The UT Institute for Geophysics (UTIG) is a world leader in expeditionary-scale geophysical research on land, at sea, and in the air. Its wide-ranging expertise includes energy, polar, marine, climate, and planetary geosciences. Whether responding to natural disasters, imaging the deep earth, or searching space for signs of life, UTIG is at the forefront of cutting edge research at home and abroad.

UTIG scientists are dedicated to understanding how worlds work. Home to 50 doctorate-level scientists—research entrepreneurs—UTIG scientists provide a broad range of geoscience expertise. For example, our staff advises and conducts international scientific ocean drilling projects, performs Rapid Response surveys following natural disasters, investigates conventional and unconventional natural resources in the Gulf of Mexico, leads airborne radar studies of ice sheets on Earth and on other planets, researches earthquake and tsunami risks, and models past and future climate. UTIG scientists supplement their fieldwork with computer analysis, modeling, and laboratory work. UTIG seeks state, national, and international opportunities to leverage its proven geophysical proficiency addressing leading issues in resource development and environmental management. When society faces critical environmental problems that cause controversy among citizens and confusion among government policymakers, UTIG scientists engage the parties, plan an appropriate and effective response, and collect data that leads to responsible solutions. For such issues, UTIG scientists don’t take sides; they find answers.
Lean and Agile

UTIG receives only $2 million per year from the state and UT, but it pumps $48 million into the Texas economy. Academic, government, and industry partners help us to leverage funding all while uncovering new knowledge that helps us understand and improve our world. This combination of support is critical to maintain the staff and infrastructure required for complex, field-based research programs and for training the next generation of geoscientists.
From the ends of the earth to the bottom of the sea to other planets, UTIG is there, making cutting-edge scientific discoveries that change the way we live and work.
A Better Future for Texas and the Gulf of Mexico
UTIG scientists study a number of issues important to Texas including earthquakes, climate, natural resources, and energy. Their research in and near Texas and the Gulf of Mexico in partnership with major stakeholders ensures a better Texas into the future.

TEXAS PANHANDLE EARTHQUAKES
UTIG scientists are evaluating the history and causes of a recent increase in Texas earthquakes, including more than three thousand earthquakes detected in the "Pecos hotspot" and a magnitude 4.0 earthquake which struck Amarillo in the Texas Panhandle, possibly induced by the region’s oil and gas production. UTIG scientists are working with the Bureau of Economic Geology’s TexNet program, which deployed seismic stations across the Texas Panhandle, to assess whether these earthquakes are influenced by human activity.

UNDERSTANDING CLIMATE IN THE GULF OF MEXICO
UTIG scientists will reconstruct the history of the Loop Current through the Florida and Yucatan Straits; the Loop Current is an important control on Gulf of Mexico climate and oceanography, both of which influence hurricane development and impact human endeavors such as oil drilling and fishing operations.

PUSHING THE LIMITS OF SEISMIC RESOLUTION
UTIG scientists and students are developing innovative mathematical and numerical models capable of resolving small scale features from seismic data including subsurface fractures. These are extremely useful for accurate description of hydrocarbon reservoirs, aquifers and mineral bearing zones, all of which have a direct impact on the economics of resource exploitation in Texas.
UTIG leads two landmark projects geared toward meeting future national energy needs. The GOM^2 project links scientists and engineers on a frontier problem with economic impact for Texas: the study of methane hydrates, the cleanest of hydrocarbon fuels and a potential source for natural gas. The project is the first in the United States to acquire and directly study methane hydrates in reservoirs from the deep water oceans.

UT GeoFluids is a research consortium managed by UTIG and supported by eleven energy companies. The group designs and develops safe and effective drilling programs to access energy reserves. The project’s next ten year phase, which begins in 2020, will focus on technologies to improve seismic imaging and well design.

Building Bridges: Academia, Industry, and Government

UTIG scientists have a long history of partnerships with industry and government through geophysical investigations around the globe. Research conducted by UTIG scientists aids industry scientists in identification and development of energy resources in the deep water Gulf and other resource-rich deep basins around the globe.

MAKING AN IMPACT AT CHICXULUB CRATER

An international research mission, co-led by UTIG researchers, has discovered how the Chicxulub Crater impact caused billions of tons of rock to move like liquid. The study, which is part of the International Ocean Discovery Program, offers insights into how impacts resurface planets, how vaporized ocean sediments were a key cause of global mass extinction 66 million years ago, and how life recovered following impact.

UTIG USES NOVEL TECHNOLOGY TO EXTRACT PRESSURIZED ROCK CORES FROM A MILE Beneath the ocean. Insights gained by studying their energy concentration, mechanical properties and fluid flow may soon allow for production in an economically viable and environmentally safe manner. Credit: Anton Caputo

THE CHICXULUB IMPACT CRATER LIES Beneath the Yucatan Peninsula. UTIG research uncovered how large impacts affect a planet’s surface. Credit: NASA/Don Davis

THE CHICXULUB IMPACT CRATER LIES Beneath the Yucatan Peninsula. UTIG research uncovered how large impacts affect a planet’s surface. Credit: NASA/Don Davis

UTIG uses novel technology to extract pressurized rock cores from a mile beneath the ocean. Insights gained by studying their energy concentration, mechanical properties and fluid flow may soon allow for production in an economically viable and environmentally safe manner. Credit: Anton Caputo
UTIG maintains several long-standing academia-industry partnerships focused on understanding the geologic history of the Gulf of Mexico. For more than three decades, the PLATES Project has been dedicated to creating accurate, high-resolution models of tectonic plate movement. These models and associated databases are especially useful to groups engaged in hydrocarbon or mineral exploration on both regional and global scales.

The Gulf Basin Depositional Synthesis Project is an ongoing industry-supported program that seeks to understand the depositional history and framework of the Gulf of Mexico. Deliverables include a GIS database, an extensive supporting bibliography and detailed maps and cross sections that provide a comprehensive picture of Gulf-wide sedimentary history.

UTIG is working with the Bureau of Ocean Energy Management to develop an inventory of offshore sand resources in the Gulf of Mexico. Understanding the location, character and quantity of sand resources around our coastline is playing an increasingly significant role in protecting our coastal communities from erosion, sea level rise and the impact of major storms.
Engaging the Next Generation of Geoscientists

UTIG’s programs with Texas K–12 students and teachers ensure that pioneering geophysics work will continue for generations. UTIG’s work with undergraduate students, graduate students and postdoctoral fellows helps prepare tomorrow’s workforce.

MARINE GEOLOGY AND GEOPHYSICS FIELD COURSE

UTIG offers a three-week, hands-on field course for graduate and upper-level undergraduate students with instruction in the collection, processing, interpretation and presentation of marine geological and geophysical data. Alumni note the course’s applicability to energy, environmental, and geotechnical industries as well as coastal restoration and management fields.

GEFORCE

UTIG houses the Jackson School of Geosciences GeoFORCE program, an experimental outreach program that prepares Texas high school students to become part of the geosciences workforce. This nationally recognized program that engages more than 640 high school students each summer.

UTIG scientists regularly participate in GeoFORCE summer field excursions. Researchers share their knowledge of Earth systems with young students at sites throughout the country. Credit: GeoFORCE

STUDENTS READY A PISTON CORER FOR OFFSHORE SEDIMENT SAMPLING NEAR GALVESTON. CREDIT: RODRIGO FERNANDEZ

MIDDLE SCHOOL STUDENTS TAKE PART IN A CRIME BUSTERS FORENSIC CHEMISTRY COMPETITION DURING A SCIENCE OLYMPIAD INVITATIONAL TOURNAMENT HELD AT UT, AUSTIN. CREDIT: SAMIKSHA RAY

UT AUSTIN SCIENCE OLYMPIAD

Each year UTIG students and scientists organize and create assessments for the UT Austin Science Olympiad Invitational and Regional tournaments. The tournaments are among the largest and best known science competitions for middle and high school students in Texas, with nearly 2,000 students competing in rigorous, standards-based challenges in all STEM (science, technology, engineering, mathematics) disciplines.
What Makes Earth Shake?

UTIG scientists bring their expertise around the world to better understand how earthquakes work and identify potential hazards. They undertake several major seagoing campaigns each year during which a variety of geophysical techniques are used to examine processes associated with earthquake generation.

EXPERTISE WORLDWIDE

UTIG scientists routinely lead interdisciplinary groundbreaking research missions from research vessels, including the scientific drilling ship, JOIDES Resolution (JR). Several UTIG scientists hold leadership roles in the International Ocean Discovery Program, an international collaboration that uses ocean-going platforms, including the JR, in the study of past Earth and climate history through the retrieval of ocean floor rocks and sediments.

UNDERSTANDING THE TOHOKU-OKI EARTHQUAKE, JAPAN

UTIG is leading an international research collaboration network whose aim is to understand the processes driving earthquakes at subduction zones around the world. UTIG studies of the earthquake that struck Japan in 2011 are contributing to this highly collaborative research community that hopes to improve forecasting models of when and where such earthquakes might strike.

CHARACTERIZING DANGEROUS PLATE MARGINS

UTIG scientists are working in an international collaboration on a multi-year, multi-platform study of the New Zealand tectonic plate boundary—a major boundary that generates destructive volcanoes, earthquakes and tsunamis. The team will evaluate the geometry, movement and deep structure of the region. The study will help characterize convergent plate boundaries and the risks they pose to citizens around the world.
Understanding Climate: Past, Present, Future

UTIG scientists investigate Earth’s climate change on timescales from seasons to millennia. With a focus on key regions such as monsoon belts and the polar oceans, and phenomenon such as El Niño, researchers can attribute change to natural or man-made factors as well as predict their future evolution.

Predicting El Niño and La Niña

Climate scientists at UTIG have significantly improved our ability to predict drought over North America caused by La Niña—a cooling pattern in the tropical Pacific. By studying La Niña’s historical records and combining them with computer models, UTIG scientist discovered subtle differences in ocean signals that helped them successfully predict the duration of the La Niña event during the winters of 2017 and 2018.

Benchmarking Climate Change Predictions

UTIG climate scientists refine their theories of future climate change by contrasting them with records of past climate changes stored in geological archives. Their research is transforming our ability to anticipate extreme climatic events that have not yet been observed, but could become the norm in the future.

Landslide-Triggered Tsunamis

UTIG scientists found that a 2015 landslide-triggered tsunami in Taan Fjord, southeast Alaska, was three times taller than the earthquake-triggered tsunamis that razed parts of Indonesia, Sri Lanka, India, and Thailand in 2004 and nearly four times taller than the 2011 Japanese tsunami that damaged the Fukushima nuclear plant in Japan. The study’s findings will help predict the risk of landslide-triggered tsunamis around the world, particularly in higher latitude regions where a warming climate melts glaciers that stabilize mountain slopes.
UTIG is part of an international collaboration to study ice-buried lowland basins in East Antarctica which hold enough ice to raise global sea levels at least 3.5 meters (about 10–13 feet). To better understand how these ice sheets are evolving, scientists are using airborne ice-penetrating radar arrays and ice core drilling to aid in evaluating both the topography and interior of the ice covering these lowlands. This novel approach will help computer modelers improve their simulations of the past and future Antarctic ice sheet and its potential impact on global sea level.

UTIG SCIENTISTS ARE USING AN AIRBORNE ICE-PENETRATING RADAR ARRAY TO CREATE A DETAILED MAP OF EAST ANTARCTICA ICE SHEETS AND WHAT LIES BENEATH THEM. CREDIT: LUCAS BEEM

A UTIG SCIENTIST INSTALLS A PRESSURE SENSOR DURING A STUDY TO UNDERSTAND THE PATH OF SURFACE WATER TO THE BOTTOM OF THE GLACIER WHERE IT CAUSES SLIDING ON A VARIETY OF TIMESCALES, PARTICULARLY IN THE MARINE-TERMINATING GLACIERS OF WEST GREENLAND. CREDIT: JASON GULLEY

UNDERSTANDING ICE-OCEAN INTERACTIONS IN WEST GREENLAND

UTIG is part of an interdisciplinary, multi-institutional team of geophysicists, geologists, glaciologists and oceanographers who are working to understand how marine-terminating glaciers in Greenland respond to climate. Detailed maps of submarine glacier faces and associated fjords, oceanographic measurements, satellite-based observations, and models help build a comprehensive understanding of the potential impact on sea level and changes to large-scale ocean circulation as the climate warms.

A UTIG SCIENTIST INSTALLS A PRESSURE SENSOR DURING A STUDY TO UNDERSTAND THE PATH OF SURFACE WATER TO THE BOTTOM OF THE GLACIER WHERE IT CAUSES SLIDING ON A VARIETY OF TIMESCALES, PARTICULARLY IN THE MARINE-TERMINATING GLACIERS OF WEST GREENLAND. CREDIT: JASON GULLEY
Exploring Other Worlds

UTIG scientists are building the scientific and technical foundations to lead the next generation of geophysical planetary missions, instruments, and discoveries. UTIG researchers study planetary systems via the tools of terrestrial analog field programs, geophysical modeling, and mission science. UTIG specializes in research related to Mars, icy satellites, and giant planets.

BULLSEYE ON WATER ICE

UTIG researchers prospect for glacial ice hidden beneath rock and soil on Mars. Future human explorers will need access to near-surface water supplies. Warm, wet oases like those on Mars are not just a potential resource for future explorers, but may be the kinds of habitable zones that have supported past Martian life.

SEARCHING OUR SOLAR SYSTEM TO FIND POTENTIAL HABITATS FOR LIFE

Scientists from UTIG are working with NASA on the Europa Clipper mission to explore whether Jupiter’s icy moon Europa could harbor conditions suitable for life. The Radar for Europa Assessment and Sounding: Ocean to Near-surface (REASON) instrument on Europa Clipper will revolutionize our understanding of Europa’s ice shell by providing the first direct measurements of its subsurface structure using techniques developed at UTIG to study ice sheets on Earth. REASON continues Texas’s long history of leading space exploration efforts.
MOSAIC OF THE VALLES MARINERIS HEMISPHERE OF MARS PROJECTED INTO POINT PERSPECTIVE, A VIEW SIMILAR TO THAT WHICH ONE WOULD SEE FROM A SPACECRAFT. CREDIT: NASA/JPL-CALTECH

(COVER) BLUE MARBLE MOSAIC CREATED FROM PHOTOGRAPHS TAKEN BY SATELLITES AND STITCHED TOGETHER TO CREATE THIS TRUE-COLOR IMAGE OF THE ENTIRE EARTH. CREDIT: NASA GODDARD SPACE FLIGHT CENTER