerospace Systems, Inc.**

Developing/Negotiating License

- TTO was **highly responsive** when startup had questions about license application and commercialization plan
- TTO negotiated a **fair upfront payment and royalty rate** and a **partially exclusive license** to maximize tech's benefit via other fields of use
- License **signed on February 25, 2016**.

Collaborating on Flight Tests

- Inventor supported **flights on a small UAS over four flight days and 70 encounters** in December 2016
- During 3 hours of FAA-observed flights, **the system successfully avoided collisions between two small UAS** and maintained safe and efficient flight operations—a crucial step forward in national airspace integration

FAA	Federal Aviation Administration
ADS-B	automated dependent surveillance broadcast
GPS	Global Positioning System

Benefits to Aviation

This technology is a major step forward in **safely integrating UAS into the NAS**. UAS are safer and less expensive for:

- Traffic monitoring
- Forest fire management
- Search-and-rescue
- Border/Law enforcement
- Mapping/Photography
- Package delivery
- Surveying farmland, pipelines, etc.
- Communications and broadcasting
- Civilian general aviation
- Data collection: Ecological, agricultural, environmental, weather

- **Safer:** Enhances UAS sense-and-avoid capabilities
- **Effective:** Provides critical command-and-control elements
- **Regulation Ready:** Satisfies federal requirements for ADS-B Out to be installed on all aircraft by 2020
- **Efficient:** Provides crucial environmental situational awareness, conflict detection, precise navigation
- **Easy to Implement:** Uses existing components and complements and enhances the use of existing aircraft avionics and air traffic control system