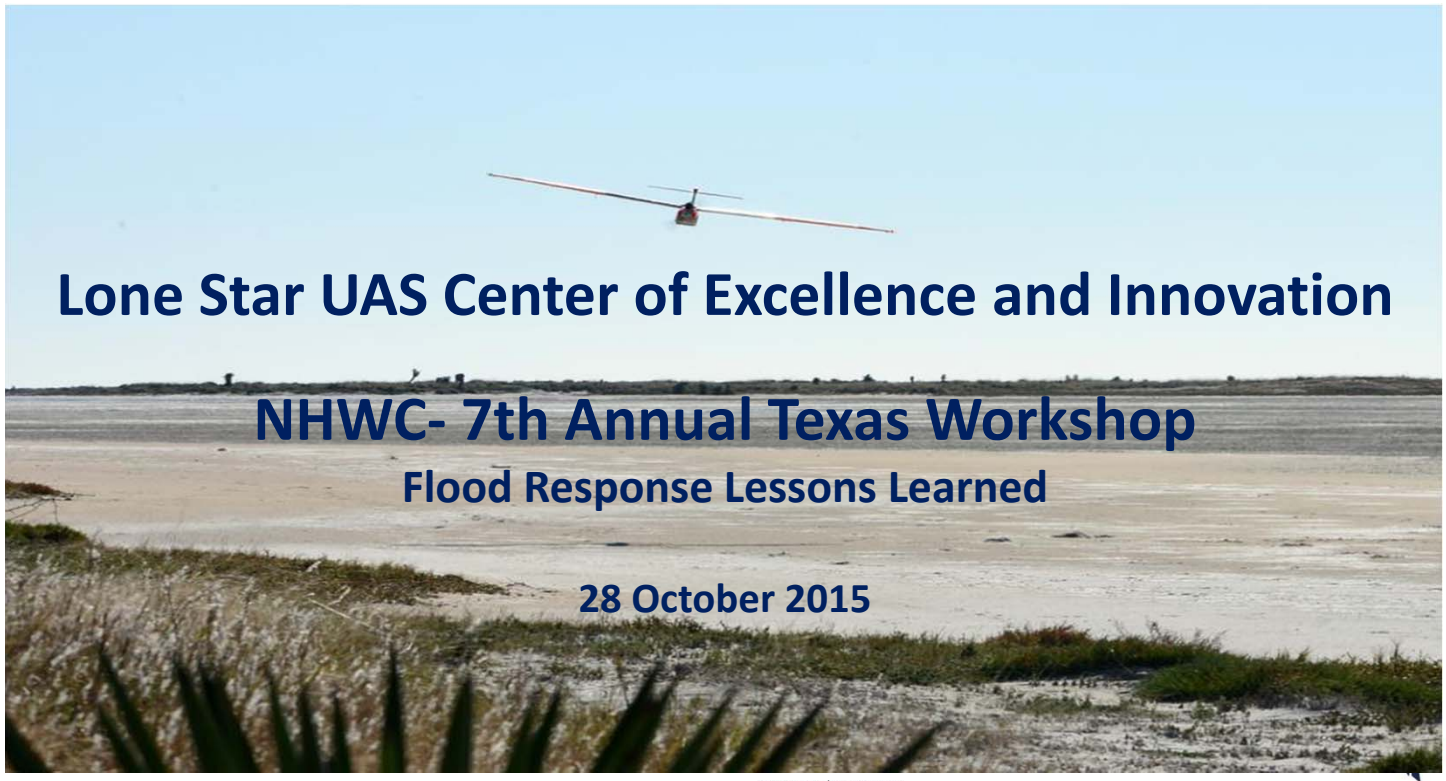
LONE STAR UAS
CENTER OF EXCELLENCE AND INNOVATION

TEXAS A&M UNIVERSITY
CORPUS CHRISTI



Lone Star UAS Center of Excellence and Innovation

NHWC- 7th Annual Texas Workshop

Flood Response Lessons Learned

28 October 2015

Camber

TEXAS A&M ENGINEERING
TEES

LONE STAR UAS
CENTER OF EXCELLENCE AND INNOVATION

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"Lone Star" Value Proposition

Represent our client's interests in UAS: technology R&D, evaluation, credentialing, standards development and commercial operations.

Enabling measurable business process enhancement resulting in improved safety and cost savings.

Our UAS Offerings Include:

- Impartial-UAS Subject Matter Expertise
- Life-Cycle Program Management Services
- R&D and Flight Test Site Operations
- Commercial Operations Management

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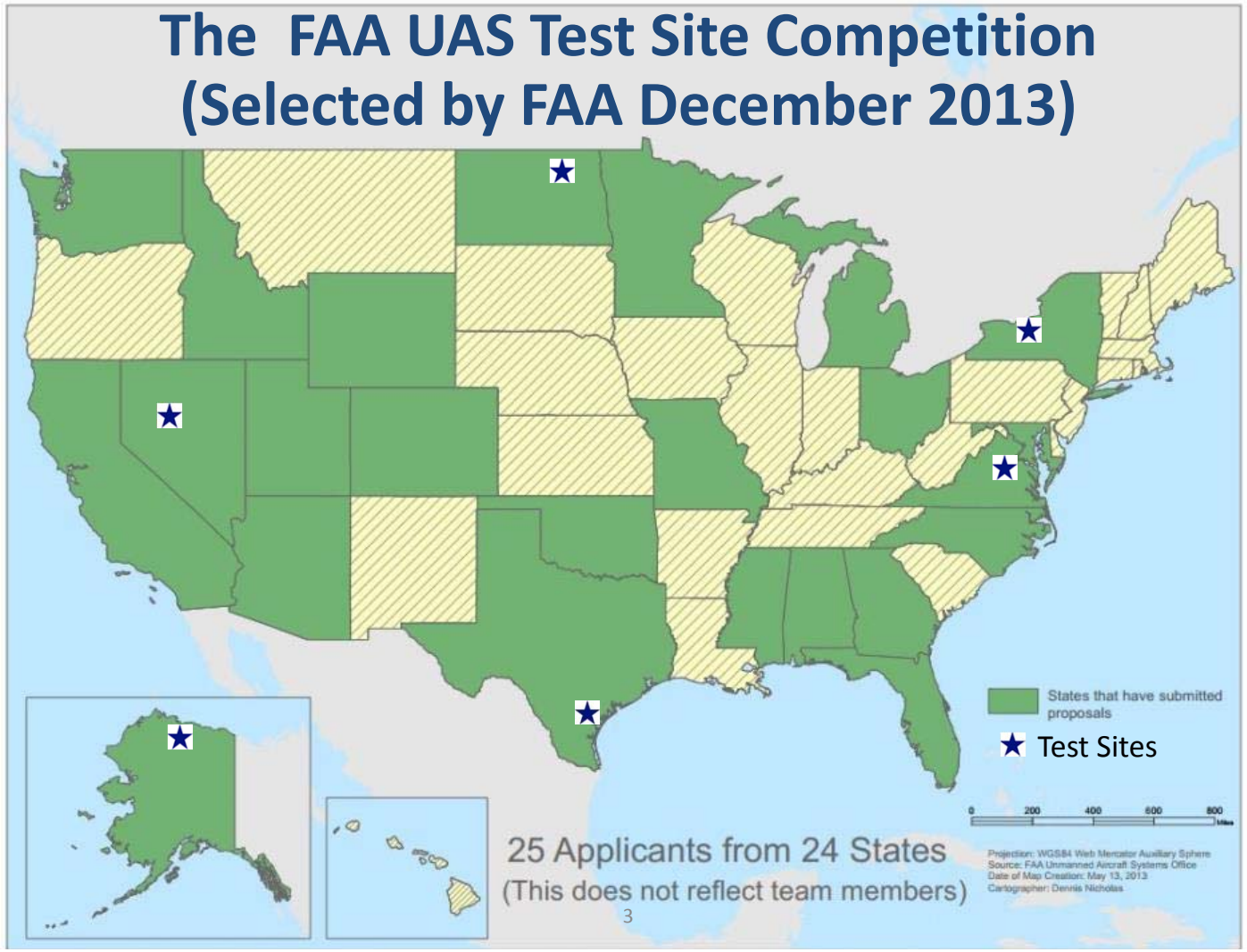
The FAA UAS Test Site Competition (Selected by FAA December 2013)




NOT TEXAS
TEXAS

Texas State Agency Partners and Interest

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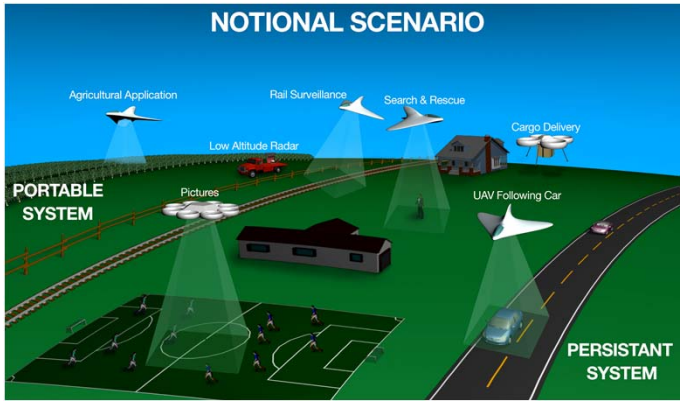
Test Site Purpose

Stand Up And Operate A FAA UAS Test Site Designated To **Safely Integrate *Public And Civil* UAS Operations Into The National Airspace**

Provide FAA R&D And Operational Data To Facilitate The ***Development Of Procedures, Standards And Regulations*** For Safe UAS Operations

Serve As **The Engine For Economic Development** On Behalf Of The Governor And The State Of Texas



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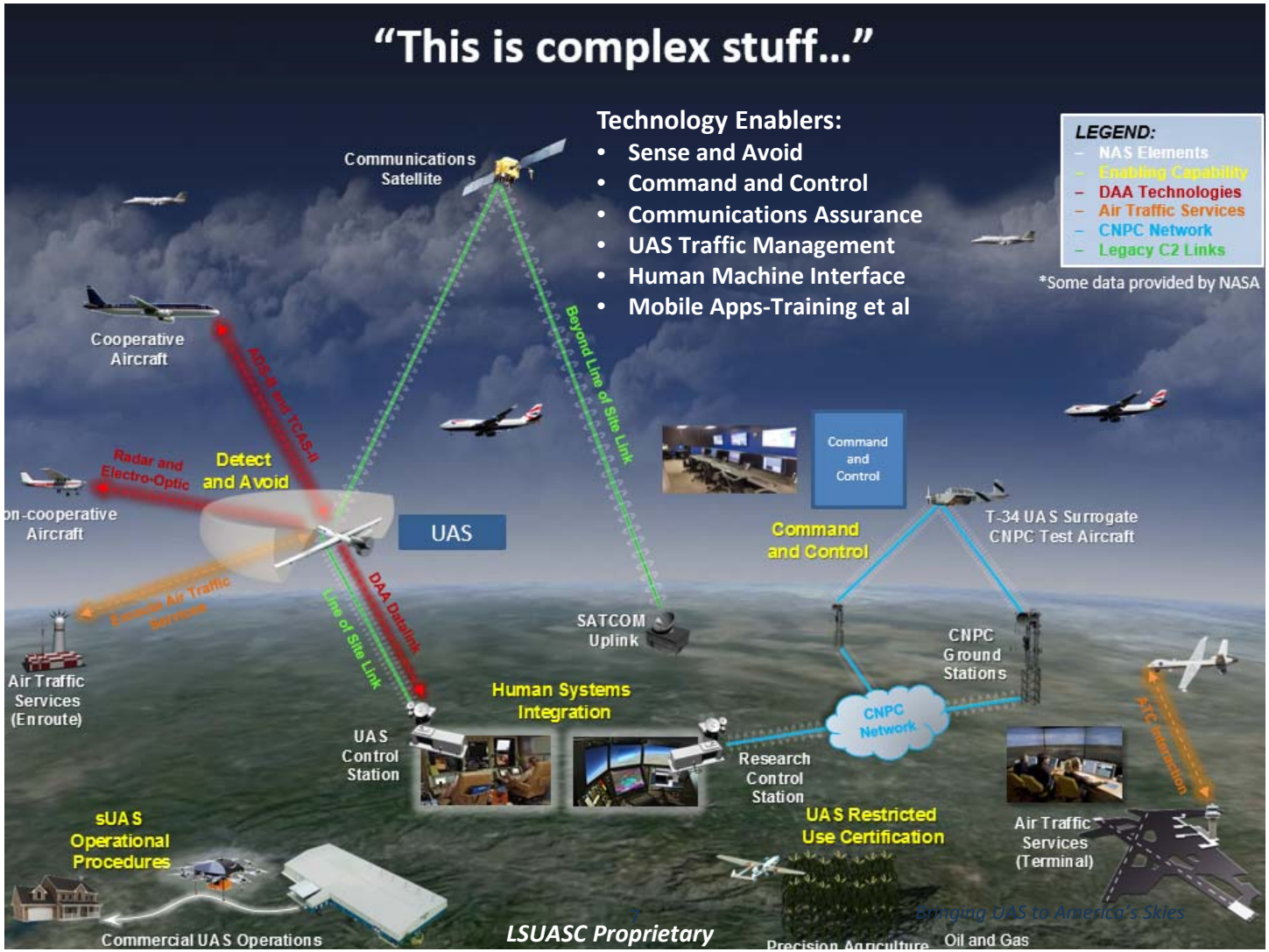
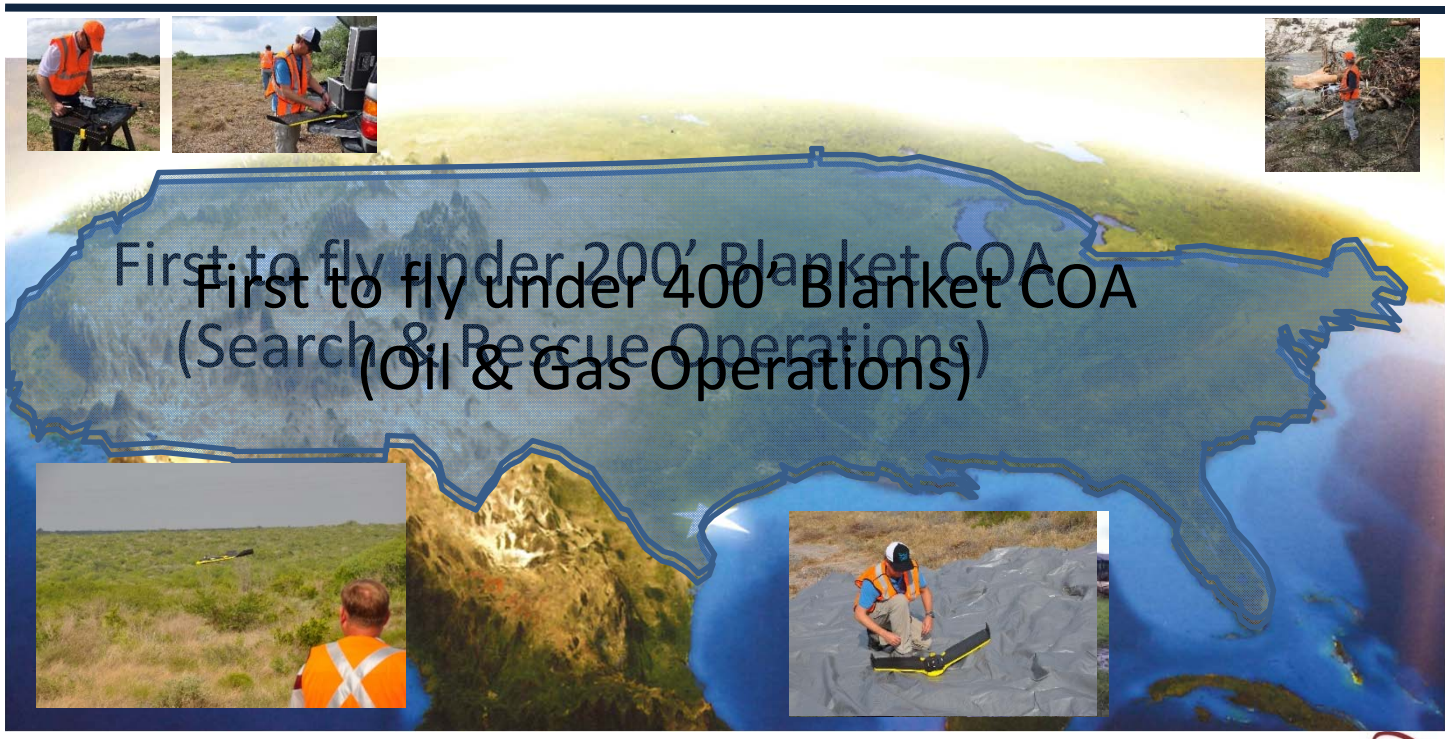

"This is complex stuff…"
Technology Enablers:
• Sense and Avoid
• Command and Control
• Communications Assurance
• UAS Traffic Management
• Human Machine Interface
• Mobile Apps-Training et al
LEGEND:
– NAS Elements
– Enabling Capability
– DAA Technologies
– Air Traffic Services
– CNPC Network
– Legacy C2 Links
*Some data provided by NASA
Communications Satellite
Cooperative Aircraft
ADS-B and TCAS-II
Beyond Line of Site Link
Radar and Electro-Optic
Detect and Avoid
Non-cooperative Aircraft
UAS
Command and Control
Command and Control
T-34 UAS Surrogate CNPC Test Aircraft
External Air Traffic Services
DAA Datalink
Line of Site Link
SATCOM Uplink
CNPC Ground Stations
Air Traffic Services (Enroute)
Human Systems Integration
UAS Control Station
CNPC Network
Research Control Station
ATC Interaction
sUAS Operational Procedures
UAS Restricted Use Certification
Air Traffic Services (Terminal)
Commercial UAS Operations
LSUASC Proprietary
Bringing UAS to America's Skies
Precision Agriculture
Oil and Gas

Lone Star Operations Today

Providing the FAA operational data through R&D to facilitate the **development of procedures, standards and regulations** for safe UAS commercial operations in the NAS

Lone Star Accomplishments



Lone Star Range Offering

Search and Recovery Operations

Flood Support- Central Texas 2015
Lessons Learned

- **Team Composition:**
  - Mission Commander
  - Pilot in Command/Supplemental Pilot
  - Visual Observer (LOS and Comms Required)
  - Safety Officer and First Aid POC
  - Environment Orientation and Coordination POC
- **Contact Information Vital**

Flood Support- Central Texas 2015
Lessons Learned

Emphasize Safety Tenants:

- Safety Briefing prior to all operations-Air or Land
- Check before deployment and carry First Aid equipment
- Pack and prepare dedicated Food and Water
- Ensure all Team Members are properly equipped:
  - Field clothing
  - Footwear (Boots, Chest Waders, Hip Boots)
  - Headlamps for night ops
  - Rain Gear

Flood Support- Central Texas 2015
Lessons Learned

- Coordinate “In Advance” with TDEM, TTF1 and the appropriate County Seat IC
- Review Safety Management System Prior to Deployment
- Coordinate ASAP w/the IC for FAA approved E-COA and TFR
- Coordinate, Plan, Check, Adjust, Confirm Prior to Operations
- Minimize Logistic Footprint To Optimize Responsiveness
- Confirm Weather and Environment Prior to Operations
- Establish and Rehearse Communication Plan
- Think-Act-Do Safety

Flood Support- Central Texas 2015
Lessons Learned

- Be prepared for the unexpected.
- Anticipate fellow Texans arriving on scene offering to help.
- Ever Shifting Environment:
  - Debris Shift
  - Unanticipated People and Vehicles
  - Wandering-alarmed wildlife
  - Property and Victim Effects
- Crowded and complicated airspace
  - Helicopters and UAS
  - Volunteer AC, First Responder AC

Flood Support- Central Texas 2015
Lessons Learned

Minimize the Logistics Footprint and Environmental Impact:

- Limited Launch & Recovery Sites available
- Transportation in and around area may be dangerous
- Small, agile-well equipped teams are essential
- Double check communications
- Be prepared to pack gear
- Emergency Gear
- Recognizable Clothing
- 4x4-Winch and Cable

Flood Support- Central Texas 2015
Lessons Learned

UAS Platform and Payload Findings

- Rotorcraft offer operational support flexibility
- Train to fly manually
- Payloads with “zoom” capabilities beneficial
- Different payloads have different impacts; Still images versus video
- Fixed wing aircraft can be used for overall mapping

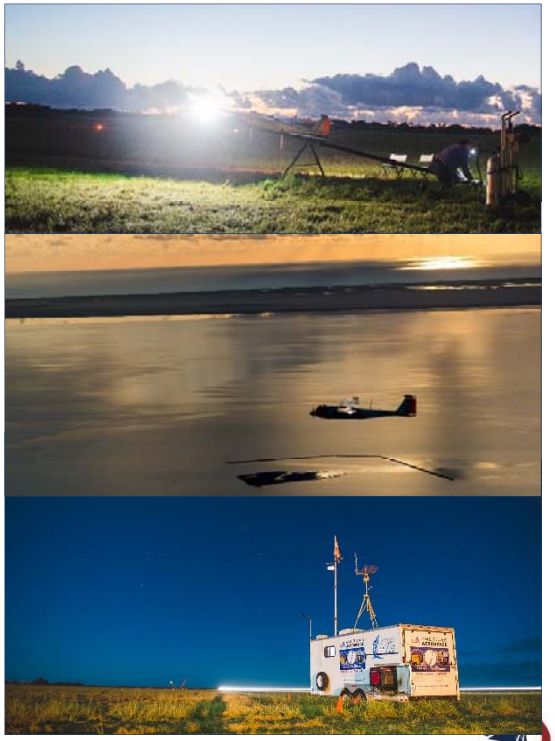
Flood Support- Central Texas 2015
Lessons Learned

Plan-Rehearse Coordinate-Communications

- Suitable (VHF) Radios w/backup batteries
  - Handheld, hands free equipped
  - Comms on Air Band VHF
  - Keep all dry throughout
- Develop-Train-Rehearse Hand Signals
- Plan to communicate with local authorities
- Plan to communicate with land owners
- Coordinate with IC Structure:
  - National
  - State Task Force
  - Volunteers
  - Dog Teams

Search and Recovery Operations

Night Operations



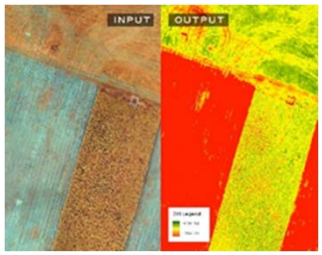
Lone Star UAS Platforms

Flight Data Provided for R&D Support
Unmanned aircraft system/registration #
Type of operation (civil or public)
Test range
Airspace categorization and altitudes
Flight take-off/landing times
Weather data
Launch/recovery locations
Flight crew qualifications
Incidents/accidents (if necessary)

Lone Star UAS Payloads and Sensors

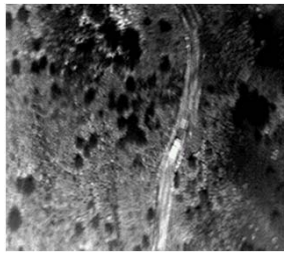
Visual (RGB)

- Visual (RGB) – Surveying/mapping, visual inspections, security, media, asset tracking, wildlife conservation
- Multispectral – Plant phenotyping, precision agriculture, topography
- Infra-Red – Temperature gradient, pipeline inspection, HAZMAT inspection, search & rescue
- UV Sensor – Fire risk assessment, flame detection, radiation measurement
- LiDAR – High resolution mapping, proximity measurements

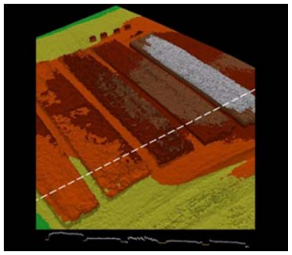


Multispectral

Infra-Red



UV

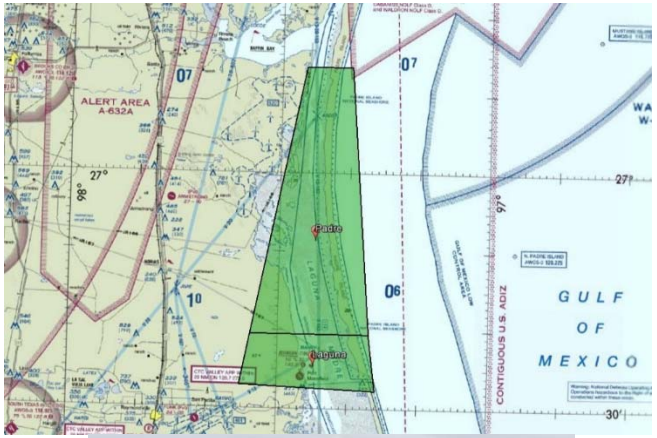


LiDAR

And the list continues to grow…

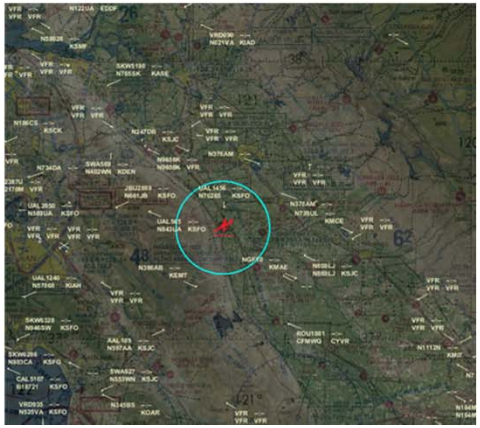
Lone Star Accomplishments

- First to fly between multiple COAs (Padre and Laguna test ranges)



Lone Star Accomplishments

First to utilize situational awareness tool during flight (Symphony® RangeVue™)



First to use ground-based detect and avoid radar (SRC Inc LSTAR®)

First to fly a large, fixed-wing UAS (greater than 55 lbs.)

Lone Star Accomplishments

First to develop an **operational** Mission Control Center (MCC)

- Fully functional test control facility
- UAS metadata and sensor collection
- Human-machine interface

Lone Star Accomplishments

First to fly and send data from the MCC to NASA's UAS Traffic Management System (UTM); recently awarded Task Order #2

First to demonstrate UTM @ NASA Ames Research Center on August 28, 2015

The LSUASC has been awarded multiple research grants from NASA!

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