IOGCC
Micro and Nano Sensors for the Sub-Surface
May 17, 2021

Bureau of Economic Geology

Jackson School of Geosciences

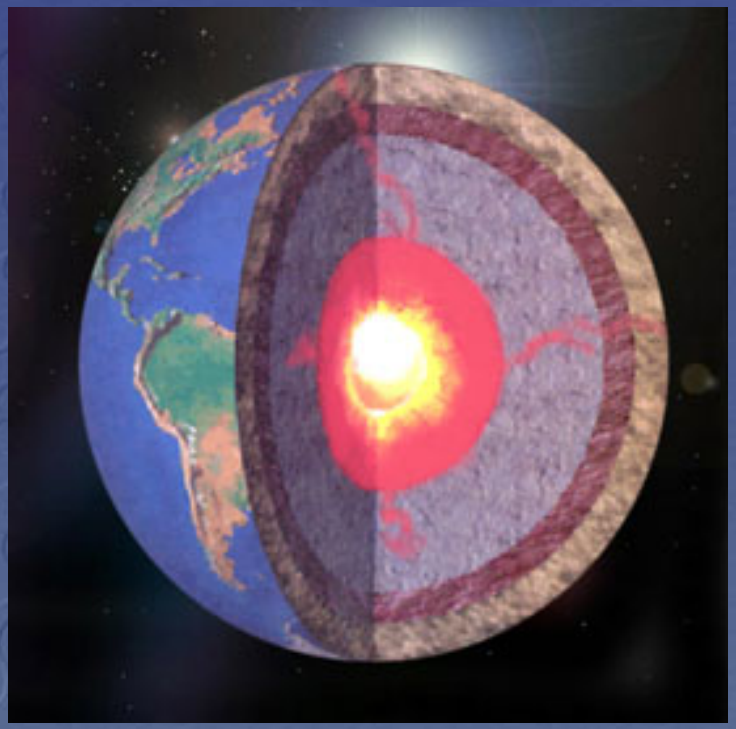
The University of Texas at Austin

AEC

ADVANCED ENERGY CONSORTIUM

Taking a Page Out of the Medical Industry…

Source - Top News Health



Source-Berkley Lab

Smart Dust

Our Vision

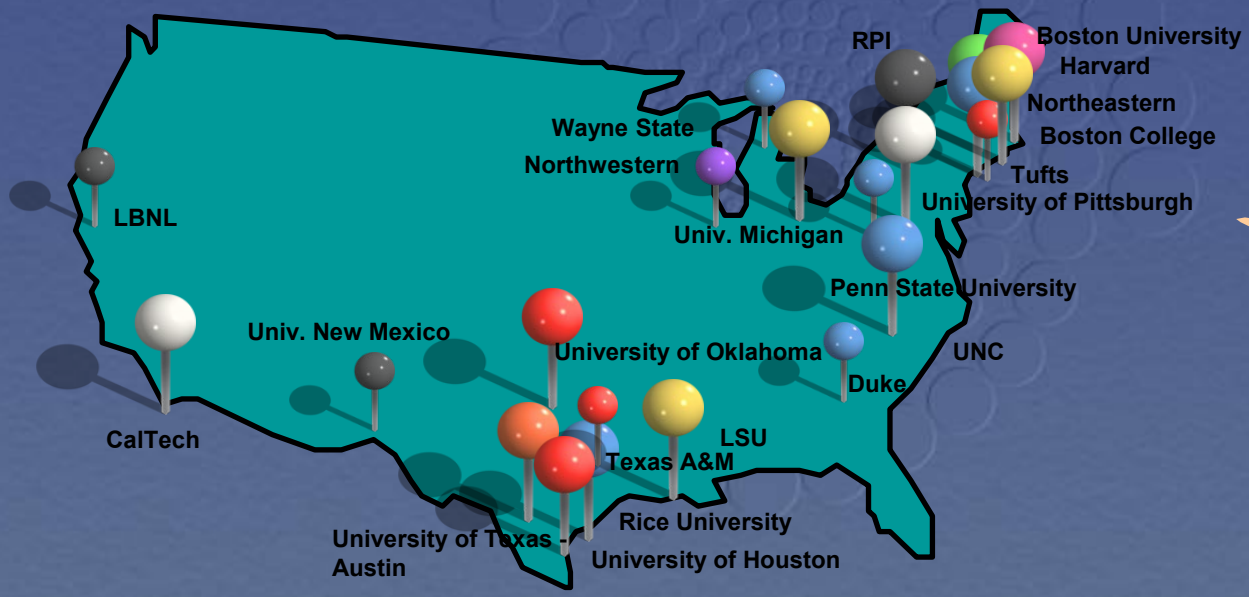
To illuminate the subsurface reservoir using novel micro- and nanosensing technology developed collaboratively with AEC members and the global community to enhance commercial extraction of oil and natural gas and create a competitive advantage for our members.

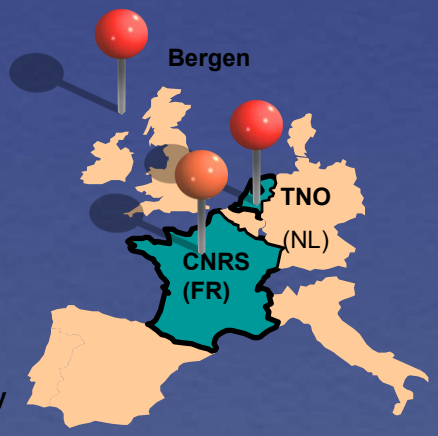
Since our inception in 2008 we have invested over $50 million in research and established more than 45 patents

But how does this effect a regulator?

We Wanted to Engage the Best and Brightest Minds

More than 400 Academics from 30 different Universities & Research Institutions around the world





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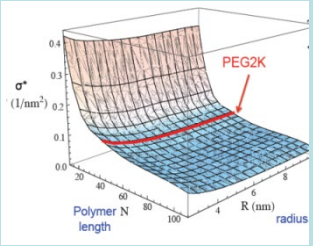
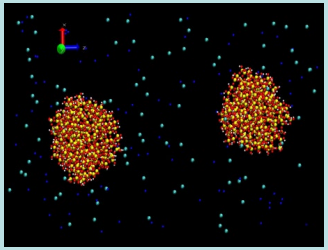
AEC Research Portfolio

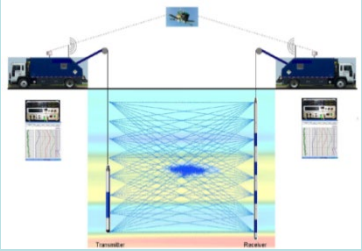
(Four Scientific Thrusts)

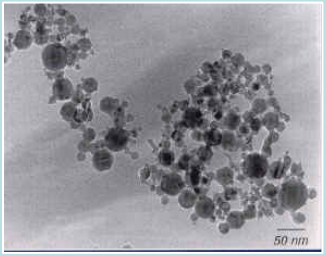
1) MOBILITY



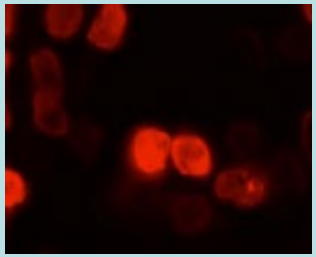


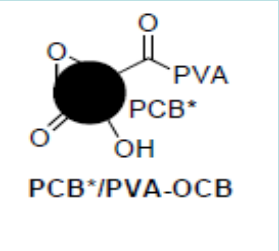
2) CONTRAST AGENTS



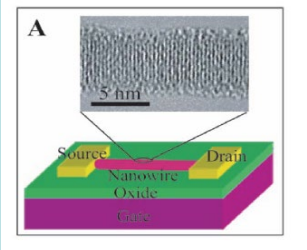


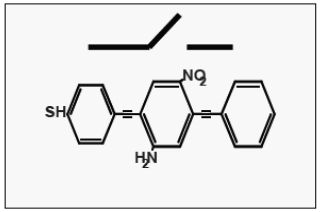
3) NANOMATERIAL SENSORS





4) MICRO-FABRICATED SENSORS





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AEC Research

In the first 6 years of the consortium we developed an impressive base of understanding

- Chemical coatings for mobility
- Smallest pressure sensors
- ph, resistivity, stress, pressure, temperature sensors
- High temperature batteries
- High temperature sensor platform
- Payload delivery capsules
- EM modelling software
- Contrast agents

Prototyping

Smarter Sensors/Proppant

Particles to illuminate the subsurface

Downhole Semiconductors

Micro and nano payload delivery capsules

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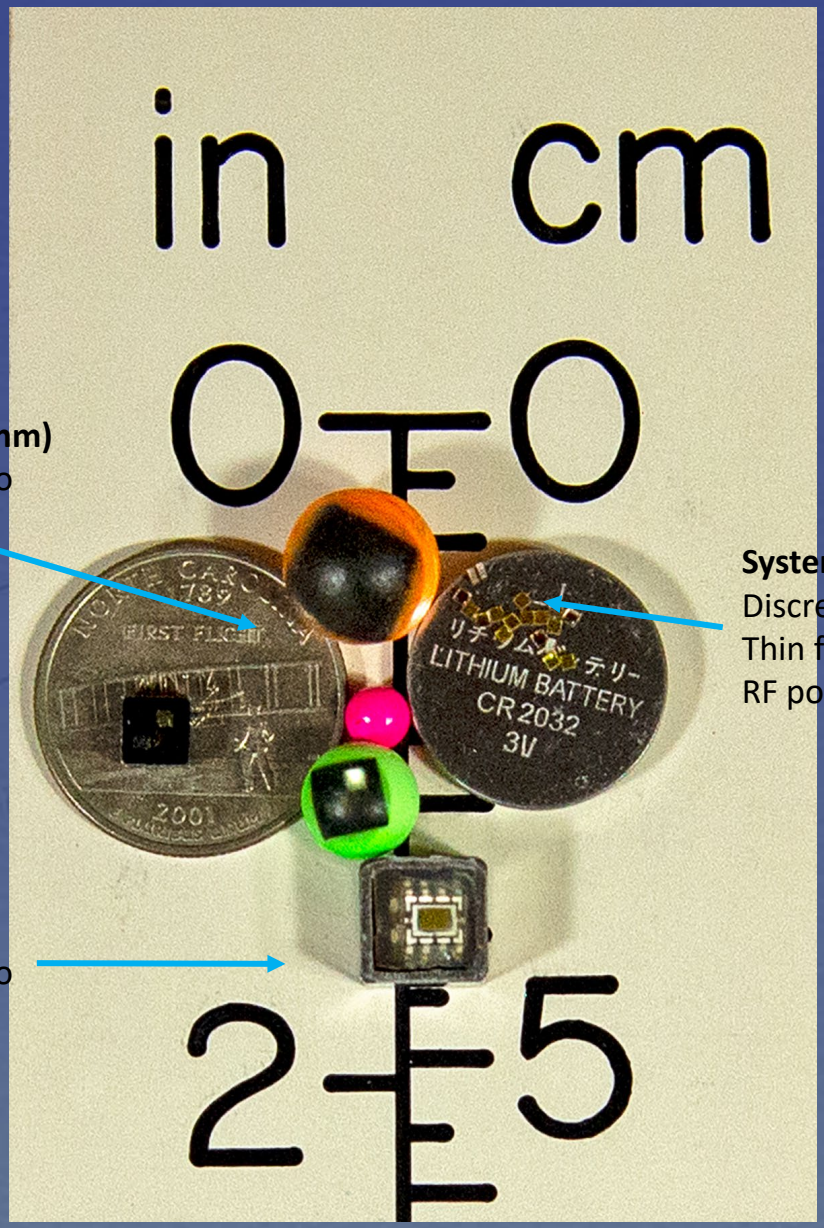
AEC's Microsensor Technology

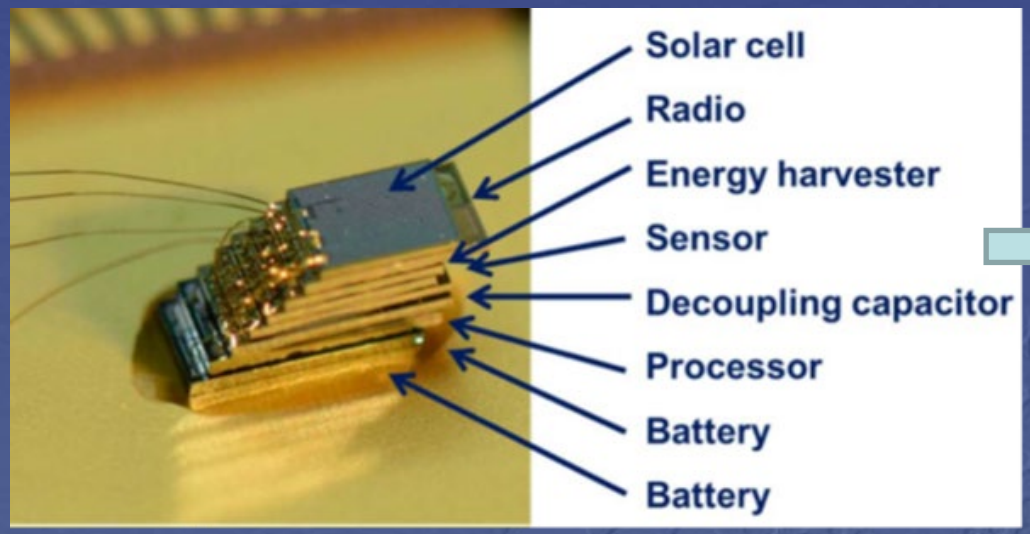


Stacked Chip System (5-12mm)
Temp/Pressure/Time Combo
Polymer Packaging
10-40hrs lifetime

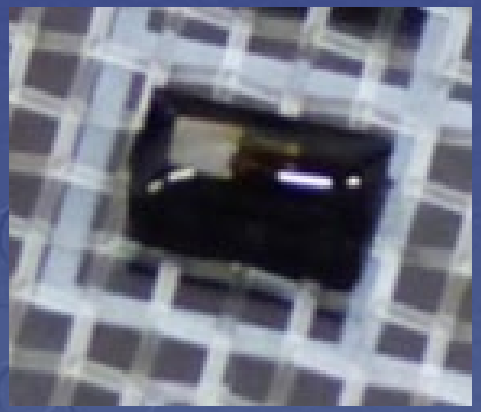
System on a Chip (1mm)
Discrete Temp, Press, Resist, pH
Thin film packaging
RF powered, battery-less, 30yr lifetime

System on a Board (8mm)
Temp/Pressure/Time Combo
Steel Packaging
10-16hrs lifetime

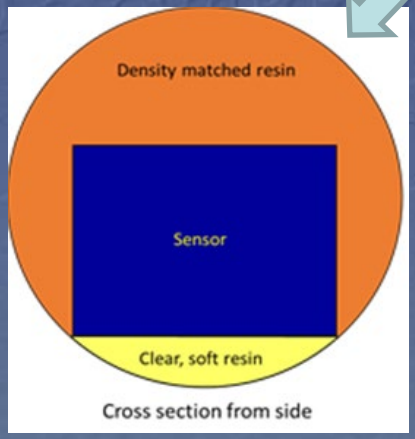
Microsystem Components



Stacked Chip System



Hermetic Encapsulation



Buoyancy Adjusting Final Encapsulation (5-12mm)

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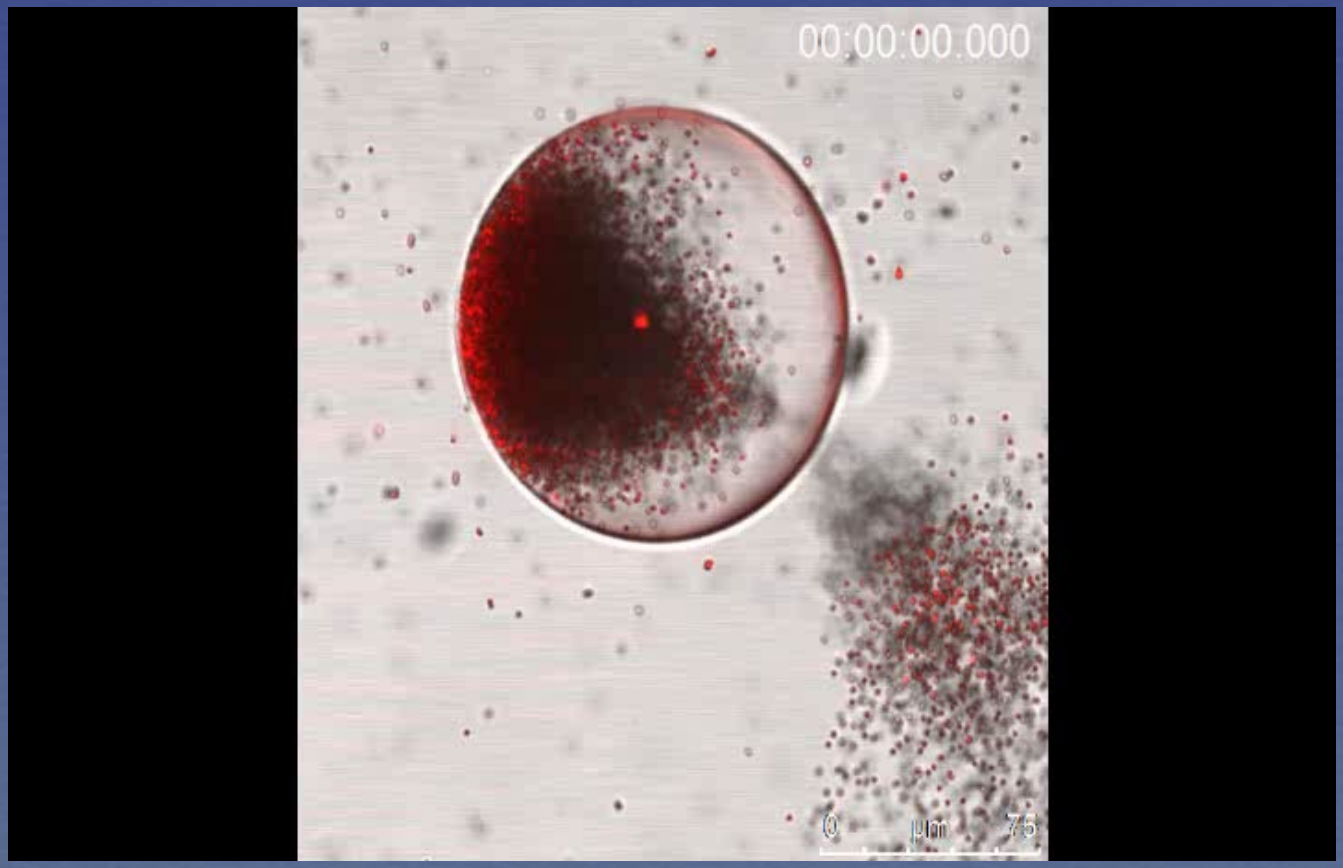
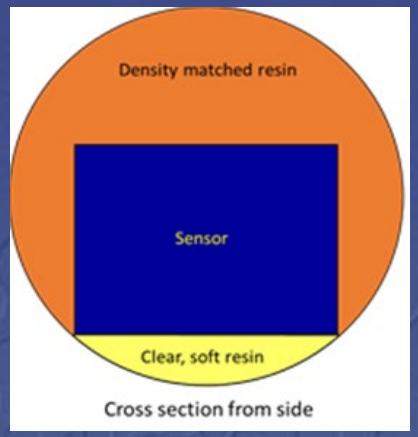
Payload Delivery

Payload Delivery



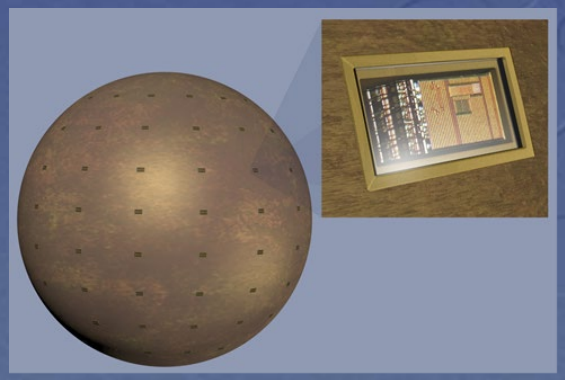
Some Current Applications

Attached to Well Rod



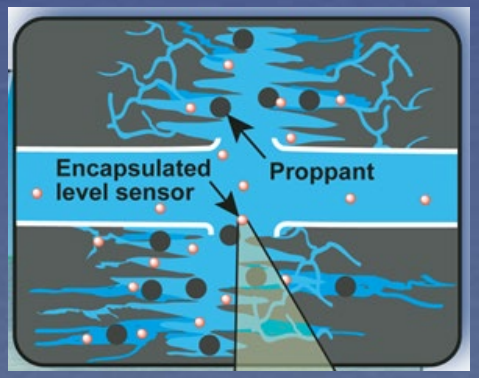
Recirculated in Wellbores, for Fracture Stage Contribution

Entrapped in Cement



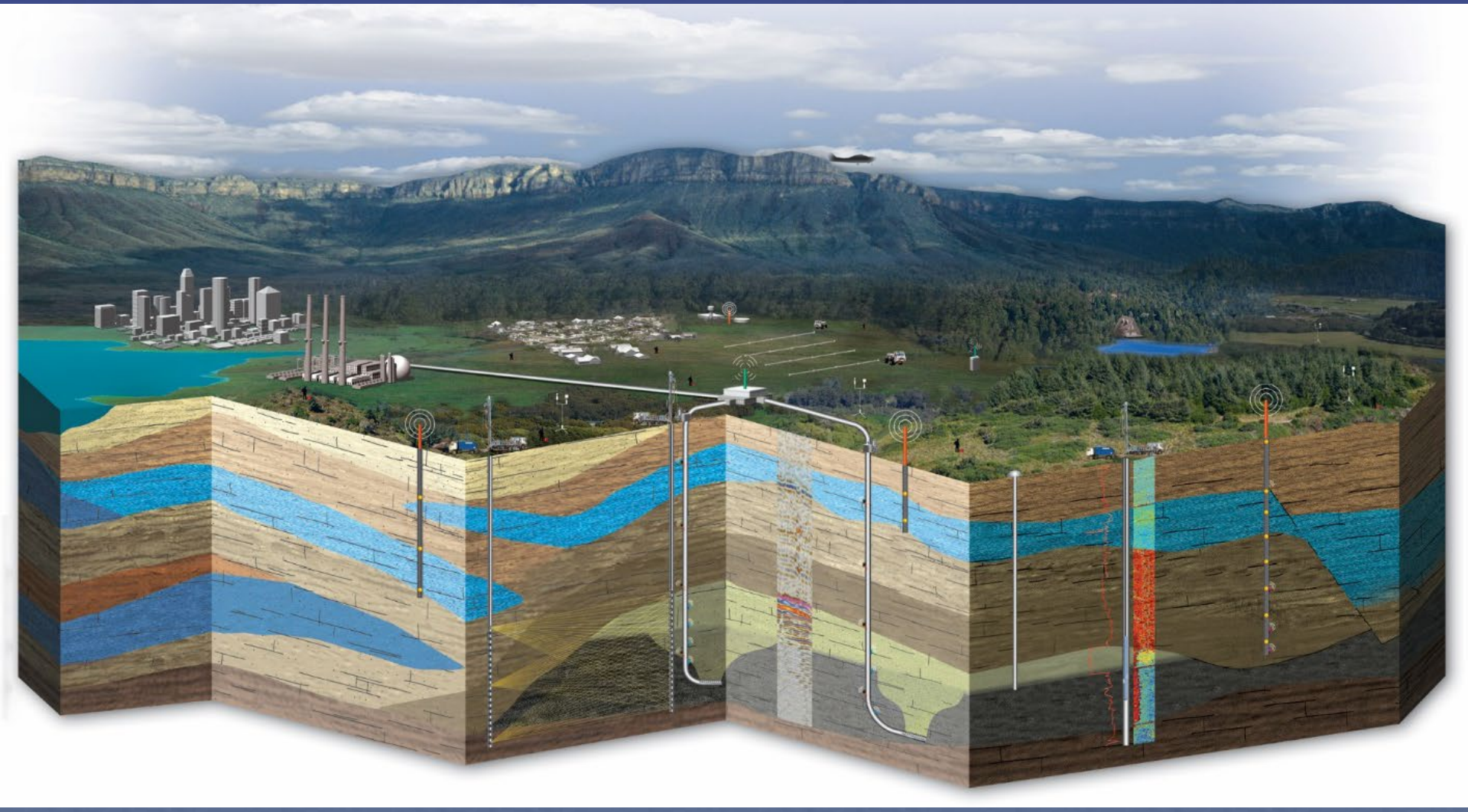
Frac Stage Isolation

Pipeline Pigging – data driven corrosion inhibitor schedule*



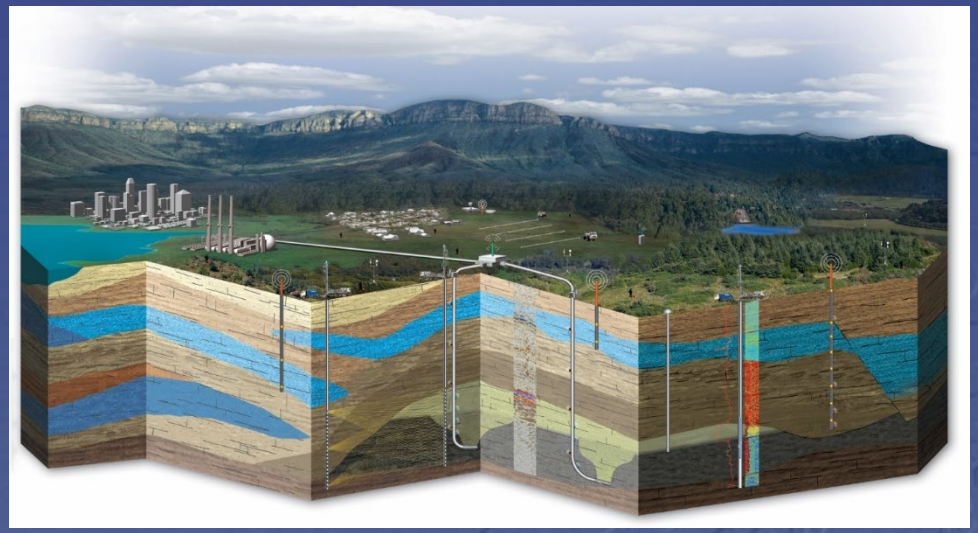
Entrapped in Fractures

Numerous Applications Identified



Images courtesy of Schlumberger Carbon Services and iStockPhoto

Non Oil & Gas Applications



There are numerous applications for subsurface sensors in other industries.

The AEC has created an impressive set of capabilities that others can leverage. We just need to find the large scale field environments to prove the value of these new cutting edge applications

- Pipelines – sensors on pipeline pigs
- Carbon Sequestration – mapping CO2 plumes
- Geothermal Energy – developing subsurface temperature maps
- Mining – sensors and mapping of leaching operations
- Nuclear – down hole well bore integrity, temperature and pressure monitoring
- Water – water remediation
- Construction – cement stress monitoring

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Images courtesy of Schlumberger Carbon Services and iStockPhoto

ADVANCED ENERGY CONSORTIUM

Summary…

- Opened consortium in Jan. 2008
- Invested more than $50 million in research
- Initiated more than 45 patents
- Over 300 peer reviewed papers
- Technologies ready to commercialize
- Potential to move into many other markets

But how does this effect a regulator?

Thank-you

Questions?