Now in its 25th year, the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawaii at Manoa (UHM) is a world-class research and academic institution. SOEST activities focus on informing solutions to some of the world’s most complex issues, including water, energy and mineral resources, geohazards and environmental/climate change. Through an integrated, comprehensive, and sustained system of Earth and planetary observations, undergraduate and graduate education, and “research that matters”, SOEST staff work to transform the way people live on Earth and to enable a healthy public, economy, and planet.

1.1 Research

Located in the heart of the Pacific Ocean, SOEST facilities provide convenient access to active volcanoes, deep ocean habitats, vibrant coral reefs, and the most isolated terrestrial ecosystems in the world. SOEST faculty and staff are recognized as international leaders in research, innovation, and education on topics as varied as renewable energy, oceanography, coral reef ecology, volcanology, remote sensing, cosmochemistry, tropical meteorology and climate modeling.

SOEST is the research powerhouse of the University, generating fully one third of the total extramural funding received at UH Manoa. The School is operational 24/7/365, with programs and people across all the Hawaiian Islands and
around the globe. The School currently employs over 870 people, including about 190 faculty, 510 staff (90 UH and 420 RCUH), and 170 graduate assistants. The total expenditures and encumbrances for FY 2012 were $145M; and $112M was received in new extramural grants and contracts, more than double that of one decade ago.

In addition to extramural success, SOEST faculty are leading the program that won the FY12-FY13 Office of the Vice Chancellor for Research and Graduate Education $1M sustainability research award: in Water Energy and Soil Sustainability (WESS). SOEST faculty work with community groups and agencies at local, state, and federal levels, to perform the fundamental research that underlies policy development in water quality, renewable energy, natural hazard management, climate change impacts, and sustainable ecosystems.

1.2 Education

SOEST faculty teach baccalaureate students in geology and geophysics, meteorology, and environmental sciences, and masters and doctoral students in geology and geophysics, meteorology, oceanography, marine biology, and ocean and resources engineering. With two large research and several coastal vessels, two submersibles, a deep-ocean cabled observatory, a satellite fabrication facility, a private island devoted to marine biology research, and dozens of other specialized laboratories, students within SOEST are trained on state-of-the-art facilities and mentored to “find their passion” by leading researchers and educators as much in the field and lab as in the classroom. The majority of graduate students are extramurally funded and all are paid at high steps on the UHM salary scale.

In the last decade, the rigorous B.S. degree in Global Environmental Sciences has developed a national reputation for preparing students for careers in the Ocean and Earth sciences. Fall 2012 inaugurated the graduate degree program in Marine Biology, joint between SOEST and the College of Natural Sciences. The Department of Geology and Geophysics has instituted an automated transfer of successful Associate Degree candidates from Kapiolani Community College and has in review a MGeo professional degree, proposed to begin Fall 2013. There remain some issues of articulation between SOEST undergraduate courses that formerly (pre-School) satisfied, but no longer fulfill, the core requirements of the four Colleges of Arts and Sciences - whose students comprise half the campus baccalaureate enrollment.

The US Bureau of Labor Statistics predicts that employment of geoscientists in the US will grow disproportionately, by 21% between 2010 and 2020 (Nature Geoscience, 5, 835, 2012). Worldwide, the number of qualified scientists is unlikely to meet demand (Nature 473, 243-244, 2011). SOEST has the capacity to help meet that demand by graduating more students but, as the geosciences are under-emphasized in high school (especially in the US), enrollment rates are simply too low for the expanding job market.
1.3 Organization and Administration

SOEST consists of four academic departments (Geology and Geophysics, Meteorology, Oceanography, Ocean and Resources Engineering), three organized research units (Hawaii Institute of Geophysics and Planetology, Hawaii Institute of Marine Biology, Hawaii Natural Energy Institute), and five specialized research and education programs (Center for Microbial Oceanography: Research and Education, Hawaii Undersea Research Lab, International Pacific Research Center, Joint Institute for Marine and Atmospheric Research, UH Sea Grant College Program). For further detail please reference the SOEST Organizational Charts included as supporting material to this document.

The heads of these units, together with the Dean, Associate Deans, and Director of Administrative Services, constitute the Executive Committee (EXCOM), which meets monthly. The EXCOM is the primary nexus of administrative oversight, decision-making and communication. The Research Council, the Education and Outreach Council, the annual all-faculty meeting, and various ad hoc topical retreats and workshops augment the EXCOM. At each of these venues, the University/Campus/School/Unit budget, priorities and values are openly discussed and reinforced, policy/procedure revisions are promulgated, and the need for refresher training may be identified (such as in recruitment, procurement, workplace issues, compliance, etc). In November 2012, the Dean created and filled a new position on the EXCOM: Director of Strategic Initiatives and External Relations.

Given its size, diversity and entrepreneurial spirit, SOEST maximizes the use of a wide variety of faculty types, including Instructional, Research, Specialist and Extension, as well as both UH and RCUH staff. Within the primary faculty types, varying proportions of each function may be expected. The SOEST biennial (recently triennial) review of all faculty uses a 25-point scale that takes into account the varying strengths and assignments of the faculty: a typical point distribution may be 10 for instruction, 10 for research and 5 for service. By agreement, this can change over time. Furthermore, many faculty appointments, both tenured and non-tenured, are fractionally supported extramurally. Faculty and staff are regularly reviewed and promoted, as per their respective union contracts, and bonus policies are executed. Tenure-track faculty hires are increasingly diverse with, for example, ~45% female recruitment in the last 7 years.

1.4 Vision and Strategic Plans

The **four-fold vision** of the School is to:

- Advance understanding of the Ocean, Earth & Planets through basic and applied research
- Provide world-class education
- Promote sustainable use of the environment
- Foster a high-tech economy
In taking up the challenge to fulfill this vision, SOEST faculty have executed **strategic plans** that have enormous societal relevance and immediate opportunities for implementation with our partners, focused around five priority areas: ocean observing, space flight, renewable energy, living marine resources, and natural hazards.

With Federal and State funding (including six new faculty positions from the Hawaii Legislature) and partnering with stakeholders, we stood up **PaciOOS**: a regional Ocean Observing System for Hawaii and the US-Flag and US-Affiliated Pacific Islands. This operational oceanographic service addresses ocean quality, safety, and productivity, and coastal resiliency, and delivers status and forecast products via the web [www.pacioos.org]. We also conducted seafloor surveys for proposed inter-island power cables, seawater air conditioning pipes, and corroding World War II era ordnance.

The **Hawaii Space Flight Lab** is a joint venture with the College of Engineering to build and launch small satellites (30-300 kg) into Sun-synchronous low-Earth orbits (altitude 300-550 km) from a rail-launcher at the Pacific Missile Range Facility on Kauai. First launch is scheduled for September 2013, using spin-stabilized solid-fuel rockets produced by Aerojet Inc. and integrated by Sandia. SOEST satellites will include hyperspectral imagers that can be used, for example, to monitor the global distribution and health of shallow coral reefs.

With its abundant natural resources yet >90% energy dependence on imported oil, Hawaii places high priority on developing **renewable energy** technologies. The Hawaii Natural Energy Institute is working on fuel cell and battery testing, thin-film semiconductors for solar systems, biomass gasification and flash carbonization, biodiesel, ocean thermal and wave power generation (also a focus of the Department of Ocean and Resources Engineering), water-energy-soil sustainability, gas hydrates, geothermal resources, and electric grid modeling and storage systems to permit increased penetration of renewables. Sea Grant has a center of excellence in Smart Building and Community Design.

**C-MORE**, an NSF Science and Technology Center, studies the biogeochemistry of marine microorganisms, which are the base of the multicellular food chain and responsible for respiration, carbon and nutrient cycling in the ocean. Although only in its 6th year, it is the most distinguished unit at UH. Partnering with the National Marine Fisheries Service and others, researchers at the Joint Institute for Marine and Atmospheric Research (JIMAR) conduct a large and diverse program in fisheries oceanography. **Marine ecosystem** research at the Hawaii Institute of Marine Biology focuses on coral reefs (gene flow, community structure and dispersal), top predators (tuna and sharks), sensory perception of marine mammals, and the scientific stewardship of Papahanaumokuakea Marine National Monument in the Northwestern Hawaiian Islands.

Hawaii’s exposure to **natural hazards** makes this a priority issue, but it has not enjoyed commensurate funding. Nonetheless, SOEST faculty study and forecast vog
distribution (highlighted on the evening news), beach safety (displayed each day in the Honolulu Star Advertiser), coastal erosion (forming the basis for revised coastal development policies), tsunami and storm surge inundation (used by Civil Defense for evacuation planning), hurricane and monsoon intensity (which affects the water supply of half the worlds population), and the effects of earthquakes and volcanic eruptions. New courses in natural hazards and climate change have been added to the curriculum. Hawaii is the only State without a Geological Survey. As such, SOEST and other UH partners play a significant role in informing environmental, climate and resource issues and policy for the State.

1.5 Budgets

For the last 5 years SOEST has operated in the midst of budgetary uncertainty at every level: Federal, State, University, Campus, and School. Despite the Augustine Report and the congressional promise to double the National Science Foundation budget, the enacted Federal multi-agency science budget has been basically flat, except for the ARRA stimulus. For the past 3 years, UH System President Greenwood and the Board of Regents have instituted a top-down rather than the former bottom-up budgetary process, without program input or change requests from individual Colleges/Departments. The results of a campus-wide 2009 prioritization planning process were shelved in the face of ballooning energy costs and State budget cuts during the recession.

Substantial State cuts to the FY10 University base budget were allocated unevenly between campuses by the President and, within the Campus, by the Chancellor: 0% to Hawaiian Knowledge, 6% to the four colleges of Arts and Sciences, vs. 12% to the rest, including SOEST. Within the School, central (Dean’s office and support) functions were cut preferentially to units but, even so, after the hiring freeze many faculty retirees could not be replaced. Former discretionary budgets of units and faculty have been virtually eliminated, with all funding sources [State General (G), Tuition (S) and Returned overhead (R)] being needed to meet (primary) salary and (lesser) operation costs. Some flexibility remains at the Deans level, largely from returned overhead and temporarily unfilled faculty/staff positions, but these are one-time rather than base funds. They are used for faculty start-up, grant cost match, salary bridging, shared-use equipment, professional development travel, and seeding new initiatives (such as the new 6km ROV).

Despite some loss of faculty positions, research success has led to expansion of laboratory and office requirements. This has been met, in part, by the $22.5M construction of the award-winning C-MORE Hale, plus a >$1M build-out of the second-floor lanai and mezzanine of the Marine Science Building, and some re-assigned spaces in the BioMed Building. Nevertheless, available space limits further growth, which is a campus-wide issue. The planned renovation of Holmes Hall, and the return of the Dole Street property and building after NOAA relocates NMFS to Ford Island, offers the prospect of new research space for expanding STEM fields, such as our renewable energy and space/satellite programs.
Sea Grant led a successful four-College proposal for the Chancellor’s “strategic” faculty cluster hire in sustainability (a cohort of 5 faculty in 5 Departments, including Oceanography, with 25% FTE each in Sea Grant) that were leveraged by two “opportunity” hires of Hawaiian scholars (one in Oceanography, one in CTAHR, both with 25% in Sea Grant). These and other Chancellor cluster hires are being funded by a 20% tax on the salaries of all retiring/leaving faculty campus wide.

Private fundraising is a nascent but important component of the SOEST budget, as private funds are often less restricted and support highly innovative activities. With a small alumni base, SOEST has an inverted pyramid of private donations (and their stewardship), dominated by large Foundation awards. SOEST maintains a good relationship with the UH Foundation and, with the recent hire of a Director of Strategic Initiatives and External Relations, the School is beginning to expand external partnering relationships with private donors and philanthropic foundations, while continuing to engage the broader community (Legislators, Agency personnel, community groups, peer and partner institutions) in an effort to ensure the invaluable work done by SOEST faculty and staff are understood, appreciated, and utilized by the community.

1.6 SWOT

Strengths:

- Incredible talent, expertise, and experience of School faculty, staff, and students, with a “can-do” (calculated risk-taking) culture and 24/7/365 operations.
- Location in the center of the Pacific Ocean, with easy access to active volcanoes, coral reefs, proximal deep-ocean, space launch facility, and natural energy resources.
- Major research funding and infrastructure, with a diverse portfolio and base of support.
- Strong international reputation and collaborative ties with Asia-Pacific partners.

Weaknesses:

- Deferred maintenance and renovation of some buildings and facilities.
- Risk-averse culture of System administration (i.e., procurement, contracts and grants, real property, risk management, legal) without regard to outcome-based metrics.
- Insufficient academic preparation of some incoming undergraduate students.
- Lack of input to annual UH budget development.
- Some areas of SOEST distinction are tied to a few faculty who are nearing retirement.
- Erosion of State-supported staff.
Opportunities:

- Diversity of talent within School provides opportunities to develop novel interdisciplinary programs and partnerships.
- Societal need for technological and scientific advances and a skilled workforce to address pressing issues related to renewable energy, fisheries, marine ecosystems, mineral exploration, environment/climate change, resource management and geohazards.
- Growth in undergraduate population through improved articulation with the four Colleges of Arts and Sciences and with other campuses in the UH system.

Threats:

- Budget uncertainty, including reliance on federal research support with changing priorities and UHM base budget.
- Hawaii's isolation and cost of living can make recruitment difficult.
- Lack of additional space and impact of proposed move of UH Marine Center.

SOEST is a wonderfully complex and innovative School, with a more diverse portfolio (including planetary sciences and renewable energy) than its peers such as WHOI, Scripps, UW and Lamont. It has proven a remarkable investment since its establishment in 1988, which has excelled to become a world-class research and academic institution. Like other Institutions within developed economies, it faces some tough challenges. Though, with some UH reinvestment to help recover from recent cuts, it has the capacity to develop and attract the best and the brightest, and to formulate creative solutions, for the benefit of all.