VIGILANT AEROSPACE SYSTEMS™

CENTRAL ROLE OF SAFETY SYSTEMS IN DRONEPORT DEVELOPMENT

SOLVING THE AIRSPACE MANAGEMENT PROBLEM

DRONEPORT Network

Agenda

Test flights at NASA Armstrong

➢ **Introduction to Vigilant Aerospace**
- Who is Vigilant Aerospace and what is FlightHorizon?

➢ **Basic Operational and Safety Questions**
- The basic questions about safety at a droneport
- What must a safety system accomplish?

➢ **Droneport Step-by-Step: The Story of Wiseville**

➢ **Services to Support Droneport Development**
- Service Packages
- Droneport Operations Development Process
- Next Steps

Flight tests at Okla. State Univ.

Flight tests at NASA Armstrong

Introduction to Vigilant Aerospace

➢ **Safety systems for droneports and individual pilots of commercial unmanned aircraft**

➢ **FlightHorizon COMMANDER is software integrated to hardware**

➢ **Automatic avoidance system exclusively licensed from NASA**

➢ **Projects:**
- NASA manned and unmanned research
- FAA IPP in N. Dakota and Alaska
- Humanitarian-Drones.org for FEMA at Hurricane Harvey
- OSU BVLOS 13-mile COA
- Standards-writing: ASTM F38
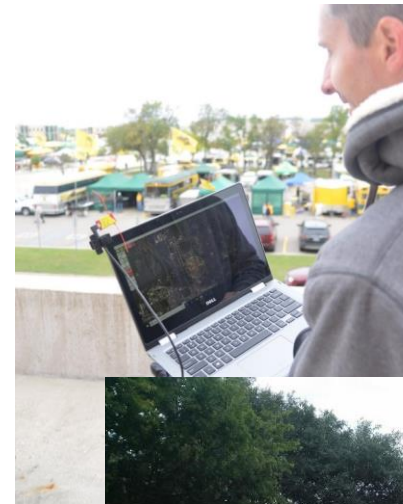
Supporting disaster response after Hurricane Harvey in Houston

FlightHorizon COMMANDER

Offshore patrols with law enforcement in Florida

- **Integrated airspace management and detect-and-avoid**

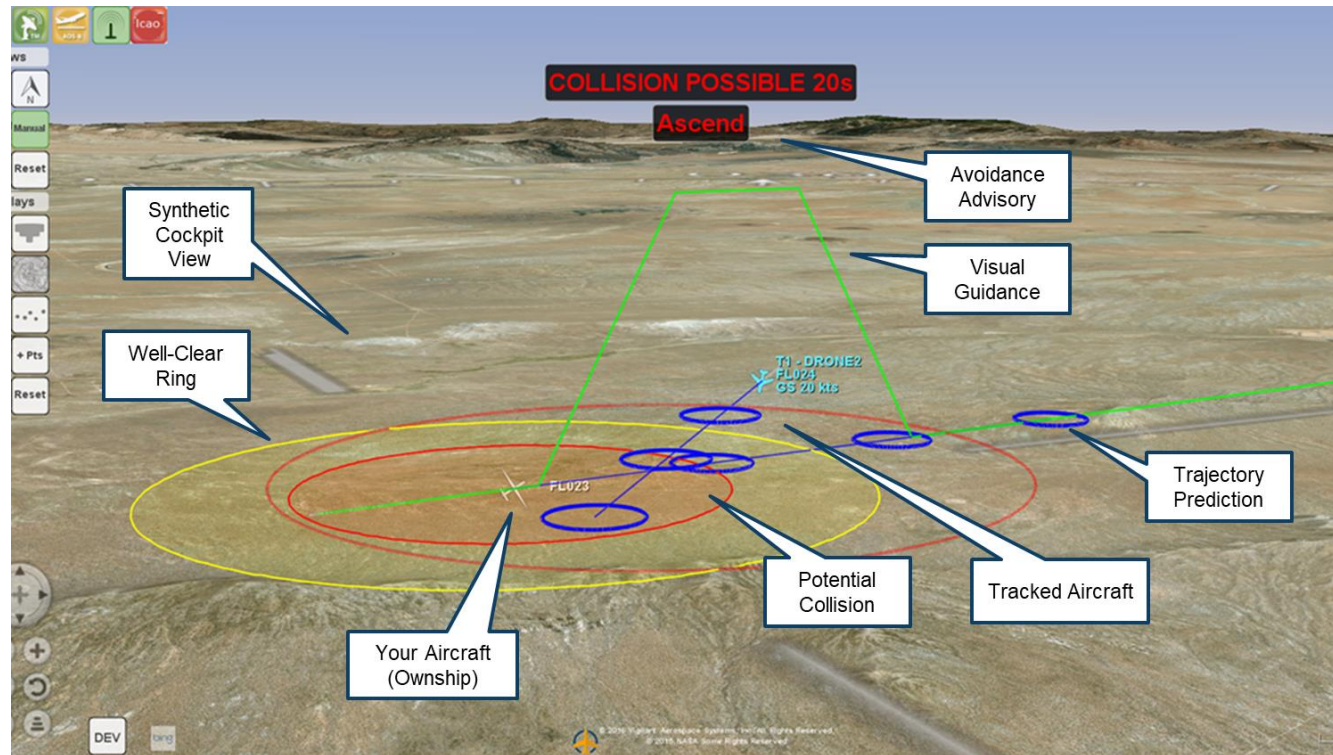- **Out-of-the-box standards compliance**

- **Reduced risk and complexity**

Airspace safety for FAA IPP flights in North Dakota

The FlightHorizon System

- Software for individual unmanned aircraft pilots or airspace managers
- Situational awareness and active avoidance of other aircraft
- Integrates with essential sensor hardware – transponders & radar
- Based on exclusively-licensed NASA patent

FlightHorizon Demo Video

THE BASIC OPERATIONAL AND SAFETY QUESTIONS

SOLVING THE AIRSPACE MANAGEMENT PROBLEM

The Basic Questions

Long-range fixed-wing UAS operations

➤ **What do we need to think about to enable BVLOS flights from our new droneport?**

➤ **Who are the fliers? What industry are we serving? How do we enable our customers?**

➤ **What does safety mean for us? What will it mean to the FAA in our context and location?**

➤ **What risks do we need to mitigate and what problems do we need to solve?**

➤ **What is a good, step-by-step plan for our droneport to get this done?**

What does my safety system need to accomplish?

- ➤ **Risk Mitigation**

- ➤ **Situational Awareness**

- ➤ **Ownship Status**

- ➤ **Detect-and-Avoid – Well Clear**

- ➤ **Demonstrate Safe Operation**

- ➤ **Demonstrate Regulatory Compliance**

- ➤ **Demonstrate Waiver Compliance**

Infrastructure inspections using drones

"Vigilance shall be maintained by each person operating an aircraft so as to <u>see and avoid</u> other aircraft."
- **14 CFR 91.113(b)**

THE STORY OF WISEVILLE'S DRONEPORT

SOLVING THE AIRSPACE MANAGEMENT PROBLEM

Where do these recommendations come from?

➢ **Part 107, Part 135, Part 91**

➢ **Existing Part 107.31 waivers**

➢ **Operation of LAANC**

➢ **SC-228 MOPS Phase I and II**

➢ **FAA Integration Pilot Program Teams**

➢ **FAA Remote ID (proposed)**

➢ **SARP Well-Clear & JARUS Airspace Risk**

➢ **FAA ASSURE A18**

➢ **NASA UTM Working Groups – SAA&C2**

➢ **ASTM F38**
- BVLOS Standard
- UTM Standard
- DAA Performance Standard
- DAA Testing Standard
- Flights Over People Standard
- Command and Control Standard - C2
- Certifiable Aircraft Standard

Part 1: The Story of Wiseville - The Initiative

➢ **Decides to explore a local droneport**

➢ **Currently un-used county-owned runway & hanger**
- Rural property, low population density, low aircraft density

➢ **Potential Industries**
- Several ranches, major oilfield within 10 miles, 30 and 60 miles

➢ **Raises money to improve the facilities**

➢ **Shared Resources – Lower Costs, Lower Risks**

Part 2: The Story of Wiseville - The Industries

- ➤ **Outreach to industry**

- ➤ **2 on-site service providers and 1 corporate operator**

- ➤ **2 agricultural survey specialist providers with small multi-rotors & FLIR**

- ➤ **1 oil and gas production company with small fixed-wing & multi-spectral**

- ➤ **Needs BVLOS to reach major customers initially within 10 miles**

Part 3: The Story of Wiseville – The Analysis

➤ **Class G airspace, uncontrolled, fly under Part 107**
- If near controlled airspace airport, use LAANC or special COA
- If at an airport, establish MOU and use LAANC, special COA, Part 135

➤ **JARUS Airspace Risk Classification – Air traffic**

➤ **DAA and Well-Clear Requirements – FAA requirements**

➤ **Primary and nearby airspaces – Other airports**

➤ **Shared droneport assets and airspace safety system**

➤ **Fly BVLOS up to 10 miles, then up to 30 and 60 miles**
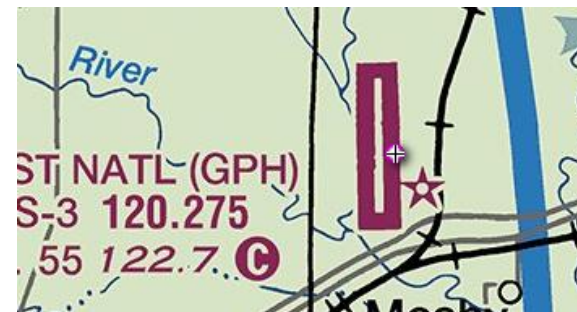
Part 4: The Story of Wiseville – The Plan

➢ **Establish the "ConOp" and "SOP"**

➢ **Strategic Risk mitigation**
  • Where, When and How you fly

➢ **Procedural Risk Mitigation**
  • Aircraft maintenance plan
  • Pre-flight checks
  • Safety system checks
  • Training plan
  • Communications plan
  • Incident plan
  • Flight logging
  • Airspace logging

➢ **Tactical Risk Mitigation**
  • Airspace management
  • Situational awareness
  • DAA / SAA
  • Future UTM integration

Strategic → Pre-planning

In-Flight → Airspace Management

Tactical → Detect-and-Avoid V2V
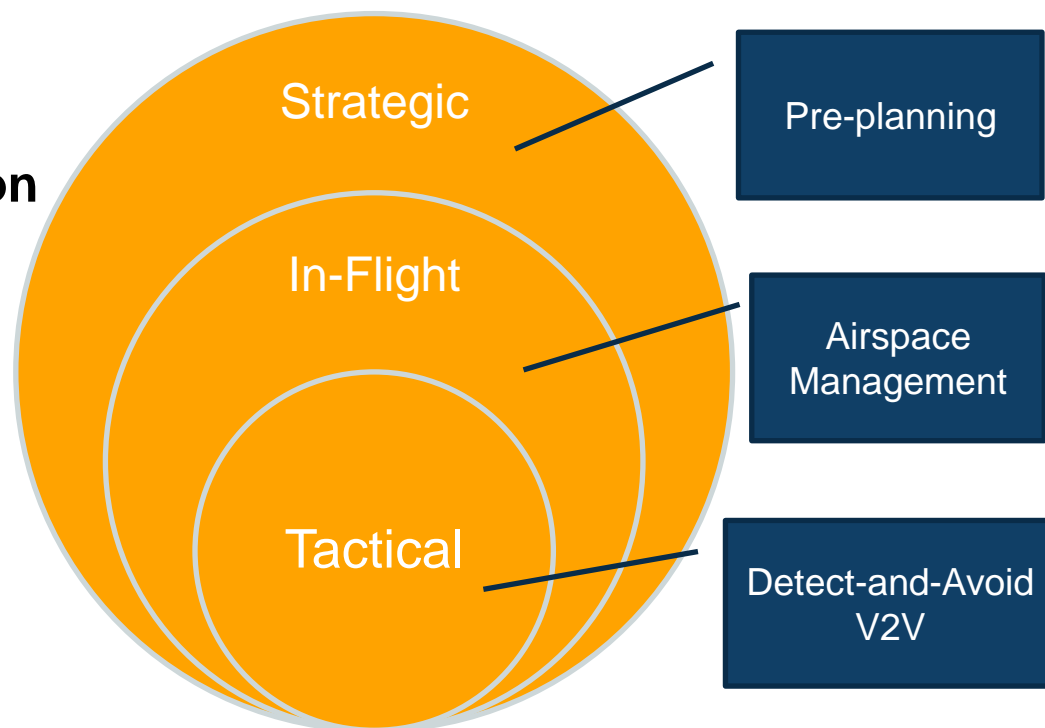
Portions of this section are derived from ICAO Doc. 9854, *Global Air Traffic Management Operational Concept*

Part 5: The Story of Wiseville – The Solution

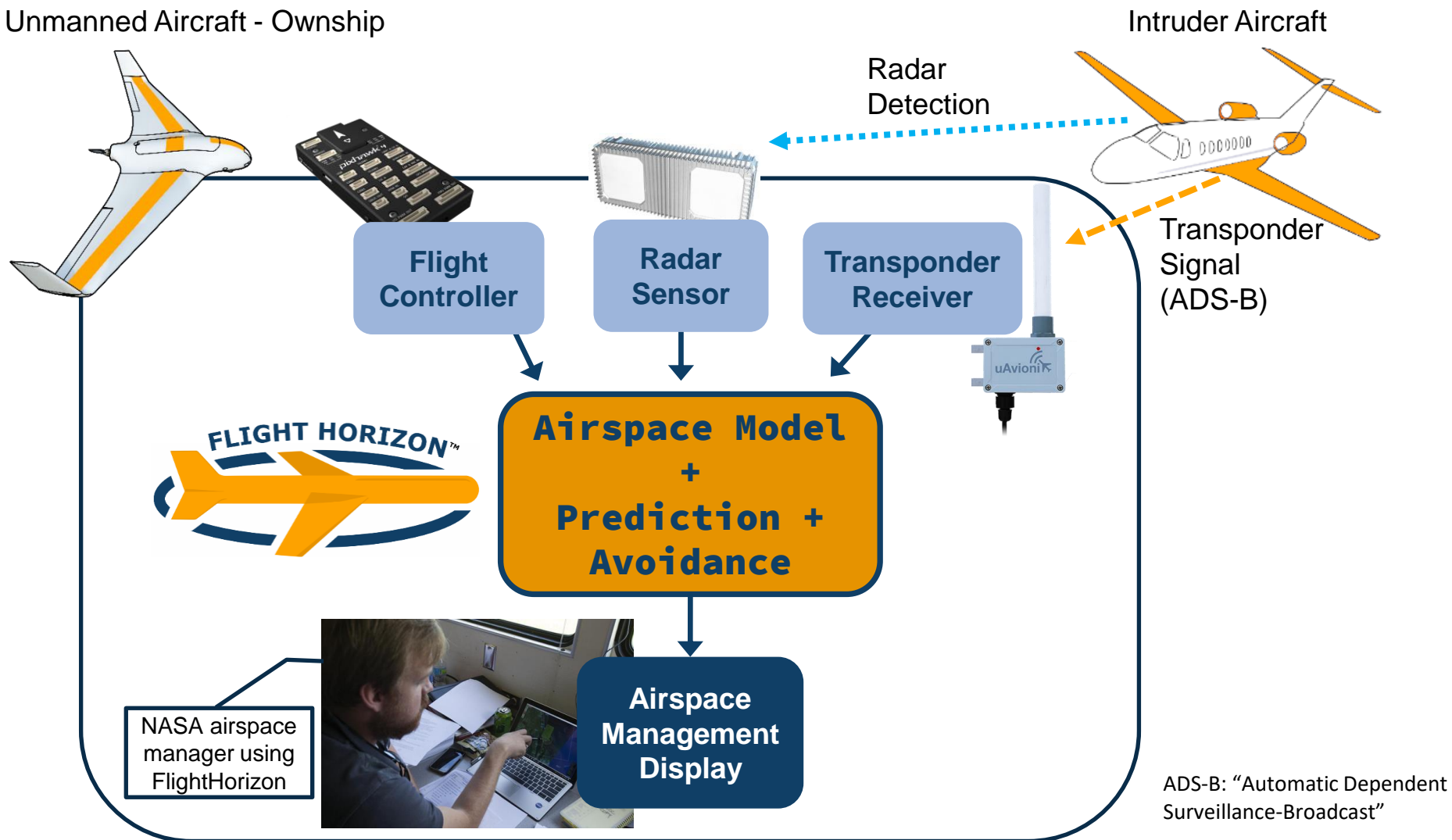➤ **Install the safety system**
- Airspace management for situational awareness
- Self-contained unmanned traffic management (UTM)
- Strategic De-Confliction
- Tactical De-Confliction
- See-and-Avoid / Detect-and-Avoid

FlightHorizon – How it Works

Unmanned Aircraft - Ownship

Intruder Aircraft

Radar Detection

Transponder Signal (ADS-B)

Flight Controller

Radar Sensor

Transponder Receiver

FLIGHT HORIZON™

Airspace Model + Prediction + Avoidance

NASA airspace manager using FlightHorizon

Airspace Management Display

ADS-B: "Automatic Dependent Surveillance-Broadcast"

Part 7: The Story of Wiseville - Enablement

➢ **Crawl / Walk / Run Process**

➢ **Fly VLOS under the SOP and document it**

➢ **Apply for Waiver**
- Select the most likely candidate – public, private
- 14 CFR § 107.31 - Visual line of sight aircraft operation
- Apply and respond to questions

➢ **Receive the Waiver – BVLOS with VO**

➢ **Fly with VO and document it**
- Operate with a VO along route and at point of operation
- Utilize system to track the UAS and all other aircraft
- Document flights with airspace log and journal

➢ **Re-apply for non-VO waiver**
- Graduate to radar-based BVLOS

➢ **Attract New Operators**
- Specialist service providers

SERVICE PACKAGES FOR DRONEPORT DEVELOPERS

SOLVING THE AIRSPACE MANAGEMENT PROBLEM

SERVICE PACKAGES FOR DRONEPORTS

TECHNICAL SERVICES

- **FlightHorizon COMMANDER for airspace management-as-a-service**

- **Hardware purchase and setup**

- **Regulatory advisory and support for waiver applications**

- **Test flights support, data collection, flight logging, flight reporting and documentation**

- **Concept of operations documentation, standard operation procedures manual for airspace management**

PROGRAM SERVICES

- **Written Plan for Droneport Development**

- **Staff training on concept of operations and FlightHorizon COMMANDER**

- **Droneport promotion support**

- **Insurance RFI support**

- **Community outreach meeting support**

- **Grant-writing support**

Droneport Operations Development

1. Operating Agreement	2. Safety Systems	3. Flight Testing	4. Draft SOP	5. Waivers & COAs	6. Finalize SOP	7. Training	8. Launch

1. **Execute operating agreement with the airport to accommodate unmanned aircraft**

2. **Install safety systems including FlightHorizon COMMANDER and related equipment**

3. **Conduct visual line-of-sight flight testing and document the safety systems**

4. **Draft standard operating procedures manual for submission with waiver or Certificate of Authorization (COA) applications**

5. **Apply to FAA for waivers or COAs for beyond visual line-of-sight flight, as needed**

6. **Write up final standard operating procedures manual based on waiver or COA compliance**

7. **Conduct training using the standard operating procedures in the use of the safety systems and in compliance with any waiver or COA**

8. **Commence droneport operations**

Next Steps

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➢ **Available upon request:**
- Subscription Quotes
- Integration Plans
- Project Proposals