

MONITOR SYSTEMS • DETECT FAULTS • MITIGATE FAILURES

# RESILIENTX

# • A G E N D A •

- **Our Story**
- **State of the Industry**
- **Identify Challenges**
- **Propose Solutions**
- **Discuss mutually beneficial relationship**



# • BACKGROUND •



2011

First unmanned aircraft flight using an FAA-approved GBSAA prototype system.



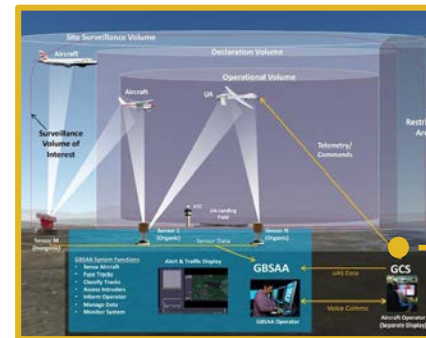
2012

Army demonstrates enhanced GBSAA system capabilities to validate design and functionality of GBSAA technology.



2015

Air National Guard adopts Army's GBSAA technology for operations.



2016

First military post, Fort Hood, begins using GBSAA technology after extensive research, development, integration, and test.

# • P R O B L E M •



**How can you tell everything is working correctly?  
What do you do when something goes wrong?**

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# • TEAM MEMBERS •



**DR. SEAN CALHOUN**  
*Autonomous Systems*



**ANDREW CARTER**  
*Safety Critical Architecture*



**RYAN PLESKACH**  
*Program Management*



**CHRISTOPHER CROWDER**  
*Systems & Safety Engineering*



**GREG DORCHIES**  
*Software Engineering & Integration*



**MATT MANNING**  
*Systems Design & Analysis*

# • STATE OF THE INDUSTRY •

- **UAS Traffic Management (UTM) is starting to transition from research to operationalization and commercialization**
- **States are looking at how to role out UTM**
- **Public – Private Partnerships (P3s) are forming**
- **Test Sites and DOTs are leading the charge**
  - **Ex. Ohio DOT, Northern Plains Test Site**

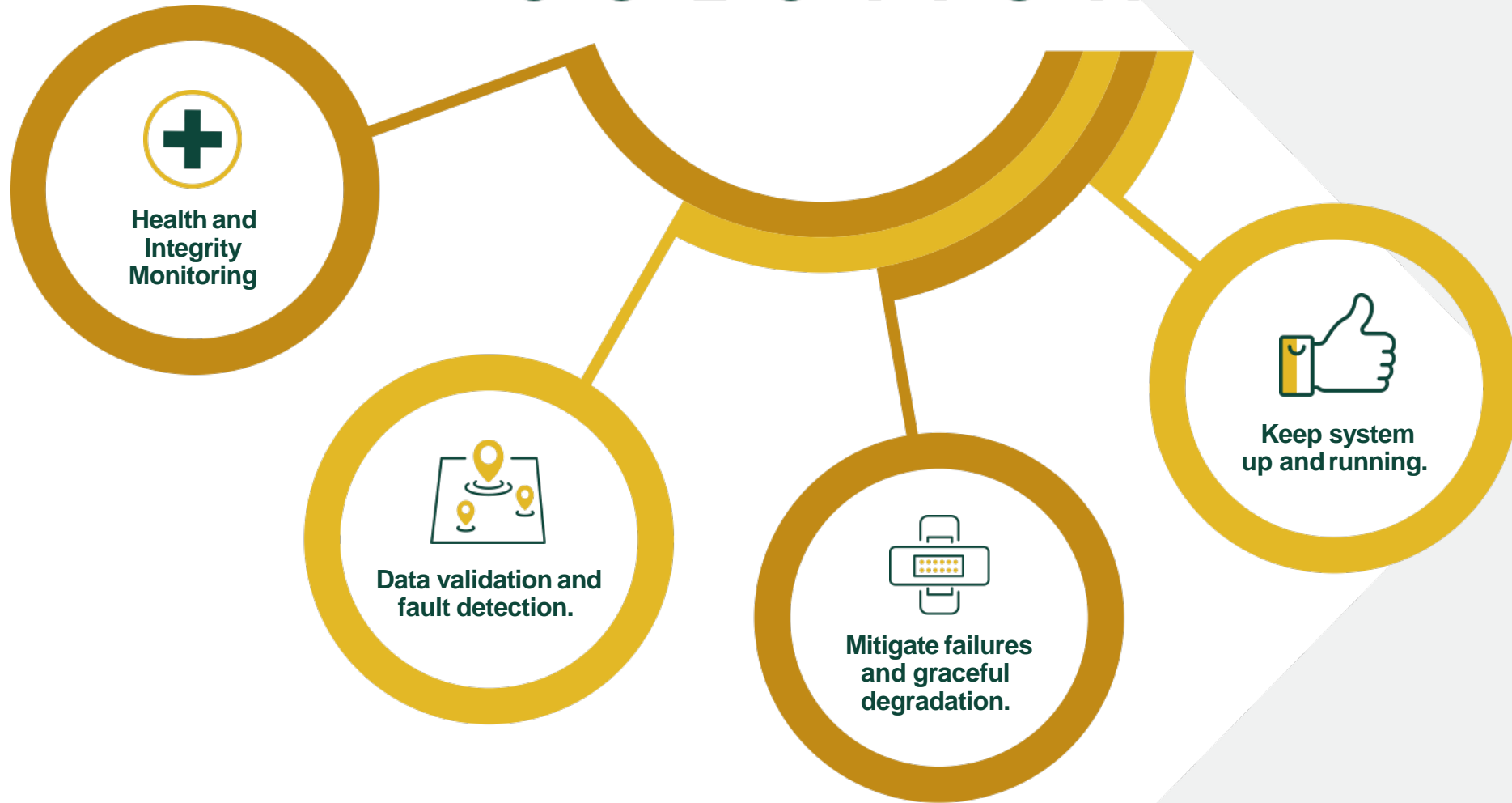
# • U T M O B S E R V A T I O N S •

- Multiple developer organizations (with different goals)
- Federated system with lack of centralized control or oversight
- Lack of standards and limited understanding of how current standards relate
- Configuration management suffers in quickly evolving environments
- System robustness has not been addressed yet
- Who/what/when/how of maintenance has not been addressed yet
- System certification/acceptance testing is evolving
  - Regression testing will be difficult in a rapidly changing environment
- No incentive to report faults/failures
  - No data verification capability identified

# • U T M C H A L L E N G E S •

Safety	<ul style="list-style-type: none"><li>• Determining the health and integrity of the System</li><li>• Verifying services meet their spec</li><li>• Configuration Management (CM) across Hardware, Firmware, Software and Configuration Versions</li><li>• Regression testing</li><li>• No 3rd party verification that “anything” is good or working</li></ul>
Uptime	<ul style="list-style-type: none"><li>• Maximizing and tracking uptime and availability</li><li>• Preventing cascading failures taking down the whole system</li><li>• Keeping the System up and running during a component failure</li></ul>
Maint.	<ul style="list-style-type: none"><li>• Lack of maintainer tools to identify, isolate and repair issues</li><li>• Root cause analysis of faults/failures</li><li>• Event reconstruction</li></ul>

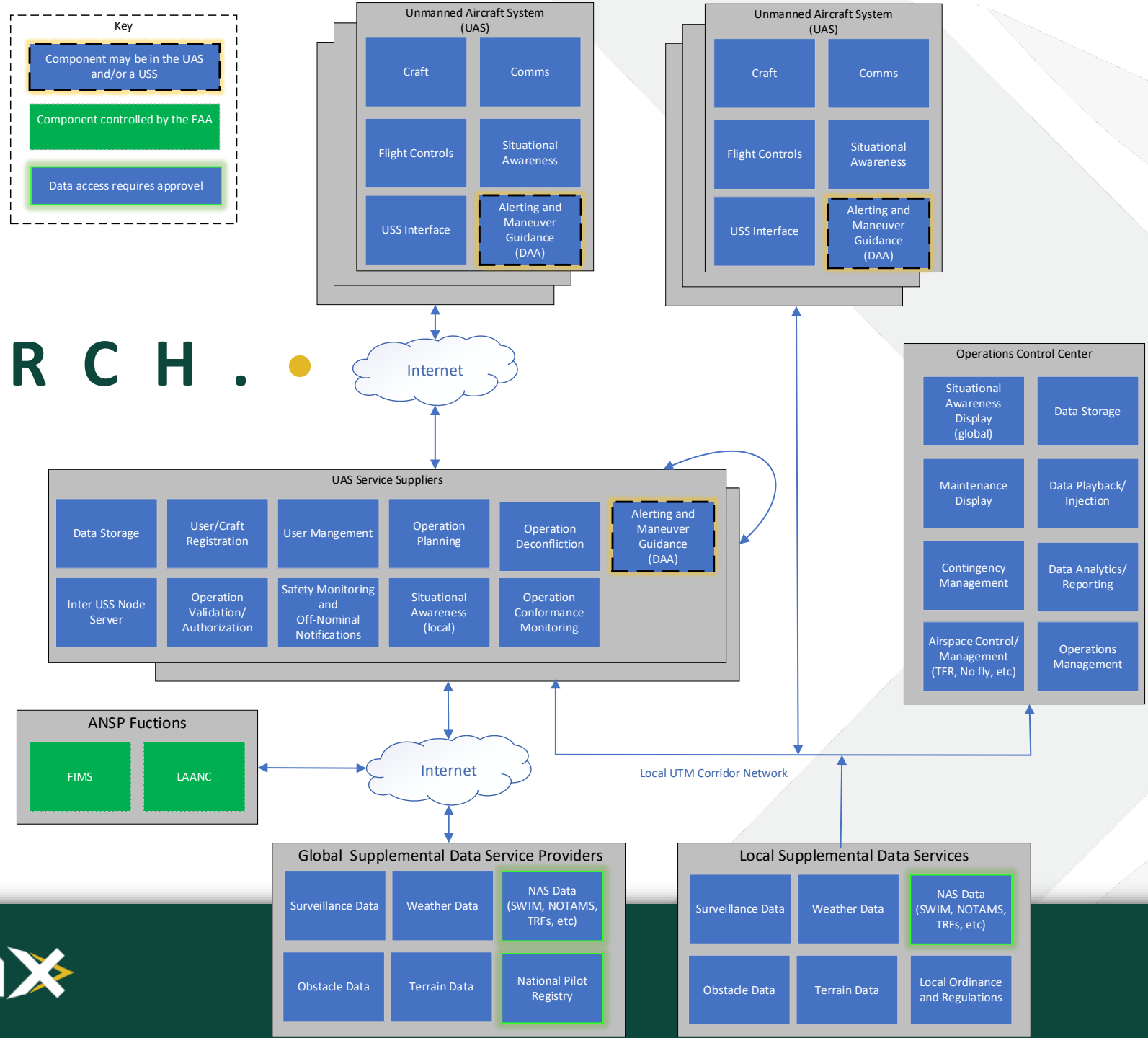
# • SOLUTION •



DEMO



# • U T M   A R C H .   •



# • U T M C O N T R O L C E N T E R •

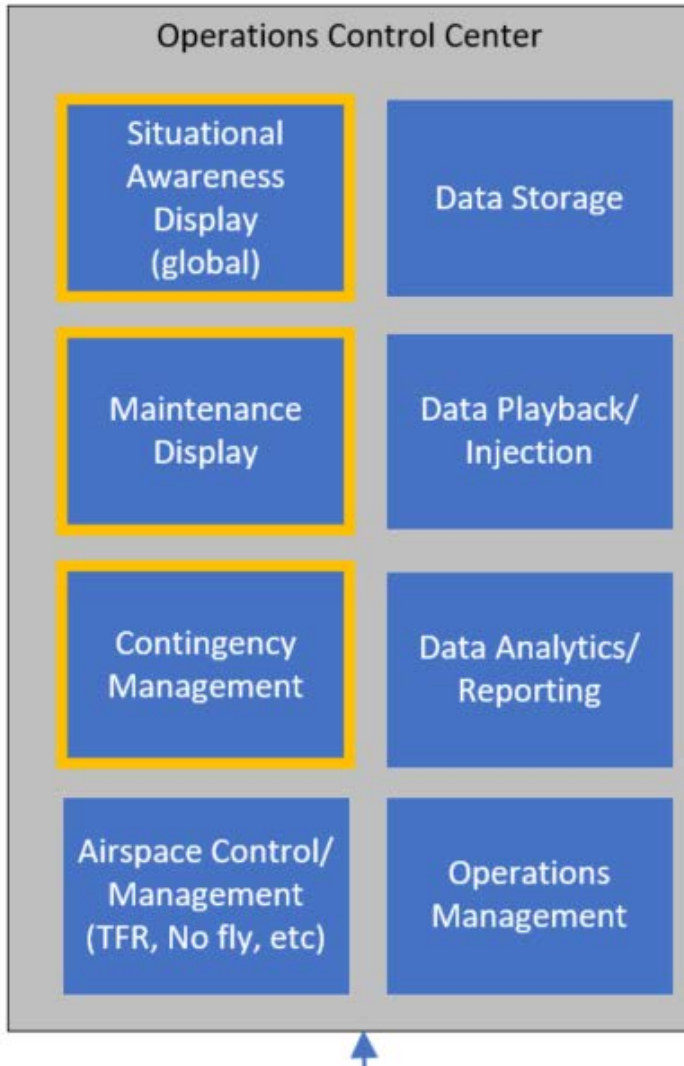


## Anticipated Functions

- Data Storage/Playback
- Data Analysis
- Airspace Control/Management
- Operations Management
- Situational Awareness
- Maintenance
- Contingency Management



# • U T M C O N T R O L C E N T E R •



## Anticipated Functions

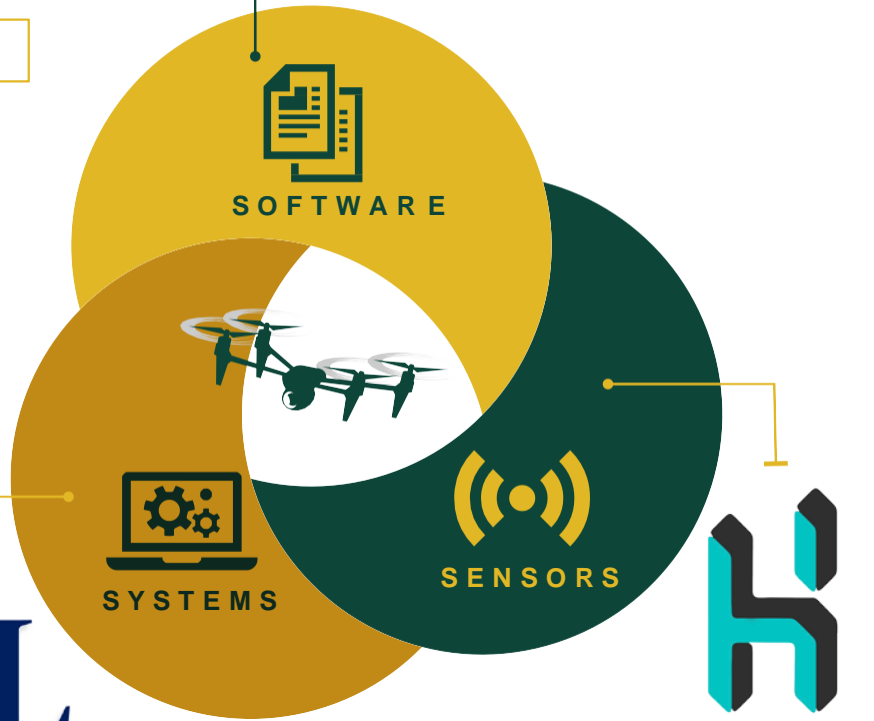
- Data Storage/Playback
- Data Analysis
- Airspace Control/Management
- Operations Management
- ✕ Situational Awareness
- ✕ Maintenance
- ✕ Contingency Management

# • PARTNERSHIPS •

## RESILIENX

STRATEGIC

INDUSTRY



**CAL**  
ANALYTICS  
Aviation & Autonomous Systems Development

**HIDDEN LEVEL**

U-space

UNIFLY

ais



ASD

Gannett Fleming

TruWeather SOLUTIONS

• TARGET CUSTOMERS •

Public Investment

Private Investment

PUBLIC

PRIVATE

PARTNERSHIP

Public Return

Private Return



# • P A T H F O R W A R D •

**We're looking to partner with anyone operationalizing UTM**

**Assist in System Engineering Activities**

**Integrate FRAIHMWORK CORE**

**Deploy Tiered Maintenance Interface (TMI) to Control Centers**

**Configure TMI for specific Components and CONOPS**

## **Benefits**

**Increased System Safety**

**Reduced Maintenance Costs**

**Ecosystem Accountability**

**Improve BVLOS COA Probability**

**Increased Economic Activity (via Increased Uptime)**

# THANK YOU FOR YOUR TIME

““

Of all the technologies out there right now, ResilienX has the one the industry needs most. ””

*-Sarah Hood,  
former USAF CPT and  
Air Traffic Controller*

““

The team has extensive experience in unmanned aircraft systems, surveillance, systems engineering, cyber security, and software engineering. ””

*-NASA SBIR  
Technical Reviewer*

““

We believe in the solutions ResilienX will bring to the table... and they will accelerate the timeline for routine commercial BVLOS operations. ””

*-Ray Young, Ph.D.,  
Chief Integration Officer, NUAIR Alliance*

# RESILIENX



# BACKUP



# • M I L E S T O N E S •

GENIUS NY  
Program

• JAN 2019 •

FAA White Paper Accepted  
Won 2 NASA SBIRs \$240K

• JUL 2019 •

Ohio GBSAA Customer  
Site Integration

• DEC 2019 •

10 Full-Time Staff

• JUN 2020 •

\$1M in Annual  
Revenue

• DEC 2020 •

• APR 2019 •

\$500K Prize/  
Investment

• SEP 2019 •

MVP Finished &  
FAA Contract Award

• MAR 2020 •

Software Build 2  
Complete

• SEP 2020 •

Brisbane, AU  
Customer Site  
Integration

# • TRACK RECORD •

## PRE-RESILIENX

- 2008-17 Multiple Army Ground Based Sense and Avoid proposals
- 2017 NASA UAS Integration Task Order 4
- 2017 NASA UAS Integration Task Order 5
- 2018 NUAIR U-SAFE UTM Program
- 2018 Ohio DoT UTM Program
- 2018 Major Theme Park Counter-UAS

*Won*  
*Won*  
*Won*  
*Won*  
*Won*  
*Won*

## RESILIENX



- 2018 GENIUS NY Program (Business Accelerator / Incubator)
- 2019 NASA SBIR: Enhancing UTM Ecosystem Robustness (as CAL)
- 2019 NASA SBIR: Data Fusion for Anomaly and Degradation Detection (as CAL)
- 2019 Massachusetts DOT UAS Implementation RFQ
- 2019 FAA BAA Whitepaper (accepted and invited to propose)
- 2019 North Carolina Drone Summit: Unmanned Up (Start Up Competition)
- 2019 FAA BAA: Contingency Management Platform
- 2019 ICAO Drone Enable 3 Whitepaper

• **Selected**  
• **Won**  
• **Won**  
• **Qualified**  
• **Selected**  
• **Won**  
• **Pending**  
• **Selected**



# Federal Aviation Administration



## Law Enforcement Assistance Program (LEAP)



Federal Aviation  
Administration  
[www.faa.gov/uas](http://www.faa.gov/uas)

# FAA ORGANIZATIONS

## Office of Security & Hazardous Materials Division:

- National Security Programs & Incident Response
- Ensures integrity of those who work in or support the National Airspace System (NAS)
- Protects FAA employees and facilities from criminal and terrorist acts
- Hazardous Material Incidents
- LEAP - Primary contact between FAA and Law Enforcement inquiries



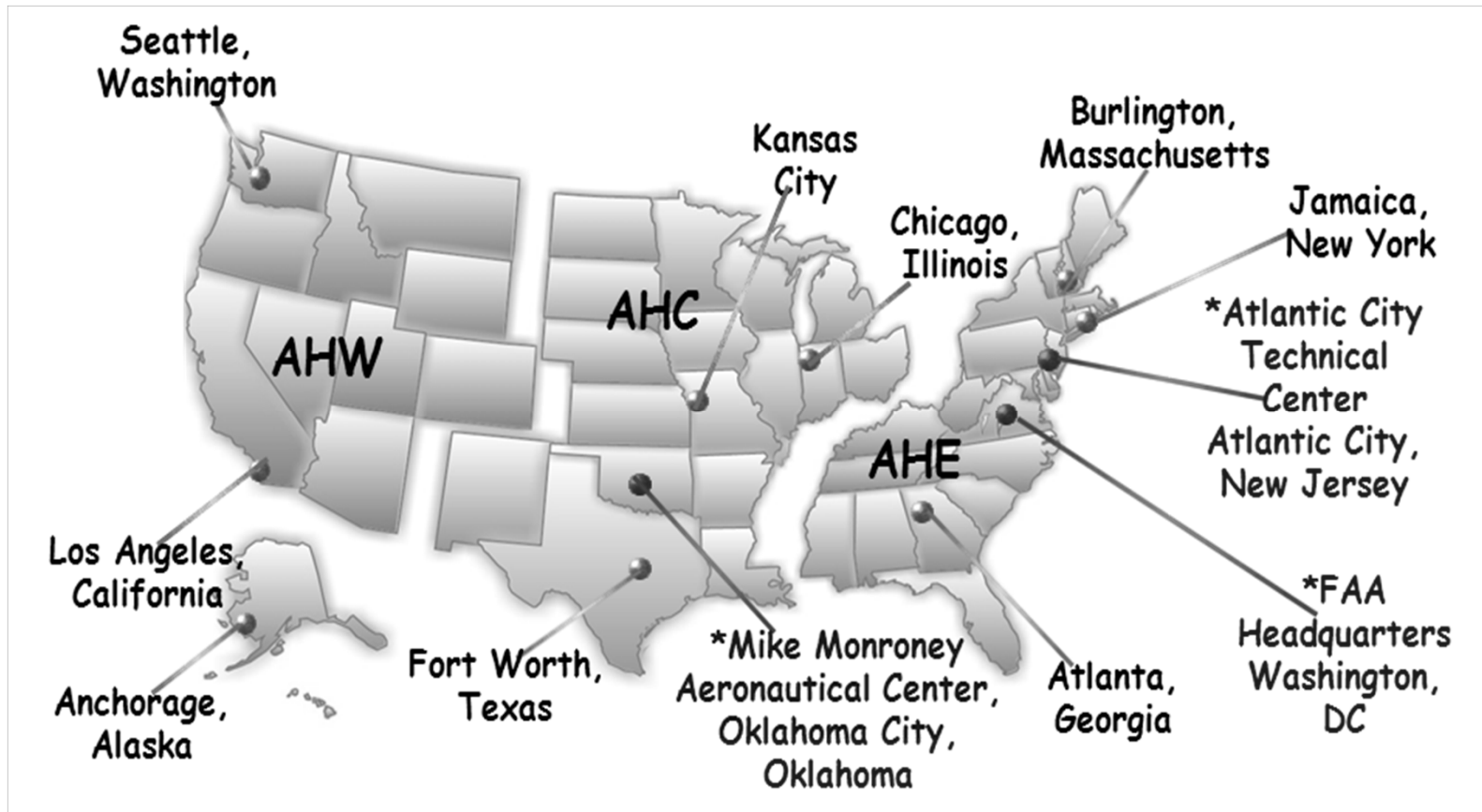
# FAA Mission

**To provide the safest, most  
efficient aerospace system in  
the world.**



**Federal Aviation  
Administration**  
[www.faa.gov/uas](http://www.faa.gov/uas)

# AREA OF RESPONSIBILITY



Federal Aviation  
Administration

# Law Enforcement Assistance Program

**CONDUCT REGULATORY INVESTIGATIONS**

**WE ASSIST AND SUPPORT LAW ENFORCEMENT AGENCIES**

**PROVIDE AVIATION RELATED EXPERT WITNESS  
TESTIMONY, GATHER EVIDENCE, AND TAKE OATHS**



**Federal Aviation  
Administration**

# UAS Safety & Security

- **FAA is safety focused not security focused**
  - FAA does partner w/ other agency for security
- **Airspace is public use**
  - Cannot limit access arbitrarily
- **State and local laws control the ground not the air**
  - Also examine the behavior not the UAS to pursue enforcement



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# Reporting Unsafe UAS Activity

- **While flying or at the airport:**
  - Report the sighting to Air Traffic Control (DEN)
    - Note the location, altitude, and characteristics of the aircraft
- **Anywhere else:**
  - Call local law enforcement
    - The FAA has published guidance for law enforcement to help them respond to unsafe UAS activity
- **Be as detailed & specific as possible**
  - Location, altitude, direction, pictures, videos, etc.



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# LAW ENFORCEMENT AND PUBLIC SAFETY



## Understanding Your Authority with Drones

Law enforcement and other public safety agencies have an important role in protecting the public from unsafe and unauthorized drone operations. As a law enforcement officer, you are often in the best position to deter, detect and investigate unsafe or unauthorized drone operations.

### UNSAFE AND/OR UNAUTHORIZED DRONE

The FAA's Law Enforcement Checklist helps you identify the necessary steps you need to take to respond to a situation involving an unsafe or unauthorized drone.

- **Detect** all available elements of the situation; attempt to locate and identify individuals operating the drone. (Look at windows/balconies/rooftops).
- **Report** the incident to the FAA Regional Operations Center (ROC). Follow-up assistance can be obtained through FAA Law Enforcement Assistance Program special agents.
- **Observe** the drone and maintain visibility of the device; look for damage or injured individuals. Note: Battery life is typically 20 to 30 minutes.
- **Notice** features: Identify the type of device (fixed-wing/multi-rotor), its size, shape, color, payload (i.e., video equipment) and activity of device.
- **Execute** appropriate police action: Maintain a safe environment for general public and first responders. Conduct field interviews; request proof of drone registration; document ALL details of the event per the guidance provided by the FAA.

Learn more at [faa.gov/go/DronePublicSafety](https://www.faa.gov/go/DronePublicSafety)

Always follow your agency policies: Take appropriate action based on the facts and circumstances of the incident and site/area-specific laws and rules. Any action taken by the FAA should not preclude law enforcement from taking action to enforce state and local laws regarding drone operations. Local laws or ordinances that may apply include, but are not limited to: reckless endangerment, criminal mischief, voyeurism, interference with law enforcement and trespassing.

### Document and provide the following information to the FAA:

- Identity of operators and witnesses (name, contact information)
- Nature of the operation (for fun, to support a business, governmental)
- Type of device(s) and registration information (number/certificate)
- Event location and incident details (date, time, place)
- Evidence collection (photos, video, registration information, device confiscation)

### CONSIDERATIONS FOR DISRUPTING DRONE OPERATIONS

State and local law enforcement entities, private-sector stakeholders, and even individuals may be interested in methods for disrupting the operation of drones believed to pose a hazard to privacy, safety or security. However, the FAA cautions all non-federal entities against pursuing the testing, evaluation or use of technologies to detect and/or mitigate drone activity, whether involving kinetic or non-kinetic capabilities, without consulting legal counsel for a thorough evaluation of the legal risks.

December 2018



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# CONTACT YOUR FAA LEAP AGENT OR FAA ROC FOR ASSISTANCE

Special agents from the FAA's **Law Enforcement Assistance Program (LEAP)** are your point of contact for federal, state, local, tribal, territorial and international law enforcement agencies. LEAP special agents can provide information on drone enforcement and registration matters. Providing a LEAP special agent with reports of suspected unauthorized UAS incidents in a timely manner increases the FAA's ability to take enforcement action when appropriate. (NOTE: You may contact any LEAP agent if your assigned agent is not available.) **Washington Headquarters Program Office and D.C. drone incidents:** 202-267-4641 LEAP@faa.gov.

## WEST

LEAP Branch Manager  
206-231-2093

- WA, ID, OR, MT and WY  
special agent: 425-495-1972
- Northern CA  
special agent: 916-956-8830
- Southern CA, NV, CO and GU  
special agent: 310-363-9435
- AZ, UT and HI  
special agent: 602-721-6091
- Alaska  
special agent: 907-201-0245

## CENTRAL

LEAP Branch Manager  
405-954-8569

- IL, IN, MI, MN, OH and WI  
special agent: 847-294-7521
- IA, KS, MO, NE, ND and SD  
special agent: 816-329-3717
- OK, AR and LA  
special agent: 817-222-5742
- TX and NM  
special agent: 817-222-5713

## EAST

LEAP Branch Manager  
404-305-6816

- CT, ME, MA, NH, RI and VT  
special agent: 781-238-7704
- DE, MD, NJ, NY and PA  
special agent: 781-238-7073
- AL, MS, TN, KY and NC  
special agent: 404-305-6759
- GA, SC, VA and WV  
special agent: 404-305-6807

- North and Central FL  
special agent: 404-430-1365
- South FL, PR and VI  
special agent: 786-778-5923  
786-409-8576

**Regional Operations Centers (ROCs)** are staffed 24/7 and should be contacted if you observe a drone that may potentially interfere with the safety or security of the National Airspace System. The ROC will ensure notification is made to manned air traffic in the vicinity as well as appropriate FAA offices.

**Western:** AK, AZ, CA, CO, HI, ID, MT, NV, OR, UT, WA, WY  
206-231-2089 / 9-wsa-opsctr@faa.gov

**Washington DC / National**  
202-267-3333 / 9-awa-ash-woc@faa.gov

**Central:** AR, IA, IL, IN, KS, LA, MI, MN, MO, ND, NE, NM, OH, OK, SD, TX, WI  
817-222-5006 / 9-csa-roc@faa.gov

**Eastern:** DC, DE, MD, NJ, NY, PA, WV, VA  
404-305-5150 / 9-ESA-ROC@faa.gov

AL, CT, FL, GA, KY, MA, ME, MS, NC, NH, PR, RI, SC, TN, VI, VT  
404-305-5180 / 9-ESA-ROC@faa.gov



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Administration**

# UAS Outreach and Education



## I FLY SAFE

All drones are aircraft—even the ones at the toy store. So when I fly a drone I am a pilot. Before I fly I always go through my pre-flight check list. I regularly check the safety guidelines at [faa.gov/uas](http://faa.gov/uas)

**FLY SMART, FLY SAFE,  
AND HAVE FUN!**

[knowbeforeyoufly.org](http://knowbeforeyoufly.org)  
[faa.gov/uas](http://faa.gov/uas)

### PRE-FLIGHT CHECKLIST

- I fly below 400 feet
- I always fly within visual line of sight
- I'm aware of FAA airspace requirements: [faa.gov/go/uastfr](http://faa.gov/go/uastfr)
- I never fly over groups of people
- I never fly over stadiums and sports events
- I never fly within 5 miles of an airport without first contacting air traffic control and airport authorities
- I never fly near emergency response efforts such as fires
- I never fly near other aircraft
- I never fly under the influence

**Federal Aviation Administration**



# UAS Outreach and Education



NATIONAL  
**DRONE SAFETY**  
AWARENESS WEEK

November 4-10, 2019



Federal Aviation  
Administration

# UAS Outreach and Education

- National Drone Safety Awareness Week will help educate the public about drone safety by highlighting how key sectors of the drone community are engaging with the public and spreading awareness throughout all 50 states on specific focus areas
- It can also be an opportunity for drone stakeholders and users to kick off new safety initiatives



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# UAS Outreach and Education

[faa.gov/go/DroneWeek](https://faa.gov/go/DroneWeek)



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# UAS Outreach and Education

- **What are we (FAA LEAP) looking for?**
  - Promote YOUR:
    - Safety stories, successes, events, and educational programs
    - Drone safety is everyone's responsibility, and
    - This event will continue to advance the public-private partnerships and collaboration.



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# UAS Outreach and Education

## SHARE YOUR CONTENT

### Social Media

- ▶ Tag your social media stories with #DroneWeek.
- ▶ Share your stories through digital content (images and videos) with the FAA on Twitter, Facebook, Instagram and LinkedIn.
- ▶ Share your stories with the FAA via [SocialMedia@faa.gov](mailto:SocialMedia@faa.gov)
- ▶ Announce new educational initiatives on social media.
- ▶ Share content about an event during #DroneWeek.
- ▶ Add drone safety content to your website and/or link to FAA.gov.
- ▶ Incorporate drone safety content into your email marketing.
- ▶ Incorporate drone safety content into materials used at conferences and events.
- ▶ Follow the FAA on social media and subscribe to our YouTube channel for updated drone safety videos.

### Earned Media

Attracting new drone users to the aviation community is another benefit of Drone Safety Awareness Week. Consider ways to generate earned media opportunities, such as reaching out to influencers who can expand your safety message beyond your usual audience through a variety of communication channels.

To register your event, go to:

<http://unmannedaircraftsafetyteam.org/safetyweek/>



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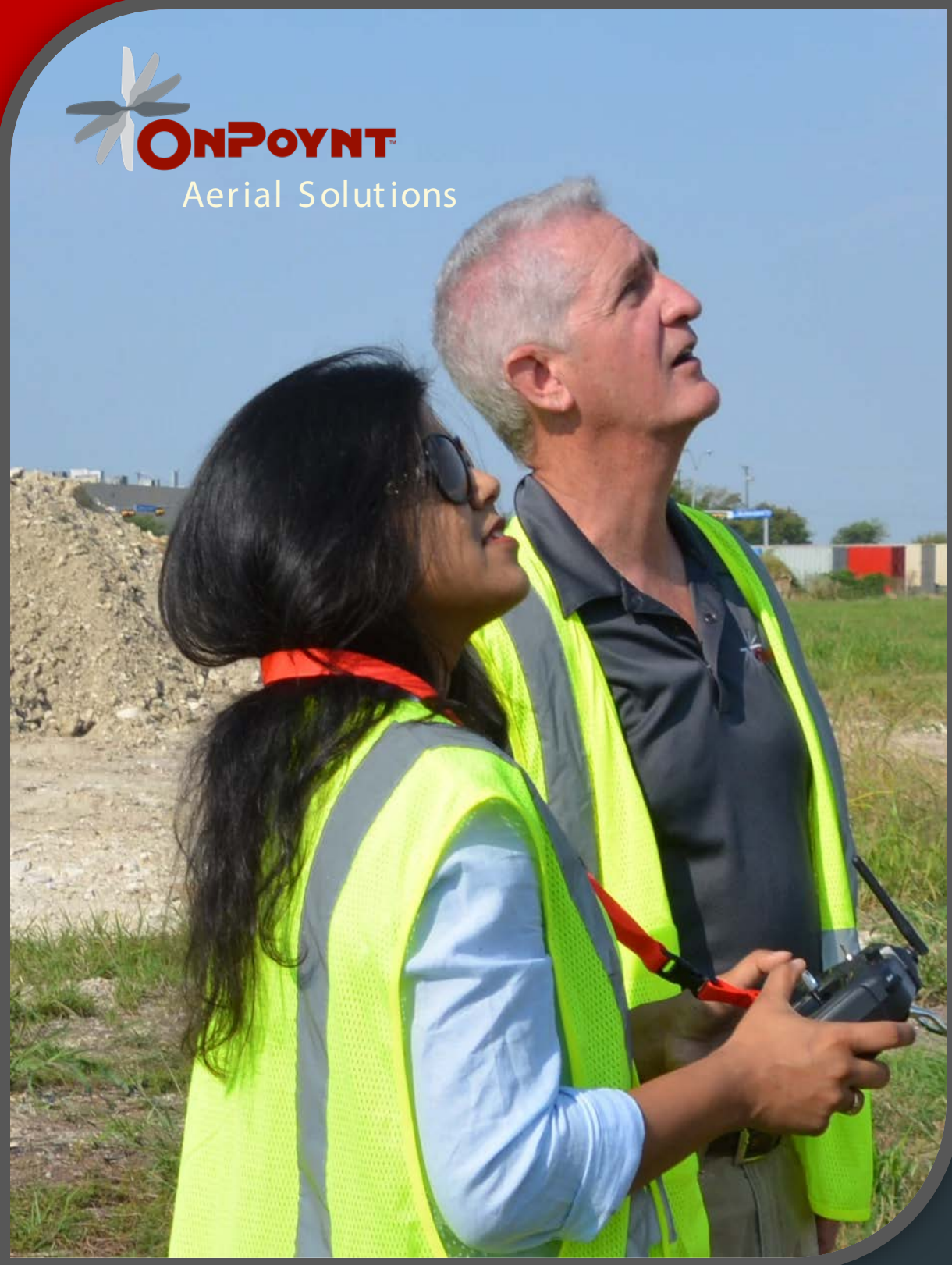


NORTH CENTRAL TEXAS

# AERIAL ROBOTICS STEM INITIATIVE

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# REGIONAL OVERVIEW

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## Aerial Robotics STEM Pathways

North Central Texas (NCTX) Aerial Robotics STEM Initiative is developing a regional network of educators and employers to develop Aerial Robotics STEM pathways.

The initiative includes a diverse consortium of 10 school districts, ranging in size from 176 to 86,039 students. The partnering districts include six major suburban districts, two rural districts, one major urban district, and one central city suburban district.

# PARTNERS

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## CROSS SECTOR PARTNERSHIPS



Azle ISD

Bell Helicopter

Birdville ISD

Cleburne ISD

Crowley ISD

Fort Worth ISD

Era ISD

Grapevine-Colleyville ISD

Hurst Eules Bedford ISD

Interlink North Central

Keller ISD

Strawn ISD

Tarrant County College District

Tarrant County Workforce Solution Texas

# KEY ACTIVITIES

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INCREASE CTE ENROLLMENT IN  
PATHWAYS ALIGNED  
WITH AERIAL ROBOTICS



OFFER TWO  
PROFESSIONAL DEVELOPMENT  
OPPORTUNITIES  
FOR TEACHERS



BUILD SUSTAINABLE  
PARTNERSHIPS THROUGH MOUS  
AND DATA-SHARING  
AGREEMENTS

# ALIGNMENT WITH LABOR DEMAND




REGIONAL LABOR MARKET

POSTSECONDARY

SECONDARY





# LINKS BETWEEN SECONDARY AND POST SECONDARY EDUCATION

## **SEAMLESS POSTSECONDARY DEGREE PLANNING**

Students' progress through seamlessly connected secondary and postsecondary programs of study and degree plans.

## **BRIDGE PROGRAMS**

Bridge programs and transfer and articulation agreements provide structures that enable students to navigate transitions between institutions without running into dead ends.

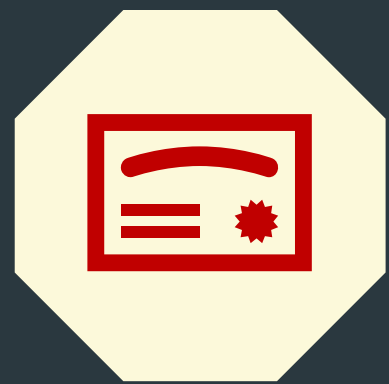
## **DEVELOPMENTAL EDUCATION**

Presentations are communication tools that can be demonstrations, lectures, speeches, reports, and more.

# CREDENTIALS WITH VALUE IN THE LABOR MARKET

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The labor market value of certifications is validated through employer input and labor market information



INDUSTRY  
RECOGNIZED



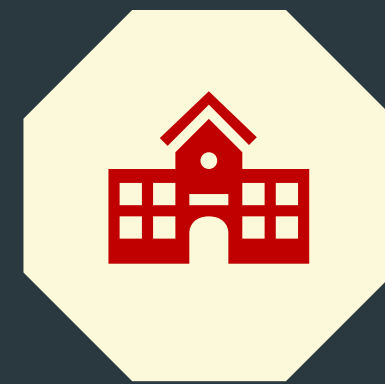
INDUSTRY  
VALUED



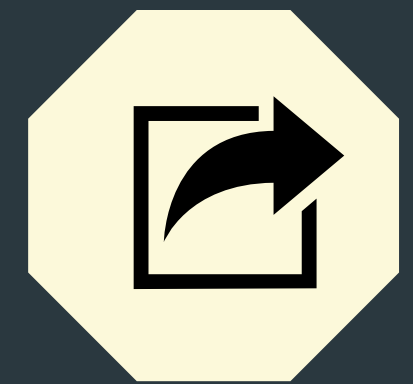
THIRD PARTY  
PROVIDER



CAPSTONE



ATTAINABLE BY  
HS STUDENTS



TRANSFERABLE

# INTEGRATION OF RIGOROUS CORE ACADEMIC AND CAREER-FOCUSED LEARNING

PATHWAY  
DESIGN

MULTIPLE  
ADVANCED  
COURSE  
OPTIONS

CORE  
AND  
CAREER  
IN CTE

TEACHER  
EXTERNSHIPS



**Texas  
OnCourse**

# COLLEGE AND CAREER INFORMATION AND ADVISING

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Texas OnCourse

Texas OnCourse is designed to ensure that every high school graduate has a plan for college and career. It provides college and career information and resources for students, families, and educators across the state.

Learn more at [texasoncourse.org](http://texasoncourse.org)



# CONTINUUM OF WORK-BASED LEARNING EXPERIENCES

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Sample State Initiatives  
that support  
Work-Based Learning

Talent Connection

Jobs and Education for Texans (JET) Program

Skills Development Fund

Texas Internship Challenge

Apprenticeship Texas Expansion Grants

# 2019 BELL VERTICAL ROBOTICS COMPETITION



# 2019 Bell VRC Schedule

## Competition - Fall Semester 2019

- Kick Off Event – Sat Oct 12<sup>th</sup>
- Competition Day – Sat/Sun Dec 7/8<sup>th</sup>
  - 8 Weeks to Design/Build/Fly/Compete

Targeting 20 DFW High Schools

Location: UTA Mavericks Activity Center (MAC)

# Help Needed: Mentors & Sponsors



## REQUEST FOR TECHNICAL MENTORS

The third annual BELL Vertical Robotics Competition is taking place this Fall semester with over 30 high schools in the DFW area. This innovative competition takes on the vertical dimension by combining drones and robotics to engage students in a wide range of skills needed for STEM+M (Manufacturing) career pathways.

This year's competition theme is **On-Demand Mobility** which will simulate air-taxi movement of people plus rapid delivery of food orders. Teams will be given eight weeks to assemble their baseline drone kit and to design, build and integrate their robotic solutions to achieve the On-Demand Mobility challenge.

## HELP NEEDED

Technical Mentors (2 per high school) will work with high school students during the 8-week design/build/fly period – Oct 12<sup>th</sup> to Dec 7<sup>th</sup>

Mentoring will take place after school hours – Typically 2 evenings a week

Desired skill sets for mentors include Project Management, Mechanical Design, Electronics, Coding, CAD design, 3-D Printing, Fabrication, Kinematic design, UAV Piloting

**Competition Event at University of Texas Arlington - MAC Sports Arena**

**Saturday Dec 7 with Finals on Sunday Dec 8**

Learn more on the competition website: <https://drobotscompany.com/vrc>

For questions email: [vrc@drobotscompany.com](mailto:vrc@drobotscompany.com)

BELL EDUCATION OUTREACH  
INSPIRING THE NEXT GENERATION & OUR FUTURE WORKFORCE!

## Bell Vertical Robotics Competition Sponsorship Levels and Benefits



The Bell Vertical Robotics Competition takes on the vertical dimension by combining UAVs with robotics to expose students to a wide range of skills needed for STEM+M (Manufacturing) career pathways.

This year's competition theme is **On-Demand Mobility** which will simulate air-taxi movement of people, package loading at a fulfillment center and rapid delivery of food orders. Teams will be given eight weeks to design, build and integrate their robotic solutions with their UAV to achieve the On-Demand Mobility challenge.

We are seeking corporate and private sponsors to help fund and promote this fun and challenging event which is specifically designed to inspire the next generation to meet rapidly changing future workforce needs.

Please review the sponsor levels below or contact us to discuss customized arrangements, including in-kind equivalence, personnel support, guided funding, etc. We are especially interested in funds to provide scholarship donations to high schools who do not have the needed funding to participate. Your donation can be given through the Persistence Development Foundation (PDF) - a not for profit corporation. (EIN 27-0583335 – Copy of 501(c)(3) letter available on request).

### \$20,000 Gold Level

- Recognition in all press releases
- Name/Logo as Gold Sponsor in Official programs and on VRC website.
- Free Exhibitor's Showcase Booth at VRC events (Kickoff and Competition)

### \$10,000 Silver Level

- Recognition in select press releases
- Name/Logo as Silver Sponsor in Official program and on VRC website.
- Free Exhibitor's Showcase Booth at VRC events (Kickoff and Competition)

### \$5,000 Scholarship Donation

- Recognition in select press releases
- Name/Logo as a Scholarship Donor on Banner for the High School recipient, in Official program and on VRC website.
- Free Exhibitor's Showcase Booth at VRC events (Kickoff and Competition)

To learn more about the 2019 Bell Vertical Robotics Competition visit our competition website at: <https://drobotscompany.com/vrc>

### For additional information contact:

Harold Strong  
Persistence Development Foundation [www.e-pdf.org](http://www.e-pdf.org)  
[harold@e-pdf.org](mailto:harold@e-pdf.org)  
972.559.9051

**Q & A**





# Lone Star UAS Center of Excellence & Innovation

NCTCOG Update

September 24 2019

*Bringing UAS to America's Skies*  
*LSUASC Proprietary*



# A Note from NASA's Project Manager, Mr. Ron Johnson

- FAA forecast: The commercial, small non-model UAS fleet will grow from 277,000 in 2018 to 835,000 in 2023. The average annual growth rate over the 5-year forecast period is 24.7 percent.
  - Many uses: package delivery, news collection, precision agriculture, infrastructure inspections, public safety, etc.
- NASA is conducting research on what a future air traffic management system for small drones would look like, and the challenges with flying drones in urban environments
- The results of this research will be provided to the FAA who will be responsible for implementing an operational system in the future
- The drone industry will also use the test results to help build more capable, safer drones
- NASA is very pleased to conduct this important research in Corpus Christi with Lone Star UAS Center of Excellence and its partners



**NASA's Concept for a possible UTM System that would safely manage diverse UAS Operations in the airspace above buildings and below crewed aircraft operations in suburban and urban areas.**





# Lone Star UAS Center of Excellence – NASA TCL-4 Summary

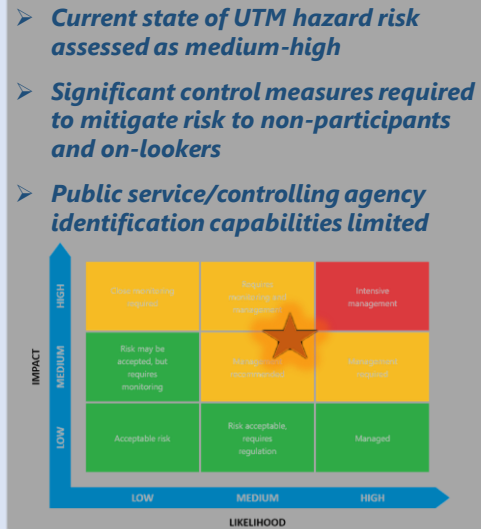
## Mission Background

LSUASC conducted a series of UAS flight demonstrations, collectively called the Technical Capability Level 4 (TCL4) Demonstration, to provide data on complex UAS operations occurring in an urban environment. All data supports NASA's continued UAS Traffic Management (UTM) project.

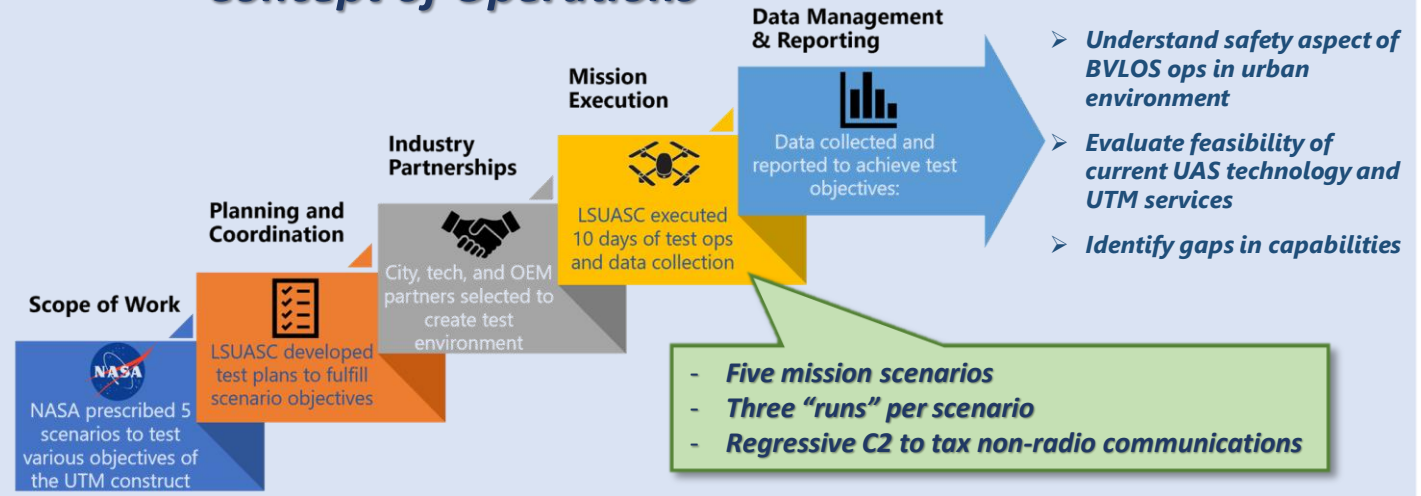
**Dates:** July-August 2019

**Location:** Corpus Christi, TX

## Partners



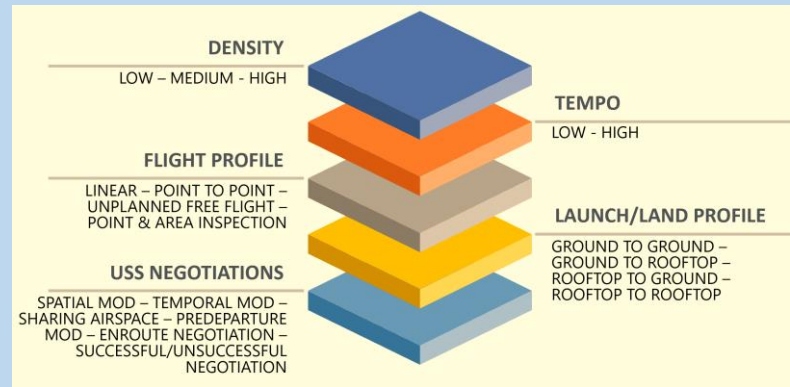
## Concept of Operations



## Trends & Observations

- Proven need to standardize all aspects of UAS operations from common terminology to USS programming
- Disconnect between reference factors such as map datums and altitude references
- Requirement for signals redundancy and non-GPS navigation to counter structural and electromagnetic interference
- Operating systems must be hardened for extreme environmental factors
- Community engagement and involvement is a critical enabler

## Results/Lesson Learned

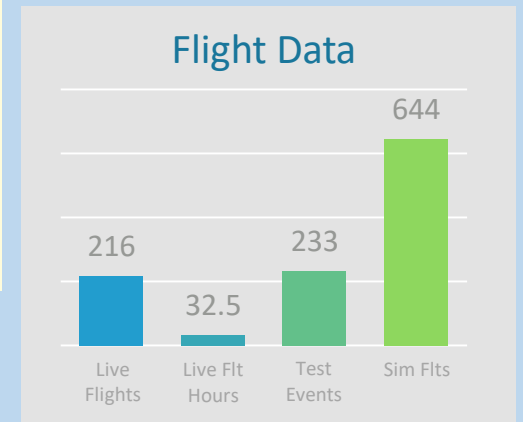


Sampling of Flight Characteristics:  
12 Groupings of 39 Unique Characteristics

Bringing UAS to America's Skies

LSUASC Proprietary

## Flight Data









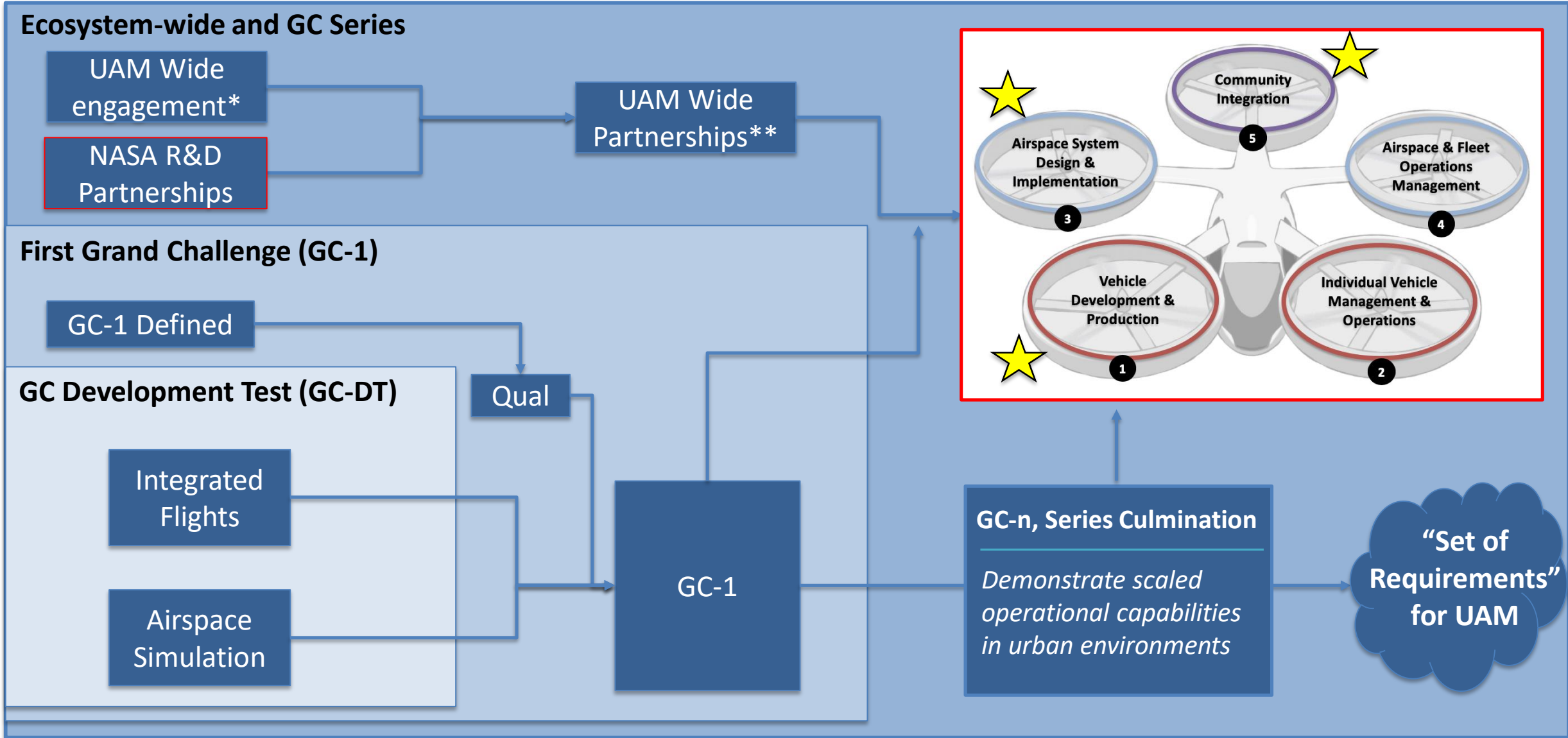


# NASA/FAA/Industry Relationship for Grand Challenge Series

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- NASA recognized early that maximum value from GC would require strong coordination with the FAA and industry
  - Achieve a UML-4 Book of Requirements (i.e. toward industry consensus standards)
- NASA and the FAA are working closely together to formulate the GC
  - Have had several formal and informal efforts to refine the overall concept and work details
  - FAA executives have been involved in formal GC reviews
  - FAA personnel from all organizations (e.g., AIR, AUS, ATO, ANG, AFS, and ARP) have been engaged through a scenarios technical working groups
- NASA has received industry input and is working to receive additional industry input
  - Previous input received primarily through Industry Day and RFI last fall
  - Aeronautics Research & Technology Roundtable and informal conversations have also shaped the GC
  - Upcoming call for Working Groups

# Partnership and Grand Challenge Series Overview



\*Continue to work future GC definition through collaborative partnership workshops

\*\* NASA recognizes it will not be involved in all UAM wide partnership activities

NCTCOG Interest





# Grand Challenge 1 Goals & Objectives

## Goal

Improve UAM safety and accelerate scalability through integrated demonstrations of candidate operational concepts and scenarios

## Objectives

1. **Accelerate Certification and Approval.** Collect relevant data through flight test that assist the FAA in developing test procedures, data requirements, and methods of compliance for UAM vehicle certification, pilot certification, and operational approval, including considerations for increasing levels of automation and autonomy
2. **Develop Flight Procedure Guidelines.** Test different flight procedures and related airspace design constructs that enable the development of preliminary flight procedure guidelines and airspace design criteria
3. **Evaluate the CNS Trade-Space.** Explore and evaluate reliable, secure, and affordable communication, navigation, and surveillance requirements, options, and trade-offs
4. **Demonstrate an Airspace Operations Management Architecture.** Demonstrate and document an airspace operations management architecture extending the UTM construct that has the potential to safely manage scalable UAM operations without burdening the current ATM system
5. **Characterize Vehicle Noise.** Conduct initial characterization of the community noise impacts of UAM vehicles through measurements of vehicle ground noise

# Next Steps

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- LSUASC recently responded to NASA UAM GC Solicitation to provide:
  - State and Local sUAS and UAM Use Case “Portfolio”
  - UAM GC support “plan” aligned with GC Series Objectives
  - Office of the Governor Engaged and Endorsed our proposal
  - 180 Day effort
- Post Award:
  - Kickoff Meeting (Date TBD) at the NCTCOG, Austin or both
  - Other State Stake Holders invited to participate
  - OEMs, Ecosystem Providers will be encouraged to participate
- Update via WEBEX during the October 29 UAS TF Meeting





**Mike Sanders**

Executive Director, LSUASC

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Corpus Christi, Texas 78418

361-825-5731

[Michael.sanders@tamucc.edu](mailto:Michael.sanders@tamucc.edu)

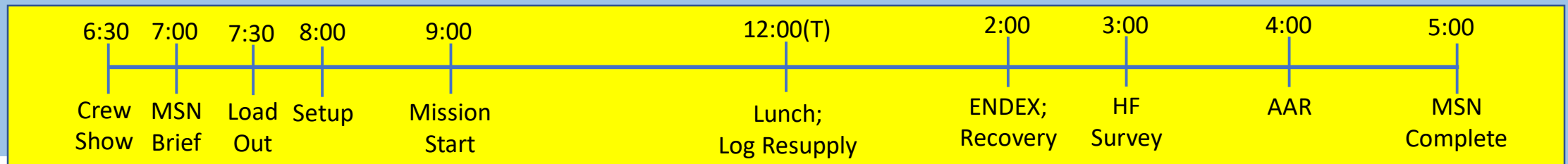
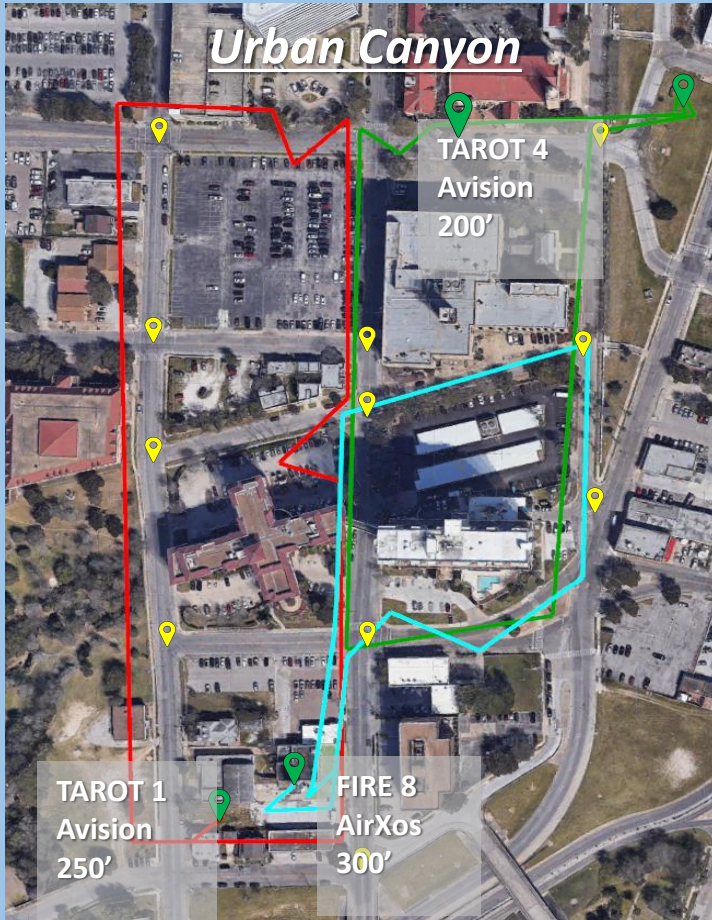
***The Urban Air Mobility Vision***

*Bringing UAS to America's Skies*  
LSUASC Proprietary

# Backup Slides



# Scenario 1 CONOP





# Scenario 2 CONOP



## MISSION

On 15 AUG 19 from 0900-1500, Lone Star UAS conducts Scenario 2 flight missions in Corpus Christi, TX for the NASA TCL4 events.

## CONCEPT OF OPERATIONS

Mission will occur in three phases:

Phase 1: Load out and movement

Phase 2: Setup and Mission Execution –Test Card v15

Phase 3: Recovery and Debrief

Time	Event	Location	Info
0630	Show	Omni Hotel	All Hands
0700	Update Brief	Nueces A Rm.	All Hands
0730	Load Out	Log Site	Aircrews
0800	Arrival and setup	Per CONOP	Aircrews
0900-1500	Scenario 2 execution	Per CONOP	All Hands
1200-1300(T)	Lunch	LRZ/GCS Sites	As Required
1230-1330	LOG Resupply	LRZ/GCS Sites	
1500-1600	Recovery Ops	Log Site	All Hands
1600-1730	Human Factors and AAR	Nueces A Rm.	All Hands
1730-1800	Scenario 1 Mission Briefing	Nueces A Rm.	All Hands
1800-1830	Closeout Briefing	Nueces A Rm.	LoneStar Staff

UNIT	TASK	PURPOSE
Tarot 1-3, 5,6; Fire 8 ; Robot 9	Execute flight operations in the SEA district using the USS's as per crew card.	Provide data ISO NASA TCL-4.
Tarot 4	Execute flight ops from the USS Lexington with USS Air Map	Provide data ISO NASA TCL-4.

# NOTAMs

**08/033** - AIRSPACE UAS WITH AN AREA  
DEFINED AS 1NM RADIUS OF  
274705N0972339W (CRP159007.6) SFC-  
400FT AGL. 16 AUG 13:00 2019 UNTIL  
16 AUG 21:00 2019. CREATED: 15 AUG  
22:44 2019







# *Discussion*

- InterLink's 2019 ~ 32<sup>nd</sup> Annual Employer Survey Executive Summary
- Regional Demand Occupations identified by employers
- Macro Trends expected to be game changers
- Emerging and Evolving Occupations
- Entry Level Skills and Attributes verified by employers
- Interlink Website ~ portal to labor market information ([www.interlink-ntx.org](http://www.interlink-ntx.org))

# *Employer Responses*

- ▶ **1271 North Central Texas Employers**
- ▶ **Representing 202,824 North Central Texas Employees**
- ▶ **153 companies representing global 1,421,950 employees**

*Occupations identified as in demand numbering over 1,000 for the next five years*

- ▶ **Elementary Teachers – 1863**
- ▶ **Secondary Teachers – 1676**
- ▶ **Cloud and Security Architects (identified by several names) – 1616**
- ▶ **Registered Nurses – 1149**
- ▶ **Electricians – 1061**

*Occupations identified as in demand numbering over 500 for the next five years:*

- ▶ Laborers and Freight Stock Material Movers (Hand) – 998
- ▶ Police Officers – 998
- ▶ Police/Sheriff Patrol Officer – 852
- ▶ Nurse, BSN – 776
- ▶ Pilot & Co-Pilot – Airline – 583
- ▶ Automotive Repair Service Technician – 551
- ▶ Maintenance & Repair Worker, General – 535
- ▶ Nurse Aid/Assistant (CNA) – 511
- ▶ Construction Laborers - 500



**When asked to identify Emerging and Evolving Occupations that may offer career opportunities, two industries were overwhelmingly identified:**

- ▶ **Drones and other UAV (unassisted air or autonomous vehicles) occupations**
- ▶ **Information Technology Security occupations**

# Part 2 ~ Gauging the use of Robotics and Artificial Intelligence (AI)

- ▶ **Regarding the use of Robotics and Artificial Intelligence (AI), of the 61 responses:**
- ▶ **62% are currently assessing or planning to use AI technology**
- ▶ **18% are currently testing or piloting the deployment of robotics**
- ▶ **20% are currently deploying the use**

***Employee reduction as a result of automation did not seem to be of concern at this time. Of the 109 responses:***

- ▶ **90% report no impact**
- ▶ **0.92% report current impact**
- ▶ **5% report an impact in 1-3 years**
- ▶ **5% report an impact beyond 3 years**

## *Affects of technology on growth or decline of occupations:*

- ▶ The use of Drones and other UAV, and Robots were the most frequently mentioned as showing the most growth potential.
- ▶ Occupations identified as having the most decline due to the use of automation are in the areas of warehousing and customer service.



# InterLink's 2019~2024 Demand and Emerging and Evolving Occupations

Descriptions of Occupations are in the  
InterLink Demand Occupations Brochure  
at  
[www.interlink-ntx.org](http://www.interlink-ntx.org)

**High Skill ~ High Demand ~ High Wage  
Occupations  
Identified by  
North Central Texas Employers**

## 2019~2024 InterLink High Demand Occupations Identified by North Central Texas Employers

*Data Source: EMSI, Texas Workforce Commission, Bureau of Labor Statistics, InterLink Regional Employer Labor Market Survey, InterLink Task Forces*

Industry Cluster ~ Job Title	Regional Median Hourly Earnings	Regional Experienced Hourly Earnings	Typical Entry Level Education
<b>Agriculture, Food and Natural Resources</b>			
Veterinary Technologists and Technicians	\$15.99	\$23.20	Associate's degree
<b>Architecture and Construction</b>			
Electricians	\$20.41	\$31.98	High school diploma or equivalent
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$20.83	\$33.69	Postsecondary nondegree award
Maintenance and Repair Workers, General	\$18.21	\$28.08	High school diploma or equivalent
Operating Engineers and Other Construction Equipment Operators	\$18.60	\$25.87	High school diploma or equivalent
Plumbers, Pipefitters, and Steamfitters	\$21.72	\$32.12	High school diploma or equivalent
Welders, Cutters, Solderers, and Brazers	\$18.04	\$27.91	High school diploma or equivalent
<b>Business, Marketing and Finance</b>			
Accountants and Auditors	\$35.27	\$59.99	Bachelor's degree
Financial Analysts	\$39.94	\$66.53	Bachelor's degree
Insurance Claims and Policy Processing Clerks	\$18.84	\$29.75	High school diploma or equivalent
<b>Education and Training</b>			
Elementary School Teachers, Except Special Ed.	\$28.23	\$37.10	Bachelor's degree
Secondary School Teachers, Except Special and Career/Technical Education	\$29.01	\$38.49	Bachelor's degree
<b>Health Science</b>			
Licensed Practical and Licensed Vocational Nurses	\$22.54	\$30.70	Postsecondary nondegree award
Medical Assistants	\$15.77	\$20.32	Postsecondary nondegree award
Medical Clinical Laboratory Technologists and Techs.	\$25.35	\$39.47	Associate's degree
Medical Records and Health Information Techs.	\$19.49	\$34.07	Postsecondary nondegree award
Nursing Assistants	\$12.30	\$17.77	Postsecondary nondegree award
Patient Care Technicians (PCT)	\$9.29	\$12.42	High school diploma or equivalent
Pharmacy Technicians	\$15.38	\$22.55	High school diploma or equivalent
Radiologic Technologists	\$28.95	\$39.31	Associate's degree
Registered Nurses	\$35.42	\$48.50	Bachelor's degree
Respiratory Therapists	\$29.73	\$38.28	Associate's degree

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## 2019~2024 InterLink High Demand Occupations Identified by North Central Texas Employers

*Data Source: EMSI, Texas Workforce Commission, Bureau of Labor Statistics, InterLink Regional Employer Labor Market Survey, InterLink Task Forces*

Industry Cluster ~ Job Title	Regional Median Hourly Earnings	Regional Experienced Hourly Earnings	Typical Entry Level Education
<b>Hospitality and Tourism</b>			
Chefs and Head Cooks	\$23.67	\$40.00	High school diploma or equivalent
Food Service Managers	\$21.34	\$43.82	High school diploma or equivalent
<b>Information Technology</b>			
Computer Network Architects	\$56.45	\$79.45	Bachelor's degree
Computer Systems Analysts	\$44.05	\$70.11	Bachelor's degree
Information Security Analysts	\$44.15	\$71.11	Bachelor's degree
Network and Computer Systems Administrators	\$43.37	\$64.56	Bachelor's degree
Software Developers, Applications	\$52.68	\$74.50	Bachelor's degree
Software Developers, Systems Software	\$51.86	\$75.21	Bachelor's degree
<b>Law and Public Service</b>			
Emergency Medical Technicians and Paramedics	\$19.39	\$28.72	Postsecondary nondegree award
Firefighters	\$27.46	\$41.32	Postsecondary nondegree award
Paralegals and Legal Assistants	\$28.32	\$42.96	Associate's degree
Police and Sheriff's Patrol Officers	\$33.43	\$45.16	High school diploma or equivalent
<b>Manufacturing</b>			
Machinists (Including CNC)	\$18.88	\$29.50	High school diploma or equivalent
<b>STEM</b>			
Civil Engineers	\$41.18	\$69.45	Bachelor's degree
Electrical Engineers	\$47.08	\$75.32	Bachelor's degree
Industrial Engineers	\$46.80	\$69.77	Bachelor's degree
Mechanical Engineers	\$43.55	\$75.31	Bachelor's degree
Video Game Designers	\$44.35	\$62.24	Bachelor's degree
<b>Transportation, Distribution and Logistics</b>			
Aircraft Mechanics and Service Technicians	\$29.54	\$47.32	Postsecondary nondegree award
Airline Pilots, Copilots, and Flight Engineers	\$75.51	\$175.49	Bachelor's degree
Automotive Body and Related Repairers	\$18.63	\$31.91	High school diploma or equivalent
Automotive Service Technicians and Mechanics	\$16.05	\$29.73	Postsecondary nondegree award
Diesel Engine Specialists	\$22.35	\$31.54	High school diploma or equivalent
Transportation, Storage, and Distribution Mgrs.	\$43.82	\$76.37	High school diploma or equivalent

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## InterLink Emerging and Evolving Occupations Projected to Offer Future Employment Opportunities

Emerging Occupations are new occupations in the workforce with new titles and skills

Evolving Occupations are traditional occupations whose knowledge, skills, and abilities have changed or evolved

SOC Code/O* Net Code	Occupation Title	Industry
19-1021	Biochemists	Science
19-4021	Biological Technicians	Science
15-1199.08	Business Intelligence Analysts/Operations Research Analyst	Information Technology
15-1199.02 Emerging	Cloud Computing Architects	Information Technology
15-1111 - Emerging	Data Scientists including Advanced Analytics	Information Technology
17-3024	Drone Operators/ Remotely Piloted Vehicle Engineering Techs. (Unassisted Air Vehicles)	Transportation
17-3025.00	Environmental Engineering Technicians	Engineering
19-4092.00	Forensic Science Technicians (Computer & Digital)	Information Technology
17-3029.10	Fuel Cell Technicians	Energy
29-9092	Genetic Counselors	Health Science
19-1029.03	Geneticists	Health Science
Emerging	Infrastructure Integration Specialist	Information Technology
13-2099.02	Market Research Analysts & Marketing Specialists	Business
17-2131.00	Materials/Smart Materials Analysts/Engineers	Science
17-2199.09	Nano Systems Engineers	Engineering
17-3029.12	Nanotechnology Engineering Technicians	Technology
17-3029.11	Nanotechnology Engineering Technologists	Technology
19-4099.01	Quality Control Analysts	Information Technology
19-4099.03	Remote Sensing Technicians	Information Technology
13-2099.02	Risk Management Specialists (Risk Analysts)	Business
17-3024.01	Robotics Technicians – Electro Mechanical Technician	Technology
47-2231	Solar Photovoltaic (Electric) Technicians Installers	Construction
Emerging	Virtual Reality Engineers/Specialists/Technicians	Technology
49-9081	Wind Turbine Service Technicians	Construction

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## Emerging and Evolving Occupations

What do employers really want?  
Basic Entry Level Skills & Attributes  
*Validated by the 2019 InterLink Employer Survey*



**Workplace Basic Skills and Attributes for Entry Level Workers**  
*Regional Employers participating with the InterLink Labor Market Survey ranked the following skills and attributes for entry level employees by their industry need*

<b>Entry Level Workforce Skills/Attributes</b>	<b>%</b>	<b>Entry Level Workforce Skills/Attributes</b>	<b>%</b>
Attention to Detail	88.89%	Multi-tasking	64.10%
Teamwork	87.18%	Technology and Tool Usage	59.83%
Pride in Work	83.76%	Decision-making	58.12%
Integrity	82.91%	Leadership	58.12%
Work Ethic	82.91%	Appreciation of Diversity	53.85%
Professionalism	82.05%	Information Gathering	53.85%
Following Directions	80.34%	Perseverance	50.43%
Problem-solving	80.34%	Creativity	48.72%
Customer Service	78.63%	Conflict Management	42.74%
Time Management	78.63%	Stress Management	41.03%
Initiative	75.21%	Numerical and Arithmetic Application	39.32%
Oral Communication	74.36%	Thoughtful Reflection	32.48%
Willingness to continue learning	74.36%	Resource Allocation	28.21%
Dedication	67.52%	Intellectual Risk-taking	26.50%
Organization	67.52%	Adaptability	0%
Written Communication	66.67%		

# WE'RE FOLLOWING POTENTIAL GAME CHANGERS



**3D/4D Printing**



**Augmented Reality  
In Healthcare**



**Autonomous  
Vehicles (AVs)**



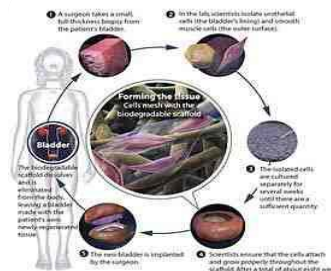
**Bio Technology**



**Drones/UAVs**



**Natural Resources,  
Food & Energy**



**Regenerative  
Medicine/Genetics**



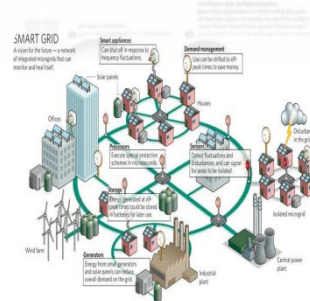
**Risk & Security  
Management**



**Robotics**



**Smart Everything**



**The Grid**



**The Internet  
of Things**

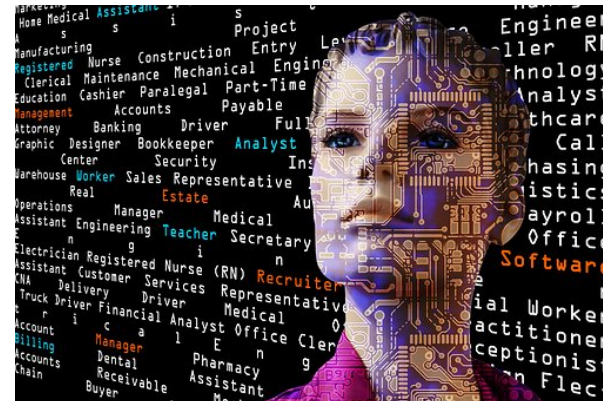


# WE'RE FOLLOWING POTENTIAL GAME CHANGERS

## #13 ~ Blockchain & Crypto Currency



## #14 ~ Automated Workforce Machine Learning





Thank you! I welcome your.....



InterLink



[www.interlink-ntx.org](http://www.interlink-ntx.org)

The online portal to  
Labor Market Resources

Candy Slocum: [www.interlink-ntx.org](http://www.interlink-ntx.org)



# *UNMANNED SUMMIT*

**SOUTHERN METHODIST UNIVERSITY**

## *IN ATTENDANCE*



- ***EDUCATIONAL SERVICE CENTERS***
- ***PUBLIC SCHOOL ADMINISTRATORS***
- ***CHARTER SCHOOL ADMINISTRATORS***
- ***TEACHERS, CTE DIRECTORS***
- ***COLLEGE ADMINISTRATORS***
- ***STUDENTS***

# AGENDA



WHY DO WE NEED AN EDUCATED WORKFORCE?

*Bell Flight, L3 Harris, Little Elm EMT*



Dallas County  
Community College District



LETOURNEAU  
UNIVERSITY



HOW DO WE GET OUR STUDENTS THERE?

*Dallas Co .Community College, Letourneau,  
Dept of Labor*



WHAT CAN WE DO TO GET OUR PROGRAM STARTED?

*Unmanned Safety Institute, Little Elm ISD,  
ELM Aerial Services*

# Survey

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175 EDUCATORS  
POLLED



475 SCHOOL DISTRICTS  
REPRESENTED



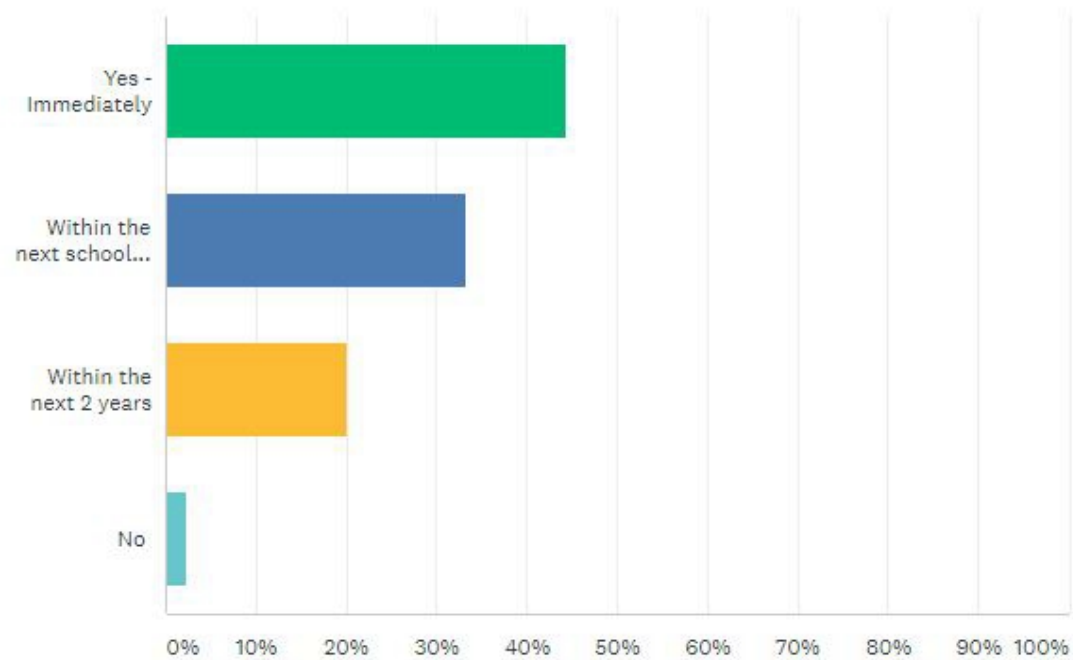
6 SERVICE REGIONS  
REPRESENTED



# UAS PROGRAMS

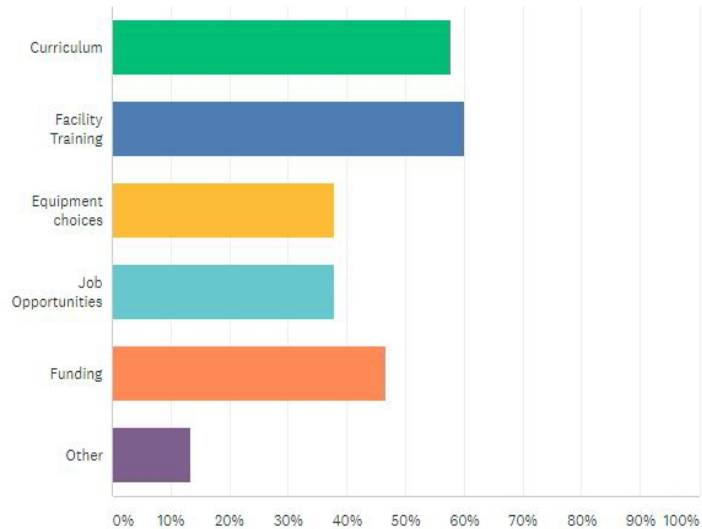
**44% IMMEDIATELY**  
**33% BY NEXT YEAR**  
**20% WITHIN 2 YEARS**  
**3% NO**

Are you building an Unmanned Aviation "Drone" Program for your school?



ANSWER CHOICES	RESPONSES
▼ Yes - Immediately	44.44%
▼ Within the next school year	33.33%
▼ Within the next 2 years	20.00%
▼ No	2.22%

Where do you need the most help to build your program?



ANSWER CHOICES	RESPONSES
▼ Curriculum	57.78%
▼ Facility Training	60.00%
▼ Equipment choices	37.78%
▼ Job Opportunities	37.78%
▼ Funding	46.67%
▼ Other	13.33%

## **PROGRAM ASSISTANCE**

**60% FACILITY TRAINING**

**57% CURRICULUM**

**37% EQUIPMENT CHOICES**

**37% WORKFORCE OPPORTUNITIES**

**46% FUNDING**

**13% OTHER**

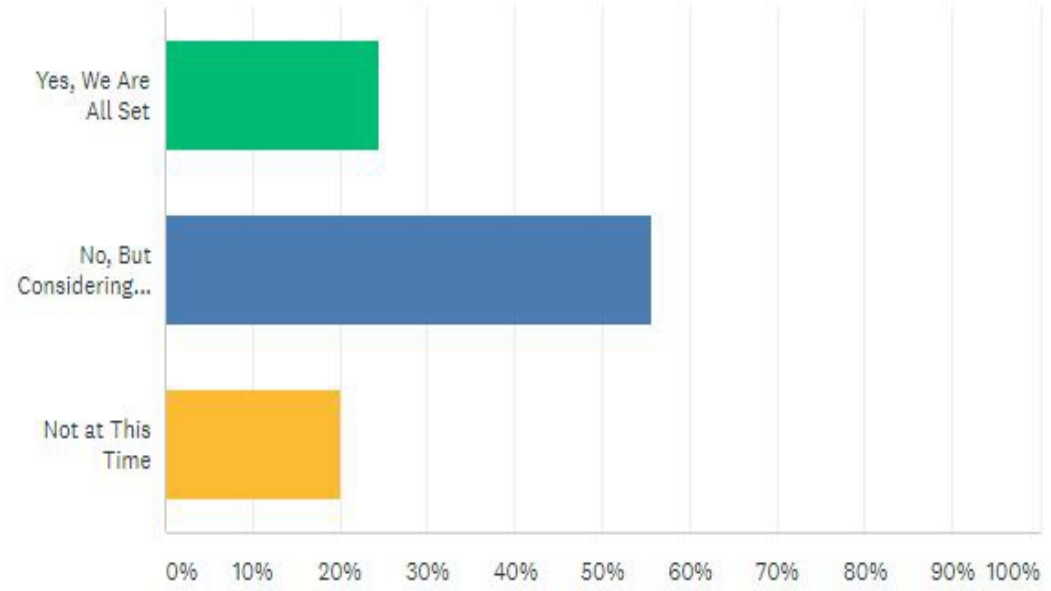
# **CURRICULUM CHOICES**

**25% CURRENT CURRICULUM**

**55% CONSIDERING USI**

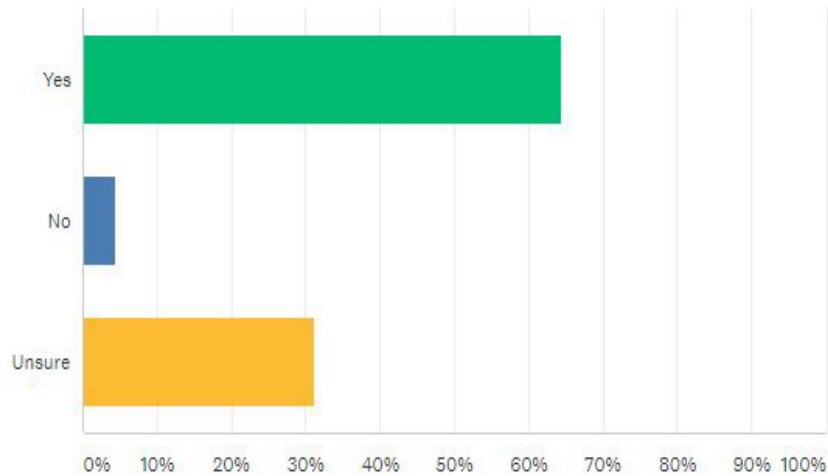
**20% NOT YET DECIDED**

Have you chosen your UAS curriculum?



ANSWER CHOICES	RESPONSES
▼ Yes, We Are All Set	24.44%
▼ No, But Considering Options	55.56%
▼ Not at This Time	20.00%

Would you like help to build out your program?



ANSWER CHOICES	RESPONSES
▼ Yes	64.44%
▼ No	4.44%
▼ Unsure	31.11%

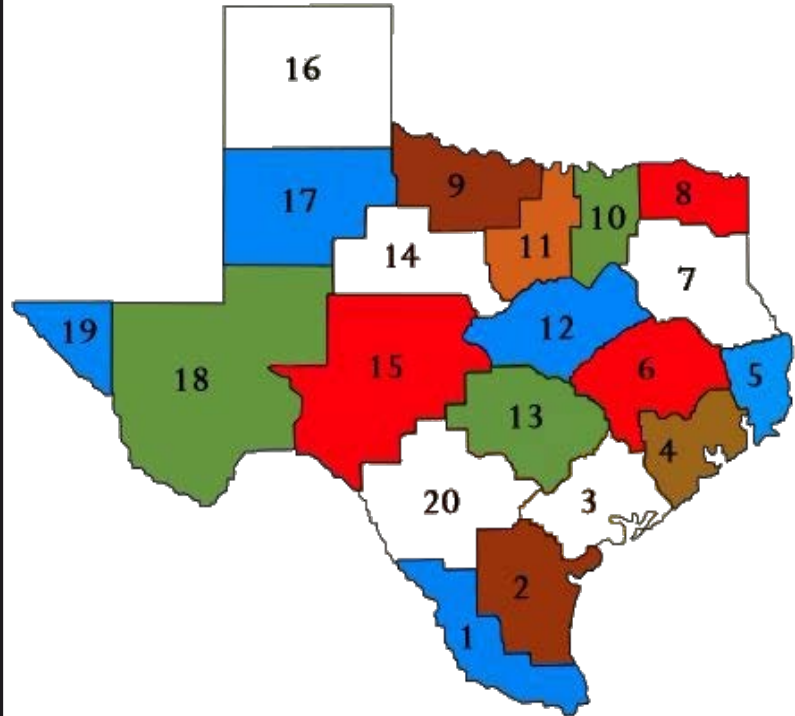
## ***PROGRAM GUIDANCE***

**64% YES**

**31% UNSURE**

**5% NO**

## GOING FORWARD



- **8 EDUCATION SERVICE CENTERS**
- **516 SCHOOL DISTRICTS**
- **8,556 SCHOOLS**
- **2,929,223 STUDENTS**

**AND GROWING!**



Cumulus Technologies, Inc.

[www.cumulustechnologiesinc.com](http://www.cumulustechnologiesinc.com)

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# UAS Safety and Integration Initiative

Know Before You Fly “Your Drone” Workshops




# What are the Workshops

- Six workshops for general public interested in recreational and commercial UAS users
- Locations throughout the Dallas-Fort Worth region
- 150 people per workshop (1,800 total)
- Promote FAA Know Before You Fly resources
- Promote safety
- Promote the UAS industry
- Promote various regional UAS initiatives and resources
- Improve public perception
- First workshop **November 16, NCTCOG Offices**

# Workshop Sponsorship Levels

## LEVELS

- 
- |   |          |   |
|---|----------|---|
| 1 | \$500    | <ul style="list-style-type: none"><li>• LOGO ON AGENDA, WEBSITE AND SOCIAL MEDIA</li></ul>  |
| 2 | \$1,000  | <ul style="list-style-type: none"><li>• LEVEL 1 +</li><li>• MENTIONED IN INTRO</li><li>• ITEMS IN GIFT BAG</li></ul>  |
| 3 | \$2,500  | <ul style="list-style-type: none"><li>• LEVEL 1 AND 2 +</li><li>• BOOTH AT WORKSHOP*</li><li>• UP TO 10 SPONSORS</li></ul>  |
| 4 | \$5,000  | <ul style="list-style-type: none"><li>• LEVEL 1, 2, AND 3 +</li><li>• SEAT ON THE Q AND A PANEL</li><li>• UP TO 3 SPONSORS</li></ul>  |
| 5 | \$10,000 | <ul style="list-style-type: none"><li>• LEVEL 1, 2, 3 AND 4 +</li><li>• LOGO ON FRONT OF ALL MARKETING MATERIALS GIVE</li><li>• OPENING PRESENTATION/REMARKS AND FEATURED ON THE WOMEN AND DRONES PODCAST</li><li>• 1 SPONSOR</li></ul> |

\*BOOTH SIZE SUBJECT TO VENUE LOCATION

Know Before  
You Fly  
Your Drone

UAS