City of Coral Gables
Drone Use Cases

Public Safety,
Government Services, Research,
Smart City Programs

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CORAL GABLES - SMART CITY DRONE USE CASES

1. Combined use case with crowd analysis, IoT, AI/ML, computer vision and data analytics.
2. Drone delivery.
3. Live video broadcasting; with autonomous routes; with cellular or satellite communications.
4. Public safety operations.
5. Fire accreditation.
6. Hurricane rescue recon.
7. Outdoor Covid-19 testing sites planning and monitoring.
8. Building rooftop water damage assessment.
10. LiDAR GIS 3D modeling in collaboration with universities and GIS / aerial photography.
11. Video analytics.
12. Our Communications / Public Affairs team also uses two drones with video for media production and creation.
SMART CITY USE CASE OF DRONES, IoT, AND A.I. IN THE ICP

- Crowd Analysis
- IoT Sensor Data
- Artificial Intelligence / Machine Learning
- Computer Vision
- Data Analytics
Crowd and Traffic Correlation Analysis:
• 1.1- Jacobs Method: produces a range of ~250-400 people (quick/approx.)
• 1.2- Computer vision AI analytics on drone footage: 324 ppl. Acc. of algorithm: ~ 90%
• 2.1- IOT traffic data analysis from the smart city hub CPS platform using optical sensors, edge analytics + cloud analytics
• 2.2- RF sensor behavioral data analytics from the smart Wi-Fi mesh network
• Correlation Analysis between 1.2, 2.1, 2.2 – Technology Sensing/Data Validation
2.1. IOT traffic data analysis:

- Using IOT traffic data from the smart city hub CPS platform (optical sensor + edge analytics + cloud analytics): it measured ~ 600 people avg. per hour during the event peak and ~350 during the last 90 minutes of the event.

- Total ~1550 during the event. In a closed system, visitors are calculated as 1/2 of foot traffic, which would produce a visitor flow of ~ 290 people, ~ 310 people, ~140 and ~35 per the charts shown.

- In an open system with reentry, passersby and unaccounted residents, it is expected an even smaller ratio of visitors/passersby.
2.2. IOT traffic data analysis:

- Method 2 - Using RF sensor behavioral data analytics from the smart Wi-Fi system on Miracle Mile adjacent block: It measured a visitors / passersby ratio of approximately 0.2 (1/5) and ~150-200 visitors each hour between 4-7pm, which is consistent with the IOT sensor data.

Correlation Results:

- Applying the behavioral ratio measured on Section 2.2 to the IOT foot traffic data from Section 2.1: 1550 * 0.2 = 310, very close to the 324 value measured before in 1.2.
Drone Delivery

• Currently testing payload & delivery mechanisms and loads / applications
• Handheld Radios
• SWAT / Hostage Response Equipment
• Small inflatable floatation devices
• Medications
Live Video Feeds

- Drone feeds through RTMP servers
- Broadcast to any compatible HTTPS browser
- Increased situational awareness to Central Command Centers
- Real time feed back to Dispatch, Command, & active Law and Fire units on scene
Hurricane Rescue Recon
ROOFTOP WATER DAMAGE ASSESSMENTS
TOWER INSPECTIONS
• Thank You for allowing us to share our story with you.

• More information can be found at www.coralgables.com/itdocs

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305-569-2448
Building “Highways in the Sky” to support advanced UAS missions

AIRHUB PLATFORM
Enables communities to manage safe integration of UAS operations by providing ground risk insights
Hazard Data Integration From Multiple, Trusted Sources

**Static data:** Schools, hospitals, government buildings, helicopter pads, airports, stadiums, rights-of-way, etc.

**Policies:** Special ordinances, land use, zoning

**Dynamic data:** Advisories, weather, population movement patterns

**Data Preparation**
Corroborating and combining datasets into the UAS Spatial Data Model to facilitate processing and enable easier maintenance.

**Model Processing**
Applying the risk model based on UAS operator inputs, time and location risk attributes. Supports the underlying routing decision tree.

**Deployment**
Approval and deploy processed data to AirHub systems, enabling the state & local government the ability to publish advisories and risk data to UAS pilots.
AIRHUB for Government: Data Exchange With UAS Operators

- Trending reports about UAS operations in the community
- Aggregation of flight data by location received from Pilots
- Event advisory information published to pilots
AIRHUB for Business and Developers

- Flight Insights for Safety Case
- Safe route recommendations
- Key data and services exposed through APIs
Applied Risk Model
Ontario, California, Is Using GIS to Look to the Sky
By MettleLink, Airspace Link

The federal, state, and local laws surrounding the commercial use of drones, particularly for those outside the aviation industry, can feel like a complicated web of regulations, rules, and restrictions. While the rise of drones at recreational events has become ubiquitous, the commercial industry has led the charge in driving the drone business forward for the last three years. Drones have become an invaluable part of the everyday workflow for construction companies, mines, utilities, and engineering firms worldwide. While construction and engineering companies have been on the bleeding edge of adoption, state and local governments are poised to rule the full potential of what this technology has to offer.

Southern California is one of the most densely populated areas in the country. The six primary counties that make up the greater Los Angeles area account for 19.1 million people. Tucked into the middle of the sprawling forty miles east of San Diego is the city of Ontario. Home to Ontario International Airport, the sixth-busiest airport in California based on the number of passengers, and one of the busiest airports for out-bound cargo, Ontario presents a difficult challenge, as most of the city lies within controlled airspace that prohibits drones from flying without a special waiver from either the Federal Aviation Administration (FAA) or the local air traffic control tower. These conditions, along with the web of governmental and occupational regulations, create a complex environment for navigating the ever-changing rules and where drones can be legally flown.

Laying the Groundwork
Over the last ten years, the FAA has been making progress in keeping pace with the regulatory requirements for an industry that has exploded in growth. As drones become safer and more reliable, new regulations continue to accommodate the diversification and needs of the industry. From 2014 to 2016, drone pilots were required to complete a 330-aircraft exemption, which was cumbersome to obtain because it required a commercial pilot’s license. Recognizing that a more streamlined process was needed, in June 2016, the FAA released the FAA Part 107 certification. This new certification, earned by more than 100,000 drone pilots in the United States since its introduction, has been the enabler required for continued growth during the initial expansion phase of the industry.

By Year Five, in a single U.S. metropolitan area, drone delivery could:

- Serve up to 53.9% of the population;
- Recover up to $582.5 million per year in total time savings for consumers;
- Support the 3.6-6.6% of metropolitan residents who lack access to a vehicle (as many as 66,000 people in a single metropolitan area);
- Help 22,000 people with mobility challenges to obtain their prescription medication;
- Generate up to $284,000 per year in new annual sales for a participating local business (up to 250% additional sales compared to a scenario without drones);
- Avoid up to 294 miles per year in road use and up to 580 car crashes per year;
- Reduce up to 113,900 tons per year of CO2 emissions, equivalent to 46,000 acres per year of new forest.

Variations exist between cities based on a range of variables including size of the existing market, demographics, population density and urban environment. For example, in communities with greater distances between commercial centers and residences, consumers may benefit more from drone delivery through time savings – as much as 31-56 hours of time saved per person per year, averaged across all residents. In denser communities with high costs of living, consumers may benefit more from the value of time saved – as much as $323.5-582.5 million per year in total time savings.
AIRHUB™ PLATFORM

TODAY
AirHub™ for Gov
AirHub™ for Pilots

BETA
AirHub™ for Developers
• OEM + Developers (Data, functions, API)

LAUNCH DEMOS
AIRHUB for Government: Digital infrastructure for state and local governments to manage, risk, while engaging with and building their drone communities.

AIRHUB for Pilots: Flight planning, logging, and LAANC authorizations

AIRHUB for Business/Developers: Risk insights, safe routing and APIs

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Safety Through Sensing

Prepared For: UAS Safety and Integration Task Force

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Founders

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14+ years in ATM, defense, CUAS

Kevin Nasman CTO
21+ years in radar, control systems, CUAS

Gary Dominicos CFO
30+ years in accounting and finance

Team Skill Sets

- Systems Engineering
- Embedded Software
- DSP Firmware
- RF Engineering
- Board Design
- Mechanical Design
- Wireless Comms

Our Team - Headquartered in Syracuse, NY

- Average team member experience: 12+ years
  - 16 current employees
- Designed, developed, fielded advanced passive detection and radar tech for commercial and defense customers
- Industry experts active in standards groups (ASTM, RTCA)

Team Highlights

- US Army CUAS Program
- NASA UTM TCLs
- FAA Pathfinder Programs
  - BNSF Railway
  - Drone Detection For Airports (DFW)
- NY State UTM Corridor
- FAA Test Site Programs
  - Virginia Tech (MAAP)
  - Griffiss International Airport (NUAIR)
Airspace Monitoring Service
The world’s first low altitude air traffic data service
Airspace Monitoring Service (AMS)

Introducing Safety Through Sensing™

One city-wide deployment, multiple applications
Uber

UAM / UTM
Supporting aerial ridesharing safety

Government / Defense
Finding solutions for national security problems

Foundational Partnerships

Infrastructure Deployment
Experienced telecom project management firm handling initial US based metropolitan deployments

Facility SOC Integrated Solution
Bundled Hidden Level AMS + SOC management and visualization platform product offering
What AMS Is

**Detection System**
- Custom built passive, persistent, wide-area, low-altitude airspace monitoring

**Infrastructure Built For Scale**
- Coverage can be built out to cover an entire metro area

**Actionable & Legal Airspace Data**
- 24/7 accurate coverage over a large area gives more warning and traceability

**Reduces Complexity**
- Eliminates burden of owning and operating expensive/changing technology

What AMS Is Not

**Mitigation System**
- AMS enables mitigation to be used effectively and efficiently

**Temporary or Single Point Installs**
- The power of AMS lies in its long range, permanently installed, distributed sensors

**Communications Link Interceptor**
- AMS does not demodulate any transmitted non-broadcast signals or extract data fields

**Require Dedicated Team or Tools**
- AMS integrates into existing systems, without overhead or maintenance
Footprint

- Up to 20 square miles
- Focused around south end of Onondaga Lake
- 2-3 Installation Sites
- 1-2 mobile sensor units

Syracuse Testbed (Urban)

Footprint

- Up to 20 square miles for low risk testing of complex test scenarios
- CNY Farmland
- Multiple Temporary Emplacement Sites
- 1-2 mobile sensor units

Syracuse Testbed (Rural)
AMS For Integration
Hidden Level UTM Integration

Supplemental Data Service Providers (SDSP)

- Weather
- Terrain
- Performance
- Surveillance

Airspace Monitoring Service

Non-Cooperative Air Traffic Ownership Positional Verification
Low Altitude Air Traffic Picture

Commercial Drone Fleet Operator

UAS Service Supplier (USS)

- Constraints, Directives
- Requests, Decisions
- Operations, Deviations
- Operations Constraints Notifications

UAS Operator

Delivery UAS

UAS Operator

Delivery UAS

Public Safety

Flight Information Management System

NAS Data Sources

National Airspace System

Common data from FAA available to UTM components (FAA SWIM, LAANC, etc)
Airspace Monitoring Service: UTM Benefits

Detect/Validate 3D Position Low Altitude Air Traffic

No on-premise sensors required
Subscribe only to data you need

Realtime Airspace Data For USS
- Report on cooperative and non-cooperative aircraft in low altitude airspace

Feed Existing GCS / Ops Center / UTM Platform
- Data integrates directly into existing systems
- Subscribe only to the data you need for operations

Enhanced Situational Awareness
- Use historical data from AMS to develop more efficient flight routes, avoiding heavily trafficked areas

Validate Remote ID / Telemetry Position
- Independent verification of broadcast or networked reported position is essential to preventing mid-air collisions (both ownship and other self-reporting UAS)
AMS For Security
Airspace Monitoring Service For Security Customers

Integrated Service To Security Platform

Lightweight Reporting Service

Data Service Direct Custom Integration

- Daily/Weekly/Monthly
  - Historical Trending
  - Heat Maps
- Alerting
  - Geographic
  - Threat Level

Customer SOC or Fusion Center

Hidden Level Direct Relationship

Hidden Level Indirect Relationship
Airspace Monitoring Service: Security Benefits

**Generate Historical Data Report**
- Use historical data to identify likely launch/recovery spots
- Intel to feed CONOPS for patrols during events

**Feed Existing VMS or GSOC**
- Data integrates into existing systems
- Reduces venue security team burden for another screen, operator station, and training

**Fast and Efficient Response Times**
- Long range and accuracy of coverage gives security team more time to respond and confidence in system with low false alarm rates

**Cue Mitigation Systems**
- Work seamlessly with approved mitigation technology when authorized
- Reduces number of systems facility must accommodate for drone security purposes

**Detect 3D Position of Intruder Drone or Operator**
- No on-premise sensors required
- Subscribe only to data you need
Let’s Work Together
Bringing AMS To Your Area

Hidden Level

Cost-effective, scalable, coverage for entire cities
Service performance suitable for security and UAS Traffic Management
Flexible capability to work across public and private sectors

✓ Provide AMS as an SDSP to UAS Service Suppliers
✓ Provide AMS data feed to your Security Operations Center
✓ Provide AMS data to support Smart City data fusion centers, Law Enforcement, Critical Infrastructure monitoring and municipal government services

Please reach out to discuss new projects and partnering initiatives!
Thanks!

James Licata
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Bell APT 70 System Integration and Operationalization (SIO)
NASA Systems Integration and Operationalization (SIO)

Furthering certification & BVLOS technology

Demonstrating Urban, Critical Medical Transport Mission
Flight demo Q3 2020
Engaging medical community support

Pushing boundaries of Urban UAS Ops
Operating >55 lb UAS
Flying with GA & Heli traffic
Transiting in & out of DFW, Class B Airspace
Overcoming urban environment challenges

Increasing BVLOS Tech TRL from 4 to 6
Detect & Avoid (DAA) with Xwing
Command & Control (C2), Internal

Building certification pathways for medium UAS
Capturing required approvals & process for air logistics missions
Contributing to standard committees on BVLOS tech
Navigating challenges with guidance and strong support from NASA
National and Local Stakeholders

Government, community and industry collaboration for furthering UAS routine UAS operations

Federal Aviation Administration (FAA)
North Central Texas Council of Government (NCTCOG)
Local Medical Community
Nation-wide Suppliers
Cities of Arlington & Fort Worth

NASA
SIO Sponsor

Bell
Vehicle, Datalink, Ground Station, System Integrator, Certification

Xwing
Detect and Avoid (DAA)

University of Massachusetts, Amherst’s Center for Collaborative Adaptive Sensing of Atmosphere
Weather Avoidance Technology
Bell Autonomous Pod Transport (APT) 70

APT is an all-electric, tail sitting Vertical Take off and Landing (VTOL) unmanned aircraft, which uniquely transitions to fixed wing flight.
Beyond Visual Line of Sight Technologies

Command and Control (C2)
- 2 RF Line of Sight (LOS) links on separate frequencies

Airborne Detect and Avoid (DAA)
- Sensor Fusion
  - ADS-B Transponder
  - Two aircraft radars
  - Visual DAA

Ground Control Station
- Weather Avoidance / Monitoring
- Integrated DAA Displays

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Crawl, Walk, Run Approach

**C2 Mission environment Validation**
Bell 407 test bed of subsystems and C2 system along flight path

**Airborne DAA Testing**
DAA system testing on Bell 407 for tuning and flight encounters

**Bell APT 70 Flight Testing**
Step-by-step remote site testing of integrated systems prior to demonstration

**Component & System Testing**
C2, DAA, GCS with DAA interface, and Weather Application testing in lab, simulation environments and component ground testing

**EMI System Compatibility**
Ground based, on vehicle testing of components

**Spectral Survey of Operating Area**
Airborne and Ground based testing
Mission Concept of Operations

9.4 nmi round trip
Flight altitudes: 500 to 1000 ft AGL

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Mission Iteration

Safety is Primary

Focused on safety, Bell iterated with the FAA and NASA on mission operations and flight path over 10 months prior to submittal of paperwork for COA application.

FAA Organizations included
- Aircraft Certification Service (AIR)
- Air Traffic Organization (ATO)
- Spectrum Engineering (AJW-1C3)
- Flight Standards (AFS)
- Fort Worth MIDO, Fort Worth FSDO

Air Safety

Proximity to DFW traffic, Non-cooperative traffic, BVLOS operations

Ground Safety

No flights over people, road crossing, land owner permissions, emergency landing zone evaluations

Mission Objectives

Controlled & Uncontrolled airspace, altitude 500 + ft AGL, representative of commercial operations
Building the pathway for Medium UAS authorization & approvals

- Capturing required approvals & processes for air logistics missions
  - Risk-based Safety Assessment
  - Mission Concept of Operations
  - Exemptions/Waiver applications

- Navigating challenges with guidance and strong support from NASA & FAA
  - Controlled Airspace
  - Spectrum

- Foundation for more robust and optimized (SWaP) solutions
  - Test Data & Analysis
  - Lessons Learned
  - Standards Requirements

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Production design & airworthiness considerations

- BVLOS technologies
- Advanced automation / Autonomy
- Durability & reliability requirements
- Aviation-grade COTS approach
- Use of additive manufacturing
- Regulations & standards definition