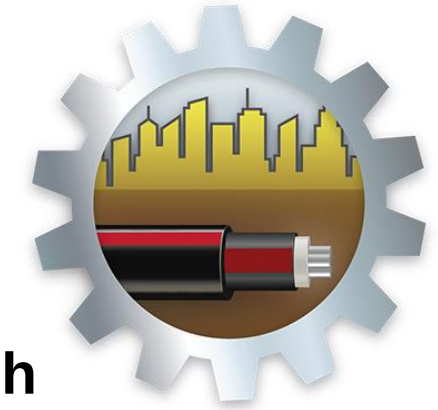
Multi-Physics, Intelligent Sensing System (MISS) for Real-Time, Look-Ahead While Drilling



Joseph P. Vantassel, Assistant Professor, Virginia Tech

Category 2.1

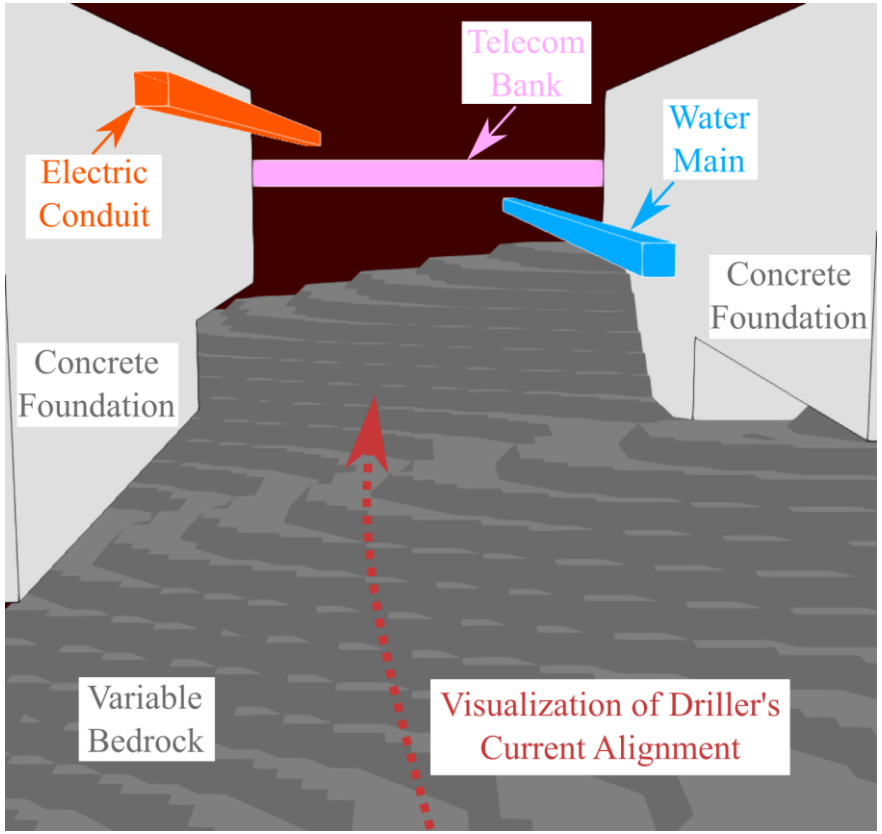
Project Vision

We are developing real-time look-ahead using multiphysics sensing and artificial intelligence to allow the drill operator to "see" ahead of the drill face.

GOPHURRS
Kickoff Meeting
May 2nd, 2024
Charlotte, NC

Project Objective

- *Drill Operator to "See" Ahead of the Drill Face*
  - *Rapidly updated 3D images (seconds) in*
  - *All noise environments (rural & urban)*
  - *All targets (plastic, metal, rock)*
  - *All geologic environments (wet & dry)*



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J.P. Vantassel
jpvantassel@vt.edu

Project Team

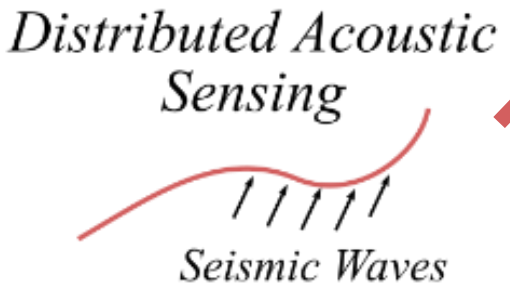
Warnick, BYU

Sarlo, VT

Westman, VT

Martin, CSM

Vantassel, VT



Predictive
AI Model

Vantassel, VT

Martin, CSM

Brown, VT

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CHANGING WHAT'S POSSIBLE

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J.P. Vantassel
jpvantassel@vt.edu

Overview of High-level Tasks

	Year 1	Year 2	Year 3
Sensing	Proof of Concept at Subsystem Level	Subsystem Integration & Data Preparation	Lab-Scale Testing

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J.P. Vantassel
jpvantassel@vt.edu

Overview of High-level Tasks

	Year 1	Year 2	Year 3
Sensing	Proof of Concept at Subsystem Level	Subsystem Integration & Data Preparation	Lab-Scale Testing
Prediction	Geostatistical Model	Multiphysics Simulation	AI Model Testing

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J.P. Vantassel
jpvantassel@vt.edu

Overview of High-level Tasks

	Year 1	Year 2	Year 3
Sensing	Proof of Concept at Subsystem Level	Subsystem Integration & Data Preparation	Lab-Scale Testing
Prediction	Geostatistical Model	Multiphysics Simulation	AI Model Testing
Commercialization	Partner Identification and Engagement	Regulatory Landscape Market Analysis Business Model	Solidify Partnerships Follow On Funding

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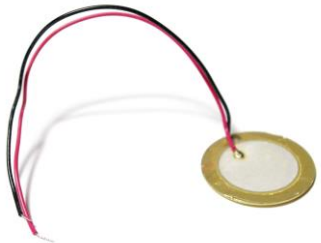
jpvantassel@vt.edu

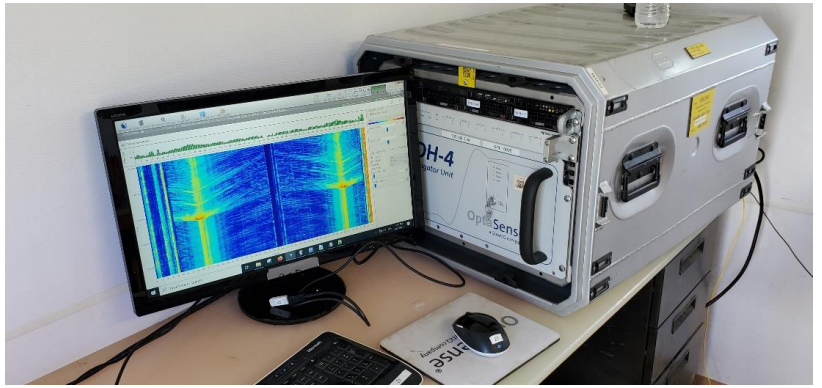
Technical Details

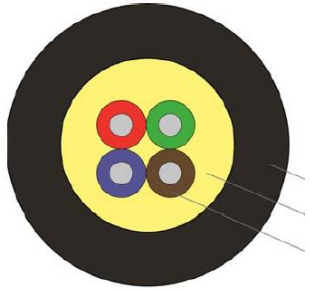
- *Develop Multi-Physics Sensing*



Seismic

Piezoelectric Sources
Accelerometers





Seismic

Distributed Acoustic

Electromagnetic

Antenna
Receiver

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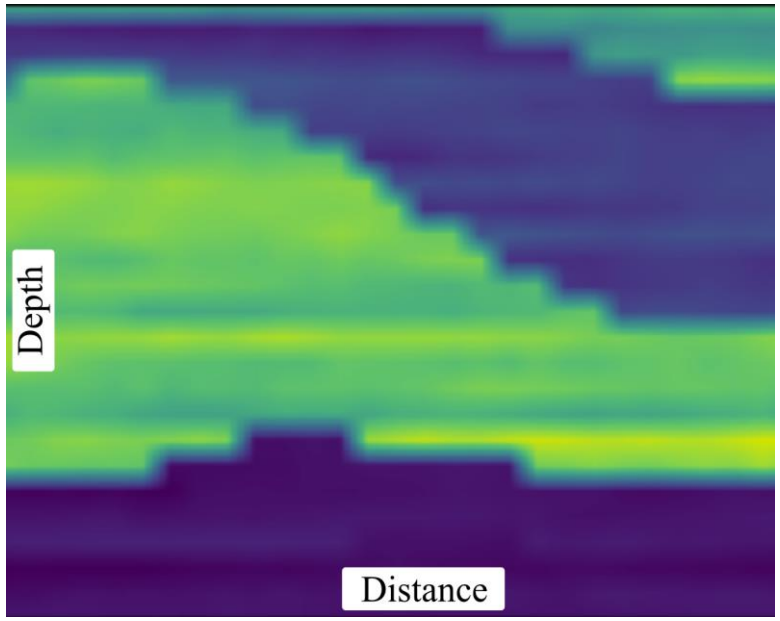
J.P. Vantassel
jpvantassel@vt.edu

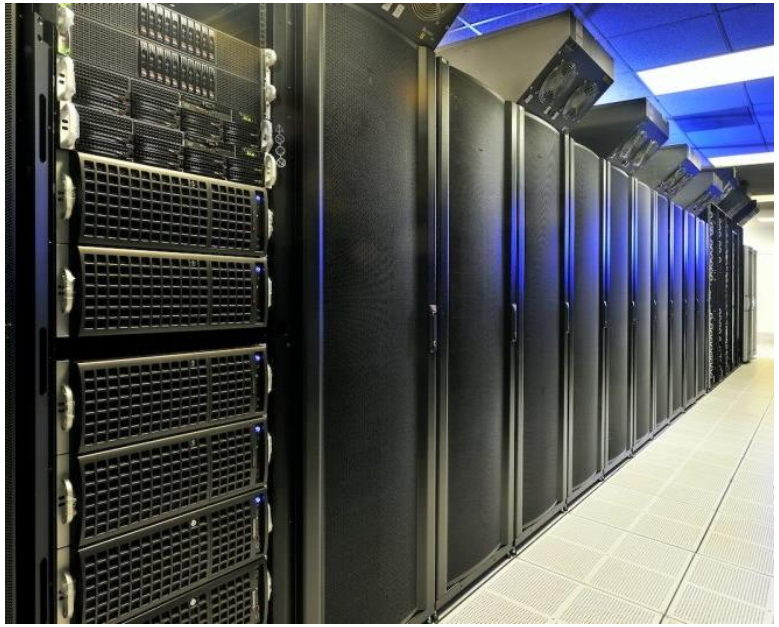
Technical Details

- *AI Model Development and Training using VT's Advanced Research Computing*

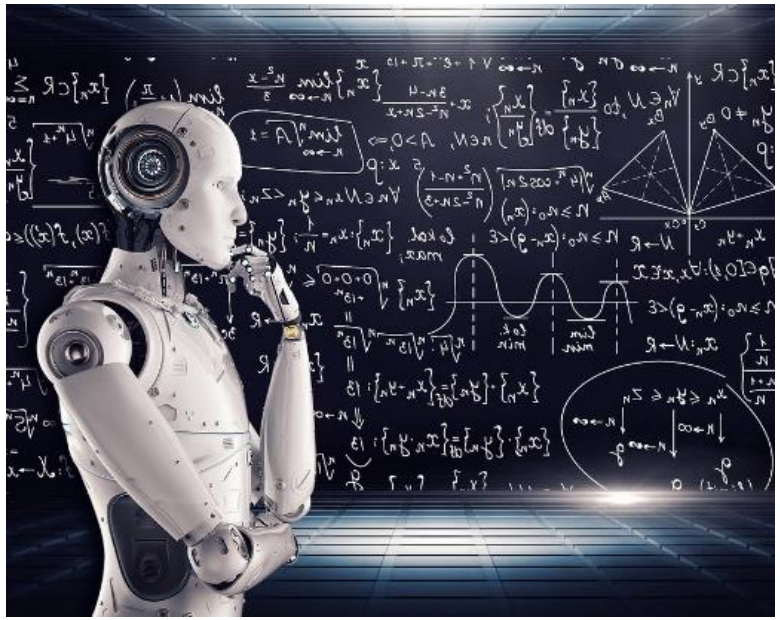
Geostatistical Model



Multiphysics Simulation



AI Model Development & Testing



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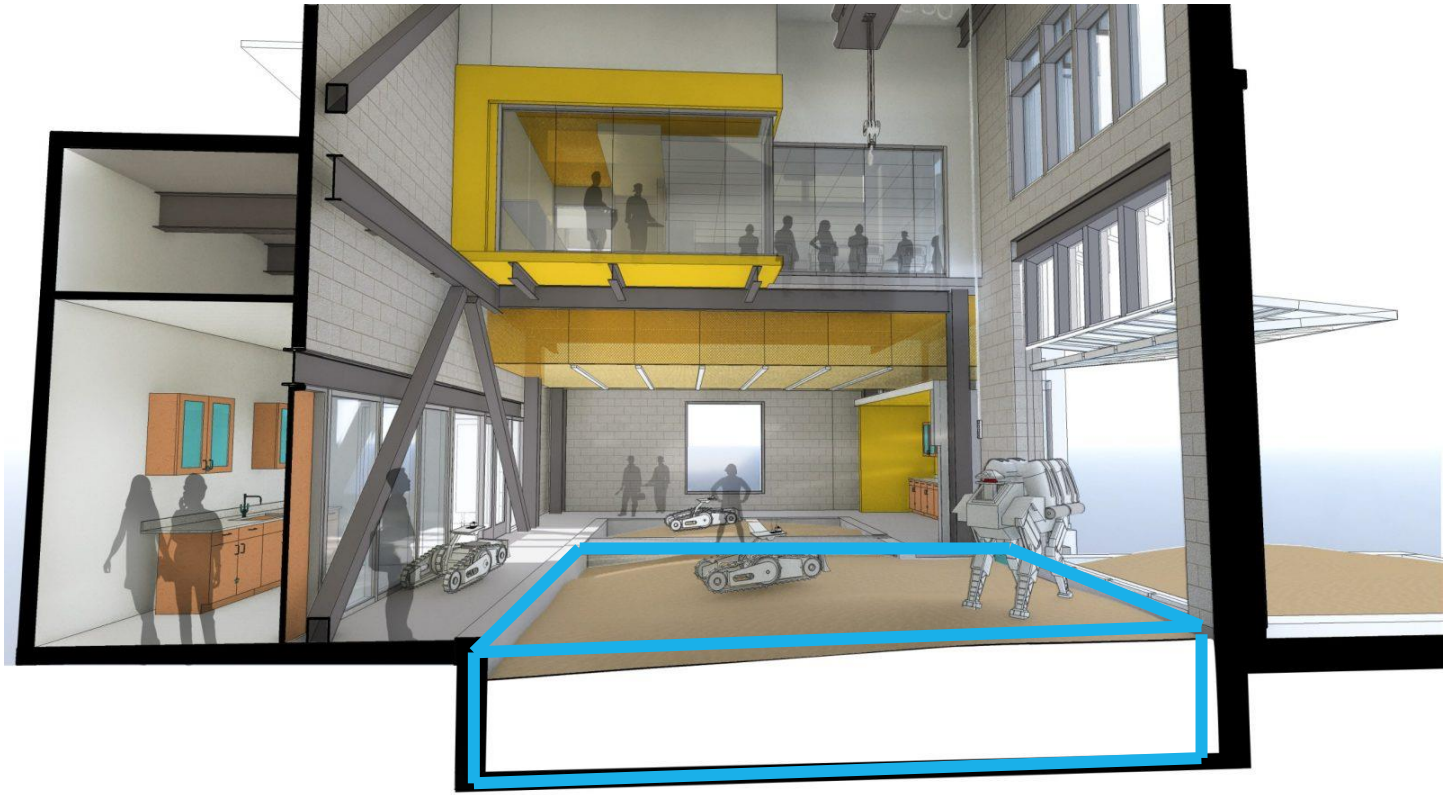
J.P. Vantassel
jpvantassel@vt.edu

Technical Details

- *Blind Laboratory Scale Testing in Center for Autonomous Mining at Virginia Tech*

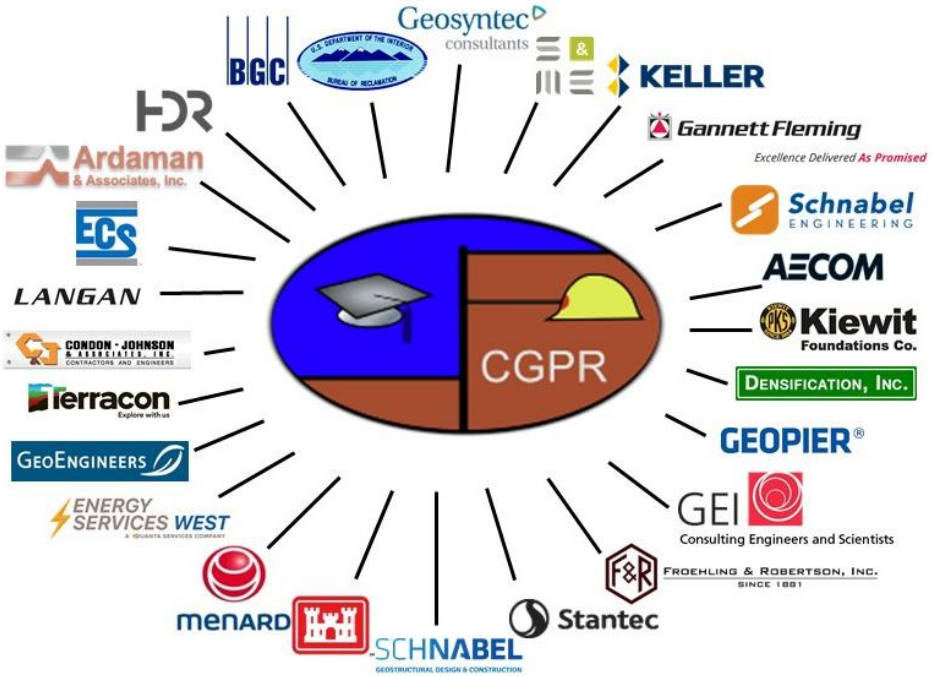


~8m by ~8m by ~1m

Technology-to-Market Approach

- *Key T2M Objectives during Award*

Industrial Advisory Board



National Science Foundation
ICORPS Training

NSF

I-CORPS
NSF Innovation Corps

VT
Link + License + Launch

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J.P. Vantassel
jpvantassel@vt.edu

Technology-to-Market Approach

- *Key T2M Objectives Post-Award |* ***Startup Venture***
  - *User-feedback experiments*
  - *Miniaturization and hardening of system.*
  - *Full-scale field tests.*
  - *Sensor hardware iteration.*
  - *Wireless power and data transmission.*
  - *User interface development*
  - *Refinement of the AI predictive model*
  - *Legal requirements for utility potholing.*

Needs and Potential Partnerships

- *Current Needs*
  - *Engage potential Industrial Advisory Board members*
- *Post-Award Needs*
  - *Partner for sensing system miniaturization and hardening*
  - *Partner for full-scale integration and testing*
- *Capabilities & Resources*
  - *Center for Autonomous Mining at Virginia Tech*
  - *Computational Resources through VT's Advanced Research Computing*

VIRGINIA TECH
J.P. Vantassel
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Q & A

U.S. DEPARTMENT OF ENERGY

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Joseph P. Vantassel
jpvantassel@vt.edu