Director’s Message

In 2005 the Bureau officially became part of the John A. and Katherine G. Jackson School of Geosciences (the School). The School comprises three units: the Department of Geosciences (Department), the Institute for Geophysics (Institute), and the Bureau of Economic Geology (Bureau).

Last fall, Dean Eric Barron initiated a strategic planning process and charged each unit to develop a plan that would “engage and excite…, define the path for our investments…, attract the next set of resources…, focus on the scholarship of teaching as well as the scholarship of research…, promote collaboration and cohesion as a strategic objective…, [and] play off [of] the existing strengths of this school and this university….” Dean Barron emphasized that he wanted to maintain the autonomy of the units and strengthen them. He also set out to determine and invest in common research interests between the units, and in so doing strengthen the School.

In this Midyear Report I would like to share with you components of the Bureau Strategic Plan that represent our vision for the Bureau as we grow into our role as a unit of the Jackson School. This transition brings both significant challenges and outstanding opportunities. The planning process engaged the entire Bureau family and was not only timely and productive but also a lot of fun!
Overview

The process of planning brought a welcome, formal, internal examination of the Bureau. It resulted in an assessment of our role in the School and the University, as well as our role as the State Geological Survey and our impact on science and society.

The Bureau today is a healthy, growing, globally recognized science and engineering organization with broad-ranging research and education strengths. Bureau researchers are engaged in programs that have the potential to impact global society. For example:

- How can we transition globally from carbon-based energy to de-carbonized energy?
- What, if anything, can be done about climate change?
- What new discoveries are possible if we put smart, mobile, microsensors into the Earth?
- How should societies adapt to coastal dynamics?
- Where will the world’s fresh water come from this century?

Since creation in 1909 in the dual role as the first Organized Research Unit at the University of Texas and the State Geological Survey of Texas, the Bureau has grown into a major research institution addressing global earth science problems in order to benefit society.

The Bureau attracts significant external research funds each year, with total annual bookings that have grown from $10 million in 2000 to $20 million today. Funds are raised from a diverse portfolio of Federal, State, private, and foundational sources. For the past 30 years, all Bureau researchers have been supported nearly 100 percent by external funding.

The Bureau has research strengths that complement those of the other units, and good opportunities exist for cross-unit collaborative growth, both in research and graduate education. In addition, as the State Geological Survey, the Bureau will remain engaged in providing scientific information to support informed decision making by regulators and legislators.

Among the Bureau’s research strengths are the multidisciplinary, collaborative research teams that engage in research sustained over
The Bureau educates at many levels—undergraduates and graduate students, K-12 students and teachers, private citizens, government employees and decision makers, and private-industry employees. Many of the projects and programs in our research portfolio thus share scientific or societal themes and constitute focus areas. There are two broad classes of focus area—one in which projects are coordinated around a common research theme and the other represented by major programs with an overarching purpose driven by the Bureau’s mission. Focus-area classification is not a perfect science, in that some projects impact more than one area and some projects defy easy classification. Research focus areas include Carbon Management, Coastal Dynamics, Fracture Processes and Structural Diagenesis, Paleoclimate, Salt and Shale Tectonics, Sedimentary Rock Systems, Seismic Imaging in Complex Environments, Sustainable Water Resources, and Unconventional Natural Gas Systems.

In addition, several major programs at the Bureau are represented by significant, ongoing, funded research or service in which the Bureau is heavily invested. These include the Advanced Energy Consortium, the Center for Energy Economics, the Gulf Coast Carbon Center, international research and education partnerships, and the State of Texas Advanced Resource Recovery (STARR).

The Bureau educates at many levels—undergraduates and graduate students, K-12 students and teachers, private citizens, government employees and decision makers, and private-industry employees. Graduate students at the Bureau are involved with research teams working on important issues, using data sets and technology generally unavailable in academe, and gaining exposure to industry contacts and careers. The Bureau has a long history of preparing graduate students for industry through internships as research assistants under the mentorship of senior scientists, as well as through traditional thesis supervision.

In addition to graduate education, the Bureau engages each year in extensive outreach and professional education. Activities include Earth Science Week, Teach the Teachers, Decision Makers Seminar and Field Trip, museum displays, Earth View Texas, GeoForce Texas, the Down-to-Earth program, K-12 science fairs, and museum educational projects. Teaching industry professionals is also an integral part of our industrial associates programs. Outreach includes the Petroleum Technology Transfer Council, State and Federal testimony, symposia, professional courses and training, field trips, leadership of professional societies, presentations at conferences, and publishing in local, regional, national, and international journals and our own publication series.
Our team-based research approach and world-class support staff combine to create a strong sense of Bureau community—the Bureau family. Building on community culture, there are several key areas in which the Bureau, supported by well-placed School investments, will help the School attain the forefront of research and education.

The Bureau’s Strategic Plan: Research Focus Areas

The dual role of Organized Research Unit and State Geological Survey has resulted in Bureau programs that run the gamut from basic to applied, short term to long term, single researcher to highly integrated team, schedule driven to open ended, product based to knowledge driven, and research to service. Bureau planning therefore requires a balance among the strategic aspects of determining and conducting research and service relevant to society in the broad areas of energy and environment, the tactical components of maintaining a diversified portfolio of external funding in order to minimize volatility, the practical challenges of attracting funding while retaining premier talent, and the desired results of societal impact and service. The Bureau must balance the need for growth and its associated strategies by growing while maintaining and strengthening what exists and is healthy today.

Bureau focus areas represent annual programs that are funded on the order of $1 million or more or that can become such. These programs have been identified as areas for growth and have the potential for substantial interaction across the School.

Carbon Management

Transfer of carbon from storage in the Earth as fossil fuel to carbon dioxide in the atmosphere is a compelling geoscience issue. Increasing CO$_2$ concentration in the atmosphere is of global concern because increasing CO$_2$ levels can lead to climate change in the form of global warming. The United States currently produces one-quarter of the world’s CO$_2$ emissions from combustion of fossil fuel—second only to China—and therefore has a critical role to play. As many of the top scientists in the world have recognized, the sooner we start to reduce these emissions, the better off we will be. Because fossil fuels will be required as a major global energy source for the next half-century or more, it is vital that we begin to capture and store CO$_2$. 

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Research has rapidly expanded to assess both causes and effects of climate change, leading to the practical question: what are the geologic options for mitigation in terms of stabilizing the change in atmospheric composition? Two types of mitigation are within the expertise of geoscience: deep subsurface storage (sequestration) of carbon captured from concentrated point sources (power plants, refineries, cement plants, etc.) and increased terrestrial storage (increased soil or plant carbon uptake). Large-scale subsurface carbon storage requires developing a new geoscience discipline that draws on expertise from reservoir characterization, sedimentology, fluid-flow simulation, geochemistry, groundwater protection, and vadose-zone gas flux and combines them in new ways.

In 2003, to address the challenge of reducing emissions on a large scale, the Bureau formed the Gulf Coast Carbon Center (GCCC) to provide needed scientific, engineering, and public-policy analysis. The GCCC is an academic-industry research consortium that recognizes the unique character of the Gulf Coast as a region of concentrated CO$_2$ sources and an array of co-located, subsurface sinks. The GCCC is working to advance technical capabilities and to identify the intersecting scientific, engineering, regulatory, legal, economic, and public-policy issues that must be overcome to move ahead. The Bureau's Frio I and Frio II pilot injection projects, which represent the first successful CO$_2$ brine sequestration experiments in the U.S., have achieved national and international recognition. The GCCC also facilitated the Bureau's leadership of the FutureGen Texas team.

The Bureau has a strong presence in this explosively growing research area and the potential to develop a role of international leadership over the next decade. To achieve such a position of leadership requires a large and integrated program, linking understanding of the modern climate system provided by the Institute and the Department with solutions such as geologic storage of carbon provided by the Bureau.

**Coastal Dynamics**

Sustaining competing uses and ensuring the viability of coastal environments in light of expected increases in population, sea level, and hurricane effects are a huge challenge. More than 50 percent of the U.S. population lives in coastal communities, many of which are situated along the low-lying, hurricane-prone continental margins of the east and Gulf coasts. Geoscientists will play a central role in studying, monitoring, and developing policy responses to the effects of climate change in the coastal zone. These tasks will be accomplished...
by charting the past, learning about the dynamics of coastal systems, and predicting future changes in coastal geoenvironments.

In addition to field mapping of these coastal environments, new space and airborne remote-sensing instruments that acquire digital photography, multi- and hyperspectral images, active radar and lidar data, gravity measurements, and electromagnetic characteristics are providing unprecedented views of change in coastal environments and revealing the processes causing that change. The School and its collaborators at The University of Texas at Austin (UT) Center for Space Research are at the forefront of developing acquisition and analysis techniques for some of these new tools. To address research opportunities in coastal change, the Bureau has invested heavily in airborne topographic lidar, GIS, and data visualization.

How can we optimally fuse these new data sets and combine them with historical data to develop reliable models of coastal change? The new remote-sensing technologies, combined with targeted ground investigations and shallow 3D geophysical data sets, could greatly lessen the trade-off between small-area, detailed studies and broad-area, general studies. Earth scientists with extensive experience in coastal depositional systems and the ability to acquire, analyze, and apply the new remote-sensing data sets will be on the frontline in addressing coastal environment problems and future effects of climate change.

**Fracture Processes and Structural Diagenesis**

Explaining the properties and processes associated with complex and heterogeneous subsurface mineral assemblages comprising porous rock formations, their mechanical evolution, and the equally complex fluids that may reside within and flow through these formations is a crucial scientific challenge. It is associated with exploration for and extraction of energy resources, geologic sequestration of large volumes of carbon dioxide, and geoscientific aspects of safely storing nuclear waste materials. The Bureau is addressing these issues in collaborative research with the Departments of Geological Sciences and Petroleum and Geosystems Engineering. The research is beginning to overturn traditional ways of approaching structural geology and geochemistry problems in sedimentary rocks. New modeling and seismic approaches, as well as deep drilling, are creating opportunities for radical improvements in how we understand complex upper crustal structures that have impacts on fluid flow and sequestration. With
support from DOE’s Office of Basic Energy Sciences, industry, and the School, we have initially focused on pursuing a breakthrough in what controls fluid flow and other processes in the deeper parts of sedimentary basins.

The deep-basin environment—broadly, rocks that have experienced burial deeper than 3 km or temperatures higher than 80°C—is an exciting frontier. Understanding postdepositional processes affecting rocks in these settings requires new models of mechanical and chemical interaction and new methods of microstructural analysis.

What are the feedbacks between chemical and mechanical processes in moderately to deeply buried, chemically reactive, fractured rocks? In breaking down the disciplinary barriers between structural geology and sedimentary petrology, the Bureau is in the vanguard of proposing new hypotheses and new approaches to measuring and modeling mechanical and chemical interaction and ways to provide the expertise that government and industry will need to address these issues. Further, the School is bridging the gap between lower temperature diagenesis and higher temperature metamorphism—a gap in which chemical and physical processes have been, up to now, poorly understood. These studies require the collaboration of sedimentary and metamorphic petrologists.

Diagenetic modeling integrated with petrographic analysis will provide fundamental breakthroughs. The program has generated many ideas for additional sponsored research, including application of seismic processing and interpretation. The program has also set a positive example of inter-unit collaboration and innovation in cross-unit student mentoring.

**Paleoclimate**

Climate is a fundamental driver of Earth systems in that it sets the tempo of cyclic sedimentary deposition; controls weathering, erosion, and sea level; energizes ocean circulation; drives fresh-water recharge; and prompts glaciation. Studies of past climate regimes (paleoclimatology) can greatly inform our predictions of future climate change. To complement the growing expertise in modern climate modeling and ocean-based climate studies being developed in the Institute for Geophysics, the Bureau is developing a research program in the area of rock-based paleoclimate studies.

Climate modeling requires a data set for validating predictions. The available data set of quantitative measurements of temperature
is temporally limited, however, compared with the time scale of some of the phenomena being predicted (such as changes in the global ocean circulation system). Study of the rock record in order to understand past climate change is therefore critical to evaluating the utility of computer models in predicting future climate change. And paleoclimatologists look at the rock record to explain past climate change events. They use evidence from the fossil record (paleoecology) and evidence from the rocks (lithostratigraphy and geochemistry) to infer the nature of past climates.

Modern anthropogenic perturbation of climate resulting in changing atmospheric composition adds urgency to the need for rigorous study of the climate and its interactions. The Bureau’s Gulf Coast Carbon Center, the Center for Energy Economics, and the Coastal Change in Texas teams are trailblazers at the frontier of climate research. Combined with ongoing programs in the Department and the Institute, the School will capture a significant component of the climate research spotlight—namely, what can be done about it—both scientifically and in terms of policy.

**Salt and Shale Tectonics**

Gravity-driven tectonics dominates all continental margins underlain by mobile substrates, such as salt or overpressured shale. Salt and shale tectonics create three-dimensionally complex structures on an impressive scale and strongly affect the interplay between bathymetry and stratigraphy. The School hosts the world’s leading research group on salt tectonics—the Applied Geodynamics Laboratory—which integrates seismic interpretation, physical modeling, numerical modeling, and fieldwork.

The program incorporates structural geology, tectonics, mechanics, stratigraphy, and regional geology. Complementary research on overpressured shale substrates by the Quantitative Clastics Laboratory uses seismic interpretation and outcrop study to explore the links between seismic geomorphology and shale tectonics. The latter is an underresearched topic in which the Bureau is poised to take the lead.

Combining the strengths of these programs—salt and shale tectonics—will impact exploration for oil and other resources—especially in improving techniques of subsalt imaging, trap prediction, and drilling. Applying this research also reduces the impact of geohazards such as submarine landslides and mudflows. Wider implications of this work can also help explain larger-scale tectonic settings, such as divergent continental margins, rift basins, inverted basins, and orogens.
Sedimentary Rock Systems

The 1960’s and 1970’s Bureau-led research movement in depositional systems, followed by the seismic stratigraphy and sequence stratigraphy revolutions in the 1980’s and 1990’s, ushered in a renaissance in stratigraphic and sedimentologic understanding. Sequence stratigraphy, in fact, recently moved into an application phase. Investigations currently focus on how sedimentology, diagenesis, fractures, and pore systems can fit into a sequence stratigraphic context and whether the evolution of matrix-pore-fluid systems can be predicted within such a context.

Stratigraphy records the Earth’s evolution, and stratigraphic architecture controls how natural resources are distributed around the globe. Concepts such as sequence stratigraphy revolutionized our understanding of the 2D temporal and spatial distribution of strata and the controls on its genesis. But significant questions remain. What controls the three-dimensional distribution of fine-scale stratigraphic elements—including stratal geometry, lithology, and primary porosity—and permeability? What are the implications of these processes for understanding change in the Earth’s evolution?

Breakthroughs will be made by studying sedimentological processes through space and time and by building stratigraphic models that exploit new and developing imaging technologies at all scales, such as multispectral Earth imaging, 3D multicomponent seismic, airborne and ground-based lidar imaging, high-resolution CT scans, and SEM imaging. One fundamental challenge in our understanding and modeling of reservoir and aquifer fluid flow is integrating sedimentology, stratigraphy, geophysics, geostatistics, numerical modeling, and fluid-rock interaction from pore to basin scale, thereby becoming better able to predict the distribution of petrophysical properties within a coherent framework.

Interactive research programs in the Bureau in the area of sedimentary rock include RCRL (Reservoir Characterization Research Laboratory), QCL (Quantitative Clastics Laboratory), PBGS (Permian Basin Geological Synthesis), Deep Sandstone Reservoir Quality, FRAC (Fracture Research and Application Consortium), EGL (Exploration Geophysical Laboratory), and STARR (State of Texas Advanced Resource Recovery). Teaming up with programs at the Department and the Institute, these programs pool their talent
in order to make breakthroughs in modeling fluid flow at multiple scales, and because of the interactivity, the research is supported by a broad range of external support.

**Seismic Imaging in Complex Environments**

Ultra-deep-water environments are a critical frontier in meeting the energy needs of the U.S. and the world. Because nearly half of the prospective area in deep-water environments is covered by shallow salt, highly complex seismic reflection wavefields generated by salt make seismic imaging of deep-subsalt reservoirs extremely difficult. Effective imaging of subsalt ultra-deep-water targets thus remains a fundamental scientific challenge and requires multidisciplinary efforts and new technologies in both processing and interpretation.

The focus of this research is threefold: (1) to achieve breakthrough improvements in accuracy, resolution, and efficiency of seismic depth imaging in complex geological environments; (2) to develop new approaches to the most challenging problems in seismic subsalt imaging—velocity model building, illumination compensation, utilization of multiple and multicomponent waves, and full-wave inversion; and (3) to create reusable 3-D models of deep-water environments and reproducible seismic modeling and imaging experiments.

**Sustainable Water Resources**

Sustainable water resource management is critical to meeting the demands for drinking water and food production, not to mention large-scale biofuel production. Understanding links among land-use change, climate variability/change, and water resources is essential to developing sustainable water resources.

Current programs at the School are making significant advances in quantifying water-cycle impacts of land-use changes (cultivation, urbanization) and climate variability/change (El Niño Southern Oscillation, Pacific Decadal Oscillation, glacial/interglacial cycles). These programs are using environmental tracers and numerical modeling analysis on a range of spatial scales from point field to regional and global measurements. Texas is a microcosm for global systems, with its wide range of climate and water-usage issues—including irrigated agriculture, diverse aquifer types, and rivers, wetlands, and coastal zones—each of which has diverse ecosystems and competing water uses, and some of which are regulated. The
Bureau and the School can have a great impact in Texas and, by extension, in the nation and around the globe.

Expansion of Bureau research in water-resource sustainability to a global scale will benefit from strong collaboration with other national and international programs, a strong visiting scientist program, and an expanded postdoctoral program.

**Unconventional Natural Gas Systems**

The Bureau is initiating a new research program in unconventional energy that will combine our existing strengths with new capabilities. Conventional energy can be produced economically from reservoirs without applying expensive stimulation techniques or utilizing special enhanced-recovery processes. In contrast, unconventional energy cannot be produced economically without using advanced stimulation techniques or enhanced-recovery processes and is commonly found in more continuous reservoir systems and unconventional trapping configurations. Typical unconventional energy sources include gas shales, tight-gas sands, coalbed methane, heavy oil, tar sands, and oil shales. The large potential volumes of unconventional gas resources, together with strong projected market demand, make unconventional gas in particular a vital element in most analyses of future energy trends.

International oil companies (IOC’s) today control less than 10 percent of the world’s global conventional oil and natural gas reserves; more than 90 percent of oil and natural gas is controlled by state oil companies. To respond to this resource deficit, the IOC’s must find a source of fossil-energy molecules, so they are pushing into ever more hostile environments (ultra-deep drilling, ultra-deep water, and the Arctic) and, more important, establishing major commitments to unconventional resources—heavy oil, tar sand, oil shale, coal gasification, coal to liquids, gas to liquids, coalbed methane, shale gas, tight gas, deep gas, and methane hydrates.

Because of all the energy uncertainties that the future will bring, rock understanding will be vital. Scott Tinker has called the phenomenon the *rock revival*. The challenge in unconventional gas is bigger than simply installing a compressor or injecting a chemical solution to optimize recovery, for recovery efficiency cannot be enhanced without an understanding of reservoir conditions. Reservoir characterization is a bottom-up process that starts with the rocks—petrography, diagenesis, rock physics, rock mechanics,
and seismic imaging. It is exciting because students will learn to link essential rock data to advanced remote sensing, simulation, and modeling. And the Jackson School, with its rich history in rock know-how, can become the world’s leading authority.

Our research will emphasize integration of basin burial, temperature, and pressure history; source-rock type, distribution, and relation to reservoir rocks; reservoir distribution and diagenetic evolution of the basin, including connectivity of the reservoir section with the source interval; structural history of the basin; basin hydrologic history; and rock physics in the context of advanced seismic imaging.

Major Programs

Now for a glimpse into individual programs that make the Bureau what it is today. Our major focus areas are represented by significant, ongoing, funded research or service, in which the Bureau is heavily invested and which commonly has a large anchor funding source. These include the Center for Energy Economics, the Gulf Coast Carbon Center, international research and education partnerships, the State Geological Survey, the State of Texas Advanced Resource Recovery (STARR) program, and professional and societal service.

Center for Energy Economics

The Center conducts research on economics of energy value chains and educates stakeholders to improve public policy and investment for economic development. The Center’s aims include becoming an international leader in understanding economic, technological, business, policy/regulatory dimensions of energy resources and infrastructure development, including impact of environmental policies. The Center’s expertise in human-capacity building can be fully integrated with science and technical service initiatives at the Bureau and other parts of the School and UT. The Center’s excellence in research, public education, and outreach on energy offers natural links to the Bureau’s STARR program, low-pressure gas, unconventional fossil energy resources, and the Gulf Coast Carbon Center, as well as to efforts in water resources, coastal processes, and decision maker education. Within the School, the Center is forging links to UT’s Center for International Energy and Environmental Policy, the Energy and Earth Resources graduate degree program, the McCombs School of Business, the Center for Energy Finance Education and Research, the Center for Petroleum Asset Risk Management, and others.
The Gulf Coast Carbon Center (GCCC), a global leader in carbon sequestration research, will grow to keep pace with this developing field by participating in student training. Its research focuses on testing the viability of large-volume, long-term, geologic storage of CO₂ in brine reservoirs, assessing security of CO₂ used for EOR, and increasing effectiveness of monitoring techniques. Alliances with specialists within the School, elsewhere in UT, and at other research institutions will help establish global leadership for the Center. There are clear opportunities for collaboration on energy policy issues with CEE, the Center for International Energy and Environmental Policy, and the LBJ School. The GCCC has the advantage of the Bureau’s expertise in reservoir characterization, together with the cooperation of reservoir engineering research at UT’s Department of Petroleum and Geosystems Engineering, carbon separation technology research in UT’s Chemical Engineering, soil and ecosystem monitoring studies at UT’s Environmental Science Institute, groundwater and vadose-zone monitoring research at the Bureau, and global climate modeling at the Department and the Institute. The GCCC anticipates participating in major field experiments over the next 10 years, establishing a carbon sequestration policy research group and a vibrant graduate program in carbon management.

International Research and Education Partnerships
The Jackson School is viewed by many national oil companies as an essential resource for integrated education and research. The Bureau has been playing this role for years because of its full-time research capability and its involvement in the type of teaching and academic supervision needed by these companies. The challenge is to be selective in partnering so that we can deliver a high-quality, comprehensive program, and by 2008, the Bureau intends to establish one or two major research and education partnerships, which can benefit from the full spectrum of basic and applied research under way at the Bureau. A goal of such a program is enrollment and graduation by national oil company/international oil company partner employees in Jackson School degree programs.
State Geological Survey

As the State Geological Survey, the Bureau serves the State of Texas and the Nation via application of research, public education, and outreach. This role can be described broadly as bringing science to citizens and decision makers. Geologic mapping and near-surface geophysics are two of the routine scientific aspects of this function, but we advise State leaders on a wide variety of geoscience issues, as well as preserving and curating geoscience data. Our goal is to bring knowledge gained from fundamental and global research to the State of Texas in order to impact resources, environment, and policy. Active partnerships with geoscience-related State agencies include the Texas General Land Office (coastal erosion), Texas Commission on Environmental Quality (water quality and sustainability), Texas Water Development Board (water availability), Railroad Commission of Texas (carbon and FutureGen), and the legislature (geological hazards such as Wink Sink). It is essential that we continue to strengthen the Bureau’s service to State and Federal legislators and decision makers in applied geoscience research. For this mission the Bureau must maintain the strength of its staff to support research, facilities, and School outreach programs (for example, the Decision Makers Seminar and Field Trip, Earth Science Week) to serve the State and Nation. The Bureau will also strengthen its position as the national leader in geoscience data preservation and curation, currently led by our three core research centers and Statewide digital log library. The Bureau provides high-impact products delivered on time, on budget, with high-quality results, and our continued State support is a testament to our being appreciated.

State of Texas Advanced Resource Recovery

State of Texas Advanced Resource Recovery (STARR) is a major Bureau program supported by the State of Texas that has the goal of making oil and gas recovery on State Lands more effective. Although independent operators produce most of Texas’ oil and gas, in many cases they lack geoscience expertise or advanced interpretation tools. STARR conducts geoscience and engineering research at a variety of scales with selected industry partners who lease mineral rights from the State Lands program. The State benefits from enhanced royalty income and severance tax revenue as a result of the program’s success. STARR is revenue-positive because our research increases understanding of and production from existing reservoirs, regional plays, unconventional plays, and enhanced recovery operations,
thus creating value that can be measured in higher production. State income is consequently significantly greater than the budgeted amount received from the State. And the program is poised to have even greater impact as the Bureau brings new technology to bear on key remaining oil and gas targets, notably in West Texas.

**Societal and Professional Service**

In addition to serving society through its research and State survey programs, the Bureau is committed to societal and professional service on many levels. We support our research and support staff members who engage in service of professional societies, community outreach, and education at all levels. Each year Bureau professionals serve as officers in local, regional, national, and international organizations—including professional societies, national associations and academies, and trade organizations. We engage in committee work, conferences, distinguished lectureships, and presentations at conferences. The Bureau has recently become a partner in scientific program development at museums, and our aim is to launch at least one new museum collaboration (program) per year. Because our societal service includes providing educational opportunities to K-12 children and educators of Texas, we must establish a permanent funding mechanism for this program, which will be part of the Bureau’s growing role in education.

**Education**

The Bureau educates at many levels—private citizens, elected officials (decision makers), government employees, scientists and engineers in industry, undergraduate and graduate students, and K-12 students and teachers. Each group is important to the mission, reputation, and advancement of the Bureau and the School. The education of teachers, citizens, policy makers, and industry have long been woven into most Bureau programs, but with the advent of the Jackson School, the Bureau is increasingly involved in formal graduate student education.

The Bureau is committed to excellence in Jackson School graduate student education. Our team-based research program naturally promotes student interaction with scientists and faculty associated with Bureau programs and a strong sense of community. Participation in Bureau research projects exposes students to research teams working on important issues, cutting-edge data sets, and leading technology. Students enjoy practical opportunities for career
advancement through contact with the Bureau’s research supporters in industry and, hence, access to prestigious internships and entry into industry careers. Students also benefit from support by human resources, information technology (IT), publishing (Media Services), and other support staff, who are engaged in student issues from visas to software to posters.

Increasing the quality and, to some degree, the number of graduate students is a School priority. Although the Department is a natural leader in undergraduate and graduate education, the Bureau is making a significant contribution as well, primarily in the context of ongoing research projects that collaborate with faculty. Research projects provide financial support, data sets, and an immersive collaborative environment in which students flourish. Bureau researchers have a long history of supervising and advising international students, who are often supported for work on industry data sets.

The Bureau offers a unique atmosphere for student employees in professional development. With a work environment and pace resembling those of industry, students can experience a professional internship without leaving Austin. Bureau employment provides students with wider experiences than typically afforded by academic training alone. By working on Bureau projects, students can become familiar with concepts, techniques, and technology outside their fields of academic training. This experience has proved advantageous to students seeking entry into the petroleum and environmental industries. Even now, with the high demand for students in the petroleum industry, work at the Bureau is an asset in the job market and an ideal way for students to enhance their skills and learn workplace discipline.

The Bureau has proposed that the School build on the foundation of the Bureau’s work environment to provide a novel, broadening, internship experience for students aiming at academic careers, who otherwise might not face this applied aspect of geoscience. Such experience would undoubtedly extend the mentoring capabilities of Jackson School graduates attaining academic posts. For our graduates pursuing careers in other fields, the wider awareness can help make them more knowledgeable citizens—with geoscience backgrounds. Project budgets currently dictate student employment opportunities at the Bureau and generally confine the experience to qualified graduate students in geosciences and petroleum engineering. School support is needed, however, to create a formal intern program.
The world-class subsurface sample collections in the core repositories in Austin, Midland, and Houston are enormously useful resources in education and outreach, as well as irreplaceable starting points for research. These facilities are a potent source of data for student projects, as well as essential elements in professional education, outreach, and service. The potential for these facilities to grow into specialized teaching and outreach venues (and into museums!) is high.

**Jackson School Research Themes**

On the basis of an assessment of the most pressing scientific issues in the broad area of geosciences and appraisal of common research interests identified in the strategic plans of each of the three units, the Jackson School developed four major research themes and three emerging cross-cutting themes that are being used to guide the hiring of new faculty and research scientists over the next several years. A description of each of these is outlined on the School’s website and in the announcements of new positions that have been widely distributed in professional journals. The Bureau is engaged in each of these defined and emerging themes:

- **Energy–Science, Environment, and Policy Research**, which seeks to discover how we can create an energy future that is sustainable and environmentally and economically robust;

- **Earth Surface and Hydrologic Processes**, which has as its goal the unraveling of how surface and hydrologic processes are influenced by their dynamic setting at the interface of the lithosphere, atmosphere, hydrosphere, and biosphere;

- **Climate Systems Science**, which aims to find out what controls the rates of change and variability of the Earth system and to see whether we can improve our ability to anticipate these changes and to determine the potential impacts on society; and
Crust/Mantle/Core Dynamics, which seeks to understand how the Earth’s core, mantle, crust, and surface interact to shape the physical and chemical evolution of the planet. Cross-cutting themes include Water and Water Resource Sustainability, Computational Geosciences, and Rapid Response Research Capability.

The process of strategic planning has brought us to the point where we recognize and have defined several such opportunities, particularly in the areas of Research and Education. We have made specific, prioritized requests and recommendations that will help us take advantage of these opportunities and accomplish our goals. We have tried to weave the threads of School fabric throughout, including programs and ideas that will

- promote student and researcher interaction across units;
- develop the next generation of faculty and scientists;
- create international research and education opportunities, specifically in Latin America, Asia, and the Middle East;
- promote industry and government relations and interactions and recognize the future needs in human-capacity building;
- promote and reward service to the profession;
- promote research, education, and outreach partnerships;
- eliminate or break down barriers; and
- involve alumni throughout the School.

The Bureau looks forward to the evolution of the Jackson School, which involves implementing the Bureau’s and the School’s Strategic Plan. We are excited to work with our colleagues in the Department and Institute under the leadership of Dean Eric Barron to pursue the once-in-a-lifetime opportunity that has the potential to better the world.