Building on 20 years of excellence and innovation
In 1988 the Board of Regents, on the recommendation of then President Al Simone, created the School of Ocean and Earth Science and Technology. SOEST has since grown to about 880 employees, including 250 Ph.Ds, 450 staff, and 180 graduate assistants. The School is an international leader in such diverse fields as Alternative Energy, Tropical Meteorology, Coral Reef Ecosystems, Volcanology, Microbial Oceanography, Seafloor Processes, Hyperspectral Remote Sensing, Cosmochemistry, Coastal Processes, and Climate Modeling — and that is just the top ten! Three quarters of SOEST’s $110M budget comes from extramural sources. The School’s extramural funding has more than tripled since its founding and accounts for 30% of the overhead generated at UH Mānoa. SOEST offers a world-class undergraduate and graduate experience, enabled by state-of-the-art instrumentation and facilities, coupled with mentoring by leading researchers and educators. The School’s success can be attributed to strong leadership, great faculty, excellent facilities, and dedicated support staff, as well as to Hawai‘i’s strategic location and long standing cultural and economic connections to the sea.

Working together with partners in industry and government, our goal is nothing less than to transform the way people live on Earth by enabling a healthy public, economy, and planet through an integrated, comprehensive, and sustained system of Earth observation, research, and education. The fundamental research, technology development, and workforce training that SOEST does to advance understanding of the Ocean Planet on which we live is required if humankind is to prosper in the face of what Al Gore calls “An Inconvenient Truth”. Humans have become the most invasive species on the planet and, as our population growth continues unabated, we are forcing a unique global experiment. By burning fossil fuels and tropical forests, and by making cement and fertilizer, humans have added to the atmosphere more than one quarter of its carbon dioxide since the beginning of the industrial revolution. The increase in greenhouse gases such as CO₂ to levels unprecedented in the last 800,000 years of Earth’s history, is causing global warming and rising sea level. Coastal communities are slowly being drowned, particularly on the low-lying atolls in the tropical western Pacific. As the climate warms and precipitation patterns change, we are experiencing an increasing intensity of the strongest tropical cyclones, notably in the Atlantic. For the first time in recorded history, there is a late summer ice-free northwest passage through the Arctic. Fish stocks have been severely depleted and the increasing acidification of seawater is decreasing the ability of corals and marine plankton to grow their hard parts. And our awareness of the global changes that we are causing is being compromised in part by gaps developing in the coverage of satellite and other systems that monitor them.

SOEST faculty have formulated strategic plans to address priority issues that have enormous societal relevance and immediate opportunities for implementation. The five priorities are ocean observing, space flight, alternative energy, living marine resources, and natural hazards. Partnerships are key to their implementation, as exemplified by the fact that SOEST faculty sponsor and advise as many graduate students in other colleges as our own.
In the area of ocean observing, the vision is to provide an operational oceanographic service to ensure a safe, productive, and clean coastal ocean, and resilient coastal zone. Partnerships of federal, state, and county agencies with academic, business, and private entities, will be required to implement a set of regional ocean observing systems to assess and predict the effects of weather, climate, and human activities on the state of the coastal ocean, on its ecosystems and living resources, and on the island economies. With funding from the National Oceanic and Atmospheric Administration, a team of faculty from across the School have initiated projects to define and forecast sea-state (including currents, waves, storm surge, flooding, and beach erosion), enhance stewardship of living marine resources (fisheries, coral reefs, and marine mammals), and develop a system of automated real-time monitoring of coastal water quality (both its chemistry and microbiology). Focused initially on O‘ahu’s south shore, these catalyst projects should be extended throughout Hawai‘i and the insular Pacific as funding becomes available. Our interest is not only the coastal ocean, but also the deep waters of the Pacific. With National Science Foundation funding we have installed an observatory on the seafloor at Station Aloha, 60 miles north of O‘ahu, with power and communications provided via a decommissioned ATT cable that comes ashore at Makaha. With funding from the State Legislature, we have hired six new tenure-track faculty to further these endeavors.

In a joint venture with the College of Engineering, we formed the Hawai‘i Space Flight Lab. It promises to have the University of Hawai‘i join only a handful of other nations capable of launching satellites into space. With federally appropriated funds and the collaboration of industrial partners such as Novasol, government labs such as Sandia, JPL, NASA-AMES, and NASA-Marshall together with the Pacific Missile Range Facility on Kaua‘i, we plan to launch micro-satellites into low Earth orbits for a fraction of the cost of current alternatives. Even so, the instrument development and first two launches will cost tens of millions of dollars. Using a rail-launch facility at PMRF and spin-stabilized solid-fuel rockets, the Hawai‘i Space Flight Lab will break the current log-jam of getting small satellites weighing 30–300 kg into Earth orbits at 300–1100 km distance. Not only will this be an amazing high-tech workforce and economic engine for Kaua‘i and Hawai‘i, but it will provide unparalleled opportunities for faculty- and student-built micro-satellite systems to get into space. One such system developed at SOEST and, before the Columbia shuttle disaster, slated for deployment on the Space Station, is a Hyperspectral Imager of the Coastal Ocean. It can be used, for example, to monitor the global distribution and health of shallow coral reefs. Federal agencies are particularly interested in the potential for SOEST to establish a low-cost, on-demand launch capability that can space validate new hardware and deploy secure communication constellations.

The cost of energy in Hawai‘i makes this a natural place for the accelerated development of globally exportable technologies to reduce our dependence on imported oil. Several such partnerships are already in place. One is the Hawai‘i Fuel Cell Test Facility, operated by the Hawai‘i Natural Energy Institute together with Hawaiian Electric. This is part of the Hawai‘i Energy and Environmental Technology initiative, funded by the Office of Naval Research, that also includes the assessment of methane hydrates as a potential future energy source. Another is the National Marine Renewable Energy center funded by the Department of Energy. A third is the biomass gasification and flash carbonization projects that have several industrial partners. A fourth is the fabrication of thin-film semi-conductors for solar hydrogen production and solar photovoltaic systems. HNEI is also partnering with General Electric and Hawaiian electric companies to evaluate and improve electric grid stability given fluctuating supplies from wind, wave, and solar power. A company formed by current and former faculty is in partnership with Royal Dutch Shell to build a demonstration facility on the Big Island that generates biodiesel by feeding CO₂ to non-modified marine algae indigenous to Hawai‘i and cultured at SOEST. Experts from the Center for Smart Building and Community Design (a partnership between Architecture and Sea Grant) are advising the University administration on ways to help reduce the campus energy bill.
A fourth SOEST priority relates to marine ecosystems. Understanding the biology, ecology, and biogeochemistry of marine microorganisms, which are the base of the multi-cellular food chain, is the focus of the NSF Science and Technology Center for Microbial Oceanography: Research and Education (C-MORE). Novel methods in molecular biology, combined with satellite- and sea-based remote sensing technologies, will link microbial process studies at spatial scales ranging from genes to the entire Pacific Ocean. At the Hawai‘i Institute of Marine Biology we have multiple programs related to the health and vitality of tropical coral reefs — from gene flow, to community structure, to dispersal patterns and resilience, to ocean acidification. In partnership with NOAA, HIMB is the “brain trust” for improving stewardship of the Papahānaumokuākea Marine National Monument in the NW Hawaiian islands, as well as for understanding the foraging patterns of top predators such as tuna and sharks. HIMB researchers also study the sensory and perceptual processes of marine mammals. Human-induced ocean noise has become an increasingly contentious issue, affecting both research and military operations. Our scientists are seeking to inform that debate with hard-to-obtain data on the echolocation capabilities of whales, dolphins, and polar bears. SOEST faculty are proposing to transition the well-established graduate field of study in Marine Biology into a graduate degree offered jointly with the College of Natural Sciences.

Hawai‘i is prone to natural hazards: earthquakes, landslides, tsunamis, volcanic eruptions, hurricanes, storm surge, drought, and flooding. Our faculty are improving storm surge and tsunami inundation maps and, with County lifeguards, have implemented a Hawai‘i Beach Hazard forecast and web site. We are working on all aspects of volcanic eruption processes, including collaborative studies with the Hawai‘i Volcano Observatory of the US Geological Survey. Partnering with the Japanese Marine Science and Technology Agency, faculty and researchers in the Department of Meteorology and the International Pacific Research Center are improving our understanding of the Asian monsoon (which affects the lives of half the world’s population), and of tropical cyclones and thunderstorms. This includes real-time, data-assimilating model studies to better forecast not only hurricane tracks but also intensity, risk, and impact projections. We have been chosen by the Department of Homeland Security to lead a National Center of Excellence for Maritime Domain Awareness and established the Center for Island, Maritime, and Extreme Environment Security, with partners in the College of Engineering, the University of Alaska, and the University of Puerto Rico, and collaboration with the Stevens Institute of Technology in New Jersey. To address environmental, legal, and policy issues of climate change, we have joined with the Schools of Law, Social Sciences, and Hawaiian Knowledge to form the Island Resiliency and Climate Policy Center within the UH Sea Grant College Program.

These are some of the key areas where we are taking up the challenge to fulfill the four-fold vision of the School, which is to:

- Advance understanding of the Ocean, Earth, and Planets
- Provide world-class education
- Foster a high-tech economy
- Promote sustainable use of the environment

My goal as Dean is to continue building an innovative faculty, supported by excellent facilities and motivated staff, that will fulfill our potential and result in our shared success. Mahalo to the administration, faculty, and staff for the trust put in me to lead this wonderful enterprise that is the School of Ocean and Earth Science and Technology.

Brian Taylor
Dean of SOEST
Department of

Geology and Geophysics

The University of Hawai‘i is a land grant, sea grant, and space grant institution, and this is reflected in the Earth and planetary sciences research and teaching programs of the Department of Geology and Geophysics.

Education and Training
The Department of Geology and Geophysics (G&G) offers a wide range of courses at the graduate and undergraduate levels. The department has a reputation for high quality faculty who provide education opportunities in the Earth, Ocean, and Space sciences. Our BA, BS, MS, and PhD degrees cover a wide range of topics in these fields which take full advantage of Hawai‘i’s natural laboratory through field trips to several islands. The rich geologic setting of Hawai‘i provides a natural focus for education and training in:

- composition and dynamics of Earth’s deep interior;
- formation, motion and recycling of Earth’s crust (also known as “the rock cycle”);
- Earth surface processes involving water, sediments, and life;
- Earth history;
- Earth hazards, resources and sustainability; and
- the Solar System.

The faculty is large (32 teaching and research faculty and about 36 additional graduate faculty) and diverse, so there are strong programs in all major sub-disciplines. The quality of the school’s research vessels, submersibles, and analytical and computing facilities reflects its commitment to excellence in field studies and theoretical and modeling studies. These components are a hallmark of the educational experience we offer at undergraduate and graduate levels. About 20,000 students are enrolled at the Mānoa campus, and the department normally has 50–70 graduate students and 40–50 undergraduate students in residence. About one third of the students are women and 15% are from foreign countries.

Research
The department is organized into three divisions:

- Geophysics and Tectonics (G&T) takes advantage of the University of Hawai‘i’s mid-Pacific setting to investigate a wide variety of geodynamic, tectonic, and geophysical phenomena that operate over a broad range of spatial and temporal scales.
- Marine and Environmental Geology (MEG) is focused on the physical, biological and chemical interactions that characterize Earth surface environments. The program includes instructional and research opportunities in a wide range of topics related to marine, coastal, and tropical watershed environments.
- Volcanology, Geochemistry, and Petrology (VGP) Hawai‘i scientists are uniquely situated to learn all major aspects of volcanic systems. Researchers study ocean spreading centers, physical volcanology, intraplate volcanism, and volcano monitoring.

Notable Service
The Hawai‘i Beach Safety web site (www.hawaiibeachsafety.org) was created in cooperation with several government agencies to give Hawai‘i beach users timely and accurate information for choosing a beach destination appropriate to their ocean skill level.

Faculty members serve on the
- National Academy of Sciences
- Hawai‘i Natural Area Reserve Commission
- Hawai‘i Legacy Lands Commission
- Hawai‘i Academy of Sciences
Geology and Geophysics at a glance

Founded 1959

Research Fields
Composition and dynamics of Earth’s deep interior
Formation, motion and recycling of Earth’s crust
Earth’s surface processes involving water, sediments, and life
Earth history
Earth hazards, resources and sustainability
The Solar System

Research Foci
Volcanism and natural hazards
Hydrogeology and coastal geology
Isotope geochemistry
Plate tectonics and deep Earth processes
Geobiology
Igneous petrology

Faculty 32, 25 of whom are tenured or tenure track

Students 50–70 graduate and 40–50 undergraduate

Degrees Offered BA, BS, MS, and PhD in Geology and Geophysics

Significant Honors
Steven Stanley: Member of the National Academy of Science
Bruce Houghton: MacDonald Chair in Volcanology
Julia Hammer: Presidential Early Career Award for Scientists and Engineers
11 Fellows of the Geological Society of America, and 1 Fellow of the Geochemical Society and the European Association for Geochemistry

Facilities
Isotope Laboratory
Deep-Ocean Observatory System
Electron Microprobe Laboratory
Isotope Biogeochemistry Laboratory
X-Ray Fluorescence Laboratory
Experimental Petrology Laboratory
Multi-collector Plasma Mass Spectrometry
Magnetic Sector Inductively Coupled Plasma Mass Spectrometry
Petrography Laboratory
Seismic Processing and Analysis Facility
Geophysics and Tectonics High-Performance Computing Laboratory

Notable Service
Scott Rowland: Commissioner, Hawai‘i Natural Area Reserve System
Chip Fletcher: Commissioner, Hawai‘i Legacy Lands Commission
Mike Garcia: Technical Judge, Nuclear Regulatory Commission
Real-time beach conditions at www.hawaiibeachsafety.org
Department of Meteorology

The Department of Meteorology is the leading Pacific basin center of expertise for education and research in weather and climate science.

Education and Training
The department offers BS, MS and PhD degree programs and attracts students from Hawai‘i, the mainland US and many other countries. Our location in the tropical Pacific has led us to develop particular expertise in education related to the weather and climate of the tropics and the Asia-Pacific region. In collaboration with the National Weather Service and the Joint Institute for Marine and Atmospheric Research (see page 22), the department oversees the Pacific Training Desk program which aids the training of operational forecasters from less developed countries in the Pacific region, including those from Pacific island nations.

Research
Faculty conduct externally funded research projects on a wide array of weather and climate related subjects. Most research projects include participation of graduate students and/or postdoctoral fellows and are thus fully integrated into our educational mission. Studies of dynamics and statistics of tropical cyclones, studies of the dynamics of larger-scale Pacific weather circulations, and characterization and modeling of small scale climate and weather features in Hawai‘i are all vigorously pursued.

Much of this research is directly applicable to short-term weather forecasting in the Hawaiian region, and this research is closely linked with application to actual operational forecasting.

Studies of the basic physics of tropical atmospheric circulations on intraseasonal and longer time scales, notably the El Niño phenomenon and the Asian monsoon circulations, have a long and distinguished history in the department.

Among many exciting recent developments in ongoing research activities are: collaboration on the development and application of novel balloon technology for atmospheric observations, application of newly available satellite data to study the role of atmosphere-ocean interactions in the dynamics of mesoscale atmospheric circulations, and the use of very fine resolution global and regional simulation models to study aspects of atmospheric and oceanic dynamics.

Notable Service
The department provides an array of important services to Hawai‘i, to US federal agencies, and to the wider national and international community. Ongoing service activities performed and managed by the department include those of the Hawai‘i State Climate Office and the Pacific ENSO Applications Center (see page 22). The department collaborates with the National Weather Service Honolulu Forecast Office to produce daily experimental short-term numerical weather forecasts for Hawai‘i. The department established and maintains the UH public weather server web page, and supports the efficient operation of Mauna Kea astronomical observatories through customized forecasts issued by the Mauna Kea Weather Center.
Meteorology at a glance

Founded 1956

Research Fields
Tropical meteorology
Climate dynamics
Atmospheric dynamics
Mesoscale meteorology

Research Foci
Tropical cyclones
Monsoon dynamics
Mesoscale modeling
Island weather
Climate variability
Specialized observing systems

Faculty 14, 13 of whom are tenured or tenure track

Students 30–40 graduate students and 20–30 undergraduates

Degrees Offered BS, MS, and PhD

Significant Honors
Kevin Hamilton: Meisinger Award of the American Meteorological Society (AMS) and Fellow of the AMS
Bin Wang: Fellow of the American Meteorological Society
Shang-Ping Xie: Medal of the Meteorological Society of Japan

Facilities
Hawai‘i State Climate Office
Mauna Kea Weather Center

Notable Service
Pao-Shin Chu: Hawai‘i State Climatologist
Kevin Hamilton: President, International Commission for the Middle Atmosphere
Thomas Schroeder: Hawai‘i State Hurricane Advisory Committee
Bin Wang: Co-Chair, CLIVAR Asian-Australian Monsoon Panel
Department of

Ocean and Resources Engineering

The Department of Ocean and Resources Engineering conducts basic and applied research in support of the graduate education program and wise utilization of coastal and ocean resources in Hawai‘i and the nation.

Education and Training
The department has seven faculty members, 10 graduate faculty members from other academic and research units at the University of Hawai‘i, and three affiliate faculty members from the ocean engineering industry in Hawai‘i. The graduate program in ocean engineering at the University of Hawai‘i was initiated in 1966 and is one of the first in the United States. The department offers an academic program leading to the MS and PhD degrees in three disciplines:

- coastal engineering,
- offshore engineering, and
- ocean resources engineering.

Students come from diverse cultural and academic backgrounds with the common objective to channel their prior education and work experience to ocean-related engineering careers. Most students receive research assistantships from the department or participate in the Ocean Engineering Internship program established between the University of Hawai‘i and the ocean engineering industry in Hawai‘i.

Research
The research program in Ocean and Resources Engineering has a good balance between numerical and laboratory modeling as well as field observation. The main research thrusts include marine hydrodynamics, coastal hazards mitigation, and ocean observing system technology.

The department has a long research record on marine hydrodynamics. Current activities include basic research on fluid-structure interaction and computation fluid dynamics (CFD) as well as development of wave energy devices and an integrated software system for ship performance analysis and mission planning. There is a joint research effort with the shipbuilding industry to develop design tools for the Navy’s T-craft program. These tools include a hydroelasticity model for marine vehicles advancing in a seaway and a customized CFD toolbox for the analysis of ship motion in the surf zone.

Hawai‘i is prone to coastal hazards associated with swells, hurricanes, and tsunamis. The capability to forecast these occurrences and assess their impacts to the coastal community is vital to federal, state, county emergency management agencies. Basic research covers long-wave propagation, breaking and runup, ocean wave dynamics, coastal wave processes, and stochastic processes. This has led to a number of applied research projects on tsunami forecast, inundation mapping, and risk on infrastructure as well as assessment and forecast of hurricane-induced coastal flooding. In addition, a nested system of third-generation spectral wave models has been providing high-resolution regional and coastal wave conditions for a 7.5-day forecast period over the Hawaiian Islands.

The Kilo Nalu Nearshore Observatory has put SOEST at the forefront of ocean observing research. The observatory facilitates collaborative research with Oceanography, Geology and Geophysics, and other universities on reef environment physics, coastal wave processes, benthic boundary layers, internal tides, sediment transport, water quality, and biogeochemistry. In addition to hosting process-oriented studies, Kilo Nalu is serving as an in-ocean test bed for new observing and numerical modeling technologies.

The department currently has joint research projects with Oregon State University, Naval Postgraduate School, Stanford University, and the Universities of Alaska and Washington.

Notable Service
The department provides advisory services to a large number of county, state and federal agencies. Notable among these services has been the update of tsunami evacuation maps, the development of the current tsunami forecasting methodology, and major input into catastrophic hurricane readiness response planning, especially accurately predicting hurricane induced flooding.
Ocean and Resources Engineering at a Glance

Founded 1966

Research Fields
Coastal engineering
Offshore engineering
Ocean resources engineering
Ocean observation and instrumentation

Research Foci
Marine hydrodynamics
Coastal processes
Coastal flood hazards
Ocean observing technologies

Faculty 7, 5 of whom are tenured or tenure track

Students 40 graduate students

Degrees Offered MS and PhD

Significant Honors
Cengiz Ertekin: Fellow of the Society of Naval Architects and Marine Engineers
Geno Pawlak: ONR Young Investigator

Facilities
Environmental Fluid Dynamics Laboratory
Hawai‘i Undersea Research Laboratory
Kilo Nalu Nearshore Reef Observatory
Two computer clusters

Notable Service
John Wiltshire: Advisor to the U.S. Secretary of the Interior
Kwok Fai Cheung: Science advisor to Hawai‘i State Civil Defense
The Department of Oceanography conducts innovative research and education programs that enhance our understanding of the ocean, and address 21st century challenges and opportunities for Hawai‘i and the blue planet.

Education and Training
The Oceanography Department was established in 1964, and the department currently has over 70 graduate students from 16 countries. MS and PhD degrees are offered in biological oceanography, marine geology & geochemistry, and physical oceanography.

The department also administers the Global Environmental Science (GES) program, which offers a BS degree. GES was established in 1998 and has grown to become the largest undergraduate program within SOEST. It currently has 60 students.

Research
The department receives over $20 million per year in external research funding. Major sources of funding include:

- National Science Foundation
- Office of Naval Research
- National Oceanic and Atmospheric Administration
- National Aeronautics and Space Administration
- Gordon and Betty Moore Foundation

The department is housed in the six-story, 72,000 sq. ft. Marine Science Building, along with additional space in other SOEST facilities.

Department scientists study the processes that shape and control the modern and past ocean, with an emphasis on interdisciplinary investigations. Research in the department covers almost all areas of oceanography, and includes studies on the following:

- shipboard, autonomous vehicle, and cabled observation programs;
- the biological structure and function of diverse marine habitats and ecosystems around the globe, from tropical to polar oceans, and from the air-sea interface to the deep-ocean crust;
- physical oceanographic processes, from small-scale internal waves to the general circulation of the oceans;
- oceanic trace elements;
- ocean-atmosphere interactions, including gas and aerosol geochemistry;
- marine biogeochemistry;
- ocean-seafloor interactions, including hydrothermal geochemistry/biogeochemistry and sediment-seawater exchange;
- land-ocean interactions, including estuarine biogeochemistry;
- climate variability and prediction;
- paleoceanography/paleoclimatology; and
- theoretical modeling and computer simulations.

Notable Service
- Lorenz Magaard: Member, State Greenhouse Gas Emissions Reduction Task Force
- Eric DeCarlo: Member, Dept. of Defense Ordnance Reef Coordinating Council
- Richard Grigg: Member, Governor’s Task Force on Beach and Water Safety
- Richard Grigg: Member, Western Pacific Fishery Management Council Precious Coral Planning Team
- Mark Merrifield: Real-time ocean wave conditions at www.soest.hawaii.edu/buoy
- UH Sea Level Center: Monthly maps of global sea level atilikai.soest.hawaii.edu/uhslc/products.html

The Department of Oceanography conducts innovative research and education programs that enhance our understanding of the ocean, and address 21st century challenges and opportunities for Hawai‘i and the blue planet.
Oceanography at a Glance

Founded 1964

Research Fields
Biological oceanography
Marine geology and geochemistry
Physical oceanography

Research Foci
Virtually all areas of open-ocean, coastal and nearshore oceanography

Faculty 52, 37 of whom are tenured or tenure track; 64 graduate faculty

Students 70 graduate and 60 undergraduate

Degrees Offered MS and PhD, plus BS through the Global Environmental Science program

Significant Honors
Dave Karl: Member of the National Academy of Science
Fred Mackenzie: The Vernadsky Medal for 2007; Gold Medal from the Geochemical section of the American Chemical Society (ACS)
Julian McCreary: Fellow of the AMS and American Geophysical Union, Sverdrup Gold Medal
Axel Timmermann: Rosenstiel Award

Facilities
The department is housed in the 6-story, 72,000 sq. ft. Marine Science Building, along with additional space in other SOEST facilities.

Notable Service
Lorenz Magaard: Member, State Greenhouse Gas Emissions Reduction Task Force
Eric DeCarlo: Member, Dept. of Defense Ordnance Reef Coordinating Council
Richard Grigg: Member, Governor’s Task Force on Beach and Water Safety and Member, Western Pacific Fishery Management Council Precious Coral Planning Team
Mark Merrifield: Real-time ocean wave conditions at www.soest.hawaii.edu/buoy/
Axel Timmermann: Chair, CLIVAR Pacific Panel
UH Sea Level Center: Monthly maps of global sea level at ilikai.soest.hawaii.edu/uhslc/products.html
The mission of the Hawai‘i Institute of Geophysics and Planetology is to solve fundamental problems in Earth and planetary science by the application and development of state-of-the-art exploration, measurement, and analysis technologies.

The Hawai‘i Institute of Geophysics and Planetology (HiGP) is a multi-disciplinary research institute engaging in advanced research, workforce training, and service in cutting-edge oceanographic, geological, geophysical, planetary, and atmospheric sciences.

**People**
The Institute is home to about 50 faculty, 25 staff, 5 post-doctoral researchers, and about 20 graduate students. It is home for the Hawai‘i Space Grant College, the Pacific Regional Planetary Data Center, and is a major player in the Hawai‘i Space Flight Laboratory. In many respects, HiGP is the entrepreneurial engine of SOEST, producing innovative research and education programs that have a major impact on UH, the state and the country.

**Research at HiGP**
HiGP solves fundamental problems in Earth and Planetary Science by the development and application of state-of-the-art exploration, measurements, and analysis technologies. The Institute serves society and the state of Hawai‘i by acquiring and disseminating new knowledge about the Earth and other planetary bodies, and developing and introducing leading edge technologies and a highly trained workforce to the state economy.

HiGP has five overarching goals:
- scientific discoveries,
- leadership in exploration,
- measuring the solar system,
- measuring Hawai‘i’s physical environment, and
- unique education focused on planetary science.

To strengthen its role as a world leader in basic scientific research in the Earth and Space Science, HiGP has three broad scientific foci for its continued growth over the next decade:

- **Moon, Mars and Beyond.** The development on instrumentation for the in situ analysis of planetary surfaces; the cosmochemical analysis of the stars and planets through the analysis of inter-planetary dust and samples returned from the asteroids, the Moon, and Mars.
- **Hawai‘i in Space.** The development of an independent capability to design, fabricate, test, launch, and control UH satellites through the development of the Hawai‘i Space Flight Lab.
- **Pulse of Hawai‘i and Planet Earth.** The Hawaiian Islands provide excellent opportunities to develop, deploy and export the science and technology of integrated Earth observational networks. The Hawai‘i Ocean Observatory and data management and mining are primary components of this research focus, and include geodetic monitoring of the islands, sensing earthquakes and interpreting the deep structure of the Hawai‘i mantle plume, and the use of imaging sonars to map the ocean floor.
HIGP at a Glance

Founded 1957

Research Fields
- Remote sensing of the Earth and planets
- Meteoritics and cosmochemistry
- Instrument development
- Infrasound
- GPS, geodesy, and geophysics
- High pressure mineral physics
- Volcanology
- Marine remote sensing and seafloor mapping
- Paleomagnetism, seismology, and marine geophysics
- Small satellites

Research Foci
- Geology of the moon and planets
- Hyperspectral remote sensing of the Earth
- Origin of the solar system
- Geodetic analysis with GPS and InSAR
- Lidar, sonar and infrasonics
- Development and flight of small satellites
- Physical volcanology
- Atmospheric science

Faculty 47, 23 of whom are tenured or tenure track

Significant Honors
- Klaus Keil: J. Lawrence Smith Medal from the National Academy of Science
- Andy Harris: Wager Medal from the International Association for Volcanology and Chemistry of the Earth’s Interior
- Edward Scott: Leonard Medal from the Meteoritical Society

Facilities
- W.M. Keck Laboratory Cosmochemistry Laboratory
- Infrared Spectroscopy Laboratory
- Infrasound Laboratory
- Hawai’i Mapping Research Group
- Pacific GPS Facility
- Raman Spectroscopy Laboratory
- Hawai’i Space Flight Lab

Notable Services
- NASA Space Grant College
- NASA Pacific Regional Planetary Data Center
- Global monitoring of active volcanism at hotspot.higp.hawaii.edu
- Planetary Science Research Discoveries at www.psrd.hawaii.edu
Hawai‘i Institute of Marine Biology

HIMB supports multi-disciplinary research and education in all aspects of tropical marine biology. HIMB’s unique location on Moku o Lo‘e with ready access to estuarine, coastal, and offshore environments promotes the integration of modern laboratory science and rigorous field-work.

The Hawai‘i Institute of Marine Biology (HIMB) traces its origins to a wooden frame biological laboratory that was established in 1912 on Waikīkī Beach. In 1919 the facility was turned over to the University of Hawai‘i and in 1947 Edwin Pauley invited the University to establish a marine laboratory on Coconut Island (Moku o Lo‘e).

People
HIMB has grown substantially since then with about 24 faculty members, 12 postdoctoral fellows, 50–60 graduate students, and visiting faculty who conduct research on tropical marine ecosystems. It houses the Alliance for Coastal Technologies, the Marine Mammal Research and Bioacoustics program, the Pelagic Research Laboratory, and a functional genomics facility capable of genomic sequencing and microarray analysis.

Faculty members hold their locus of tenure at HIMB and maintain graduate faculty status in the Departments of Oceanography, Animal Sciences, Geography, Zoology, Microbiology, and Molecular Biosciences and Engineering at the University of Hawai‘i. HIMB affiliate faculty members are also associated with the Bishop Museum, University of Wisconsin, University of California at Los Angeles, University of Zurich, University of the Ryukyus, Smithsonian Institute and the National Zoo, Russian Academy of Sciences, and Tokyo University.

The state of Hawai‘i provides salary support for tenured/tenure-track faculty and a portion of the research infrastructure. Research support is largely funded through federal grants obtained from NSF, USDA, EPA, NOAA, ONR, and NASA. Contracts from the state of Hawai‘i fund research and monitoring of the coral reef and the coastal marine ecosystems.

Research at HIMB
HIMB research follows six broad themes:

- coral physiology and coral reef ecology,
- biological connectivity of marine ecosystems,
- endocrinology and disease in aquaculture,
- marine mammal research,
- environmental toxicology, and
- marine bioengineering and bioacoustics.

The level of biological connectivity among isolated reef habitats is being measured by acoustic tagging studies of large predatory fish and genetic techniques for smaller fish, invertebrates, and marine micro-organisms. Classic ecological studies requiring careful field observations of behavior, habitat characterization, and biogeochemical analyses are also employed by our scientists. Physiological studies using genetic techniques, endocrine assays, and mass spectra analyses measure the responses of algae, fish, micro-organisms, and corals to changes in the marine environment.

The marine biosphere is one of the Earth’s richest, but least characterized, habitats. Moreover, the Hawaiian Archipelago is one of the most remote tropical marine ecosystems on Earth. Thus, the Hawaiian Islands are a perfect natural laboratory for the study of marine speciation and the effects of oceanic currents and climate on dispersal and behavior of marine organisms. In this context, HIMB scientists are:

- improving aquaculture of Hawaiian fish and shellfish with solutions in disease, reproduction, and growth rates;
- determining the management areas for Hawaiian species including the ‘ōpīhi (Cellana spp.), uku (grey snapper) and the range of giant trevally, tiger shark, spiny lobster, and coral;
- detecting marine mammals that include humpback whales, dolphins, monk seals, and false killer whales with Ecological Acoustic Recorders (EARS) in remote areas of the Northwestern Hawaiian Islands;
- mapping the benthic habitat for the entire Hawaiian Archipelago;
- determining the causative agent(s) for coral diseases of Hawai‘i’s reefs;
- determining the physical parameters of wave action on coral physiology and biogeochemistry;
- developing and testing sensors for ocean observing systems; and
- educating graduate, undergraduate, K-12 students and the public to promote the responsible stewardship of our marine ecosystems and to provide training opportunities for future marine scientists, managers, and community members.
HIMB AT A GLANCE

Founded 1912

Research Fields
- Coral physiology and coral reef ecology
- Biological connectivity of marine ecosystems
- Endocrinology and disease in aquaculture
- Marine mammal research
- Environmental toxicology
- Marine bioengineering and bioacoustics

Research Foci
- Hawaiian marine species range
- Benthic habitat mapping for the Hawaiian Archipelago
- Marine mammal acoustics
- Sensors for ocean fauna
- Coral diseases, coral physiology, and biogeochemistry
- Aquaculture

Faculty 24, 15 of whom are tenured or tenure track

Students 50-60 graduate students

Degrees Offered MS and PhD through academic departments of Zoology, Oceanography, Botany, Microbiology, and Molecular Biology and BioEngineering

Facilities
- Functional Genomics Laboratory
- Isotope Laboratory
- Nutrient Analysis Laboratory
- Running Seawater Facilities
- Dolphin Holding Facilities
- Marine Lagoons
- Wave Flume Laboratory
- Coral Rearing Facilities
- LC Mass Spectrometer

Notable Service
- Jo-Ann Leong: Chairperson, Board of Directors, Center for Tropical & Subtropical Aquaculture
- Paul Nachtigall: U.S. Marine Mammal Commission’s Federal Advisory Committee on Acoustic Impacts on Marine Mammals
- Paul Jokiel: Coral Reef Assessment and Monitoring Program
Hawai‘i Natural Energy Institute

The Hawai‘i Natural Energy Institute (HNEI) develops renewable energy resources and technologies to reduce Hawai‘i’s dependence on fossil fuels. HNEI conducts basic and applied research, and fosters development of public-private partnerships to address critical energy and environmental problems.

The Hawai‘i Natural Energy Institute (HNEI) is a research unit created by the Hawai‘i state legislature in 1974 to develop renewable energy resources and technologies to reduce the state’s dependence on fossil fuels.

**People**
The Institute is home to about 25 faculty and technical staff, 15 post-doctoral researchers and visiting scholars, and 8 graduate assistants. It is home for the Hawai‘i Fuel Cell Test Facility, Biofuels and Fuels Processing Lab, Renewable Resources Research lab, Thin Films Lab, and Electrochemical Power Systems Laboratory.

**Research at HNEI**
HNEI conducts research on a wide variety of topics including biofuels, bioenergy, fuel cells, ocean resources, thin film technology, and battery/vehicle testing. Within these programs are projects working to develop cost-effective technologies for renewable hydrogen production. There are also programs aimed at accelerating acceptance of developing energy technologies. HNEI’s technology validation and system integration programs often include partnerships involving local and national industry as well as our local energy office under DBEDT. A final program area addresses resource analysis and energy policy issues.

Specific areas are outlined below:
- **Biofuels.** Emphasis is on high-value products and fuels from biomass. Specific projects include hydrogen production from biomass and a patented process with a commercial-scale reactor on campus that is demonstrating charcoal production.
- **Bioenergy from Bacterial/Microalgal Systems.** Projects include oil-bearing microalgae, fermentation hydrogen production, production/extraction of bio-oils from microalgae/yeast/oil seeds, and ethanol oxidation in enzyme fuel cells.
- **Fuel Cell and Fuel Cell Systems Technology.** Key is the Hawai‘i Fuel Cell Test Facility, a 4000 sq ft unit with 8 test stands, including Hardware-in-Loop capability, on-site hydrogen generation/storage, and on-line gas analysis. Efforts include fuel cell durability and fuel purity studies, assessing biocarbon fuel cells, developing a benthic biological fuel cell, and capability for producing membrane electrode assemblies.
- **Ocean Resources.** Significant emphasis is on deep water methane hydrates (a huge hydrocarbon reservoir). Work includes field/lab studies, modeling to develop recovery methods and plot environmental impacts, and international collaboration. More recently, HNEI was selected by the US Department of Energy to establish one of two National Marine Renewable Energy Centers. The primary objectives of the Hawai‘i center will be to facilitate the development and implementation of commercial wave energy systems for use in Hawai‘i and elsewhere in the world, and to help in moving ocean thermal energy conversion systems beyond proof-of-concept to pre-commercialization. HNEI anticipates working closely with the local utility, other government agencies and its industrial ocean technology partners.
- **Thin Films Technology.** Specialized films have been developed for photovoltaics, hydrogen production, and optical sensors. HNEI is a pioneer in patented development of photo-electrochemical systems for making hydrogen from sunlight.
- **Battery and Vehicle Testing.** This area studies advanced batteries, ultracapacitors, and fuel cells. Lab evaluation plus computer simulations help develop power source systems for energy storage and conversion applications.
- **Technology Deployment, System Integration, Resource Analysis and Energy Policy.** The aim is to accelerate renewable energy implementation/acceptance, using partnerships with federal, state, and local governments plus utilities and energy equipment companies, greater penetration of renewable resources is facilitated, reducing dependence on fossil fuels. Energy analysis
HNEI at a glance

Founded 1974

Research Fields
Fuel cells
Hydrogen
Biomass
Ocean resources
Photovoltaics
Battery and electric vehicles
Biotechnology

Research Foci
PEM fuel cell testing and development
Bio-fuel cells
Hydrogen from renewable resources
Hydrogen energy infrastructure
Biocarbon production
Liquid and gaseous biofuels production
Biotechnology for energy applications
Methane hydrates
Energy policy and security

Faculty 19, 9 of whom are tenured or tenure track

Significant Honors
Michael J. Antal, Jr. Coral Industries Professor of Renewable Energy Resources

Facilities
Biomass and Fuels Processing Laboratory
Electrochemical Power Systems Laboratory
Hawai‘i Fuel Cell Test Facility
Ocean Resources and Applications Laboratory
Renewable Resources Research Laboratory
Thin Films Laboratory

deals with using renewables for electricity to the local grid and overcoming barriers. Public policy reviews and outreach programs combine to ensure linking technologies with state/federal policy and regulations. The latest project is a $14 million grant to demonstrate reduced peak electricity demand plus provide reliable and stable electricity with increased renewable resources.
Hawai‘i Undersea Research Laboratory

HURL is a cooperative research program between the University of Hawai‘i and the U.S. National Oceanic and Atmospheric Administration (NOAA). It serves as one of the national laboratories constituting NOAA’s Undersea Research Program, and is the National Undersea Research Center for Hawai‘i and the Western Pacific.

The Hawai‘i Undersea Research Laboratory is a cooperative program between the U.S. National Oceanic and Atmospheric Administration (NOAA) and the University of Hawai‘i. The lab serves as a seagoing operational research element of SOEST.

People and Equipment
It operates two deep diving (2,000m) submersibles, a remotely operated vehicle, a multi-beam mapping system and a range of associated sea-going instrumentation. The lab also has a Data Department that houses one of the largest annotated underwater video collections in the Pacific (approx. 8000 hours). This collection is fully annotated and electronically searchable. The lab has a staff of 20 and a budget of $3–4 million per year.

Research at HURL
Research services are both contracted for the use of the laboratory’s deep diving submersibles and awarded through a competitive proposal process using NOAA funds. The research administered by the lab is typically focused toward NOAA-related priorities. Perhaps the most significant of these is in ecosystem management. This includes studies of deep water coral, fisheries management issues such as marine protected areas, and fisheries recruitment issues in various habitats. Other areas of research specialization include volcanic systems and hazards. The submersibles are well suited to investigate extreme environments, such as hydrothermal vents, which have been routinely sampled for micro-organisms. A recent area of success has been in marine archeology.

Perhaps the lab’s most famous discovery was the wreck of the Japanese Midget Submarine, which led the December 7th attack on Pearl Harbor in 1941. This highly advanced two-man submarine was sunk by the USS Ward an hour and 15 minutes before the aerial attack began. The discovery of this wreck in 2002 by HURL validated the claim by the USS Ward to have fired the first shot, given warning of the impending attack and sunk the first enemy vessel of World War II in the Pacific. In 2005, HURL also found the wreck of the world’s largest diesel electric submarine. This highly innovative Japanese aircraft carrying submarine, the I-401, was intended for a 1945 unrealized attack on the Panama Canal. HURL organized and led a five-month diving expedition in 2005 to look at the Kermadec volcanic arc north of New Zealand. This expedition involved four countries and 12 universities and research institutes. The giant undersea volcanoes of this arc have unique ecosystems, spew out large amounts of greenhouse gases, and form the very active eastern margin of the tectonic plate that generated the December 26, 2004 tsunami. This was the first comprehensive submersible expedition to this volcanic arc. A return expedition is being planned.

Lō‘ihi Seamount, the next Hawaiian Island, has been an area of ongoing research focus. A new bacteria, Idiomarina loihiensis, was collected in a pressurized heated sampler developed by HURL. Its genome was fully characterized using the Maui supercomputer. The bacteria can survive hydrothermal vent temperatures and extreme pressures. It has considerable potential for genetic engineering applications in pharmaceuticals and industrial enzymes. Lō‘ihi is also actively studied for clues to the growth of Pacific volcanic islands and their potential for landslide and tsunami generating events.

The new Northwestern Hawaiian Islands National Marine Monument, Papahānaumokuākea, will be an upcoming focus of HURL dives. HURL has already identified at least 17 new species of deep sea corals in the monument, has documented their major genetic diversity compared to shallow corals, and has proved that they are key habitats for many fish and other animals, including the endangered monk seals. With two of only nine deep diving submersibles in the world and the ability to work in tandem on the bottom, SOEST has the capacity to open new deep sea areas and conduct groundbreaking research that cannot easily be done elsewhere.
HURL at a Glance

Founded 1980

Research Fields
Ecosystems
Deep sea geological processes
Deep water corals
Fisheries
Environmental change
Marine biotechnology
Marine archeology

Research Foci
Submersible-based research
Instrument development and video production

Faculty 20 staff, including nine faculty who are members of the departments of Ocean and Resources Engineering and Oceanography

Students Two to five graduate students

Degrees Offered MS and PhD degrees are offered through the Departments of Oceanography and Ocean and Resources Engineering

Significant Honors
NOAA recognition award for the discovery of the wreck of the Japanese Midget Submarine which led the Dec. 7, 1941, attack on Pearl Harbor

Facilities
Submersibles Pisces IV and Pisces V
1000 m ROV, towed camera system, CTD
Multibeam mapping system
Bathymetric analysis lab
Data facility and full service video lab

Notable Service
Staff serve in senior advisory capacities to the state of Hawai‘i (Kelley) and U.S. Department of the Interior (Wiltshire)
In spring 1997, Japanese Prime Minister Hashimoto and US Vice President Al Gore recognized that environmental challenges facing humanity from global change would benefit from a long-term research partnership between Japan and the United States and added climate research to the “Japan – United States Common Agenda for Cooperation in Global Perspective.” This governmental directive became a reality in October 1997 with the establishment of the International Pacific Research Center (IPRC) at the School of Ocean and Earth Science and Technology on the Mānoa Campus of the University of Hawai‘i.

The IPRC has grown to become a leading climate research center with its own parallel computing facility. It employs over 40 scientists from around the world and hosts dozens of scientific visitors each year.

Funding is through a unique partnership among the Japan Agency for Marine-Earth Science and Technology, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and the state of Hawai‘i.

Research at IPRC
Research at IPRC aims to improve understanding and prediction of the variations in the climate system on a wide range of space and time scales, including long-term climate trends. Most research is conducted through analysis of existing data sets from satellites and other observing systems, and through the application of computer model simulations of the climate system. The emphasis is on studying aspects of the climate system directly relevant to the Asia-Pacific region. One focus is on understanding key phenomena rooted in the tropical ocean and atmosphere system, such as the El Niño–Southern Oscillation, monsoon circulations, interannual variability in the Indian Ocean, intraseasonal oscillations of the tropical atmosphere, and tropical cyclones.

Other important issues being researched include the nature of decadal variations in the extratropical North Pacific Ocean and the dynamics of the very strong Kuroshio and Oyashio ocean currents in the western North Pacific. Concerns about human-induced climate change are addressed through modeling studies of past climate and through assessment of model predictions for future trends in climate, including the climate change outlook for Hawai‘i.

Service
The IPRC provides direct service to the general public and the specialized scientific research community through its Asia-Pacific Data Research Center (APDRC). The APDRC maintains a public web interface that allows oceanic and atmospheric data sets to be conveniently examined and downloaded. The nearly 100 data sets available range from current weather forecasts for the Hawaiian region, which are updated twice a day, to extensive collections of oceanic observations that have resulted from many years of specialized research cruises, to archives of long climate simulations conducted with computer models. The APDRC also undertakes data-intensive research activities that both advance knowledge and lead to improvements in data preparation and data products.
IPRC AT A GLANCE

Founded 1997 under the US-Japan Common Agenda for Cooperation in Global Perspectives

Research Fields
Indo-Pacific Ocean climate
Regional ocean influences
Asian-Australian Monsoon System
Impacts of global environmental change
Asia-Pacific Data-Research Center

Research Foci
Air-sea interactions
Satellite data analysis
Regional climate modeling
Model development
Climate variability
Ocean dynamics and circulation
Monsoon modeling
Data-product development and data-serving and archiving

Scientists
Nine tenured faculty with joint appointments in Departments of Oceanography or Meteorology; and approximately 30 researchers and postdoctoral fellows

Facilities
The IPRC Parallel Computing Facility

Significant Honors
Kevin Hamilton: Meisinger Award of the American Meteorological Society (AMS) and Fellow of the AMS
Julian McCreary: Fellow of the AMS and American Geophysical Union, Sverdrup Gold Medal
Bin Wang: Fellow of the AMS
Axel Timmermann: Rosenstiel Award
Shang-Ping Xie: Medal of the Meteorological Society of Japan

Notable Service
Kevin Hamilton: President, International Commission for the Middle Atmosphere
Axel Timmermann: Chair, CLIVAR Pacific Panel
Bin Wang: Co-Chair, CLIVAR Asian-Australian Monsoon Panel
The Joint Institute for Marine and Atmospheric Research (JIMAR) is a cooperative institute created by the National Oceanic and Atmospheric Administration (NOAA) and the University of Hawai‘i at Mānoa in 1977. JIMAR conducts the research necessary to properly understand and predict the changes in the Indo-Pacific environment and to conserve and manage coastal and marine resources in the US-Affiliated Pacific Islands with a special emphasis on the Hawaiian Islands, for purposes of meeting the Nation’s economic, social, and environmental needs in these regions.

People

JIMAR Fellows come from both the University of Hawai‘i and NOAA. The primary NOAA partners are NOAA Research (especially the Pacific Marine Environmental Laboratory, the Atlantic Oceanographic and Meteorological Laboratory, and the Earth System Research Laboratory), NOAA Fisheries, and the National Weather Service.

JIMAR scientific and support staff include approximately 230 individuals, 2/3 of whom are employees of the Research Corporation of the University of Hawai‘i. Included in these staff are both graduate research assistants and undergraduate student assistants.

Primary funding is through grants from NOAA line offices and competitive grants programs. In special cases, JIMAR accepts grants from other federal, state, and international agencies.

Research at JIMAR

JIMAR research follows six broad themes which were mutually determined by the University and its NOAA partners: tsunamis and other long-period ocean waves, equatorial oceanography, climate, fisheries oceanography, tropical meteorology, and coastal research.

At any given time, JIMAR scientists are engaged in approximately 60 discrete scientific projects. Some featured activities include:

• The UH Sea Level Center (UHSLC): Established as part of the Tropical Ocean Global Atmosphere (TOGA) program, UHSLC maintains coastal tide gages throughout the Pacific and Indian Oceans. While primarily designed for study of equatorial oceanography and climate (El Niño/Southern Oscillation (ENSO)) these gages have real-time capability which renders them useful in tsunami detection and warning.

• The Pelagic Fisheries Research Program (PFRP) supports individual research projects on all aspects of the Pacific pelagic fisheries. Research spans physical sciences, reproductive biology, genetics, sociology and economics. PFRP works closely with NOAA Fisheries and the Western Pacific Fisheries Management Council.

• The Pacific ENSO Applications Center (PEAC) prepares experimental climate forecasts for the US-Affiliated Pacific Islands. PEAC is a collaboration among JIMAR, the UH Department of Meteorology, the National Weather Service Pacific Region, University of Guam, East-West Center, and the UH Social Science Research Institute.

• The Sustaining Healthy Coastal Ecosystems Project is a collaboration between the Pacific Islands Fisheries Science Center’s Coral Reef Ecosystems Division (CRED) and UH/JIMAR. CRED studies the coral reef ecosystems of all US-Affiliated Pacific Islands.
JIMAR at a Glance

Founded 1977

Research Fields
- Tsunamis and other long-period ocean waves
- Equatorial oceanography
- Climate
- Fisheries oceanography
- Tropical meteorology
- Coastal research

Major Research Groups
- UH Sea-Level Center
- Pelagic Fisheries Research Program
- Pacific El Niño/Southern Oscillation Applications Center
- Sustaining Healthy Coastal Ecosystems

Faculty
- 25 Senior Fellows (12 UH faculty and 13 NOAA scientists)

Staff
- Between 220 and 230 scientific and support staff, including graduate research assistants and undergraduate student assistants
The University of Hawai‘i Sea Grant College Program (UH Sea Grant) is dedicated to achieving resilient coastal communities characterized by vibrant economies, social and cultural sustainability, and environmental soundness. These communities will be healthy and safe places for our citizens to live, work, and enjoy.

The University of Hawai‘i Sea Grant College Program (UH Sea Grant) supports an innovative program of research, education, and extension services directed toward the improved understanding and stewardship of coastal and marine resources of the state of Hawai‘i, Pacific region, and nation.

**People**

UH Sea Grant is part of a national network of 32 university-based programs that promote better understanding, conservation, and use of coastal resources.

As part of the University of Hawai‘i’s prestigious School of Ocean and Earth Sciences and Technology (SOEST), we partner with the National Oceanic and Atmospheric Administration (NOAA) to provide links between academia, federal, state, and local government, industry, and the local community.

**Research, Outreach, and Education at UH Sea Grant**

UH Sea Grant funds research and graduate and undergraduate education to support our mission of ensuring the overall health and sustainability of Hawai‘i’s coastal communities and coastal and marine resources.

We address diverse topics vital to human and environmental health through five Centers of Excellence:

- Center for Smart Building and Community Design
- Center of Excellence in Island Resiliency and Climate Policy
- Center of Excellence in Sustainable Aquaculture
- Center of Excellence in Sustainable Tourism
- Center of Excellence in Marine Education

UH Sea Grant focuses on the relevant issues and concerns of Hawai‘i’s coastal communities by:

- Addressing growth and development issues and their impact on the natural environment;
- Helping to preserve beaches and making them safer recreation areas;
- Supporting culturally-sensitive education that explores sustainable social-ecological interactions;
- Funding research that addresses natural hazard impacts on coastal communities, such as tsunami modeling;
- Assisting in the development of the first successful open-ocean aquaculture farm in the nation;
- Establishing the Hanauma Bay Education Program, which continues to engage more people than any other marine reserve in the state;
- Funding graduate, undergraduate, and post-doctorate education in support of the next generation of environmental resource professionals.

The interconnectedness of research, outreach, and education contributes to our program’s effectiveness.

UH Sea Grant funded research contributes to increased knowledge of the marine and coastal environment, and also builds human resources by supporting graduate students to assist in the research. This knowledge and skilled personnel are then transmitted to the community to address the needs of Hawai‘i’s coastal communities.

In addition, extension faculty provide the dynamic link between university-based research and island communities. By interacting closely with the communities in which they live and work, UH Sea Grant extension faculty are able to identify and present research and information in a manner that is most relevant to their specific communities.
UH Sea Grant at a Glance

Founded: 1967

Research Fields:
Ocean and Earth sciences
Social sciences
Design sciences

Research Foci:
Safe and sustainable seafood supply
Sustainable coastal development
Healthy coastal ecosystems
Hazard resilience in coastal communities

Students: 30–40 graduate students and 20–30 undergraduate students

Significant Honors:
UH Sea Grant Ranked Tier 1 of all SG Programs Nationwide
Four NOAA Environmental Hero Awards
UH Sea Grant: Marine Environmental Stewardship Award
Hanauma Bay Education Program: Hawaii’s 15th Annual First Lady’s Outstanding Volunteer Award and Chevron Conservation Award
Reef and Shore Fishes of the Hawaiian Islands by Dr. John E. Randall: Ka Palapala Po'okela Book Award of Excellence in Natural Science for
Kuhio Beach restoration project: American Shore and Beach Preservation Association’s Best Restored Beach Award
Psychologically Healthy Workplace Award by the Hawaii Psychological Association

Facilities:
Hanauma Bay Education Program exhibit center
Pacific Aquaculture and Coastal Resources Center
Windward Community College Freshwater Aquaculture Facility

Notable Service:
E. Gordon Grau, Stephen Meder: City Charter Commission
E. Gordon Grau: President-elect of the Sea Grant Association
Center for Microbial Oceanography: Research and Education

C-MORE is a multi-institutional Science and Technology Center, sponsored by the National Science Foundation, working for a more unified and complete understanding of the living ocean, with a special emphasis on microbial plankton diversity and dynamics. The center’s primary mission and unifying vision is expressed in the motto: Linking Genomes to Biomes.

The Center for Microbial Oceanography: Research and Education (C-MORE) was established in August 2006 as a National Science Foundation sponsored Science and Technology Center. The center is designed to facilitate a more comprehensive understanding of the biological and ecological diversity of marine micro-organisms. Life has its origins in the sea: the first living things were microbes. Marine microbes are the most abundant life forms on Earth, and everything about them is extraordinarily diverse: their structures, their genomes, their physiologies, and their ecological interactions with each other and with the rest of life on the planet.

As a global research information center working across disciplines, C-MORE brings together teams of experts—scientists, educators, and community members—who usually have little opportunity to interact, facilitating the creation and dissemination of a new understanding of the critically important role of marine microbes in global habitability.

People
With the University of Hawai‘i at Mānoa serving as the coordinating institution, C-MORE has about 100 team members at five Partner Institutions:

- Massachusetts Institute of Technology,
- Woods Hole Oceanographic Institution,
- Monterey Bay Aquarium Research Institute,
- University of California at Santa Cruz, and
- Oregon State University.

UH Mānoa contributes eight faculty members and about 31 other science and education personnel (including support staff, graduate and undergraduate students, and post-doctoral scholars). C-MORE is proud to have four faculty, including center director David Karl, who are members of the National Academy of Sciences.

Research at C-MORE
Center Research Programs are organized around four interconnected themes:

I Microbial biodiversity. Theme I is focused on all aspects of marine microbial diversity. It centers on cataloguing, categorizing, archiving, and interpreting microbial diversity in the living ocean system. It is tightly integrated with C-MORE’s other central Themes.

II Metabolism and C-N-P-energy flow. Theme II is critical for identifying and quantifying key microbial biological functions and chemical transformations that need to be monitored routinely in the oceans, and that can be incorporated in predictive models of the ocean’s roles in the biosphere.

III Remote and continuous sensing and links to climate variability. Theme III goals are to develop and apply new, and use existing, autonomous sensor systems so that C-MORE investigators can remotely and continually assess bulk biological, chemical, and physical properties of study sites in a sustainable manner while measuring whole community metabolic rates and detecting specific genes and gene products. Observations and models are then used to generate hypotheses, and the capability for testing these hypotheses in situ is developed.

IV Ecosystem modeling, simulation, and prediction. Theme IV involves a hierarchy of models that link information and knowledge among research thrusts to provide an understanding of the role of microbes in the ocean ecosystem. One of the central hypotheses C-MORE researchers are investigating is that inclusion of
a more representative collection of functional microbial groups within food web models will allow us to address fundamental issues in marine science that have not been resolvable with existing models.

**Education and Outreach**

Center Education Programs are directed toward increasing the understanding and appreciation of microbial oceanography. In doing so, we promote increasing knowledge and awareness of ocean microbes, their key roles in ocean processes, and their essential roles in the habitability and sustainability of life on Earth. Activities range from K–12 curriculum enhancements and outreach (including opportunities for teacher training in the lab, the classroom, and at sea) to a variety of undergraduate, graduate, and post-doctoral programs to prepare the next generation of microbial oceanographers.
The SOEST Open House is a biennial two-day extravaganza of entertaining and educational activities, displays, and demonstrations showcasing the extraordinary research activities of SOEST personnel in the ocean, earth, atmospheric, and space sciences. It is a celebration of the excellence and innovation that the school’s faculty, staff, and students represent.

Visitors to our facilities learn about volcanoes, tsunamis, global climate change, El Niño, planetary exploration, hurricanes, coastal erosion, marine ecosystems, and more, through interactive demonstrations, videos, and posters. They visit some of the world’s most advanced laboratories and learn about the latest scientific ideas and technologies from the scientists themselves: the men and women who do the work.

Friday is structured around groups of K–12 students, with thousands of students from all over O’ahu attending. Saturday is more informal, with many students returning with their families. SOEST personnel can also take that day to bring their own children so they can learn more about what mom and dad do.

As they participate in the Open House, SOEST faculty, staff, and students share their knowledge and enthusiasm with the next generation of researchers and educators.