

**DOE-FIU Cooperative Agreement Annual Research Review – FIU Year 3** 

# Project 5 – Task 2 Climate Resiliency and Long-Term Surveillance of DOE-LM Disposal Cells

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Advancing the research and academic mission of Florida International University



## Introduction

DOE-LM is charged with the responsibility for the long-term surveillance and maintenance, restructure, land use planning, and community assistance for **101 sites** in the United States and the territory of Puerto Rico.



#### **Objective:**

- Develop an integrated ground penetrating radar mobile robotic platform that is capable of traversing Legacy Management's disposal cell features.
- Evaluate the acquired ground penetrating radar's data.





## Introduction









#### Disposal Cell Characterization

- The Rifle disposal cell is roughly triangular and measures approximately 3,000 ft on each side.
- Encompasses an area of 71-acres on the 205-acre site.
- 3.5 million cubic yards of contaminated materials with a total activity of 2,738 curies of radium-226.



## Introduction

- The Long-Term Surveillance Plan ensures the disposal cells are meeting or exceeding standards to protect human health and the environment.
- LM conducts annual site inspections to evaluate surface feature conditions, perform necessary site maintenance, and monitor groundwater to verify the disposal cells' integrity.







## **EROSION COMPLICATIONS**

- During the 2017 annual inspection, erosion was discovered at the Mexican Hat cell in Utah.
- Erosion manifested itself towards the surface, near the top rock cover layer.
- Disposal cell design proposed to be effective for at least 200 years.



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## **Platform Development**

- Platform development based on designing around the GPR sensor
- Designed elbow mounting structures
- 4 wheelchair motors
- 13-inch lug wheels
- 250 MHz ground penetrating radar



















## Platform Development





## **FIU** FIU's Disposal Cell Mock-up

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LM's Disposal cell layer design:

#### **Variety of Disposal Cell Features**

Disposal Cell	Erosion Protection	Bedding	Frost Protection	Bio Intrusion Riprap Type A	Bedding	Radon Barrier
Durango	1'0"	6"	1'6"	1'6"	6"	2'0"
Rifle	1'0"	6"	7'6" - 18'	None	6"	1'6"
Mexican Hat	8" & 12"	6"	None	None	None	2'0"
Lakeview	1'0"	18"	None	None	None	18"
Sherwood	6"	12.6' - 20'	None	None	None	None



## **FIU** FIU's Disposal Cell Mock-up

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Testbed 3	Testbed 2	<u>Testbed 1</u>	
1' Riprap (Layer of rocks)	0.656'Riprap (Layer of rocks)	1'Riprap (Layer of rocks)	
<sup>1</sup> /2'Bedding (Layer of rock/soil mixture)	<sup>1</sup> /2'Bedding (Layer of rock/soil mixture)	<sup>1</sup> /2'Bedding (Layer of rock/soil mixture)	
<sup>1</sup> / <sub>2</sub> ' Frost protection (Layer of compacted soil)	<sup>1</sup> /2'Bentonite Clay (Radon barrier)	1'Frost protection (Layer of compacted soil)	
<sup>1</sup> /2' Bentonite clay (Radon barrier)	N/A	N/A	



- Data from mock-up.
- Variety of testing parameters were used.
- Experience allowed for additional platform design.



## FIU Platform Development

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- Design implementations based on GPR data analysis.
- Linear Actuator to decrease GPR clearance from the surface.
- Increases data visualization of subsurface features.



- Addition of a turning mechanism based on Ackerman steering geometry.
- Rotates the front wheels 38 degrees that avoids tire sliding.

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## **Future Work**

**RGPR:** 

- Understand RGPR Data Processing to produce 2D subsurface features.
- Using available online GPR data to prepare real survey data.







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## **Future work**

• Deployment:







- The platform will be deployed at several erosion prone sites.
- Surveying these sites will have an outlook at subsurface features while testing the performance of the integrated GPR platform.



• Data processing.





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## Thank You. Questions?