“GoMCarb” Partnership
Offshore Gulf of Mexico Partnership for Carbon Storage Resources and Technology Development
Cooperative Agreement: DE-FE0031558

Susan Hovorka, Tip Meckel, and Ramón Treviño
Gulf Coast Carbon Center,
Bureau of Economic Geology
Jackson School of Geosciences
The University of Texas at Austin

U.S. Department of Energy
National Energy Technology Laboratory
Mastering the Subsurface Through Technology Innovation, Partnerships and Collaboration:
Carbon Storage and Oil and Natural Gas Technologies Review Meeting
August 13-16, 2018
Presentation Outline

Project Evolution
  – background

• Scope of work
• Team member overview
• Expected outcomes
• Task/subtask overview
• Synergy
• Accomplishments first quarter
## Project Evolution

### offshore Projects

<table>
<thead>
<tr>
<th>#</th>
<th>Project Title</th>
<th>External Agency</th>
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<td>10</td>
<td>Offshore Gulf of Mexico Partnership for Carbon Storage--Resources and Technology Development</td>
<td>DOE - NETL</td>
<td>4/11/2018</td>
<td>1/31/2022</td>
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<td>GCCC support for ACORN Project (HR3D)</td>
<td>Univ. Edinburgh</td>
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<td>CarbonSAFE Phase I: Pre-feasibility Study - Northwest Gulf of Mexico CO2 Storage Complex</td>
<td>DOE - NETL</td>
<td>2/1/2017</td>
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<td>Validation of MVA Tools for Offshore CCS: Novel Ultra-High-Resolution 3D Marine Seismic Technology Integrated with Coring and Geochemistry</td>
<td>DOE - NETL</td>
<td>10/1/2016</td>
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<td>Atlantic Offshore CO2 Storage Resource Assessment</td>
<td>Battelle (DOE)</td>
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<td>Offshore Storage Resource Assessment of the Northern Gulf of Mexico (TXLA)</td>
<td>DOE - NETL</td>
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<td>4</td>
<td>BEG Support to DOE FE Climate Change Working Group (China)</td>
<td>DOE - HQ</td>
<td>4/1/2015</td>
<td>5/15/2016</td>
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**Geologic Characterization:** 6  
**HR3D Seismic:** 3
Why mature storage resource in Offshore Gulf of Mexico?

- Very large storage resource – more than 1/3 of US storage resource is offshore
- Public ownership of surface, subsurface and minerals
- Will it be needed? Proximal to sources – de-risking onshore capacity
- Much is known about geology, however low on resource maturity

Global significance
History of Cenozoic North American drainage basin evolution, sediment yield, and accumulation in the Gulf of Mexico basin

William E. Galloway¹, Timothy L. Whiteaker², and Patricia Ganey-Curry¹

¹Institute for Geophysics, University of Texas at Austin, 10100 Burnet Road, Austin, Texas 78758-4445, USA
²Center for Research in Water Resources, University of Texas at Austin, 10100 Burnet Road, Austin, Texas 78758-4445, USA

Middle Miocene Paleogeography
A bit of background...

Regional assessment in NETL atlas
A bit more background...

One case of linking sources to sinks via pipeline and boat.

Net CO₂ Capacity
Total Project Area = 129 Gt

166 MMT in structural trap

Carbon SAFE July 2017
Offshore Partnerships Division of Effort
Scope of Work

- Offshore Storage Resources Characterization
- Risk Assessment, Simulation, and Modeling
- Monitoring, verification, and accounting (MVA)
- Infrastructure, Operations, and Permitting
- Knowledge Dissemination
GoMCarb Organizational Chart

Task 1.0 Management
BEG: Hovorka, Meckel, Trevino

Task 2.1 Offshore storage characterization data base development
BEG: Meckel, Texas and Integration
UTIG-GBDS-whole GoM
LA GS - Groot - LA waters

Task 2.2 Data Gap Assessment
Fugro
TDI-Brooks

Task 2.3 Offshore and reservoir storage EOR potential
BEG - Nunez
USGS

Task 3.1 Risk Assessment and Mitigation Strategies
LBNL - Oldenberg
LLNL - White

Task 3.2 Geologic Modeling
GCCC - Nunez
UTX Petroleum Engineering - Lake

Task 3.3 Offshore storage characterization data base development
GCCC - Meckel, Romanak
Lamar University - Chen
LBNL- Ajo Franklin
FUGRO

Task 4.1 MVA Technologies and Methodologies
GCCC Meckel, Romanak
Lamar University - Chen
LBNL- Ajo Franklin
Fugro

Task 4.2 Plans for field testing MVA Technologies
GCCC Meckel, Romanak
LBNL- Ajo Franklin
Fugro

Task 5.1 CO₂ Transport and delivery
Trimeric

Task 5.2 Scenrio Optimization
GCCC Hovorka

Task 5.3 Communication
GCCC Hovorka

Task 6.1 Stakeholder Outreach
Hovorka
Trimeric - Source outreach
Battelle - Atlantic storage

Task 6.2 Technical Outreach
Hovorka
Trimeric - Source outreach
Battelle - Atlantic storage

Explanation
Lead (bold)
GCCC staff
Federal participant
Commerical participant
State or University Participant
U Texas staff
NGO or other

Task 6.3 Advisory Panel
Hovorka, Romanak
Members:
Dixon IEA GHG UK
Batum - BOEM US
Telezke - Exxon Mobil
Tucker - Shell UK
Berley - IEA Paris
Hoffman Carbon Net Au
Zhou - Guazhou China
Haszeldine - Edinburgh UK
Xue - RITE Japan
Mota _SENER - Mexico
Gaucruz - PEMEX Mexico
Hill - CATF Env NGO

communication to all tasks as needed
## Technical Team Member Roles

<table>
<thead>
<tr>
<th>Institution</th>
<th>Location</th>
<th>Expertise</th>
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<tr>
<td>GCCC</td>
<td>Austin, TX</td>
<td>CCS Project Lead</td>
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<td>Gulf of Mexico Basin Synthesis (GBDS)</td>
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<td>Petroleum &amp; Geosystems Engineering</td>
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<td>Fugro</td>
<td>Houston, TX</td>
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<td>TDI-Brooks, Int.</td>
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<td>MVA Technologies</td>
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<td>Lamar University</td>
<td>Beaumont, TX</td>
<td>Risk Assessment; Outreach</td>
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<td>Trimeric</td>
<td>Round Rock, TX</td>
<td>Engineering; Infrastructure and Operations</td>
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<td>USGS</td>
<td>Reston, VA</td>
<td>Characterization and Capacity Assessment</td>
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<td>Louisiana Geologic Survey</td>
<td>Baton Rouge, LA</td>
<td>Characterization; Database Development</td>
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<td>LBNL</td>
<td>Berkeley, CA</td>
<td>Risk Assessment; MVA Technologies</td>
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<tr>
<td>LLNL</td>
<td>Livermore, CA</td>
<td>Risk Assessment</td>
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</table>
GBDS Products

- **Map suites** for 18 Cenozoic and 15 Mesozoic depositional episodes.
  - Unit top, unit thickness, sandstone-bearing interval thickness, limestone-bearing interval thickness, structural framework, paleogeography, and more...

- Maps and all supporting data, including interpreted well logs and reference materials, are provided and organized in an ArcGIS database.

2337 total wells in Database
  - 413 New Wells

2130 References in Database
  - 1123 georeferenced images
  - 353 New refs
  - 274 Mexico refs (39 theses)

260 preconstructed maps:
  - 167 Cenozoic
  - 81 Mesozoic

1148 map layers for primary database
  - 563 map layers for references

https://ig.utexas.edu/energy/gbds/
Expected Outcomes (1)

- Combine the capabilities and experience of industry, academia, and government to ensure safe, long-term, economically-viable carbon storage in offshore environments:
  1. Characterize storage resource;
     - Geologic maps (structure, porosity, facies, etc.)
     - Seismic interpretation (key biostratigraphic horizons)
  2. Develop and design testing for key MMV technologies.
Evaluate the significance of accessible, secure, large-volume CO₂ offshore storage (including CCUS for hydrocarbon recovery) for supporting a secure future for the concentrated, growing, carbon-intensive industries of the areas bordering the Gulf of Mexico.

NATCARB-Refining sources
Expected Outcomes (3)

- Participation of industry practitioners, IEAGHG, CSLF.
- The knowledge base created by the Offshore Carbon Storage Partnership will facilitate subsequent development of technology-focused permitting processes needed by regulators.
  - DOI, BOEM, and EPA.

### Risk Perceptions and Information Behaviors in the Context of Carbon Capture and Storage in Southeast Texas

Lee Ann Kahlor, Stan Richards School of Advertising and Public Relations, The University of Texas at Austin
Task/Subtask Breakdown

• **Task 1:** Project Management, Planning, and Reporting: PMP, DMP, TMP

• **Task 2:** Offshore Storage Resources Characterization
  2.1: Database development
  2.2: Data Gap Assessment (regional)
  2.3: Offshore Reservoir Storage and EOR

BEG, UTIG, LAGS
Fugro, TDI-Brooks
BEG, USGS
## Data available to GoMCarb

<table>
<thead>
<tr>
<th>DATABASE</th>
<th>200 Gigabyte GoM-wide ArcGIS Project</th>
<th>GBDS</th>
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<tr>
<td><strong>Well Data</strong></td>
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<tr>
<td>raster &amp; digital well logs</td>
<td>2,337 Interpreted Wells</td>
<td>GBDS</td>
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<tr>
<td>paleontological data (stratigraphic tops)</td>
<td>6,054 Wells</td>
<td>IHS Database</td>
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<td>Production data</td>
<td>&gt;54,000 Wells</td>
<td>BOEM/BSSE</td>
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<tr>
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<tr>
<td><strong>2D seismic data</strong></td>
<td>&gt;160,000 linear miles total</td>
<td>GBDS</td>
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<tr>
<td></td>
<td>(150,000 linear miles from NAMSS currently in project)</td>
<td>Public: NAMSS Database</td>
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<tr>
<td></td>
<td></td>
<td>Proprietary 2D: ION Geophysical (Gulfspan Merge)</td>
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<tr>
<td></td>
<td>2,304 sq. mi.</td>
<td>GBCC Offshore CCS Projects</td>
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<td><strong>3D seismic data</strong></td>
<td>22,000 sq. mi.</td>
<td>Vendor Loan (GBDS)</td>
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<td>150,000 sq. mi. available</td>
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<td>997 sq. mi.</td>
<td>Proprietary: Seismic Exchange, Inc.</td>
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<td><strong>Depositional Systems Interp.</strong></td>
<td>34 Gulf-wide maps</td>
<td>GBDS</td>
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<td><strong>Well Geologic Samples</strong></td>
<td>788 wells identified</td>
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<td>Core, cuttings</td>
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<td><strong>Stratigraphic Unit Interpretation</strong></td>
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<td>georeferenced images</td>
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1. National Archive of Marine Seismic Surveys; See: [https://walrus.wr.usgs.gov/NAMSS/](https://walrus.wr.usgs.gov/NAMSS/)
2. 3D Seismic Data available in NAMSS database for public download.
3. Chandeleur Islands & Breton Sound, LA
Available wireline logs
Available Seismic (GBDS)
Task/Subtask Breakdown

• Task 3: Risk Assessment, Simulation, and Modeling
  – 3.1: Risk Assessment and Mitigation Strategies
  – 3.2: Geologic Modeling
Task/Subtask Breakdown

• Task 4: Monitoring, Verification, and Accounting (MVA)
  – 4.1: MVA Technologies and Methodologies
    • 4.1.1: Geochemical Monitoring of Seabed Sediments
    • 4.1.2: HR3D Seismic (P-cable)
    • 4.1.3: Distributed Acoustic Sensors
  – 4.2: Plans for Testing MVA Technologies
    • Priority technology list and testing methods
Task/Subtask Breakdown

• Task 5.0: Infrastructure, Operations, and Permitting
  – 5.1: CO$_2$ Transport and Delivery (nearshore)
  – 5.2: Scenario Optimization
    • 5.2.1: Analog Site Optimization
  – 5.3: Communication
    • BOEM, EPA, US-ACE, etc.
Task/Subtask Breakdown

• Task 6: Knowledge Dissemination
  – 6.1: Stakeholder Outreach
  – 6.2: Technical Outreach
  – 6.3: Advisory Committee
<table>
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<tr>
<th>Advisor</th>
<th>Institution</th>
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<th>Expertise and Role</th>
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<tbody>
<tr>
<td>Tim Dixon</td>
<td>IEA GHG R&amp;D development program</td>
<td>Cheltenham, UK</td>
<td>Chair advisory committee, assure connection of partnership with international CCS community</td>
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<tr>
<td>Melissa Batum</td>
<td>BOEM</td>
<td>Reston VA</td>
<td>Liaison to BOEM</td>
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<tr>
<td>Gary Teletzke</td>
<td>Exxon-Mobil</td>
<td>Houston TX</td>
<td>Liaison to industry EOR and CCS expertise</td>
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<td>Owain Tucker</td>
<td>Shell</td>
<td>Scotland, UK</td>
<td>Liaison to industry, Technical advice from offshore project in North Sea</td>
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<td>Thomas Berley</td>
<td>IEA</td>
<td>Paris France</td>
<td>Liaison to international policy</td>
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<td>Nick Hoffman</td>
<td>CO2 GeoNET</td>
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<td>Technical advice from similar near offshore project in Victoria</td>
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<td>Zhou Di</td>
<td>South China Sea Institute of Oceanology, Chinese Academy of Sciences of Guangzhou, China</td>
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<td>Technical advice from related project in Pearl River Mouth Basin, China</td>
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<td>Stuart Haszeldine</td>
<td>Scottish CCS Centre, University of Edinburgh</td>
<td>Edinburgh, Scotland</td>
<td>Technical advice from related projects in UK sector of the North Sea</td>
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<td>Ziqiu Xue</td>
<td>RITE, University of Kyoto</td>
<td>Kyoto, Japan</td>
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<td>Jasmin Mota Nieto</td>
<td>Secretaría de Energia (SENER)</td>
<td>Mexico City, Mexico</td>
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<td>Heron Gachuz</td>
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<td>Bruce Hill</td>
<td>Clear Air Task Force</td>
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<td>Environmental NGO with interest in CCS, geologic expertise</td>
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<td>Robert Hatter</td>
<td>Texas General Land Office</td>
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<td>Niels Peter Christensen</td>
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<td>Rob Finley</td>
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<td>Noel Kamrajh</td>
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<td>Offshore project development</td>
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<td>Douglas Connelly</td>
<td>National Oceanography Centre</td>
<td>Southampton UK</td>
<td>Offshore monitoring</td>
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Synergy Opportunities

Offshore CCS at GCCC

GULF OF MEXICO
- GomCARB Partnership
  - CarbonSAFE
  - TXLA
  - BOEM
  - Miocene Megatransect
    - HR3D Seismic
    - Geochemistry

ATLANTIC
- Battelle Mid-Atlantic
  - SSEB South Atlantic

JAPAN
- Tomakomai
  - Pearl River Mouth Basin

CHINA

NORTH SEA
- Scotland ACORN
  - NTNU
  - IODP GlaciStore

GLOBAL
- CSLF & IEA-GHG
  - International Offshore Storage Workshops
  - UNFCC (Nigeria)

HR3D SEISMIC
- 3 GoM 1 Japan surveys
  - Service Center
Accomplishments First Quarter

Kick-off meeting
Two calls with advisors
Negotiated and loaded Chandeleur Sound 3-D survey

Contract negotiations underway to form partnership
--but big ambitions!--
Thanks!

Photo by Jennifer Edwards
Appendix

– These slides will not be discussed during the presentation, but are mandatory.
Benefit to the Program

- Determining the CO$_2$ storage resource potential of offshore oil, gas, and saline bearing formations.
- Improving carbon storage efficiency and security by advancing new and early-stage monitoring tools and models.
- Improving capabilities to evaluate and manage environmental risks and uncertainty through integrated risk-based strategic monitoring and mitigation protocols.
- Disseminating findings and lessons learned to the broader CCS community and key stakeholders.
Project Overview: Goals and Objectives

• The primary objective of this FOA is to develop an Offshore Carbon Storage Partnership that is similar in structure to the existing RCSPs Characterization Phase, but is focused on sub-seafloor saline or hydrocarbon reservoir-associated geologic storage.

• Assemble the knowledge base required for secure, long-term, large-scale CO$_2$ storage, with or without enhanced hydrocarbon recovery.

• Identify and address knowledge gaps, regulatory issues, infrastructure requirements, and technical challenges associated with offshore CO$_2$ storage.
# Gantt Chart

## Partnership for Offshore Carbon Storage Resources and Technology Development in the Gulf of Mexico

<table>
<thead>
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<th>Task</th>
<th>Tasks</th>
<th>BUDGET PERIOD 1</th>
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<td>M2</td>
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<td>Revision and Maintenance of Project Management Plan</td>
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<td>Database Development</td>
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<td>Offshore EOR Potential</td>
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<td>Infrastructure, Operations, and Permitting</td>
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<td>5.3</td>
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<td>6.3</td>
<td>Advisory Panel</td>
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</table>

G = Quarterly Report; A = Annual Report; M = Milestone; DP = Decision Point; D = Deliverable; G-NG = Go/no-go decision point; FR = Final Report
Bibliography

No publications during the first quarter of this project!