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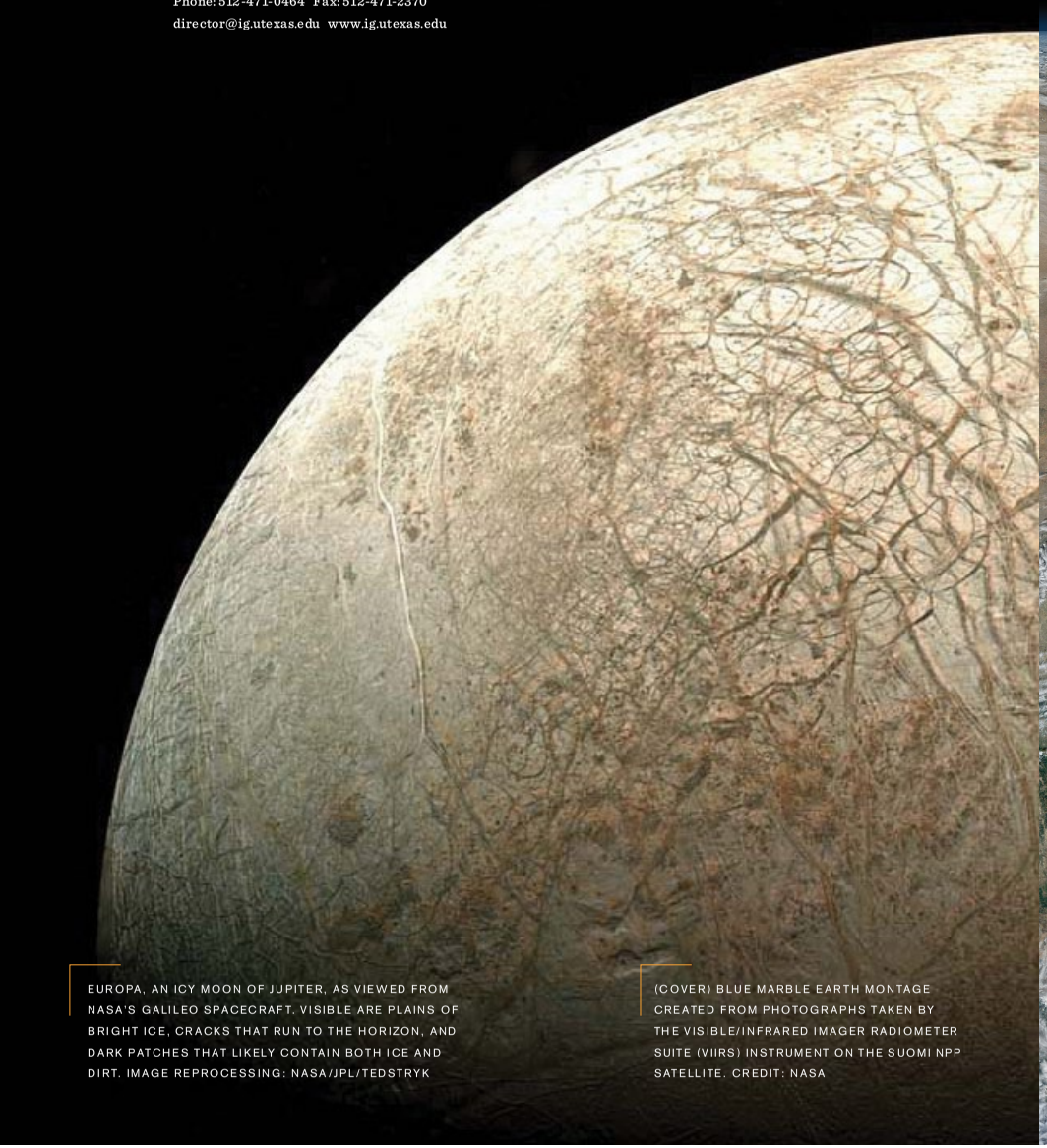
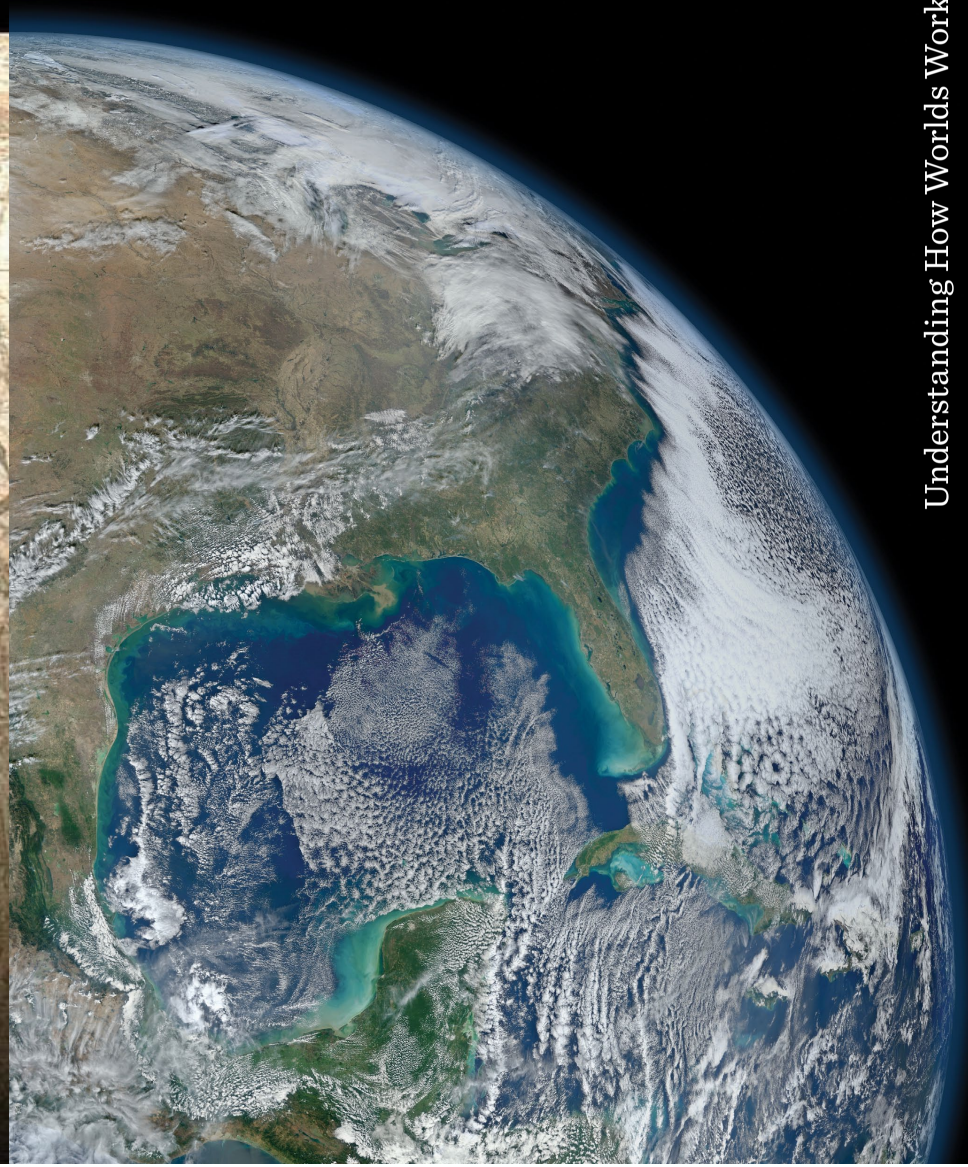
Understanding How Worlds Work



EUROPA, AN ICY MOON OF JUPITER, AS VIEWED FROM NASA'S GALILEO SPACECRAFT. VISIBLE ARE PLAINS OF BRIGHT ICE, CRACKS THAT RUN TO THE HORIZON, AND DARK PATCHES THAT LIKELY CONTAIN BOTH ICE AND DIRT. IMAGE REPROCESSING: NASA/JPL/TEDSTRYK



(COVER) BLUE MARBLE EARTH MONTAGE CREATED FROM PHOTOGRAPHS TAKEN BY THE VISIBLE/INFRARED IMAGER RADIOMETER SUITE (VIIRS) INSTRUMENT ON THE SUOMI NPP SATELLITE. CREDIT: NASA

UTIG SCIENTISTS ROUTINELY LEAD INTERNATIONALLY COLLABORATIVE, GROUNDBREAKING RESEARCH STUDYING GEOLOGIC HAZARDS, EARTHQUAKES, PLATE TECTONICS, AND OCEAN HISTORY FROM RESEARCH VESSELS, INCLUDING THE SCIENTIFIC DRILLING SHIP, JOIDES RESOLUTION. CREDIT: BILL CRAWFORD, IODP

The UT Institute for Geophysics (UTIG) is a world leader in expeditionary-scale geophysical research, conducting investigations over land, at sea, and in the air. Whether collecting seismic data, responding to natural disasters, or searching space for signs of life, UTIG is there.

UTIG scientists are dedicated to understanding how worlds work. When a deadly earthquake devastated Haiti, UTIG scientists arrived within weeks, assessing the damage, identifying future hazards, and advising rebuilding efforts. When Hurricane Ike hit Galveston, UTIG took to the seas, conducting a Rapid Response survey that showed dramatic changes to the seafloor, information vital to the recovery process. And when the Galileo spacecraft sent back images from Jupiter's moon Europa, UTIG used its knowledge of Earth's ice sheets to find a potential habitat for life hidden under Europa's icy shell. ¶ UTIG is home to 35 doctorate-level scientists — research entrepreneurs — providing a broadband of expertise that can do everything from conducting scientific ocean drilling to leading airborne radar studies of ice sheets. UTIG scientists supplement their fieldwork with computer analysis, modeling, and laboratory work. ¶ UTIG seeks state, national, and international opportunities to leverage its proven geophysical expertise to address 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 the 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 $23 million into the Texas economy, all while uncovering new knowledge that helps us understand and improve our world. In addition to UTIG's robust research enterprise, its work with graduate students and postdoctoral fellows helps prepare tomorrow's workforce. And its programs with K-12 students and teachers ensure that pioneering geophysics work will continue for generations. ¶ The bulk of UTIG's budget comes from external funding — grants from the National Science Foundation, NASA, international partners, foundations, and private industry — making it a revenue-positive operation. The UTIG structure is nimble and can respond rapidly to natural disasters and other research opportunities. Because UTIG is a research institute, it is not tied to the academic calendar, providing scientists the flexibility to work on projects that require quick turnarounds or several months in the field.

UTIG by the Numbers

STATE AND UNIVERSITY PER YEAR	*$2 million*
DIRECT EXPENDITURES PER YEAR	*$11 million*
INDIRECT ECONOMIC ACTIVITY	*$12 million*
ECONOMIC IMPACT ON TEXAS	*$23 million*
SCIENTISTS ON STAFF	*35*
YEARS OPEN	*40*
PEER-REVIEWED SCIENTIFIC PAPERS PUBLISHED (2008–2012)	*299*
NUMBER OF PAPERS WITH STUDENT CO-AUTHORS (2008–2012)	*85*

UTIG MILESTONES

1972 — ESTABLISHED LUNAR SEISMOLOGY PROGRAM AT UT.

1974 — CONDUCTED FIRST ACADEMIC MARINE MULTICHANNEL SEISMIC PROGRAM.

1984 — ESTABLISHED PLATES PROGRAM, AN ONGOING ACADEMIC-INDUSTRY PARTNERSHIP.

1987 — FIRST ACADEMIC 3-D MARINE MULTICHANNEL SEISMIC PROGRAM.

1993 — ESTABLISHED AEROGEOPHYSICAL POLAR RESEARCH PROGRAM AT UT.

1995 — ESTABLISHED GULF BASE DEPOSITIONAL SYNTHESIS PROGRAM, AN ONGOING ACADEMIC-INDUSTRY PARTNERSHIP IN THE GULF OF MEXICO.

2000 — ESTABLISHED FIRST COMPREHENSIVE CLIMATE RESEARCH PROGRAM AT UT.

2003 — ESTABLISHMENT OF GLOBAL MARINE SEISMIC DATA CENTER AT UTIG, WHICH SUPPORTS LONG-TERM ACCESS AND ARCHIVING OF SEISMIC DATA, NOW DONE VIA A WEB-BASED PORTAL.

2007 — DEVELOPED AND INITIATED RAPID RESPONSE PROGRAM TO INVESTIGATE EARTHQUAKES, HURRICANE AND TSUNAMI HAZARDS.

STUDIED THE INNER WORKINGS OF JAPANESE TSUNAMI FACTORY USING 3D SEISMIC ARRAY.

2008 — ESTABLISHED FIELD COURSE IN MARINE GEOLOGY AND GEOPHYSICS.

ESTABLISHED TEACHER DEVELOPMENT ACADEMIES FOR TEACHING EARTH AND SPACE SCIENCE IN TEXAS PUBLIC SCHOOLS.

USED GEOPHYSICAL SURVEY TO REVEAL THE EXTENT OF HURRICANE IKE'S UNDERWATER DAMAGE TO GALVESTON.

2009 — LED A TEAM THAT MEASURED THE VERTICAL MOTION OF THE BEDROCK IN WEST ANTARCTICA.

2010 — DISCOVER MAGAZINE CITED TWO UTIG SCIENCE STORIES AMONG TOP 100 OF THE YEAR: HAITI EARTHQUAKE AND MARS POLAR ICE CAP.

RAPID RESPONSE TEAM INVESTIGATED THE RECENT HAITI EARTHQUAKE, BUILDING ON A LONG HISTORY OF RESEARCH IN THE AREA.

2011 — DEMONSTRATED THE CAUSE OF 2004 MAJOR TSUNAMI-GENERATING EARTHQUAKE IN SUMATRA.

DISCOVERED GIANT ICE CUT CHANNELS BENEATH EAST ANTARCTIC ICE SHEET.

FOUND EVIDENCE FOR "GREAT LAKE" ON JUPITER'S MOON EUROPA.

HELPED INSTALL A SUBSURFACE OBSERVATORY AT THE FAULT THAT CAUSED THE GREAT JAPANESE EARTHQUAKE AND TSUNAMI.

2012 — HELPED DESIGN A SPACE PROBE TO JUPITER'S ICY MOONS.

Major Accomplishments Expected in the Near Future

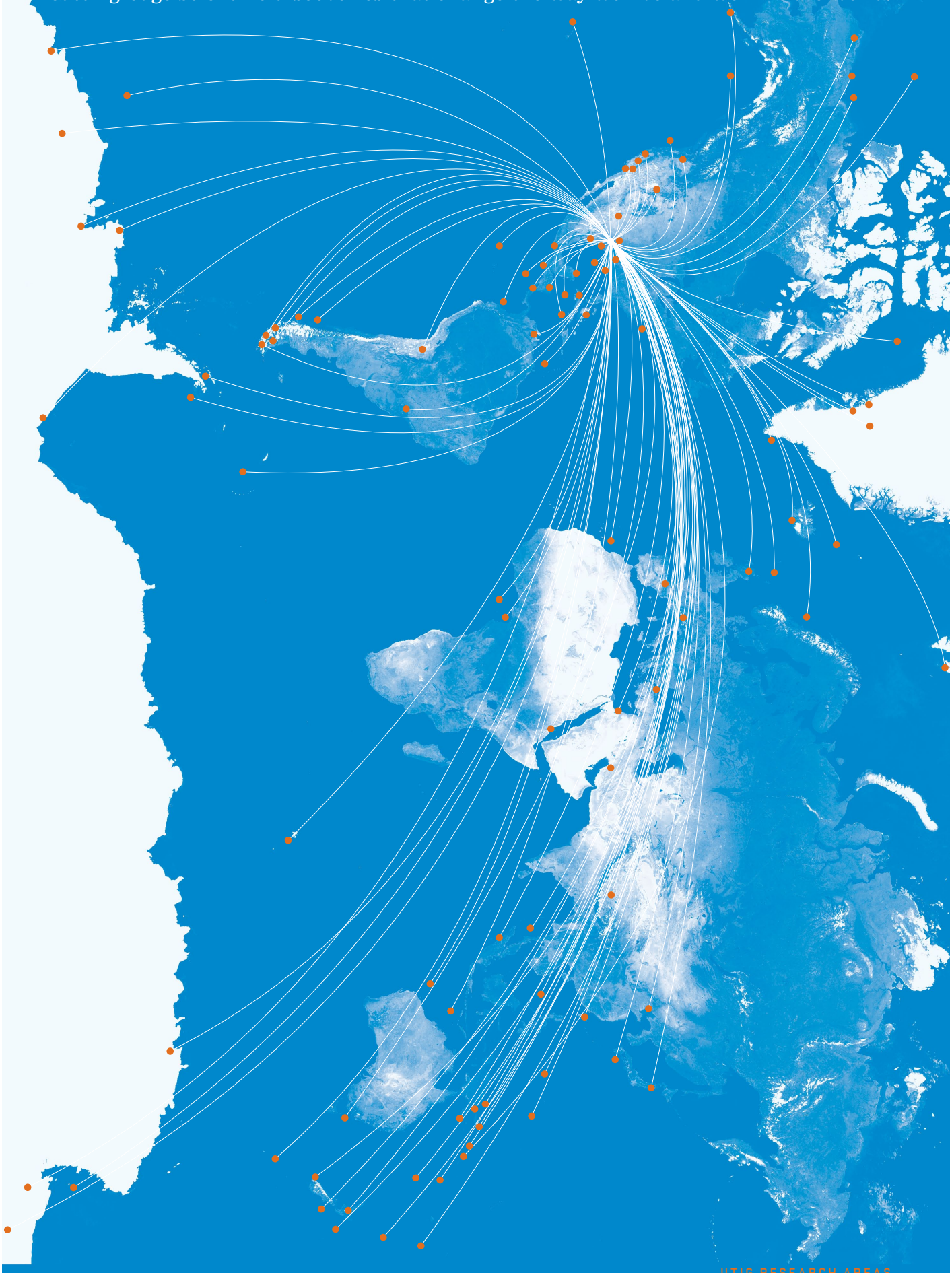
UTIG SCIENTISTS WILL EXPAND THE STUDY AREA OF GULF BASE DEPOSITIONAL SYNTHESIS PROGRAM INTO EASTERN AND WESTERN MARGINS OF THE GULF OF MEXICO.

LEAD A GEOPHYSICAL STUDY OF CONTINENTAL MARGINS OFFSHORE SURINAME AND FRENCH GUYANA.

LEAD A SCIENTIFIC OCEAN DRILLING EXPEDITION OFFSHORE OF SOUTHEAST ALASKA.

LEAD GEOPHYSICAL STUDIES OF EARTHQUAKE PRONE REGIONS SUCH AS JAPAN, ALASKA, AND NEW ZEALAND.

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 in the world.



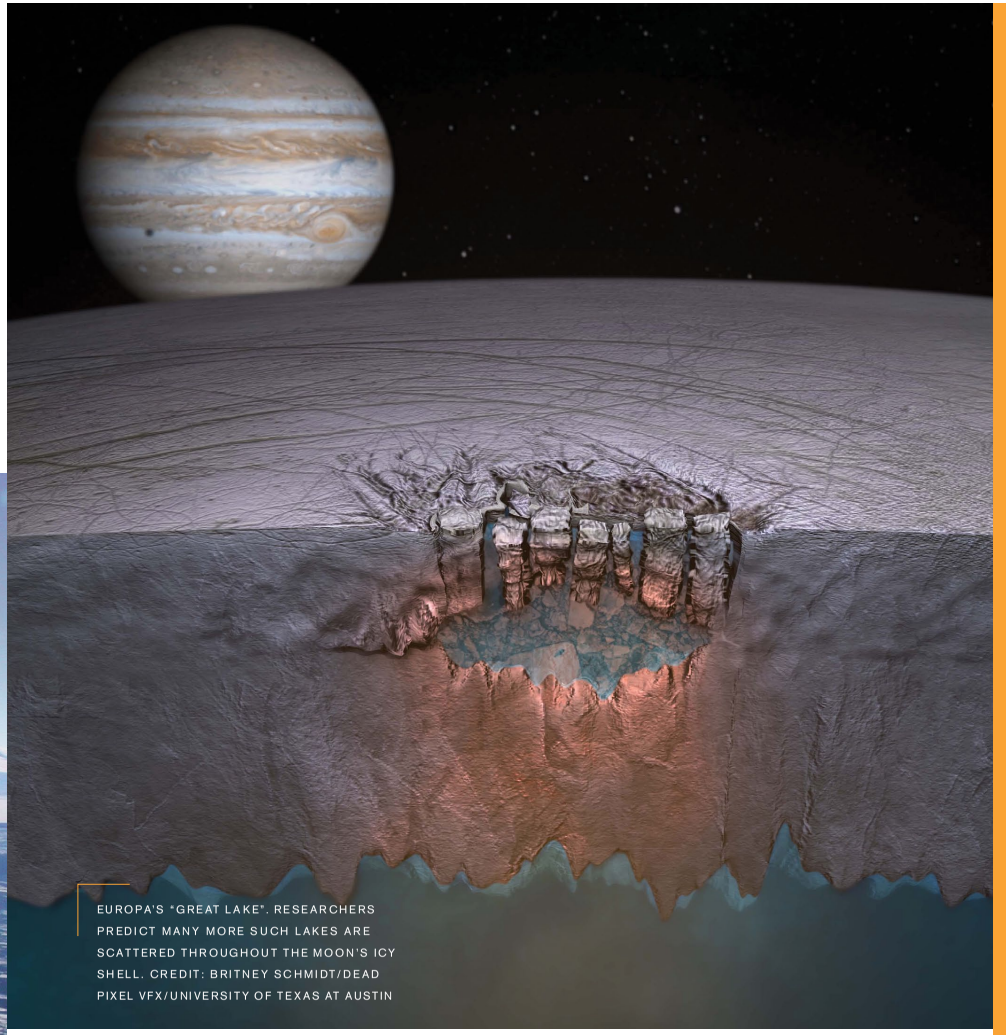
UTIG RESEARCH AREAS

CHARTING THE UNCHARTED

EAST ANTARCTICA

Scientists from the U.S., U.K., and Australia have used ice-penetrating radar to create the first high-resolution topographic map of one of the last uncharted regions of Earth, the Aurora Subglacial Basin, an ice-buried lowland in East Antarctica larger than Texas. The map reveals some of the largest fjords or ice-cut channels on Earth, providing important insights into the history of ice in Antarctica. The data will help computer modelers improve their simulations of the past and future Antarctic ice sheet and its potential impact on global sea level.

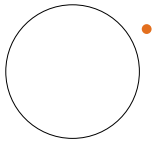
UTIG SCIENTISTS USE A SKI-EQUIPPED DC-3T CONFIGURED WITH THE UTIG AEROGEPHYSICAL SUITE TO MAP ANTARCTICA'S ICE SHEETS AND SUBGLACIAL TOPOGRAPHY. VHF RADAR ANTENNAS ARE MOUNTED UNDER EACH WING. A TAIL BOOM USES A CESIUM VAPOR MAGNETOMETER. CREDIT: JACK HOLT, UTIG



EUROPA'S "GREAT LAKE". RESEARCHERS PREDICT MANY MORE SUCH LAKES ARE SCATTERED THROUGHOUT THE MOON'S ICY SHELL. CREDIT: BRITNEY SCHMIDT/DEAD PIXEL VFX/UNIVERSITY OF TEXAS AT AUSTIN

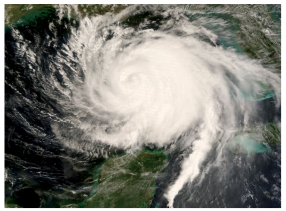
SCIENTISTS FIND POTENTIAL NEW HABITAT FOR LIFE

EUROPA, MOON OF JUPITER



In a significant finding in the search for life beyond Earth, scientists from UTIG have helped discover a body of liquid water locked inside the icy shell of Jupiter's moon Europa. The water, the volume of the North American Great Lakes, could represent a potential habitat for life, and many more such lakes might exist throughout the shallow regions of Europa's shell. Knowledge gained over 20 years' study of Earth's ice sheets and floating ice shelves made the discovery possible.

IMAGING EARTH AND BEYOND



SATELLITE IMAGES SHOW THE CENTRAL TEXAS COAST BEFORE (LEFT) AND AFTER (RIGHT) HURRICANE IKE. CHANGES IN VEGETATION (SHOWN IN RED) CLEARLY SHOW THE EXTENT OF THE 7M STORM SURGE, WHICH PUSHED SALT WATER INLAND MORE THAN 9M. CREDIT: NASA/GSFC/METI/JAPAN SPACE SYSTEMS AND U.S./JAPAN ASTER SCIENCE TEAM

SURVEY REVEALS EXTENT OF HURRICANE IKE'S UNDERWATER DAMAGE TO GALVESTON

GALVESTON, TX

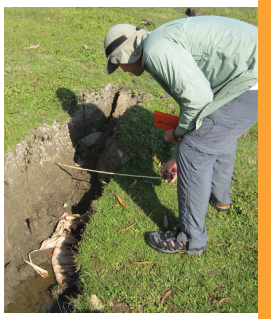
Conducting a Rapid Response research mission after Hurricane Ike, UTIG scientists surveyed the inlet between Galveston Bay and the Gulf of Mexico, and discovered that the hurricane significantly reshaped the seafloor and carried an enormous amount of sand and sediment into the gulf. The ongoing research revealed the role storms play in building and eroding barrier islands such as Galveston and could help coastal communities gauge the effectiveness of their sometimes controversial efforts to replenish eroding sand along shorelines.

HELPING HAITI PREPARE FOR THE NEXT BIG EARTHQUAKE

HAITI

Within weeks of the 2010 Haiti earthquake, UTIG scientists helped lead multiple expeditions to the island nation to help assess the damage, identify future earthquake hazards, and make recommendations about how and where to rebuild. They surveyed Haiti from the air, land, and sea.

UTIG scientists and colleagues combined data from their Rapid Response expeditions, seismological observations, and measurements from space to show that the earthquake wasn't caused entirely, or even largely, by the Enriquillo-Plantain Garden Fault. Rather, most of the motion was on previously unknown shallow faults. The report notes that much more strain is still waiting to be released on the Enriquillo-Plantain Garden Fault, possibly as another large earthquake.

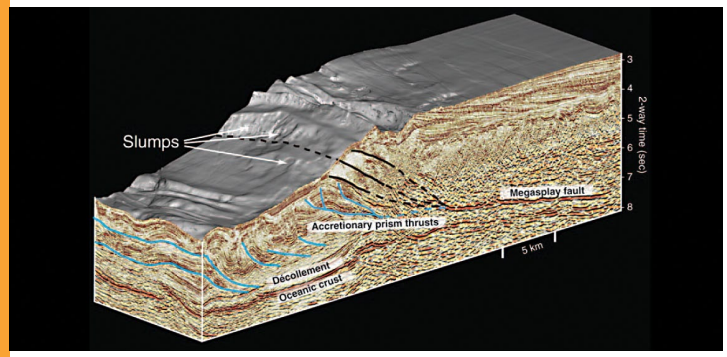


FOLLOWING THE 2010 HAITI EARTHQUAKE UTIG SCIENTISTS ASSESS EARTHQUAKE HISTORY AND FAULT MOVEMENT USING OCEAN FLOOR CORE SAMPLES, UPLIFTED CORALS, AND OTHER SEISMIC INDICATORS. CREW FROM THE PUBLIC BROADCASTING TV SHOW NOVA FILMED SOME OF THE LAND SURVEY FOR A SPECIAL ON THE EARTHQUAKE. CREDITS: PAUL MANN, UNIVERSITY OF HOUSTON, AND SEAN GULICK, UTIG

JAPAN 2011

The March 2011 earthquake and tsunami off the coast of Japan killed more than 15,000 people. With an eye toward better understanding of the fault and identifying potential hazards at other large faults around the world, UTIG researchers are studying the ocean trench and fault where the magnitude-9.0 Tohoku quake occurred. It is one of the largest quakes in recorded history.

JAPAN



SLIP ON FAULTS SIMILAR TO THOSE IMAGED BY UTIG SCIENTISTS OFF SOUTHERN JAPAN ARE RESPONSIBLE FOR THE TOHOKU EARTHQUAKE. CREDIT: NATHAN BANGS

TIMPSON, TX

EAST TEXAS 2012

A UTIG scientist is investigating East Texas' largest earthquake ever — a 4.8 magnitude-temblor near Timpson in May, 2012. Because the quake epicenter was just a few miles from some injection disposal wells, drilled to store waste fluids from hydraulic fracturing, the two could be linked. Studies are ongoing — stay tuned.

(LEFT) EAST TEXAS INJECTION DISPOSAL WELLS MAY BE LINKED TO AREA EARTHQUAKES. CREDIT:JIM OLIVE, STOCKYARD (RIGHT) A FREE-STANDING BRICK WALL IS DESTROYED AS A RESULT OF THE TIMPSON EARTHQUAKE. CREDIT: TIMPSON AND TENAHA NEWS

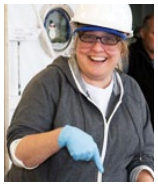
BUILDING BRIDGES: ACADEMIA, INDUSTRY, AND GOVERNMENT

UTIG scientists have a long history of creating partnerships with industry and government through geophysical investigations around the globe. The Gulf Basin Depositional Synthesis Project (GBDS) is one such longstanding UTIG project with industry partners that seeks to understand the depositional history of the economically important Gulf of Mexico. Another recent example of an UTIG-industry partnership involves the seismic investigation of the deep structure and earliest geologic history of the Gulf of Mexico. Research conducted by UTIG scientists continues to help industry scientists to more efficiently identify and develop energy resources in the deep gulf. Lessons learned from the studies in the Gulf of Mexico are used in other resrouce-rich deep basins around the globe.

THE GULF BASIN DEPOSITIONAL SYNTHESIS PROJECT IS AN INDUSTRY-SPONSORED SYNTHESIS OF THE LAST 250 MILLION YEARS OF DEPOSITION IN THE GULF OF MEXICO BASIN. SPONSORS RECEIVE DATA, DATABASES AND INTERACTIVE TOOLS THAT HELP PROVIDE A FRAMEWORK FOR EXPLORATION IN THE GULF OF MEXICO.

TEACHER AT SEA

A UTIG scientist co-led an Integrated Ocean Drilling Program expedition to Canterbury Basin off the eastern coast of New Zealand's South Island, where he and fellow scientists measured seafloor sediments as old as 35 million years. A middle school science teacher from Watauga, Texas, was also aboard the New Zealand expedition. She learned alongside the expedition's science party and shared her experiences with students and the public through a blog and live video conferences. She connected directly with students in Texas, Nebraska, California, and France.



TXESS REVOLUTION

The TeXas Earth and Space Science Revolution (TXESS Revolution) is a professional development program for eighth-grade and high school teachers preparing to teach the senior capstone course in Earth and Space Science. The project has served 172 teachers over four years. These teachers have directly affected more than 21,000 students; 69 percent of whom are underrepresented minorities.

GEOFORCE

The Jackson School of Geosciences GeoFORCE program and its staff are housed at UTIG. GeoFORCE is an experiential outreach program that prepares Texas high school students to become part of the geosciences workforce. UTIG scientists regularly participate in the summer field excursions associated with this nationally recognized program that engages more than 640 high school students each summer, 85 percent of whom are minorities.

SCIENTISTS FLAG A SUPPLY HELICOPTER DURING A 2011 CREVASSE STUDY NEAR THE JAKOBSHAVN GLACIER, WEST GREENLAND. CREDIT: LAUREN ANDREWS, UTIG