LONE STAR UAS
CENTER OF EXCELLENCE AND INNOVATION

Bringing UAS to America's Skies

Activities at Lone Star UAS Test Site and TAMUCC

An update
Scientific Committee for Oceanographic Aircraft Research
August 16, 2017

Presenter:
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Assistant Professor
School of Engineering and Computing Sciences

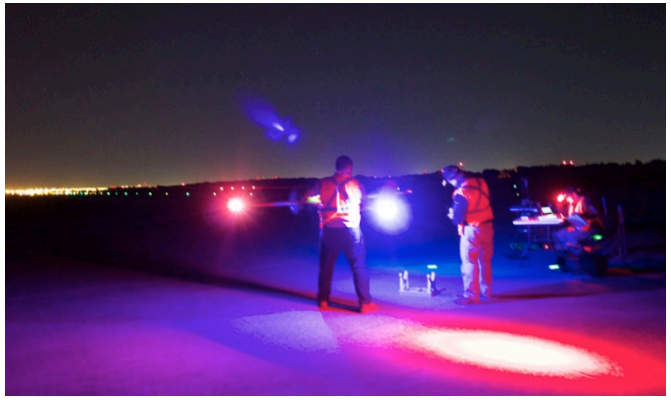
Camber
TEXAS A&M UNIVERSITY CORPUS CHRISTI
TEXAS A&M ENGINEERING TEES

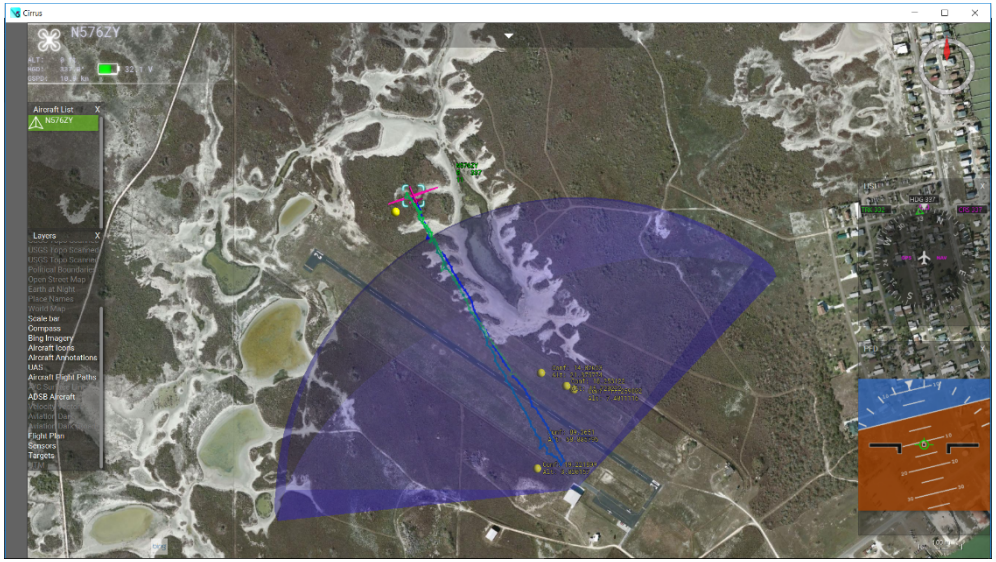
LSUASC Recent Highlights (since August 2016)

NASA Unmanned Traffic Management (UTM) Technical Capability Level 2 Demonstration Flights	2016-10
Counter UAS Missions at DFW Airport for the FAA	2017-04
Second Annual Texas UAS Summit and first Student Poster Competition in Dallas, Texas	2017-05
Second Space Act Agreement with NASA signed for work on autonomous software architectures for small UAS	2017-05
Memorandum of Agreement signed with Quebec UAS Centre of Excellence and Texas A&M Engineering Extension Service	2017-05
NASA UTM: Air-to-air detection of sUAS by a radar on a sUAS	2017-06

UAS Detection Mission at DFW Airport (April 2017)

- UAS detection operations for FAA's Pathfinder 4 project
- Flights occurred at Dallas/Fort Worth International Airport using multiple drones
- LSUASC's first operation in Class B airspace





UAS Detection Mission at DFW Airport

List of Partners:

Gryphon Sensors * FAA * DHS * DoD * FBI * FCC * CBP * DOI * DOE * NASA * DOJ * BOP * USS * USCP * DOT

NASA EVAA: Autonomous Architectures

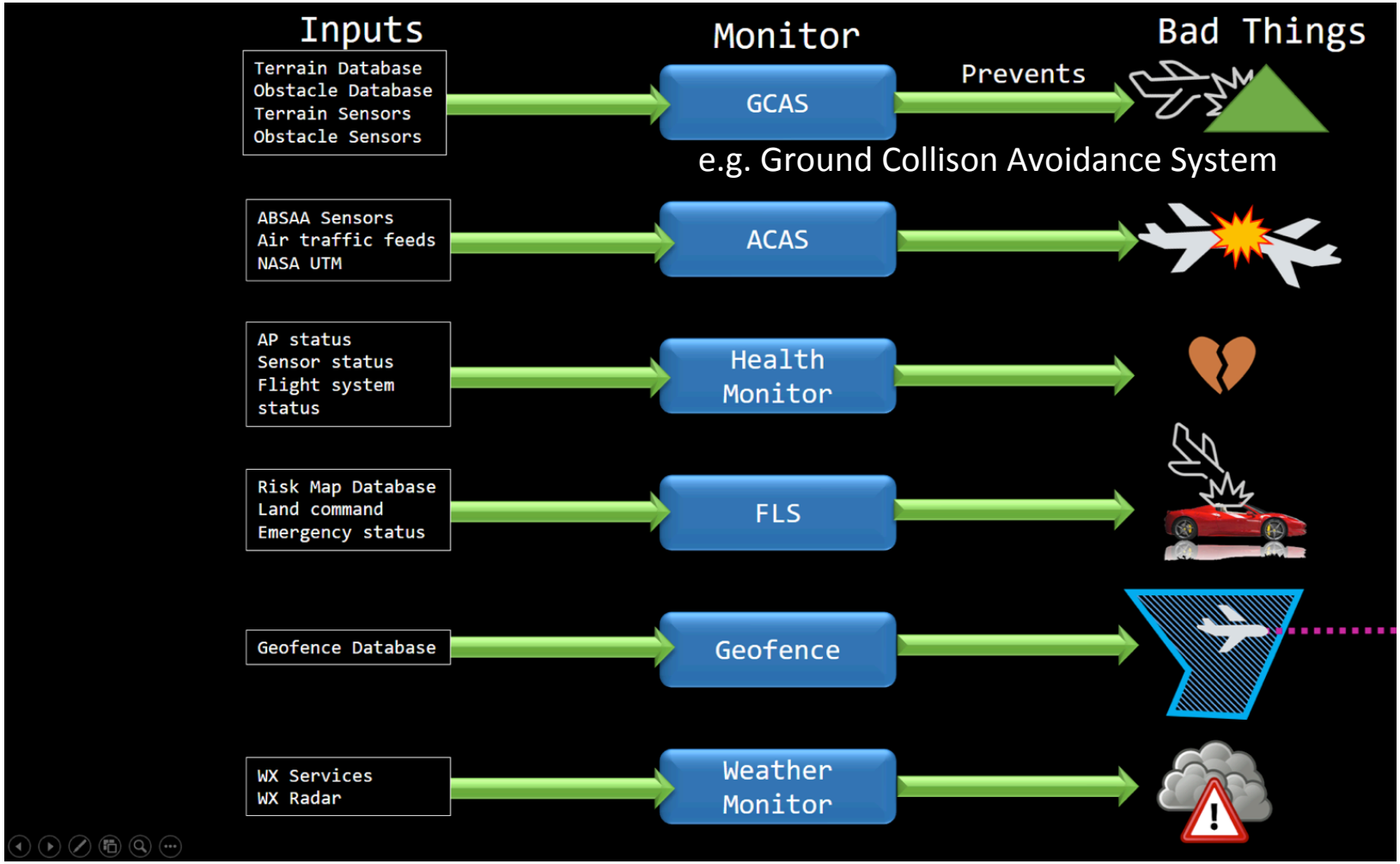
Expandable Variable Autonomy Architecture (EVAA)

- Need for 'trustworthy' autonomous systems
  - Package delivery
  - Surveying
  - Inspection
  - BVLOS/BRLOS
- Challenge of verification & certification of autonomous systems
- Multi-monitor run-time assurance (MM-RTA)

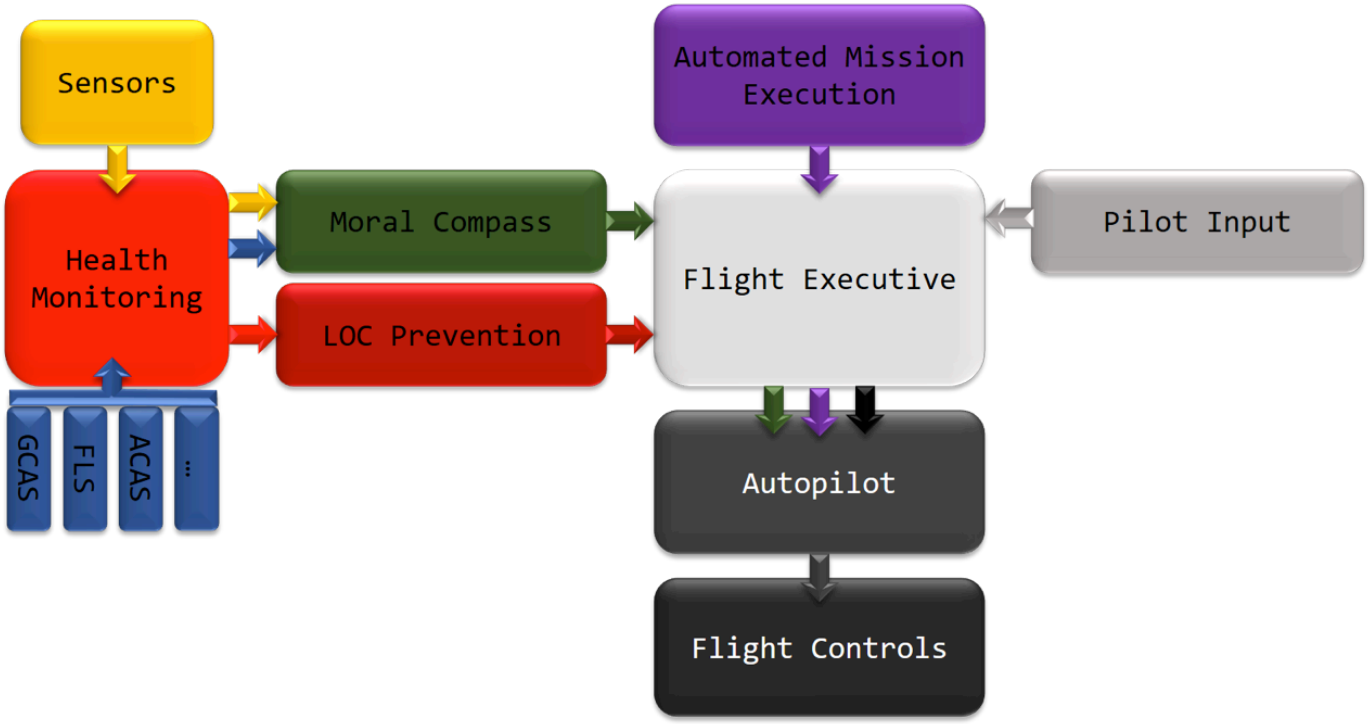
NASA EVAA: Autonomous Architectures

- At this stage, we do not know all requirements (Phase 1-2)
  - Rapid prototyping
- We are doing proof-of-concepts before building a safety case
- Non-traditional; goes against current attitudes
  - EVAA can override pilot inputs
  - **Full autonomy (minimal user input)**
  - Not using current rigorous aviation software/hardware standards (DO-178C, RTOS, etc.)

NASA EVAA: Autonomous Architectures



NASA EVAA: Autonomous Architectures



Autonomy Testbed

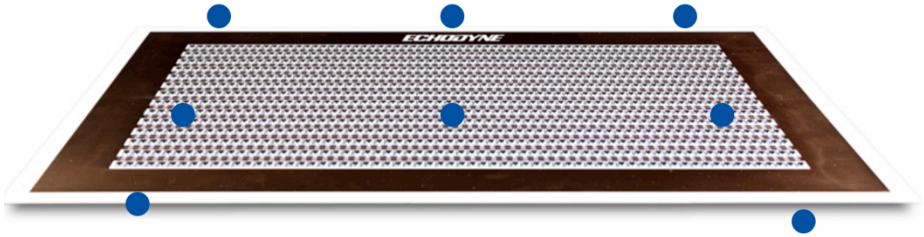
VTOL/Flying-Wing
5ft wingspan
< 10 lbs
COTS < $2,500
20-45min endurance
15min turnaround

NASA UTM Detect and Avoid (small UAS)

NASA UTM Detect and Avoid (small UAS)

- Use of a low cost, size, weight, and power radar (the Echodyne MESA-DAA ~ 2 lbs)
- Integration onboard a small UAS (the AirRobot AR180)
- Detection of other small UAS by the radar when airborne (air-to-air)
- Display of detected targets in LSUASC's Cirrus software to allow the PIC to avoid targets

Echodyne MESA-DAA Radar



- compact high-performance radar that can be mounted on small to medium-sized UAVs to safely and reliably Detect And Avoid obstacles for beyond line of sight flight operations.

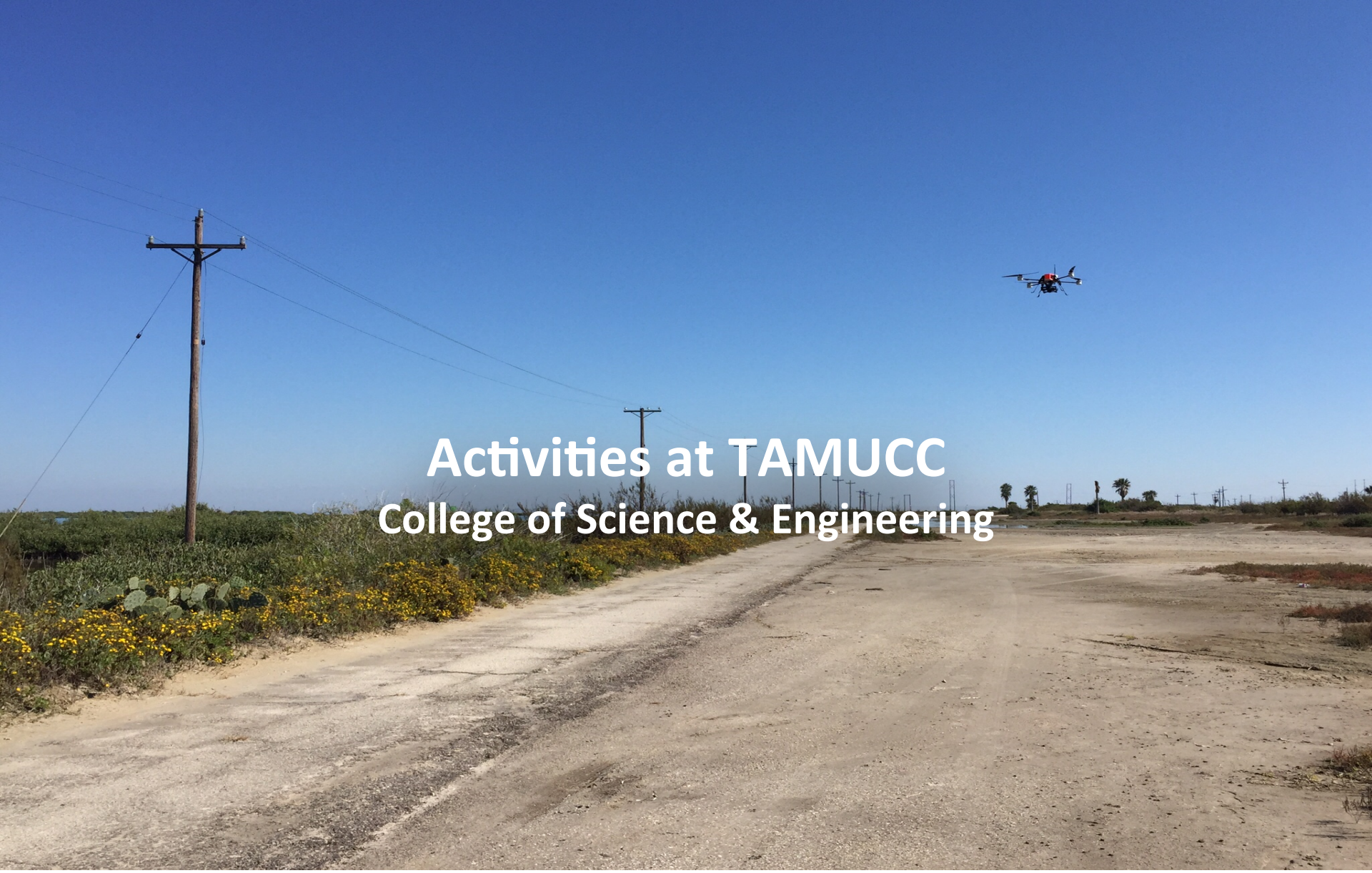
- operates like a phased array radar with true beam scanning in both azimuth and elevation

Phantom 4 detected @ 750 m range

Video

Cirrus Air-to-Air Radar Target Display, June 2017 Test

Cirrus Air-to-Air Radar Target Display, June 2017 Test



Activities at TAMUCC

College of Science & Engineering

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sUAS
Coastal Surveying

adaptive.

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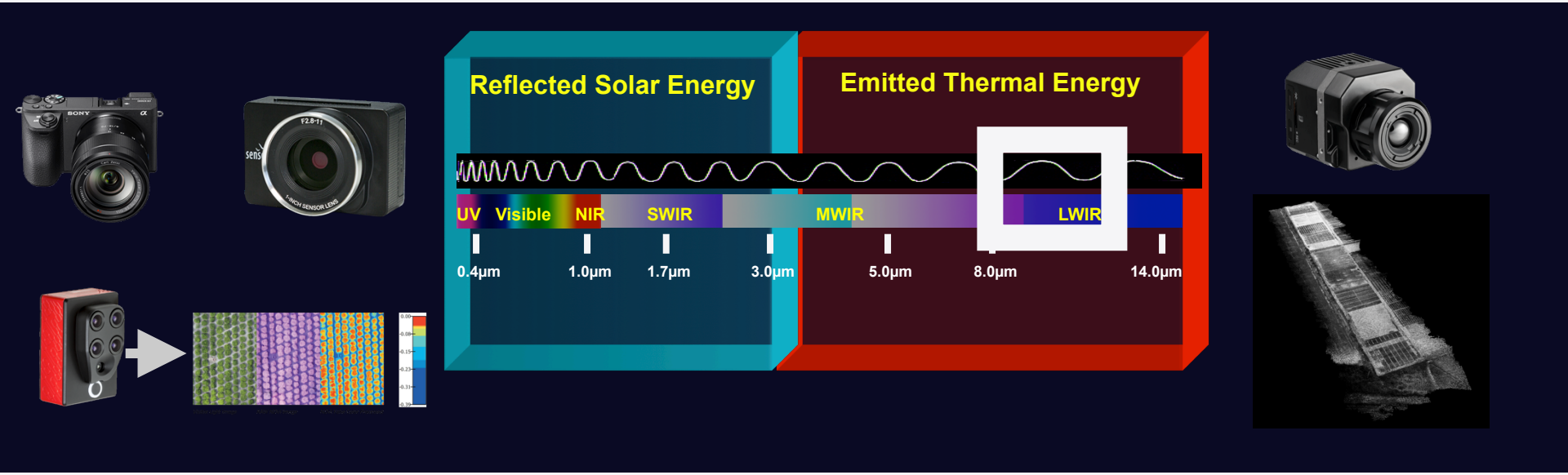
sUAS
sensor integration



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

Payload

5.8 kg

Sony A7Rii (42.4 MP)

Microportable Greenhouse Gas Analyzer (CH_4, CO_2, H_2O)

source: image from maker of the gas analyzer

Penguin B UAV

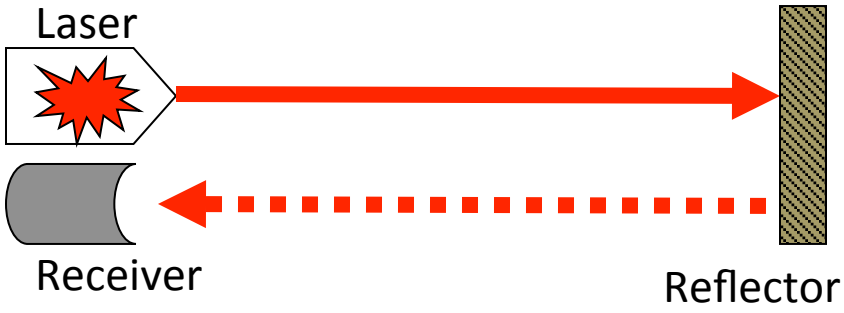
PARAMETER	VALUE
MTOW	21.5 kg
Empty Weight (excl fuel and payload)[1]	10 kg
Wing Span	3.3 m
Length	2.27 m
Wing Area	0.79 m^2
Powerplant	2.5 hp
Max Payload	10 kg
Takeoff method	Catapult, Runway or car top launch

Performance:

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

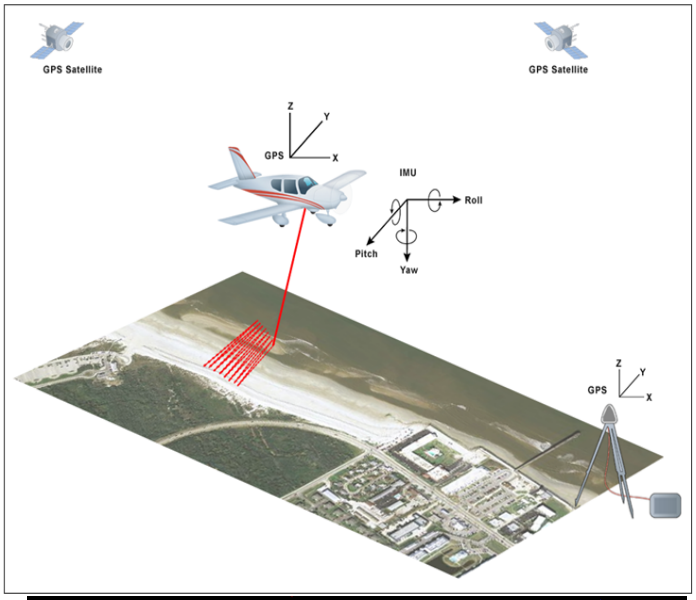
Topographic Light Detection and Ranging (Lidar)

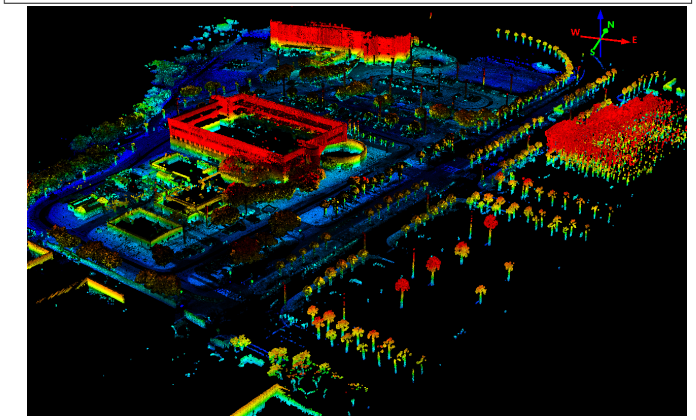
1. Pulse a laser from an airborne platform to the surface and records reflected energy



2. Measure Time of Travel (T_t)

   $T_t/2 * c$ = range





Multi-echo 3D point cloud

UAS Lidar

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

- Up to 1350 m range @ 60% reflectivity
- Multi-echo detection, waveform processing

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

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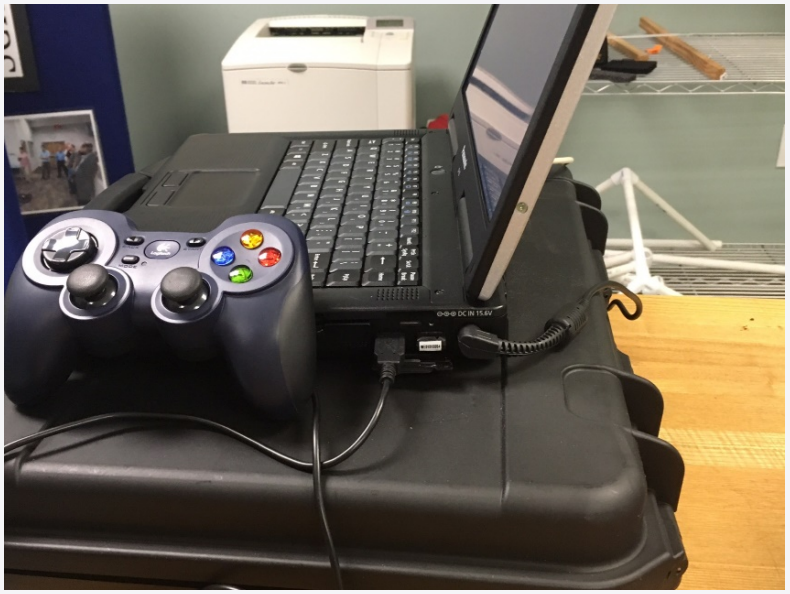
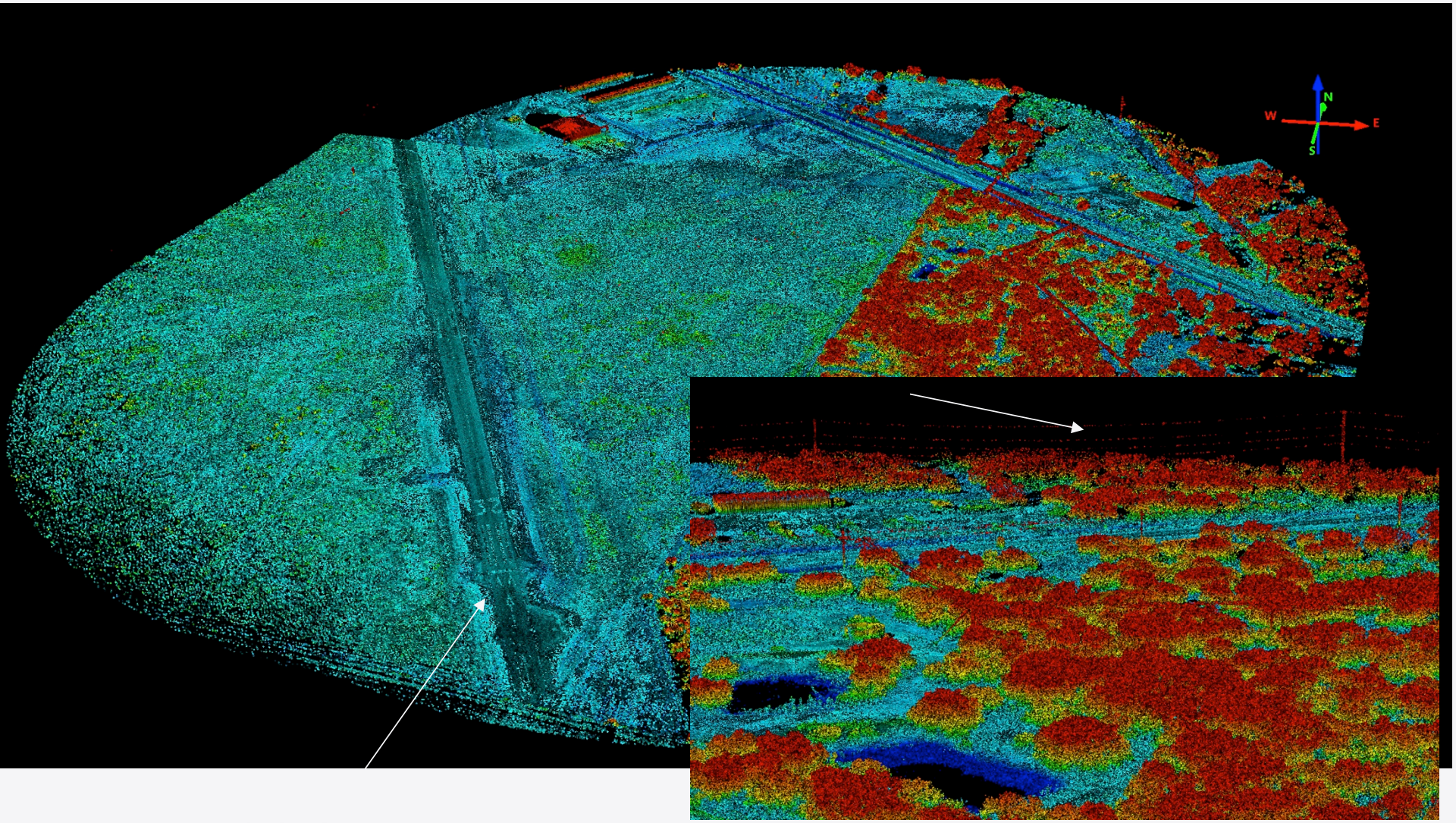
UAS Lidar





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projects

Education

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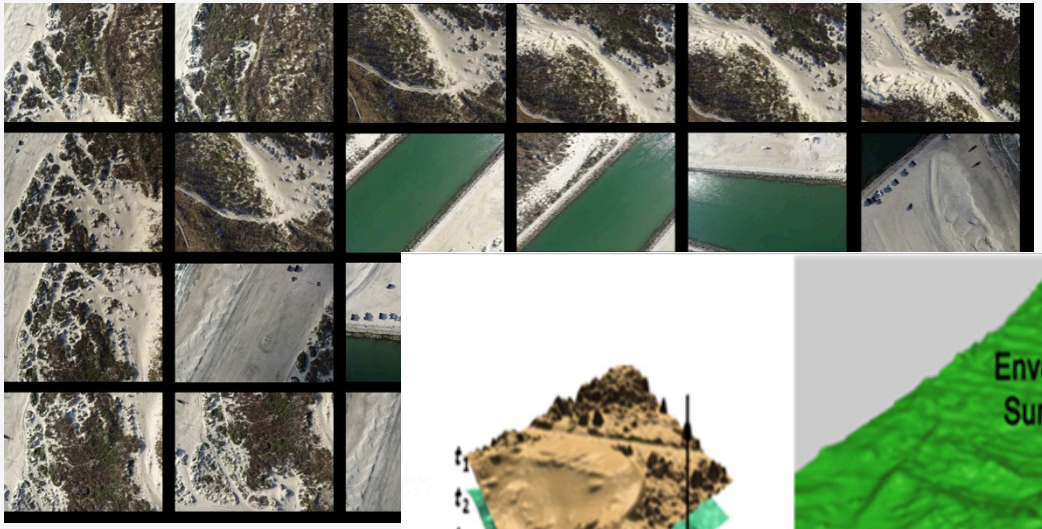
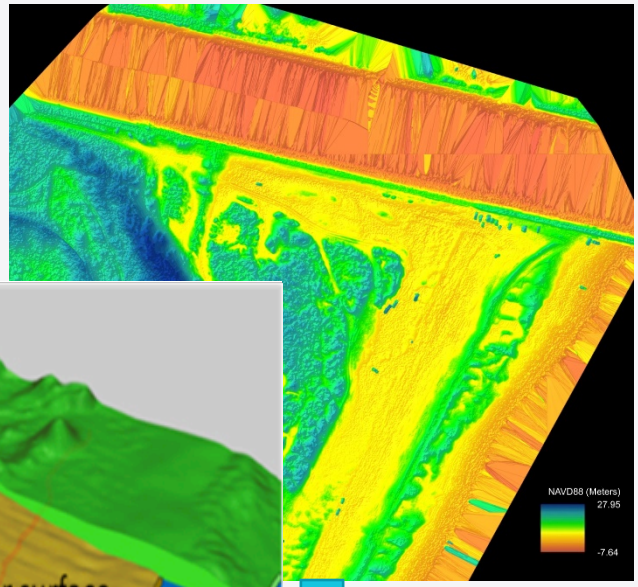
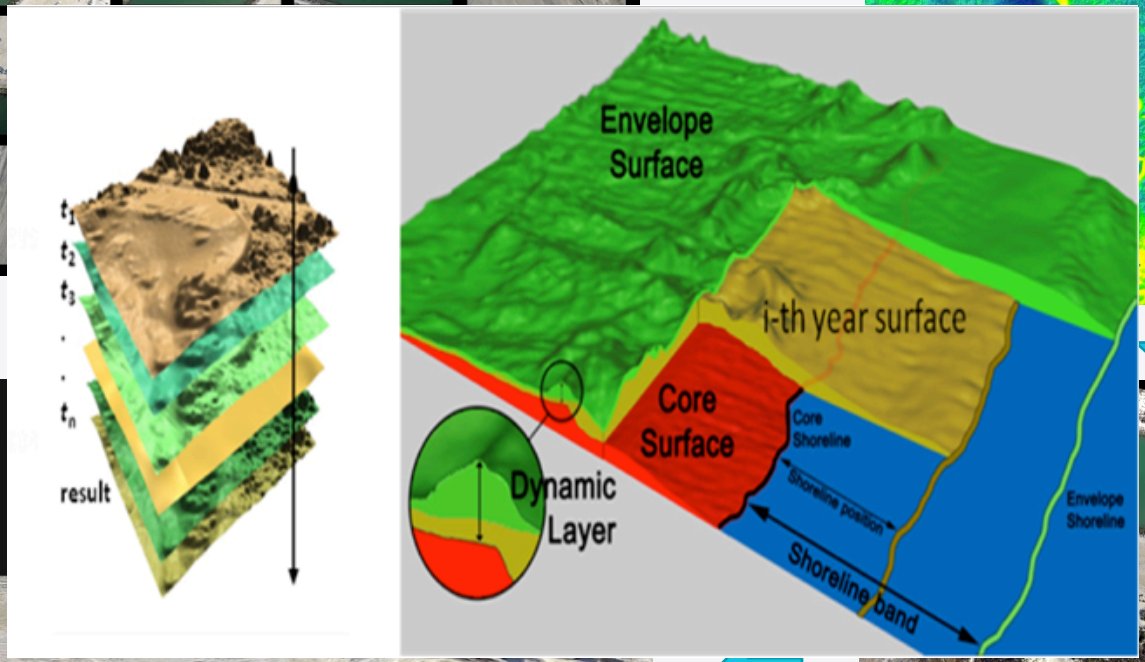
DEL MAR COLLEGE

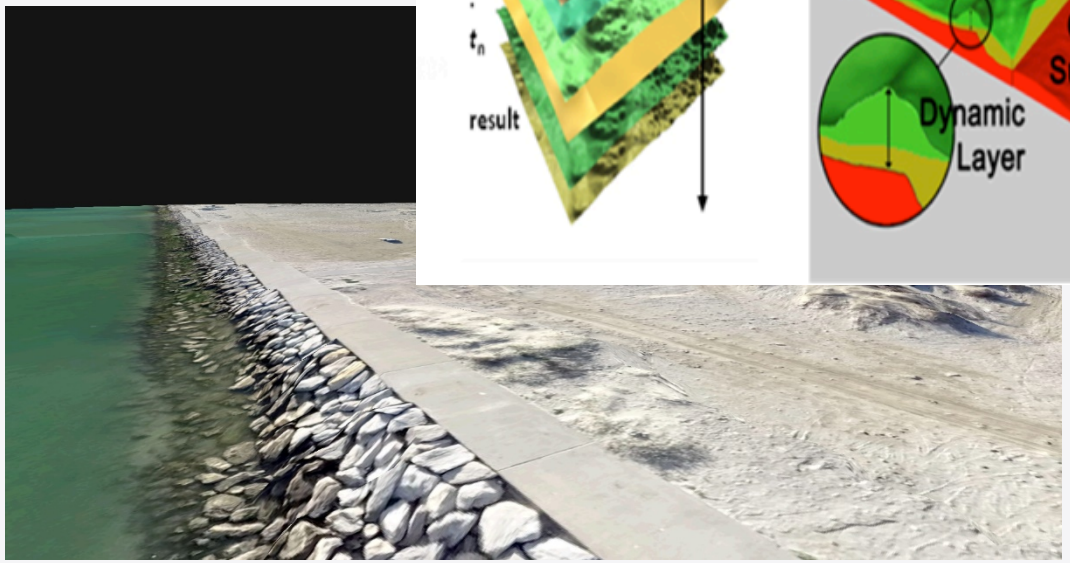
NSF National Science Foundation WHERE DISCOVERIES BEGIN

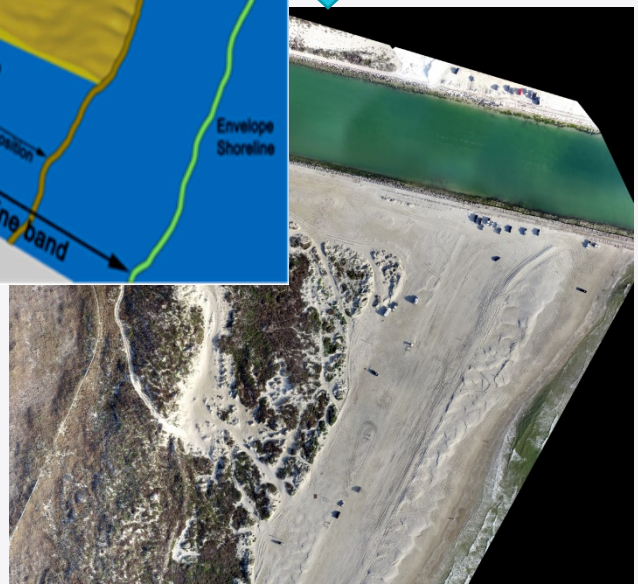
Erosion Monitoring
Packery Channel, TX



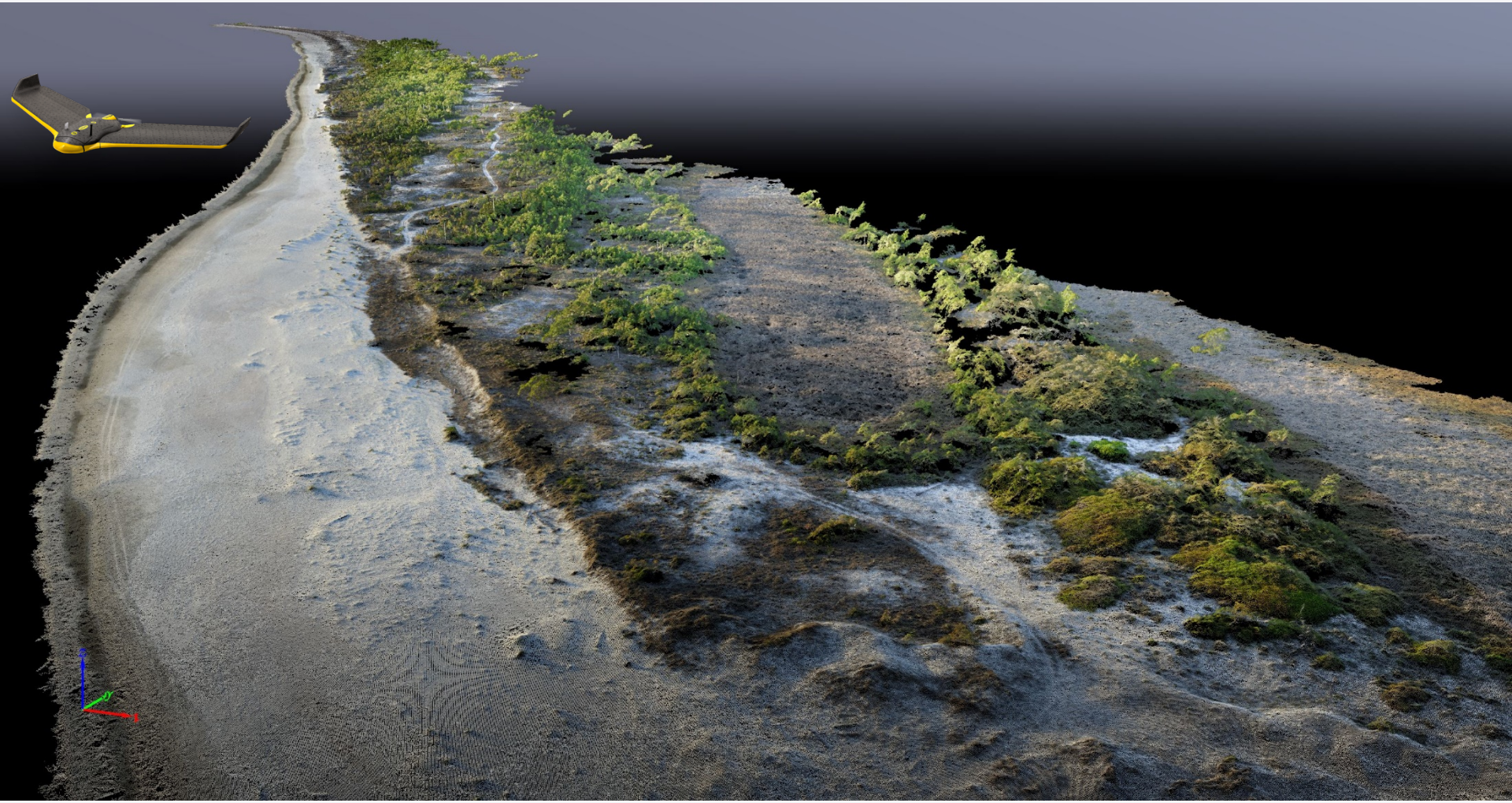








Coastal Survey of Little St. George Island, FL (10 km)
NOAA Apalachicola NERR



Dense, textured 3D point cloud, > *1000 pts/m²*, March 2017

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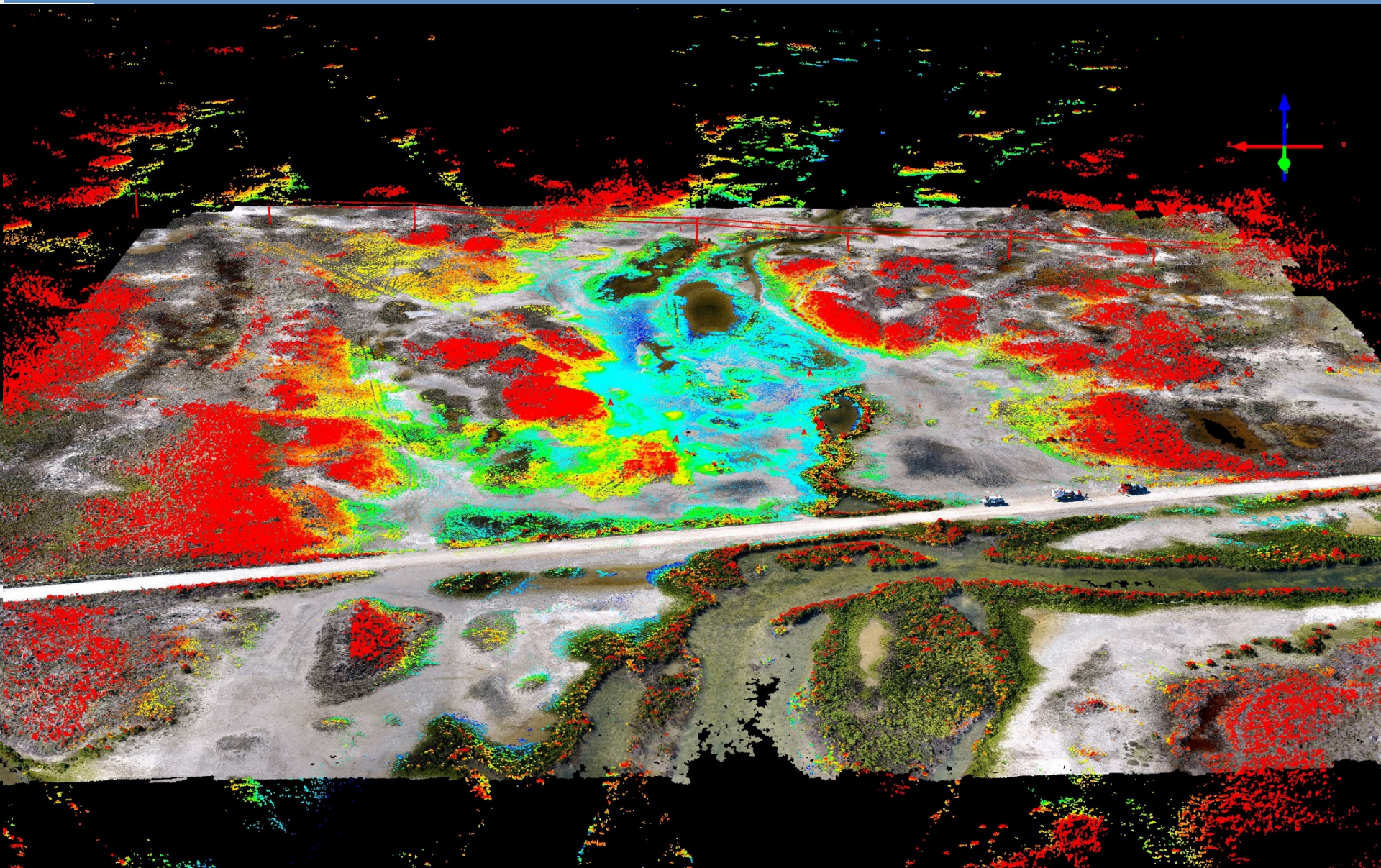
Wetland Observatory

Mustang Island, TX





Thank you SCOAR!

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