UTM

UAS TRAFFIC MANAGEMENT

NTX Safety and Integration Task Force Meeting
Jul 30, 2024

What is the DFW UTM Key Site Operational Evaluation?

UTM Operational Evaluation Overview

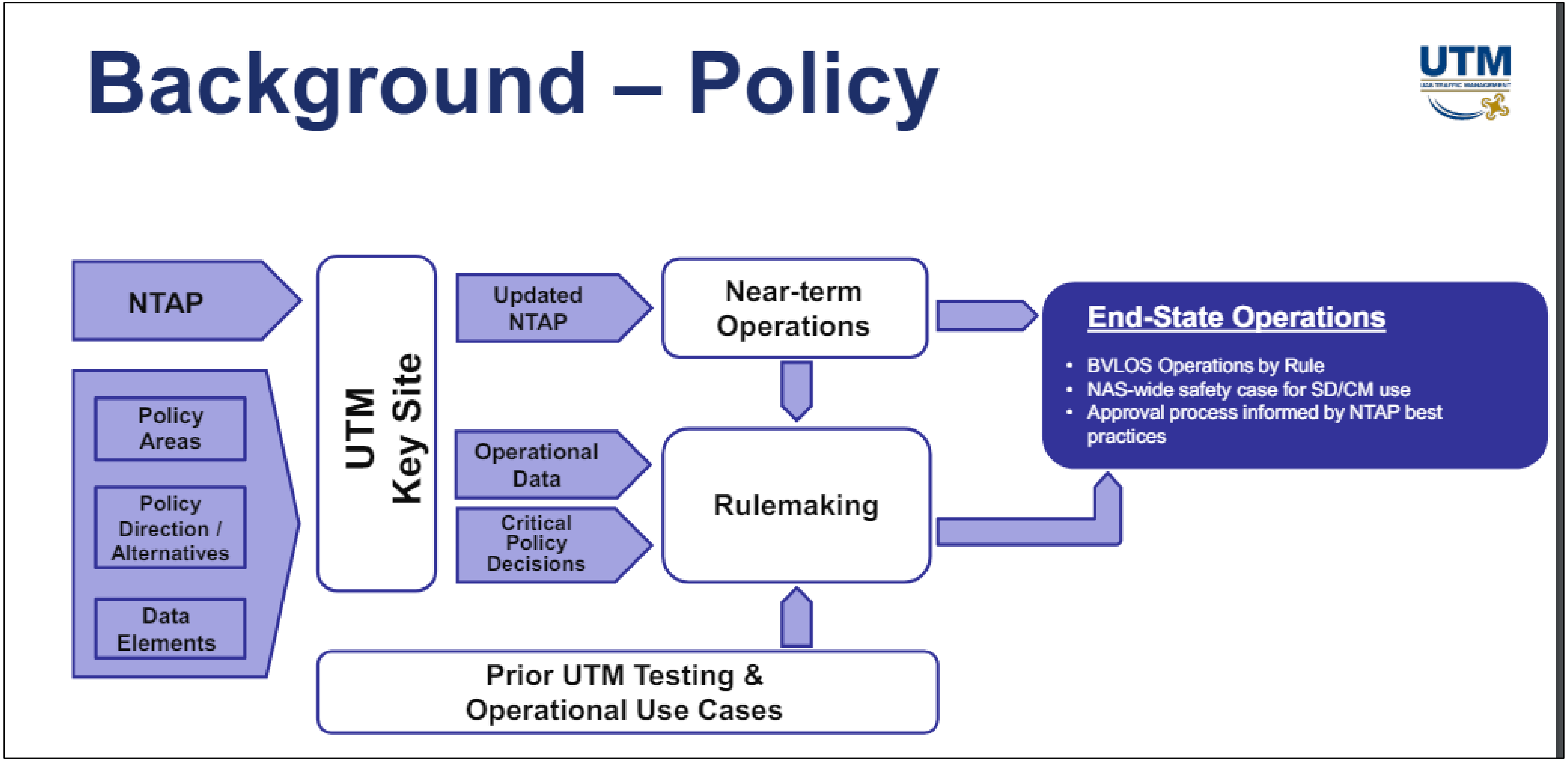
UTM

- Consortium of industry operators convened to facilitate preparations and execution of overlapping BVLOS operations in the Dallas-Fort Worth, Texas area
- Precedent-setting exemptions for BVLOS, where operators can leverage UTM services as operational risk mitigators
- UTM services leverage USS interoperability standards to manage and mitigate UA-to-UA conflicts
- Deployed ecosystem will be the basis for routine operations in Dallas-Fort Worth
- Evaluation will define common requirements to enable routine BVLOS operations in other locations

Federal Aviation Administration

12

Relationship of Key Site to Policy Informing End State Operations



UTM Key Site Expects to Inform Critical Policy Decisions

Public Safety Objectives of UTM Key Site

Enable direct self-representation of public safety in key site operator and technical committees

Enable a leave-behind capability establishing data sharing & governance that benefits public safety

Identify & prioritize the future roadmap of required capability to support public safety operators needs

Establish and share lessons learned on public safety UAS operations that benefit all communities

Key Site Is an Opportunity for Public Safety Input Ahead of FAA BVLOS Ruling

Data Sharing Need by Public Safety Mission Type

Higher Cooperative Planning Need

- Drone as First Responder (DFR) nominal flight
- Large planned event support (with and without TFR)
- Multiple-Vehicle deployment to single location
- Special Government Interest (SGI) request

- Single vehicle tactical deployment onsite using VLOS
- Indoor/interior operations

Lower Cooperative Planning Need

More complex missions will receive greatest benefit from intent sharing

Priority Public Safety Operations

The overwhelming majority of Public Safety missions are Priority

Questions?

TEXAS A&M UNIVERSITY CORPUS CHRISTI | LONE STAR UAS
CENTER OF EXCELLENCE & INNOVATION

Capabilities Briefing

The Future is Taking Off at LSUASC!

7/29/2024

Our Mission

Lone Star UAS Center of Excellence and Innovation (LSUASC) advances the integration of Unmanned Aircraft Systems (UAS) and Autonomous Aviation (AAV) technologies across educational, public, and commercial agency interests; provides an economic stimulus to attract related industry partners; and informs governing agencies on UAS and AAV operations in the National Airspace System (NAS).

LSUASC Test Site Purpose

Advance the **safe integration of civil and public UAS operations into the NAS**

- Educate students and further UAS research & innovation
- Provide FAA R&D and operational data to facilitate the ***development of procedures, standards and regulations***
- Coordinate and execute Advanced Air Mobility (AAM) concept demonstrations and evaluation
- Guide Industry (US and Foreign) through the FAA safety and maturity process ***required*** to safely integrate commercial UAS operations into the NAS

5,476+ sorties flown since 2014 FAA certification

Modernizing the NAS

Supporting the FAA Next Generation Office:
- Communication Latency Research
- AAM & UAM Support
- Federated PSU Network (FPN) Fall 24

New Entrants & Aerospace Innovation
- Radar Pilot Program

UAS Test Range Services
- Public & Civil Authorizations
- Restricted Airspace for Aeronautics, Test and Evaluation et al
- FPN Development
- Cooperative Flow Management
- Supplemental Data Service Providers (SDSS)

Advancing AAM for Texas
- Creating an AAM R&D Corridor "Sand Box"
- Participate in FAA Beyond Program for All of Texas
- CCIA Tenant for BVLOS and Vertiport R&D

Value Proposition

- AAM Ecosystem Development
- AAM Use Case Development
- AAM Research and Development (R&D)
- Mobile and Deployable Test Range Services
- Centralized and Mobile Mission Control Operations
- Flight Operations — **320,000 Cubic Foot, 5 Story Netted Enclosure**
- Data Collection to support regulatory and standards development
- Development of documents to support FAA waiver and exemption requests.
  - **Airworthiness Certification (AWC).**

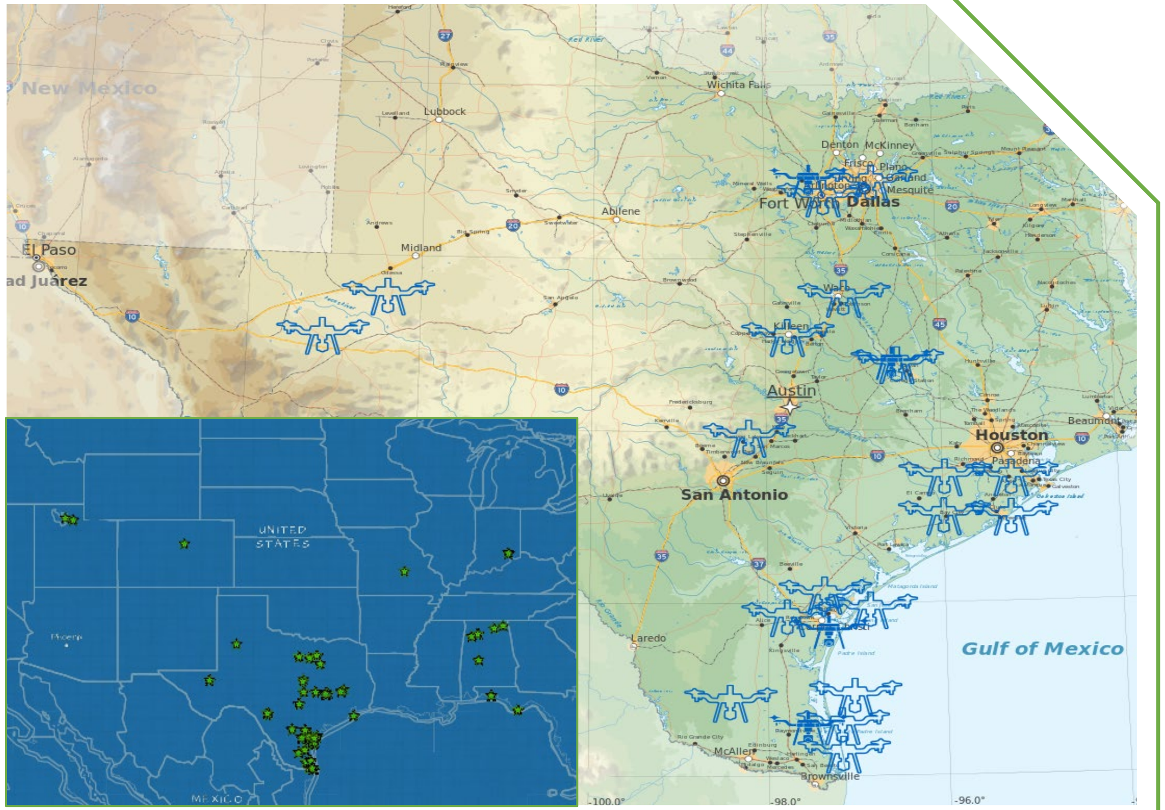
Modernizing the NAS

Delivering cost savings & enhanced safety to our clients and partners through:

- Advanced Air Mobility (AAM) Research & Development
- UAS Transition to AAM Test & Evaluation
- Educating the Public Operations Community of Practice on UAS and AAM Technology Innovations

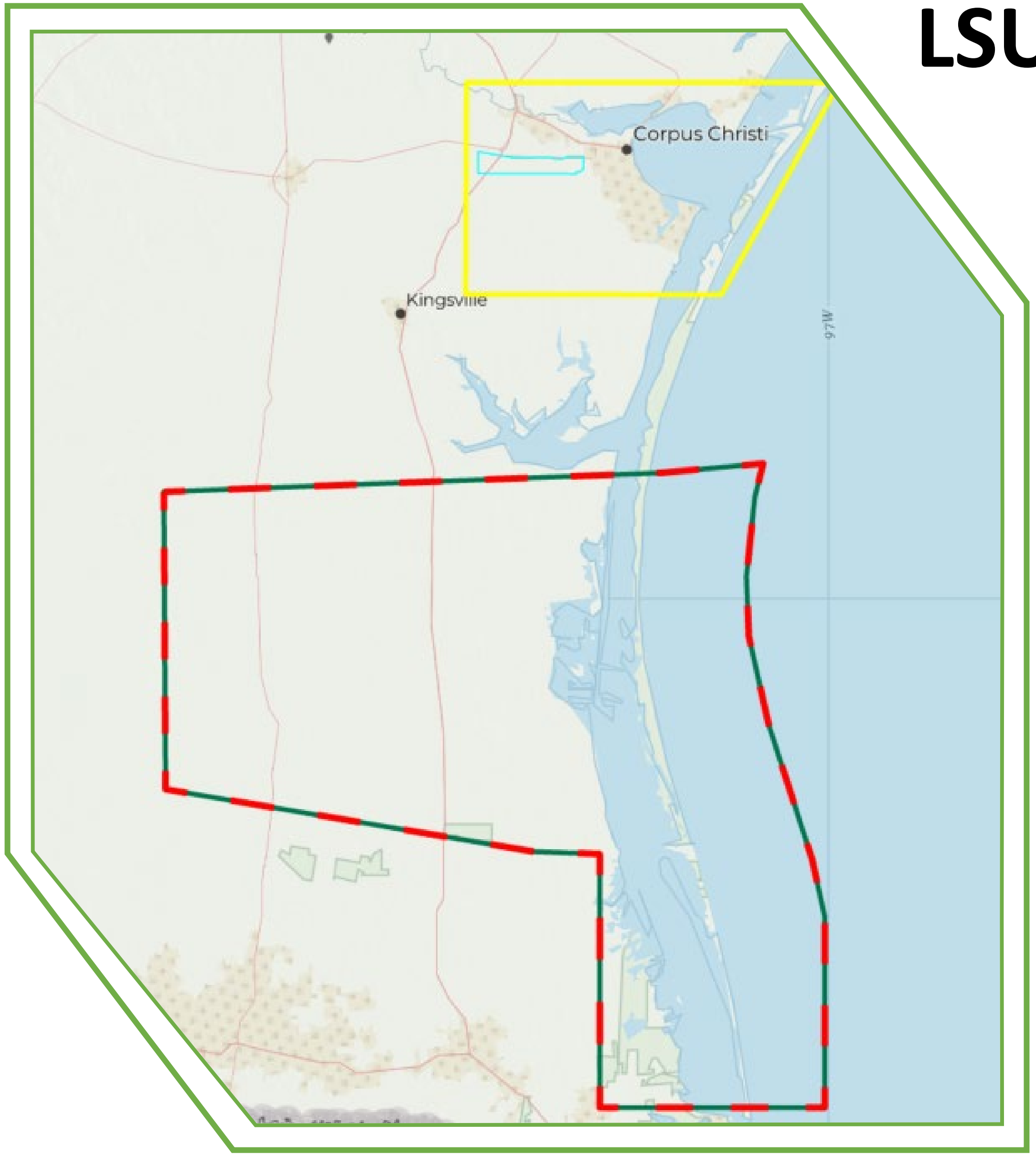
Lone Star UAS Center Operations

Multiple Fixed and Mobile Operations Centers



Multiple Texas Test Ranges and Airspace Authorizations
National Airspace System (NAS) Availability

LSUASC Certificates of Authorization

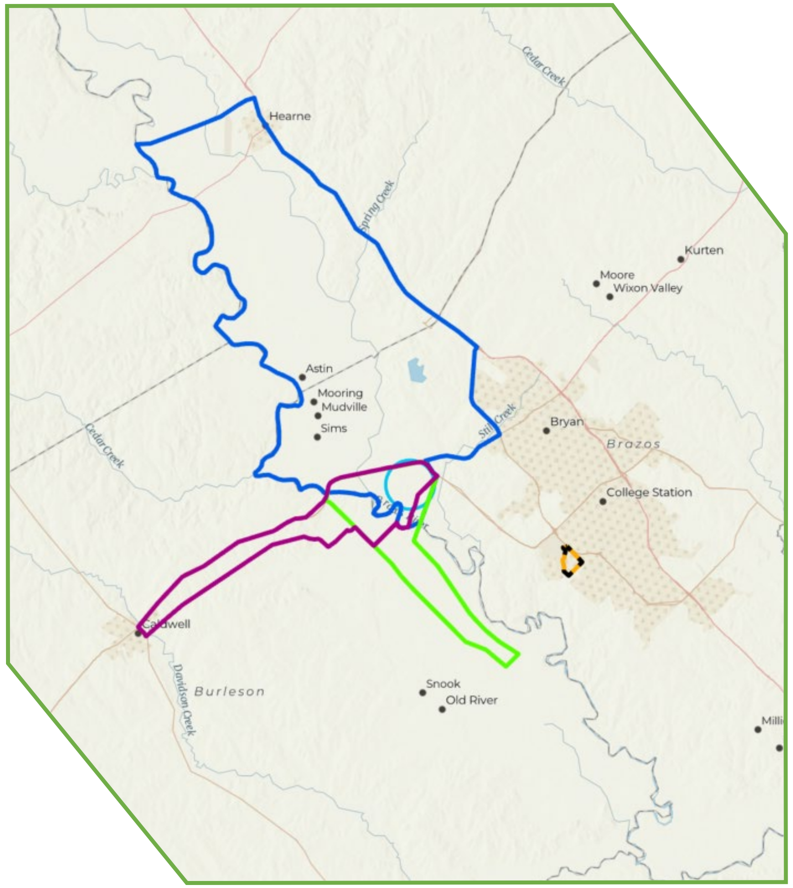


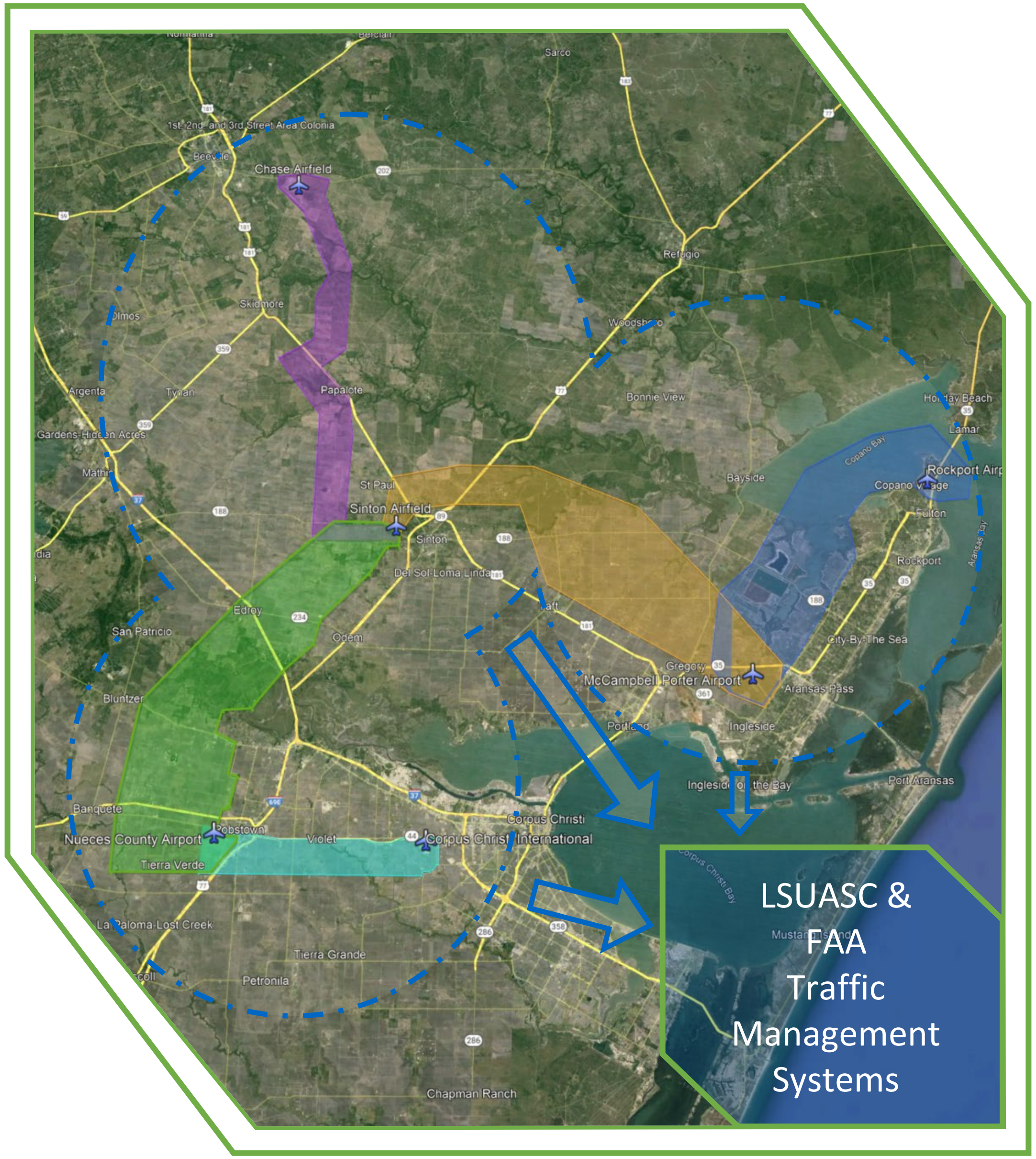
Public:

- Southern Range
- Corpus West
- Keypad System – LOA w/ Corpus TRACON is a work in progress
- RELLIS (Bryan/College Station, TX)
  - North
  - South
  - West
  - Campus
- Disaster City

Civil:

- Southern Range
- Disaster City
- Corpus West - 2024

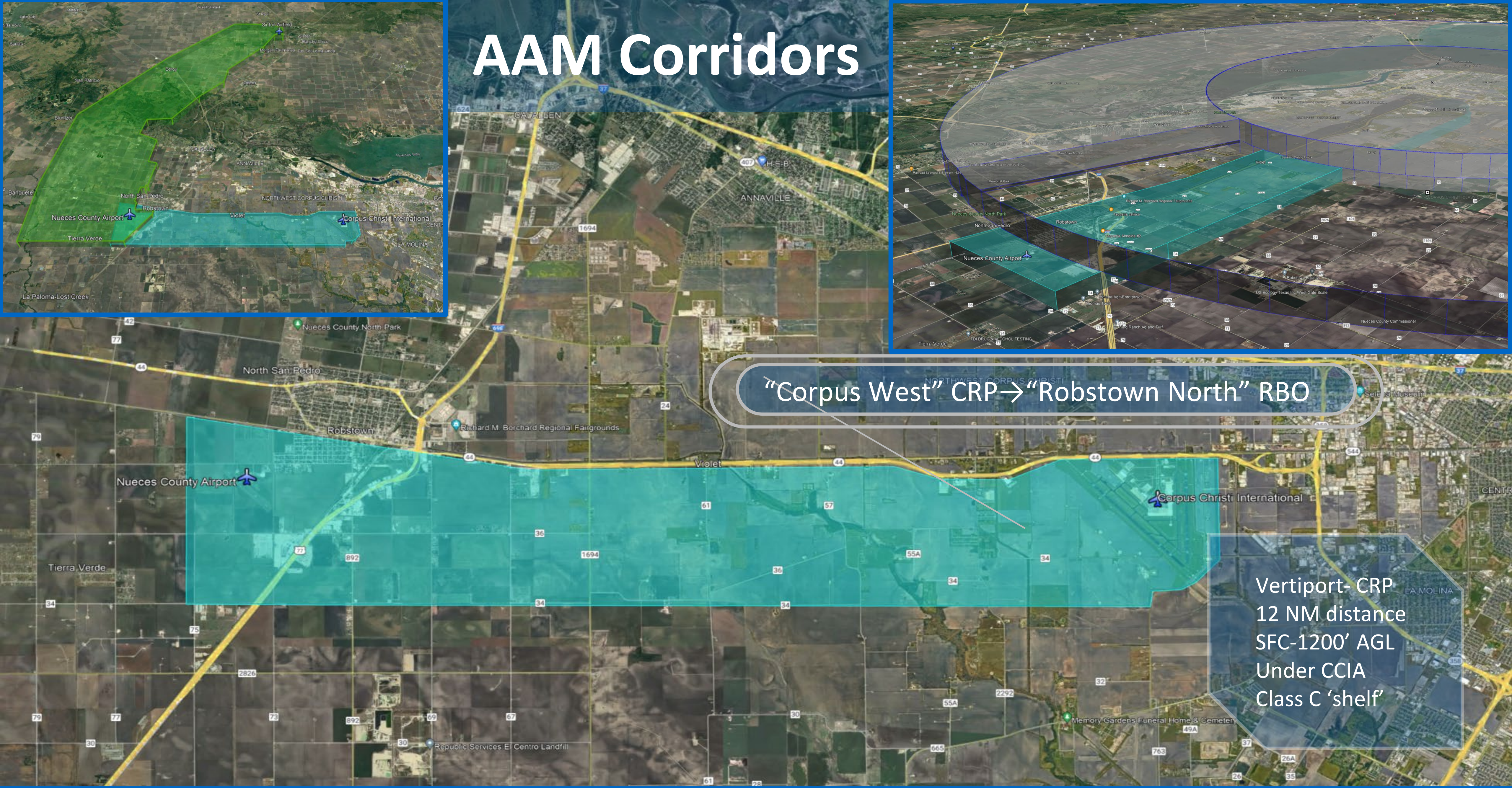




Coastal Bend Range AAM Corridors

- 5 total corridors spanning Nueces, San Patricio, Aransas, and Bee counties
- 6th corridor connecting LSUASC Southern Range Complex
- First two corridors: “Corpus West” & “Robstown North” – “Corpus West” COA Approved in 2023
- Approx. 90 miles of travel distance covered
- Altitudes up to 1200’ Above Ground Level (AGL)
- Federated PSU Network for AAM Concepts Testing Nationwide – 2024

AAM Corridors



"Corpus West" CRP→"Robstown North" RBO

Vertiport- CRP
12 NM distance
SFC-1200' AGL
Under CCIA
Class C 'shelf'

LSUASC Public Operations

Working to advance the **safe integration of UAS operations into the Public Safety realm**

- Provided disaster response support to:
  - Wimberley Flooding
  - 3 Hurricanes
  - Ship grounding
  - 6 Exercises – Internal & External up to Operational Readiness Exercises and Full-Scale Exercises
  - 17 counties
  - 12+ local and state agencies
- Self-sustaining teams
- Multiple mission sets

Facilities

- **Flour Bluff campus**
    - 3rd Floor Mission Control Center
    - 3rd Floor LVC Lab
    - 2nd Floor Sim Lab
    - 1st Floor FabLab
    - The Net – 80x80 enclosure
- **Electronics Systems Integration Lab –** Flour Bluff campus
- **Maintenance Facility –** Corpus Christi International Airport
- **Southern Range Complex –** Port Mansfield, TX
- **Downtown Corpus Christi TAMU-CC building** (*under construction*)

Infrastructure

Vehicle Fleet

- Off road capable mobile ground control station truck
- Mobile operations center trailer
- Area operations 5th wheel trailer
- Dedicated logistics van and 1-ton truck
- 24’ logistics trailer
- Four other vehicles of various types, suitable for multiple mission sets
- 2 all-terrain vehicles and 1 side by side

Infrastructure

Aircraft Fleet

3 Vertical Take-Off and Landing (VTOL) Fixed Wing Equipage:

- Trillium EO/IR Camera
- Foxtech Map-A7R Full Frame mapping camera
- Chimera UL EO/IO Camera

9 Rotorcraft equipped with:

- Sony A7R IVA-61 Camera System
- FLIR Boson IR Camera
- 1 w/Night Vision Camera & 1 w/4K camera

Thank You

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Human Factors Implications of Advanced Air Mobility

ATLASLab
Advancing Technology-interaction & Learning in Aviation Systems

FLORIDA TECH

Introduction

Bhoomin B Chauhan, Ph.D.

Education:

- Ph.D. Aviation Sciences, Advanced Air Mobility Human Factors
- Master in Applied Aviation Safety

Experience:

- Human Factor Researcher, College of Aeronautics 2020 – 2024
- Advanced Air Mobility Specialist, Hovecon, 2023 – Present
- Client Service intern, EY-P
- Aviation Research Analyst, Skymantics
- Airport Operations Intern, Valkaria Airport

ATLAS Lab @ Florida Tech

Dr. Meredith Carroll
Founder/Director, ATLAS Lab
Professor, Aviation Human Factors
College of Aeronautics

Research Areas Related to Manned/Unmanned Aviation

- Cognition and Decision-Making with Complex Systems
  - Decision-Making Under Stress, Uncertainty
- Human Machine Teaming
  - Human Autonomy/Agent Teaming and Trust
  - Interface Design and Evaluation
- Learning and Expertise Development
  - Learner Engagement and Motivation
  - Adaptive and Individualized Training
  - Cognitive, Behavioral, Physiological Assessment
- Human Performance and Individual Difference
  - Personality, Cognitive Ability, Motivation

What is Advanced Air Mobility?

"Advanced Air Mobility (AAM) is an umbrella term for aircraft that are likely highly automated and electric. These aircraft are often referred to as air taxis or electric vertical takeoff and landing (eVTOL) aircraft."

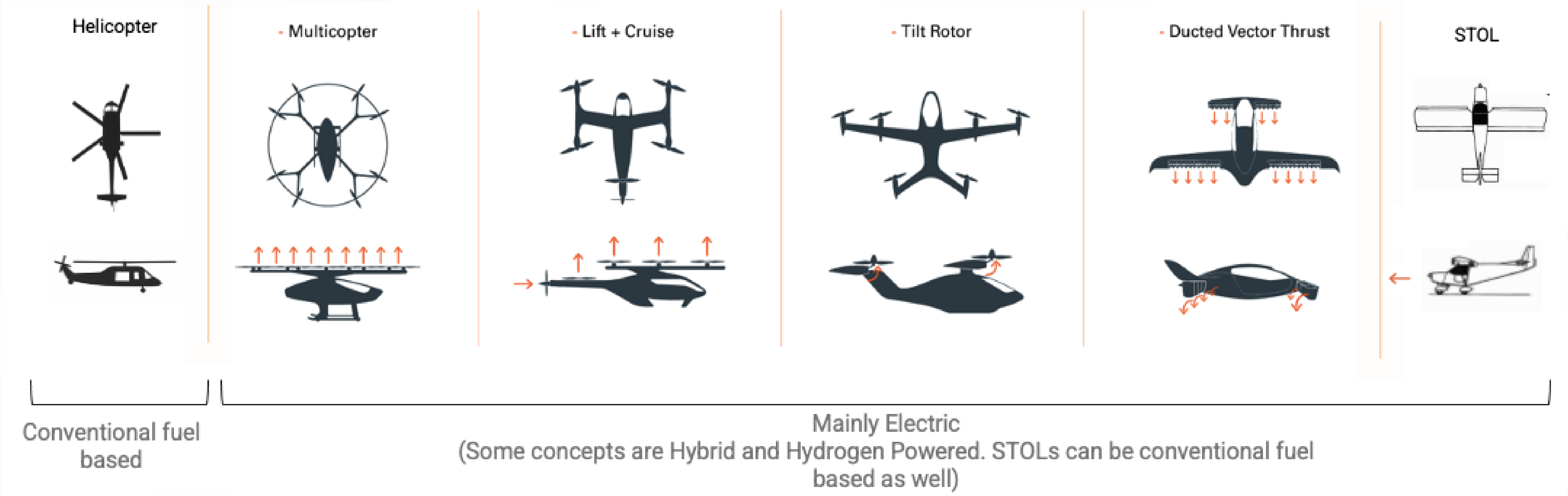
- FAA

Use Cases:

- Transport cargo and passengers,
- Help with firefighting,
- Provide search and rescue operations,
- Potential to connect underserved and rural communities to other destinations or community services.

Source: Federal Aviation Administration

AAM & eVTOL Aircraft



Source: Lilium

So, what is different?

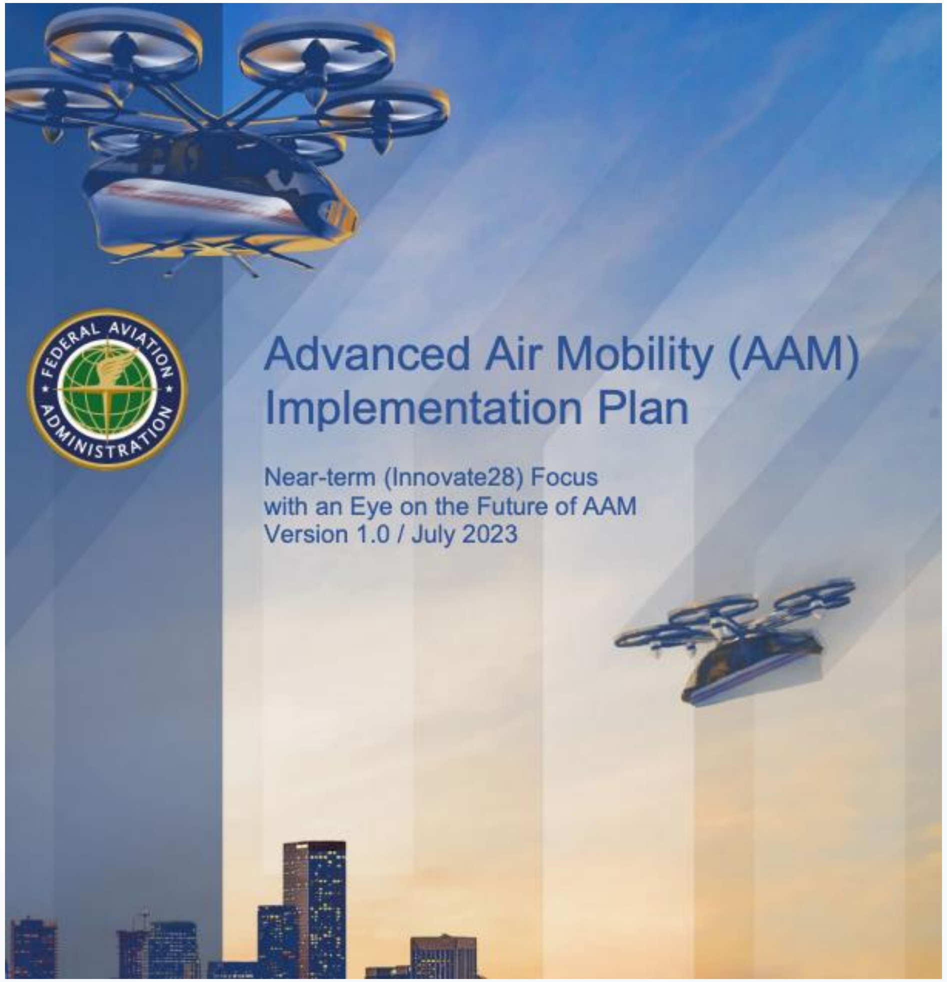
- Use of electric propulsion
- Aircraft design — An amalgamation of vertical take-off and landing (VTOL) capabilities with the use of wings
- Advanced automation – Simplified vehicle operations (SVO)

Concept of Operations – Pilot Requirement

According to the Federal Aviation Administration (FAA):

- eVTOL operations will begin at a lower tempo.
- Air taxis will fly much as helicopters do today.
- Emergent eVTOL operations will be crewed operations, i.e., *a pilot will be onboard the aircraft*.

"New rules are necessary because many of the proposed aircraft take off and land like a helicopter but fly enroute like an airplane." - FAA



Source: Federal Aviation Administration

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What is Changing?

1. Flight Deck:
   a. *Integration of electric propulsion information*
   b. Number of displays
   c. Level of automation
   d. Single pilot operations

2. Operations:
   a. Passenger vs. cargo

Source: Top – Airbus, Bottom – Lilium

Source: Top – Blade Air, Bottom – Archer Aviation

Present

Future

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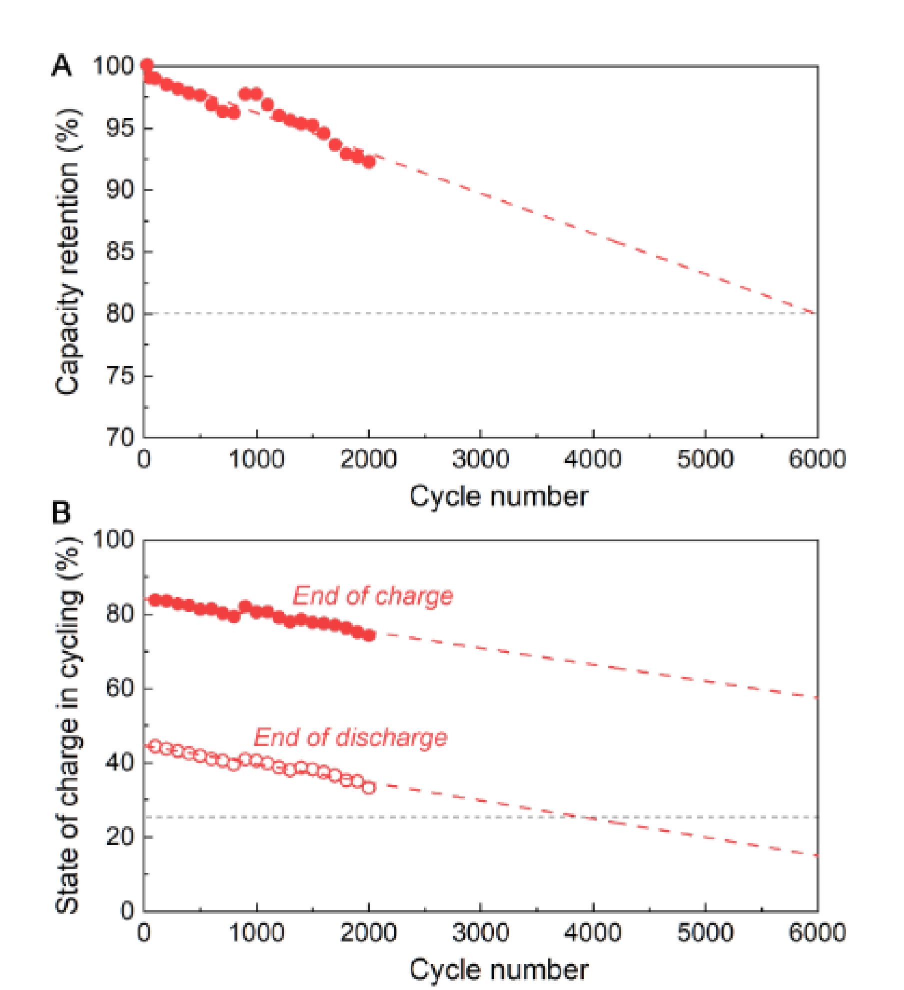
The Research Gap: Electric Propulsion vs. Traditional Fuel

- The implications of an electric battery on aircraft performance are different than with traditional jet fuel.
- Major difference:
  - Non-linear discharge rate
  - Internal battery temperature
  - Power draw
  - Capacity over time
  - Available range
  - Environmental conditions (e.g., headwind)



Yang et al. (2021)

Human Factors Issues

- Urban Air Mobility (UAM)/Advanced Air Mobility (AAM) domain targeted to be mostly eVTOL aircraft transitioning from:
  - Near Term: Pilot onboard
  - Mid Term: Remotely-piloted
  - Long Term: Autonomous operations
- There are a range of human factors (HF) research gaps associated with pilot/operator interfaces and autonomy. A few key issues:
  - What information should be presented to the pilot/operator as operations transition from pilot onboard to remotely piloted to autonomous operations?
  - How should novel information like battery information be presented to the operator?
  - As autonomy increases, what roles should be allocated to the autonomy vs. the human operators?

Source: Joby Aviation

Human Factors Considerations for eVTOL Pilot Interfaces

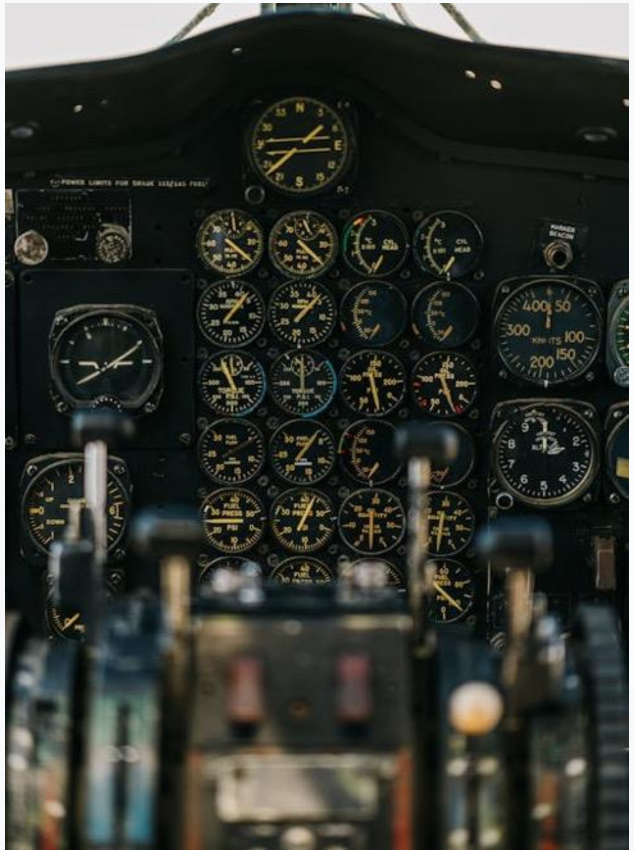
eVTOL Pilot Interface Trends

- Single pilot operations interface.
- Larger glass, touch with customizable displays.
- Reduced information redundancy.
- Integration of battery information.
- Inceptors to fly the aircraft.
- Use of technologies, like synthetic vision, advanced sensors information display.

Joby S4 Simulator Pilot Interface

Archer Midnight Prototype Pilot Interface

Flight Deck Clutter – Past, Present, and Future



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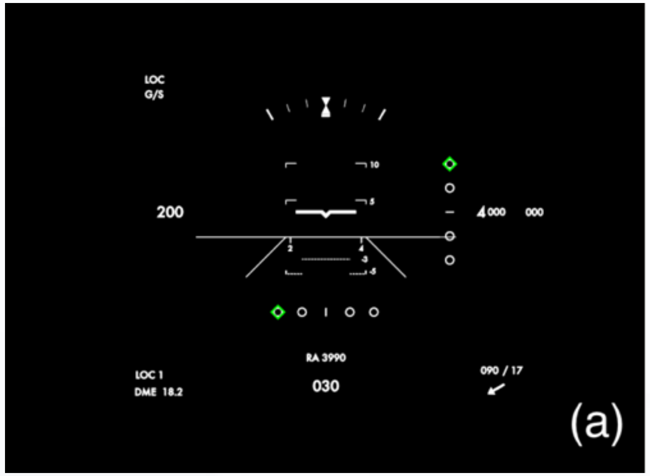
Literature Review: Clutter

What is clutter?

- "Unwanted or unnecessary information" (Lohrenz et al., 2009, p. 90)
- "Redundant information" (Ahlstrom, 2005, p. 90)
- "An abundance of irrelevant information" (Doyon-Poulin et al., 2012, p. 2D1–2).

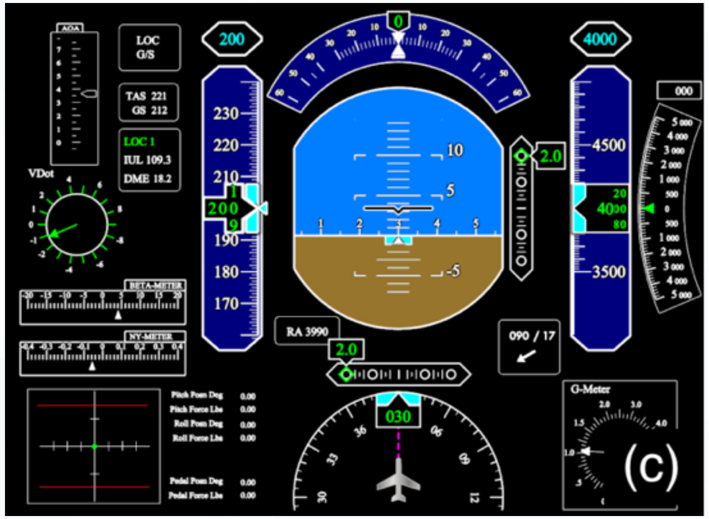
Contributors to clutter:

- Data-driven property of a display (i.e., ***visual/display density***, physical appearance, eccentricity, proximity).
- Knowledge-driven property of the display (i.e., ***information density***, relevancy, and redundancy).



Low Clutter

Medium Clutter



High Clutter

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Purpose

The purpose of the study was to examine the effect of varying levels of visual density (VD) and information density (ID) of a simulated electric vertical take-off and landing (eVTOL) aircraft pilot interface on:

- Situation awareness (SA; SAGAT, Endsley, 1998),
- Workload (NASA-TLX; Hart, 1986), and
- Search performance (time to identify information)

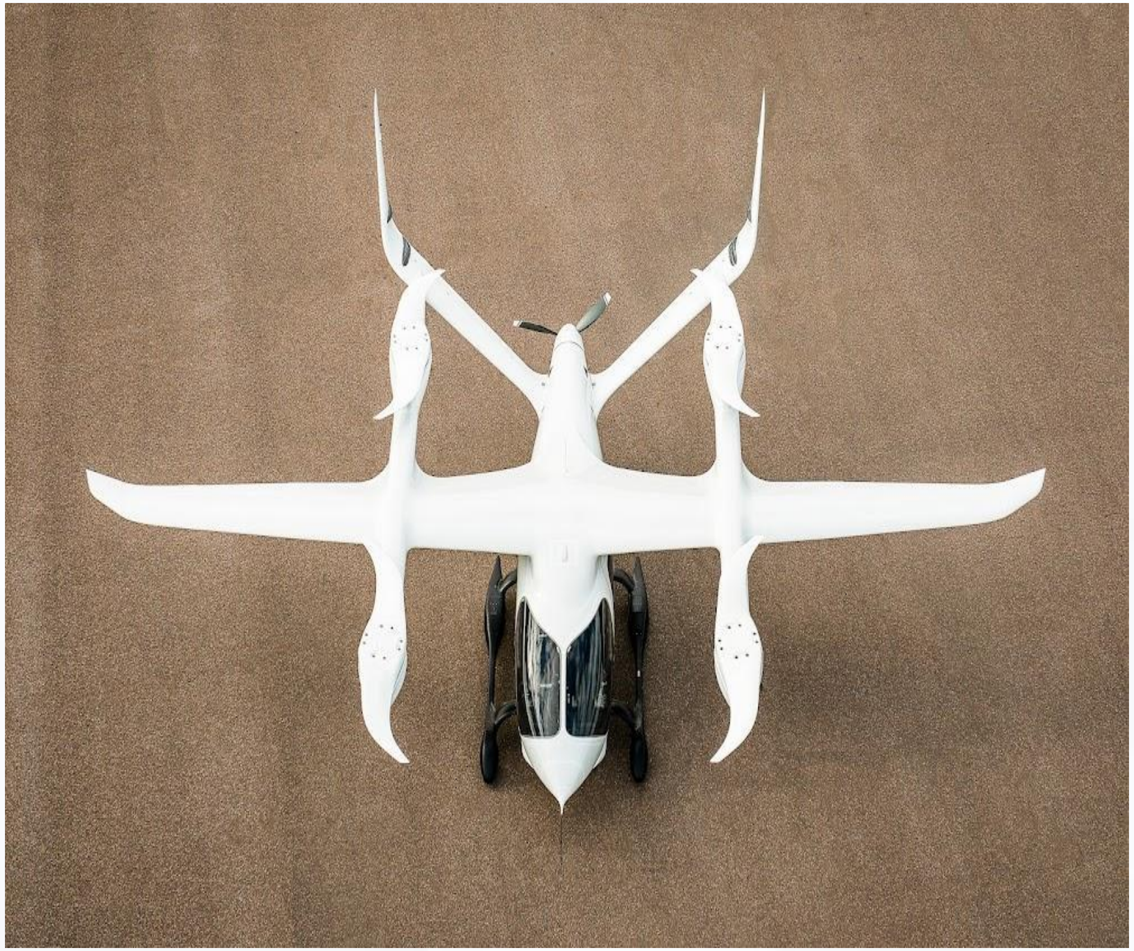
Source: Beta Technologies

Experimental Testbed

- Custom-built central processing unit (CPU) equipped with an Intel i9-10850K CPU, 64 GB of RAM, an NVIDIA RTX 3090 Ti graphics card, and Windows 10 Pro operating system.
- Samsung Odyssey G9 Curved gaming monitor to display out-of-the-window view.
- Two RealFlightSim Gear PFD and MFD display panels.
- Logitech X-56 H.O.T.A.S Flight Stick and throttle lever to control and fly the aircraft.
- X-Plane 12 Flight Simulator

Flight Simulator Testbed

eVTOL Aircraft



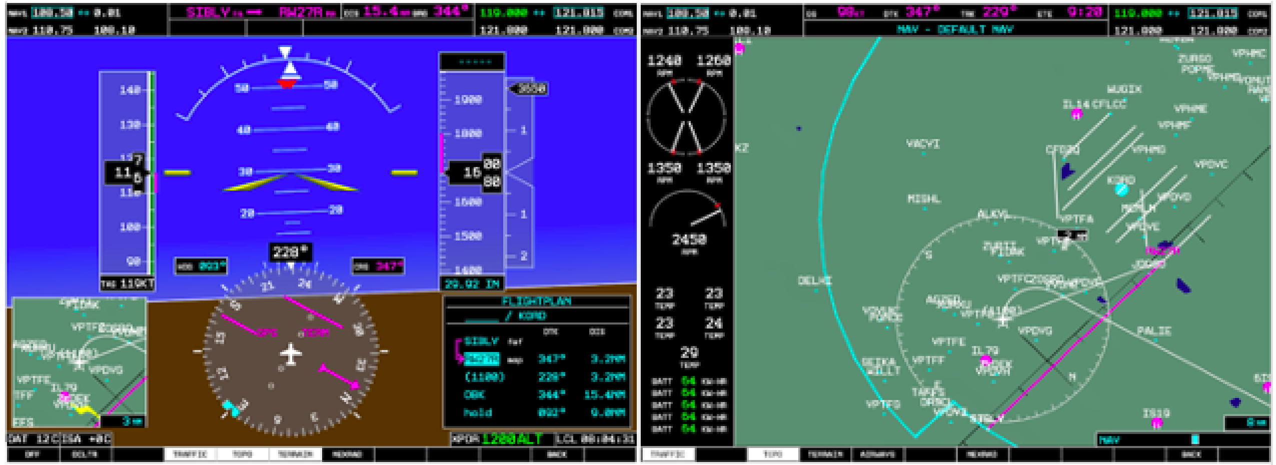
Beta Technologies ALIA eVTOL Aircraft Prototype

=

Beta Technologies ALIA eVTOL Aircraft in X-Plane 12

Display Conditions

High VD, High ID

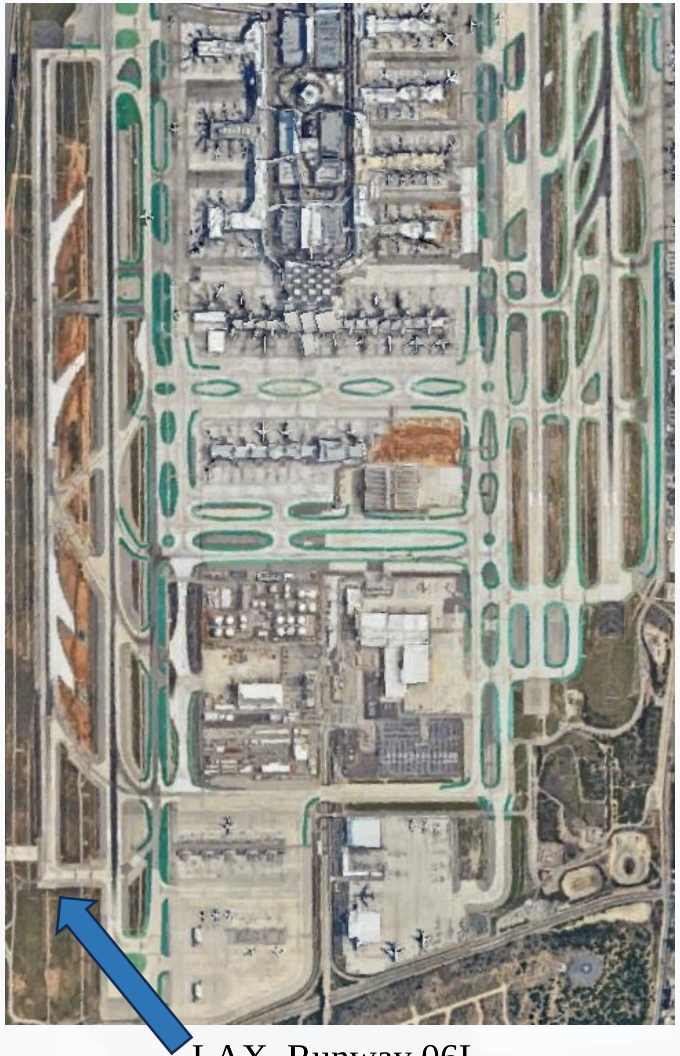


Low VD, Low ID

High VD, Low ID

Low VD, High ID

Experimental Task



LAX, Runway 06L

EWR, Runway 22L

ORD, Runway 27R

JFK, Runway 31R

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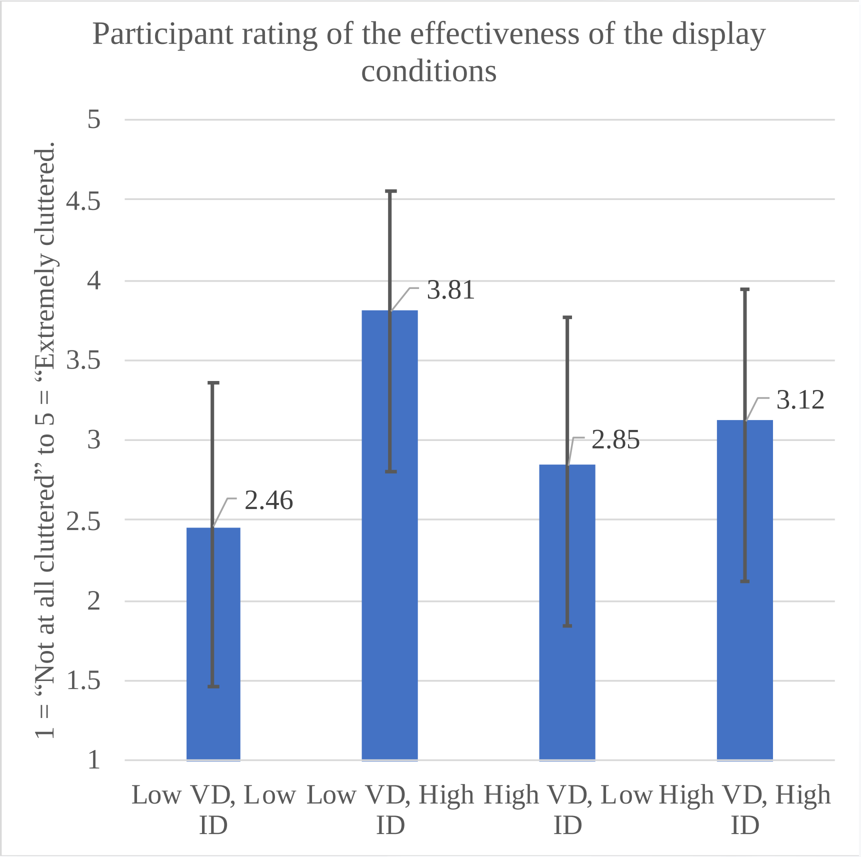
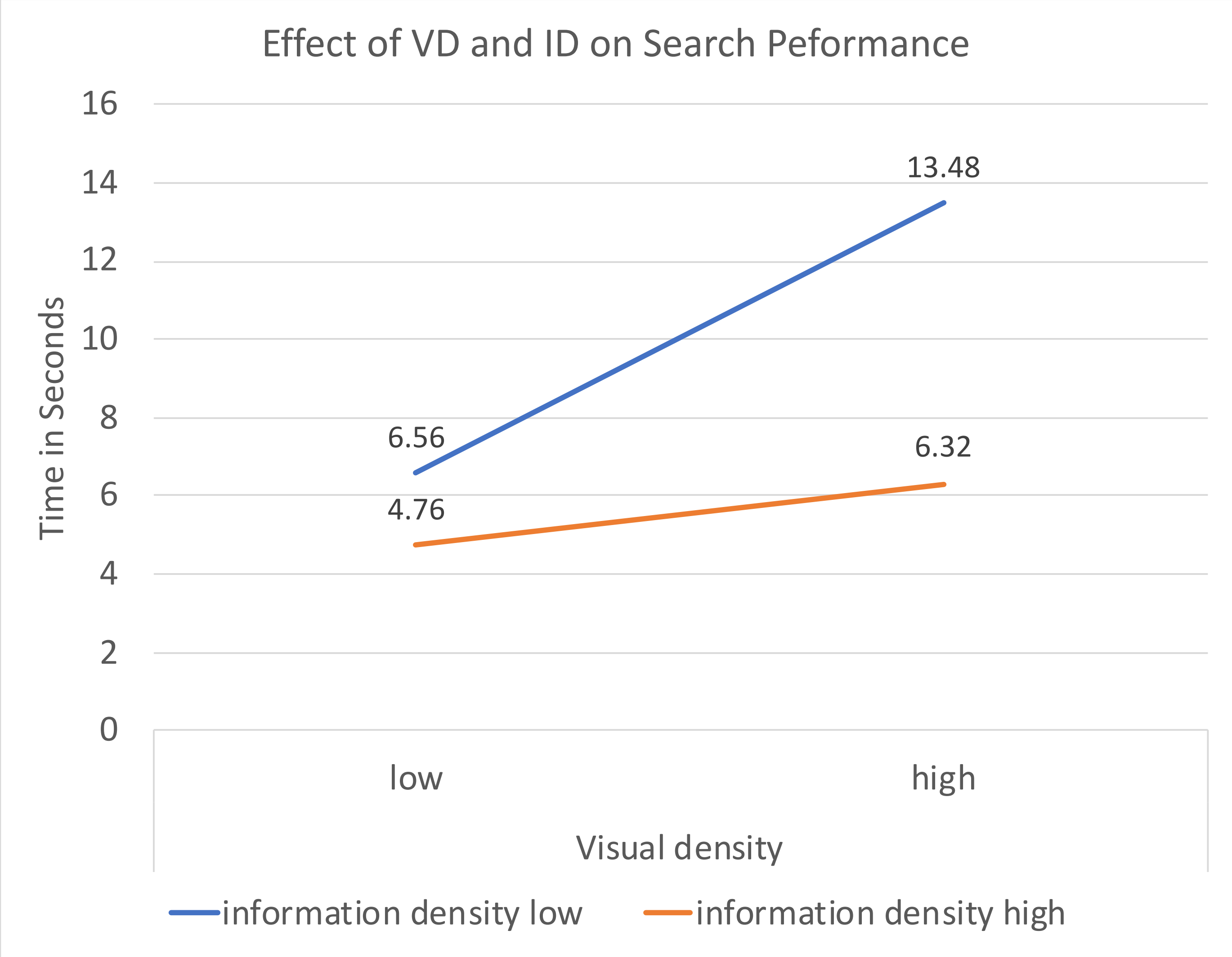
Results

<u>Significant effect</u> of visual density and information density on pilot SA, workload, and search performance



Note. The level of effectiveness was rated on a scale from 1 = "Not at all effective" to 5 = "Extremely effective."



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Significance

Potential Significance for AAM Stakeholders:

- Assist AAM operators in understanding how the eVTOL pilot interface impacts pilot performance.
- Insights to OEMs for developing safer and more efficient interfaces.
- Inform guidelines on display customization requirements.
- Certification requirements for eVTOL flight deck designs.
- Help understand the impact of information presentation of an eVTOL aircraft

Future Research (Ongoing):

- Develop and evaluate different types of eVTOL battery information displays
- Determine which information will be presented to pilots
- Prototype and test battery display conditions

BETA Technologies eVTOL Aircraft Transition Flight Test

Currently looking for a full-time job!

Thank You!

Questions?

ATLAS Lab

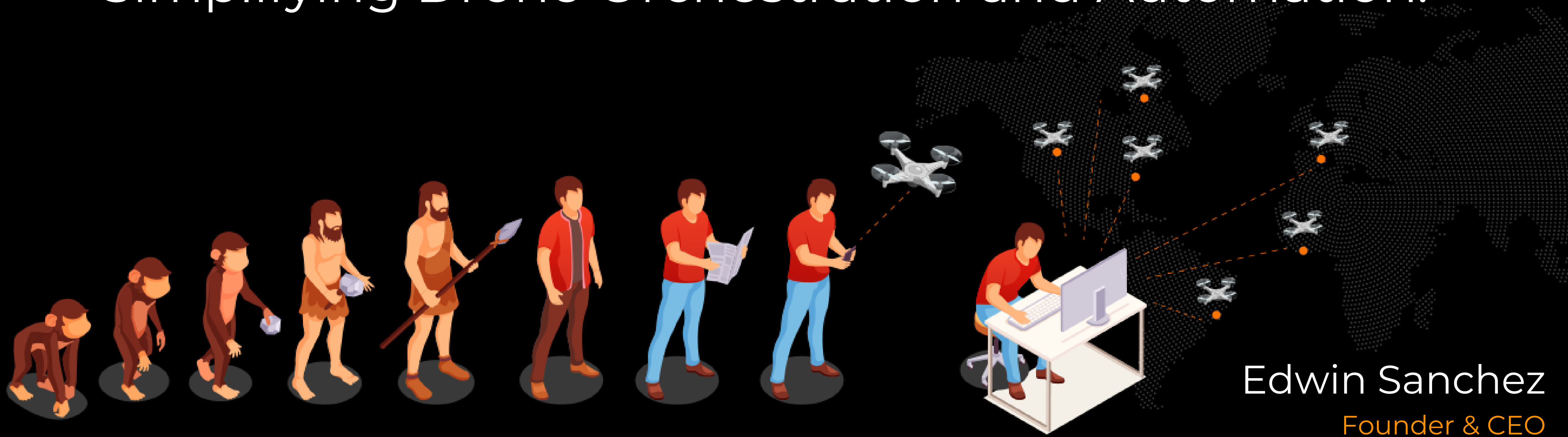
LinkedIn

Portfolio Website

ATLASLab Advancing Technology-Interaction & Learning in Aviation Systems | FLORIDA TECH

VOTIX

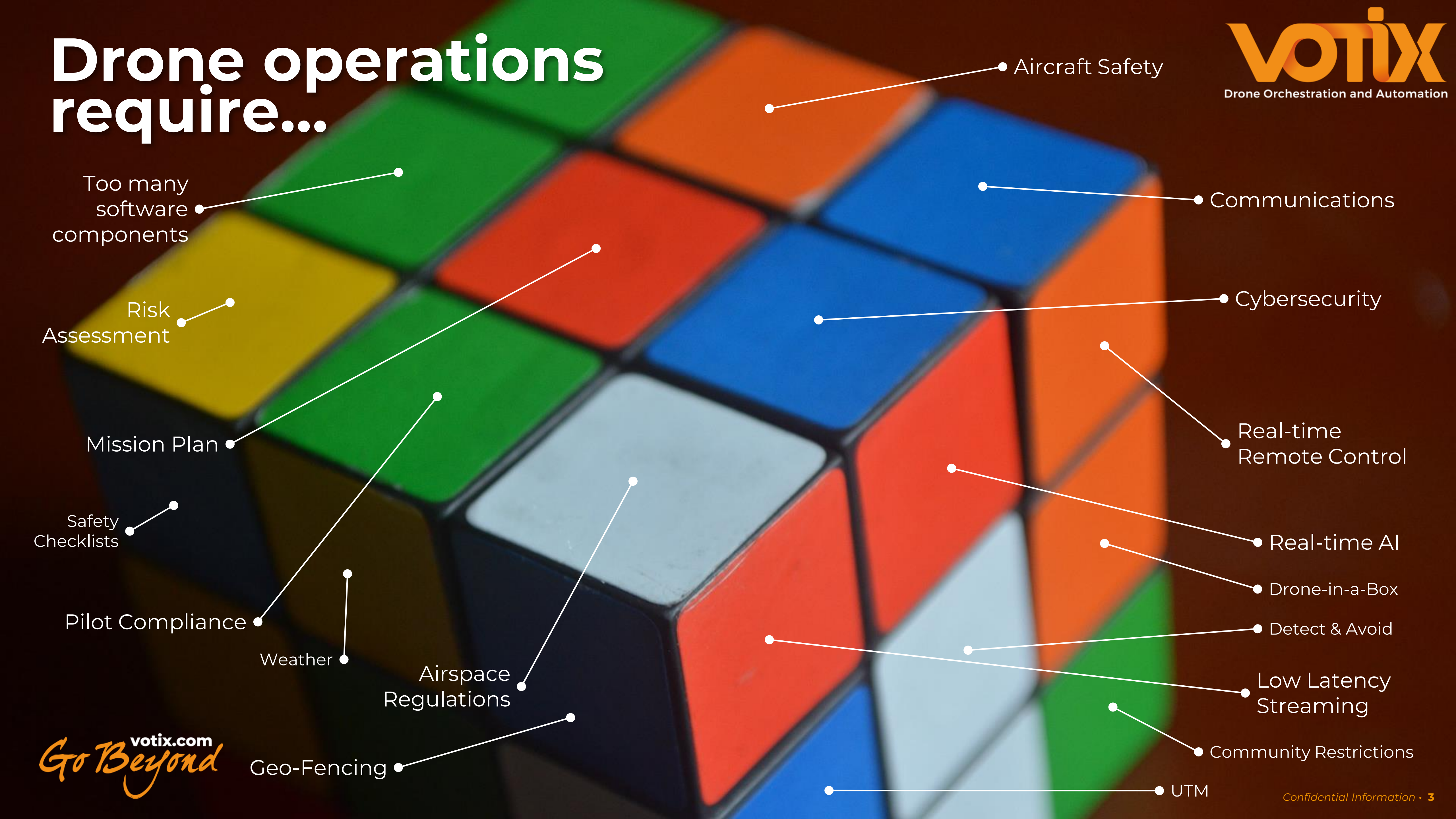
Simplifying Drone Orchestration and Automation.



Edwin Sanchez
Founder & CEO

Drone operations require...

VOTIX
Drone Orchestration and Automation



Go Beyond votix.com

VOTIX
Drone Orchestration and Automation

- Construction
- Mining
- Surveying
- Agriculture
- Real State
- Public Safety
- Insurance
- Surveillance
- Natural Resources
- Environment
- Disaster Attention
- Port Management
- Freight
- Education
- Tourism
- Healthcare
- Energy
- Communications

AI/AR/DT/VI
Enhanced Ops &
Deep Analysis

ML - Predictive

LLMs

SETUP/PLANNING | **COLLABORATING** | **OPERATING** | **DATA MGMT & ANALYTICS**

Cloud - Cybersecure

Automation – Telepresence

Interoperation - Analytics

Integration

- **Maps** (ortho mosaics, Photogrammetry, Contours, etc.)
- **Crops** (Health, Count, Spraying, Progress, Dimensions, etc.)
- **Assets** (State, Capacity, Wearing, Measuring, etc.)
- **Media** (Films, photography, broadcast)
- **Sports**
- **Tourism**
- **Freight**
- **Medicines**

Automation Levels – Currently in Level 2

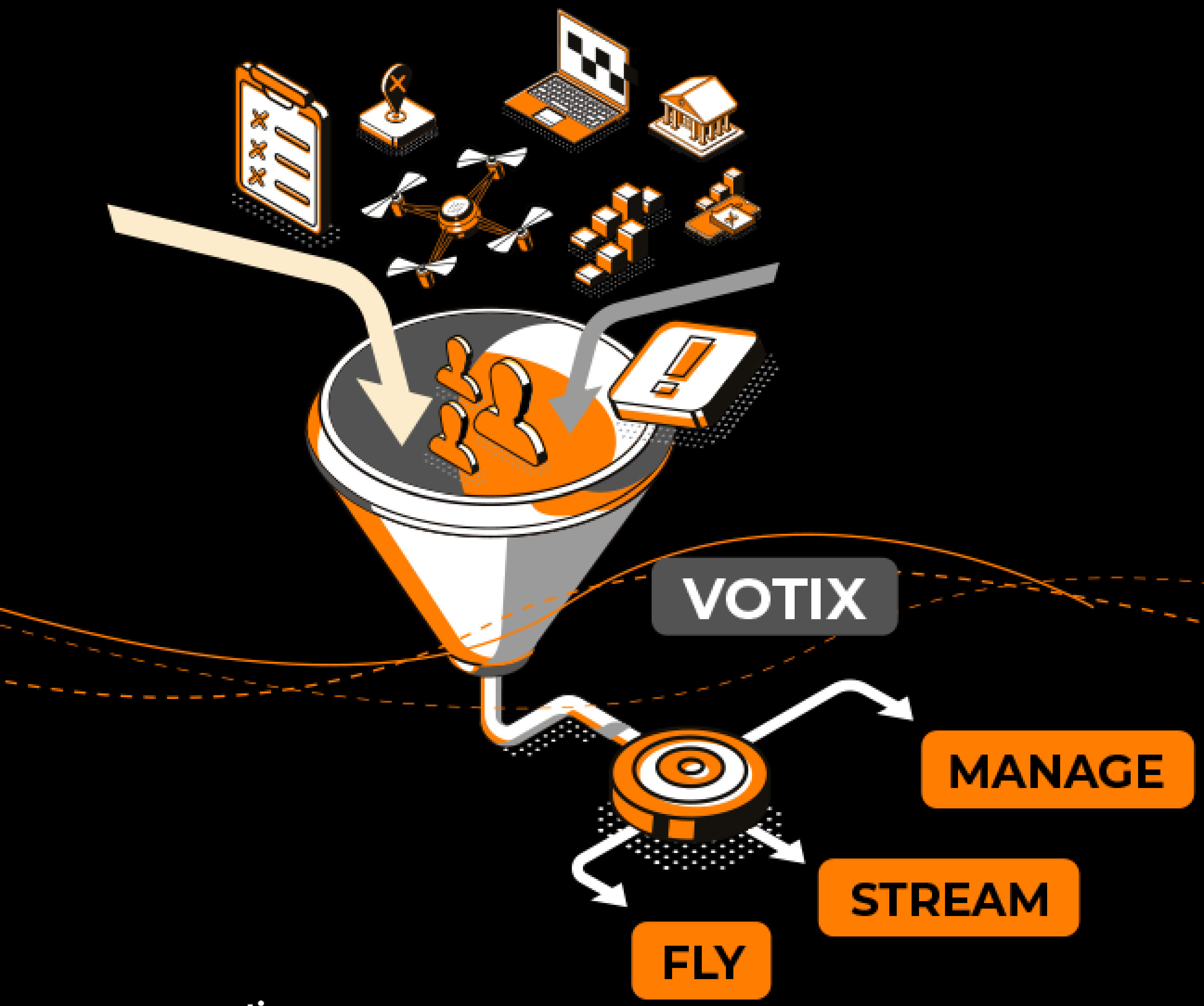
VOTIX
Drone Orchestration and Automation

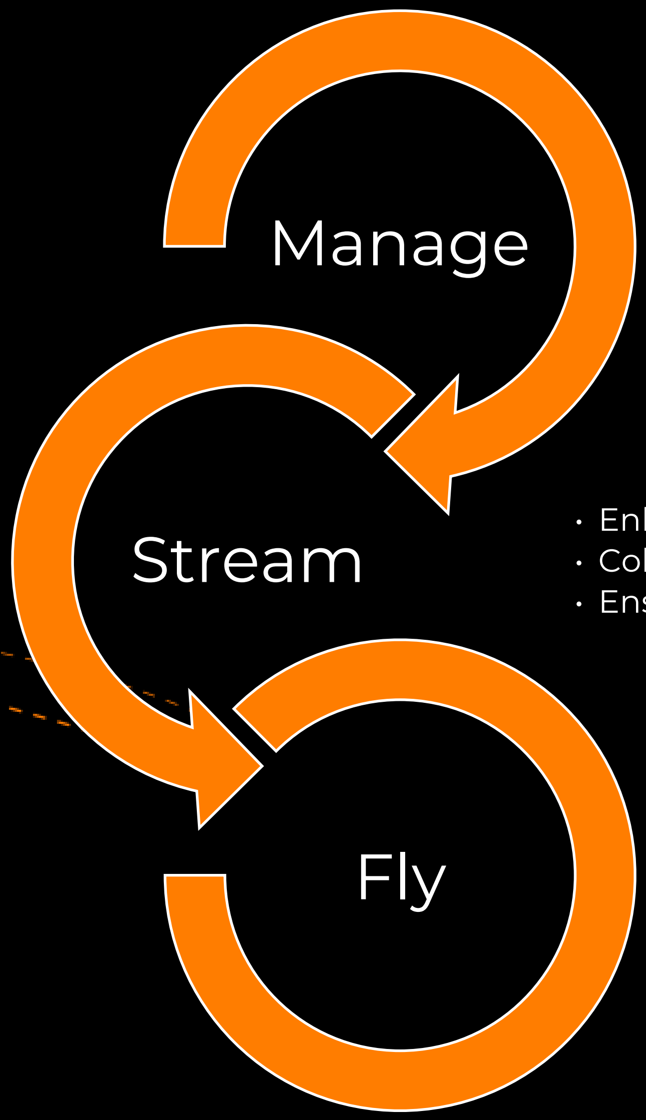
Levels	Type	Definition
0	Manual Control	The drone is entirely operated by a human operator/pilot, and it does not have autonomous capabilities. All aspects of the mission, including navigation and control, require direct human input.
1	Assisted Control	The drone has basic assistance features like stabilization systems and limited automation. However, the human operator retains control over critical aspects of the mission.
2	Partial Automation	The drone can perform specific tasks autonomously, such as waypoint navigation or basic obstacle avoidance. The human operator is still responsible for overall control and decision-making.
3	Conditional Automation	Drones at this level can operate autonomously in certain conditions or environments. The human operator may intervene, but the drone can handle tasks independently within predefined scenarios.
4	High-Level Automation	The drone can perform most tasks autonomously without constant human oversight. Human intervention is only required in exceptional or unforeseen circumstances.
5	Full Automation	The drone is fully autonomous and capable of handling all aspects of the mission execution without human intervention. Human operators may still be able to intervene but are not required for normal operations.

votix.com
Go Beyond

Product – Simplify to enable scale

Drone Orchestration and Automation





- Plan & and schedule missions
- Manage drone fleet
- Analyze logs/performance

- Enhance operational awareness
- Collaborate with flexibility
- Ensure security and clearance

- Fly from anywhere
- Enhance operations with AI
- Enable autonomy

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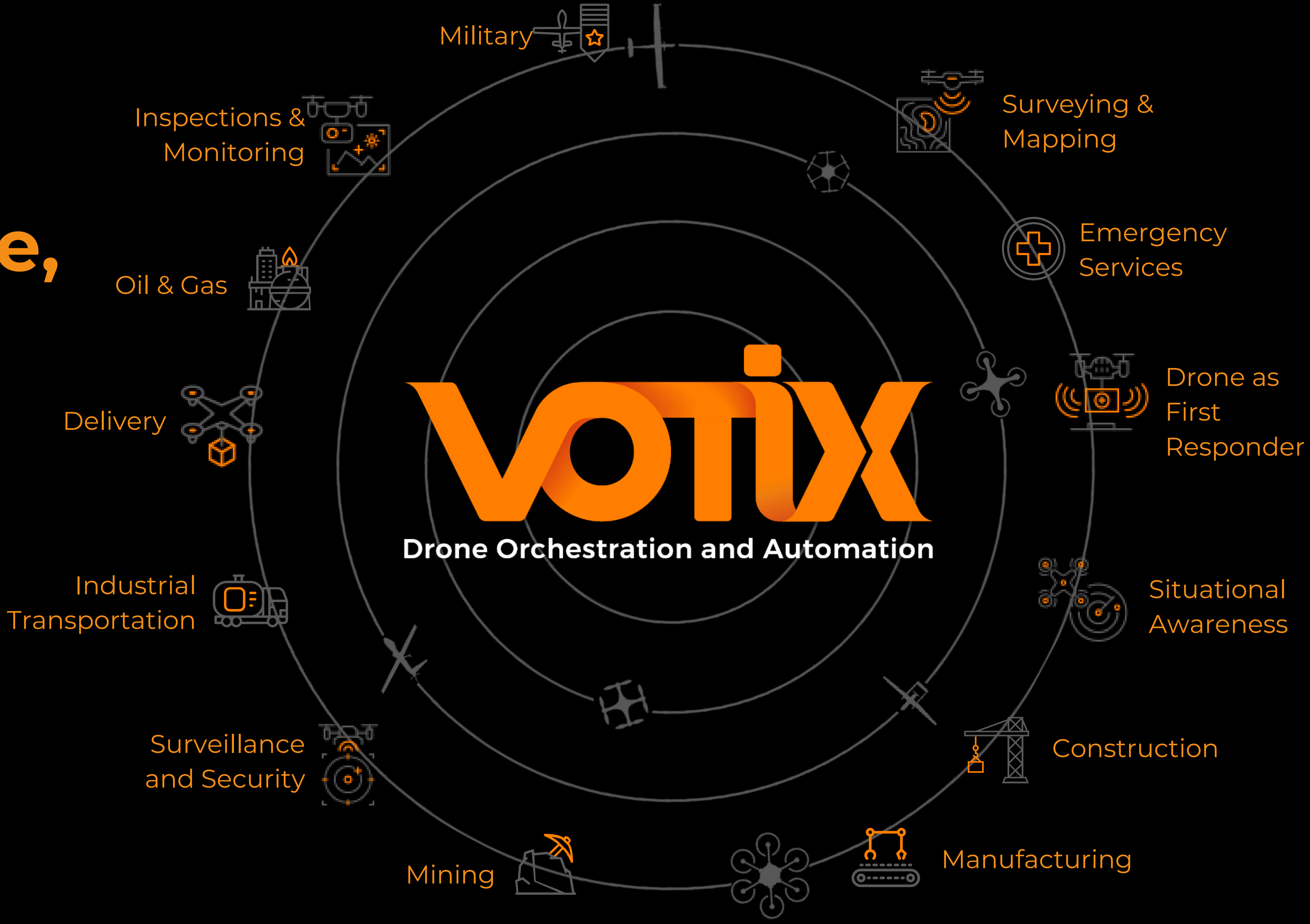
Go Beyond

Anyone,
Anyhow,
Anywhere,
Anytime!



Scan for platform overview

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Go Beyond

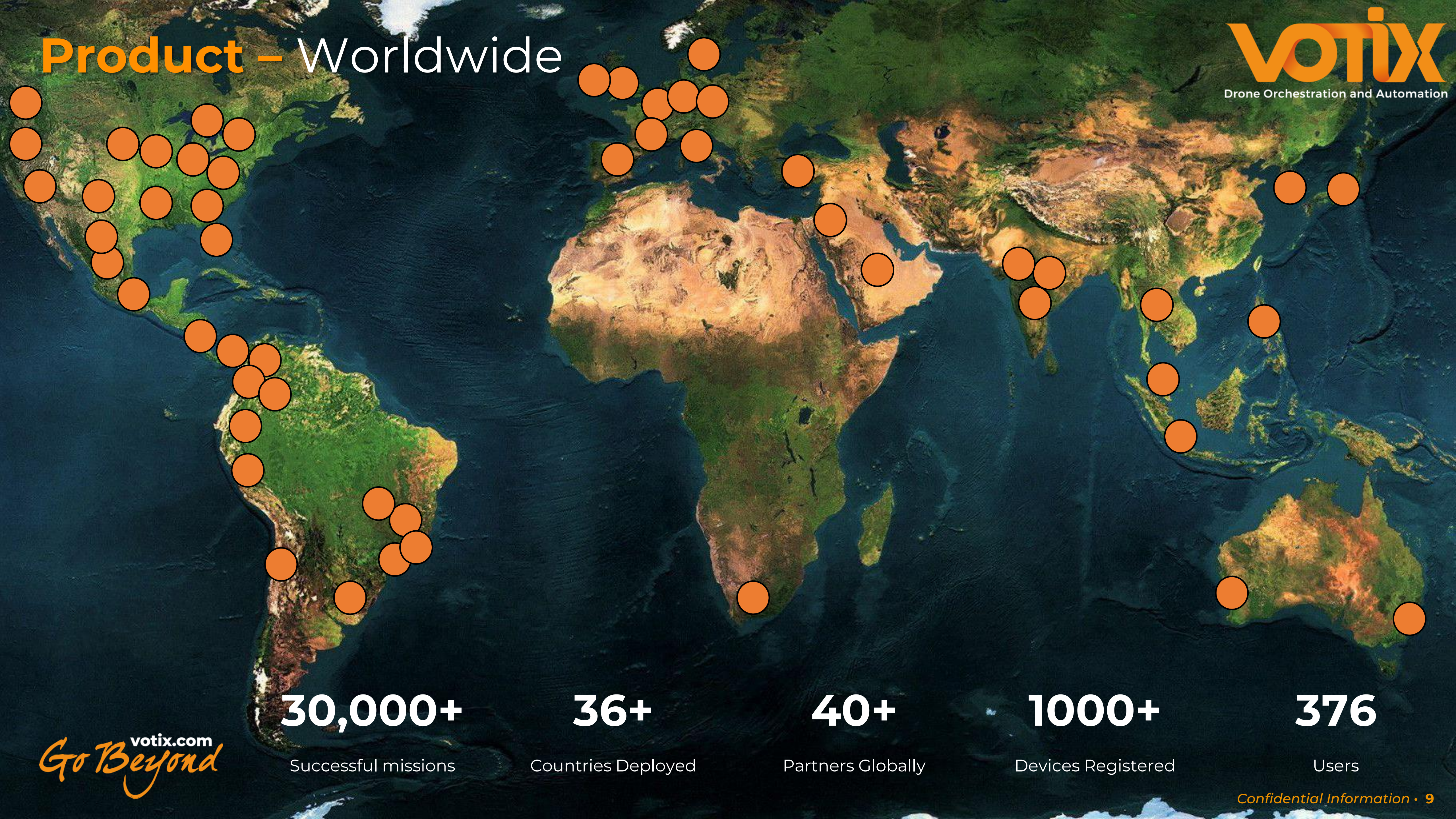
Market Learnings

Drone Orchestration and Automation

- Adoption is hindered by escalating complexity
- Cities need a multi-purpose platform
- One size does not fit all
- Variety and flexibility protect investments
- Users are looking for automated orchestration
- Real-time collaboration is critical for enhanced decision-making
- Automation is currently in level 2. In the next 10 years could reach level 4
- Regulation demanding Enterprise Drone Software (EDS) behind any drone operation
- Drone ecosystem is diverse in nature
- EDS must support all sorts of autonomous vehicles (air, land, water, hybrid)

Product – Worldwide

VOTIX
Drone Orchestration and Automation



30,000+
Successful missions

36+
Countries Deployed

40+
Partners Globally

1000+
Devices Registered

376
Users

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Drone Orchestration and Automation

Let's Go Beyond together!

Edwin Sanchez
Founder & CEO
Enterprise Software

Microsoft
ORACLE

Eduardo Boucas
Founder & Chairman
Cybersecurity

cipher a PROSEGUR company
Blockbit

Daniel Echeverri
Founder & CTO
Drone Expert

Drone Sports International DSI

Santiago Echeverri
CCO
Drone Sales

microdrones®

50	36	8	46
Years	**Years**	**Companies**	**Countries**
Enterprise Software	Drone Technology	Previously Founded	Past Penetration