

Activities at Lone Star UAS Test Site and TAMUCC

An update

Scientific Committee for Oceanographic Aircraft Research

August 22, 2018

Presenter:

Michael Starek

Associate Professor

Civil and Geospatial Engineering

FAA Test Site: ~3200 flights and 250+ customers (to date)



**Update information provided by
Jerry Hendrix, Executive Director of LSUASC**

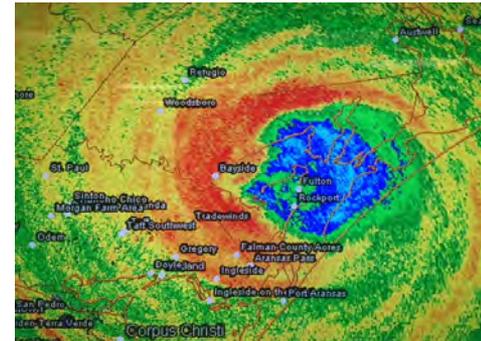


Hurricane Harvey

The Need

- Damaged areas in Texas (Storm Surge, Hurricane/Tornado Wind Damage, Flooding)
- All **Emergency Operations Centers (EOC)** were functional in an area the size of the state of New York

– 54,000 square miles



- Flooding in Houston
- 1212 Square Miles



Hurricane Harvey

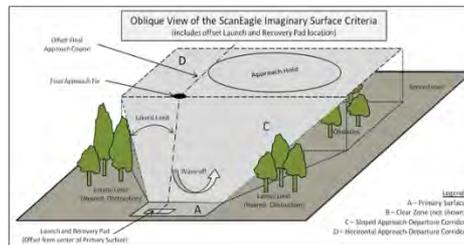
Missions

- LSUASC provided an Emergency Response UAS Initial Operational Capability document to the state EOC/AOC
- Provided reconnaissance assistance to the County/State EOCs
 - Aransas County Search, Rescue and Recovery
 - Survey of the Port of Corpus Christi and ship channel
 - Houston flooding survey in west Houston areas
 - Survey for the General Land Office (GLO) of oil platforms from barges
 - Assessment of a Port Mansfield ship channel damaged vessel



BVLOS Operations

- Temporary Flight Restriction (TFR) and ECOA approved
 - State, FAA, US Navy, Boeing, Port of Corpus Christi, USACE, LSUASC
 - ScanEagle UAS operating with a transponder & call sign
 - Flight area Aransas County / Rockport TX
 - Part 107 Waivers approved to 14 CFR Part 107.31, 107.41, 107.51



FAA FORM 7711-1 UAS PART 107 AUTHORIZATION
2017-AHQ-052-P107



 <p>FEDERAL AVIATION ADMINISTRATION</p>	<p>FEDERAL AVIATION ADMINISTRATION SYSTEM OPERATIONS SECURITY</p>	<p>FAA REQUEST FOR AN ADDENDUM TO CURRENT COA/FAA EXEMPTION (E-COA) FOR UAS FLIGHT OPERATIONS</p>
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Operators Name, Organization/Agency and Address:

**Ft Bend County TX / US Army Corps of Engineers / A&M Lone Star
State UAS Center of Excellence**



Hurricane Harvey

Regulatory Lessons Learned

- It is imperative to get Temporary Flight Restrictions (TFRs) and eCOAs/ Special Governmental Interest COAs in place as soon as possible
- Part 107 Waivers can be obtained quickly during a disaster (BVLOS, Operations over People, Class Airspace)
- Understanding the standup of national and regional support from the FAA is imperative
- Work within incident structure → **No** research!
- Credentialing of operators to support disasters is critical
- Future rescue, recovery and resiliency planning is needed
- **Activate a BVLOS eCOA along the coast of Texas prior to landfall**





What is next for Texas!



- TAMU System was chartered by the Governor to lead Rebuild Texas
- All disasters start and end at the local level
- Texas recognized the need of **UAS** as part of the State emergency “air” response
- The LSUASC has now been selected as Texas Task Force Air Wing 1

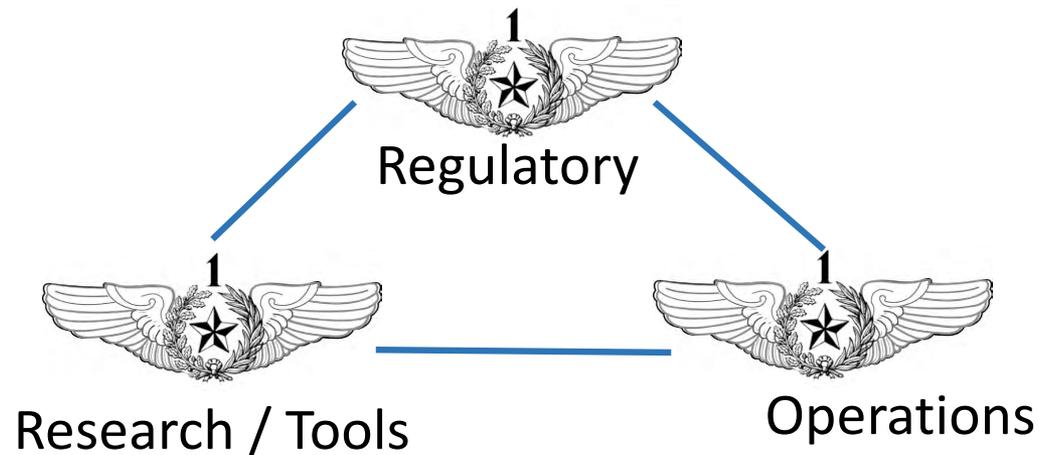


Driving Force: Controlled, organized and **safe** UAS operations in the state of Texas in the midst of Disaster Response.



Texas Task Force Air Wing 1 Way Ahead

- Establish operational paradigms and finalize arrangements across Texas
- Establish Emergency Operations Center Air Boss for UAS
- Conduct research and acquire environmentally hardened operational aircraft
- Create a backend data repository and central imagery storage node for near-real time analysis and support planning



A photograph of a dirt road in a coastal area. The road is paved and runs from the foreground towards the horizon. On the left side of the road, there is a line of utility poles with power lines. The ground is sandy and covered with sparse vegetation, including yellow wildflowers and cacti. In the distance, there are palm trees and a body of water. A drone is flying in the clear blue sky on the right side of the image.

UAS Activities at TAMUCC



max of Cat 1 wind gusts on campus





Geotechnical Extreme Events Reconnaissance
Turning Disaster into Knowledge
Sponsored by the National Science Foundation

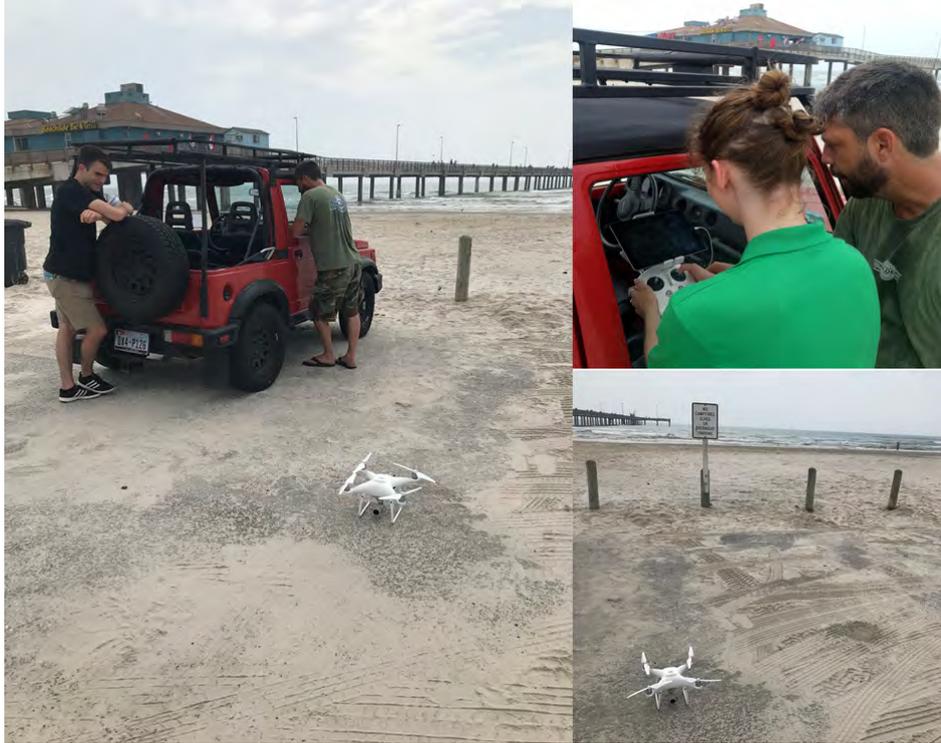


Salt Lake Neighborhood, Rockport TX

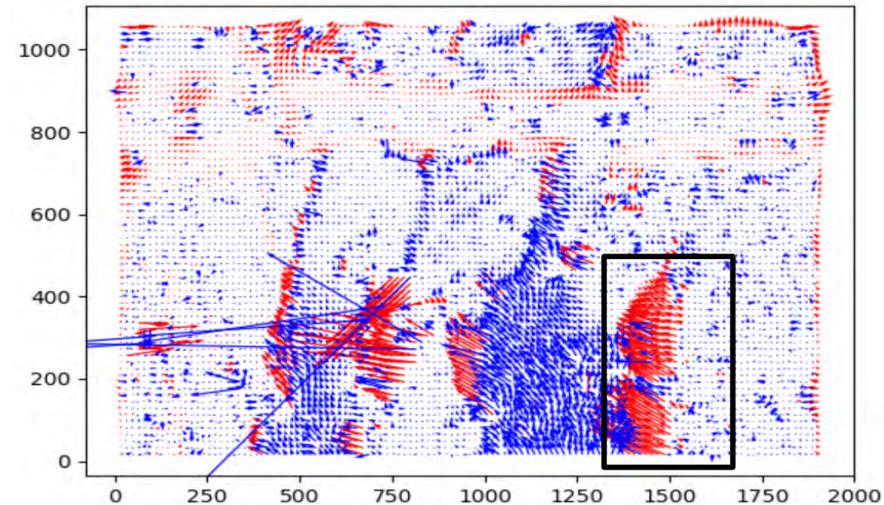
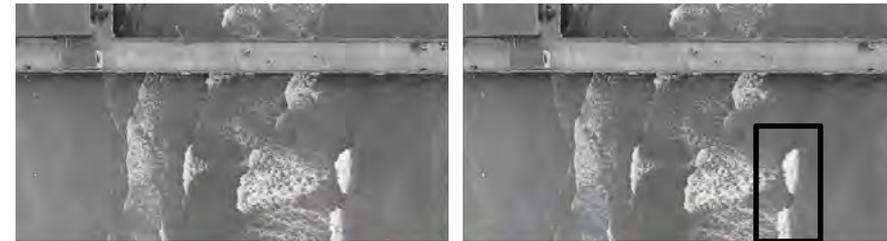


Particle Image Velocimetry (PIV) for Surf Zone Wave Properties

Summer 2019 DILL on Computing for UAC



Experiment conducted at Bob Hall Pier, TX



1. Python PIV sequential image pair
2. Image stabilization
3. Estimate velocity vector field

UAS and TLS survey of Eleuthera, Bahamas

January, 2018



Study Purpose: determine potential of massive storm waves to transport “boulders”, mapped ~9 linear miles of coast

NSF MRI Grant: Development of an Integrated Gas Monitoring and Source Identification UAS for Exploration, Compliance and Assessment

Payloads



5.8 kg

Microportable Greenhouse Gas Analyzer (CH_4 , CO_2 , H_2O)



Sony A6000 with GeoSnap Pro for smoothed orientation/positioning

Penguin B UAV



UAV Factory

PARAMETER	VALUE
MTOW	21.5 kg
Empty Weight (excl fuel and payload) ¹	10 kg
Wing Span	3.3 m
Length	2.27 m
Wing Area	0.79 m ²
Powerplant	2.5 hp
Max Payload	10 kg
Takeoff method	Catapult, Runway or car top launch

Performance:

PARAMETER	VALUE
Endurance ²	20+ hours
Cruise Speed	22 m/s

Flight Operations Training completed at the UAV Factory in Latvia, May 2018



Dr. David Bridges, Mo Griffin (Lone Star)

Sensor integration in progress



Lidar + UAS

Riegl VUX-LR

LASER PROPERTIES	Class 1 (eye safe), 1550 nm
RANGE MIN	5 m
LASER BEAM FOOTPRINT	50mm @ 100m, 150mm @ 250m, 250mm @ 500m
MAX EFFECTIVE MEASUREMENT RATE	750,000 meas./s
FIELD OF VIEW	360°
ACCURACY	15 mm one Sigma @ 150m



- Up to 1350 m range @ 60 reflectivity
- Multi-echo detection > 10 +returns
- 7.7 lbs (3.5 kg), 905 nm



- two batteries in series
12-cell 44,000 mAh
- ~20 lbs (9 kg) weight

Pulse Aerospace Vapor 55



SPECIFICATIONS

Gross Weight	55 lbs
Useful Load - (Battery + Payload)	34 lbs
Allowable Payload - With Full Endurance*	< 11 lbs
Max Cruise Endurance - With Full Payload	60 Minutes
Max Hover Endurance - With Full Payload	45 Minutes



Original IMU and Replacement



Litespeed IMU-μIMU (20 Hz vibration issue)

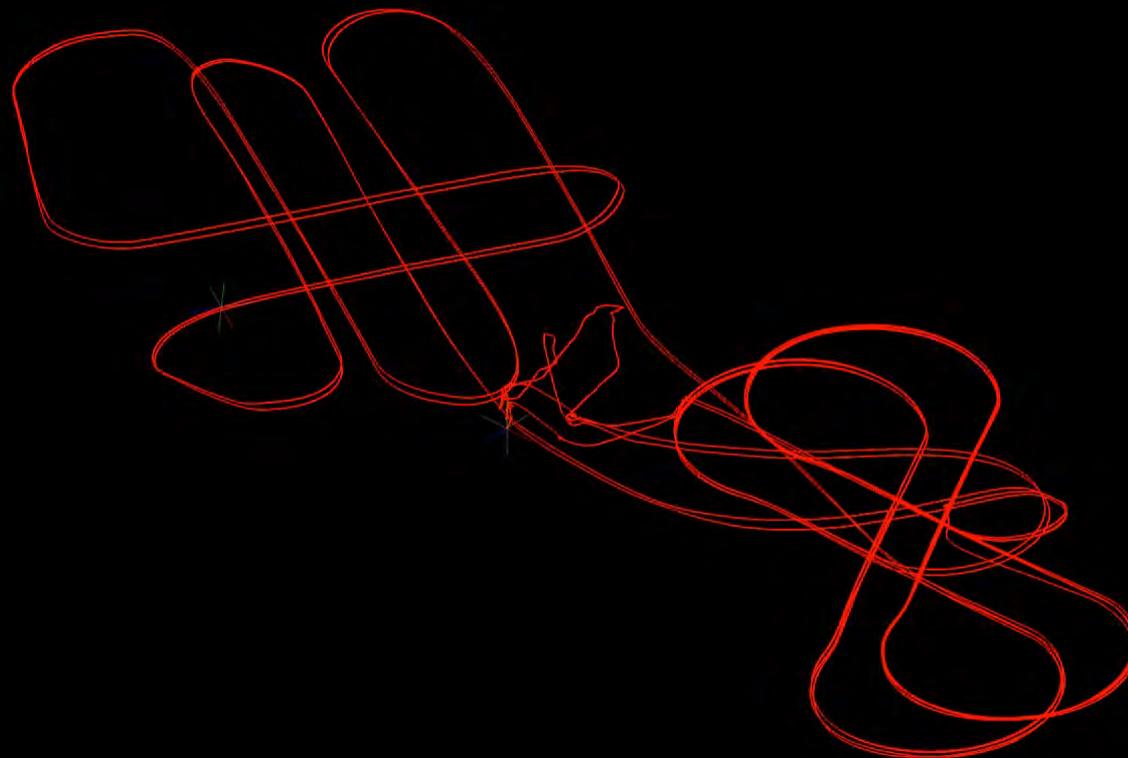


KVH 1750 IMU

	Litespeed IMU-μIMU	KVH 1750 IMU
Type of gyro	MEMS	Fiber Optic
Gyro bias stability (°/hr)	6	0.05
Gyro Bias offset (°/hr)	10	2
Angular Random Walk (°/√h)	0.3	0.012
Accel bias offset (mg)	3	2
Velocity random walk (mg/√Hz)	0.25	0.12
Data rate	200 Hz	200 Hz
Dimension (Ø x H)	85 x 60 mm	74 x 89 mm
Weight (g)	680	700



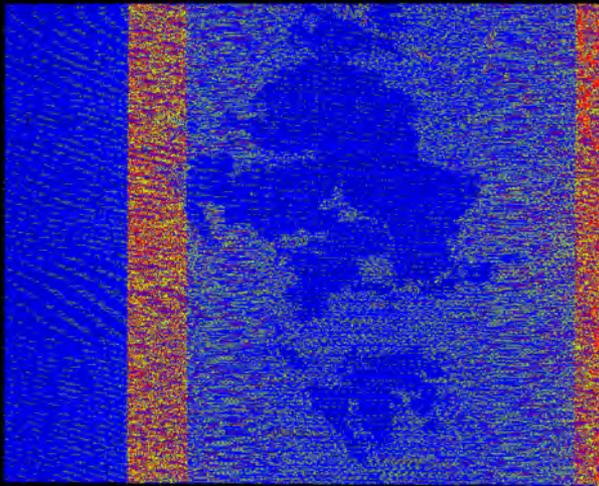
Real time (wifi transmitted) Point Cloud using onboard INS solution



Comparison

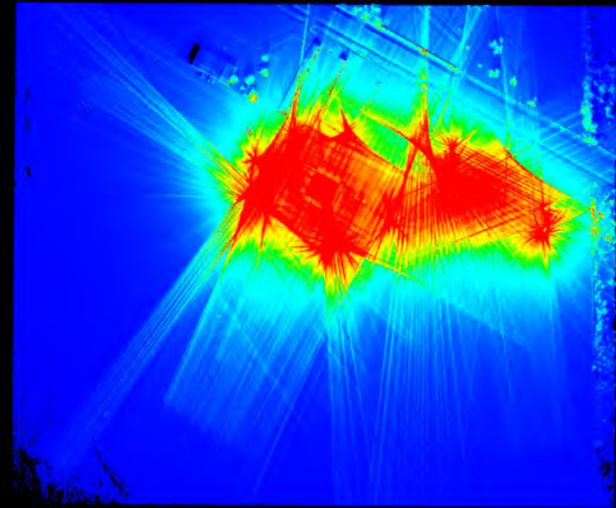
Airborne versus UAS

2006 FEMA Airborne Lidar Survey



Airborne = 1 pts/m²

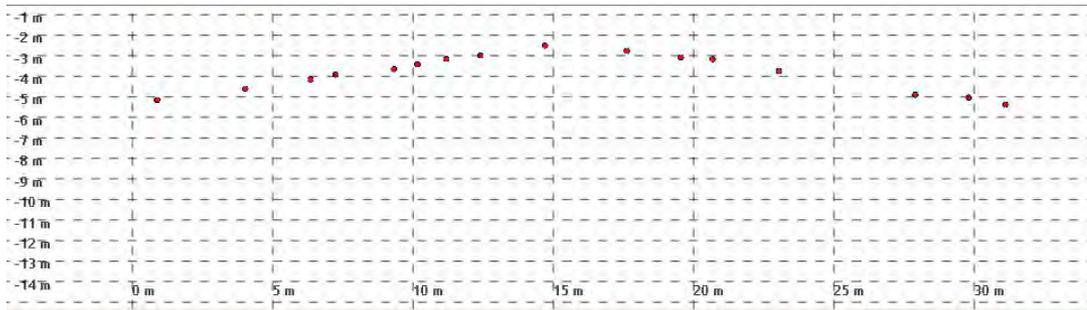
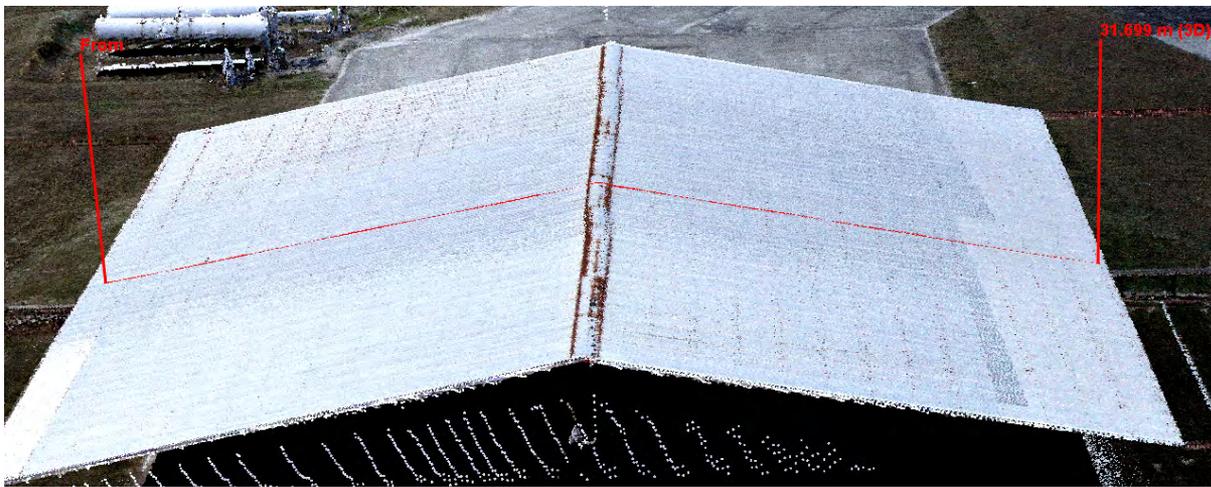
2018 UAS Lidar Survey



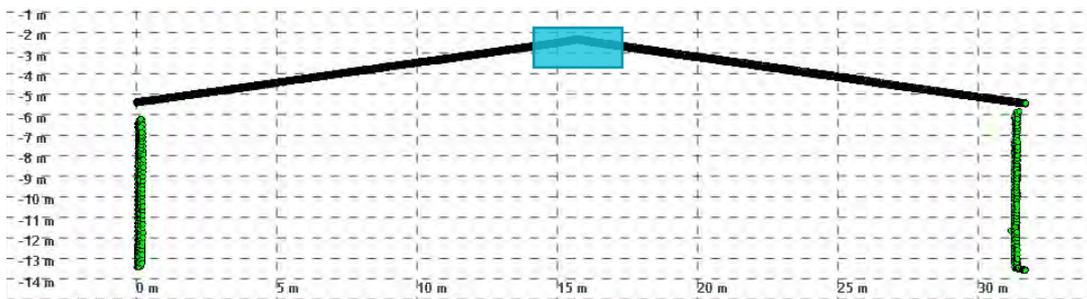
> 3000 pts/m² in overlap zone

3D Structure

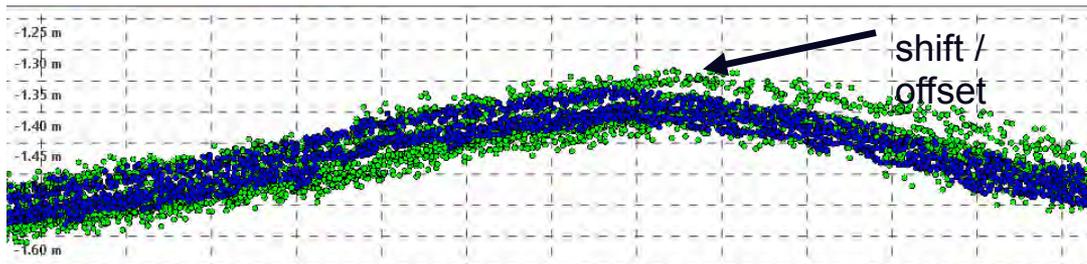




Airborne



UAS
Post-processed
(all flights)



UAS
(both
flights)

Thank you SCOAR!



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