Project OASIS (DE-FE0032267)

Optimizing Alabama's CO_2 Storage in Shelby County

Ben Wernette, PhD
Southern States Energy Board

George Koperna
Advanced Resources International

Standard Disclaimer

This presentation is based upon work supported by the Department of Energy and was prepared as an account of work sponsored by an agency of the United States Government. *Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendations, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.*

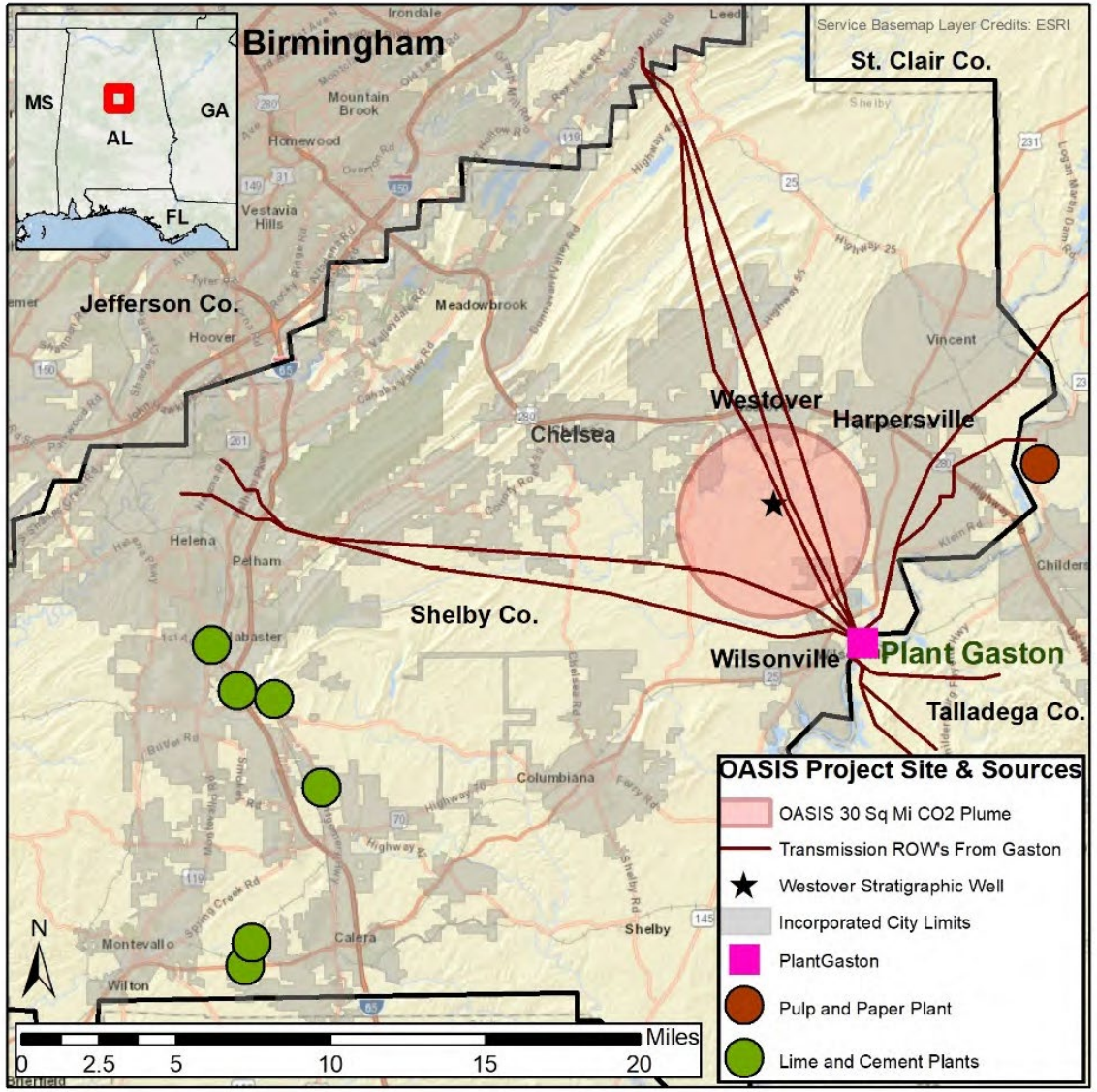
NATIONAL ENERGY TECHNOLOGY LABORATORY

Project Motivation

- Establish the foundation for a commercial-scale geologic storage complex for CO_2 captured from Plant Gaston and surrounding industrial sources of CO_2 located in Shelby County, Alabama
    1. Demonstrate that the subsurface saline formations at the storage complex can store commercial volumes of CO_2 safely and permanently;
    2. Develop a comprehensive Community and Stakeholder Engagement Plan;
    3. Develop the infrastructure framework for a CO_2 storage hub;
    4. Develop a rigorous risk registry and conduct a comprehensive risk assessment;
    5. Develop a monitoring plan;
    6. Develop a comprehensive site characterization plan to support an Underground Injection Control Class VI Permit in Phase III; and
    7. Evaluate project commerciality.

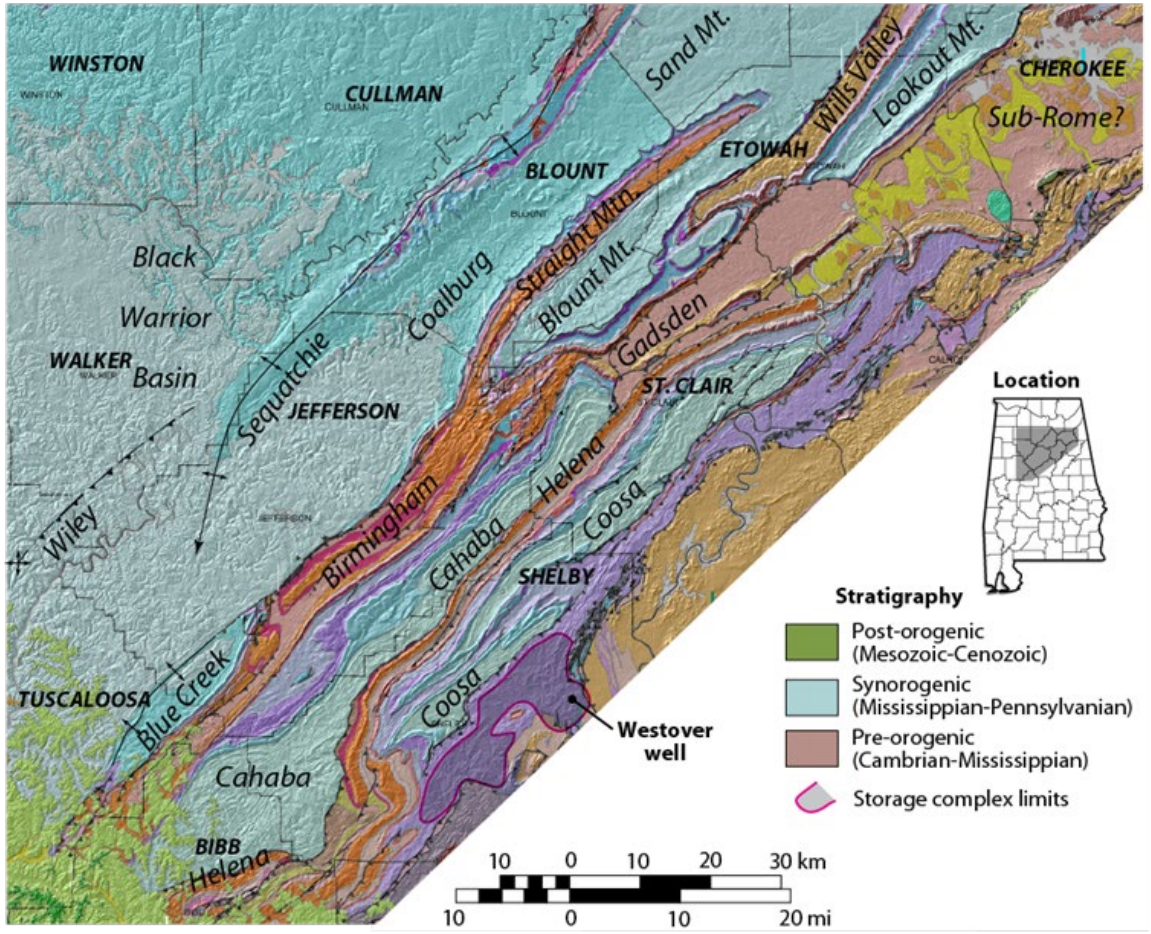
Location

- The proposed storage complex site is located 30 miles southeast of Birmingham.
- The complex will provide storage for the CO2 emissions captured from Alabama Power's Plant Gaston and is the site of the DOE's National Carbon Capture Center (NCCC) in Wilsonville, Alabama.
- The proposed storage site could also serve as a central CO2 storage hub for the seven large cement plants and a major pulp and paper plant located in the area.



Geology

- Located in the Alabama fold and thrust belt
- Relatively flat lying structural panels between thrust faults may serve as regional storage complexes
- Cambro-Ordovician carbonates and Cambrian clastic units offer multiple storage intervals
- Shales, including the tectonically thickened Floyd-Parkwood, provide containment



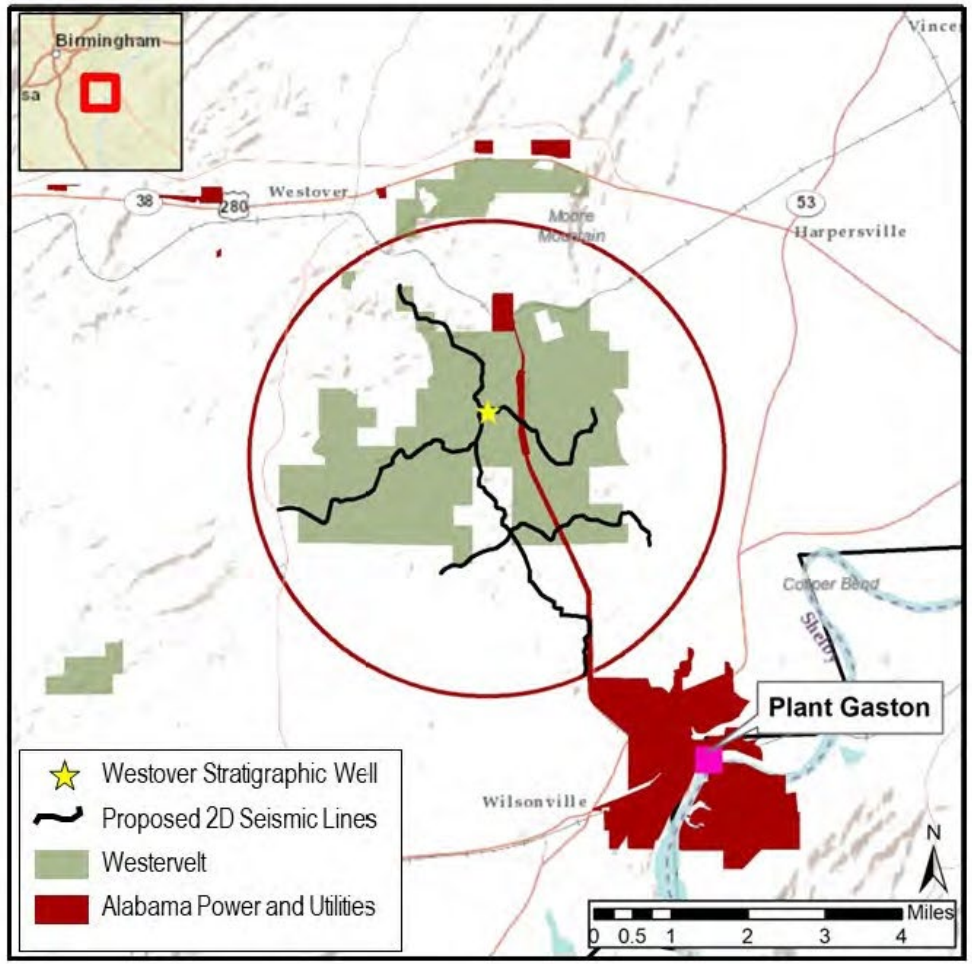
What Have We Been Up To?

- In 2022, a stratigraphic borehole (Westover Strat #1) was drilled to explore an otherwise untested region of central Alabama.
- Based on regional structural trends, the Cambrian-Ordivician (OCk) storage formations were thought to occur at 5,000-6,000 ft and overlain by the Floyd Shale/Parkwood MUSHWAD.
  - Malleable Unctuous SHale, Weak-layer Accretion in a Ductile complex.
  - Forms due to bulk ductile deformations and large-scale tectonic thickening of a thick, weak, décollement host strata. (Translation: tough drilling!)
- Directional drilling was used to maintain verticality, but a 6,500 ft test did not reach the storage interval.
- Openhole logs, including sonic, collected to tie to legacy and future 2D seismic lines

What Have We Been Up To?

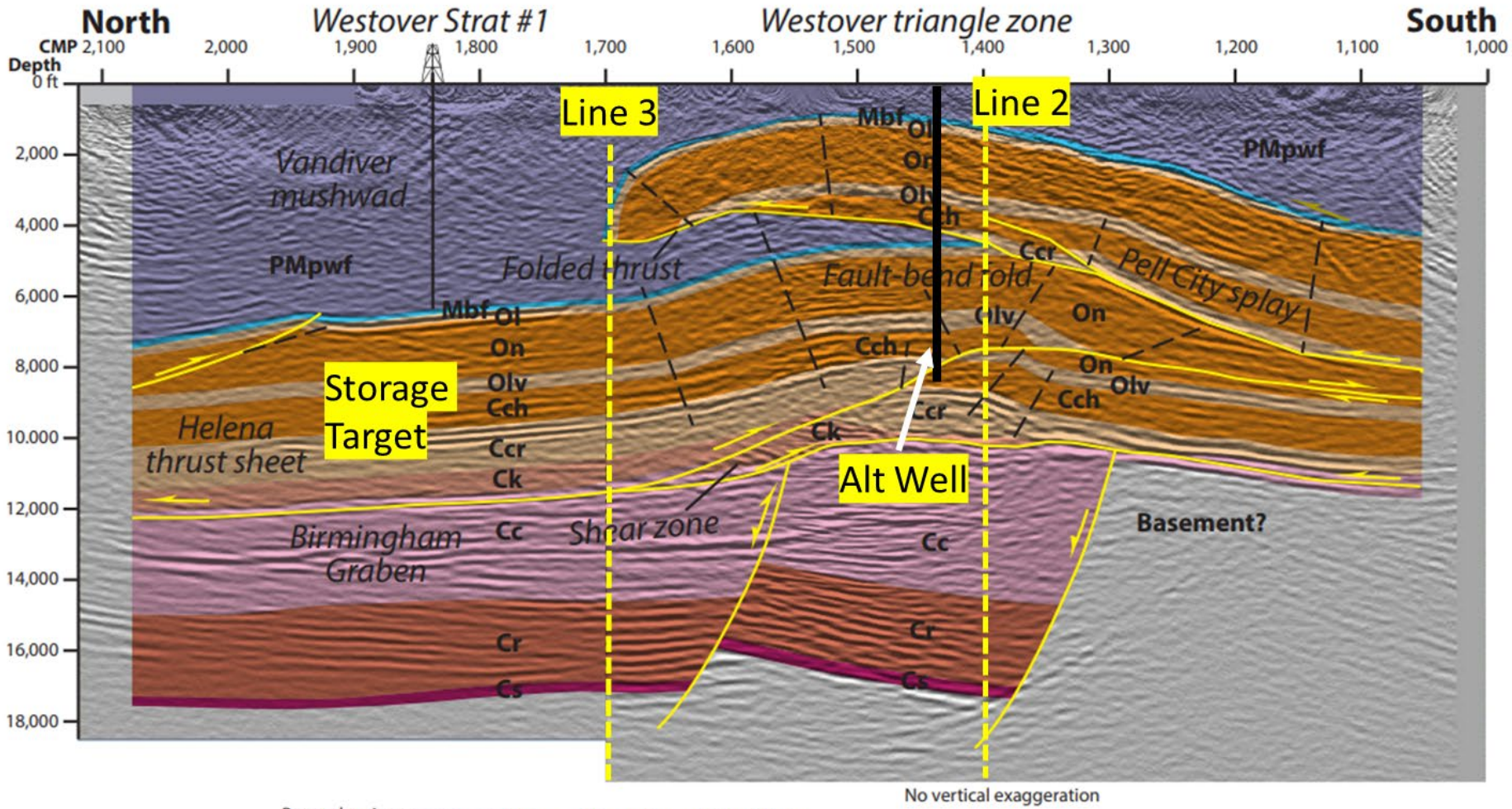
In November (2022), a multi-2D seismic survey was collected across the area of interest.

- 3 lines, 17-line miles
- 110 ft source spacing
- 55 ft receiver spacing
- 4 vibes, sweeping 2 to 100 Hz
- Trace length of 5,000 ms, 2 ms sampling



Transcending Boundaries

Line #1 Interpretation (Pashin)



Storage Target(s)

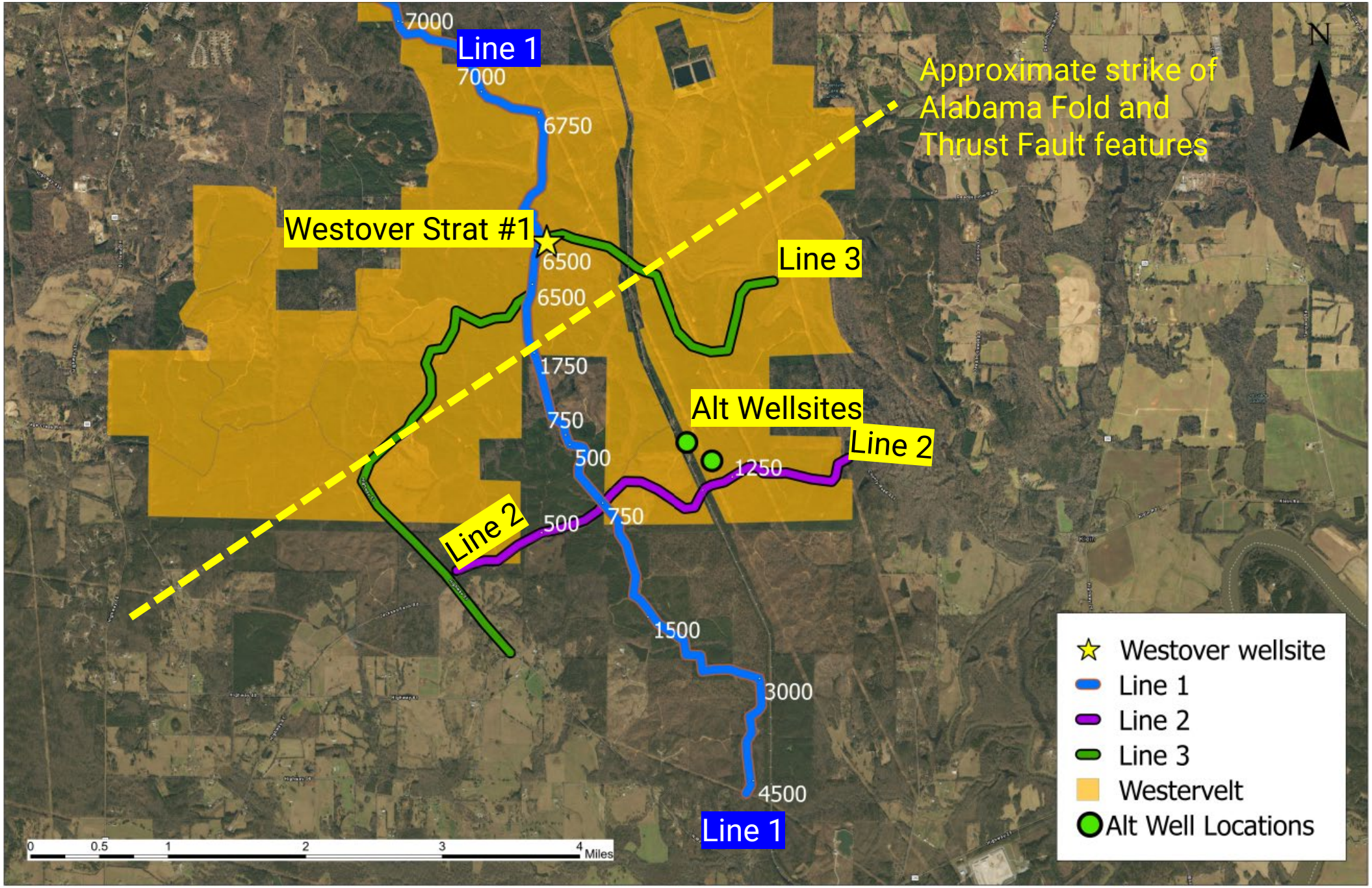
Pennsylvanian	PMpwf	Parkwood Formation and Floyd Shale	
Mississippian	Mbf	Bangor Limestone and Fort Payne Chert	
Ordovician	Ol	Lenoir Limestone	
	On	Newala Limestone	Knox Group
	Olv	Longview Limestone	
	Och	Chepultepec Dolomite	
	Ccr	Copper Ridge Dolomite	
Cambrian	Ck	Ketona Dolomite	
	Cc	Conasauga Formation	
	Cr	Rome Formation	
	Cs	Shady Dolomite	
Precambrian	Basement	Crystalline basement	

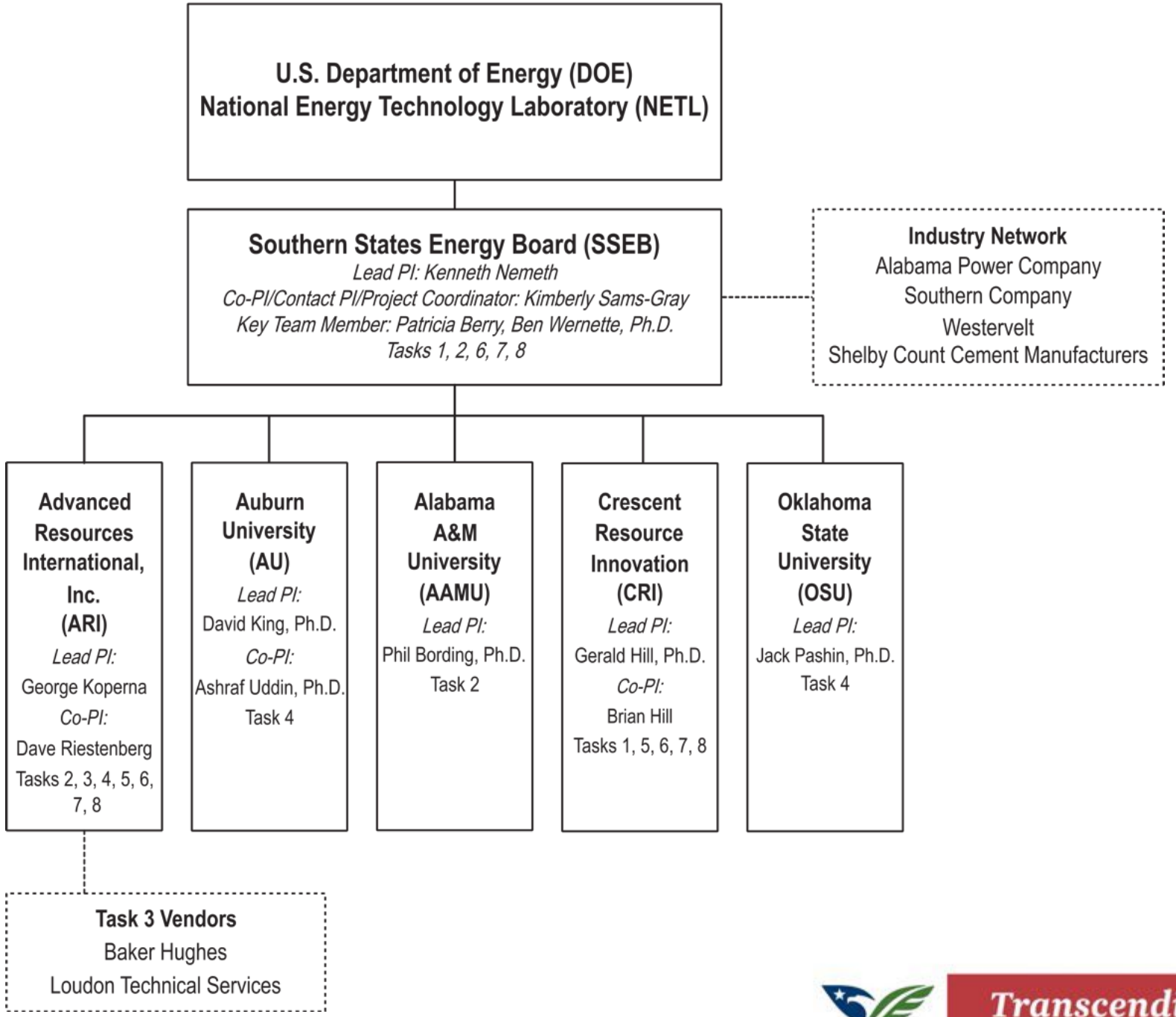
Fold hinge

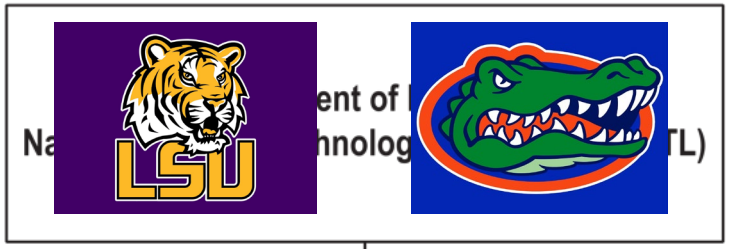
Fault; arrow indicates sense of motion

What Have We Been Up To?

- Located in an area where the storage reservoirs occur shallower than Westover Strat #1
- Site was recently logged by site host (Westervelt)
- Site’s egress, natural grade and extent appears to be adequate for a stratigraphic test
- APCO railroad grade visible on the left and power line ROW on the right
- A secondary site was also located to the south which is further from the rail line
- Working with Southern Company ROW specialist, on issues related to power lines and rail line


7000
Line 1
7000
6750
Approximate strike of
Alabama Fold and
Thrust Fault features
N
Westover Strat #1
6500
Line 3
6500
1750
Alt Wellsites
750
Line 2
500
1250
Line 2
500
750
1500
3000
4500
Line 1
0
0,5
1
2
3
4
Miles
Westover wellsite
Line 1
Line 2
Line 3
Westervelt
Alt Well Locations


U.S. Department of Energy (DOE)
National Energy Technology Laboratory (NETL)
Southern States Energy Board (SSEB)
Lead PI: Kenneth Nemeth
Co-PI/Contact PI/Project Coordinator: Kimberly Sams-Gray
Key Team Member: Patricia Berry, Ben Wernette, Ph.D.
Tasks 1, 2, 6, 7, 8
Industry Network
Alabama Power Company
Southern Company
Westervelt
Shelby Count Cement Manufacturers
Advanced Resources International, Inc. (ARI)
Lead PI:
George Koperna
Co-PI:
Dave Riestenberg
Tasks 2, 3, 4, 5, 6, 7, 8
Auburn University (AU)
Lead PI:
David King, Ph.D.
Co-PI:
Ashraf Uddin, Ph.D.
Task 4
Alabama A&M University (AAMU)
Lead PI:
Phil Bording, Ph.D.
Task 2
Crescent Resource Innovation (CRI)
Lead PI:
Gerald Hill, Ph.D.
Co-PI:
Brian Hill
Tasks 1, 5, 6, 7, 8
Oklahoma State University (OSU)
Lead PI:
Jack Pashin, Ph.D.
Task 4
Task 3 Vendors
Baker Hughes
Loudon Technical Services



Advanced Resources

Auburn University

Task 4

Alabama A&M

Crescent Resource

Brian Hill

Tasks 1, 5, 6, 7, 8

Oklahoma State

Transcending Boundaries

Project Objectives

Site specific characterization and assessment of the CO2 storage complex via stratigraphic test well drilling, formation testing, and geologic data collection

A project risk assessment with mitigation and management plans

A plan for subsequent detailed site characterization and UIC Class VI permitting

A project technical and economic feasibility assessment, including conceptual level design study for CO2 transport

A robust Community and Stakeholder engagement plan

Tasks

Task 1 – Project Management and Planning

Task 2 – Community Benefits Plan

Task 3 – Site Specific Characterization and Assessment of the CO_2 Storage Complex

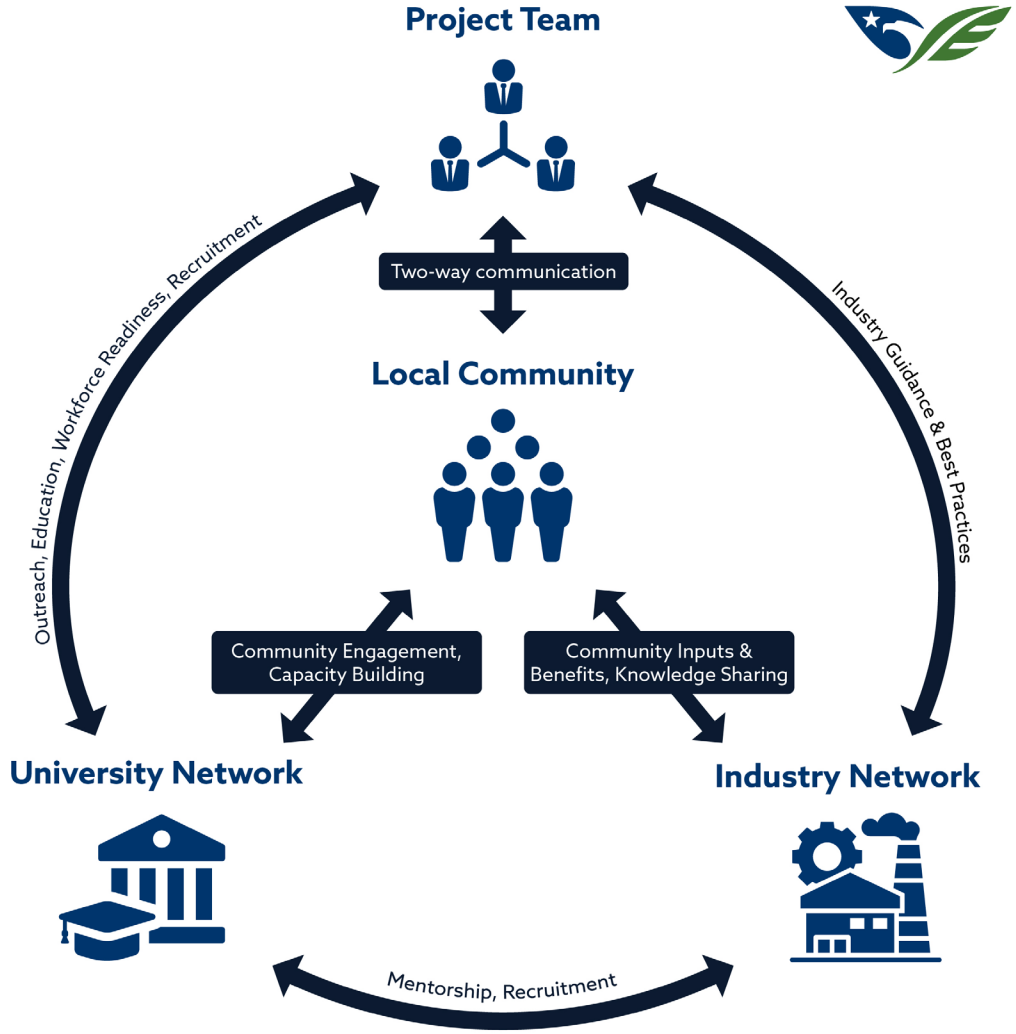
Task 4 – Geologic Data Analysis

Task 5 – Infrastructure Assessment

Task 6 – CarbonSAFE Phase III Readiness

Task 2 – Community Benefits Plan

- Coordinating with participating academic partners Alabama A&M University and Auburn University
- Goals of CBP
  - Increase community involvement in project decision making
  - Increasing access to educational and career opportunities for those from disadvantaged and/or minority communities
    - Expanding existing computer programming classes to include seismic processing



Task 3 - Site Specific Characterization and Assessment of the CO_2 Storage Complex

- Seismic interpretations suggest new stratigraphic test location will minimize drilling challenges
- Targeting the Ketona Dolomite, Knox Group, and Conasauga Formation
- Risk workshop to mitigate challenges
- Wireline testing, sidewall core

Drill bit.

Stratigraphic test well rig and ancillary equipment..

Deliverables

Task/ Subtask Number	Deliverable Title	Due Date
1.0	Project Management Plan (D1)	Update due 30 days after award. Revisions to the PMP shall be submitted as requested by the NETL Project Manager.
3.0	Stratigraphic Test Well Drilling Report (D2)	To be completed after drilling operations.
4.0	Geologic Analysis Report – Core Analysis, Refined Geologic Model, and Reservoir Modeling (D3)	30 Days Prior to End of Performance Period.
5.0	Infrastructure Assessment Report (D4)	30 Days into Year 2 of Performance Period.
6.0	CarbonSAFE Phase III Readiness Report (D5)	30 Days Prior to End of Performance Period.
7.0	Social and Environmental Risk Assessment Report (D6)	30 Days Prior to End of Performance Period.
8.0	Commercialization Plan (D7)	30 Days Prior to End of Performance Period.

Thanks!

Ben Wernette, PhD
Southern States Energy Board
wernette@sseb.org

George Koperna
Advanced Resources International
gkoperna@adv-res.com