Research Consortiums at the Bureau

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Research Partnerships with the Bureau of Economic Geology

The Bureau of Economic Geology conducts impactful research on subjects of high interest to the energy industry and to environmental firms, and a broad spectrum of companies and other organizations actively participate in its 11 research consortia. These unique partnerships study subjects as diverse as salt tectonics, carbonate reservoir characterization, natural fractures and geophysics, carbon storage, nanotechnology, quantitative clastics, computational seismology, and mudrock reservoirs.

Collectively, these 11 consortia enjoy the support of more than 45 partners globally, with some companies and organizations participating in multiple separate programs. Each research consortium was designed to complement industry efforts to explain a key exploration, production, environmental and/or economic problem. Participation is on a subscription basis. Member benefits vary but generally include first-look privileges at research outcomes, access to research teams, invitations to annual review meetings, and office visits by researchers for presentation and interaction. Members also benefit from interactions with counterparts in fellow sponsoring organizations.

Each Bureau research consortium has a dedicated team of full-time researchers, including postdocs. Many of them host talented graduate students, the teams combining seasoned experts and early-career specialists. A number of researchers have industry backgrounds, and all share a passion for university-based research.

We invite you to review this brochure and to contact the principal investigator of any program of interest to you. If you would like further information about these research consortia, or about the breadth of your organization’s engagement with the Bureau, please contact us at www.beg.utexas.edu, or by phone at 512-471-1534.
Who We Are

Established in 1909, the Bureau of Economic Geology is the oldest research unit at The University of Texas at Austin. The Bureau functions as the State Geological Survey of Texas and has been an integral part of the development of the state’s oil and gas industry through the years. Our mission is to serve society by conducting objective, impactful, and integrated geoscience research on relevant energy, environmental, and economic issues. Our vision is to be a trusted scientific voice to academia, industry, government, and the public, all of whom we serve. Bureau researchers spearhead basic and applied research projects globally in energy resources and economics, coastal and environmental studies, land resources and use, geologic and mineral mapping, hydrogeology, geochemistry, and subsurface nanotechnology. The Bureau provides advisory, educational, technical, and informational services related to the resources and geology of Texas, the nation, and the world.

Bureau Programs

The Bureau is an international leader in a number of research thrusts, working at the intersection of energy, the environment, and the economy, with strengths that include:

- Unconventional oil and gas exploration and production
- Salt tectonics
- Natural fractures and structural diagenesis
- Reservoir characterization in carbonates, mudrocks, and sandstones
- Carbon storage in geological reservoirs
- The water-energy nexus
- Energy economics

Talented people are key to the Bureau’s success. The research staff includes more than 120 scientists, engineers, and economists, representing 27 countries, working in integrated, multidisciplinary research teams. Together with 40 skilled graduate students and 15 postdocs, they solve the world’s greatest challenges in energy and environmental research.
Partnerships

Partnerships drive strategy, innovation, and investigation, and the Bureau engages partners, new and old, on many levels. Investments in Bureau research provide significant returns. Corporate partners participate in, and gain vital new insights from, the Bureau’s many productive research consortia, which are described herein. Government, agency, foundation, and nongovernmental organization partners include the State of Texas, the Alfred P. Sloan Foundation, the U.S. Department of Energy, and the Environmental Defense Fund.

Facilities

Superb facilities and equipment, some cofunded by industry, give researchers the tools they need to find objective, rock-based research solutions. Such facilities and equipment include:

- More than 18 individual laboratories hosting research teams investigating everything from nanoparticles to shale porosity and permeability
- Three massive well-core research and storage facilities, in Houston, Austin, and Midland—collectively, housing what may be the largest archive of rock material in the world
- One of the largest collections of well logs in the United States
- An extensive inventory of modern imaging devices and integrated technologies for outcrop and land-surface mapping

Results

More than 100 years of producing research results has earned the Bureau an unparalleled reputation. Successful outcomes can be measured by many yardsticks, and Bureau researchers more than measure up:

- More than 170 peer-reviewed articles and books published annually
- More than 50 keynote addresses made annually
- Bureau researchers’ frequently being made presidents of international professional societies and editors of major professional journals, and being recognized by their peers with top medals and awards in their fields

- Hundreds of abstracts and articles published each year in Conference Proceedings volumes
Mission
Our mission is to illuminate the subsurface reservoir using novel micro- and nanosensing technology developed collaboratively with Advanced Energy Consortium (AEC) members and the global community.

Research Challenges
Since its inception, the AEC has invested more than $50 million in research with 30 university and research facilities around the world and has progressed from fundamental to applied research. It is now targeting commercial applications ("use cases") that will help its members enhance their commercial extraction of oil and natural gas.
Advanced Energy Consortium

Research Thrusts

This research organization is dedicated to achieving a transformational understanding of subsurface oil and natural gas reservoirs through the deployment of unique micro- and nanosensors. However, the technologies developed by the AEC are showing themselves to have much broader potential applications than just oil and gas. Areas such as hot-dry rock geothermal, seal integrity, and other applications for monitoring in carbon capture and storage, as well as cement integrity in nuclear waste and nuclear power generation, are areas of clear potential.

Membership

In only 10 years, progress of the consortium has been remarkable. The AEC has created a whole new scientific space, published hundreds of peer-reviewed papers, created a patent portfolio exceeding 50 inventions (including the world record for smallest subsurface-conditions battery and pressure sensor), and is now on the verge of completing commercial-scale proof-of-concept tests. Membership is $375,000 per year, with an initial 2-year membership commitment.
Mission

Pure and applied research in salt tectonics has been a strong component of the Bureau's research program since the late 1970's. At the heart of this research is the Applied Geodynamics Laboratory (AGL), an industry-funded consortium dedicated to producing innovative concepts in salt tectonics. Research comprises a mix of physical and mathematical modeling; seismic- and field-based mapping; and structural-stratigraphic analysis of some of the world’s most spectacular salt basins—including those of the Gulf of Mexico, West Africa, Brazil, the Mediterranean, and the Canadian High Arctic. Research has also been applied extraterrestrially to Mars and Triton.

Research Thrusts

Concepts and terminology pioneered by the AGL over the last quarter-century have profoundly influenced salt tectonics and are now widely disseminated throughout the oil industry. AGL strives to effectively communicate these results via a variety of media, including The Salt Mine: A Digital Atlas of Salt Tectonics, a book and interactive DVD designed to be the most comprehensive collection of salt-tectonic images and animations ever assembled.

Research Challenges

❖ To develop a conceptual framework for the full range of salt tectonics
❖ To analyze connections between physical models, mathematical models, seismic data sets, and field examples from all over the world
❖ To disseminate complex technical information to a constantly shifting spectrum of industrial and academic supporters

Numerical model showing contours of strain in sedimentary rocks encasing a salt sheet advancing to the right.
Research Challenges (continued)

- Salt weld
- Salt canopy
- Reactive, falling, and squeezed diapirs
- Shape of passive diapirs and sheets
- Fault families (with University of Colorado)
- Extrusive salt sheets (with BP, Exxon)
- Extensional turtle and mock turtle
- Mechanics of salt-sheet advance
- Origin of minibasins
- Intrusive salt plumes
- Salt sutures

Membership

The many supporting companies of the Applied Geodynamics Laboratory include a wide range of industry partners from around the world.

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Mission

The Center for Integrated Seismicity Research (CISR) at The University of Texas at Austin is a multidisciplinary, intercollegiate research consortium managed by the Bureau of Economic Geology. CISR and TexNet are two parts of a whole, TexNet being the State-funded network of seismometers across Texas that conducts research into earthquake causation in key areas. With its industry partnerships, CISR significantly extends and deepens the scope of research and monitoring into a broadly integrated realm toward an understanding of the processes that influence seismicity, quantification of the hazards, and improvement of standards of practice for mitigation.

Research Challenges

Over the last decade, the rate of seismicity in the south-central United States has increased markedly, especially in unconventional play areas where water management has become an important challenge. Understanding the interplay between complex operational drivers and interdependent subsurface physical processes (that understanding then leading to research that can inform practices) is a daunting challenge that the Bureau has adopted head-on.

Research Thrusts

CISR conducts fundamental and applied research to better explain seismicity of all causes and its associated hazards. CISR brings together researchers from UT’s Bureau of Economic Geology; Institute for Geophysics; Department of Petroleum and Geosystems Engineering; and the Department of Civil, Architectural, and Environmental Engineering. Researchers at SMU, Texas A&M, the University of Houston, UT Dallas, and UT El Paso also contribute.

Seismology: Detailed spatial and temporal earthquake observations provide rich datasets for investigating the physics of faulting—essential to other components of TexNet and CISR.

Geologic Characterization: Geologic and subsurface conditions influence the occurrence of natural and induced earthquakes. Quantitative characterization provides for regional assessments of seismicity hazard, and informs reservoir models.

Geomechanics and Reservoir Engineering: Key to TexNet and CISR research is an understanding of the dynamic interaction of regional to local reservoir structure, in situ stress, fluid pressure and flow, and faulting. Geomechanical characterizations and simulations constrain the conditions associated with fault reactivation and provide guidance as to where and how injection practices might be modified to reduce the hazard.

Seismic Hazard and Risk Assessment: Seismic hazard and risk assessment provides a rational approach to the evaluation of potential adverse effects to the built environment.

Outreach: TexNet and CISR maintain broad portfolios of outreach activities to inform and update all stakeholders in Texas and globally about seismicity, earthquake trends in Texas, and the rapid pace of scientific advancement in the field. TexNet and CISR researchers meet quarterly with the TexNet Technical Advisory Committee, the CISR Science Advisory Committee, the Railroad Commission of Texas, and the TX, OK, KS, AR, and NM Regional Induced Seismicity Collaborative (RISC), which is administered by the Bureau.
Membership

Most of the major energy companies that operate in Texas unconventional plays are CISR members. Each member company provides a technical contact who serves on the CISR Advisory Committee, who meet in person quarterly to discuss the design and application of TexNet-CISR research. In addition, member companies are encouraged to contribute proprietary data and information that can guide and advance CISR research. Proprietary data are protected by The University of Texas at Austin’s strong intellectual property controls.

Saltwater disposal into the Fort Worth Basin showing number of active disposal wells, cumulative injection, and monthly count of Mw ≥ 2.5 earthquakes.

Interpretation of potentially seismogenic faults in Dallas-Fort Worth area colored by slip potential, which is a probabilistic measure of hazard.

Portion of Delaware Basin, TexNet seismic monitoring stations, earthquakes of all magnitudes as cataloged by TexNet in 2017-18 (amber dots), fault-plane solutions (red and white balls), and new structural model in development.

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TexNet and Center for Integrated Seismicity Research

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Mission

Natural-fracture research at The University of Texas at Austin seeks fundamental understanding of fractures and fracture processes with the aim of finding new geological, geophysical, and engineering methods to explain and successfully predict, characterize, and simulate reservoir-scale structures.

The purpose of this research is both fundamental and practical—to improve prediction and diagnosis of natural-fracture attributes in hydrocarbon reservoirs and accurately simulate their influence on production. Research is organized around the Fracture Research and Application Consortium (FRAC), an alliance of scientists from the Bureau and the departments of Petroleum and Geosystems Engineering and Geological Sciences, together with scientists from member companies. Student participation is an important part of our program. Many students find placement with member companies.

Research Thrusts

More accurate prediction and characterization of fractures hold great potential for improving production by increasing the success and efficiency of exploration and recovery processes. New analytical methods will lead to more realistic characterization and prediction of fractured and faulted hydrocarbon-bearing carbonate, mudstone, and sandstone reservoir rocks. These methods produce data that can enhance well-test and seismic interpretations and that can readily be used in reservoir simulators. We are developing new and more reliable and efficient methods to predict hydraulic-fracture propagation in naturally fractured and other unconventional reservoirs.

Research Challenges

Many faults and fractures are difficult or impossible to characterize adequately using currently available technology. Fractures have been intractable to effective description and interpretation, posing serious challenges to exploration and development, as well as to accurate reservoir simulation and reservoir management. Our approach is helping to overcome the limitations of current methods.
Fracture Research and Application Consortium

Membership

Results are germane to exploration and production. Our research includes measurement, interpretation, prediction, and simulation of fractures in carbonate rocks, mudstones, and sandstones to

♦ Create and test new methods of measuring attributes of reservoir-scale fractures, particularly as fluid conduits and barriers

♦ Understand and predict the interaction of natural and hydraulic fractures

♦ Measure attributes at the reservoir scale through rigorous mathematical techniques and help build accurate and useful 3D models for the interwell region (members have exclusive access to our software)

♦ Develop the capability to accurately predict reservoir-scale flow using geomechanical, structural, diagenetic, and linked geomechanical/diagenetic models

♦ Improve the usefulness of seismic response as an indicator of reservoir-scale structure by providing methods of calibrating and verifying seismic fracture-detection methods

♦ Design new ways to incorporate geological and geophysical information into reservoir simulation and verify the accuracy of the simulation

Training in techniques, software, and our workflow is a benefit of membership.

Participants examine fractures in tight-gas sandstones in the Canadian Foothills; FRAC field trip, fall 2013.

Quartz/dolomite/bitumen-filled fracture compacted by folding and faulting; the H1–H2 compacted fracture height is 70 cm; Blocher Member, New Albany Shale, Kentucky.

(a) Fracture-height patterns in New Albany shale roadcut with hierarchical fracture traces, eastern Kentucky. Some fracture traces cut multiple beds (F). Others are bed bounded (Lb = bed boundary).
(b–e) Fracture-height classification categories from Hooker et al. (2013).

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Mission

The Gulf Coast Carbon Center (GCCC) conducts research and outreach in geologic storage technologies used to reduce emissions of carbon dioxide. Carbon dioxide produced by combustion of fossil fuels and from other industrial processes is captured and injected into porous rocks at locations where it is stored.

Research Thrusts

Large-volume CO₂ Storage

♦ Improve structural and stratigraphic characterization methods and simulation approaches to identify suitable locations and increase confidence in the technologies.
♦ Create workflows for characterization at basin scale that prepare multiple sites to be operated at maximum injection rates and over prolonged time periods.
♦ Assess storage resources in offshore subsea settings in Gulf of Mexico and globally.

CO₂ Accounting

♦ Build confidence in confirming that CO₂ storage is in a well-selected and well-operated site by inventorying possible mechanisms of loss from storage, then documenting via targeted monitoring that no loss has occurred.
♦ Increase skills in targeting monitoring by observations of analogs such as hydrocarbons where leakage has occurred and designing physical and numerical experiments to explain migration mechanism, rate, and process.
♦ Develop effective monitoring strategies and tools under different settings, different risk-tolerance conditions, and different regulatory environments.

CO₂-EOR

♦ Assess the best methods and economic value of use of CO₂ for enhanced oil recovery (EOR) in various traditional and novel settings.
♦ Intersect the economic value with the storage value. Develop a transparent life cycle, accounting for storage and EOR.
Research Challenges

CCS deployment is not happening at the rate and scale needed to achieve emissions-reduction goals. Many influential stakeholders, from industrial investors to policymakers to journalists, do not have the information needed to see the critical role of CCS in attaining these goals and the viability of CCS.

GCCC staff experience leads to trained CCS workforce.

High resolution seismic slice collected in shallow water allows improved above-zone monitoring design.

Membership

Members meet twice a year (sometimes jointly with other related groups), and they receive a quarterly newsletter.

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Mission

The Bureau’s Mudrock Systems Research Laboratory (MSRL) program brings together a broad spectrum of research expertise necessary to confront the complicated, multidisciplinary questions that are key to a better understanding of mudrock systems. The goal of the program is to integrate observations and data from all scales, ranging from nanoscale pores to regional basin settings, from element maps to borehole and 3D geophysics, from fractures to flow modeling, and from clay diagenesis to sequence stratigraphy. Only through this kind of integrated approach can the multiscalar heterogeneities of mudrocks be effectively characterized and models leading to better predictions of reservoir quality be developed.

Research Thrusts

- FE-SEM and atomic-force microscopy of Ar-ion-milled surfaces to reveal pore architecture
- Analysis of mechanical properties of mudrocks in time and space
- Application of element and isotope geochemistry to better define facies and their continuity
- Delineation and modeling of regional and local trends in depositional and diagenetic facies distribution
- Development of more accurate ways to determine porosity, permeability, and model flow
- Critical appraisal of conventional methods of mudrock analysis techniques, history, thermal maturation, and rock-attribute development

- Calibration and interpretation of borehole geophysical data
- Nanopore analysis: field-emission SEM microscopy, Ar-ion milling, N2 adsorption, and X-ray CT
- Elemental and mineralogical composition: field-emission SEM, cathodoluminescence, and light microscopy; XRD, ICP-MS, XRF, and stable-isotope analysis
- Fluid-flow modeling
- Organic matter and hydrocarbon analysis: Rock Eval, GC, vitrinite reflectance, and kerogen analysis
- Attribute distribution: integrated outcrop, core, and geophysical analysis
Mudrock Systems Research Laboratory

Research Challenges

Mudrock systems in many ways constitute a last frontier in sedimentological research. Despite their abundance in the Earth’s crust, these rocks are much less well understood than other systems. The current explosion of interest in these rocks stems from their potential as oil and gas reservoirs. However, few, if any, of the approaches used for more conventional sandstone and carbonate hydrocarbon successions are applicable. The challenge is to develop new methodologies for characterizing these rocks. Much of this work must be carried out on high-precision, high-resolution instruments that are not required or commonly utilized in other sedimentary rock systems.

Membership

Consortium members receive exclusive priority access to all research data, interpretations, and reports. Results are distributed to program participants through annual workshops, seminars, field trips, and the web.

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Mission

The mission of the Quantitative Clastics Laboratory (QCL) is to carry out integrated geologic studies for our industry members at multiple scales to develop predictive models for processes and controls on sediment transport and the stratigraphic evolution of depositional systems.

Research Thrusts

QCL researchers leverage the broad, world-class expertise of the Jackson School of Geosciences—including collaborations with groups specializing in structural geology, Texas and Gulf of Mexico depositional syntheses, seismic interpretation, and burgeoning technology in geochronology and thermochronology—to address key challenges in the exploration and development of natural resources: the evaluation of reservoir presence and quality in data-limited frontier basins, and the characterization of connectivity and heterogeneity of reservoirs. The QCL has unique clastic research consortia access to industry subsurface data, including global seismic-reflection datasets and Bureau core repositories. The project team uses subsurface, outcrop, Earth surface, and marine geology datasets to evaluate predictive, source-to-sink relationships between hinterland, fluvial, shoreline, shelf, slope, and deep-basin environments. Researchers develop models of stratigraphic evolution and evaluate the impact of facies modeling on reservoir performance. Active research focus areas are prospective sedimentary basins around the world.

QCL researchers annually host multiple meetings and workshops and pursue regular face-to-face interaction and collaboration with industry personnel. The QCL offers industry members unique access to expertise of the Jackson School of Geosciences, industry subsurface data, investigations of multiple scales of depositional environments and their interconnections, and an evolving quantitative database on clastic depositional-systems architecture.

High-resolution imagery and lidar

Seismic-coherence image of submarine-channel deposits, mud diapirs, and mass-transport deposits, offshore Trinidad

1800-m-long lidar survey of McMurray Formation outcrops along Athabasca River, Canada
Research Challenges

The Reservoir Analog Architecture and Dimensional Database is being improved to provide an intuitive, searchable source of quantitative information on reservoir architecture to our industry members. QCL aims to provide quantitative distributions, not just ranges, of reservoir architectural elements in a variety of settings. QCL has established search functionality for legacy data and is organizing the database according to a simplified scheme of architectural elements of fluvial, shallow-marine, and deep-water depositional elements. This organic database is continually improving: through 2016, thousands of new data points were added on sediment delivery to continental margins and the grain size and geometry of deep-water depositional systems and reservoir elements.

Membership

- Each year’s research calendar begins January 1 and runs through December 31.
- Multiple meetings, workshops, and face-to-face consultation with industry members are held annually.
- Website and database access is limited to active members; however, annual meeting presentation material, field-trip guides, and publications remain available to inactive members for their membership years.

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Mission

RCRL’s mission is to use outcrop and subsurface geologic, geophysical, and petrophysical data from carbonate reservoir strata as the basis for developing new and integrated methodologies and concepts to better explain and describe the 3D reservoir environment, and to improve hydrocarbon recovery factors. In addition to this research mission, RCRL is dedicated to technology transfer and education, and consistently offers state-of-the-art training in the form of short courses, field seminars, in-house reviews of selected assets, and extensive graduate student supervision and guided research.

Research Thrusts

RCRL approaches reservoir characterization through four main scales of investigation: (1) platform-to-basin-scale stratigraphy; (2) reservoir architecture, including both matrix and nonmatrix systems (e.g., fractures and paleokarst); (3) structural and geomechanical properties characterization; and (4) pore networks and their reservoir distribution. Research questions for each theme are developed using both subsurface data and outcrop analogs. RCRL emphasizes quantifying what is observed so that its research is applicable to reservoir models and is valuable in providing predictive relationships and conceptual tools for reservoir characterization and play analysis.

Research Challenges

- Early Permian shelf-to-basin synorogenic to early post-orogenic stratigraphy of the Delaware and Midland Basins
- Gulf of Mexico carbonate reservoir settings, pore systems, fracture character, and margin variability
- Cenozoic carbonate-platform systems, high-resolution stratigraphy, and structural configuration of shelf margins
- Fractured carbonate reservoir characterization in outcrop and subsurface analogs
- Origin and petrophysics of tight limestone and dolomite reservoirs
- Regional reservoir characterization of the Austin Chalk trend
- Carbonate rock mechanics and acoustic-properties research
Membership

The RCRL sponsor contribution to the program is $55,000 per year. Sponsors are encouraged to commit to a 2-year agreement to better plan a longer-range research program and reduce the effort in securing agreements. A 2-year agreement is currently being offered at $50,000 per year through 2020 (total of $100,000). Industrial sponsors receive research results at annual review meetings, in short courses, during mentoring activities, in publications, and on the continually updated, members-only RCRL website database (http://www.beg.utexas.edu/rcrl/members/). The searchable website protects the investment in RCRL research and makes previously presented material easy to locate. The data area contains digital presentations, including archived video and annotated presentations, core workshop guidebooks, and field-trip guidebooks. Supplemental data such as maps, core photos, porosity and permeability data, and digital outcrop reservoir models are available upon request. In addition to the Annual Review Meeting with its associated Field Trip and Core Workshop, a training workshop is offered in the spring. These workshops are interactive and utilize subsurface data, along with applicable outcrop analogs to emphasize applications of key elements that have been developed by RCRL. Typically, they consist of a week-long series of 1-day, stand-alone courses that include (1) introduction to carbonates and principles of carbonate exploration and exploitation; (2) seismic characterization of carbonate systems; (3) integrated core, log, and seismic analysis for construction of high-resolution sequence frameworks for reservoir characterization and modeling; (4) principles of evaporite karst and associated reservoirs; and (5) 3D fracture modeling using carbonate rock properties and mechanical stratigraphy.
Mission

The mission of the State of Texas Advanced Oil and Gas Resource Recovery (STARR) program at the Bureau of Economic Geology is to conduct geologic research that increases the production and profitability of oil and gas in the state of Texas. Since its inception in 1996, STARR has helped raise $515.6 million in severance-tax revenues, offsetting Texas’ $39.8 million funding investment. In its more than 20-year history, STARR has undertaken more than 60 field (reservoir characterization) and 15 regional studies, with over 50 Texas oil and gas operators participating in the program.

Research Thrusts

Research thrusts of the STARR program are applied toward technology transfer to operators in the oil and gas industry in Texas in three main areas:

- Integrated geologic characterization studies that employ seismic, core, wireline-log, and petrophysical data for documenting areas with additional oil and gas potential, at both field and regional scales
- Imaging and characterization of lithology, facies, and micropore systems in unconventional reservoirs, including shale-gas systems
- Advanced seismic mapping techniques for imaging potential oil and gas reservoirs not currently contacted by existing well bores
Research Challenges

The main challenge in the STARR group is to explain controls on oil and gas production in the wide variety of oil and gas reservoirs in Texas. Geoscientists at STARR employ a technical approach that emphasizes rock data for better characterizing reservoir quality and continuity, two important factors in determining oil and gas producibility. The STARR group, wherever possible, integrates rock-property data in both field- and regional-scale projects, drawing upon its extensive well-core collection at the Bureau of Economic Geology.

Membership

No costs are associated with participation in the STARR program, which is funded by the State of Texas. STARR partners receive a variety of technical products that include stratigraphic and structural interpretations, facies and depositional systems analysis from cores, wireline logs, and seismic data, as well as interpretations of geologic controls on reservoir quality. Program results are disseminated through numerous Bureau publications and articles, as well as in workshops, professional society meetings, and university classrooms. STARR’s study of East Texas Field was the first to fully explain the subsurface distribution of reservoir sandstone bodies in the largest oil field in the Lower 48 states in terms of original oil in place. The study demonstrated that East Texas Field still has the potential for hundreds of millions of barrels of additional oil production, which will continue to benefit the State of Texas.

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www.beg.utexas.edu/research/programs/starr
Mission

- To address the most important and challenging research problems in computational geophysics as experienced by the energy industry
- To educate the next generation of research geophysicists and computational scientists

Research Challenges

The Texas Consortium for Computational Seismology (TCCS) is a collaboration between the Bureau of Economic Geology and the Institute for Computational Engineering and Sciences (ICES) involved in:

- Estimating seismic velocities by using full waveform information
- Identifying the most accurate and efficient seismic imaging algorithms while controlling the trade-off between accuracy and efficiency
- Increasing the resolution of seismic reservoir characterization
- Assisting the seismic interpreter by automating common interpretation and signal-processing tasks
Research Thrusts

- High-Resolution Imaging of the Barrolka Dataset Using Diffraction Attributes
- Characterization of Fractured Shale Reservoirs Using Anelliptic Parameters
- Phase Correction of Prestack Seismic Data Using Local Attributes
- Extracting Seismic Events by Predictive Painting and Time Warping
- Lowrank Reverse Time Migration for Subsalt Imaging
- High-Resolution Seismic Attributes for Fracture Characterization in Grosmont Formation
- Waveform Tomography with Cost Function in the Image Domain
- Multiazimuth Seismic Diffraction Imaging for Fracture Characterization in Low-Permeability Gas Formations
- Seismic-Wave Focusing for Subsurface Imaging and Enhanced Oil Recovery

Membership

TCCS publications follow the discipline of reproducible research: results of each computational experiment are supplied with open-source software code required for reproducing and verifying the experiment. The TCCS group consists of scientists from five countries who are united in their goal to advance science. Research staff include two principal investigators, six Ph.D. students, three M.S. students, a postdoc, a B.S. student, a senior research fellow, and a visiting scholar.

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Mission

The Tight Oil Resource Assessment (TORA) program is an industry consortium created in 2016 to fund a multidisciplinary study of tight-oil producing horizons in the Midland and Delaware Basins. In 2018, other tight, resource-reservoir evaluations and studies completed by the Bureau of Economic Geology were combined into the TORA consortium. TORA has built on a century of the Bureau’s Permian research, and the recently completed national shale-play resource and production rate studies, to analyze this complex gas- and oil-rich source-rock system.

Research Challenges

TORA narrows the range of recoverable resource estimates, building integrated, market-independent basin outlooks. TORA researchers employ a newly developed workflow utilizing 3D geocellular models. That workflow will predict ultimate hydrocarbon recoveries, economic viability, and playwide production rates. TORA studies tight oil and gas formations in order to produce unbiased, comprehensive, and publicly available results.

The program brings together an integrated, multidisciplinary team who will create production outlooks and investigate the following topics:

- Optimal well spacing and fracture design
- Impacts of formation characteristics on fracture extent and effectiveness
- Optimization of recovery in thick stratigraphic sections
- Detailed facies description and analysis
- Assessment of alternatives in areas having low recovery efficiency

Original oil-in-place estimates across the Midland Basin

Midland Basin well trajectories color coded by landing formation (e.g., WCB = blue)
Research Thrusts

The TORA multidisciplinary team employs a bottom-up, highly iterative resource-evaluation process. The TORA research model allows team members from different disciplines to share information and inform study results. Team members are experts in their respective fields, which include:

- Geology and petrophysics
- Engineering
- Economics
- Water management

Membership

Membership in TORA is $50,000 annually. Benefits to industry partners include:

- Detailed insights from geologic, petrophysical, engineering, statistical, and economic methodologies in the form of semiannual-update meetings and annual reports
- Access to the multidisciplinary TORA research team
- Leveraged funding through State of Texas support and other operator contributions
- Consortium-supported data sharing between companies and the Bureau