PROJECT 5

Long-Term Stewardship of Environmental Remedies: Contaminated Soils and Water and STEM Workforce Development

Project Tasks and Scope

TASK 1: USE OF APATITE FOR URANIUM (U) SEQUESTRATION AT OLD RIFLE SITE	
Subtask 1.4	Desorption Experiments
TASK 2: CLIMATE RESILIENCY STUDIES FOR LONG-TERM SURVEILLANCE OF DOE-LM SITES	
Subtask 2.1	Robot Upgrade
Subtask 2.2	Data Analysis
Subtask 2.3	Field Deployment
TASK 3: STEM WORKFORCE DEVELOPMENT	

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Task 2

Climate Resiliency Studies for Long-Term Surveillance of DOE-LM Sites

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Task 2: Climate Resiliency Studies for Long-Term Surveillance of DOE-LM Sites

Overall Problem:

- Disposal cells of DOE-LM's designed to be effective for at least 200 years. Concerns started when spots of subsurface erosion were discovered in 2017 at the Mexican Hat cell in Utah. Furthermore, unexpectedly, groundwater buildup has been observed at the Rifle cell in Colorado. These is issues are potentially caused by:
    - Construction issues (e.g. the use of dispersive clays between the radon barrier and the overlying rock cover).
    - Increases in precipitation intensities due to climate change.

Site Needs:

- Develop a methodology that allows for active monitoring of DOE-LM disposal cells, including the identification of erosion and groundwater buildup, and measure changes over time.
- The proposed study will contribute to Goal 4 of DOE-LM's 2020-2025 Strategic Plan: “"Sustainably manage and optimize the use of land and assets, addressing severe weather events”.

Objectives:

- Develop and autonomous platform that allows for fast monitoring of a given disposal cell
- Make use of Ground Penetrating Radar (GPR) methods to scan the subsurface of a disposal cell
- Establish long-term monitoring strategy to identify temporal changes
- Collect field data to support model calibration & validation.
- Train FIU grad. & undergrad. students (DOE Fellows).

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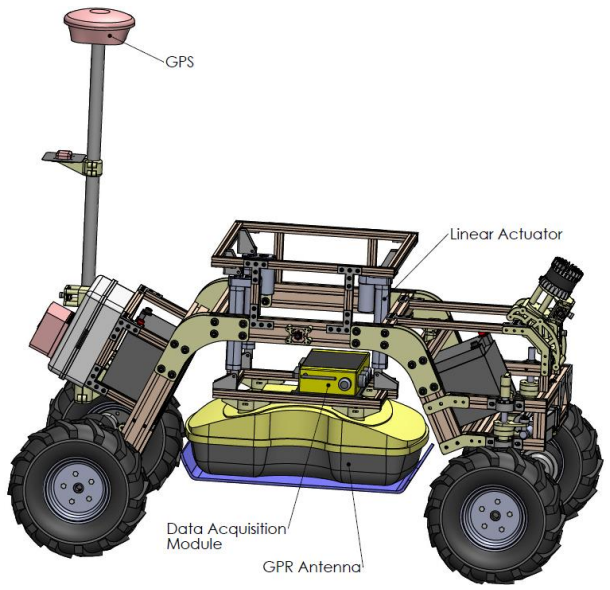
Subtask 2.1: Robot upgrade

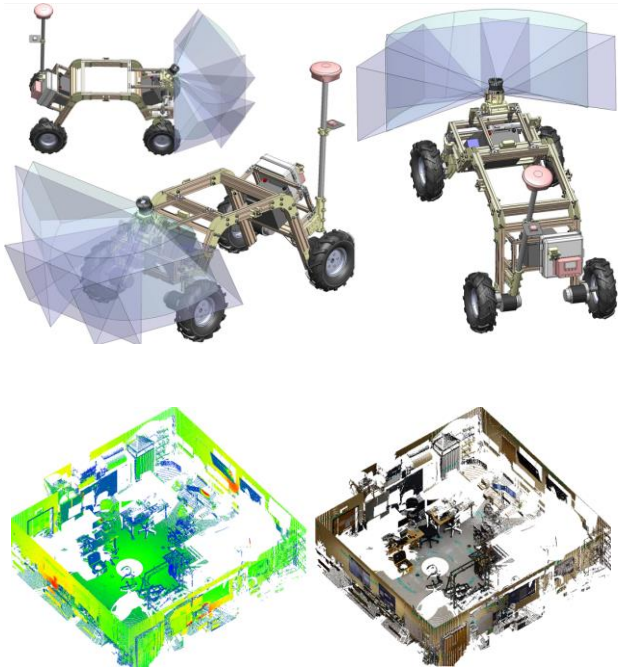
Accomplishments:

- Added a GPS and lidar to the robotic platform to obtain information on spatial position as well as surrounding surface conditions.
- Upgraded the wheels, motors as well as lift mechanisms
- Improved the design of steering mechanism to allow for more robust driving on top of the rip rap
- Former DOE Fellow, Shawn Cameron, graduated with Master degree in Mechanical Engineer.

Overall setup

- 

Inclusion of lidar



Subtask 2.2: Data Analysis

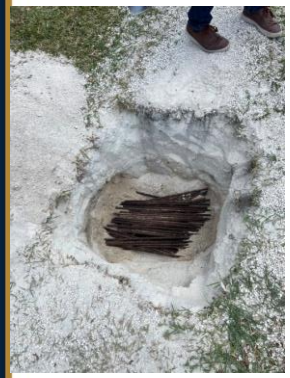
FIU Year 4 Research Accomplishments:

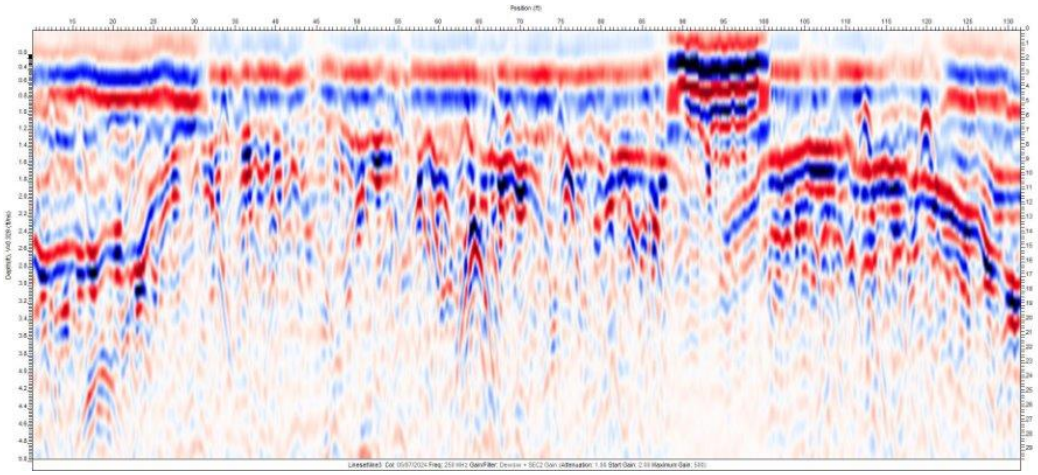
Objectives for FIU Year 4:

- Obtain detailed understanding of GPR to measure erosion and groundwater.
- Extent a mockup setup at FIU.
- Develop software for quick evaluation of results

Accomplishments:

- Develop new mockup setup outside of FIU for GPR testing and data analysis
- Completed multiple GPR testing scenarios corresponding to anticipated disposal cell conditions (e.g. existence of void, surface pointing, existence of saturated conditions).
- Integrated GPR measurements with GPR observations.
- Develop software in Python to evaluate data

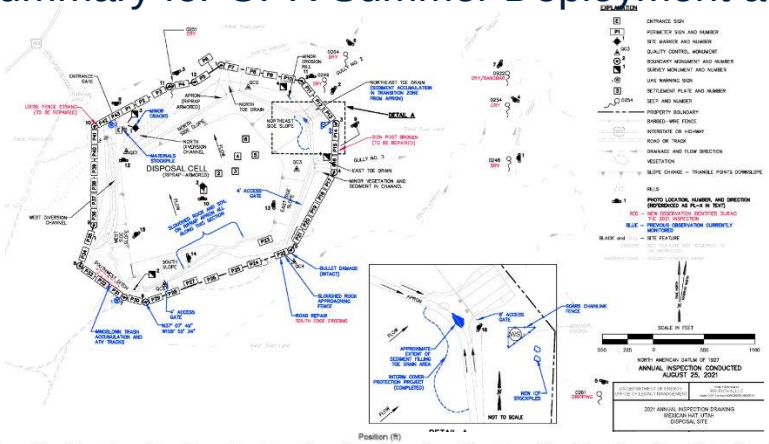


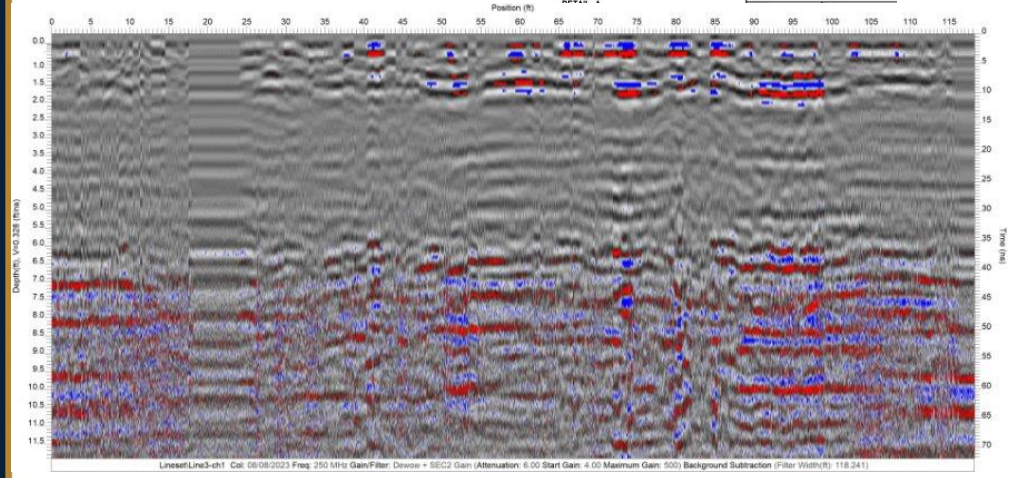


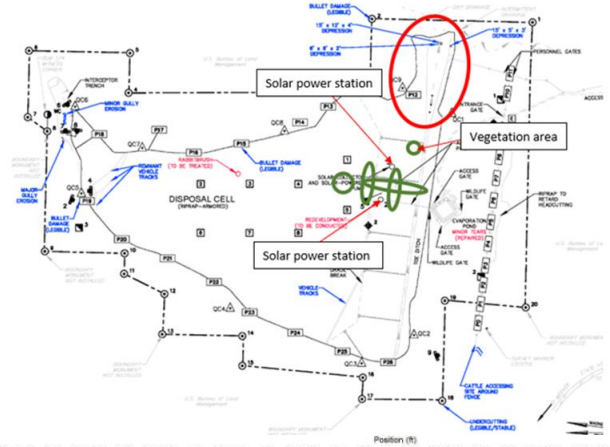
Subtask 2.3: Field deployment at Mexican Hat and Rifle disposal cells

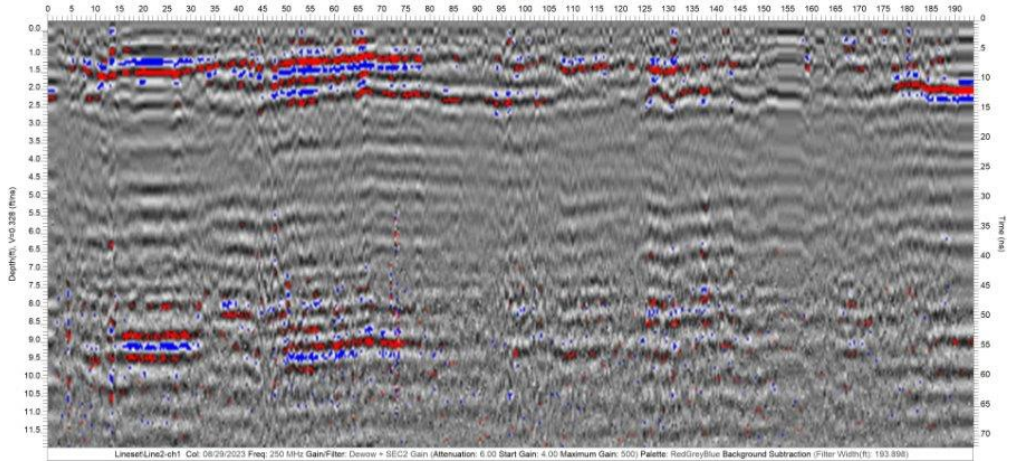
Accomplishments:

- Evaluated GPR observations from Rifle and Mexican Hat disposal cells obtained during summer of 2023
- Given a Data Analysis update presentation (Milestone 2023-P5-M5)
- Field campaign for summer of 2024 was initially postponed due to delayed and shortened internship program of DOE Fellow. Ultimately, the field campaign has been postponed to Spring of 2025 (Deliverable 2023-P5-D5 - Summary for GPR Summer Deployment at LM Sites)









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Proposed future steps

FIU Year 4 Projected Scope

- Finalize design of robot upgrade.
- Perform robotic platform and sensor integration test.

FIU Year 5 Proposed Scope

- Test updated design in the field.
- Evaluated integration of various sensors (GPR, GPS, lidar).
- Develop software for evaluation of GPR data (e.g. identification of zones of interest, 3D integration of data.
- Obtain deeper information using a new 100 MHz GPR (we now use a 250 MHz) which is especially of interest for the Rifle disposal cell.
- Test update platform at Rifle and Mexican Hat disposal cells in both the Spring and late summer.

Thank You. Questions?