Unmanned Aerial Vehicle (UAV) Surveying for DOE Legacy Management Sites and Climate Change and Resilience

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DOE-FIU Science and Technology Workforce Development Program

Applied Research Center

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Project Description

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Objective

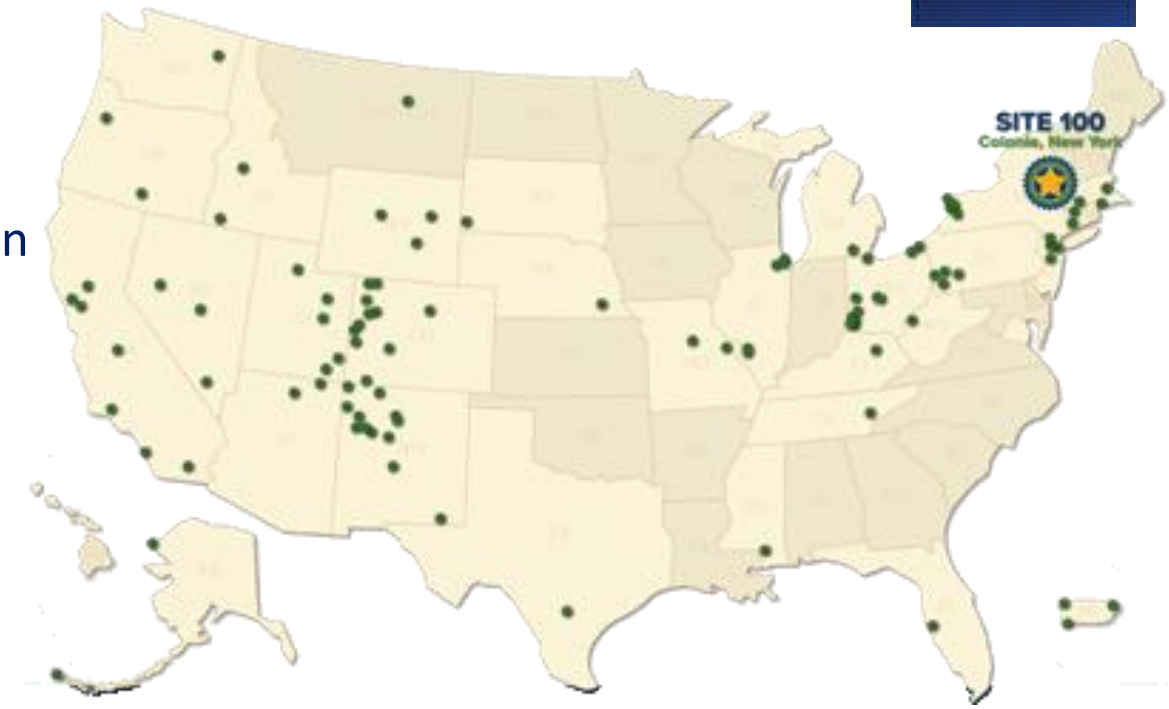
Evaluate suitable remote sensing imagery techniques, to evaluate the different environmental characteristics present in current LM sites

Relevance to the LM Strategic Plan

Goal 4: Sustainably manage and optimize the use of land and assets and address severe weather events

This task will

- Research site-specific commercially available technologies with the potential for addressing issues related to climate change and resilience
- Compile a matrix containing the appropriate remote sensing technology adequate to surveying each LM site



Considering across the country

- Land features, use, cover and conditions
- Elevation
- Hydrology
- Weather conditions

Scope

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What are the long-term effects of climate change at LM sites?

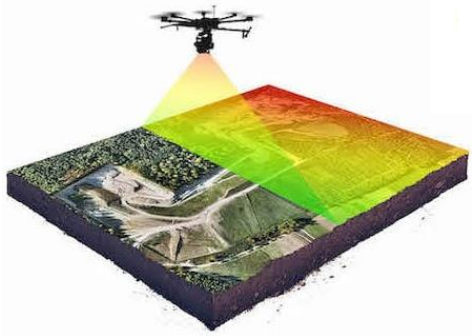
- Land management, development, cover and erosion
- Vegetation
- Surface hydrology
- Wildlife migration patterns
- Severe weather events

How address climate change effects over time?

- Public and commercially available remove sensing imagery database
- On demand UAV in-house site survey

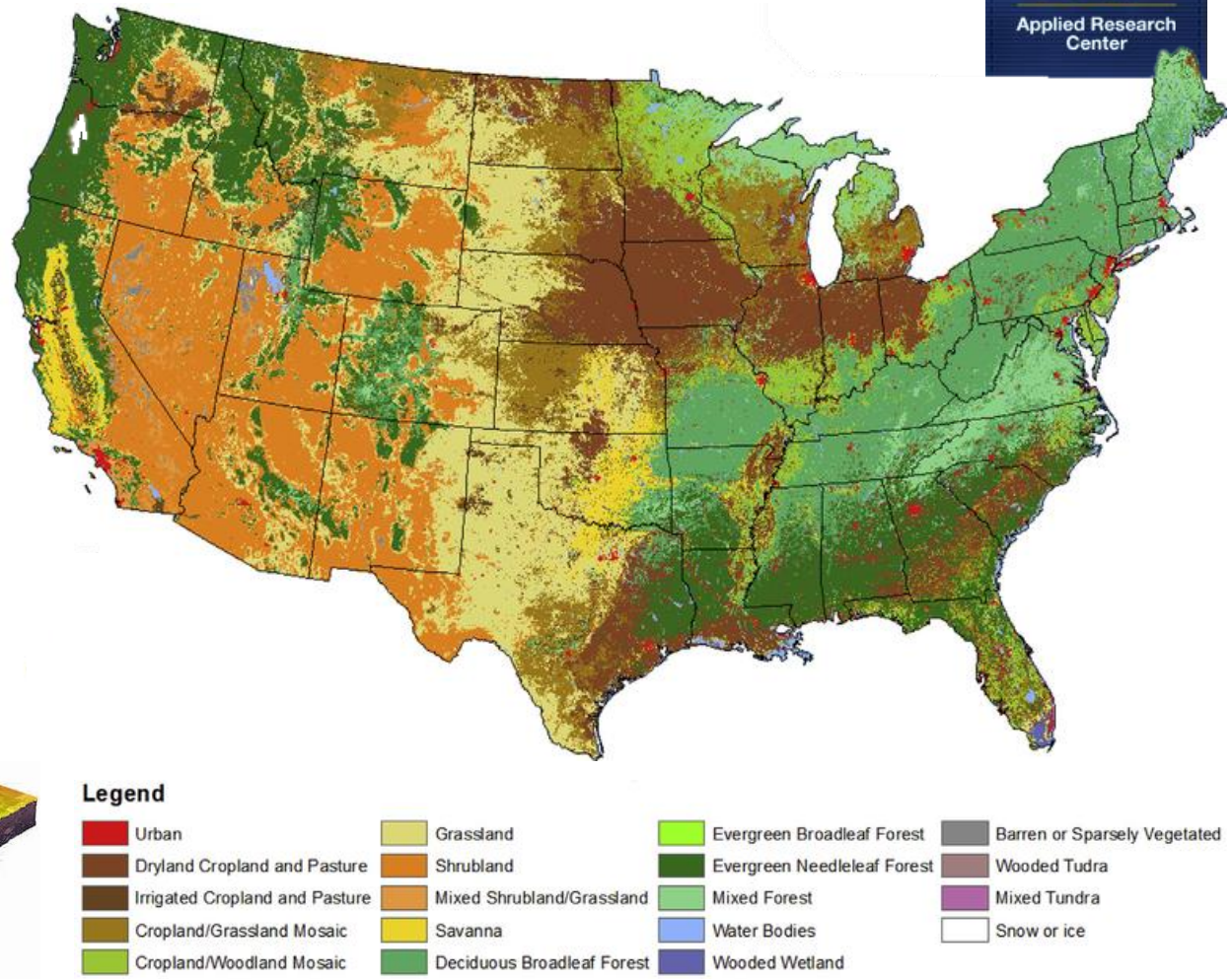
Onsite surveys

- Orthomosaic maps
- 3D point cloud (Photogrammetry & LiDAR)
- Stockpile volumetric measurements
- Slope monitoring
- Digital surface and terrain models



Automated geospatial data analytics

- Machine Learning & Artificial Intelligence (AI)

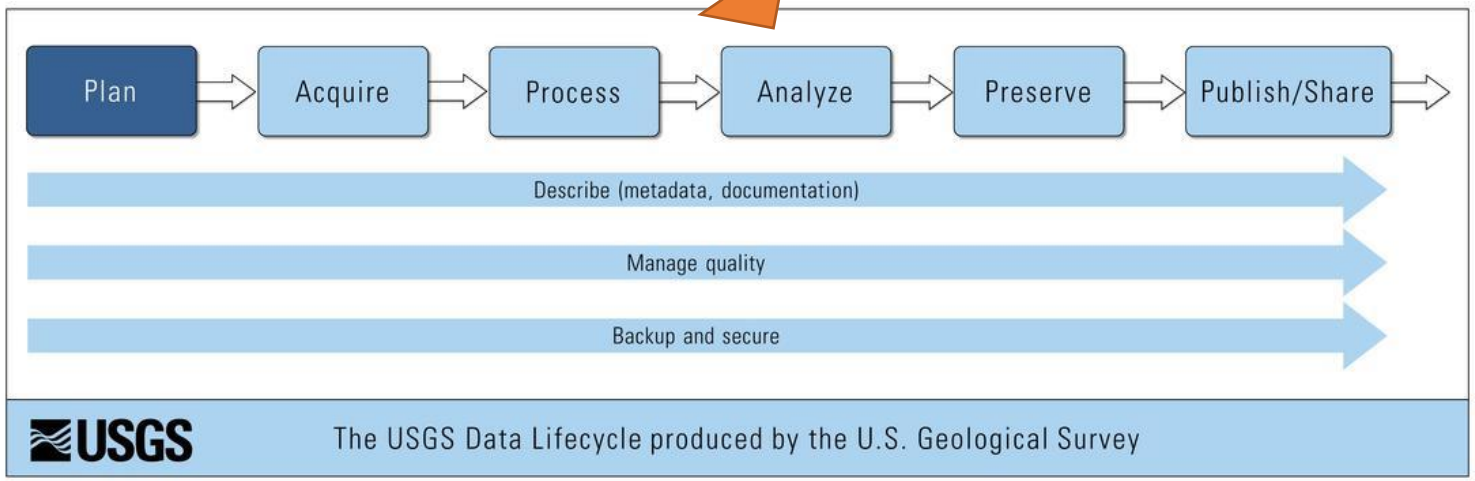


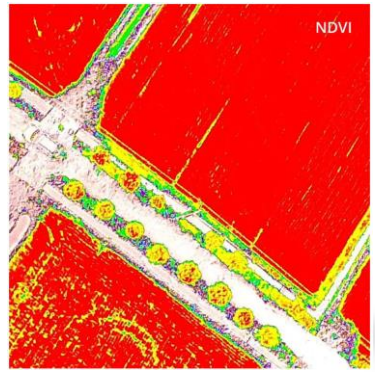
U.S Geological Survey Land Cover Institute
https://archive.usgs.gov/archive/sites/landcover.usgs.gov/landcoverdata.html

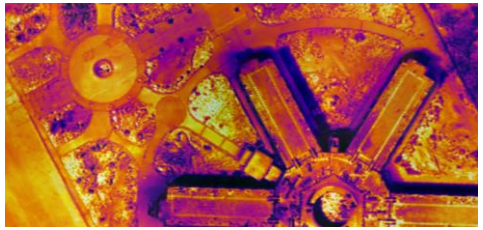
Method

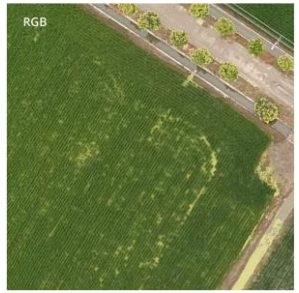
Onsite UAV surveys?

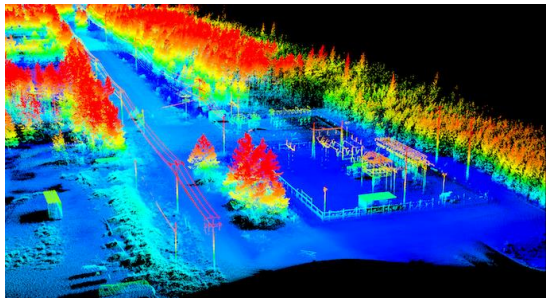
- Centimeter-level precision
- Cost effective
- Meaningful data at your disposal
- Broad custom-built sensory
- See beneath the surface
- **Automated data collection Machine Learning and AI detecting historical change**
- Data-driven decision-making











Multispectral

Thermal

RGB

LiDAR

Preliminary Results

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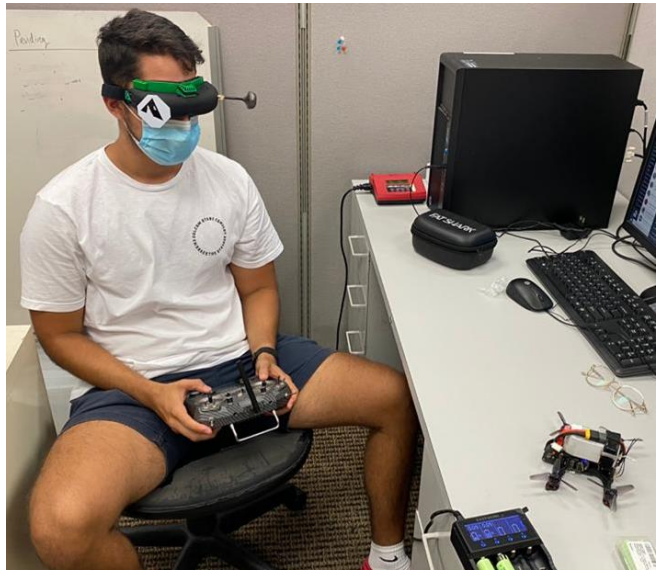
Characterized LM Sites

Introductory training

- Modern Photogrammetry and Optimal Flight Plans
- UAV designing and flight
- LiDAR mapping



Preliminary Results

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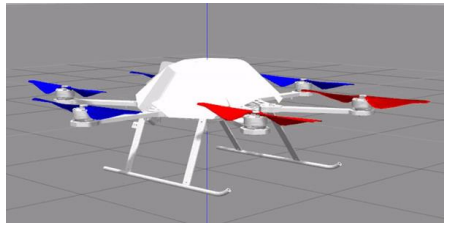
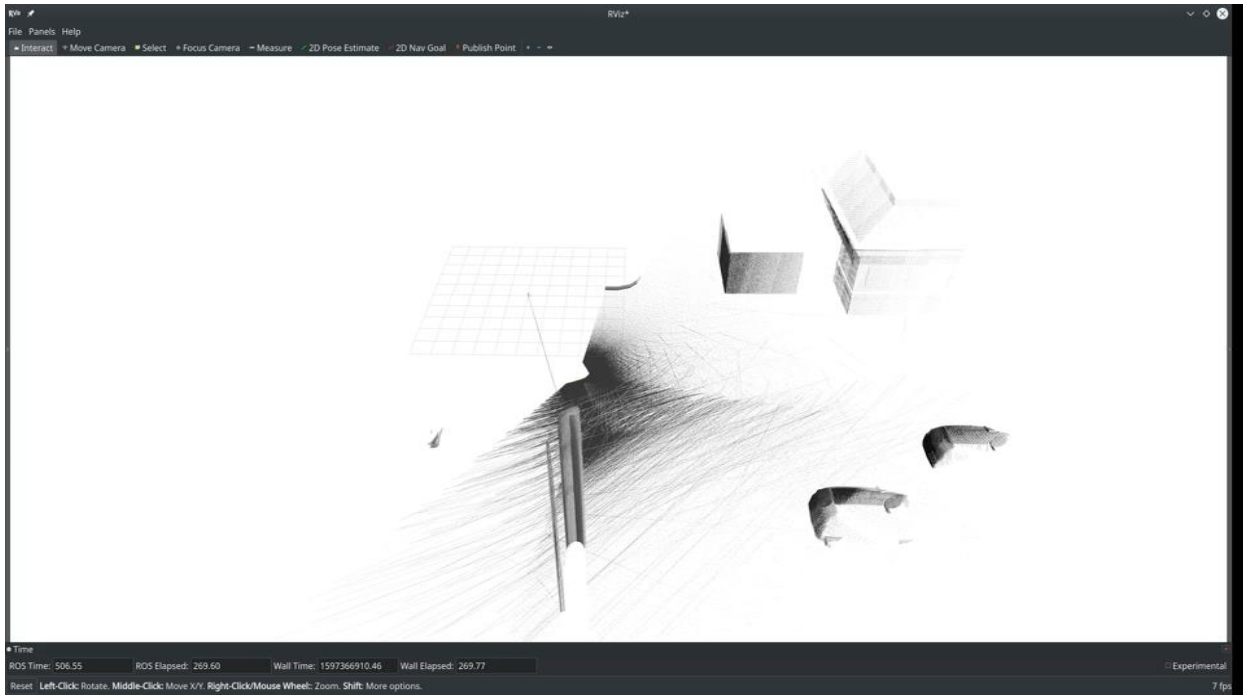
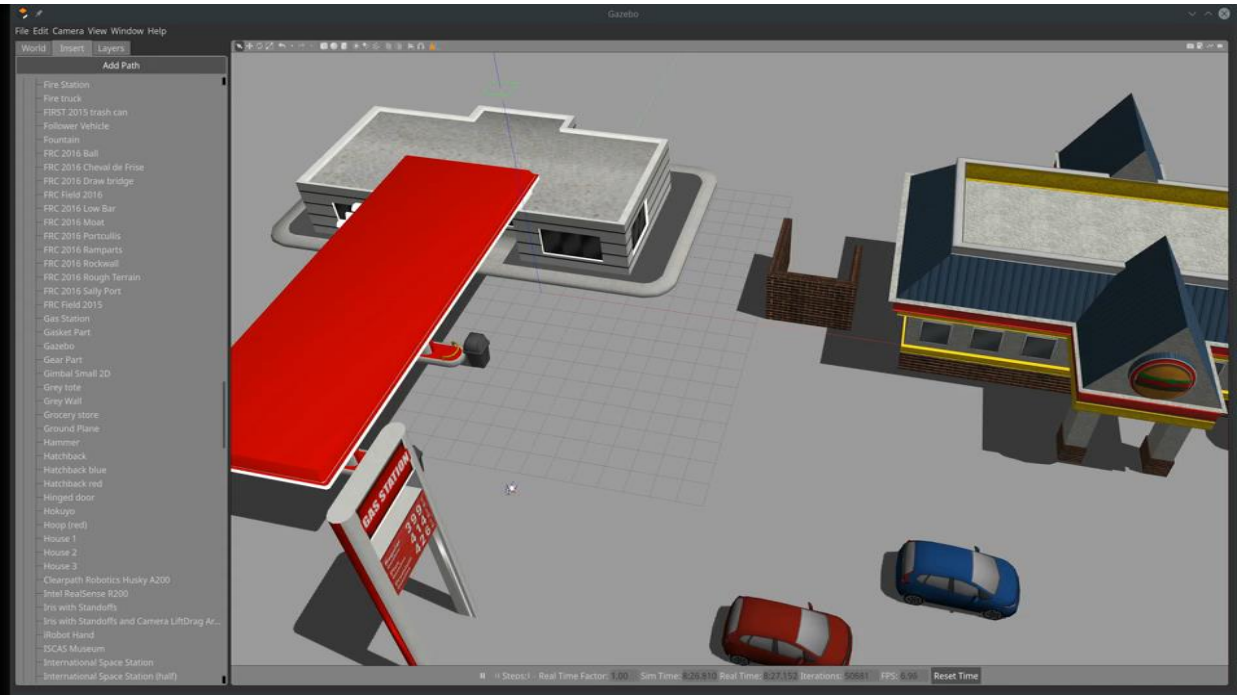
UAV Mapping Simulation

- ROS Gazebo
- Optimal sensory configuration
- Mission planning parameters



DJI Phantom 3 + DJI S1000





Summary and Future Work

On demand UAV in-house site survey, Machine Learning and AI have demonstrated enormous potential in autonomously surveying LM sites and addressing issues related to climate change and resilience

Geo Spatial Data Lifecycle

- Record management
- Data format standards, interchangeability and management cost
- Machine learning and Artificial intelligence analyze tools

UAV LiDAR Integration

In-house surveys

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