From the Ocean Floor to the

Scripps Institution of Oceanography 1970 to 1985

Edge of Space

SPURRED BY PRESIDENTIAL DECREE and a perceived threat from the Soviet Union, the space race superseded ocean exploration on the American science agenda during the Cold War. As a result, more is known today about the dark side of the Moon than the bottom of the sea.

"The conquest of space may be a great national or individual achievement, but it is not a part of the average man's world," said William A. Nierenberg, a distinguished physicist and the institution's seventh director, who is credited with launching oceanography into the Space Age.

During his 22- year tenure as director, Nierenberg brought new research and scientific innovations to Scripps in a concerted effort to fill gaps in researchers' knowledge of the oceans while acquiring satellite and computer technology to modernize the century-old science of oceanography.

"He was very quick to see the important developments in science on national and international levels, and he anticipated how these would impact oceanography," said Scripps archivist Deborah Day.

Above, *The Scripps Satellite Oceanography Facility.* **Left,** *William A. Nierenberg watches Mary Johrde of NSF during the dedication ceremony at the Nimitz Marine Facility.* **Below,** *R/Vs* Melville *and* Robert Gordon Sproul.

"This foresight led him to build programs that enabled Scripps to do research on the hottest topics of the day."

MORE SCIENCE FOR THE BUCK

To support the expansion of these programs, Nierenberg believed it was necessary to invest in buildings, equipment, research vessels, and technology. Throughout 1975, there was more building activity on campus than had occurred since the development of the UC San Diego campus in 1960. The institution's great expansion included the establishment of a new physical oceanography laboratory, called Norpax, to accommodate the multi-institutional North Pacific Experiment and the opening of what is now the world's most extensive marine-science library, housed in the Carl Eckart Building. Additionally, Hubbs Hall was opened, a massive new home for the Marine Biology Research Division, named in honor of Carl L. Hubbs, an eminent ichthyologist who established, at Scripps, one of the world's largest collections of marine fishes.

In 1979 the Satellite Oceanography Facility was opened, featuring a large dish antenna that lent high-tech prestige to the seaside institution. Building construction also included expansion on the east side of the main campus. Located on the hillside above the institution, the Physical Oceanography and Space Science Building was opened in 1984 with a sweeping view of La Jolla Bay and the Pacific Ocean. It was renamed Nierenberg Hall in 1988.

As director, Nierenberg demanded "more science for the buck." One way of achieving this was to rely more extensively on the new technology of remote sensing, rather than depending entirely on shipboard operations to obtain data. The Satellite Oceanography Facility was designed to receive much of this telemetry, including data about climate-related sea-surface conditions around the world.

In spite of these new innovations, then as now, there was simply no substitute for "surface-truth" data obtained at sea. Two ships joined the Scripps fleet during Nierenberg's era. In 1978, R/V *New Horizon* became the first oceanographic research vessel funded by the state of California, and in 1984 Scripps acquired R/V *Robert Gordon Sproul.* Sproul, who had been president of the University of California for nearly 30 years, attended the ship's dedi-

Left, *Inside the Scripps Satellite Oceanography Facility in the 1970s.* **Bottom,** *The Marine Physical Laboratory's remotely operated vehicle Deep Tow was used to collect data and images from the deep sea.*

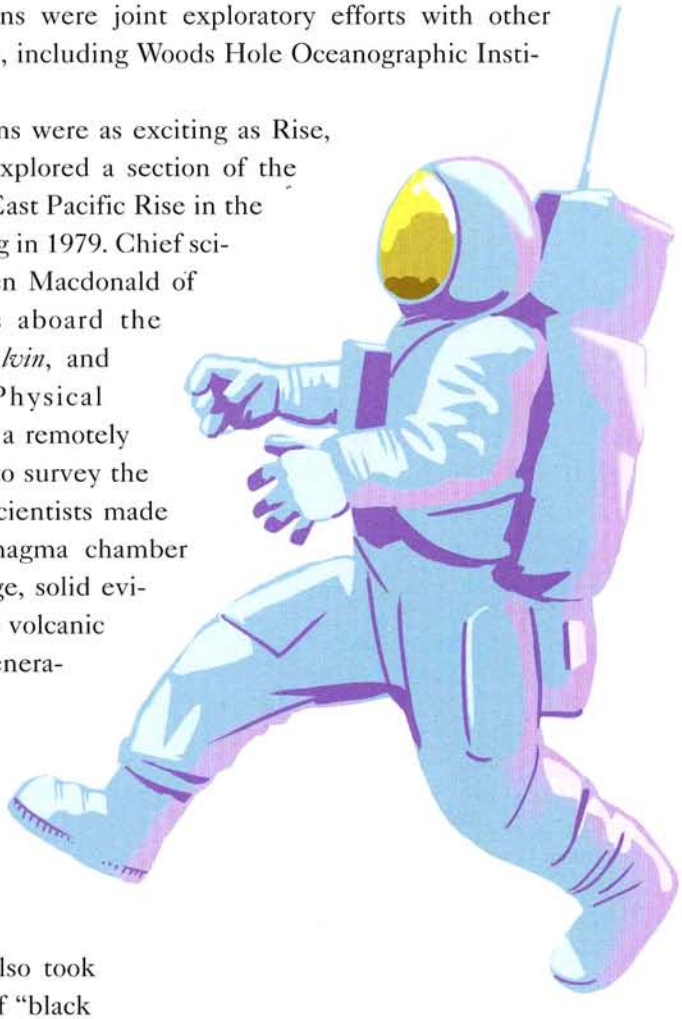
cation ceremony on Point Loma, near the Scripps campus.

The expanded Scripps fleet adopted computer technology and the latest in seafloor mapping capabilities. The new SeaBeam sidescan sonar enabled oceanographers to map wide swaths of the seafloor in real time as the ship made rapid headway across the ocean's surface. Since its introduction during Nierenberg's tenure, SeaBeam technology deployed aboard Scripps vessels, and those of other research universities, has been used to survey hundreds of thousands of square miles of seafloor, with an accuracy undreamed of in the early days of sounding with weighted lines.

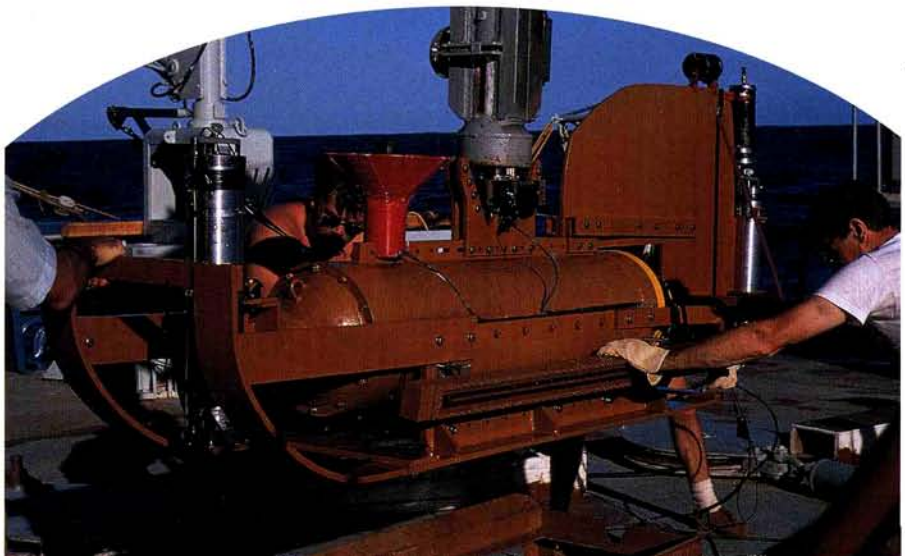
LOGGING MILES IN SEARCH OF ANSWERS

Between 1960 and 1980, Scripps vessels logged more than 2.3 million expedition miles. Research on many of the expeditions launched at this time, such as Lusiad, Nova, Quebrada, Antipode, Rama, and Protea, contributed enormously to the development of geological theories describing the composition and formation of the seafloor. Specifically, during the late 1960s and early 1970s, Scripps scientists gathered geological evidence supporting plate tectonics—the theory explaining that Earth's outer layer is composed of thin, rigid plates that are in constant motion to form volcanoes, mountains, and ocean basins. Several of these expeditions were joint exploratory efforts with other oceanographic organizations, including Woods Hole Oceanographic Institution (WHOI).

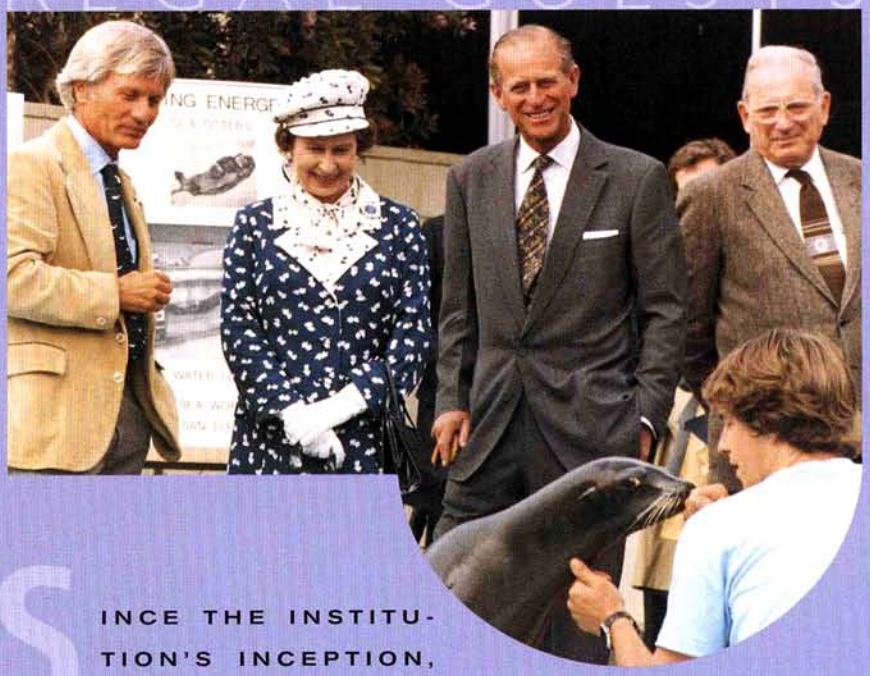
Perhaps few expeditions were as exciting as Rise, during which researchers explored a section of the mid-ocean ridge along the East Pacific Rise in the Gulf of California, beginning in 1979. Chief scientists Fred Spiess and Ken Macdonald of Scripps made excursions aboard the deep-diving submersible *Alvin*, and deployed the Marine Physical Laboratory's Deep Tow, a remotely operated vehicle designed to survey the seafloor in detail. Scripps scientists made the first discovery of a magma chamber beneath the mid-ocean ridge, solid evidence of the role submarine volcanic activity has played in the generation of new seafloor —a process key to plate tectonics.



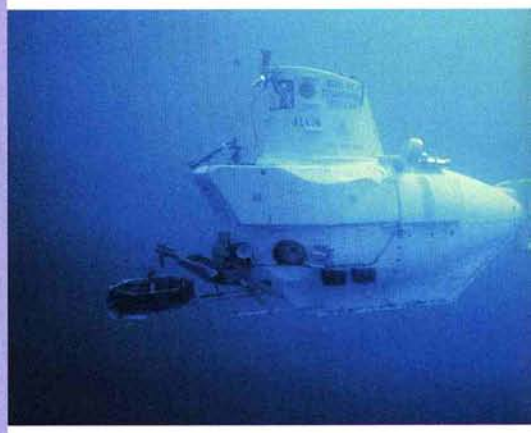
Staging from Scripps's R/V *Melville* and *Lulu* (*Alvin's* mother ship, operated by WHOI), Spiess and MacDonald also took the first-ever photographs of "black



REGAL GUESTS



Top left (left to right), *Scripps marine biologist Gerald Kooyman, Queen Elizabeth II, Prince Philip, and William Nierenberg.* **Bottom left,** *Nierenberg and Emperor Hirohito of Japan on a tour of the campus.* **Below,** *The deep-diving submersible Alvin.*



SINCE THE INSTITUTION'S INCEPTION, notable personalities, politicians, and renowned scientists have visited the Scripps campus as its reputation has grown worldwide. Two especially noteworthy visits occurred during William A. Nieren-berg's tenure as director: one by Emperor Hirohito of Japan on October 9, 1975, and another by Queen Elizabeth II of Great Britain on February 26, 1983.

The Japanese emperor and empress were on their first visit to the United States at the time, and it was at the emperor's re-quest that a tour of Scripps was arranged. A lifelong naturalist, Emperor Hirohito was a noted authority on hydrozoa, and had established a marine laboratory near Tokyo. He showed great interest in the biological specimens displayed for him at Scripps, one of which he took home as a souvenir. In his welcoming address, Nierenberg acknowledged the emperor's many scientific publications, some of which are in the Scripps library. The emperor humbly replied, "In my spare time away from official duties, I have been trying my hand at the study of marine biology."

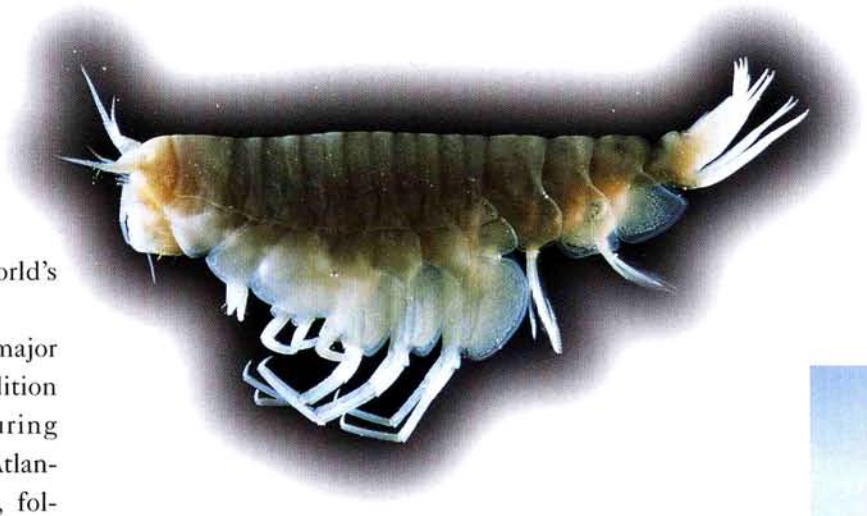
During the British royal visit, Queen Elizabeth was accompanied by her husband Prince Philip, an outspoken supporter of wildlife conservation. The two met with Scripps scientists, including those at the Phy-siological Resea-rch Laboratory, where studies were conducted on marine mammals. Biologist Gerald Kooyman introduced the entourage to one of his research subjects, a trained California sea lion. The institution's official gift to the royals was a volume of color photographs of nudibranchs prepared by Scripps biologist James Lance.

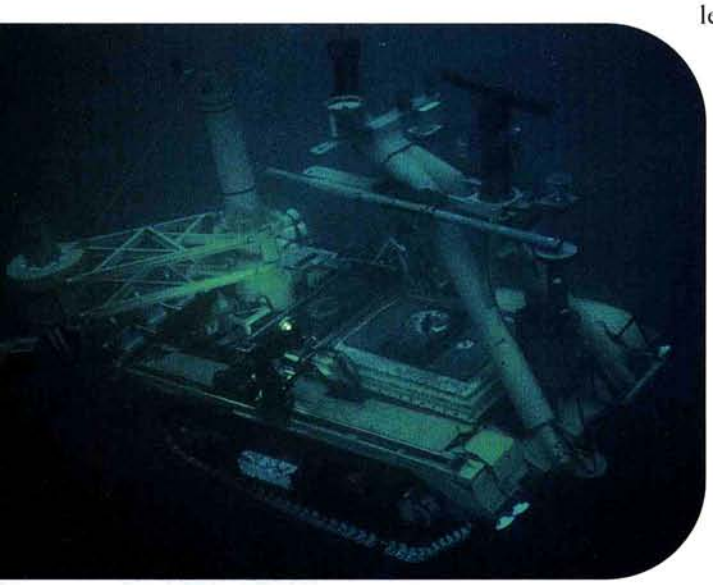
smokers," tall, chimneylike towers consisting of darkly colored minerals deposited by plumes of scalding volcanic waters emanating from the seafloor. The astounding black smokers stood amid a field of hydrothermal vents, the existence of which had only recently been confirmed by scientists, including Scripps geochemists Harmon Craig and Ray Weiss.

Craig and Weiss demonstrated that water rising from seafloor hot springs was the source of rare Helium-3 isotopes in the deep ocean. Craig spent much of his career seeking Helium-3 around the world and at the bottom of the sea. He was appointed by Nierenberg to represent Scripps on the executive committee of the multi-institutional Geochemical Ocean Sections Study (GEOSECS) project, launched in 1971 to map the geochem-

istry of the world's oceans.

The first major GEOSECS Expedition took place during 1972–73 in the Atlantic aboard WHOI's R/V *Knorr*, followed by the GEOSECS Pacific Ocean leg of 1973–74, which was one of the most technologically advanced oceanographic expeditions up to that time, according to participant Weiss. Scripps's *Melville* sailed 56,000 kilometers (35,000 miles), from the Bering Sea to the Antarctic, making thousands of instrument casts to determine salinity, temperature, and depth across broad expanses of the Pacific water column.





water temperature extremes and the absence of sunlight. This discovery captured the imagination of Scripps biologists Robert Hessler, Art Yayanos, and George Somero, among others, who each went on to make successful deep-sea retrievals of various living organisms.

Scripps and WHOI joined forces again on the East Pacific Rise for the 1982 Oasis Expedition. Diving aboard the submersible *Alvin* to an active seafloor volcano, Hessler collected the first specimens of a giant clam previously unknown to science. Despite the challenges associated with deep-sea specimen collection, Yayanos succeeded in retrieving live amphipods from the Marianas Trench, the deepest region in the world's oceans. Only the unmanned submersible bathyscaphe Trieste had ever visited these 10,000-plus-meter depths (33,000 feet), which it did only once, in 1960, at which time no attempt was made to bring back live organisms. Yayanos devised a special collecting device that maintained specimens under their natural conditions. With this innovation, he successfully transported abyssal creatures back to his laboratory to study the effects of temperature and pressure on their metabolic processes.

NEW LIFE FORMS

Along with the discovery of hydrothermal vents came the revelation that unimaginably vast communities of specialized organisms exist in the deep sea. These organisms somehow thrive amid the volcanic chemistry of black smokers and hydrothermal vents, unaffected by

THE SANDS OF TIME AND TIDE

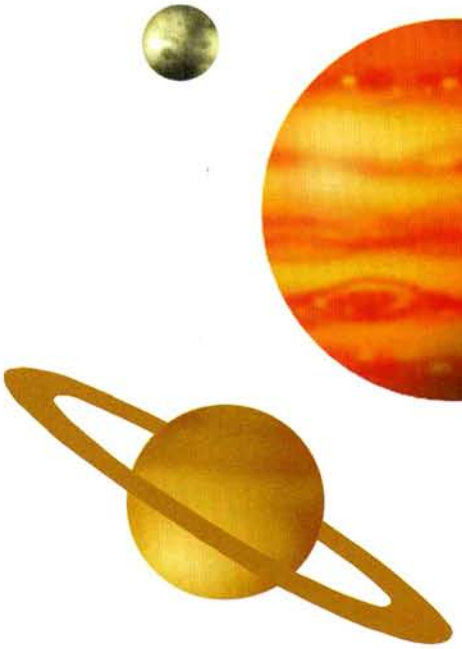
Not all Scripps research during the Nierenberg era was focused on the atmosphere, the deep sea, or the open ocean. The study of coastal

Left, *The remote underwater manipulator was a bottom crawler used to collect data and samples.* **Top,** *An amphipod collected from record depths by Scripps marine biologist Art Yayanos.* **Right,** *Scripps biologist Robert Hessler examines a seafloor specimen.* **Bottom,** *Giant tube worms thrive next to a "black smoker."*

THE NIERENBERG ROSES

DURING THE EARLY YEARS of UCSD's establishment and expansion, the university's groundskeepers preferred to plant only low-maintenance shrubbery. According to those who worked with him at the time, Scripps Director William A. Nierenberg decried the lack of color on Scripps's semiarid campus. An accomplished rosarian, Nierenberg wanted to plant a rose garden at the entrance to the director's office. Although UCSD's Physical Plant Services balked, in his typically persistent manner, Nierenberg pressed for a garden, insisting that he would pay for the plants and care for them himself.

As campus facilitator during this time, Jim Blattenberger made several trips to area nurseries in search of specific varieties and suitably healthy plants to accommodate the director's dream. Finally, in 1974, Nierenberg was able to step outside his office and attend to his beloved roses on a regular basis, often to the surprise of passersby. Zealously protective of the roses, Nierenberg was the only one allowed to cut any blossoms, and he vigilantly supervised their pruning and day-to-day care. The Nierenberg roses continue to bloom and thrive on the Scripps campus today.



processes, a program of research initiated at the institution during the postwar years, was expanded during the 1970s by the Shore Processes Study Group, directed by Douglas Inman, later known as the Center for Coastal Studies and now part of the Integrative Oceanography Division.

Inman, who served as a marine during World War II, developed an interest in wave–beach interaction while participating in amphibious operations in the South Pacific. Starting at Scripps in 1953 under mentor Francis Shepherd, and continuing with two subsequent generations of Scripps students and colleagues, Inman has spent more than 50 years deciphering the dynamics of wave action and sand transport along the southern California coastline.

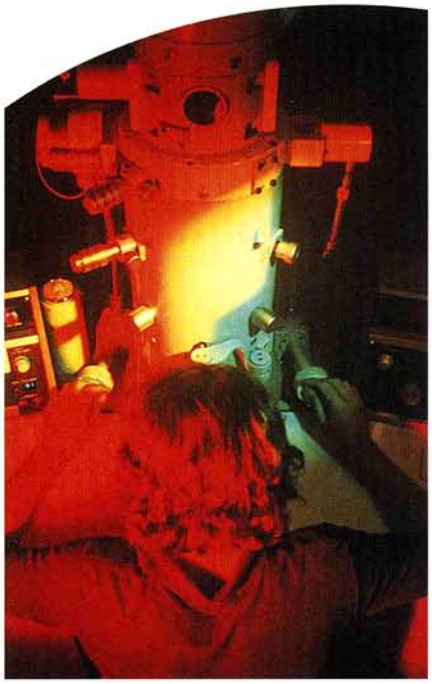
A CLIMATE FOR NEW RESEARCH

Nierenberg's experience as an advisor to the U.S. government on scientific issues pertaining to the oceans and atmosphere prepared him to lead the institution at a time when there was increasing awareness of environmental change and its impact on global climate. He edited a study for the government on the contribution of carbon dioxide to the greenhouse effect, acknowledging the influence of former director Roger Revelle's work on this frontier.

"Nierenberg is responsible for Scripps being seriously involved in the atmospheric science aspects of climate," explained Richard Somerville, the first professor of

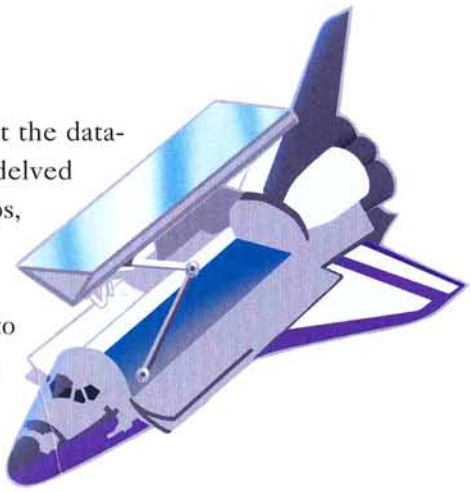
Above, *The T. Wayland Vaughan Aquarium-Museum opened at Scripps in 1950 and was a popular attraction for more than a generation.*

Right, opposite page, *A Pacific Islander participates in the North Pacific Experiment.*



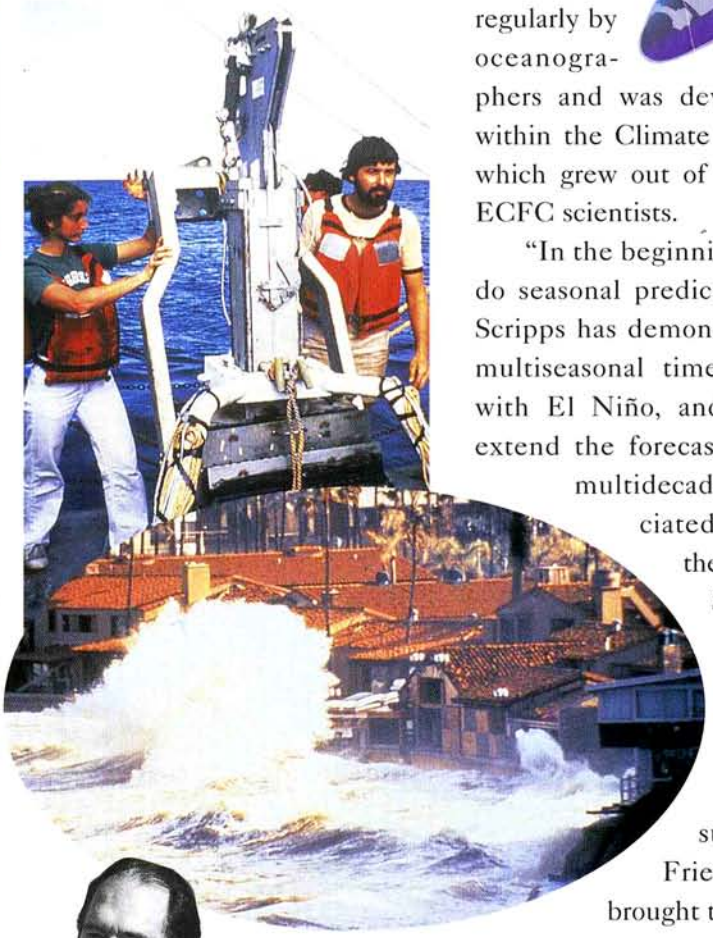
atmospheric science at Scripps. "He made the decision and committed the resources. Not everyone agreed, but he was convinced that climate was simply one of the best reasons for doing oceanography."

The Experimental Climate Forecast Center (ECFC) was founded under Nierenberg and included Somerville, meteorologist Jerome Namias, and climate scientists Tim Barnett, Dan Cayan, and John Roads. Once viewed with skepticism, the computer modeling conducted at ECFC flourished under Nierenberg.



Somerville enthusiastically reflects about the data-crunching that went on as the institution delved into climate modeling: "We didn't need ships, labs, or instruments to make field observations, but boy did we compute."

In fact, ocean modeling, a tool used to describe the physical dynamics of the oceans, is now used regularly by oceanographers and was developed at Scripps within the Climate Research Division, which grew out of the small group of ECFC scientists.

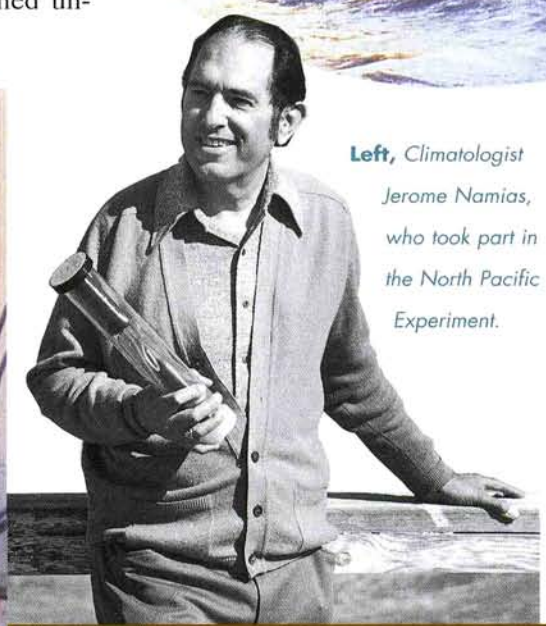


"In the beginning, we were able to do seasonal predictions at best. Now Scripps has demonstrated skill on the multiseasonal time scales associated with El Niño, and is attempting to extend the forecast range out to the multidecadal time scales associated with changes in the greenhouse effect," Somerville said.

A SECOND CENTURY OF DISCOVERY

In the words of his successor, Edward Frieman, "Nierenberg brought the institution to the forefront of modern science by spearheading innovative programs, initiating new technologies for oceanography, and recruiting outstanding staff and faculty."

Frieman, as Scripps's eighth director, would expand on Nierenberg's legacy by making the institution an important center for integrated global environmental research and a national resource for the converging interests of science and society.



Left, *Climatologist Jerome Namias, who took part in the North Pacific Experiment.*

A scanning electron microscope (top left) and a mechanical trap used for sampling the seafloor (top right) were among the new technologies developed for marine research during this era. **Above,** *A 1983 El Niño wave smashes into La Jolla.*