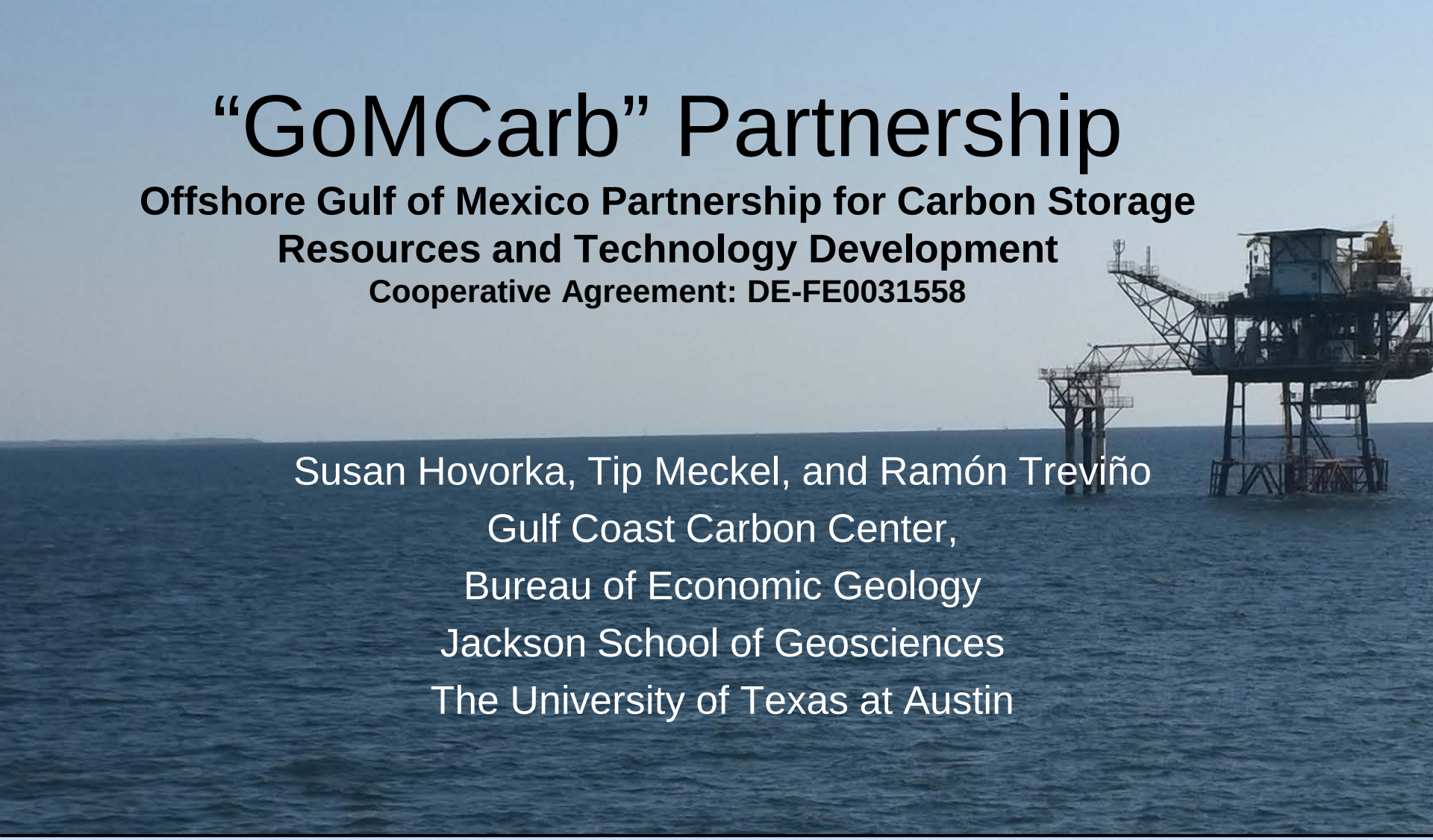
“GoMCarb” Partnership

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

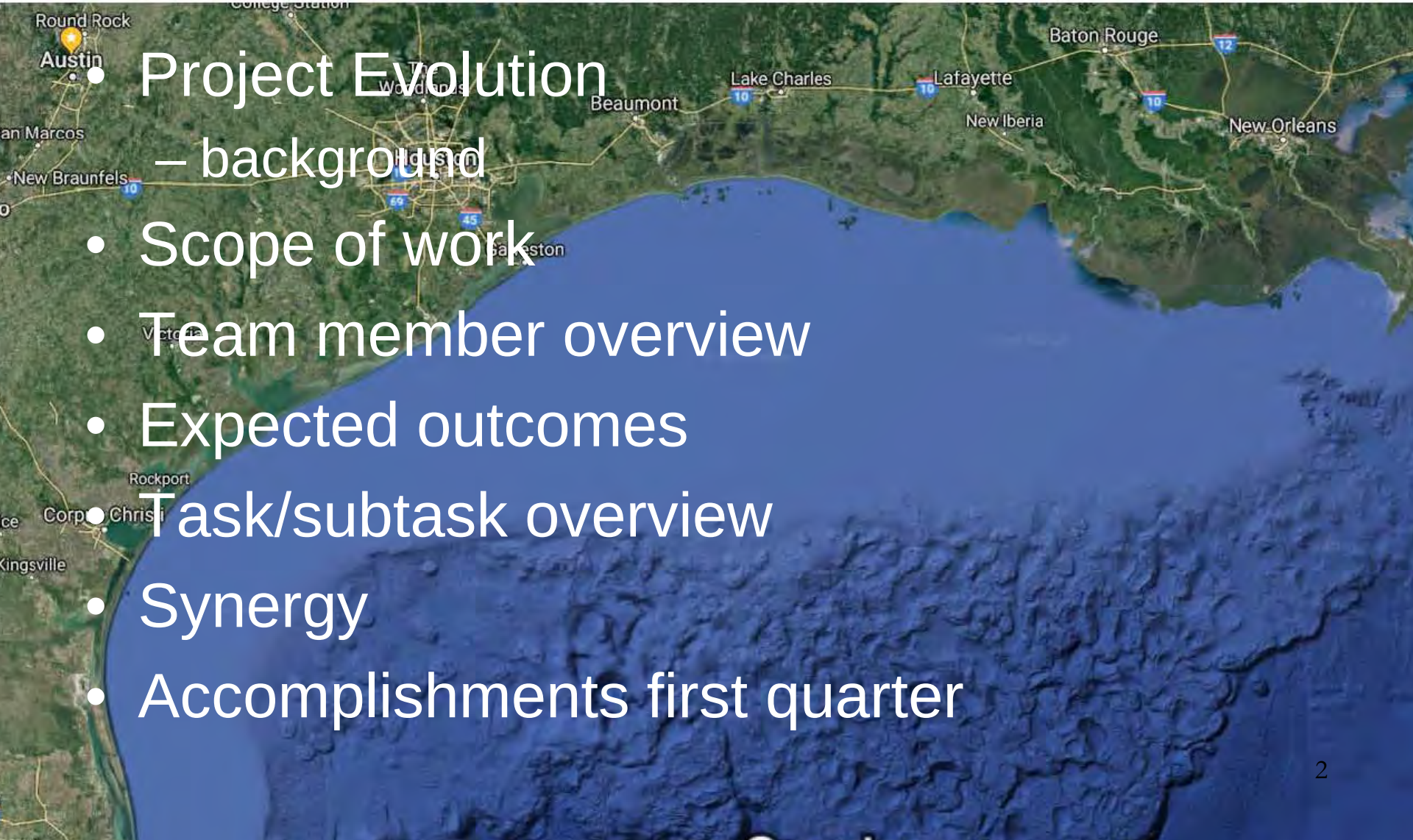
U.S. Department of Energy

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

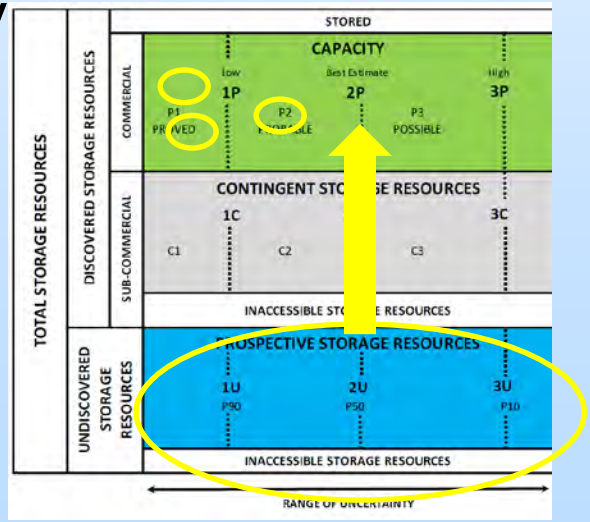
First quarter

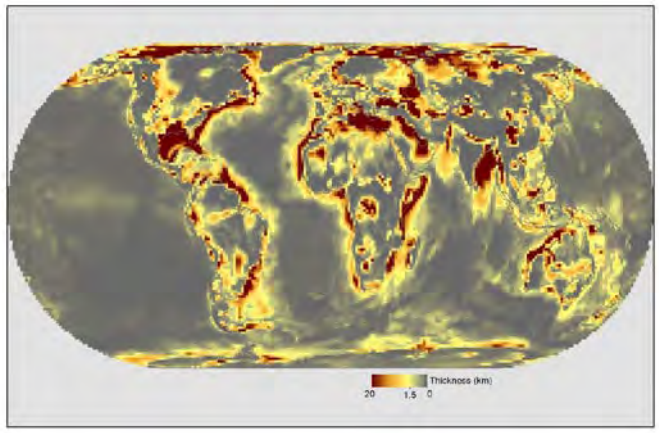
	OFFSHORE PROJECTS			
		External	Dates	
	Project Title	Agency	Begin	End
10	Offshore Gulf of Mexico Partnership for Carbon Storage--Resources and Technology Development	DOE - NETL	4/11/2018	1/31/2022
9	GCCC support for ACORN Project (HR3D)	Univ. Edinburgh	3/31/2018	12/30/2018
8	CarbonSAFE Phase I: Pre-feasibility Study - Northwest Gulf of Mexico CO2 Storage Complex	DOE - NETL	2/1/2017	7/30/2018
7	Validation of MVA Tools for Offshore CCS: Novel Ultra-High-Resolution 3D Marine Seismic Technology Integrated with Coring and Geochemistry	DOE - NETL	10/1/2016	9/30/2019
6	Atlantic Offshore CO2 Storage Resource Assessment	Battelle (DOE)	2/1/2016	5/31/2018
5	Offshore Storage Resource Assessment of the Northern Gulf of Mexico (TXLA)	DOE - NETL	9/1/2015	8/31/2018
4	BEG Support to DOE FE Climate Change Working Group (China)	DOE - HQ	4/1/2015	5/15/2016
3	Sub-seabed Geologic Carbon Dioxide Sequestration Best Management Practices	DOI - BOEMRE	4/1/2015	9/30/2016
2	Characterization of Offshore Texas State Lands for Carbon Sequestration (Miocene Megatransect)	DOE - NETL	10/1/2010	9/30/2015
1	Offshore Carbon Sequestration on Texas State Lands	Texas General Land Office	12/8/2009	9/30/2015

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

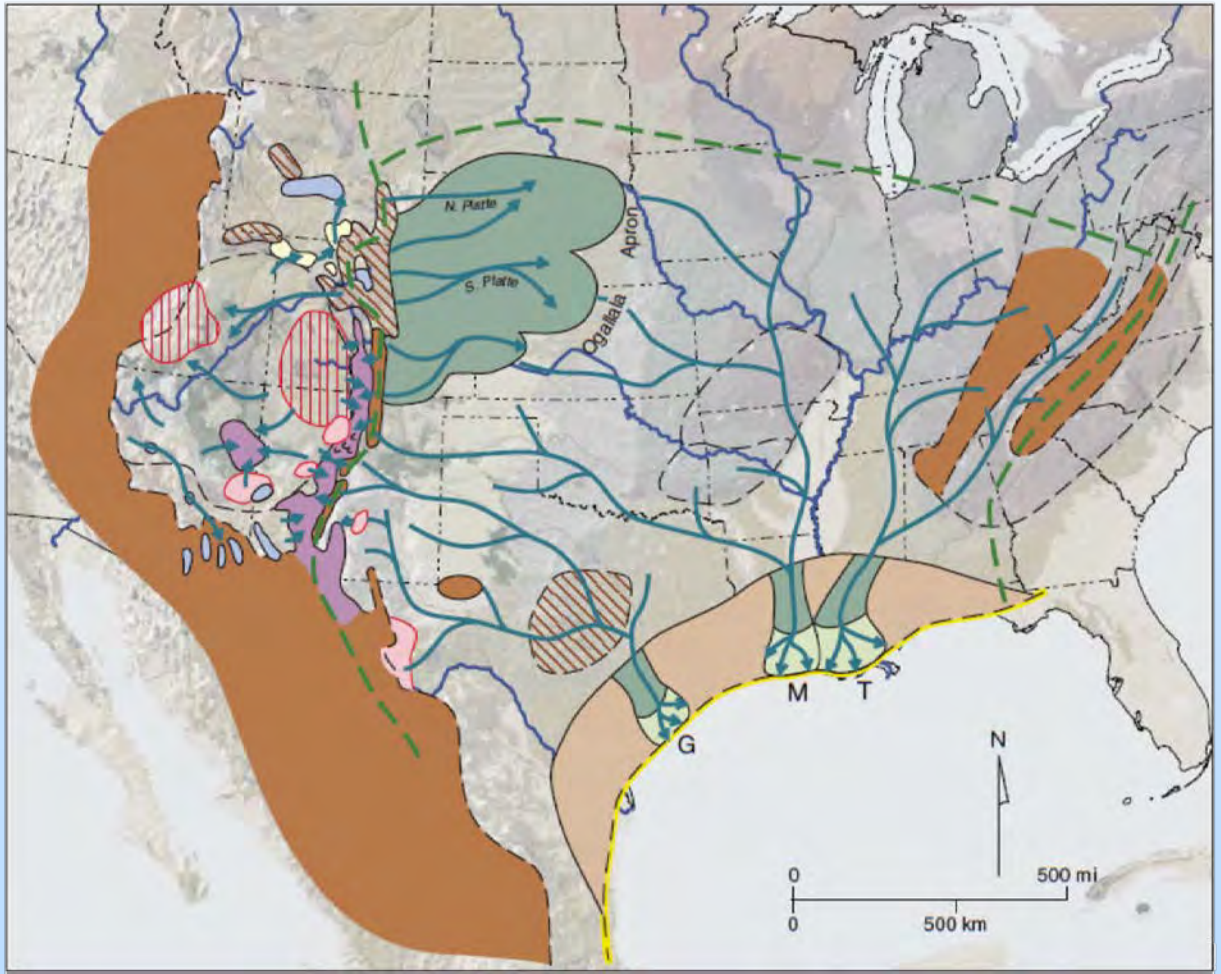
2011

William E. Galloway[1], Timothy L. Whiteaker[2], and Patricia Ganey-Curry[1]

[1]*Institute for Geophysics, University of Texas at Austin, 10100 Burnet Road, Austin, Texas 78758-4445, USA*

[2]*Center for Research in Water Resources, University of Texas at Austin, 10100 Burnet Road, Austin, Texas 78758-4445, USA*

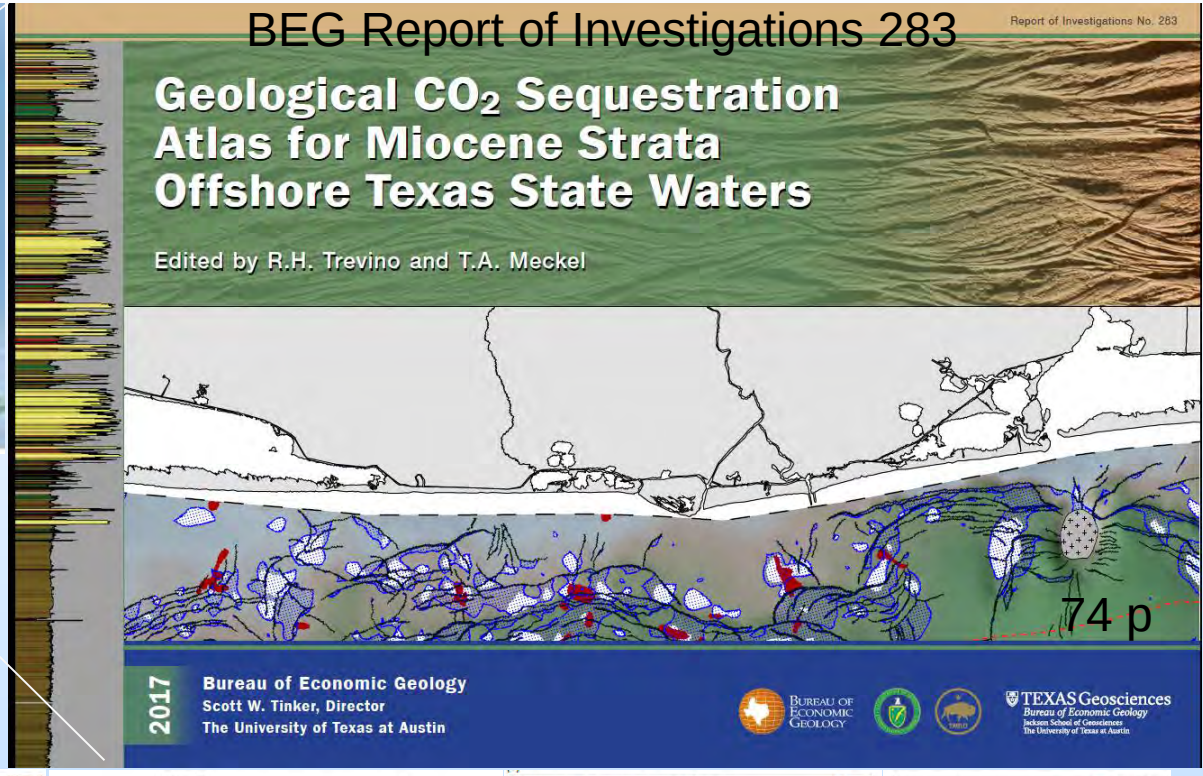
Middle Miocene Paleogeography

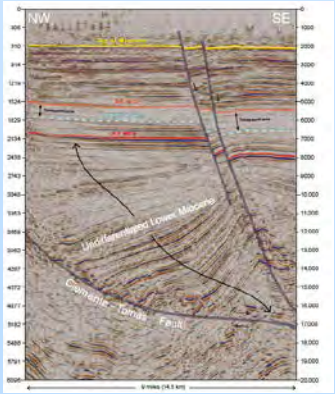


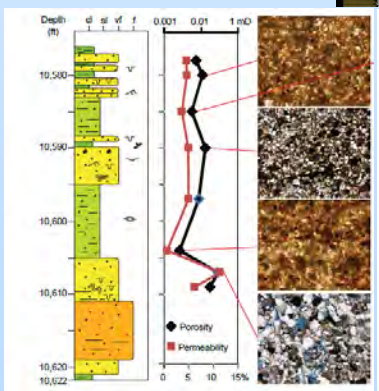
A bit of background...

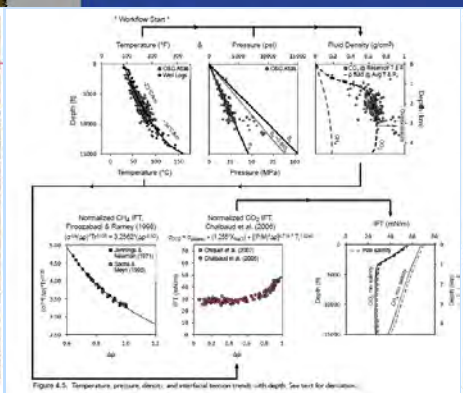
Regional assessment in NETL atlas

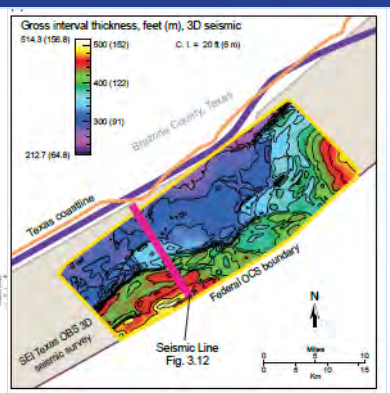
BEG Report of Investigations 283

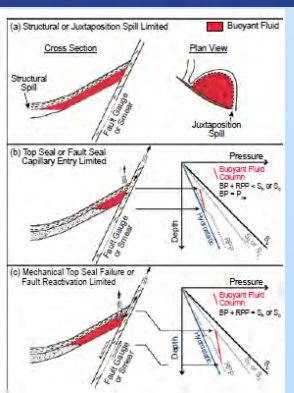












A bit more background...

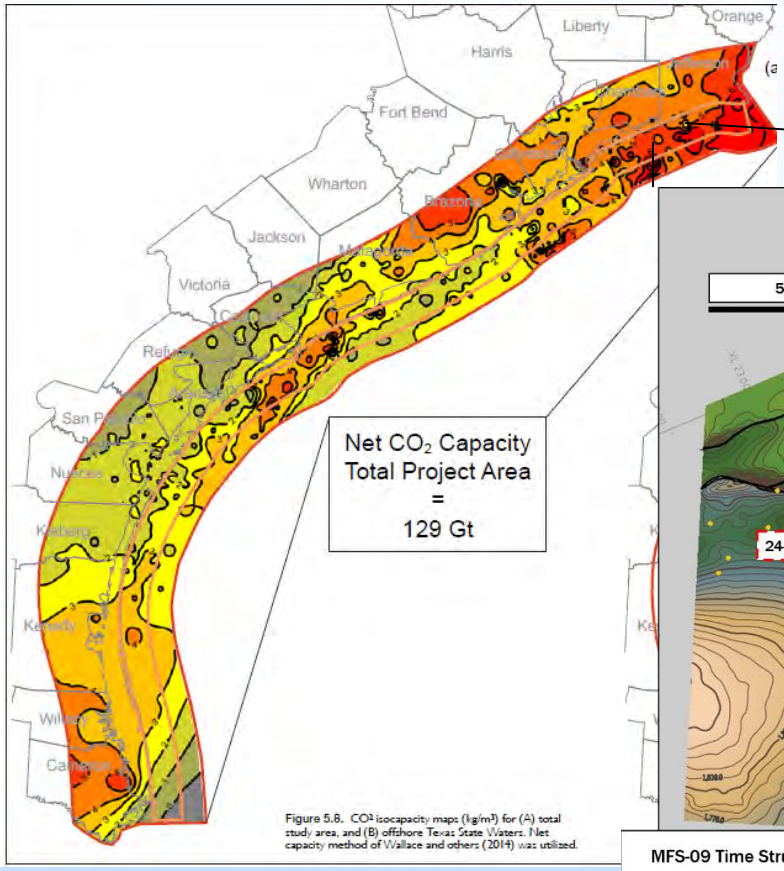
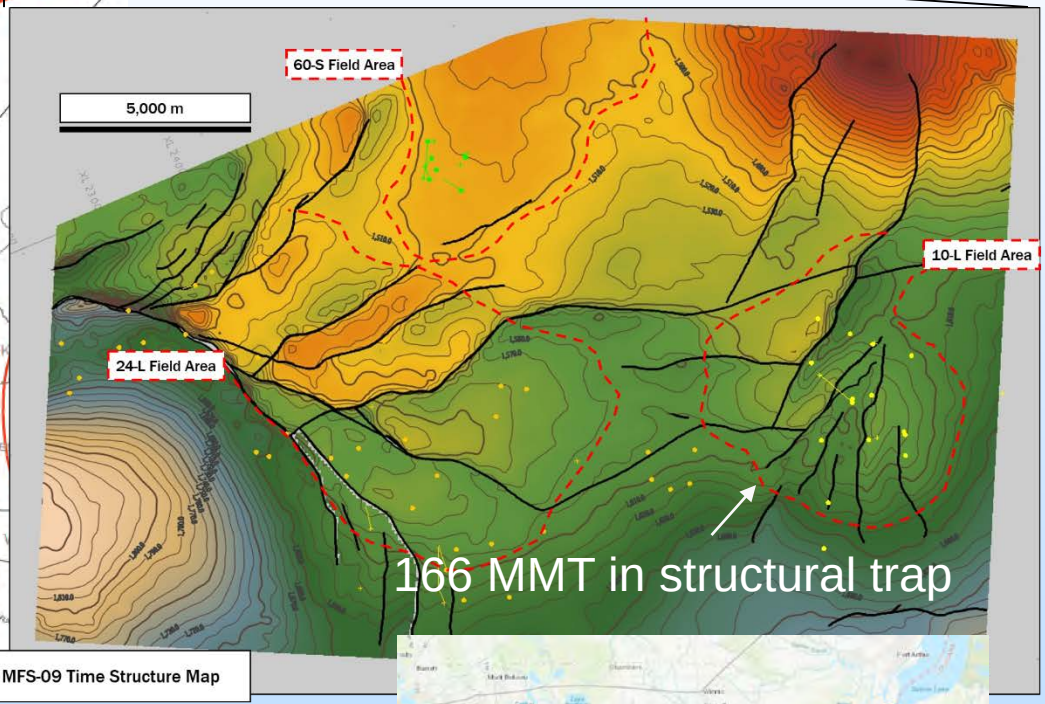
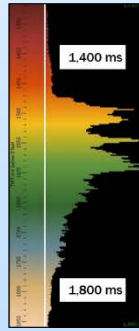


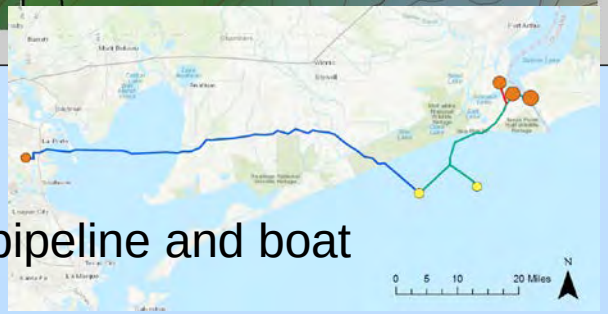
Figure 5.8. CO_2 isocapacity maps (kg/m³) for (A) total study area, and (B) offshore Texas State Waters. Net capacity method of Wallace and others (2014) was utilized.

Carbon SAFE July 201



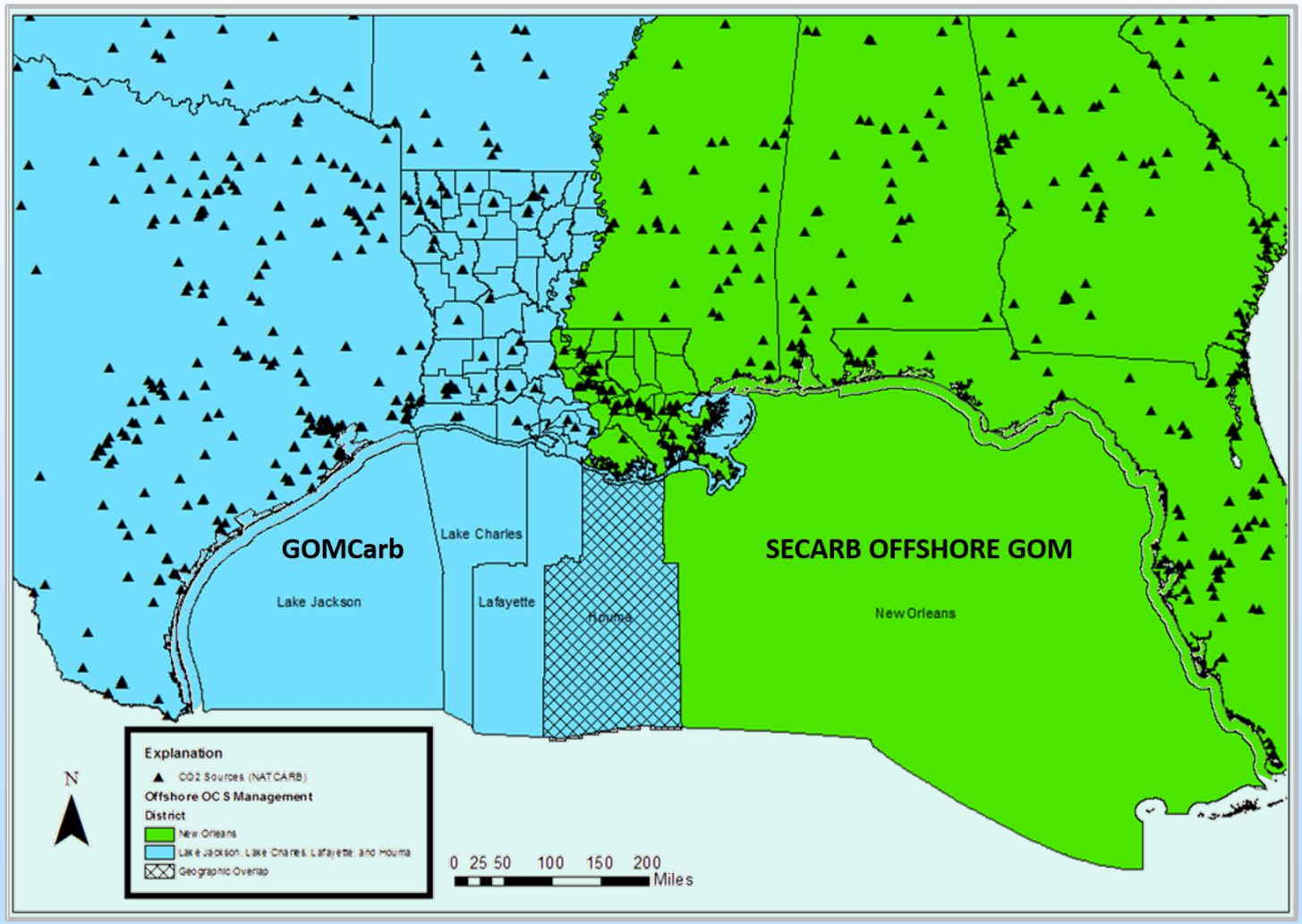
MFS-09 Time Structure Map





One case of linking sources to sinks via pipeline and boat

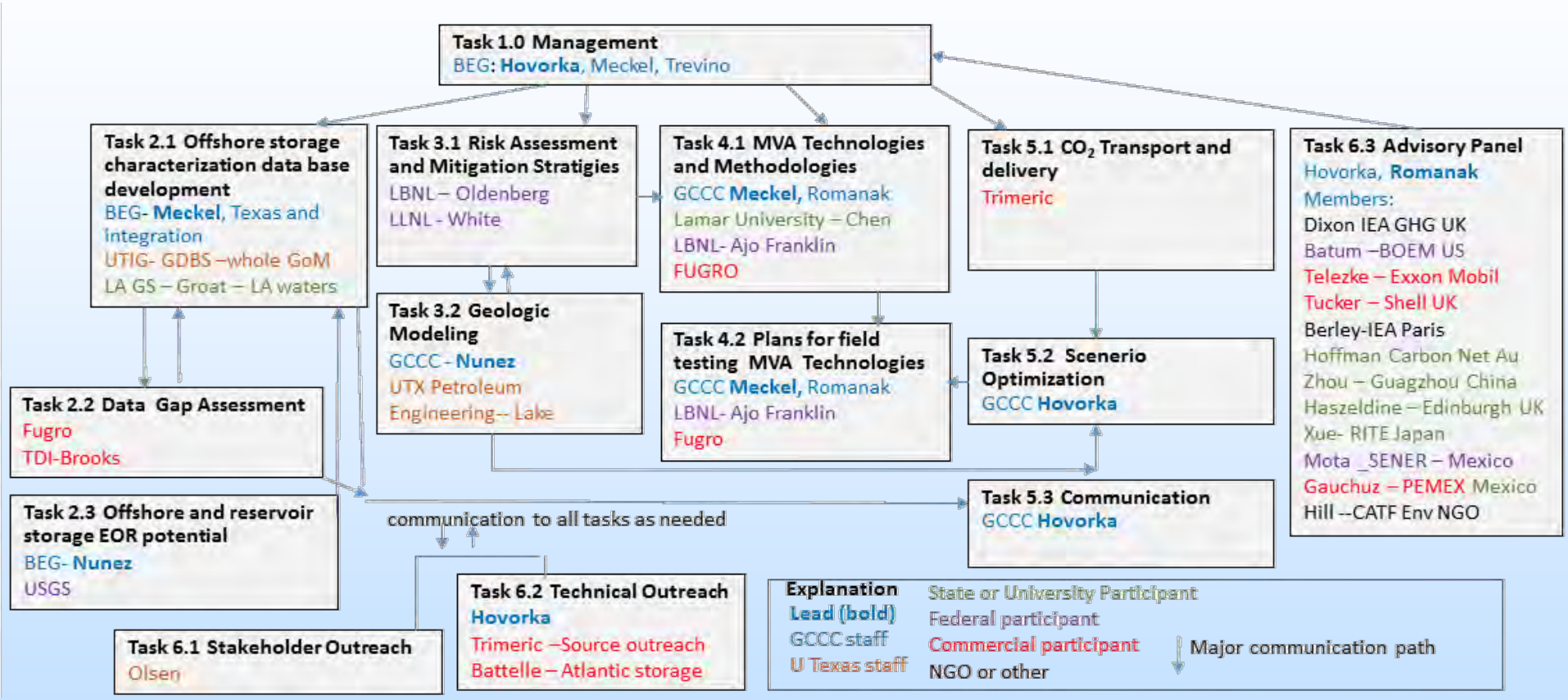
Offshore Partnerships Division of Effort



Scope of Work

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

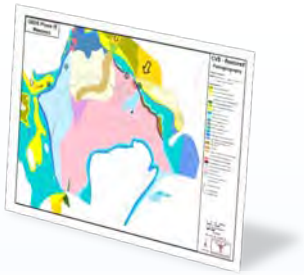
GoMCarb Organizational Chart



Technical Team Member Roles

Institution	Location	Expertise
GCCC	Austin, TX	CCS Project Lead
Gulf of Mexico Basin Synthesis (GBDS)	Austin, TX	GoM Basin Geology
Petroleum & Geosystems Engineering	Austin, TX	Reservoir Simulation
Fugro	Houston, TX	MVA Technologies
TDI-Brooks, Int.	College Station, TX	MVA Technologies
Lamar University	Beaumont, TX	Risk Assessment; Outreach
Trimeric	Round Rock, TX	Engineering; Infrastructure and Operations
USGS	Reston, VA	Characterization and Capacity Assessment
Louisiana Geologic Survey	Baton Rouge, LA	Characterization; Database Development
LBNL	Berkeley, CA	Risk Assessment; MVA Technologies
LLNL	Livermore, CA	Risk Assessment

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.

https://ig.utexas.edu/energy/gbds/

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

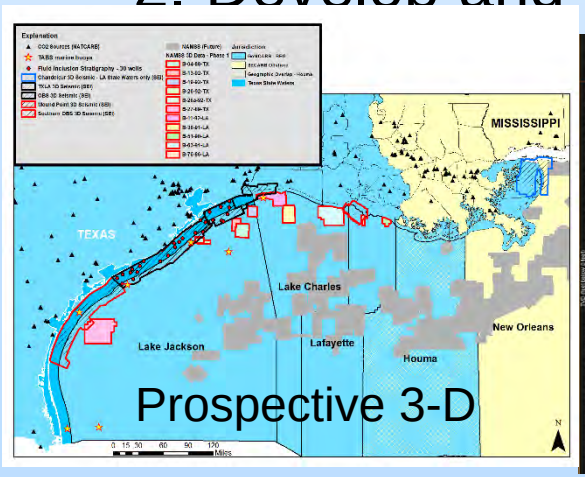
81 Mesozoic

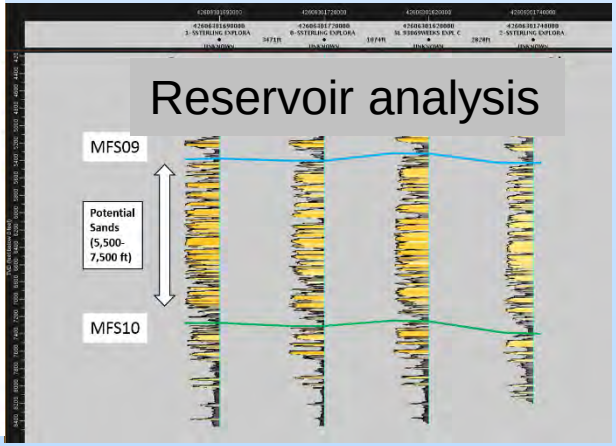
1148 map layers for primary database

563 map layers for references

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.

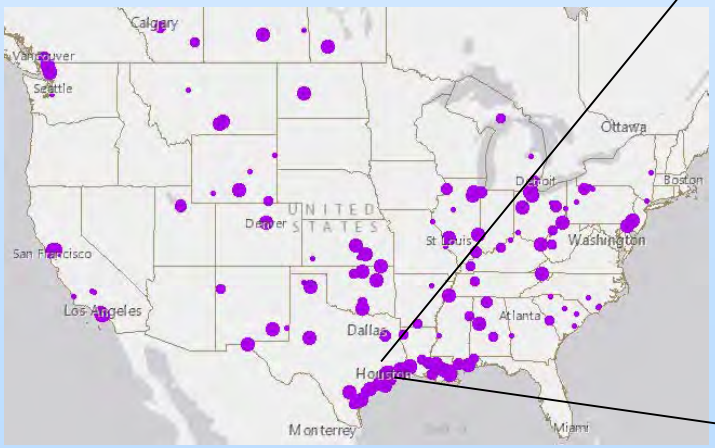




Expected Outcomes (2)

Evaluate the significance of accessible, secure, large-volume CO_2 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.

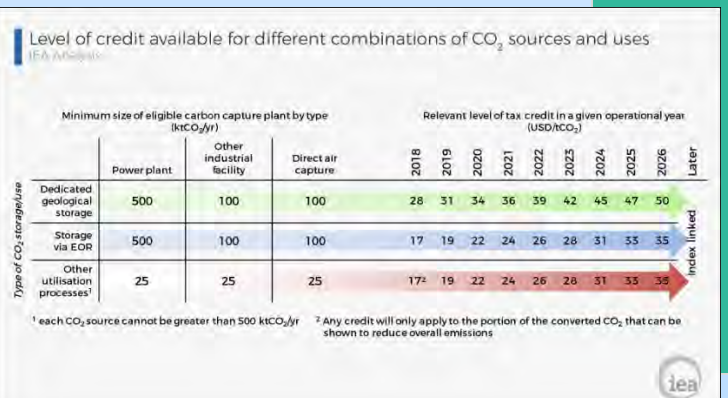
NATCARB-Refining sources

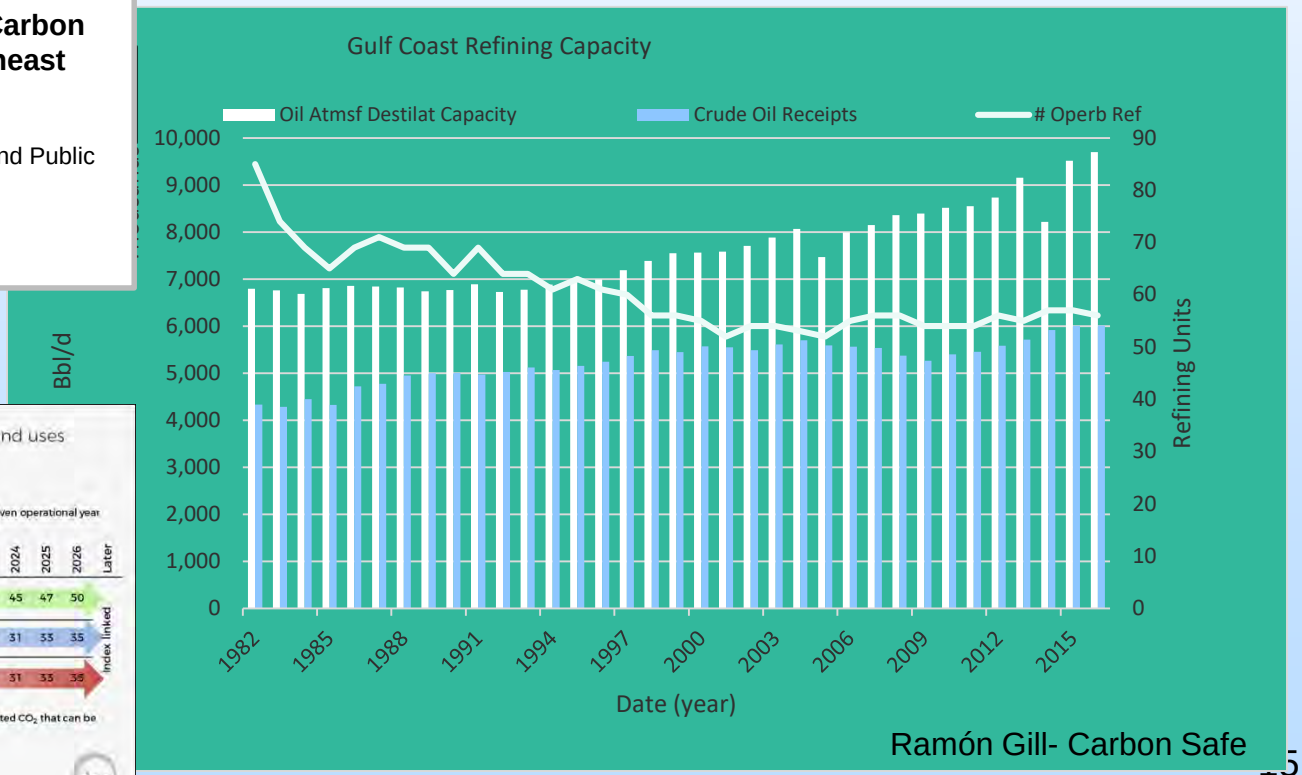


Expected Outcomes (3)

- 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





Ramón Gill- Carbon Safe

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**

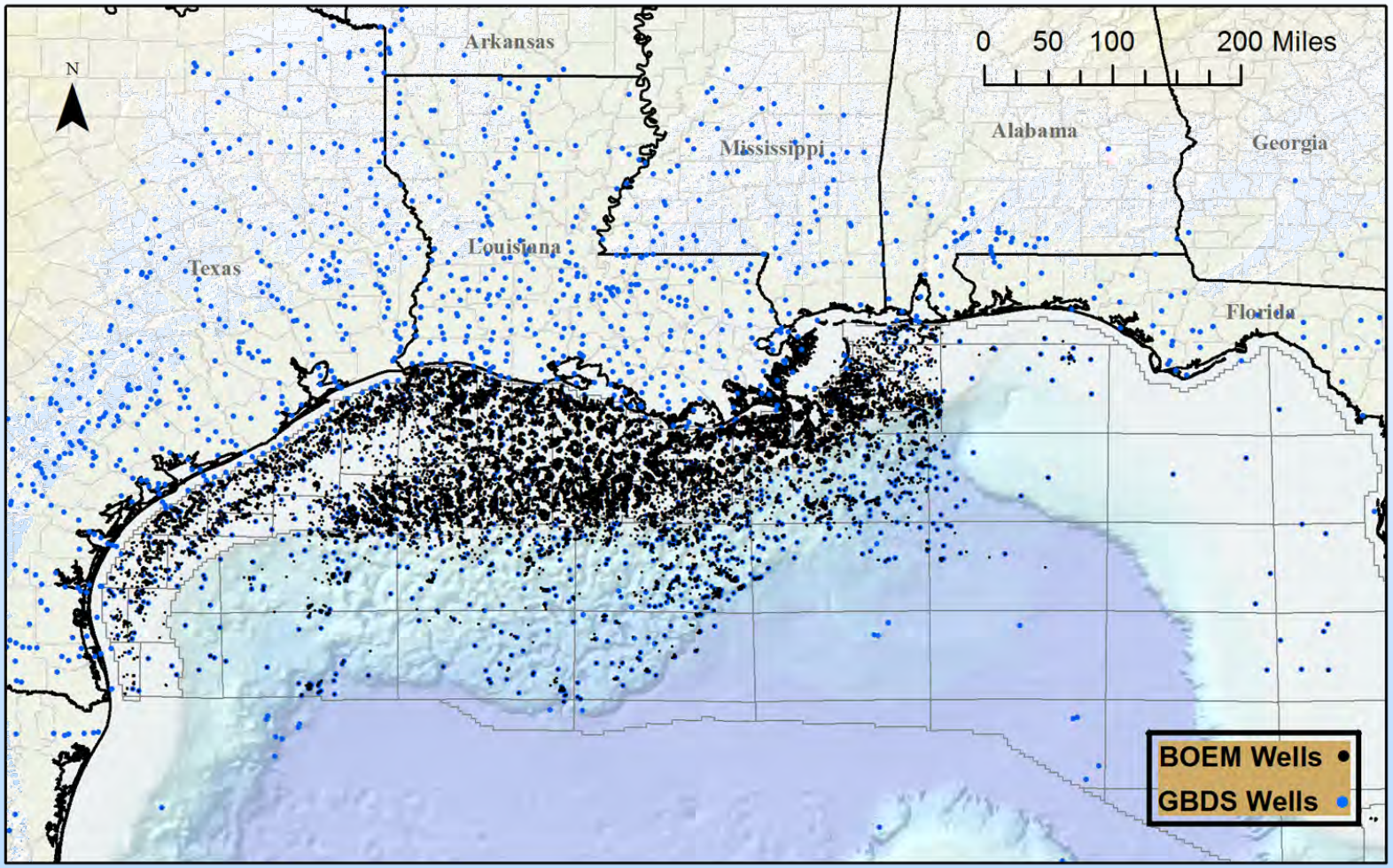
BEG, UTIG, LAGS
Fugro, TDI-Brooks
BEG, USGS

Data available to GoMCarb

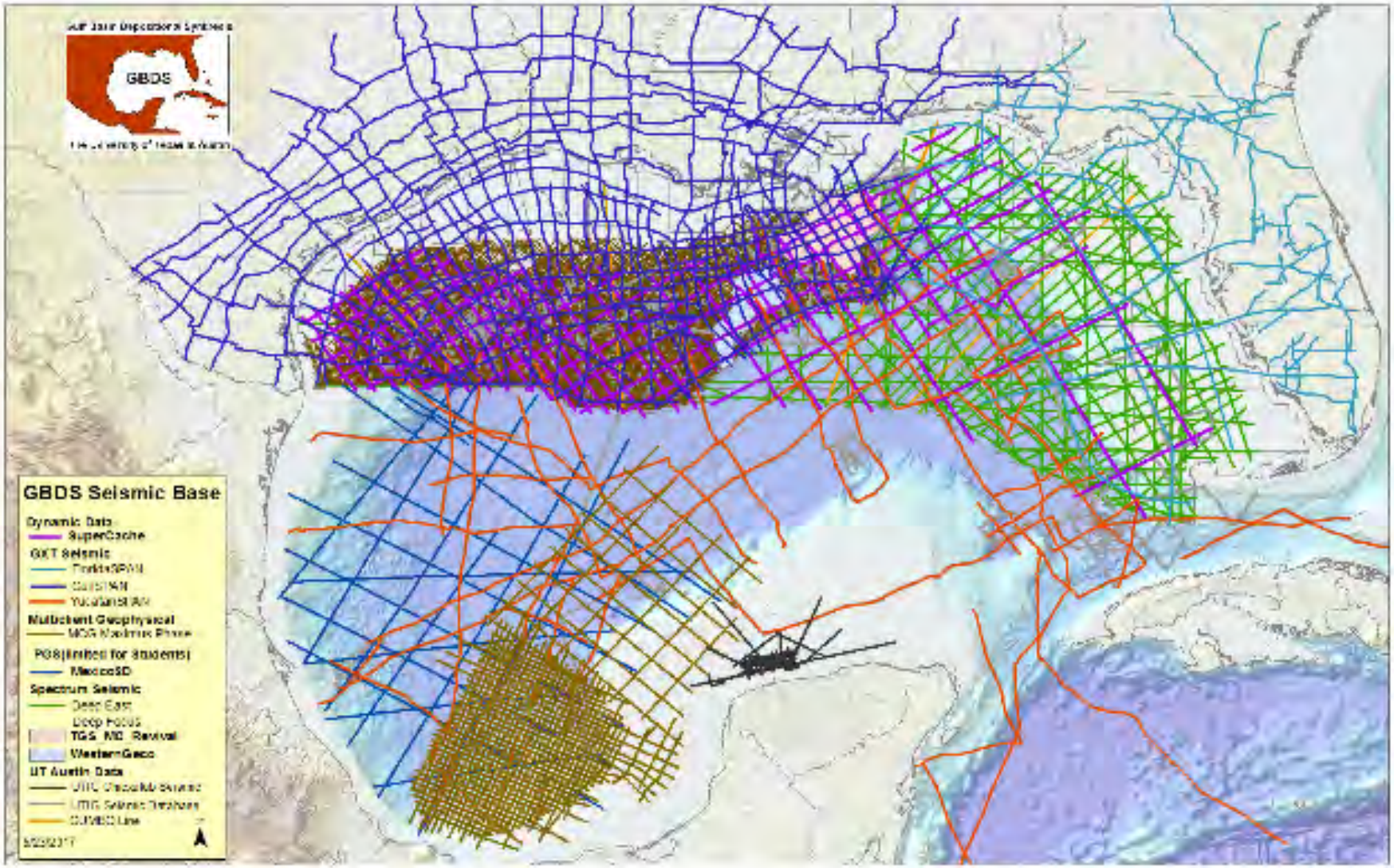
DATABASE	200 Gigabyte GoM-wide ArcGIS Project	GBDS
Well Data raster & digital well logs paleontological data (stratigraphic tops) Production data	**2,337 Interpreted Wells** **6,054 Wells** **>54,000 Wells**	**GBDS** **IHS Database** **BOEM/BSSE**
2D seismic data	**>160,000 linear miles total** **(150,000 linear miles from NAMSS currently in project)**	**GBDS** **Public: NAMSS Database** **Proprietary 2D: ION Geophysical (Gulfspan Merge)**
3D seismic data	**2,304 sq. mi.** **22,000 sq. mi.** **150,000 sq. mi. available** **997 sq. mi.**	**GCCC Offshore CCS Projects** **Vendor Loan (GBDS)** **Public: NAMSS Data** **Proprietary: Seismic Exchange, Inc.**
Depositional Systems Interp.	**34 Gulf-wide maps**	**GBDS**
Well Geologic Samples Core, cuttings	**788 wells identified**	**BEG Core Repositories** **Austin, Houston, Midland**
Stratigraphic Unit Interpretation	**18 Cenozoic & 16 Mesozoic surfaces**	**GBDS**
Digital References Published papers with georeferenced images	**2,130 files**	**GBDS**

[1] National Archive of Marine Seismic Surveys; See: https://walrus.wr.usgs.gov/NAMSS/
[3] 3D Seismic Data available in NAMSS database for public download.
[4] 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 Aaccounting (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**

TDI-Brooks, GCCC, LBNL
Fugro

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.**

Trimeric
GCCC
GCCC, Lamar Univ., Trimeric

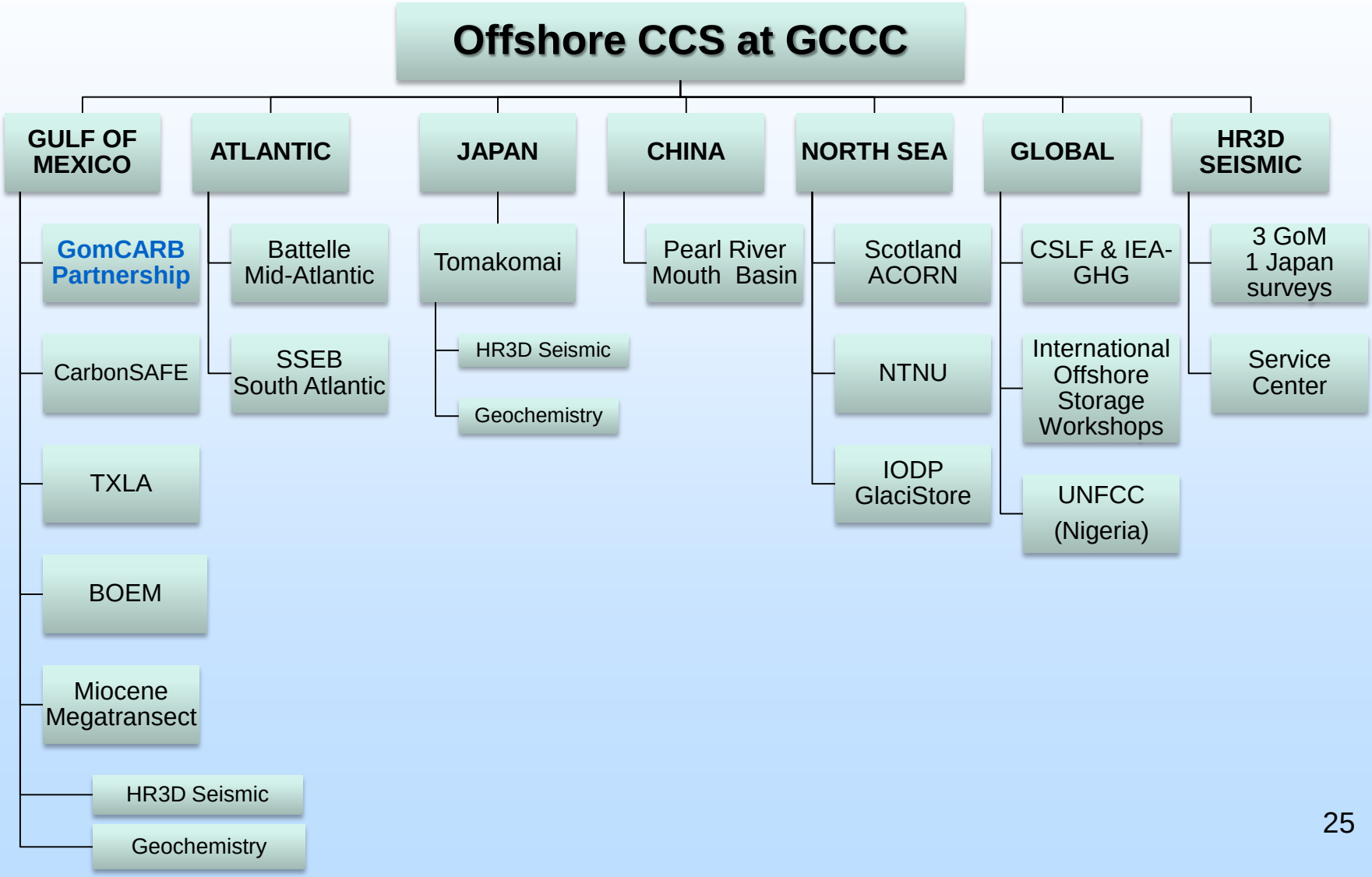
Task/Subtask Breakdown

- **Task 6: Knowledge Dissemination**
  - **6.1:Stakeholder Outreach**
  - **6.2: Technical Outreach**
  - **6.3: Advisory Committee**

Advisors to GoMCarb

Advisor	Institution	Location	Expertise and Role
Tim Dixon	IEA GHG R&D development program	Cheltenham, UK	Chair advisory committee, assure connection of partnership with international CCS community
Melissa Batum	BOEM	Reston VA	Liaison to BOEM
Gary Teletzke	Exxon-Mobil	Houston TX	Liaison to industry EOR and CCS expertise
Owain Tucker	Shell	Scotland, UK	Liaison to industry, Technical advice from offshore project in North Sea
Thomas Berley	IEA	Paris France	Liaison to international policy
Nick Hoffman	CO2 GeoNET	Melbourne, Victoria, Australia	Technical advice from similar near offshore project in Victoria
Zhou Di	South China Sea Institute of Oceanology, Chinese Academy of Sciences	Guangzhou, China	Technical advice from related project in Pearl River Mouth Basin, China
Stuart Haszeldine	Scottish CCS Centre, University of Edinburgh	Edinburgh, Scotland	Technical advice from related projects in UK sector of the North Sea
Ziqiu Xue	RITE, University of Kyoto	Kyoto, Japan	Technical advice from related project in Tomakomai, Japan
Jasmin Mota Nieto	Secretaría de Energia (SENER)	Mexico City, Mexico	Linkage to the Mexican part of the Gulf Of Mexico
Heron Gachuz	Pemex	Villahermosa, Mexico	Linkage to the Mexican part of the Gulf Of Mexico
Bruce Hill	Clear Air Task Force	New Hampshire	Environmental NGO with interest in CCS, geologic expertise
Robert Hatter	Texas General Land Office	Austin, TX	Management of offshore Texas State Lands
Niels Peter Christensen	Gassnova	Norway	Norway's industrial project
Jun Kita	Japan CCS	Japan	Marine monitoring
Anastasia Ilgen	Sandia NL	US	Geochemical monitoring
Rob Finley	Retired Illinois Geologic Survey	UA	Reservoir characterization
Noel Kamrajh	SANEDI	South Africa	Characterization and project development
Owain Tucker	Shell	UK	Offshore project development
Douglas Connelly	National Oceanography Centre	Southhampton UK	Offshore monitoring

Synergy Opportunities



Accomplishments First Quarter

Kick-off meeting

Two calls with advisors

Negotiated and loaded Chandeleur Sound 3-D survey

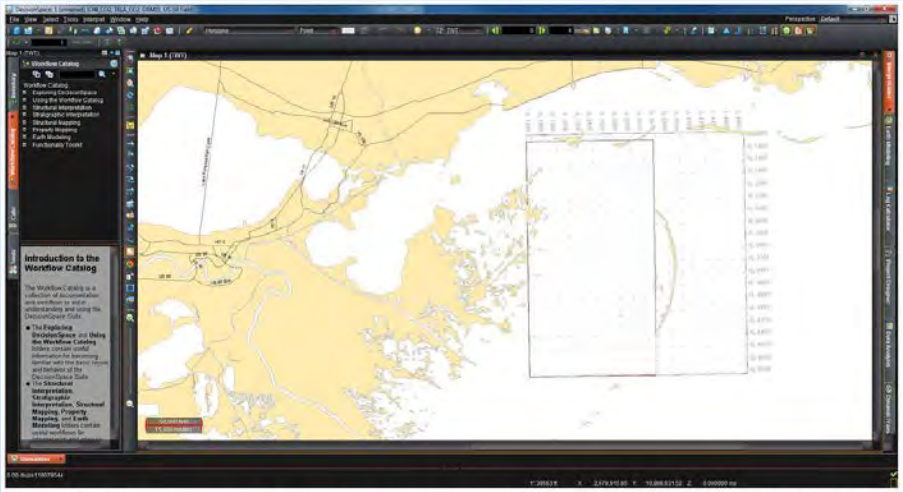


Figure 2.1.2.2 – Basemap of the northeastern waters of the State of Louisiana. The location of the Chandeleur Sound 3D dataset is outlined by the red rectangle.

Contract negotiations underway to form partnership

--but big ambitions!--

Photo by Jennifer Edwards

Appendix

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

Benefit to the Program

- **Establishment of a Government-Academic-Industry Partnership for Offshore CCS Research.**
- **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		BUDGET PERIOD 1								BUDGET PERIOD 2							
		YEAR 1 (2018)				YEAR 2 (2019)				YEAR 3 (2020)				YEAR 4 (2021)			
Task	Tasks	qtr 1	qtr2	qtr3	qtr4	qtr 1	qtr2	qtr3	qtr4	qtr 1	qtr2	qtr3	qtr4	qtr 1	qtr2	qtr3	qtr4
		J-F-M	A-M-J	J-A-S	O-N-D	J-F-M	A-M-J	J-A-S	O-N-D	J-F-M	A-M-J	J-A-S	O-N-D	J-F-M	A-M-J	J-A-S	O-N-D
		2018				2019				2020				2021			
1	**Project Management, Planning, and Reporting**	M1		M2													
	Revision and Maintenance of Project Management Plan	D1a D1b							G-NG								
	Progress Report	Q	Q	Q	Q/A	Q	Q	Q	Q/A	Q	Q	Q	Q/A	Q	Q	Q	Q/A/FR
2	**Offshore Storage Resources Characterization**						M4								M8		
2.1	Database Development		D2.1a		M3		D2.1b				D2.1c				D2.1d		
2.2	Data Gap Assessment		D2.2a				D2.2b				D2.2c				D2.2d		
2.3	Offshore EOR Potential		D2.3a				D2.3b				D2.3c				D2.3d		
3	**Risk Assessment, Simulation and Modeling**								M5				M6				
3.1	Risk Assessment and Mitigation Strategies				D3.1a				D3.1b				D3.1c				D3.1d
3.2	Geologic Modeling				D3.2a				D3.2b				D3.2c				D3.2d
4	**Monitoring, Verification, Accounting (MVA) and Assessment**												M7				
4.1	MVA Technologies and Methodologies				D4.1a				D4.1b				D4.1c				D4.1d
4.2	Plans for Field Testing of MVA Technologies				D4.2a				D4.2b				D4.2c				D4.2d
5	**Infrastructure, Operations, and Permitting**																
5.1	CO2 Transport and Delivery			D5.1a				D5.1b				D5.1c				D5.1d	
5.2	Scenario Optimization			D5.2a				D5.2b				D5.2c				D5.2d	
5.3	Communication			D5.3a				D5.3b				D5.3c				D5.3d	
6	**Knowledge Dissemination**																M9
6.1	Stakeholder Outreach	D6.1a				D6.1b				D6.1c				D6.1d			
6.2	Technical Outreach	D6.2a				D6.2b				D6.2c				D6.2d			
6.3	Advisory Panel				D6.3a				D6.3b				D6.3c				6.3d

Q = 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!