Strategic Plan

The Jackson School of Geosciences at The University of Texas at Austin is one of the largest and most prestigious academic geoscience institutions in the world. It was established as a college-level school in 2005, as the result of the bequest of Jack and Katie Jackson, with the overarching goal of becoming the preeminent academic geoscience program, with international prominence in geology and geophysics, energy, mineral and water resources and in the broad areas of earth science, including Earth’s environment.

The school consists of the Department of Geological Sciences (DGS), Institute for Geophysics (UTIG), and Bureau of Economic Geology (BEG), which also serves as the Texas Geological Survey. It is made up of 55 faculty, 90 research scientists and postdoctoral scientists, 600 graduate and undergraduate students, and 140 support staff, working together to create a distinctive academic institution unlike any other in combined scope, impact, and direct societal relevance.

MISSION

The Jackson School of Geosciences (JSG) seeks to advance the understanding of Earth as a system, its resources, and environment, for the lasting benefit of humankind. Combining innovative research with educational experiences, we work to train future generations of geoscience leaders.

VISION

The goals of the Jackson School of Geosciences are to:

- Address fundamental geosciences questions regarding Earth’s transitions over space and time. We will lead research in the areas of Earth science that directly relate to societal challenges of the 21st century, including water, energy, natural hazards, natural resources, climate, life, land use, and soils.
- Foster a diverse community of scholars that includes collaborative research groups that promote transformative research at the interfaces between traditional disciplines. We will develop new programs and capabilities by not only working between units within the JSG, but also collaborating with other schools and colleges at UT-Austin, as well as at the state, national, and international levels.
- Provide world-class education for students at all levels by involving them in research, offering comprehensive, innovative curricula and field and practical experiences, focusing on student learning outcomes, and preparing them for successful careers so they can create, innovate, and lead the geosciences into the future.

EXECUTIVE SUMMARY

Top to Bottom: GEO 660 Class at Grand Teton National Park; JACKSON SCHOOL OF GEOSCIENCES; Europa, an icy moon of Jupiter, is one of the planetary bodies that the Jackson School is actively researching. NASA/JPL; Structures in the Grenville age Albany-Fraser belt in Western Australia’s Bremer Bay. JACKSON SCHOOL OF GEOSCIENCES.
This Strategic Plan for the Jackson School of Geosciences (JSG) identifies the vision, objectives, priority areas and roadmap for success of the school’s enterprises over the next 50 years. The plan will: (1) inform the school’s long-term funding priorities and infrastructure investments; (2) guide engagement with federal and state agencies, industry, non-governmental organizations and philanthropists, as well as institutions based in other countries; (3) influence new directions for improving education of JSG students; and (4) help faculty and research scientists organize into teams for major research initiatives. The primary components of this Strategic Plan are:

1. Research: JSG research encompasses all parts of the Earth’s dynamic systems, investigating the linkages between the Earth’s interior, surface, hydroosphere, cryosphere, biosphere, and atmosphere, and coupling among chemical, physical, biological, and geological processes. This research spans from deep time to the present day and from basic to applied science. The Strategic Plan for research explores transitions on Earth and other planetary bodies with three broad areas of concentration:

- **Earth in 2100: Water, Energy, Land, and Climate:** Some of the grand challenges facing the world in this century are rooted in the geosciences. We will address these challenges on local to global scale to provide the scientific data and models needed for predicting and managing the effects of human activities on habitat and global climate, on securing affordable energy resources, and on providing sustainable water, food, and human consumption and a diverse natural environment.

- **Geodynamic Systems and Linkages:** Couplings between the mantle, lithosphere, surface, and atmosphere drive geologic change at vastly different temporal and spatial scales. We seek to advance our understanding of these critical processes and their interactions, including mantle convection, tectonics, evolution of surface topography, basin formation, geochemical cycling, and impact of climate. All of these are fundamental to the evolution of the Earth and other planetary bodies.

- **Transitions, Boundary Events and Resilience of Life:** Changing conditions at temporal boundaries have produced profound effects on the Earth’s composition, including mass extinction and mass survival. We seek to understand the long-term processes and discrete events that have influenced life over the limits and requirements for life on other planetary bodies.

The JSG Research Themes provide an established mechanism to facilitate and promote research collaborations across the JSG and the university. Essentially all research in the Jackson School falls within one of six Research Themes: Surface and Hydrologic Processes; Solid Earth and Tectonic Processes; Energy Geosciences; Marine Geosciences; Climate, Carbon and Geobiology; and Planetary Geosciences. Leaders for each one of the themes are chosen by the Dean with input from the Associate Dean for Research and theme members. The responsibility of implementing the Strategic Research Plan for the Jackson School of Geosciences primarily resides with all members of the Research Themes, the three unit leaders, the Associate Dean for Research, and the JSG Dean.

2. Education: Our strategic plan for education focuses on developing the conceptual understanding, skills, and competencies that our students need to be successful into the future. We will achieve these goals through an increased emphasis on experiential learning, quantitative and computational reasoning, independent research, and field experiences. Research and education are intimately intertwined. By integrating our research into our undergraduate courses and increasing its emphasis at the graduate level, our students will learn how to think critically, identify and address geoscience problems, and work in multi- and interdisciplinary teams. Moreover, they will develop a firm understanding of important geoscience concepts and be able to apply them to real-life research questions and applications. We will continue to have a strong focus on written and verbal scientific communication to multiple audiences, with an increased emphasis on the importance of scholarly publications by our graduate students. We will transform our undergraduate courses, curriculum and teaching to improve student learning outcomes and to prepare our students for graduate school and/or the future workforce. Our graduate courses and curriculum will constantly evolve to reflect the changing areas of scientific inquiry and technological advances and to prepare students for success in all future geoscience careers. Our goal is to develop the future leaders of academia, industry, government and non-governmental organizations.

The responsibility of implementing the Strategic Education Plan for the Jackson School Geosciences primarily resides with the DGS faculty, the JSG Graduate Studies Committee, the Associate Dean for Academic Affairs, the DGS Chair, and the JSG Dean.

3. Broader Impacts for Equity and Inclusiveness: We will focus on broadening the societal impact of our research and teaching by increasing diversity within the Jackson School and the geosciences and geoscientific literacy of citizens and policy makers.

Responsibility for implementing this plan primarily resides with the JSG Committee for Inclusion and Equity, the Director of Outreach and Diversity, and the JSG Dean.

I. RESEARCH

The history of Earth and our planetary system is characterized by alternating periods of relative quiescence and rapid change. We seek to understand how these transitions, both gradual and abrupt, change the planet’s surface and structure of the Earth, and its habitats for life, over time and space. Fundamental questions include:

- What are the linkages among Earth’s interior, surface, hydrosphere, cryosphere, biosphere, and atmosphere? How do processes in one affect those in others? How does chemical, physical, and biological processes interact to shape the evolution of Earth and life?

- What are the dominant processes, both gradual and abrupt, that shaped Earth and other planetary bodies in the past and that are active in present?

- What are the significant spatial and temporal transitions and their relative importance? What are the driving forces for these changes, their triggering mechanisms, and the feedbacks among them?

- What are thresholds for change for these processes that have been recorded in the geologic record? How do changes of global significance emerge from the interaction of multiple, perhaps initially unrelated processes that occur at a local or regional scale?

Goal: Our goal is to lead the scientific and societal discourse in three significant areas over the next 50 years and to expand our reputation as a forward-looking academic institution. These initiatives crosscut JSG Research Themes and JSG organizational units and build on our unique strengths.

By integrating study of the present day with study of the geologic past, we understand the long-term impacts and consequences of short- and long-term processes acting on Earth. Much of the research directly relates to societal challenges of this century, and the results can be applied to policy, management, and other decisions that benefit society. We will work across units within the JSG and will also collaborate with other schools and colleges at UT-Austin, as well as at the state, national, and international levels.

**INITIATIVE I: EARTH IN 2100: WATER, ENERGY, LAND USE, AND CLIMATE**

Building on current strengths in water, energy, environment, ocean, and climate research, Jackson School researchers will investigate how these critical resources and systems interact in order to address first-order geoscience challenges of the 21st century. These challenges include predicting and managing the effects of human activities on habitats, water resources, climate, and Earth’s oceans and other major water bodies; securing affordable and reliable energy and water resources; and providing sustainable access to clean water for human consumption and a diverse natural environment. We will address these challenges on both local and global scales through direct observation, field and laboratory experiments, data analysis, and numerical modeling. Our research will deliver fundamental scientific understanding, practical methodologies, and applied science and technology solutions to inform decision making by public entities, policy makers, industry, academics, small businesses, and the general public. We will approach these challenges in new ways that benefit the global community. Meeting these challenges will require answers to fundamental and applied research questions, including:

- How does Earth surface respond to coupled physical, chemical, and biological processes at the interface of atmosphere, land, ice, and ocean, and to human activity that affects its water, sea level, atmosphere, and climate?

- How do changing climate and land use patterns affect surface and groundwater resources?

- How can society meet local and global energy demands in an affordable, reliable, environmentally responsible, and sustainable way?

- What are the linkages change as a result of climate variability, limited resource availability, waste management, and ever-increasing human population?

JSG researchers will address these and related questions using integrated approaches that span across established academic disciplines. We will emphasize the integration across all aspects of Earth resource and energy geoscience, the following four areas will see increasing attention:

- **Environmental Change:** Complex feedbacks and interactions between land, atmosphere, hydrosphere (surface and groundwater, oceans, ice sheets), and biosphere (including humans) significantly impact Earth’s surface and its habitats. We will develop observation-driven models for land use, hydrology, and climate at both regional and global scales to address environmental change in areas that include polar regions and coastal zones. Particular attention will be given to Texas and other arid regions. Research will take advantage of novel approaches in surface-based sensor technology, remote sensing, data collection and transmission, and computation to track and understand active processes of environmental change. In addition, we will build the rich geologic record to generate quantitative descriptions of past Earth states with an eye toward informing resource management in the 21st century.
energy and mineral resources:

- Investigating new geologic sources. We will develop reliable systems to track potential environmental impacts and hazards related to production of energy and mineral resources and waste management and research additional methods for providing necessary resources in an environmentally responsible way.

- How and over what time scales do internal dynamics influence subsurface and surface processes on Earth and other planets?

- What are the vertical and lateral couplings that govern the dynamics and evolution of plate boundaries and plate interiors and associated hazards and deformation?

- How do we better understand the interactions, transitions, and thresholds in the linkages of tectonics, climate, and source-to-sink systems? How do we best differentiate between correlations and causations?

- How are global-scale changes in climate and atmosphere reflected in the evolution of planetary bodies? Are there diagnostic surface or subsurface properties that reflect such changes? Are there common geologic signatures linking all planets through solar-system-wide events?

JSG researchers will address these and related questions using integrated approaches that span across established academic disciplines. While we emphasize integration across all aspects of geodynamic systems and linkages, the following four areas will see increasing attention:

1. **Linkages between mantle dynamics and lithospheric and surface processes:** We will develop a holistic understanding of the spatial and temporal linkages between Earth’s interior and surface by understanding how the mantle flows and is coupled to the lithosphere, and how landscapes and surface processes reflect these deep-Earth processes. Additionally, this research is critical to understanding processes resulting in tectonic-related natural hazards, including volcanism, earthquakes, tsunamis and slow slip events.

2. **Monitoring systems to track potential environmental impacts and hazards related to production of energy and mineral resources and waste management and research additional methods for providing necessary resources in an environmentally responsible way.**

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IMPLEMENTATION OF RESEARCH INITIATIVES

The JSG will achieve its strategic research goal of being a national and global leader in these overarching interdisciplinary research initiatives by harnessing the potential of the school as a whole and catalyzing the intellectual firepower of students, researchers, and faculty. Our focus will be on establishing new organizational approaches and structures to catalyze multi- and inter-disciplinary collaborative research across the school, university and broader community. While we recognize the importance of research by individual scientists and small research teams in achieving our strategic goal, we see a critical need to promote larger JSG teams to achieve significant breakthroughs.

Strategy 1: Establish Research Incubators and Think Tanks.

Research incubators and think tanks will enable our scientists to focus on major scientific questions, generate proposals for external funding, and potentially lead to additional interdisciplinary scientific investigations. The Associate Dean for Research with guidance from the Dean will provide the necessary short-term resources to successful science teams. Proposals could include three to five years of partial support for collocation or shared space, visiting scholar support, workshop organization, computational resources, grant writing, and other administrative support. Funding might also be used for teaching relief, salary support, and matching funds.

Action Items

- Develop protocols for submitting proposals to establish new research incubators or think tanks and for critical yearly review using Key Performance Indicators.
- Evaluate proposals by groups of faculty and research scientists internally by an ad-hoc review panel made up of Research Theme members who will make recommendations to the Dean, the Associate Dean for Research, and the JSG Executive Committee.
- Identify and develop collaborative spaces on both the Pickle and main campuses for JSG faculty, research scientists, and students to work and interact.
- Establish a coordination network to optimize scientific and timeframes. Similar types of support may be requested by proposals, but also could include travel, key equipment, logistical and undergraduate student support.

Geographic foci and collaborators should integrate with the JSG educational mission where possible.

Action Items

- Hold a set of meetings where faculty and research scientists working in specific regions, such as the Gulf of Mexico, the Arctic (including Greenland and Alaska), and the Andes mountains and Amazon Basin, can discuss how to better coordinate and redefine of independent projects could result in a more focused and overlapping scientific contribution related to one of the three JSG research initiatives.
- Establish a Texas Observatory that focuses on the science and human impacts of water, weather, surface processes, energy resources, tectonics, and geochemistry on the state of Texas. The two nodes of this real-time observatory will be centered in the Central Texas and the Texas coast where this can take advantage of existing long-term JSG monitoring programs. The collection, processing, and analysis of Texas Observatory data will be integrated with the JSG undergraduate research program, providing a ready means to incorporate interdisciplinary research into undergraduate education while harnessing the benefits of undergraduate and graduate research to produce major new datasets.
- Establish a geographic focus and collaboration for Mexico in cooperation with Universidad Nacional Autónoma de México (UNAM) and other Mexican universities and government agencies. Expand current efforts by JSG researchers that make us ideally positioned to achieve major advances in the southern region of North America on the fundamental questions of the three JSG research initiatives.

Foci and Collaboratories.

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Strategy 3: Establish Infrastructural Nodes.

Infrastructural nodes can be analytical facilities, multi-user instrumentation, systematic research collections, and equipment pools that link JSG researchers together. Thesenodes must promote cutting-edge research that grows the long-term reputation of the JSG. Infrastructural nodes represent major investments that would have profound long-term impacts on research, education, and national and international collaborations. Many methodological and technological advances stem from ‘tinkering’ and the ability to perform high-risk, in-house research. The JSG is well-situated to establish such infrastructure nodes given its intellectual breadth and its existing facilities and resources. Infrastructural nodes must have a centralized and integrated management, as well as a cost center structure that facilitates schoolwide, university and external use and covers the costs of management, technical support, operations, and maintenance. Support for the nodes through the cost centers could be any combination of external grants, user fees, contracts and philanthropy.

Action Items
- Establish the Center for Earth Surface Assessment and Rapid Response (CESARR) to provide researchers and students with an unparalleled opportunity to survey the evolution of Earth’s surface by air, at sea, and land, using shared instrumentation and software. Provide a mechanism for drone users to submit real time imagery to the program.
- Establish a Nano-to-Macro Imaging and Visualization Center for Earth Materials by coordinating and growing facilities presently housed within individual JSG units.
- Evaluate existing JSG capacities, facilities, equipment and instrument pools to identify potential Infrastructural Nodes that through research coordination across the school would advance our scientific goals. Potential linkages to other UT organizations (e.g., TACC) and other universities or organizations will also be taken into consideration.

Strategy 4: Extend the JSG Research Community.

In addition to the three larger-scale implementation strategies, there exist a number of smaller-scale opportunities that when enacted will promote success of the JSG Research Plan, as well as the national and international visibility of the JSG research program.

Action Items
- Organize regular Research Theme meetings to discuss ongoing research, funding opportunities, strategic initiatives, and future projects. These forums will allow faculty and researchers from different units to stay current with each other’s research, establish collaborative relationships, and encourage interactions across school boundaries and the university.
- Integrate graduate students and postdoctoral fellows into Research Themes and encourage participation in Research Theme activities.
- Develop support to sustain Jackson School-wide post-doctoral and graduate-student fellowship programs in order to attract top-notch young scientists as partners in the Jackson School research enterprise.
- Establish a Jackson School Distinguished Visitor Program for long-term visits by exceptional scientists in order to foster research collaborations and promote new research directions.
- Host highly visible Jackson School conferences and workshops. Research Themes may propose and organize multi-day symposia with JSG, UT Austin, and external speakers.
- Identify optimal graduate curricula and programs for each Research Theme, including formal courses, workshops, and other activities through discussions with faculty and research scientists involved in graduate education and supervision. Theme leaders will work with the department and dean’s office to facilitate meeting the needs of graduate students within each theme.
- Create a JSG-level awards committee designed to promote external recognition of research accomplishments by our faculty and research scientists.
- Provide a mechanism for grass-roots input into future strategic planning. Theme leaders will serve on the Strategic Planning Council. This planning includes discussions of any future all-school hires.

Strategy 5: Sustaining Strengths.

The Jackson School and its units are nationally and globally recognized for fundamental and applied research in both traditional and emerging areas of geoscience. To sustain our strengths we will:

- Ensure that the core areas of the geosciences remain strong by diligently seeking out new faculty and research scientists.
- Continually evaluate the scientific and educational benefit of creating new programs and capabilities.
- Foster a community of scholars by promoting individual scientists, as well as research projects driven by science teams conducting transformative and novel research at the interfaces between traditional disciplines.
- Uphold excellence in the hiring and promoting of innovative and collaborative faculty and research scientists.
- Attract the very best graduate students by providing an environment to conduct innovative research so they can become the leaders of the future.
- Foster an inclusive environment through vigilant training on preventing implicit bias, bullying, hostile workplaces, and harassment.

Action Items
- Identify current core areas that need to be maintained and which current faculty and research scientists fulfill these strengths.
- Each request for posting or advertising a position or request for a retention effort must include a statement of the effect on the individual unit and/or Jackson School research programs. Cases of potential wider impact, as identified by the Dean or unit leaders, will be discussed by the executive committee and/ or strategic planning committee as appropriate.
- Unit leaders and Dean instruct search committees, budget councils, evaluation and promotion committees, and the JSG Appointments Committee to maintain the highest standards.
- School leaders will stay current on national and global grand challenges and government agency strategic documents.
- Have an external visiting committee review the research and educational programs every seven years in conjunction with the required graduate program reviews.

Measures of Success:

- Establish the Texas Observatory and integrate its science and research into JSG undergraduate curriculum. Develop cooperative relationships with other UT programs monitoring the Texas environment, including the UT Bridging Barriers Initiative and its Planet Texas 2050 Grand Challenge.
- Ensure that at least one research incubator and think tank or geographic foci and collaboratory becomes self-sustaining for three or more years following its JSG support window.
- Continue to rank in the top five for scientific productivity as measured by Nature Index and the Center for World University Rankings or other similar measures of productivity.
- Secure funding for 10 graduate-student fellowships and three JSG-wide Distinguished Postdoctoral Fellows within four years.

- Make competitive offers for the highest quality Ph.D. students, faculty and research scientists; maintain state-of-the-art facilities, associated technical support, and an inclusive work environment.
- Build a strong culture of leadership through hiring, training, and by example. Treat committee service as a training ground for leadership positions.
- Offer leadership training and workshops for undergraduate and graduate students.
- Recognize and reward exemplary leadership and service through awards, merit raises, and promotions.
- Develop a mentorship program for young faculty and research scientists, postdoctoral fellows and students.
Strategy 2: Increase student diversity and inclusiveness.
Geosciences has one of the lowest percentages of minorities of any STEM field, which means that geoscience is missing a large portion of the future workforce and is not benefiting from the value provided by diverse viewpoints.

**Action Items:**
- Appoint a graduate student diversity liaison to disseminate information on available diversity fellowships and about the status of diversity of students applying to the program.
- Establish one or more targeted JSJ diversity fellowships (within legal constraints) and increase faculty awareness of existing diversity-driven student support options across campus.
- Keep track of majors and college placement of GeoFORCE (and STEMFORCE) students and actively recruit geoscience and other appropriate majors into our graduate program.

Strategy 3: Provide opportunities and resources for M.S. and Ph.D. students to be successful in a wide variety of careers.
The range of professions for geoscientists has increased markedly, and our students need to be exposed to these opportunities and be prepared for success regardless of their career choice.

**Action Items:**
- Create opportunities for graduate students to increase exposure to these opportunities and be prepared for success.
- Keep track of student placement immediately after graduation, and any subsequent changes in employment.

Strategy 4: Increase student diversity and inclusiveness.

**Action Items:**
- Appoint dedicated Admissions and Support Committee members with strong commitments to improving the graduate program and representing the Research Themes within the school.
- Continually monitor the impact and relative merits of any STEM field, which means that geoscience is missing a large portion of the future workforce and is not benefiting from the value provided by diverse viewpoints.

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- Establish one or more targeted JSJ diversity fellowships (within legal constraints) and increase faculty awareness of existing diversity-driven student support options across campus.
- Keep track of majors and college placement of GeoFORCE (and STEMFORCE) students and actively recruit geoscience and other appropriate majors into our graduate program.

Strategy 5: Increase transparency in communication of expectations, procedures and requirements.
The size of our program, split between the J.J. Pickle Research Campus and the main campus, and a GSC composed of faculty and non-faculty, all require us to make extra efforts in communication.

**Action Items:**
- Hold town meetings with graduate students each semester with Department Chair, Graduate Advisor, Graduate Coordinator, and as appropriate Dean and/or Associate Dean for Academic Affairs.
- Keep the graduate student handbook up-to-date online and provide links to university-wide resources; send notices of any changes in policies, procedures and requirements to all graduate students in a timely manner.
- Keep GSC and all non-GSC co-supervisors informed of deadlines, policy changes, etc., and have GSC chair and Graduate Coordinator meet with all new supervisors and co-supervisors to go over policies and procedures.
M.S. PROGRAM

The M.S. program is a distinctive strength of the Jackson School of Geosciences and is the optimal degree for most industry positions.

Goal: Increase presentation and publication of research results and strengthen the educational experience.

Strategy 1: Develop M.S. graduates that are proficient in a broad range of technical and socially relevant areas of the geosciences.

Action Items:
- Continue to offer courses and research opportunities that prepare students for a wide variety of careers and review course requirements and curricula periodically.
- Require short (three-page total) thesis proposal and committee review by end of second semester.
- Require two-page progress report and timeline to be submitted to committee during the third semester that includes publications and presentations.
- Retain three-member committee with no fewer than two GSC members, one of whom is a faculty member.
- Provide strong encouragement from the unit leaders and Dean for supervisor attendance at Master's Saturday.

Strategy 2: Produce highest quality M.S. graduates in terms of conducting and presenting research results.

Action Items:
- Increase the percentage of M.S. thesis research published in peer-reviewed journals by having all theses composed and formatted consistent with manuscripts submitted to full-length, externally peer-reviewed journals to be agreed upon by the student and adviser.
- Develop a rubric for review of the M.S. thesis analogous to those of peer-reviewed journals.
- Expect all JSG M.S. research to be presented at regional, national, and/or international meetings.

Strategy 3: Continue to support a strong M.S. program as a distinctive part of JSG to fulfill an important national workforce need.

Action Items:
- Keep high admission standards to maintain the high quality of students admitted to the M.S. program.
- Maintain strong connections to industry and encourage continued interaction and support.

Strategy 4: Increase level of financial support for M.S. students.

Action Items:
- Periodically review our stipend levels relative to our peers and factor in the local cost of living.
- Continue to provide yearly raises for TAs and GRAs.
- Encourage industry-sponsored fellowships and research support and demonstrate their value to industry.
GRADUATE EDUCATION IN ENERGY AND EARTH RESOURCES
The premise of the Energy and Earth Resources (EER) graduate program is that all energy and resource problems are inherently multidisciplinary and require interdisciplinary solutions. As a multidisciplinary program, it is administered by the Jackson School of Geosciences but supported as well by 35 faculty and researchers from JSG, the Cockrell School of Engineering, the McCombs School of Business, the LBJ School of Public Affairs, the School of Law and the Energy Institute. The course of study offers students, most with undergraduate degrees in science and engineering and several years of work experience, the opportunity to broaden in areas as diverse as business, finance, economics, law, policy, and the environment while furthering their understanding in the geosciences and engineering.

Goal: Develop the knowledge and skills, through multidisciplinary studies and research, which facilitate interdisciplinary solutions to problems in a very rapidly changing energy and resource world.

Left Page, Left to Right: Ph.D. students installing a weather station on Alaska’s Sourdough Rock Glacier; A Ph.D. student running degassing tests on a trip to collect and test samples of methane hydrate from under the seafloor of the Gulf of Mexico.
Right Page, Counterclockwise: Collecting rock samples in Newfoundland; Studying the evolution of the Andes mountains in southern Peru; Students conducting hydrological field work in Valles Caldera National Preserve in New Mexico.

ALL PHOTOS: JACKSON SCHOOL OF GEOSCIENCES.

UNDERGRADUATE EDUCATION
The Jackson School has a reputation for excellence in undergraduate education in the geosciences, producing students who are sought after by graduate programs and employers. Though we have ample reason to be proud of our program, we also recognize that the geosciences are evolving, as are the knowledge and skills that a successful geoscientist will need in the coming decades. Similarly, research in pedagogy is providing new insights into how to optimize the learning process and account for differences in background and preparation among students.

Accordingly, through deliberate and continuous effort, we will undertake a fundamental realignment of our undergraduate program, preserving and building upon our strengths while updating our content and teaching methods.

Goal: Develop a program that:
• Teaches the knowledge and skills necessary for the geoscientists of the future.
• Incorporates students into the research enterprise of the Jackson School and provides training in the practice of science, including critical thinking and analysis of real datasets.
• Features instructional innovation and promotes active and experiential learning.

We will continuously assess the efficacy of our efforts as a mechanism for progressive improvement.
Our program goals and strategies for achieving them will be overseen by the Associate Dean for Academic Affairs and DGS Chair, with input from an Undergraduate Curriculum Transformation Committee, and through discussion with and concurrence of the faculty.

Strategy 1: Ensure both curriculum and research stay abreast of rapidly evolving energy and resource issues and societal and business needs. Capitalize on the tremendous intellectual diversity of the schools and faculty supporting EER and the EER student body.

Action Items:
• Define and periodically refresh core curriculum and selection of courses for each concentration (technology, finance and policy).
• Improve quality of research.

Strategy 2: Attract the best students, while improving minority representation. Preserve the right balance of international and U.S. students.

Action Items:
• Improve admissions selectivity, yield and minority representation through proactive outreach.
• Identify key countries where domestic needs align with the EER program objectives.

Strategy 3: Put in place a robust administrative and financial structure. Seek opportunities to externally represent the program and increase its visibility.

Action Items:
• Brand the program so that it is well understood by prospective students, faculty and recruiters.
• Build recruiting pipelines beyond traditional oil and gas companies.
• Establish external advisory team to critically assess program plans, ensure relevance and facilitate external connections to job opportunities and funding.
• Seek additional endowment.

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Action Items:
• Define and periodically refresh core curriculum and selection of courses for each concentration (technology, finance and policy).
• Improve quality of research.

Strategy 2: Attract the best students, while improving minority representation. Preserve the right balance of international and U.S. students.

Action Items:
• Improve admissions selectivity, yield and minority representation through proactive outreach.
• Identify key countries where domestic needs align with the EER program objectives.

Strategy 3: Put in place a robust administrative and financial structure. Seek opportunities to externally represent the program and increase its visibility.

Action Items:
• Brand the program so that it is well understood by prospective students, faculty and recruiters.
• Build recruiting pipelines beyond traditional oil and gas companies.
• Establish external advisory team to critically assess program plans, ensure relevance and facilitate external connections to job opportunities and funding.
• Seek additional endowment.
Strategy 1: Evaluate and modify the undergraduate curriculum and continue to assess whether it is meeting our goals.

**Action Items:**
- Faculty will engage in a broad and active discussion of curriculum reform, using as a starting point the recommendations of the Undergraduate Curriculum Transformation Committee.
- Develop a knowledge and skills matrix that shows which concepts and skills are taught in each course and how courses build upon and reinforce each other. Use matrix to evaluate currently taught material in the curriculum and sequencing and compare with recommendations from the national “Future of Undergraduate Geoscience Education” initiative. Delineate gaps and redundancies and identify needed changes.
- Ensure that students experience curriculum content that is representative of all three programs of the department: “Lithosphere and Deep Earth,” “Subsurface, Surface, and Life,” and “Water, Climate, and Environment.”
- Every three years, survey alumni within five years of their degree on their success and their view of their preparedness.

Strategy 2: Increase quantitative and computational skills and exposure to material requiring quantitative methods throughout the curriculum.

**Action Items:**
- Define the knowledge and skills goals for our required computational coursework, and use those to assess the propriety of an expansion in course options to meet the computational requirement.
- Use a matrix approach to ensure more challenging quantitative content appears in the early stages of our curriculum to incentivize mastery of these skills and prepare students to use them for upper-division coursework and research, and that quantitative skills are used in upper-division courses.
- Evaluate technical electives for scientific rigor and recommend changes to faculty.
- Discuss and adopt core science requirements that more closely resemble our graduate admissions requirements. (Currently two calculus-level mathematics courses, plus at least four science courses in at least two of the four areas of chemistry, physics, biology, and computer science.)

Strategy 3: Increase, diversify, and continuously update field programs and field experiences.

**Action Items:**
- Recognizing the importance of field courses and experiences in understanding material presented in classrooms, 3D and 4D visualization, geoscience reasoning and synthesis, and development of field skills, we will continue to maintain and improve our field programs.
- Explore possibilities to increase field exercises and field trips in sophomore- and junior-level classes.
- Review the range of options for the junior- and senior-level field courses and ensure flexibility to meet a broad variety of future careers.

Strategy 4: Add experiential and active learning to required and elective courses.

**Action Items:**
- Expand opportunities for faculty to learn about and adopt active learning practices in their classes, including providing funding for faculty to attend workshops on effective teaching.
- Increase the use of active learning techniques in classes of all sizes so that students have opportunities to actively monitor their understanding in a variety of activities during class, work with partners or small collaborative groups, and are constantly engaged in opportunities to practice skills and use concepts.
- Challenge students to answer questions that require the use of higher order thinking skills in class and during in-class homework exercises and labs.
- Integrate exercises and projects using and analyzing real data in courses, including visualization, simulation, and modeling of real data.
- Develop small team projects within courses that build collaboration and integration of ideas and where appropriate are interdisciplinary.

Strategy 5: Create new experiential learning and inquiry courses.

**Action Items:**
- Design additional project-based courses where the entire course centers around either a team-based or an individual project with clearly defined goals (i.e., similar to engineering design courses).
- Develop courses that involve students in authentic research environments, including course-based research experiences from freshman to senior year. Provide multiple on-ramps for students to acquire more in-depth training in various research areas, including use of virtual data rooms and digital access to data manipulation applications.
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Strategy 6: Create more opportunities for students to participate in and conduct research.

**Action Items:**
- Take advantage of other JSG research initiatives (e.g., collaboratories) to create research environments that may feature multidisciplinary work, data sets gathered across multiple years and student cohorts, and allow students to place their work in the context of a larger whole.
- Identify ways to adjust scheduling of our upper-division courses to enable such time-intensive group research activities (e.g., ensure that non-research classes do not meet on Fridays).

Strategy 7: Work with other colleges and schools and upper administration to effect change in policies and processes.

The Undergraduate Curriculum Transformation Committee identified several university-wide constraints that affect implementation of curriculum reform. Those include barriers to modular scheduling, allocation of teaching credit for faculty teaching in the summer, distributed teaching load credit, and undergraduate class size requirements.

**Action Items:**
- Continue to stress and emphasize the need for changes at the university level with other deans and the Provost.
- Work with university-wide programs as appropriate to develop strategies to ensure smooth implementation of curriculum reform over the next several years.
- Leverage establishment of the Dell Medical School’s modular curriculum to argue for such changes.

**MEASURES OF SUCCESS**
- Graduate and undergraduate students demonstrate the skills, competencies and conceptual understanding needed to be successful in future careers of their choice.
- Ph.D. and M.S. students consistently publish their dissertation and thesis research and this becomes part of the JSG culture.
- The percentage of minority graduate and undergraduate students is increased to above the national average for geoscience fields within five years.
- Increasing financial support for graduate students, including fellowship and summer support, is at least comparable with that from peer-institutions within three years.
- Substantial expansion of undergraduate participation in the research mission of the school, which includes establishing Research Fridays (or a similar rearrangement of upper-division classes) as part of the JSG and undergraduate culture within three years.

Left Page: A student conducting geochemistry research.

Right Page: Top to Bottom: GEO 660 students trek through the Sawtooth Mountains in Montana; Marine Geology and Geophysics students retrieving core samples on the R/V Manta in Galveston Bay.

ALL PHOTOS: JACKSON SCHOOL OF GEOSCIENCES.
III. BROADER IMPACTS FOR EQUITY AND INCLUSIVENESS

Broader Impacts of research and teaching, as defined by the National Science Foundation, include broadening participation in the sciences, benefiting society; broadening dissemination to advance understanding, and promoting training and learning. The Jackson School has made major efforts in these areas and will continue to enhance and expand these efforts.

- The Jackson School of Geosciences has a history of providing equitable access to opportunities to learn about the physical, chemical, and biological processes that impact issues such as energy, water, minerals, natural hazards, and the environment.
- GeoFORCE Texas has provided field learning experiences for over 1,700 high school students in rural southwest Texas and inner-city Houston since the summer of 2009.
- Collaboration with HBCU (Historically Black Colleges and Universities) designated Fort Valley State University in Georgia and their Mathematics, Science, and Engineering Academy (MSEA) for high school students. This has provided experiences for diverse high school students from across the country including mentorship in week-long STEM academies, summer research internships, and transfers to the Jackson School to complete a B.S. degree.
- The TXESS Revolution teacher professional development program and the JGK Texas (Diversity and Innovation in Geosciences) earth science course roadmaps have had a strong impact on Texas middle and high school education.

Goal: Broaden the societal impact of the research and teaching of its faculty and research scientists by broadening participation in the geosciences and increasing the geoscience literacy of citizens and policy makers.

Strategy 1: Create an integrated program for Broader Impacts of Geoscience Research (BIGR) to assist faculty, research scientists, students, alumni and staff with broader impacts. Develop “broader impact” groups for dissemination of societal impact of research, broadening participation, and citizen geoscience literacy.

Action Items:
- Assist faculty and research scientists with broader impacts requirements for research proposals by advising them of ways to integrate their efforts with current programs or by developing new initiatives. Award mini-grants for broader impacts initiatives.
- Increase dissemination of societally important research to increase public understanding and awareness of the geosciences. Possible examples include:
  - Implement science cafes for different demographic groups at the university location or participate in already established ones;
  - Develop a JSG BIGR (Broader Impacts of Geoscience Research) lightning talks speaking tour;
  - Create traveling ESI Hot Science, Cool Talks related to current events affected by the geosciences and/or broadcast current talks in selected locations;
  - Increase distribution of podcasts that present current initiatives such as Hot Science, Cool Talks and lightning talks by JSG geoscience researchers and faculty; create a geoscience of the U.S. and geoscience of the world podcasts for targeted distribution;
  - Increase involvement of students in outreach to local schools. For example, implement JSG student geoscience factoids campaigns with independent school districts; disseminate the Science Y’All blog widely; lead tours of facilities and demonstrate research.
- Develop more awareness of geology in Texas and areas of research. Increase the coverage of the BEG Texas GeoSign Project “geology of place” signage initiative; work with park officials to create signs or brochures in areas of JSG research.
- Create a Geology of the National Parks smartphone app based on GeoFORCE and other JSG field guides.
- Update “Be A Geo” website, brochure, and posters for use with “Earth is Calling” and continue to promote and disseminate widely. Work with FANS group to encourage alumni to speak to students in STEM high school academies with a significant number of economically disadvantaged students. Create an alumni mentor program with STEM students who are high achievers in STEM in schools with a significant number of economically disadvantaged students.
- Expand the JSG commitment to engaging and serving state and federal legislators, such as attendance at Congressional Science Visits Days, the BEG-led Decision Makers Field Trip, and invitations for laboratory and site visits and major events (e.g., building openings and major lab openings, etc.).

Strategy 2: Increase the number of opportunities for JSG faculty, researchers and students to engage with diverse geoscience researchers and students.

Action Items:
- Establish a Jackson School Distinguished Speaker award designed to promote the travel of a JSG faculty member or scientist to minority-serving institutions.
- Create a visiting geoscientists series for and hosted by JSG student groups to invite geoscience faculty and researchers from HBCUs, MSIs, HSIs, Tribal Colleges and other institutions.
- Form partnerships with national organizations and other colleges and universities that promote equity and inclusion in the geosciences.

Strategy 3: Increase the number of underrepresented students enrolled in JSG at the undergraduate and graduate level.

Action Items:
- Work with university admissions to recruit underrepresented high school students to the geosciences who have expressed an interest in chemistry, mathematics, physics, biology or geology.
- Create opportunities for JSG summer research and field experiences for undergraduates and faculty from HBCUs, HSIs, Tribal Colleges and two-year colleges with high numbers of underrepresented students.
- Invite undergraduate seniors from HBCUs, HSIs, and MSIs with geoscience departments and GeoFORCE/STEMFORCE undergraduate seniors graduating in sciences and geosciences to a JSG Graduate School Fall Open House hosted by JSG graduate students.
- Host invitational workshops for underrepresented geoscience senior undergraduates and graduate students on proposal writing, teaching, research, and publishing/writing.

Strategy 4: Increase the number of underrepresented faculty, research scientists and staff in JSG.

Action Items:
- Require search committee chairs (and members) to attend training sessions and/or workshops on implicit bias and diversity and inclusive hiring practices.
- Send faculty and/or research scientist representatives to national STEM conferences focused on equity and inclusion and to other national conferences organized by various demographic groups (e.g., National Association of Black Geologists) to identify potential future faculty and research scientist candidates from their technical talks.
- Place advertisements for new faculty and research scientist positions in higher education media with African American, Hispanic, American Indian, women, LBGTQ, and veteran audiences.
- Share staff job opportunities with UT Black Faculty and Staff Association, UT Hispanic Faculty/Staff Association and other campus staff affinity groups.
- Share open staff positions with African American and Latino professional associations in Central Texas.
- Share posted faculty, research scientist and staff positions with Chief Diversity Officers’ offices in Texas and bordering states.

Strategy 5: Increase the participation of underrepresented groups in geosciences and other STEM fields.

Action Items:
- Support and strengthen GeoFORCE and STEMFORCE programs, continually evaluating the outcomes at all stages of the students’ pathway, and modifying programs as needed to improve outcomes in a cost effective way.
- Evaluate options for increasing GeoFORCE and STEMFORCE students’ calculus, chemistry, and computation abilities prior to college, and potential funding sources. Depending on evaluation, implement Special Edition GeoFORCE Summer Calculus, Chemistry, and Computation Bridging Academies focused on students who have been accepted to JSG and, if financially possible, to other geoscience majors.
- Expand GeoFORCE Texas to recruit students from STEM High School Academies with significant numbers of economically disadvantaged students.
- Identify additional funding for GeoFORCE Texas and/or STEMFORCE from supplemental research funding from government and private agencies and other foundation and industry sources.
- Develop “GeoFORCE”-like summer field experiences for Mexican students from UNAM or other summer field-program exchanges for Mexican and UT Austin students.
Strategy 6: Provide national leadership in high school and undergraduate geoscience education.

**Action Items:**
- Leverage university-wide programs, such as Project 2021, to develop and implement new innovative ways of online education, in-class methods, and experiential learning and showcase these as models at national meetings. Develop additional non-major geoscience courses using active learning and other innovative educational methods.
- Increase the number of students enrolled in the JSG Bachelor of Science in Geoscientific Sciences Option V: Teaching.
- Use OnRamps relationship to grow online geoscience instruction for HBCUs, MSIs, HSIs, Tribal Colleges and two-year colleges and create a Virtual Department of Geosciences for additional online content.
- Expand the current GeoFORCE in-service professional development for high school science teachers.
- Expand the current partnership between GeoFORCE and UTeach for providing pre-service geoscience teaching training for undergraduates interning as education coaches on GeoFORCE field learning experiences.
- Continue the ‘Future of Undergraduate Geoscience Education’ initiative efforts to implement changes in undergraduate programs nationally to prepare students for future geoscience careers in conjunction with the American Geoscience Institute (AGI) workforce program.
- Identify funds and create a program for geoscience education professional development aligned with Next Generation Science Standards (NGSS). Host geoscience education professional development conferences in the West, Southwest, Midwest, East, and Southeast for current STEM high school teachers and undergraduate STEM education majors. Collaborate with National Association of Geoscience Teachers (NAGT) and National Earth Science Teachers Association (Nesta) to recruit for the proposed regional geoscience teacher professional development conferences.

**MEASURES OF SUCCESS**
- Clearly defined opportunities and help for writing meaningful and easy-to-implement broader impacts in grant proposals within one year.
- Visits by geoscientists from diverse institutions and by JSG faculty and/or researchers to minority serving institutions – at least one of each per year within one year.
- An increased number of GeoFORCE Texas and/or STEMFORCE students graduating from college with a major in a STEM field.
- A “Vision and Change” document for the Future of Undergraduate Geoscience Education initiative is completed and published with AGI as the publisher within two years.

**IV. BUILDINGS AND OTHER FACILITIES**

Critical to advancing our research and educational goals and priorities are modern, up-to-date facilities for research and teaching. New methods of teaching require reconfigured spaces that allow for active and experiential learning. Research laboratories built or renovated to accommodate state-of-the-art equipment and the necessary power, temperature controls, airflow requirements, and IT are essential for ongoing and proposed research. Collaborative spaces for faculty, research scientists and students from across the three JSG units and other parts of the university are needed.

Goal: Over the next five to 10 years, undertake facility and building construction and planning needed to accomplish research and educational goals.

**Strategy 1: Identify, plan, build, and develop funding for significant upgrades or new construction of facilities and buildings to meet our current and growing programs.**

**Action Items:**
- Complete building of new BEG Core Research Facility and Imaging Center within three years.
- Renovate BEG Energy and Environmental Laboratory Building (Building 131) and complete concurrent HVAC upgrades.
- Complete development of climate controlled space for the Non-Vertebrate Paleontology Laboratory (NPL) and expand the climate-controlled footprint to contain the rest of the NPL collections.
- Develop climate-controlled space for the Vertebrate Paleontology Laboratory (VPL).
- Build either a new wing on JSG or a new building on campus adjacent to JGB to house state-of-the-art research laboratories, active and experimental learning classrooms and “makerspaces,” and collaborative research and education spaces. A new building would allow co-location of more of the Jackson School as recommended by the External Review Visiting Committee.

**MEASURES OF SUCCESS**
- BEG new building and renovations completed in less than two years.
- Climate control for NPL and VPL within five years.
- New JSG wing and/or new building funded and plans completed within 10 years.