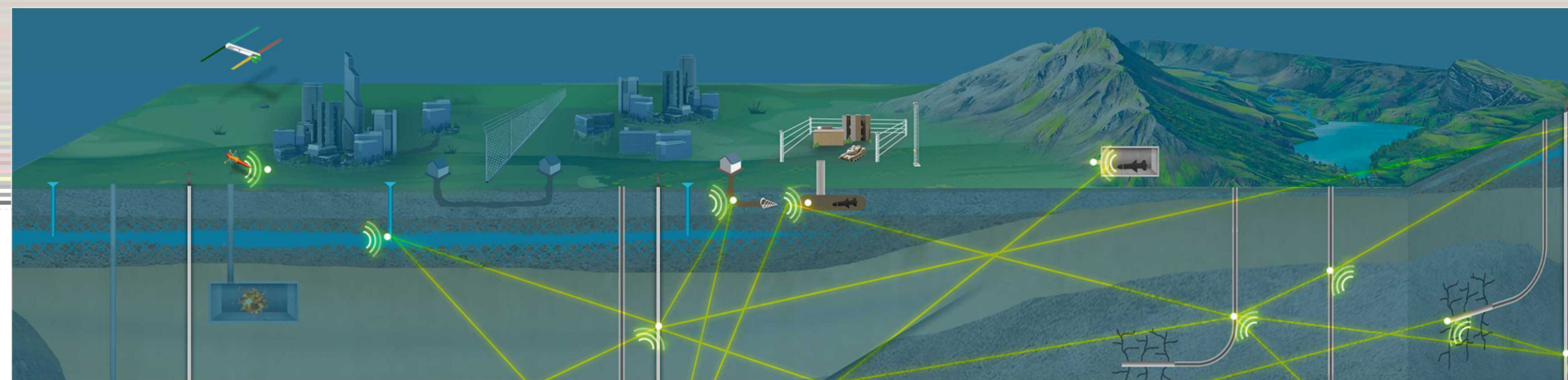


# Real-time Subsurface Event Assessment and Detection (RESEAD)

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Charlie Vollmer, and Chet Weiss  
PM: Giorgia Bettin

**GOAL:** The project aims to develop technologies to increase resolution and efficiency of subsurface characterization and event detection by multiple orders of magnitude

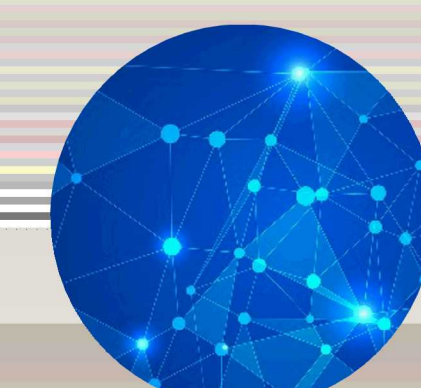


## VISION

- Deployment of permanent sensor arrays to capture multi-physical and multi-dimensional data.
- Testing of novel instrumentation types and installation methods
- Development of capabilities for real-time processing of high-volume datasets to provide timely information for decision making.



Data Analytics

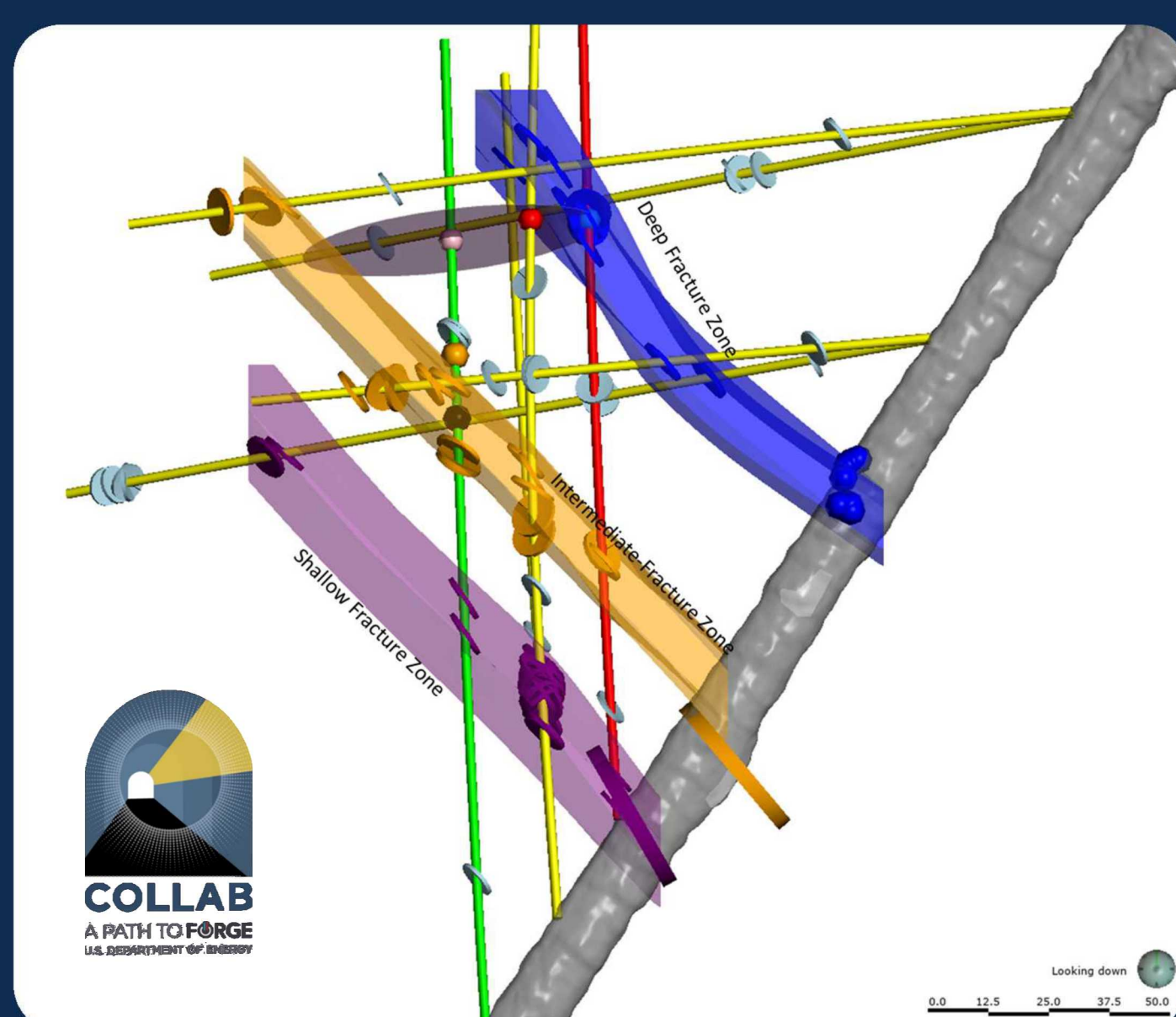
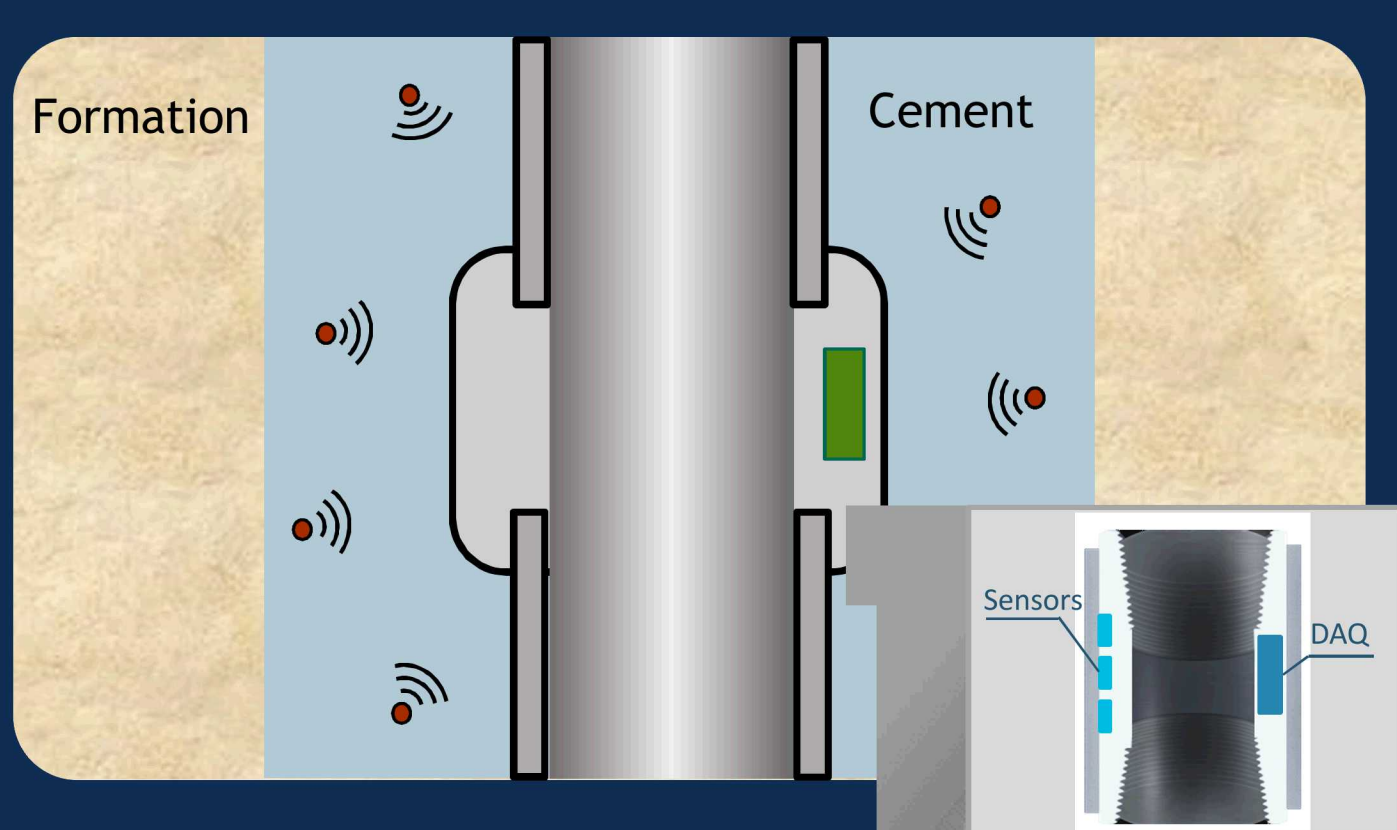
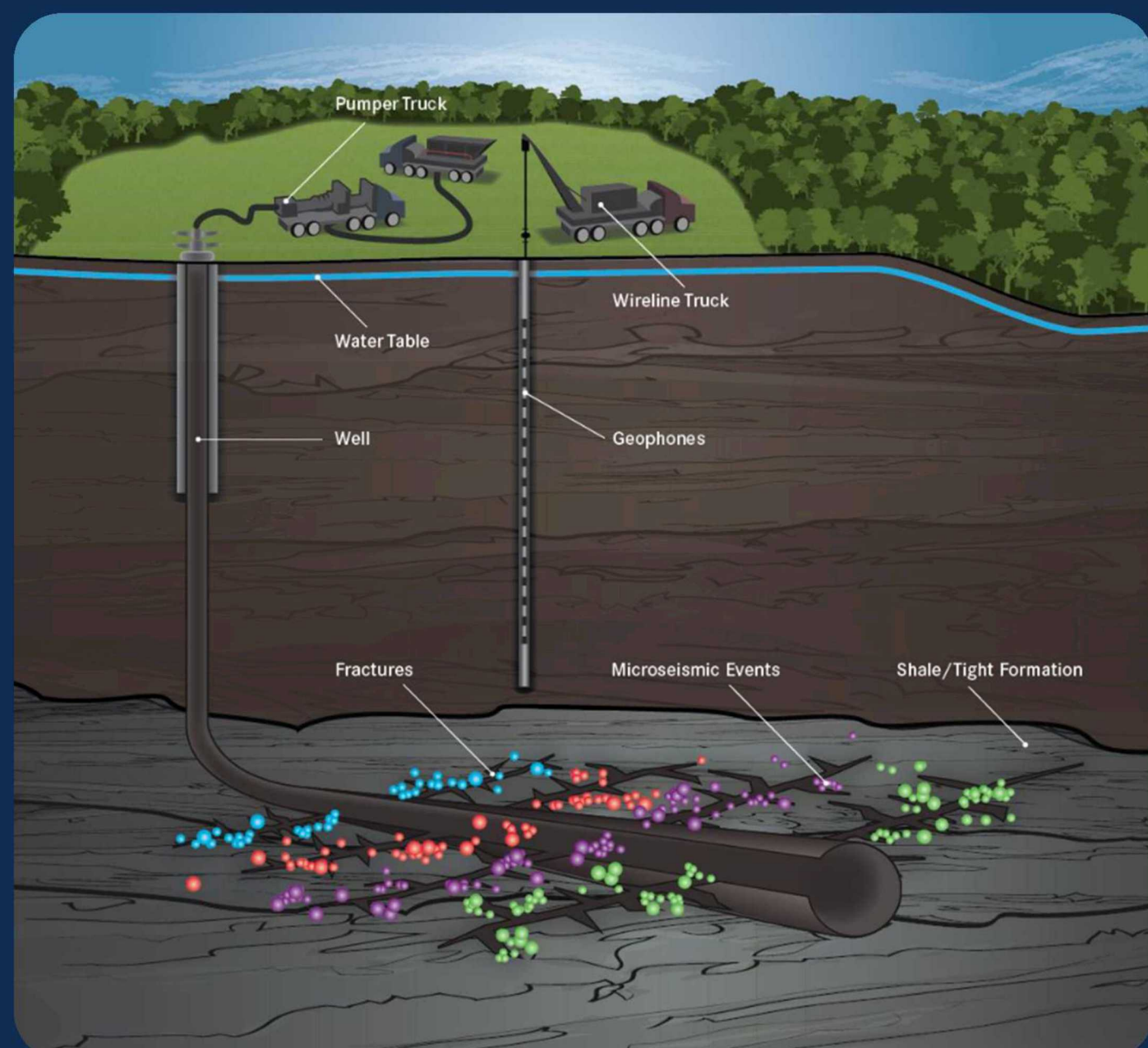


Sensor Technologies



Machine Learning

Development of new computational capabilities and validation with field measurements, enabling large scale optimization, machine learning, sensing, and computational tools



## STRATEGY



- 5-year R&D plan with integrated approach to source physics, data science, and sensor technologies
- Advance/integrate machine learning, data analytics, and sensor technologies
- Leverage existing data sets (e.g., EGS Collab)
- Establish academic partnerships to expand capabilities



## DEVELOP DATA ANALYTICS FRAMEWORK

- ✓ Real-time Event Monitoring
- ✓ Hybrid Machine Learning
- ✓ Physics-Based modeling

## LEVERAGE STATE-OF-THE-ART COMPUTATIONAL TOOLS

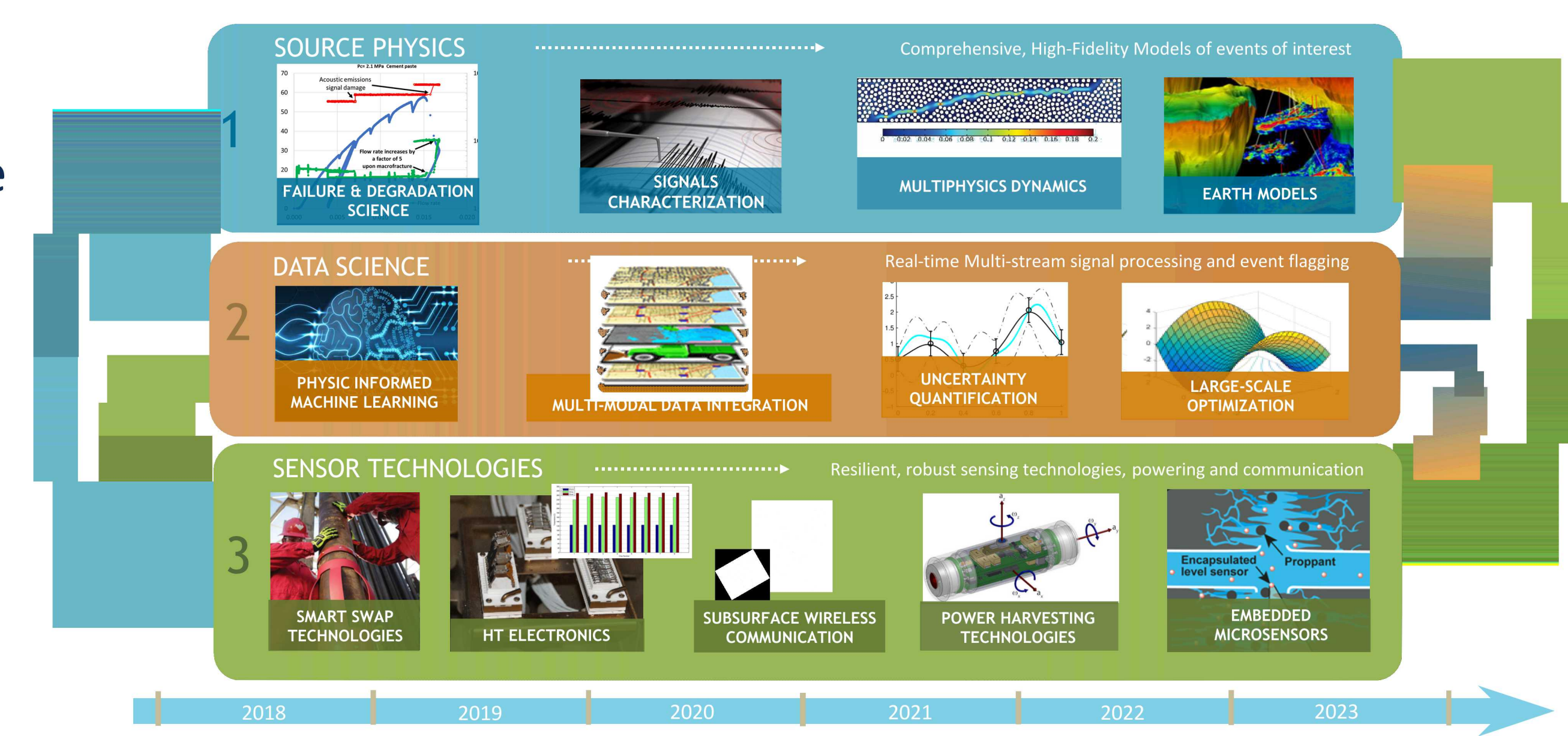
- Peridynamics – computational mechanics tool designed to accurately predict fracturing
- Multiscale/multiphysics interface for large-scale optimization
- Electromagnetic hierarchical simulation
- Ichos seismic full-waveform inversion

## EGS COLLAB FRACTURE STIMULATIONS

Instrumentation Configuration



Test and validate our approach on subsurface datasets from this fracture stimulation field experiment



Three interconnected R&D thrusts

## APPLICATIONS



Counter Proliferation



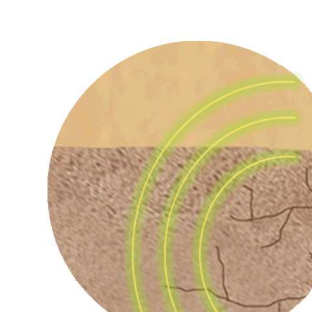
Border Security



Non Proliferation



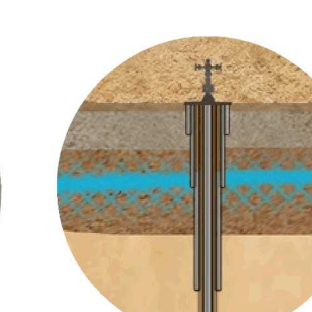
Ground Based monitoring



Seismicity



Tunnel Detection



Wellbore Integrity

## SENSOR TECHNOLOGY

Development of smart sensor technologies to provide high-quality data in real-time, inexpensively

- Ability to withstand harsh environments, maintain power, & communicate with surface
- Optimal experimental design to help guide temporal and spatial prioritization
- Differentiation between other sensor types

