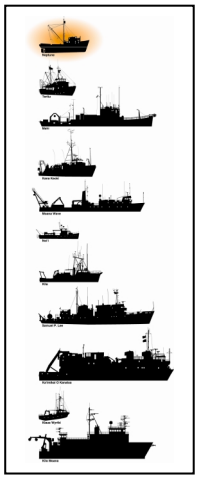
Chapter 13. The UH Fleet Assets (1962-2003)

"An oceanographic institution could not be operated to any advantage without a seagoing vessel."
Henry Bryant Bigelow
Founding director, WHOI
(1879-1967)


Bigelow at the wheel of the schooner Grampus (1912)

13.1. R/V *Neptune* (1962-1965)





The UH oceanographic fleet assets from 1962 to the present. The vessels shown at left are shown to approximate scale with R/V Kila *equal to 100 feet. The vessels are arranged chronologically in the order they entered the fleet. See subsequent sections for more detail. (design by N. Hulbirt)*

The most significant and joyous event in the history of the R/V *Neptune* (also known as *Neptune I*) was the announcement – in November 1965 – that it would be replaced with a more capable, modern vessel.

The 82-foot, diesel-propelled *Neptune* (Figure 13.1) was purchased by UH in 1962 for about $50 K, just as the new oceanography degree program was getting started (see section 4.5). The vessel was built on the west coast and operated as a purse seiner for the sardine industry before joining the UH "fleet." After a few years of service to the marine sciences community Robert Hiatt – then UH director of research – was quoted in a newspaper article, "she was not very capable of conducting open ocean research and needs to be replaced." Most users agreed.

The vessel eventually went to the highest bidder, R. R. Clark of Wilmington, California, who bought it for $12 K, to be used for scrap. At the time of the sale, Hiatt said the proceeds would be applied to the purchase of a replacement vessel – but he also realistically acknowledged that about $1 M in additional money would be needed to purchase a suitable oceangoing vessel. Locating this capital and justifying the need was a major challenge for the emergent marine expeditionary program at UH, and its leaders.

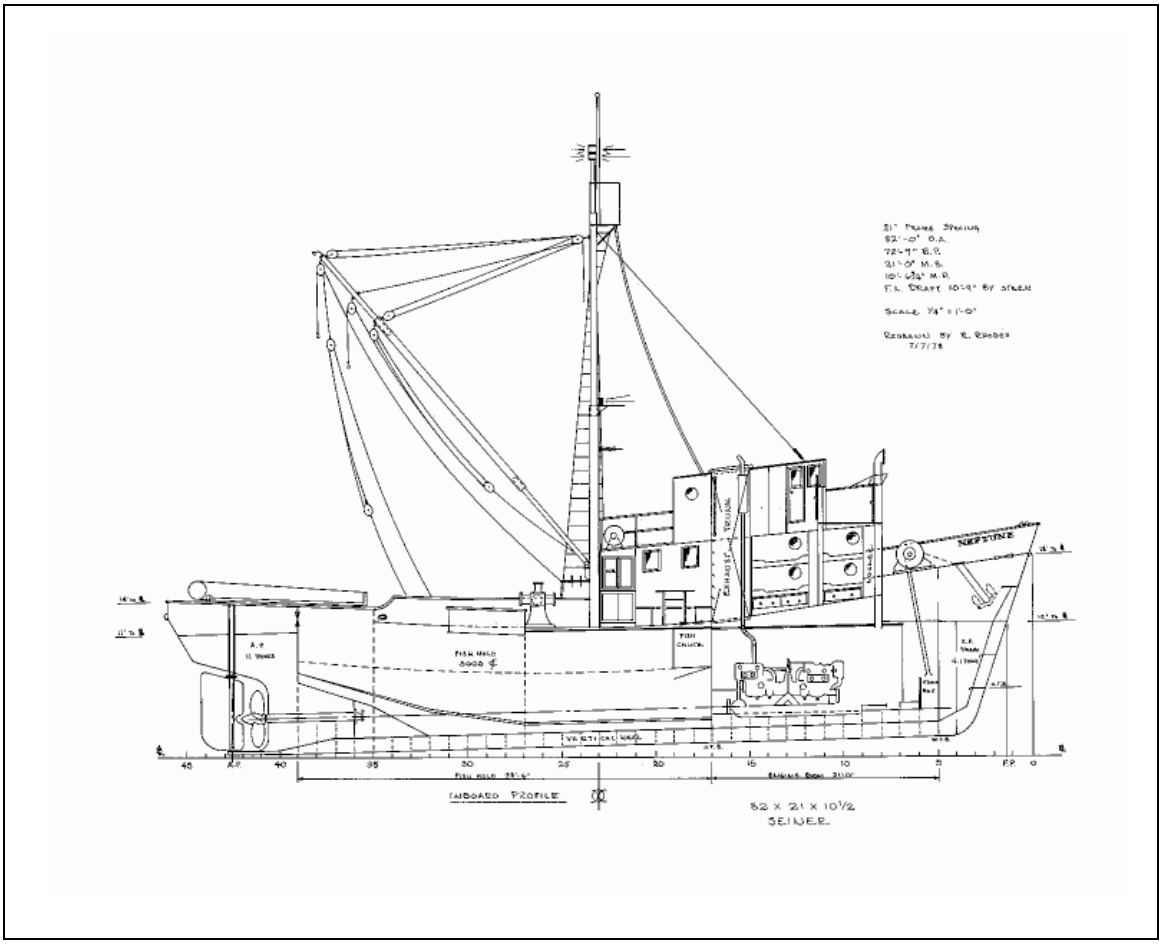
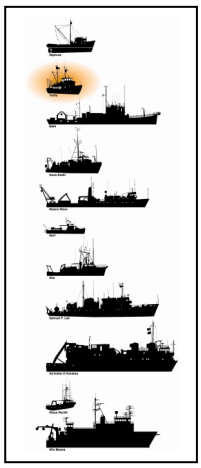


Figure 13.1: Drawing of the purse seiner *Neptune* circa 1962 when it became the "core" of the UH marine research fleet. (drawing by Richard Rhodes, HIG graphic artist; from SOEST archives)

13.2 R/V *Teritu* (1964-1974)





The R/V *Teritu*, a 136-ton, twin-screw, double-ended, steel motor vessel was built in Sanderborg, Denmark in 1953 as the yacht *Glenmore*. The design was by Kund K. Hanse, naval architect from Copenhagen.

The vessel was purchased by UH in April 1964 from millionaire A. A. Jergins of San Antonio, Texas (Figure 13.2). According to a 25 August 1965 article by Helen Altonn in the *Honolulu Star-Bulletin*, the University purchased the vessel for $145 K, considerably less than its value. UH – presumably research director Hiatt – had received a $400 K grant from NSF for acquisition and conversion of the yacht for oceanographic research.





Figure 13.2: Possibly one of the first "cruises" aboard the *Teritu* in May 1964, prior to its conversion to a research vessel. (from R. Brock, Sea Grant / SOEST)

The conversion of the 90-foot *Teritu* – from yacht to research vessel – began in June 1964. Once reconfigured, the vessel was powered by two GM 8V7IN diesel engines (228 HP each at 1800 RPM); cruising speed was 8 knots and range was 6000 nautical miles (Figure 13.3). In addition, the pilot house was raised to provide laboratory space forward, a gyro compass was installed, and a Markey Machinery Company DYSH-6 hydraulic trawl and coring winch was installed along with an "A" frame for deployment of nets, bottom samples, and other heavy gear. A small bathythermograph (BT) winch

and a second mast/boom were installed aft to handle lighter gear (up to 5000 pounds). A weather balloon / meteorology observations station was built on the 01-level. Two laboratories were constructed on the main deck. The main lab, under the raised pilothouse, was air-conditioned for use of electronic gear and specialized instrumentation. The aft lab was for processing water samples, i.e., a wet lab. The equipment inventory list included two Gifft model ESRTR-3B transceivers, a Beckman DU spectrophotometer, a Phleger corer, three Nakai type dredges, 24 Nansen reversing water bottles, an Alpine piston cover, a Hytech model 6210 salinometer, a Varian model V-4937 proton magnetometer, a Geomagnetic Electro Kinetograph (GEK), Watanabe Keiki reversing thermometers, plankton nets, and a Boston Whaler work boat. The galley and quarters for crew of nine was forward and air-conditioned quarters for a science party of six (3 two-person staterooms) was aft, below the main deck. For day trips, mostly education missions, the vessel accommodated 40 people. The layout of this vessel may sound spacious, even luxurious, but all those who have been to sea on a 90-foot, 136-ton research vessel with 15 other people realize how cramped these quarters must have been.

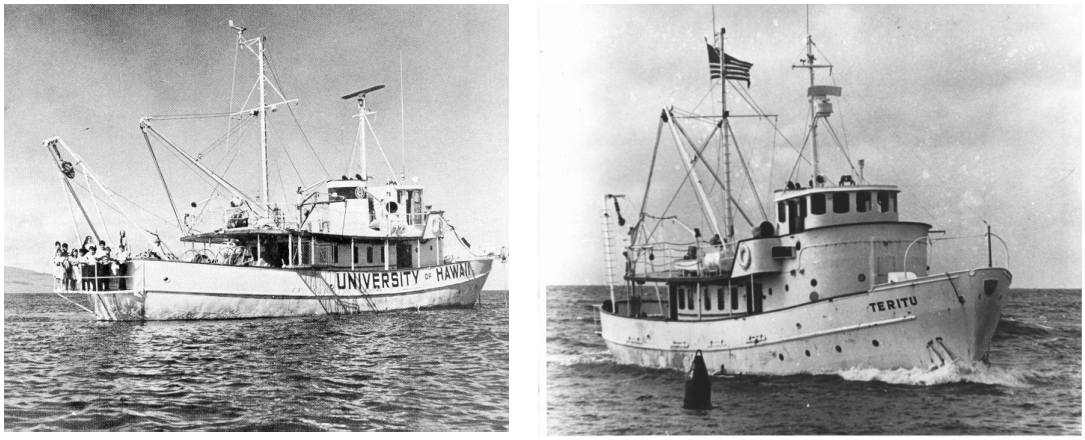


Figure 13.3: The R/V *Teritu*, after its conversion from yacht to research vessel, working in waters off Oahu circa 1965. (from SOEST archives)

Despite its relatively small size and support limitations, the R/V *Teritu* soon became a well-used and sought-after asset for field programs at UH. Only one year after being put into service, R/V *Teritu* was working more than 220 days per year in support of various research and education missions (Figure 13.4). At that time, the *Teritu* was considered "expensive" at about $600 per day; Lee O. Gregg served as the vessel's first master followed by William Schlotz

Port facilities in August 1965 consisted of a dock in Keehi Lagoon, but in mid-September the R/V *Teritu* was moved to Kewalo Basin near the site of the old "Marineland," and eventually to pier 18 (Figure 13.5). At the time the R/V *Teritu* entered the UH fleet it joined the decrepit R/V *Neptune* (see section 13.1). It was hoped that *Neptune* would be replaced with a more capable vessel, and that the new two-ship fleet would become the nucleus of the growing marine expeditionary center at Kewalo Basin.

The R/V *Teritu* was eventually replaced with the much more capable R/V *Moana Wave* in 1974. According to a reliable source, the R/V *Teritu* was sold to a religious organization that wanted to start a new country in the South Pacific. However, the vessel never sailed and instead was anchored for many years in Keehi Lagoon. The author was unable to determine its final fate.



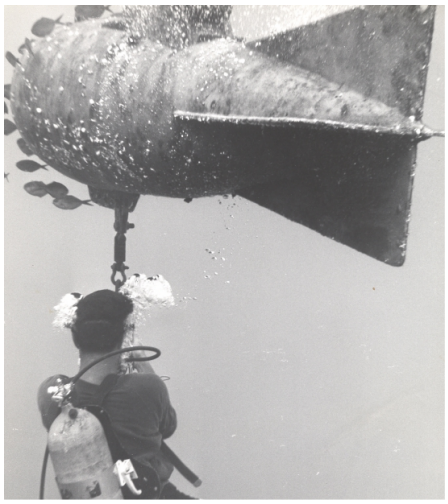
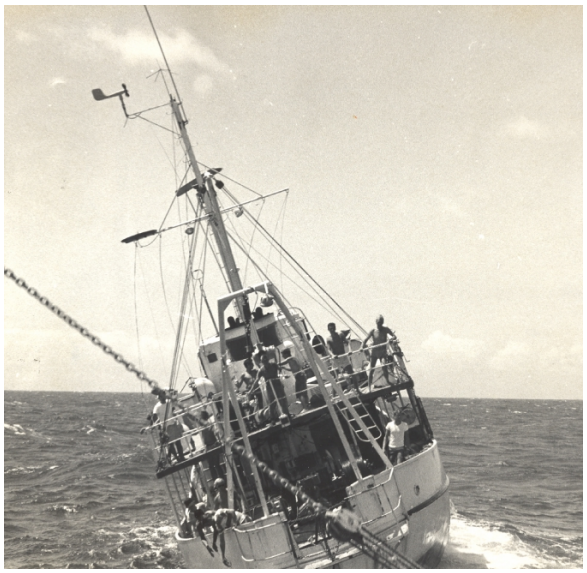




Figure 13.4: [Top] Deployment of a current meter off the stern of the R/V *Teritu* circa 1967. Underwater view of current meter, diver, and fish. (from the estate of Robert Harvey, courtesy of Steve Dang). [Left] A student training cruise aboard the R/V *Teritu* circa 1965; teaching assistant Jack Levitz on "hero platform" demonstrates the proper technique for stringing a Nansen bottle. (from SOEST archives). [Bottom] R/V *Teritu* in Kaneohe Bay circa April 1965 (photo by Ernst Reese)





R/V Teritu *on a "calm" day in June 1966, as seen from a more stable platform (from F. Campbell)*

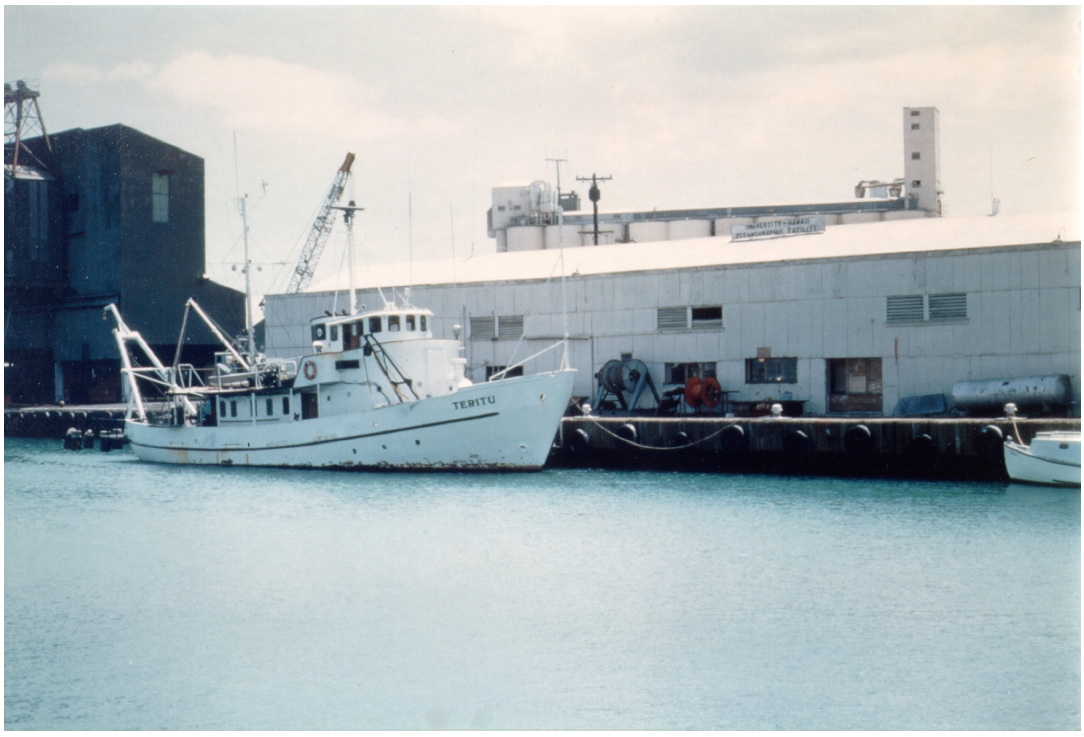
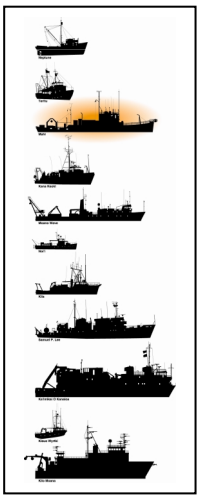
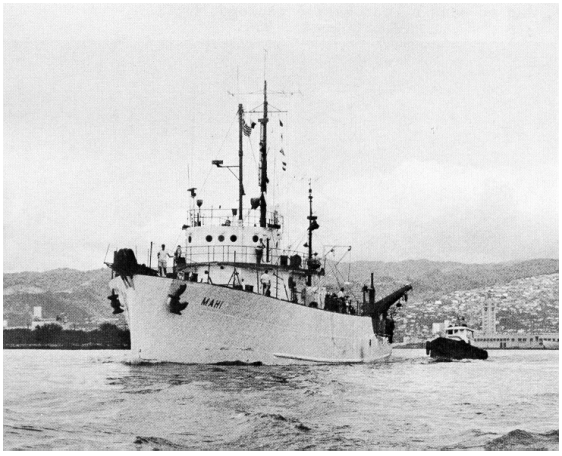


Figure 13.5: R/V *Teritu* at its berth at the UH marine expeditionary center – then located at pier 18 – circa 1971. The Marine Center consisted of a facing pier, shown above, and warehouse building behind. (from SOEST archives)

13.3. R/V *Mahi* (1968-1971)





The R/V *Mahi* joined the UH-HIG fleet in June 1968 on a charter agreement with the ship's owner, Dillingham Maritime Services in Honolulu. Dillingham Corporation had purchased *Mahi* in March 1968 and reconfigured it for research at the Dillingham shipyard in Honolulu. Despite having a Hawaiian name ("mahi" is the Hawaiian common name for the pelagic fish *Coryphaena bippurus*, also known as dophin (or dorado) fish; "mahi" also means strong or energetic) and home port of Honolulu, the vessel was registered in Nassau, The Bahamas. At that time, Richard Longfield – who would later become a key figure in UH marine programs – worked for Dillingham.

The R/V *Mahi* was a converted US Navy mine-sweeper, 186 feet in length and 800-ton displacement (Figure 13.6). According to marine technician Pierluigi Pozzi, "*Mahi* was the only vessel in the Pacific with four stacks – The Queen Mary only had three stacks!" This, presumably was a holdover from the vessel's previous military mission – the greater the number of stacks, the harder it is to bring the ship down.

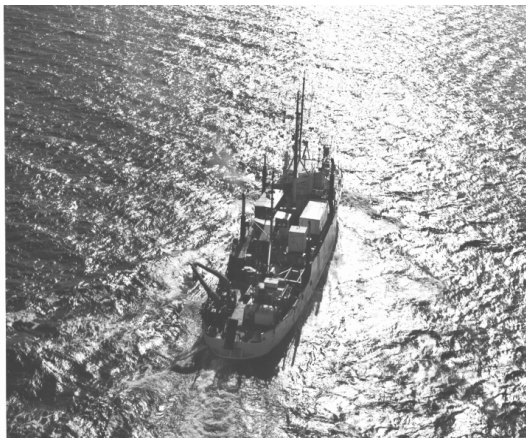




Figure 13.6: R/V *Mahi* at work off Oahu Hawaii. (from SOEST archives)

The reconfigured vessel was equipped with a heavy duty Pengo wire hauler for deep sea coring and dredging, sparker, air guns, magnetometer, gravimeter, 3.5-kHz and 12-kHz transducers, precision depth recorders, piston corer, and water sampling devices; the normal science complement in addition to the crew was 17.

The R/V *Mahi* provided HIG scientists with a much needed, long-endurance vessel for remote Pacific Ocean exploration. For example, in January 1969 HIG scientists completed a 17,000 nautical mile, 100 days-at-sea research expedition to the South Pacific. Loren Kroenke (see *Box 13.1*) and George Sutton, both from HIG, served as expedition leaders on legs 1 and 2, respectively. Much of the time was spent in and around the Solomon Islands, the Line Islands, and the Marshall-Gilbert group, conducting crucial geophysical measurements in support of the relatively new theory of seafloor spreading.

Approximately one year later, a second South Pacific geophysical expedition was conducted with George Sutton in charge. Other lead scientists were Jim Andrews, Alex Malahoff, Loren Kroenke, John Rose, and Augustine Furumoto (Figure 13.7). The voyage was to last from April to December 1970, 8 months of intensive field research. This would be the largest expedition yet undertaken by UH scientists – 48,000 nautical miles, scientists from 50 institutions and a price tag of approximately $1 M. In a *Honolulu Star-Bulletin* newspaper article published on 6 April 1970, HIG Director Woollard called it the "monster cruise." He went on to say that "every type of measurement will be done, except biological." The cruise was funded by ONR and NSF.

The monster cruise was a grand success. One UH marine technician, Pierluigi Pozzi, was aboard for the entire 8 months of research (Figures 13.8 and 13.9). Pozzi was in charge of sediment coring and helped with explosion seismology (see *Box 13.2*) on the expedition, and when interviewed at pier 18 after the 8-month long historic voyage he said, "I'm ready to go back."

According to a *Honolulu Star-Bulletin* account of the voyage written by Helen Altonn on 17 December 1970, oceanographic history was made during the expedition when the Russian ship *Vityaz* made a rendezvous with the *Mahi* at sea for 8 days of collaborative seismic research; this was, after all, the height of the cold war (see *Box 13.3*). UH Dean of Marine Programs John Craven called the US-USSR open sea meeting "quite symbolic." We can't seem to work together on land, but marine research was something very different. Chief scientist Malahoff, who was Russian by birth, said "we tried to avoid discussions of politics….we went about our business professionally."

The R/V *Mahi* remained in charter service to UH-HIG until January 1971 when it was replaced by the R/V *Kana Keoki* (see section 13.4). There was certainly a need for both vessels, but the funding for ship support had not kept pace with escalating operating costs. This was a very difficult decision for HIG Director Woollard, given the potential negative impacts on UH's expanding marine expeditionary research mission, but the decision was made not to renew the R/V *Mahi* charter agreement.

***Box 13.1*: Loren Kroenke: The Iron Man of UH Expeditionary Marine Research**



"There is nothing more enticing, disenchanting and enslaving than life at sea."

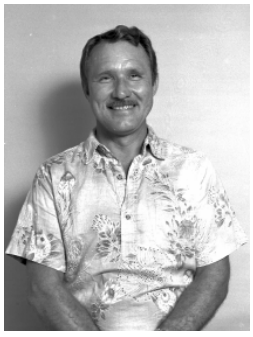
Joseph Conrad
(1857-1924)
"Lord Jim"

Loren Kroenke joined HIG in 1963 as one of Woollard's "hand-picked" sea-going colleagues; in fact, he was a superb complement to Woollard who had a tendency for sea sickness! Loren was appointed into a "faculty position," technically a junior geophysicist (R-1), and came up for tenure while still a graduate student in geology and geophysics! As the story goes, he was denied tenure in 1971 because he didn't have his Ph.D. The following year he completed all graduation requirements and was reinstated in good standing.

From 27 February 1962 to 19 June 1963, Kronke participated in eight back-to-back NSF-sponsored legs of the USNS *Eltanin*, from Bayonne, New Jersey, USA to Deception Island, Antarctica to Talcahuano, Chile, and many ports in between. After his arrival in Hawaii, Loren conducted research aboard UH research vessels *Neptune I*, *Teritu*, *Mahi*, *Kana Keoki*, *Noi'i*, and *Moana Wave*, as well as the drill ships *Glomar Challenger* and *Joides Resolution*. He served as chief scientist, or co-chief scientist, on many expeditions including *Glomar Challenger* leg #59, *Joides Resolution* leg #130, and on the Honolulu-to-Pago Pago-to-Suva legs of the 1970 "monster cruise" aboard the R/V *Mahi* (see section 13.3 and *Box 13.3*).

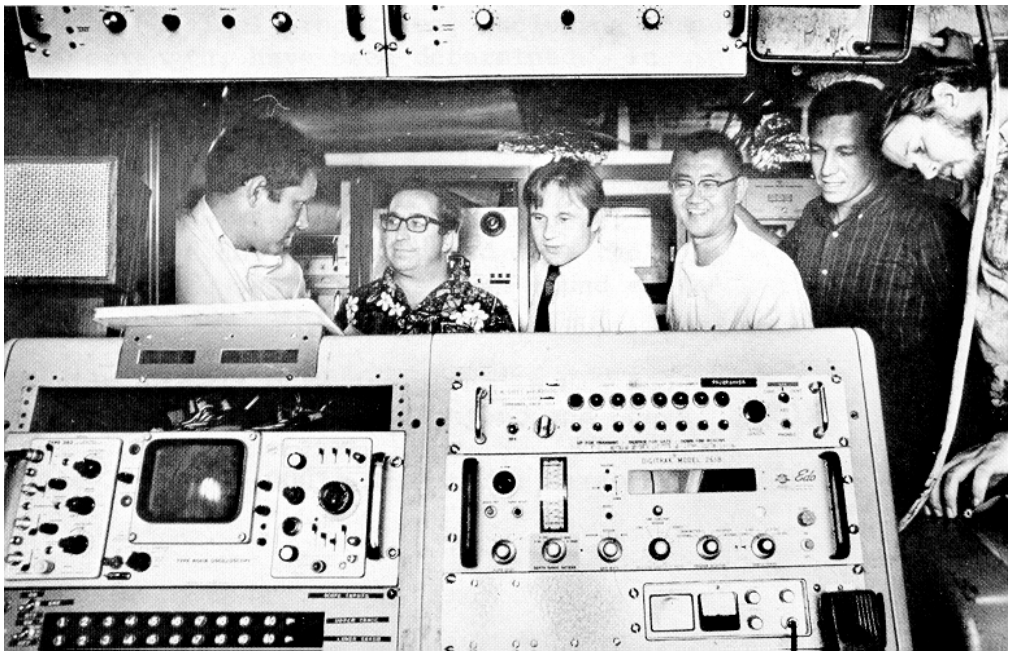


Loren Kroenke at sea (left) circa 1970 and in his HIG office between cruises. (from SOEST



During his more than four decades of expeditionary marine research, Loren logged in excess of 4½ years at sea, rightfully earning the title of "iron man of UH expeditionary marine research." Few, if any, other scientists at UH, with the possible exception of Don Hussong and Fris Campbell, can match his remarkable achievements of dedication and endurance.

After retirement from the UH fleet, the R/V *Mahi* supported several marine research projects in and around the Hawaiian Islands but was not called on again for the global ocean mission begun with her by the UH-HIG scientists. With time, the vessel fell out of repair and eventually became one of many derelicts in Keehi Lagoon (Figure 13.10). *Mahi* was eventually towed offshore and sunk where it now serves as part of an artificial reef. So even in "death," the *Mahi* continues to support Hawaii's marine resources.





The Green Sheet

FEBRUARY 1971

A UNIVERSITY OF HAWAII FACULTY NEWSLETTER VOL. 3 NO. 6

Activities aboard the Mahi *Photo by William Peterson*

Research Ship Sails Home From Historical Encounters

History is often made on a university campus, of course . . . . . sometimes it steals in silently, often it comes with flamboyance and fanfare, but almost certainly behind it are great preparations and diligence and plain hard work by a great many people.

History has been made by a Research Ship called the Mahi and a group of UH scientists from the Hawaii Institute of Geophysics.

Now safely home, the courageous Mahi is completely worn out and will die a natural death. But the 50 or 60 HIG scientists who coordinated and sailed the 48,000 miles on her appear stimulated and excited by the whole long research voyage of nine months. It was the longest and most expansive research venture so far undertaken by HIG.

The scientists who took part in it are all busy re-drafting maps of the area they covered, writing reports, making appraisals and analyses, writing new data.

Giant charts, almost as large as the room, were lying on a table, filled with tracings of the Mahi trek. "The Research Cruise was done in five legs," one of the scientists explained, "with 16 people on duty during each leg. The territory covered was from Hawaii to Samoa and Fiji; Fiji to Rabaul in New Guinea; New Guinea to Guam; across the Pacific and return to Guam; then Guam back to Hawaii."

Each group of 16 was composed of a chief scientist, assistant chief, graduate students, undergraduates, and specialists. The chief scientists on the various legs were: Don Hussong, John Halunen, Loren Kroenke, George Sutton, Alexander Malahoff, Gus Furumoto, and James Andrews. Leonard Knowles, assistant director of HIG, was the logistic coordinator—known amongst the crews as the "Honolulu-based troubleshooter."

. . . Significant purposes of voyage . . .

The five Mission Impossibles the scientists undertook. . .and made possible. . .were:

To study and chart the until-now uncharted Canton Trough near Canton Island, the deepest area of the central basin of the Pacific Ocean.

To study the flow of heat out of the earth near Fiji, which is, scientifically speaking, one of the hottest areas on the globe and therefore excellent for this phase of study which gives information of the earth's crust.

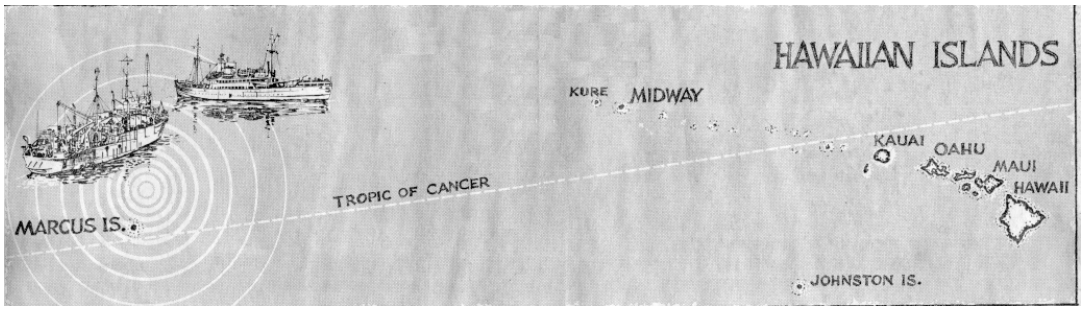
To take seismic refraction measurements—that is, after making their own explosions and sound wave recordings, the men could determine the thickness of the crust, and study the history of the formation of the Southwest Pacific islands.

To make a reconnaissance of the Central Pacific, looking for the origin of abyssal hills and manganese nodules and stratigraphy of the Central Basin.

To work, in cooperation with the Russians, in the area north of Marcus Island, which was of international importance.

Continued on last page . . . . .

Figure 13.7: [Top] A few of the many HIG scientists and staff who contributed to the "monster cruise" aboard the R/V *Mahi* in 1970. Shown from left are: Loren Kroenke, George Sutton, Alex Malahoff, Gus Furumoto, John Halunen, and Jim Andrews. [Left] Monster cruise makes front page news on "The Green Sheet," February 1971, a University of Hawaii faculty newsletter. (from SOEST archives)





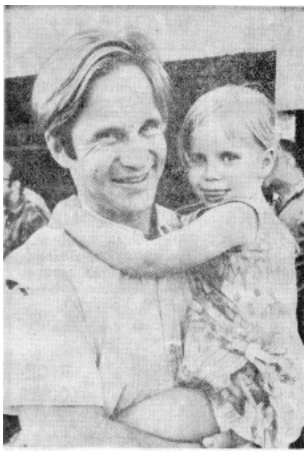


Figure 13.8: [Above] The "monster cruise" made history when UH and Soviet marine scientists conducted a 2-ship collaborative operation north of Marcus Island in the western Pacific Ocean in fall 1970. Shown at left is marine technician Pierluigi Pozzi who was aboard for the entire 8-month expedition, and at right one of the expedition chief scientists – Alex Malahoff – reunited with his daughter after the historic *Mahi-Vityaz* leg of the "monster cruise" expedition. ([Top] from *Honolulu Star-Bulletin*, 18 January 1971 and 17 December 1970 articles by Helen Altonn. [Center] photos by *Honolulu Star-Bulletin* photographer Terry Luke). [Below] Three "surviving participants" of the monster cruise – Pierluigi Pozzi, Loren Kroenke, and Bob Mitiguy – gathered to honor Ralph Moberly at his retirement celebration in September 2003. (photo by D. Karl)





Figure 13.9: R/V *Mahi* approaching pier 18 (left) and back home with well wishers (right) after the successful 8-month long "monster" cruise. (from SOEST archives)

***Box 13.2*: The "Big Bang" of UH Marine Research**

In the mid-1940s it was discovered that low frequency sound waves would penetrate the seabed and reflect from the sub-seabed layers. These reflections provided invaluable insights into the nature of the sediments and the underlying seafloor. Seismic reflection profiling is an extension of the echo sounder principle, except that a more powerful sound source is used and reflections are obtained not only from the seafloor, but also from prominent layers within the sediment and seabed rocks.

Later, marine scientists began using explosives, some with timed fuses that were designed to set off the charge at a specific depth. This soon became a "cottage-industry" in marine geophysics and there was always an interest in setting off larger and larger explosions to produce sound waves with greater penetrating potential. In 1977 DuPont ceased domestic production of dynamite – the preferred explosive – and switched to safer, "water gel" explosives like Tovex®, that were used extensively in UH seismic research.



UH marine technician Pierluigi Pozzi doing his "thing" aboard the R/V Kana Keoki *circa 1973. (from SOEST archives)*

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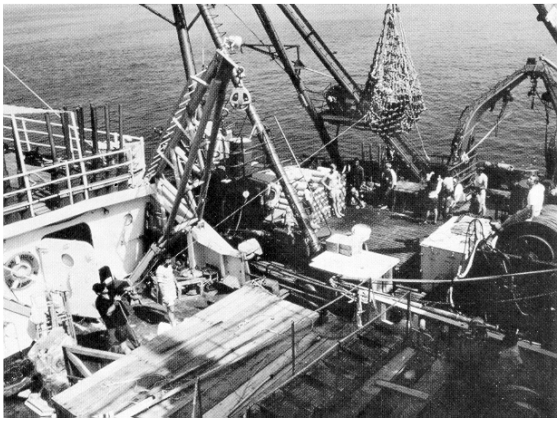
***Box 13.2*: The "Big Bang" of UH Marine Research (continued)**



UH marine research technician Bob Mitiguy posing with a one-ton package of explosives on the fantail of the R/V Kana Keoki *circa 1970, and surface manifestation of a successful shot (from Bob Mitiguy)*



In February 1972, the R/V *Kana Keoki* from UH and R/V *Yaquina* from Oregon State University (OSU) conducted a joint expedition to the Nazca Plate. Both vessels were to load explosives for seismic refraction work in Callao, Peru. When Peruvian authorities would not allow the explosives to be loaded aboard the ships in the country's primary harbor, they were ordered to go to the port of Ancon, Peru, approximately 30 miles north of Callao to re-supply. According to a first-hand account by OSU scientist Peter Kalk, that appeared in the L. Burt and M. Ludwig book, *Oceanography at Oregon State University: The First Two Decades (1954-1975)*, the local authorities did not allow the R/V *Yaquina* to receive any explosives because of incomplete paperwork. Not to worry – the *Kana Keoki* took all they could, about 4000 cans of Nitromon – 2 truckloads full. The next morning the R/V *Kana Keoki* came alongside the R/V *Yaquina* and used their crane to move the Yaquina's share of explosives – and off they both went.



Transferring explosives from the R/V Kana Keoki *to the R/V* Yaquina *at Ancon, Peru. (from SOEST archives)*

In March 1973, during project "Narino," scientists aboard the R/V *Kana Keoki* fired 19 one- and two-ton explosive charges along a line from Malpelo Island to Tumaco off the coast of Columbia. Later a record was set with the detonation of several five-ton (10,000 pound) charges; this was the "big bang" of UH marine research. According to reliable eye-witness sources, these explosive charges were contained in 24x55 gallon drums, packaged and wired together (below). As Pierluigi Pozzi described it, "They were wide as the A-frame and more than 2 m high." They were deployed from the fantail of the R/V *Kana Keoki*, and detonated at a depth of 80-100 m. All personnel aboard – and for miles around – sensed the excitement of this research!

Box 13.3*: Historic Research at Sea: The meeting of the *Mahi* and the *Vityaz

During one leg of the "monster cruise" in 1970, the R/V *Mahi* and the UH scientists aboard made history by conducting the first ever joint oceanographic study with Soviet scientists aboard their vessel *Vityaz*. The common scientific objectives were to study the ocean bottom near Marcus Island, a site adjacent to the junction between the Marianas and Japan deep sea trenches. Research performed near that location just a few years prior to the *Mahi-Vityaz* expedition suggested that this might be the oldest seafloor yet discovered, some 150 million years old, or older. The at-sea rendezvous was arranged by HIG Director Woollard and was implemented by UH oceanographer Alex Malahoff and his field team. This joint research program was a first for any American university, and by any measure was a huge success.





The two ships involved in the historic US-USSR joint expedition near Marcus Island in 1970; R/V Mahi *(left) and R/V* Vityaz.

According to newspaper accounts of the collaboration – which appeared as several feature articles by Helen Altonn published in the *Honolulu Star-Bulletin* – Don Hussong and Mark Odegard, two UH marine scientists, boarded the *Vityaz* in Japan while all other Americans were aboard the R/V *Mahi*. Once on site, there was a two-way exchange of scientists on both a short-term and longer-term basis so in addition to the science that was conducted there was also ample opportunity for cultural exchange among the scientists.

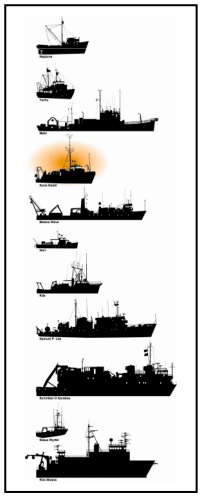
According to Hussong, in a 8 December 1970 *Honolulu Star-Bulletin* account of the event, "Everybody visited each other's ships and had toasts together – whiskey on our side and vodka on theirs." (note: Back then, most research vessels had no explicit alcohol policy, at least not for the scientific parties. Today most vessels have "zero tolerance.") This historic scientific encounter took place over Thanksgiving so there was even more reason to celebrate!

The R/V *Vityaz* was, by all accounts, a remarkable vessel and many of the UH scientists found it hard to leave when the at-sea work was done. The *Vityaz* was built as *Mars* in Germany in 1939 as a dry cargo vessel – initially carrying fruit. During World War II the vessel was converted to a personnel transport ship; immediately after the war, the vessel was claimed by England and renamed *Forward Empire*. In 1946 it was transferred to the Soviet Union, renamed and converted for a science mission. The R/V *Vityaz* was an enormous vessel, 5500-ton displacement with 14 laboratories, eight deep-sea winches, and a science party of 70. The *Vityaz* was in service from 1949 to 1979 during which time it conducted 65 major research expeditions. After retirement in Kaliningrad, the *Vityaz* was converted into the Museum of the World Ocean (http://www.vitiaz.ru/english/).



Figure 13.10: The next to the final resting place of the R/V *Mahi*, shown here as a derelict, abandoned vessel in Keehi Lagoon circa late 1970s prior to being towed out to sea to serve as part of an artificial habitat for reef fish. (from P. Pozzi, SOEST)

13.4 R/V *Kana Keoki* (1971-1987)





On 18 December 1970 Helen Altonn reported, in an article published in the *Honolulu Star-Bulletin*, a major fleet replacement plan that provided new opportunities for marine research at UH. With the termination of the Dillingham Corporation lease of the R/V *Mahi* (see section 13.3), it was announced that UH would soon be operating two new

open ocean-capable research vessels; the 156-foot R/V *Kana Keoki*, a reconfigured offshore supply vessel, and a new 165-foot "Gyre-class" Navy AGOR vessel (see *Box 13.4*) that would eventually become the R/V *Moana Wave* (AGOR-22). The *Kana Keoki* would arrive in January 1971 and the AGOR-22 would be delivered in 1972 (see section 13.5), at which time the much less capable R/V *Teritu* would be retired.

Box 13.4: **What is an AGOR?**

Research vessel designation is systematic but not obvious. According to the Naval Vessel Register, AGOR vessels are Auxiliary General Oceanographic Research, AGS vessels are Auxiliary General Service, and AGOS vessels are Auxiliary General Ocean Surveillance. If the vessel status is operated by and for the US Navy, the vessel class has a "T" designation; e.g., T-AGOR, T-AGS, T-AGOS. There are currently no T-AGOR class vessels; however, there are many Navy-owned, university-operated AGORs.

AGOR-1, the *Josiah Williard Gibbs* ("Gibbs class"), was used for many years in support of oceanographic research. The AGOR-3, R/V *Robert D. Conrad*, – operated by Lamont Doherty Geological Observatory of Columbia University – was the first of several (AGOR-3 to AGOR-7, AGOR-9, -10, -12 to -15) "Conrad class" vessels that included the venerable R/V *Melville* (operated by Scripps) and R/V *Knorr* (operated by WHOI). AGOR-8, the *Eltanin* ("Eltanin class"), spent many years in support of Antarctic research. AGOR-9, the *Thomas G. Thompson*, was operated for many years by the University of Washington until replaced by the new *Thomas G. Thompson* (AGOR-23, "Thompson class") as a capable, and comfortable class 1 UNOLS vessel. Other Thompson class AGOR vessels include the R/V *Roger Revelle* (AGOR-24), R/V *Atlantis* (AGOR-25), and R/V *Ronald H. Brown* (note: the R/V *Ronald H. Brown* was built by NOAA, so it is technically not an AGOR – i.e., navy – vessel, but is otherwise identical to the other Thompson-class AGOR vessels).

Over the years, some AGOR vessels were purpose-built for oceanography (e.g., AGOR-4, R/V *James M. Gillis* and AGOR-9, R/V *Thomas Washington*); others were reconfigured (e.g., the AGOR-17, R/V *Chain*, was built as an ARS-20 and converted in 1958 to oceanographic research). Several AGOR "vessels," including AGOR-19 and AGOR-20, were planned and designated, but never built! AGOR-22, the R/V *Moana Wave* ("Gyre-class") was built in 1973 and operated for many years by UH (see section 13.5). The R/V *Moana Wave* was retired in 1999 and was recently replaced by AGOR-26, the R/V *Kilo Moana* ("Kilo Moana class"), a new Small Waterplane Area Twin Hull (SWATH) design that is operated by UH (see section 13.11).





Over the years, the UH marine center at pier 45 has hosted and supported many AGOR vessels during their mid-Pacific expeditions. Shown here are the R/V Gyre *(AGOR-21; left), the sister ship of the R/V* Moana Wave *(see section 13.5), and the R/V* Thomas G. Thompson *(AGOR-9; right).*

UH's acquisition of the R/V *Kana Keoki* in 1971 provided the opportunity for continued marine research throughout the Pacific. The new vessel's name – *Kana Keoki* – is Hawaiian for Saint George, in honor of HIG Director George Woollard, and in appreciation for his leadership of UH marine expeditionary programs (Figures 13.11 and 13.12).

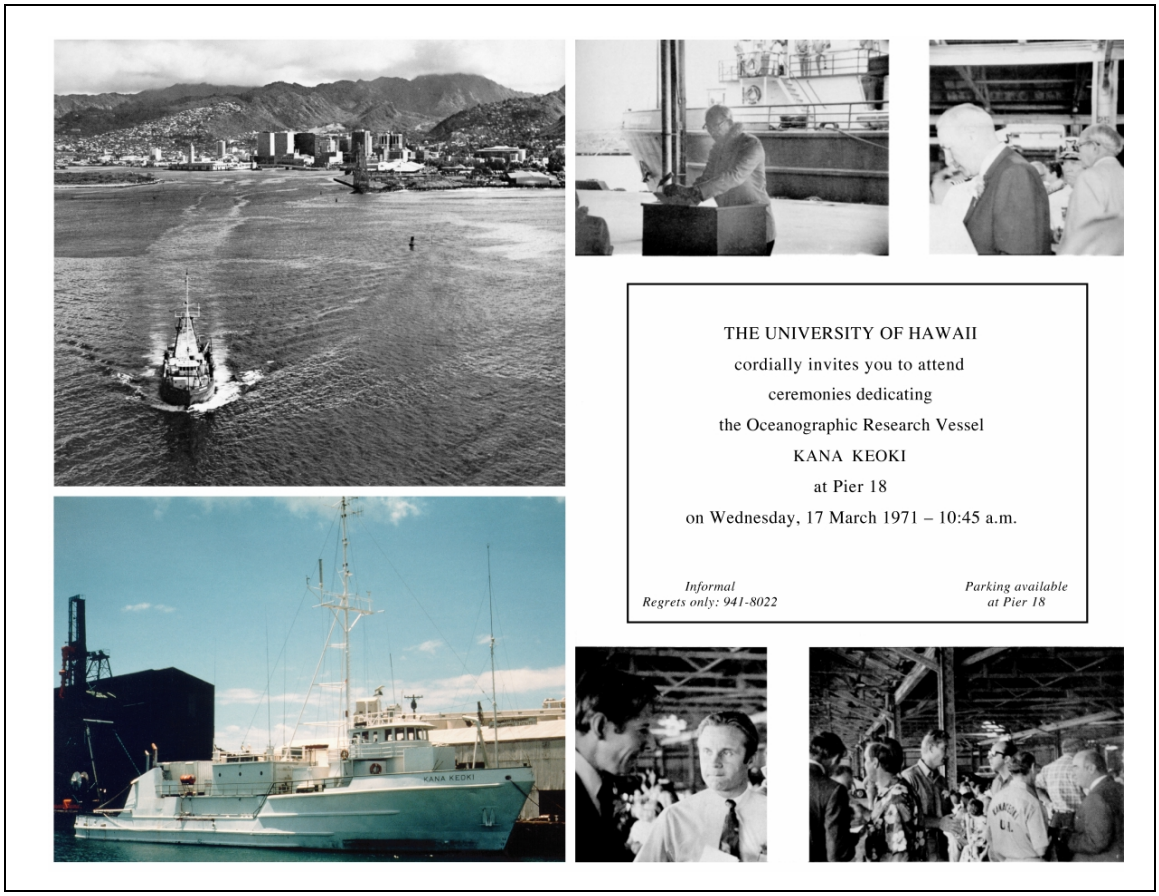


Figure 13.11: The early days of the R/V *Kana Keoki* from the formal christening ceremony at pier 18 on 17 March 1971 (right) to several of its many expeditions from Honolulu harbor (top left) and back at the marine facility at pier 18 (lower left). (from SOEST archives)

The R/V *Kana Keoki* was built by Halter Marine in New Orleans in 1967 from plans developed jointly by UH and Halter. Unfortunately, UH was unable to secure the funding to negotiate the purchase, or even to enter into a short-term lease agreement at that time; however, Halter decided to construct the vessel at their own expense. The vessel was christened MV *Dantzler Biloxi*, and placed into service in the Gulf of Mexico to support the offshore oil industry. Several years later, NSF, ONR, and the state of Hawaii collectively provided $1 M to purchase the vessel from Halter Marine.



Figure 13.12: The R/V *Kana Keoki* and its namesake, HIG Director George Woollard (aka, "Saint George"), who was responsible for acquiring the vessel for UH marine programs. Shown here with Woollard (inside the ring buoy) is UH President Harlan Cleveland (left) and Yuen Ocmakovsky (right) – a Russian marine scientist who was visiting Hawaii at this time during a port call of the vessel *Dmitry Mendeleev*. Upon arrival in Hawaii, the hull of the *Kana Keoki* was painted green. This was later changed to white, with UH green stripes as in Figure 13.13. This photo by Albert Yamauchi first appeared in the *Honolulu Star-Bulletin* on 18 March 1971 (reproduced with permission from *The Honolulu Advertiser*)

In December 1970, Captain Willard Austin and his crew traveled from Honolulu to New Orleans to complete dockside preparations and necessary training to bring the R/V *Kana Keoki* to the Pacific Ocean to begin a new research mission. Things got off to an auspicious start. On the maiden voyage from New Orleans to Honolulu, just two days out in the Gulf of Mexico, there was an engine room fire. Fortunately Captain Austin and his crew limited the blaze to superficial damage – less than $1,000 in total. The *Kana Keoki* put into Grand Cayman Island to install the new engine parts, and on 5 February 1971 the vessel cleared the Panama Canal en route to a new Pacific Ocean home.

On 17 March 1971, the R/V *Kana Keoki* was dedicated and blessed at a public ceremony aboard the vessel at pier 18 (Figure 13.11). Guest speakers included then Governor John A. Burns and HIG Director George Woollard; John Craven, then UH dean of marine programs and state marine affairs coordinator, served as master of ceremonies. Several Soviet scientists from the visiting 407-foot R/V *Dmitry Mendeleev* also attended the dedication (Figure 13.12).

The R/V *Kana Keoki* was equipped with the same suite of geological and geophysical gear previously used on the R/V *Mahi*, as well as a much enhanced "general oceanography" capability with hydrographic and bathythermograph winches, an expendable bathythermograph (XBT) launcher, a salinity-temperature-depth (STD) instrument package, and shipboard photo lab. During summer 1971, a computer system based on Data General Super Nova hardware was installed for science use.

Over the next 14 years, until retirement in November 1984, the R/V *Kana Keoki* supported interdisciplinary oceanographic research throughout the Pacific Ocean, from Wellington and Easter Island in the southern hemisphere to Seattle and Yokohama in the north (Figure 13.13). One extended expedition, in particular, was of historic proportion. On 6 June 1972, the R/V *Kana Keoki* returned to Honolulu after a 14-month, 72,000 nautical mile expedition to investigate the geological history of the Pacific basin. Ralph Moberly, John Rose, Loren Kroenke, Jim Andrews, George Sutton, and Don Hussong – among others – served as chief scientists on the various legs under the overall direction of HIG Director Woollard. The expedition was funded by NSF through their International Decade of Ocean Exploration program (see *Box 5.3*).

Perhaps the most challenging and demanding of all R/V *Kana Keoki* cruises – and certainly the most frustrating, disappointing, and solemn – was the seven-day search (KK-78-12-15) for the missing motor vessel *Holoholo* (see section 14 and *Box 14.1*). The M/V *Holoholo* was lost at sea on 11 December 1978 with 10 aboard, including three UH scientists. Despite gale force winds and unfavorable seas, Chief Scientist Don Hussong and the dedicated science party and crew provided invaluable sea support to what had become one of the largest air-sea search and rescue efforts ever in Hawaiian waters. The *Holoholo* was never located (see section 14).

In March 1987 the university sold the R/V *Kana Keoki* to Elwood Latta of the Bay Fresh Fish Company in Seattle, Washington for $110 K. The sale included two Appleton cranes that were stored at Snug Harbor; the terms were "as is, where is."

From this point on, the post-UH history of the vessel is less certain. According to information obtained by the author from Duane Leafdahl, the vessel was brought to the Pacific Marine Ship Repair on the Umpquq River in Reedsport, Oregon and converted to a king crabber. The main deck was cleared and the wheelhouse was replaced by one about three times as large. The Unger family purchased the original wheelhouse to serve as a seafood restaurant beside Jim's Waterfront in Reedsport (Figure 13.14). If you are in the neighborhood, stop by for a bite to eat or simply to reminisce about the "good old days" at sea.

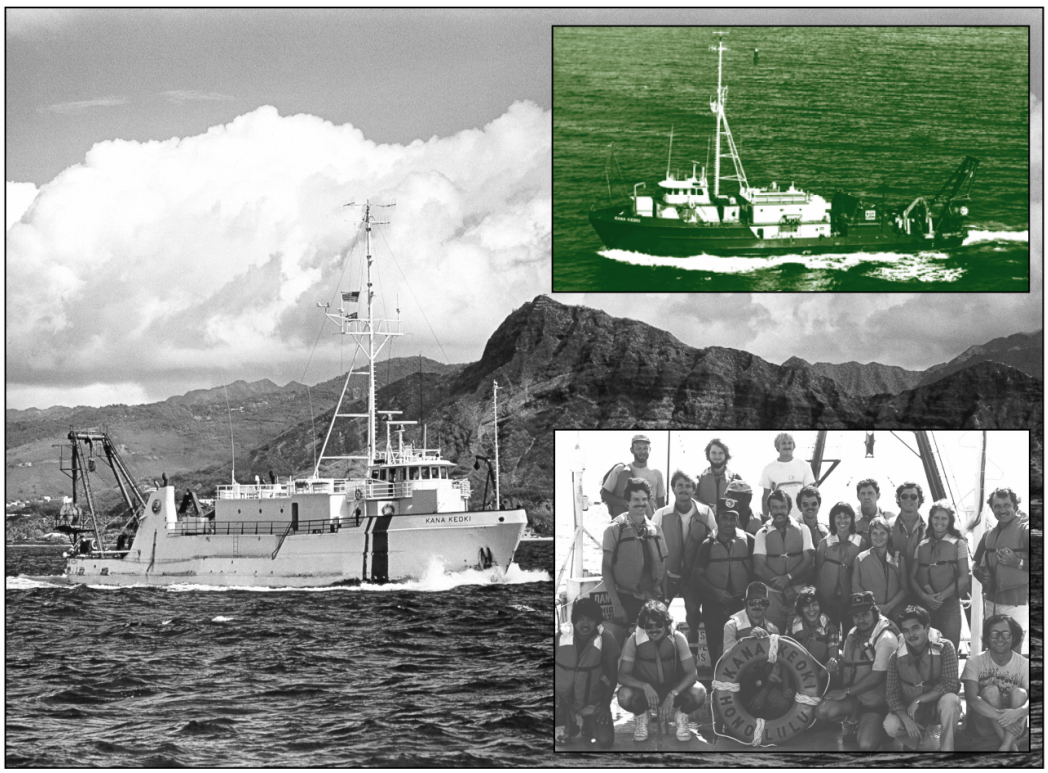


Figure 13.13: The two "faces" of the R/V *Kana Keoki*. At top right in Halter Marine green – dubbed the "green latrine" and after a fresh coat of the more familiar UH white paint. Shown at bottom right is one of the many mandatory science party portraits typically taken on the bow or the fantail after a successful expedition. (from SOEST archives; collage design by N. Hulbirt)



After a hard day of work, a relaxing "swim call." (from SOEST archives)



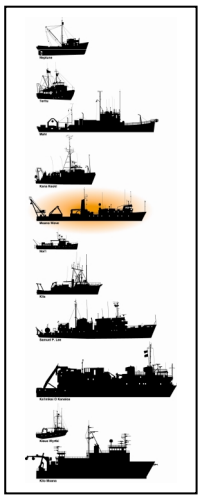


Figure 13.14: The "final" resting place of a magnificent research vessel, – the R/V *Kana Keoki*, at least the upper decks thereof, as the "wheelhouse restaurant" in Reedsport, Oregon. (from J. F. Campbell and D. Leafdahl)

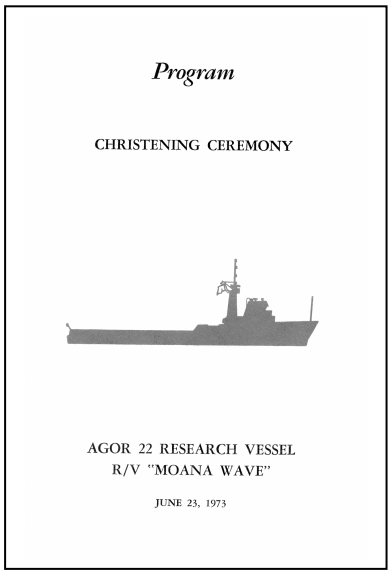


At sea aboard the R/V Kana Keoki *in the North Pacific Ocean. (from SOEST archives)*

13.5. R/V *Moana Wave* (1973-1999)







Program

CHRISTENING CEREMONY

AGOR 22 RESEARCH VESSEL
R/V "MOANA WAVE"

JUNE 23, 1973

OWNER: U. S. NAVY

BUILDER: HALTER MARINE SERVICES, INC.

USER: HAWAII INSTITUTE OF GEOPHYSICS, UNIVERSITY OF HAWAII

LIAAEN CONTROLLABLE PITCH PROPELLERS
REDUCTION GEARS AND SHAFTING
by
PROPULSION SYSTEMS, INC.
Port Washington, New York

CATERPILLAR
MAIN ENGINES AND GENERATORS
by
BOYCE MACHINERY CORPORATION
Reserve, Louisiana

ELECTRONICS AND NAVIGATIONAL AIDS
by
F & L INDUSTRIAL ELECTRONICS SERVICE, INC.
New Orleans, Louisiana

Welcoming: MR. JOSEPH LEBLANC, *Executive Vice President*, HALTER MARINE SERVICES, INC.

Invocation: LT. ROBERT S. MCGINNIS, JR., CH.C., USNR-R

National Anthem: EIGHTH NAVAL DISTRICT BAND

Introduction: MR. HAROLD P. HALTER, *President*, HALTER MARINE SERVICES, INC.

REAR ADMIRAL R. E. RIERA, USN, *Commandant* — Eighth Naval District

REAR ADMIRAL STANLEY FINE, USN, *Deputy Commander*, Naval Ship Systems Command

REAR ADMIRAL JOHN A. SCOTT, SC, USN, Defense Supply Agency

MR. JULIAN C. MCLEAN, *Principal Surveyor*, American Bureau of Shipping

REAR ADMIRAL J. EDWARD SNYDER, JR., USN, Oceanographer of the Navy

Remarks: HONORABLE HIRAM FONG, Senator, Hawaii

Christening: MRS. HIRAM FONG, *Sponsor*
MRS. HENRY H. THOMPSON, *Matron of Honor*

Anchors Aweigh Hawaii Ponoi: EIGHTH NAVAL DISTRICT BAND

Response: DR. JOHN CRAVEN, *Dean*, University of Hawaii

Benediction: LT. MCGINNIS

The 210-foot *Moana Wave* ("moana" is the Hawaiian word for ocean, or open sea), or simply "*Wave*" as the vessel was affectionately called by those who sailed aboard it, was christened and launched on 23 June 1973 at Halter Marine in New Orleans (above); the vessel was built for the US Navy as AGOR-22 ("Gyre-class"). The R/V *Moana Wave* was delivered to the US Navy on 16 January 1974, and immediately thereafter UH-HIG was designated the vessel's operator.

The R/V *Moana Wave* was designed was for multidisciplinary use with general capabilities that allowed it to conduct a broad range of scientific missions (Figure 13.15). The vessel was equipped with a 150-hp bow thruster, evaporators for the at-sea production of fresh water, air conditioning, and a shore discharge sewage system. It was designed to carry portable laboratory vans for maximum flexibility in addition to its built-in science support equipment, including 3.5- and 12-kHz echo sounders, deep sea trawling and hydrographic winches, and an Omega navigation system.



Figure 13.15: The R/V *Moana Wave* (AGOR-22) shown here under construction at Halter Marine in New Orleans in 1972 (upper left), and at the christening ceremony (upper right) with dignitaries, including Senator Hiram Fong (with dark suit and maile lei) and UH Marine Dean John Craven (inset, white suit) in June 1973. HIG also hosted a local celebration at pier 18 when the vessel first arrived in Honolulu in February 1974 (center and bottom). (from P. Pozzi and SOEST archives; collage design by N. Hulbirt)

When the *Wave* (at that point a modest 173-foot vessel) arrived in Honolulu it replaced the 90-foot R/V *Teritu*. With a 14,000 nautical mile range and 50-day endurance, the *Wave* was a superb replacement for this much smaller, less capable ship. With the vessel's arrival in Honolulu in February 1974, the R/V *Moana Wave* joined the R/V *Kana Keoki* to provide outstanding support to the growing UH marine expeditionary programs. At this time the UH research "fleet" was home-ported at the marine expeditionary center at pier 18 in Honolulu Harbor, but later moved to pier 45 (see section 12.3).

Moana Wave began service in South America and also worked in Alaska and off the west coast of the US during the first few years of service. In 1977 the vessel entered a long-term charter agreement with the Naval Electronics System Command and spent six years operating out of Fort Lauderdale, Florida, and Little Creek, Virginia, where the *Wave* supported the development and testing of the Navy's SURface-Towed Array System (SURTAS). Following a mid-lift overhaul and refit in 1984, the R/V *Moana*

Wave came out of the yard a larger (a 30-foot section was added amidships and a 7-foot extension was added to the main deck at the stern) and more sea- and science-capable vessel (Figure 13.16).



Figure 13.16: The mid-life stretch of the R/V *Moana Wave* showing the vessel in the "as built" 173-foot configuration (top left) and with its new 30-foot amidships section and an extended main working deck (bottom left). (from SOEST archives; collage design by N. Hulbirt)

In September 1984 the *Wave* returned to Honolulu where it remained active until retirement on 31 May 1999 (see *Box 13.5*). During this period, the *Wave* supported diverse research missions throughout the Pacific basin from Korea to Antarctica and numerous exotic ports in between. The vessel's research mission and support capabilities were fully tested during one especially busy 2-year period from 1987 to 1988; the *Wave* logged nearly 100,000 nautical miles and spent 633 days at sea (Table 13.1). Not a single operating day was lost for repair or maintenance, which is an outstanding service record by any measure.

The end of this demanding 2-year period coincided with the start of the Hawaii Ocean Time-series (HOT) project with its inaugural cruise in October 1988. Over the next decade, the R/V *Moana Wave* would go on to support 71 expeditions to Station ALOHA, earning the well-deserved reputation as the HOT program flagship (Figure 13.17).

Table 13.1: No Rest for the Weary, A True Test of Endurance and Worth (1987-88: 97,307 nmi and 633 days at sea)

1987-88

Expedition	*Study Region*	*Name/PI*	*Institution*	*Dates*	*Port*
MW87-01	Fiji Basin	Kroenke	Hawaii	12 Jan – 02 Feb	Pago Pago
MW87-02	Cook Island	Coulbourn	Hawaii	06 Feb – 03 Mar	Honolulu
MW87-03	ADIOS	Betzer	So. Fla.	18 Mar – 16 Apr	Honolulu
MW87-04	Transit	N/A	N/A	24 Apr – 26 Apr	Kawaihae
MW87-05	Transit	N/A	N/A	27 Apr – 08 May	Manzanillo
MW87-06	ONR SMII	Macdonald	UCSB	09 May – 03 Jun	Manzanillo
MW87-07	Rise Crest SMII	Fornari	LDGO	07 Jun – 09 Jul	Guayaquil
MW87-08	Peru Margin	Farrington	WHOI	12 Jul – 28 Jul	Callao
MW87-09	Peru/Chile	Moberly	Hawaii	01 Aug – 02 Sep	Guayaquil
MW87-10	E. Pac. Rise	Macdonald	UCSB	06 Sep – 14 Oct	Easter Island
MW87-11	Easter Microplate	Hey	Hawaii	17 Oct – 17 Nov	Easter Island
MW87-12	E. Pac. Rise	Sinton	Hawaii	19 Nov – 22 Dec	Papeete
MW87-13	Transit/Papeete	N/A	N/A	28 Dec – 11 Jan	Melbourne
MW88-01	Antarctica	Christie	LDGO	16 Jan – 20 Feb	Freemantle
MW88-02	Transit	N/A	N/A	25 Feb – 07 Mar	Manila
MW88-03	Taiwan Survey	Hussong	Non-Fed	11 Mar – 27 Mar	Manila
MW88-04	SUB SEA	Karig	Cornell	31 Mar – 19 Apr	Guam
MW88-05	GUYOTS	Duennebier	Hawaii	23 Apr – 29 May	Guam
MW88-06	EPOC	Lukas	Hawaii	17 Jun – 07 Jul	Palau
MW88-06	EPOC	Lukas	Hawaii	04 Jul – 30 Jul	Manila
MW88-07	SULU SEA	Thunnel	S. Car.	03 Aug – 25 Aug	Guam
MW88-08	Transit	N/A	N/A	29 Aug – 12 Sep	Honolulu
MW88-09	Loihi Seamount	Karl	Hawaii	21 Sep – 30 Sep	Honolulu
MW88-10	Squid	Tsuji	Scripps	04 Oct – 18 Oct	Honolulu
MW88-11	HOT	Karl/Lukas	Hawaii	29 Oct – 03 Nov	Honolulu
MW88-12	Line Island	Lukas	Hawaii	05 Nov – 28 Nov	Honolulu
MW88-13	HOT	Karl/Lukas	Hawaii	30 Nov – 04 Dec	Honolulu





Figure 13.17: [Above] The retirement of the R/V *Moana Wave* was a sad event for many UH marine scientists. The final cruise in May 1999 marked the end of a successful and event-filled era of marine research at UH. The final cruise was to Station ALOHA to service the HOT mooring shown in center. Several of the HOT science party are shown next to the lei-draped *Wave* (center, right). Brian Taylor (top, right), then associate dean of SOEST and Bill Coste, then UH marine superintendent (lower left) addressed the crowd assembled for the formal retirement ceremony in early June 1999. (photos by D. Karl). [Below] At sea, aboard the R/V *Moana Wave*. (photos by P. Morris, SOEST)



Box 13.5: **R/V *Moana Wave* retires from UNOLS fleet**



"O captain! My captain! Our fearful trip is done,
The ship has weathered every rack,
The prize we sought is won"

Walt Whitman
(1819-1892)

At 0800 hrs on 28 May 1999, the research vessel *Moana Wave* departed Honolulu harbor under sunny skies and light trade winds. When it cleared the last sea buoy en route to Station ALOHA, all hands were on deck to watch the island of Oahu disappear in the horizon as science parties had done so many times during the 26-year history of this capable ship. A major difference, however, was that this would be the last voyage in support of UH oceanographic research. During the routine fire and boat drills, suddenly the reality – and the finality – of it all struck home. Soon UH scientists and the US ocean sciences community at large would lose a key UNOLS vessel that had served them so well over the past two decades.

Early in the morning on 30 May 1999, as the Honolulu city lights reappeared in the distance on the home-bound leg of the final sea voyage of the *Wave* there was mixed emotion among both the scientists and the crew. As it docked at pier 45, the lei-draped *Moana Wave* lowered the flag for the last time.







This retirement seemed premature and hard to justify given the fine condition of the vessel, the exceptional qualifications of its crew and the large amount of funded marine science that still needed to be done. The R/V *Moana Wave* will be a very hard act to follow. Throughout its sea life, the *Wave* was a user-friendly ship with a cheerful and competent crew. May you all have fair winds and a following sea as you deploy on your next assignments.

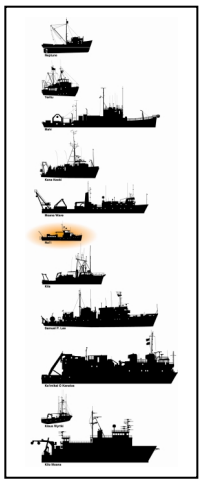


The author (right) returning to Snug Harbor following the final cruise of the R/V Moana Wave *in May 1999.*



Following retirement in June 1999, it was announced that the R/V *Moana Wave* would be transferred from the US Navy inventory to Ahtna Inc., an Alaska based subsidiary of Clearwater Environmental Inc. The regional Alaska Native Corporation acquired the *Wave* for a $50 K fee through a government surplus property program; the vessel was appraised at $5.44 M! After investing about $2 M in upgrades, the vessel entered the marine charter market with a potential to work on anything from sunken vessel salvage and recovery to marine mammal and climate research. In 2002, the R/V *Moana Wave* made a port call in Honolulu during a year-long charter to Seafloor Surveys Inc. (SSI), a private research company that was founded in 1985 by ex-HIG scientists including Don Hussong and Fris Campbell.

13.6. R/V *Noi'i* (1976-1981)





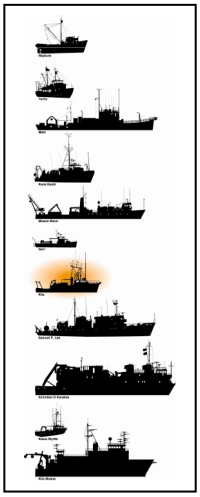
The R/V *Noi'i* (Hawaiian for "to seek information or knowledge in great detail"; according to Fris Campbell, this name was suggested by Rubellite "Ruby" Johnson – then a faculty member at UH and expert in the Hawaiian language) was a small, 65-foot vessel that conducted 16 research cruises between April 1976 and August 1981 in addition to being used extensively by the Blue-Water Marine Laboratory (see *Box 6.6*) in support of its high school education mission (Figure 13.18). Many of the science cruises were relatively short, 1-2 day voyages for equipment testing or similar purposes. This vessel was not capable of sustained open ocean research. Because of this rather restricted mission the author was not able to obtain much written information about the *Noi'i*. The vessel had been a navy patrol boat and admiral's launch in its previous life, and that William Kerr – then UH marine center port captain – obtained *Noi'i* for UH from navy surplus. Wes Shockley – a long-term crew member on the *Kana Keoki* and *Moana Wave* – reportedly used this vessel in Subic Bay, the Philippines when he was in military service. The vessel was transported to Pearl Harbor and used there before its transfer to UH in 1976. Prior to retirement from the UH fleet, *Noi'i* ran aground off Molokai – but further details are lacking. The author does not know what happened to *Noi'i* after it was retired from the UH fleet.





Figure 13.18: ***Noi'i*** **in her usual position at the end pier at Snug Harbor. The small size of the vessel and its marginal science mission accommodations limited the mission profile for this "research" vessel. (from SOEST archives)**

13.7. R/V *Kila* (1982-1998)





The vessel *Viken* (later named *American Patriot*, then *Galaxy 10*) was built as a fishing boat at Bender Welding and Machine Inc. in Mobile, Alabama in 1977. It was a steel-hulled, twin screw, 104-foot vessel with a displacement of approximately 175 tons (note: technically this vessel was 103 feet, 6 inches in length and was reported in some legal documents as being 103 feet and in others as being 104 feet); the vessel was registered in Panama. At the time *Galaxy 10* entered "commercial" service in the Gulf of Mexico, no one could have predicted the events that were about to occur.

Just a few years later, *Galaxy 10* was seized in Palau by the US government and charged with smuggling drugs earlier that year. It was reported that both Thai-stick marijuana from Asia and cocaine from South America were aboard the vessel. The impounded vessel was brought to Honolulu's pier 4 in May 1981 and was under 24-hr-a-day guard until placed onto the auction block with an upset price of $400 K. According to a *The Honolulu Advertiser* article published on 16 September 1981, if no minimum bid was submitted, then the vessel would be turned over to the Navy for an amount of money equivalent to the funds invested by the marshal's office for the arrest and seizure

operations. Before the public auction, it was estimated that the vessel was worth $1 M, with over $500 K in sophisticated navigation and communications equipment. No bids above the threshold minimum were received, so on 12 January 1982 the ONR acquired the now "drug-free" *Galaxy 10* from the US marshal, Honolulu district, for a transfer fee of $75 K!

The *Galaxy 10* was then moved to Snug Harbor in preparation for its new research mission (Figure 13.19). When fully reconfigured, the R/V *Kila* was equipped with a 3.5-ton telescopic crane, a 5-ton deck winch, 10-ton stern A-frame, towing bit, a small wet lab off the main 16x18 foot working deck, air-conditioned accommodations for 17 (5 crew, 12 science berths), and a "cozy" galley. In this new configuration the R/V *Kila* had a 5000-nautical mile, 23-day endurance, and a cruising speed of 8 knots.

ONR held title to the vessel and UH entered into a charter party agreement in April 1982, and became the ship's operator. In September 1982, the NSF-sponsored Plankton Rate Processes in Oligotrophic Ocean Systems (PRPOOS) group – that included Ed Laws and Dave Karl from UH – was the first "customer" for the newly acquired research vessel. On 12 September 1983 the ONR contract was amended to change the hull designator of the vessel from *Galaxy 10* to *Kila*, in honor of the legendary Hawaiian navigator (see *Box 13.6*; "Kila" is also the Hawaiian word for steel). This name was provided to HIG by Ruby Johnson who had also named *Noi'i*.



Figure 13.19: The *Galaxy 10* shown here at pier 45 shortly after its transfer from the US marshal to the Office of Naval Research (ONR). ONR later transferred the title to the National Science Foundation (NSF), and eventually NSF transferred the title to UH for use in their marine research and education programs. (from SOEST archives)

Box 13.6: **The Legend of Mo'ikeha and Kila**

The voyaging story of Mo'ikeha-Kila-La'amaikahiki is a traditional Hawaiian legend (http://pvs-hawaii.org/stories/moikeha_kila.htm). Mo'ikeha, a high chief from Tahiti, migrated to Kauai to start a new life. He remarried and had five children, all boys, including Kila. As time passed, Mo'ikeha yearned to see the son he had left behind on Tahiti, ali'i La'amaikahiki. Following a canoe competition among his siblings, Kila, the youngest, was chosen to sail to Tahiti to escort his step-brother back to Kauai, which he accomplished with great skill earning him a life-long reputation as a skilled navigator of the high seas.



Landfall in Hawaii from Peter Buck's Vikings of the Pacific *(http://pvs-Hawaii.org/stories/mokeha_kila.htm).*

On 23 April 1987, title for the R/V *Kila* was transferred from ONR to NSF using a standard form DD-1149 that listed the vessel as: 1 ea, fishing research vessel (103 feet, 6 inches length), ABS No. 7533418, US Registry No. 586986, unit price $75 K.

On 29 May 1987 title to the R/V *Kila* was transferred from NSF to UH – technically to UH faculty member Dick Young because an amendment to his research grant was the vehicle used for title transfer. The official letter for NSF award OCE85-00664, amendment #2 read, "…the subject amendment is to convey full title, right, and interest in the 103-foot R/V *Kila* to the University of Hawaii for use in the research project entitled, 'Aspects of the Ecology of Oceanic Cephalopods: The Early Life History Stages,' under the direction of Dr. Richard E. Young, Hawaii Institute of Geophysics, principal investigator. The grant will terminate on 31 December 1987." It was also stated that upon completion of the referenced grant, the property be utilized for "other scientific research or science education" projects. Furthermore, at such time as the property is deemed by the grantee to be no longer useful for such purposes, it can then be disposed of. The proceeds therefrom shall be used by the grantee for the support of other scientific research or science education projects." – in other words, good riddance!

Unfortunately the 104-foot R/V *Kila*, like previous vessels of similar size, was incapable of an efficient and safe open ocean mission in Hawaii's high seas. After failing the field test for several research projects – including the Hawaii Ocean Time-series program – *Kila* served as the mother ship for the HURL submersible program, towing the launch-recovery-transport vehicle and submersible to site for research dives (Figure 13.20; also see section 13.13). While this was a modest improvement over the previous use of the tugboat *Holokai* (also known as "Rollokai"), R/V *Kila* was still fairly weather-

limited – as was the LRT used for launching the submersible – and its overall performance in that mission was marginal, at best (Figure 13.21). *Kila* was also used for deploying and servicing fish aggregation buoys for the State of Hawaii.



Figure 13.20: R/V *Kila* with HURL's Launch-Recovery-Transport (LRT) vehicle and *Pisces V* submersible in tow off Loihi Seamount circa 1998. (photo by D. Karl)



Figure 13.21: "Rock-n-roll" was the norm aboard R/V *Kila*, even in relatively calm waters, shown here (at left) in calm seas off South Point, Hawaii and (at right) in double-exposure action to document the extent of its motion. (photos by D. Karl)

After 1994, when the new submersible support vessel – *Ka'imikai-O-Kanaloa* – entered the UH fleet (see section 13.9), the R/V *Kila* had light usage. For example, in 1996 the vessel had only 50 days at sea; 30 were in support of the Blue-Water Marine Laboratory education program, which was terminated in 1997 (see *Box 6.6*).

On Friday evening, 26 September 1997, the R/V *Kila* ran hard aground in the vicinity of the Lahaina boat harbor off Maui. The vessel had just completed a long day supporting the MOBY buoy project off Lanai when it hit the reef. The damage reported at that time by divers was to both rudders and the rudder skeg. This damage rendered the vessel inoperative, so *Kila* had to be towed by the *Hawaiian Islander* from Maui to Snug Harbor.

In October 1997, the R/V *Kila* was towed to the Honolulu Shipyard Inc. at neighboring pier 41 for a more complete damage assessment. There, the vessel was dry docked and fully inspected (Figure 13.22). It was determined that there was "considerable damage" to both rudders; the port rudder sustained the most severe damage. The skeg to each rudder was bent and broken. Both the port and starboard shaft, strut and stern tubes were also damaged. A minimum estimate for repairing the damage was $75-100 K.



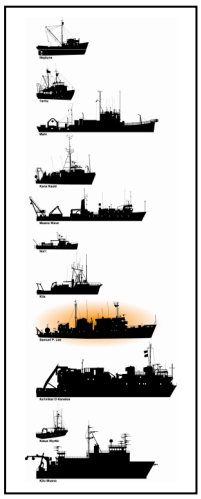
Figure 13.22: High and dry in the yard after the R/V *Kila* ran hard around off Maui in 1997. Shown at left is the damage to both rudders. The vessel was not repaired, and was eventually sold for $100 K, "as is, where is." (from SOEST archives)

The vessel was not repaired at that time, but was refloated and towed back to pier 45. Shortly thereafter, in fall 1998, the R/V *Kila* was placed up for public sale with an asking price of $135 K – as is, where is! At that time it was estimated that the replacement cost was $1,250,000 at the high end; the scrap value was estimated to be $5,450.

On 21 December 1998 the R/V *Kila* was purchased by the Enewetak/Ujeland Local Government Council for $100 K after submitting an initial, unacceptable offer of $60 K.

After some additional yard work, the vessel was taken to the Marshall Islands. Neither their intended nor actual use of this vessel is known to the author. So from our UH perspective, the *Galaxy 10 – Kila* service lifetime (1982-1998) was a full circle, from the Marshal to the Marshalls, no pun intended!

13.8. R/V *Samuel P. Lee* (1983-1992)





The R/V *Samuel P. Lee* (or *S. P. Lee* as the vessel was known locally) was named in honor of Rear Admiral Samuel Phillips Lee (1812-1897) who commanded the North Atlantic blockading squadron during the Civil War. There were actually two US Navy ships named in his honor. The first, USS *Samuel P. Lee* (DD-310) was commissioned in 1920. The 1190-ton *Clemson*-class destroyer was built in San Francisco and served mostly on the west coast. On 8 September 1923 – just three years after entering service – the *S. P. Lee* and its squadron left San Francisco for San Diego but was stranded and wrecked at Honda Point, north of Santa Barbara, due to faulty navigation and poor visibility. The USS *Nicholas* (DD-311) was also lost during the same grounding incident.

The second vessel, the USNS *Samuel P. Lee* was built at Defoe Shipbuilding Co., Bay St. Louis, Mississippi as T-AGS-31 (see *Box 13.4*). The vessel was launched on 19 October 1967 and placed into US Navy service from 1968 to 1974 at which time the vessel was redesignated "auxiliary general" (T-AG-192), and transferred to the US Geological Survey (USGS) of the department of interior. The 208-foot *S. P. Lee* was operated by USGS in support of a broad range of geology and geophysics missions from the high artic to Ross Sea, Antarctica. In October 1983 the *S. P. Lee* arrived at Snug Harbor from Alaska. UH had been selected to manage the vessel during its extended Pacific Ocean research mission. For the duration of this mission, the vessel was serviced from pier 45, Snug Harbor.

With the addition of the R/V *Samuel P. Lee*, the UH fleet swelled to four ocean-capable vessels (others were R/V *Kila*, R/V *Moana Wave*, R/V *Kana Keoki*); the NOAA fisheries vessel *Townsend Cromwell* was also home-ported at Snug Harbor but was operated by NMFS (see *Box 5.6*). A rare photo of this impressive fleet was taken circa 1985 during the Christmas holiday stand-down period (Figure 13.23). At this time, the

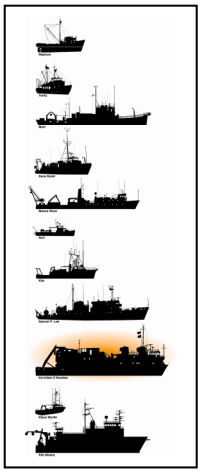
UH Marine Expeditionary Center at Snug Harbor was the third largest US academic research vessel facility behind Scripps and WHOI.



Figure 13.23: The UH Marine Expeditionary Center, pier 45, during Christmas holiday stand down sometime in the mid-1980s. Vessels in port include (from left): R/V *Kana Keoki*, R/V *Moana Wave*, R/V *Kila*, R/V *S. P. Lee* (on the pier), the University of Washington's vessel *Thomas G. Thompson* (outside the *S. P. Lee*), an unidentified vessel (at far right on the pier), and a frequently used charter sailing vessel, the *Machias* on the outside. (from SOEST archives)

In October 1992 the *S. P. Lee* was struck from the naval register and shortly thereafter transferred to the Mexican navy under the security assistance program. According to the Marinas del Mundo: Mexico web page, the *S. P. Lee* was renamed *Antares* and currently serves as a hydrographic survey ship.

13.9. R/V *Ka'imikai-O-Kanaloa* (1994-present)





In July 1992, a new UH vessel was christened by Beverly Malahoff in Mobile, Alabama. The *Ka'imikai-O-Kanaloa* (also known as the *K-O-K*) was built by Mangove Shipbuilding Co., Houston, Texas in 1979 (Hull #126). It had been used for more than a decade for oil exploration until spotted by Beverly's husband, UH oceanographer and

director of HURL, Alex Malahoff. Malahoff thought this vessel could become a valuable asset for the growing UH submersible science programs (see section 13.13).

Director Malahoff worked tirelessly to acquire and reconfigure this 185-foot vessel to serve as the support ship for HURL's two manned submersibles, *Makali'i* and *Pisces V*, and for the remotely operated vehicle (RC V-150). The new, reconfigured platform, R/V *Ka'imikai-O-Kanaloa* (Hawaiian for "Heavenly Searcher of the Seas of Kanaloa") emerged from Bender Shipbuilding and Repair Co. as a versatile oceanographic research vessel (Hull #9884). The approximately $5 M conversion was funded by the state of Hawaii and NOAA; the state of Hawaii held the ship's title.

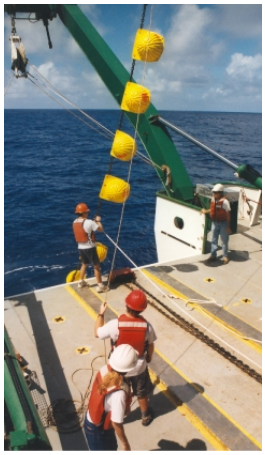
In its reconfigured state, the 223-foot, 1961-ton displacement *K-O-K* had a cruising speed of 10 knots, a 15,000 nautical mile range (50 day endurance) with a crew of 14 and 19 science berths (Figure 13.24). The vessel was equipped with two 1,035 HP Detroit diesel main engines, a 1,000 HP electric bow thruster, a 250 KW diesel generator, and a variety of deck cranes and winches in addition to a 15-ton capacity moveable stern A-frame fitted with a submersible launch/recovery system. There were four interior laboratories (total 1,053 sq. ft.), a science conference room, and a library/lounge. A 2-story 1,332 sq. ft. hangar, designed to serve as a shelter for the submersibles while at sea, was constructed mid-ship just forward of the main working deck. The *K-O-K* was also equipped with a Sea Beam 210 multibeam sonar bathymetric mapping system that was capable of acoustically charting the seafloor at nearly any ocean depth.



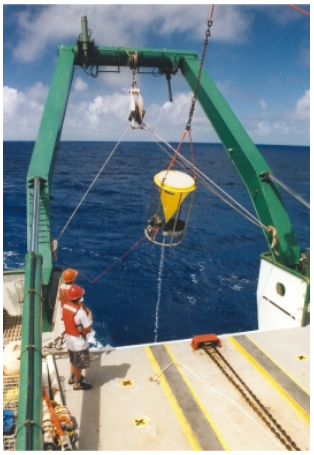


Figure 13.24: The R/V *K-O-K* at pier 45 (left) and at sea near Station ALOHA. This vessel was reconfigured primarily for use as a tender for the HURL submersibles, but later adopted a general oceanography mission as well. (photos by P. Morris, SOEST)

On 15 January 1994 Malahoff's dream became a reality during a dedication ceremony at Snug Harbor, the vessel's new home port. Since that time, the *K-O-K* has been used for a variety of missions in addition to submersible support, ranging from the deployment of deep-sea moorings, to hydrographic surveys, to experimental marine biogeochemistry.

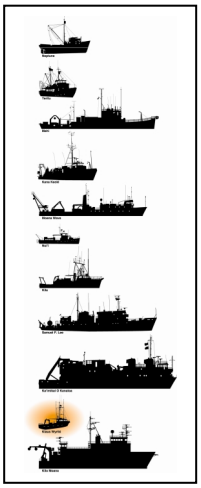






At sea aboard the R/V Kaimikai-O-Kanaloa *in the North Pacific Ocean. (photos by D. Karl, A. Gasc, and P. Morris)*

13.10. R/V *Klaus Wyrtki* (2001-present)





In 1993, Charles Wells brought his 57-foot longline fishing vessel *Shaman II* from Alaska to Hawaii to try his luck fishing in tropical waters. He worked the vessel until he retired in 2001, at which time he donated the *Shaman II* to UH-SOEST for use in their marine research programs. Later that year the *Shaman II* was reconfigured for its new mission and renamed the R/V *Klaus Wyrtki* in honor of the leading oceanographer in the 40-year history of the UH oceanography program (see *Box 4.7* and Figure 13.25). The vessel is intended to be used exclusively for coastal marine research, equipment testing, and for a variety of marine education programs. In this regard, the mission profile is very likely to replicate the R/V *Noi'i* that was in service from 1976-1981 (see section 13.6).

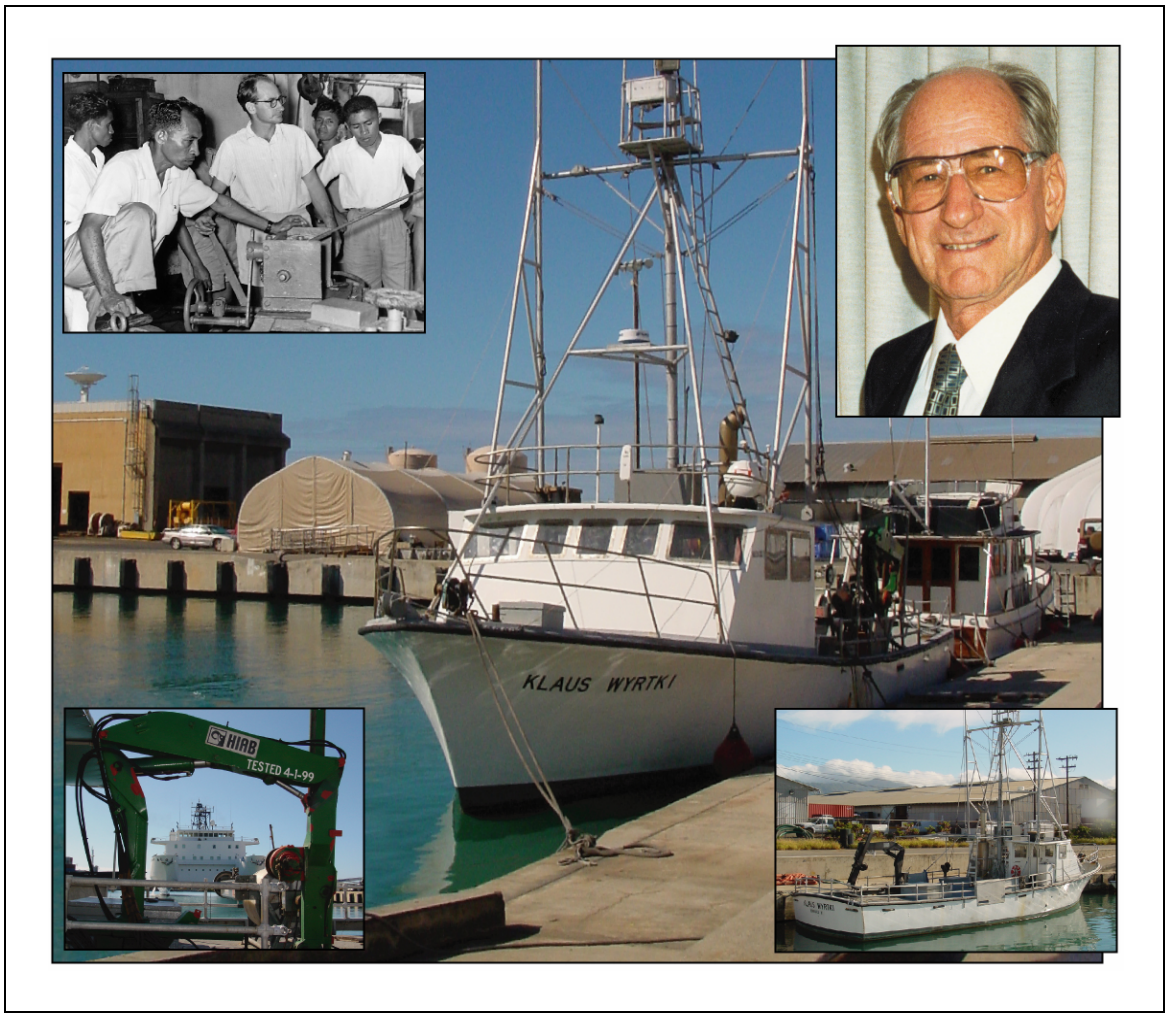
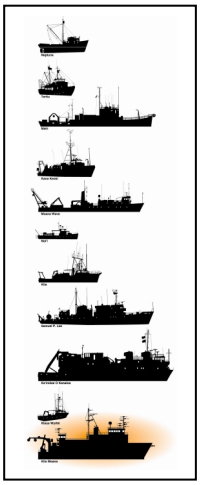
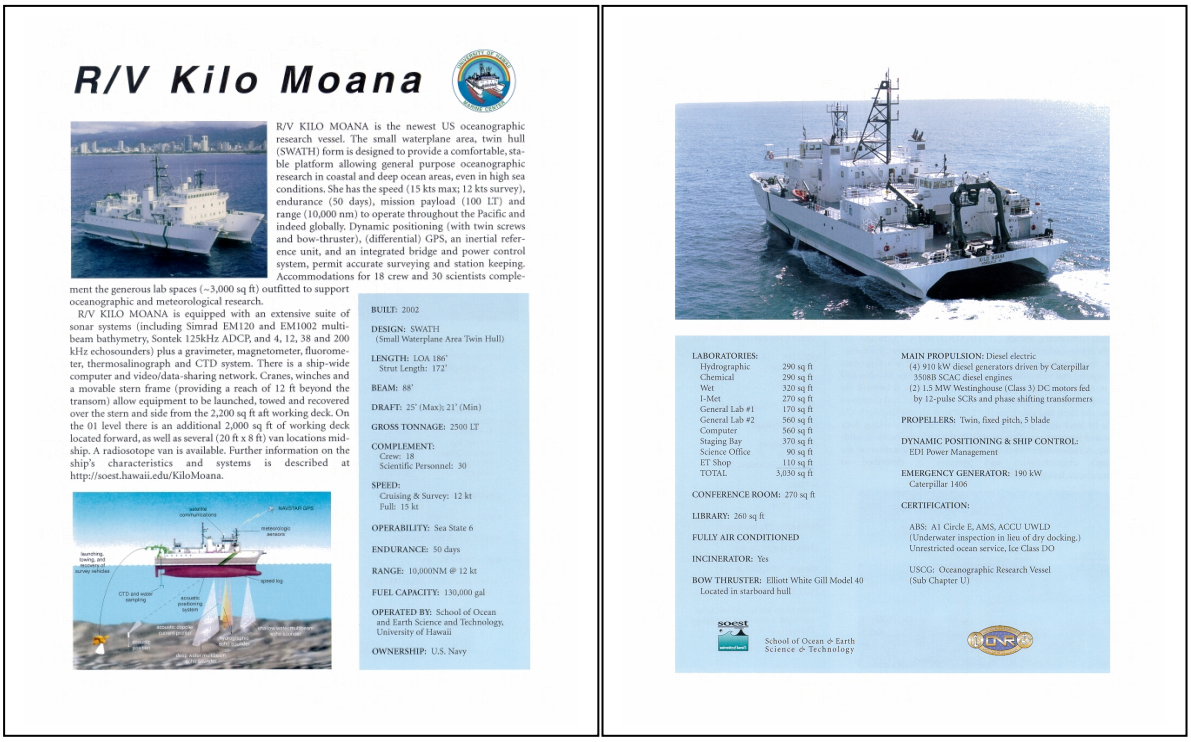


Figure 13.25: The R/V *Klaus Wyrtki* and portraits of its namesake shown in upper left (in center with eyeglasses) working at sea as a young scientist, and in upper right as a distinguished senior scientist at UH circa 1995. (portraits from SOEST archives; vessel photos by D. Karl; collage design by N. Hulbirt)

13.11. R/V *Kilo Moana* (2001-present)







R/V Kilo Moana

R/V KILO MOANA is the newest US oceanographic research vessel. The small waterplane area, twin hull (SWATH) form is designed to provide a comfortable, stable platform allowing general purpose oceanographic research in coastal and deep ocean areas, even in high sea conditions. She has the speed (15 kts max; 12 kts survey), endurance (50 days), mission payload (100 LT) and range (10,000 nm) to operate throughout the Pacific and indeed globally. Dynamic positioning (with twin screws and bow-thruster), (differential) GPS, an inertial reference unit, and an integrated bridge and power control system, permit accurate surveying and station keeping. Accommodations for 18 crew and 30 scientists complement the generous lab spaces (~3,000 sq ft) outfitted to support oceanographic and meteorological research.

R/V KILO MOANA is equipped with an extensive suite of sonar systems (including Simrad EM120 and EM1002 multibeam bathymetry, Sontek 125kHz ADCP, and 4, 12, 38 and 200 kHz echosounders) plus a gravimeter, magnetometer, fluorometer, thermosalinograph and CTD system. There is a ship-wide computer and video/data-sharing network. Cranes, winches and a movable stern frame (providing a reach of 12 ft beyond the transom) allow equipment to be launched, towed and recovered over the stern and side from the 2,200 sq ft aft working deck. On the 01 level there is an additional 2,000 sq ft of working deck located forward, as well as several (20 ft x 8 ft) van locations midship. A radiosotope van is available. Further information on the ship's characteristics and systems is described at http://soest.hawaii.edu/KiloMoana.

BUILT: 2002

DESIGN: SWATH
(Small Waterplane Area Twin Hull)

LENGTH: LOA 186'
Strut Length: 172'

BEAM: 88'

DRAFT: 25' (Max); 21' (Min)

GROSS TONNAGE: 2500 LT

COMPLEMENT:
Crew: 18
Scientific Personnel: 30

SPEED:
Cruising & Survey: 12 kt
Full: 15 kt

OPERABILITY: Sea State 6

ENDURANCE: 50 days

RANGE: 10,000NM @ 12 kt

FUEL CAPACITY: 130,000 gal

OPERATED BY: School of Ocean and Earth Science and Technology, University of Hawaii

OWNERSHIP: U.S. Navy

LABORATORIES:

Hydrographic	290 sq ft
Chemical	290 sq ft
Wet	320 sq ft
I-Met	270 sq ft
General Lab #1	170 sq ft
General Lab #2	560 sq ft
Computer	560 sq ft
Staging Bay	370 sq ft
Science Office	90 sq ft
ET Shop	110 sq ft
TOTAL	3,030 sq ft

CONFERENCE ROOM: 270 sq ft

LIBRARY: 260 sq ft

FULLY AIR CONDITIONED

INCINERATOR: Yes

BOW THRUSTER: Elliott White Gill Model 40
Located in starboard hull

MAIN PROPULSION: Diesel electric
(4) 910 kW diesel generators driven by Caterpillar 3508B SCAC diesel engines
(2) 1.5 MW Westinghouse (Class 3) DC motors fed by 12-pulse SCRs and phase shifting transformers

PROPELLERS: Twin, fixed pitch, 5 blade

DYNAMIC POSITIONING & SHIP CONTROL:
EDI Power Management

EMERGENCY GENERATOR: 190 kW
Caterpillar 1406

CERTIFICATION:

ABS: A1 Circle E, AMS, ACCU UWLD
(Underwater inspection in lieu of dry docking.)
Unrestricted ocean service, Ice Class DO

USCG: Oceanographic Research Vessel
(Sub Chapter U)

SOEST
School of Ocean & Earth Science & Technology

On 1 May 1991, C. Barry Raleigh, then dean of SOEST, submitted a proposal to the chief of the Office of Naval Research for the "Assignment and Operation of the Deep Ocean Research Ship AGOR 24/25." Thus began a decade-long quest for a UNOLS vessel to replace the aging R/V *Moana Wave* (AGOR-22).

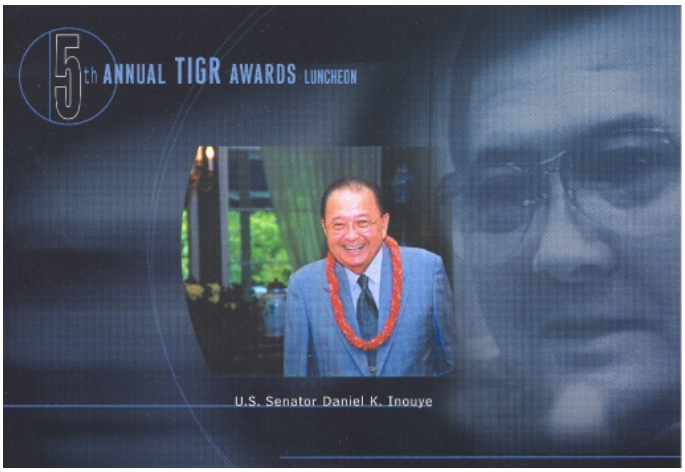
With the availability of AGOR-24 in 1994, or the AGOR-25 shortly thereafter, SOEST would be able to enhance its wide-ranging and excellent oceanographic research and teaching programs. In addition, an open ocean capable UNOLS vessel home-ported in Honolulu would provide a strategic and economically favorable fleet asset for national research in the western Pacific and Indian Ocean regions. The justifications for a research vessel upgrade at UH seemed overwhelming.

Dean Raleigh's comprehensive proposal detailed acquisition and outfitting plans as well as vessel and shore support staffing and operations. According to the 1991 proposal, the R/V *Moana Wave* would be operated until deactivation was necessary to cross-deck equipment or to schedule crew assignments to the new AGOR, probably about December 1993 for a November 1994 delivery of the vessel (assuming AGOR-24). Finally, SOEST agreed to support student training cruises, science equipment upgrades, and other measures to enhance the research capability of the vessel in the amount of $450,000 per annum.

All marine scientists at SOEST were excited about this potential, significant upgrade to our marine expeditionary programs, but in the end the AGOR-24 and AGOR-25 – both "Thompson-class" vessels – were awarded to Scripps (eventually the R/V *Roger Revelle*)

and WHOI (eventually the new R/V *Atlantis*) in large part based on the amount of ONR work that was funded at those institutions. To make matters worse, there was a general announcement from ONR and NSF that no additional ships were needed in the UNOLS fleet in the near future. This negative outcome was, by any measure, a major disappointment for all SOEST faculty, and potentially a major setback for UH marine expeditionary programs.

If this had been the end of the story, UH would most likely still be operating the R/V *Moana Wave* today or be out of the business of "blue-water" oceanography altogether. Enter Hawaii's congressional delegation with senior senator Dan Inouye at the helm. On Tuesday 1 October 1996, a press release from Senator Inouye's office in Washington, D.C. announced the final passage of H.R. 4278, the omnibus appropriations bill. In the 1997 fiscal year Department of Defense appropriation was a line "For the construction of a new oceanographic ship to replace the aging *Moana Wave* operated by the University of Hawaii…$45,000,000." The senator had done it again!



One of many Senator Dan Inouye "appreciation" days – this one a luncheon sponsored by TIGR (Targeted Industries Growth Report) in August 2003. The citation (http://www.tigrnet.org/tigr/reports/08_03issue.html) read: "Senator Daniel K. Inouye, arguably the single most important individual contributor in the last decade to birth, growth and/or current success of eight out of twelve TIGR industries in Hawaii – particularly ocean sciences."

Even before this decision had been made –and especially after it – there was a tidal wave of controversy surrounding this legislative earmark, including articles in *Science* (vol. 273: 176, 12 July 1996), *The Chronicle of Higher Education* (19 July 1996 issue, page A-30), and in the Honolulu newspapers. The most vocal criticism came from administrators at Scripps and WHOI which, according to Dean Raleigh in a 6 July 1996 *Honolulu Star-Bulletin* Letter to the Editor, was "not exactly credible opposition, especially since the proposed ship will cost less than ships just acquired by them." He went on to say that "Senator Inouye is doing a public service – not just for Hawaii but for the national cause of maintaining a modern, cost-effective research fleet." Most reasonable people, at least those in Hawaii, agreed.

The long, involved, and complete saga of the "AGOR-26" will not be reported here – perhaps former SOEST Dean Raleigh or current Associate Dean Brian Taylor can prepare that novel at some point in the future; only a few significant benchmarks are noted (Table 13.2, and below). Suffice it to say that the national defense authorization and appropriations act for FY97 provided $45 M in the category of Ship Construction,

Navy (SCN) for the acquisition of a Small Waterplane Area Twin Hull (SWATH) oceanographic vessel as a replacement for the R/V *Moana Wave*. In FY98 these funds were transferred from the ship construction account to Research, Development, Test and Evaluation, Navy (RDTE,N), at the Navy's request. This provided for the use of a relatively new procedure specified in section 845 of the national defense authorization act for FY94 – to streamline the ship acquisition process.

Table 13.2: The Evolution of the R/V *Kilo Moana* (AGOR-26) (prepared by Robert Hinton, SOEST)

Date	***Event/Benchmark***
Jan 1998	UH selected to operate AGOR-26
5 May 1998	Lockheed Martin Corporation selected to head industry team for design, then construction
27 Oct 1999	Construction contract awarded to Lockheed Martin
18 Mar 2000	Completion of model testing in wave tank in San Diego
8 Jan 2001	Begin cutting steel (module #3)
9 Feb 2001	Keel laying ceremony (module #3)
2 May 2001	Motors installed
16 Nov 2001	Complete steel work
17 Nov 2001	Christen and launch R/V *Kilo Moana*
3 May 2002	Complete sea trials
24 Jun 2002	Preliminary acceptance of vessel by ONR-NAVSEA and assignment of the vessel to UH as per the terms of the charter party agreement
3 Sept 2002	R/V *Kilo Moana* arrives at pier 45, Snug Harbor
10 Sept 2002	R/V *Kilo Moana* is blessed at a ceremony at Aloha Tower, and immediately enters service to ocean science community

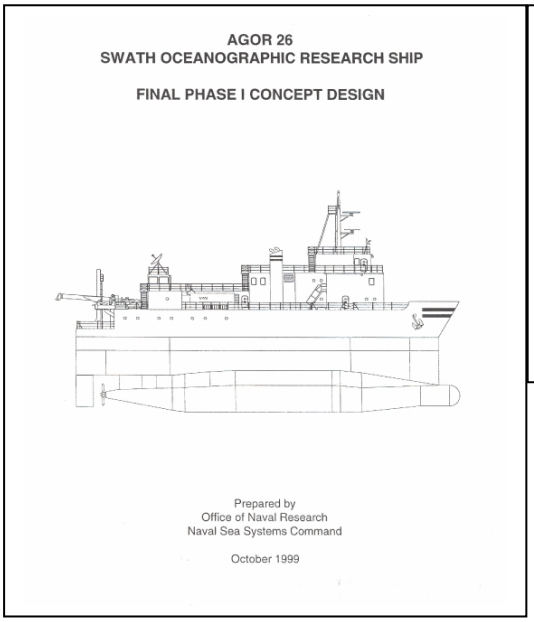
In January 1998, UH was selected to operate the planned AGOR-26 and after another competitive solicitation, Lockheed Martin Corporation was selected on 5 May 1998 to head the industry team for the design ($1 M) and the construction ($36 M) phases of the project. Phase I (design) was completed on 10 March 1999 and shortly thereafter, Atlantic Marine Industries located in Jacksonville, Florida was selected as the shipyard where the vessel would be built. (note: The initial intent was to have this vessel constructed at Ingalls Shipbuilding, Inc., in Mississippi – Senator Trent Lott's district; this failed after that shipyard returned an inflated bid.) Lockheed Martin selected Guido Perla and Associates as their design agent. A detailed list of "desired operational capabilities" and mission requirements was assembled, in large part, from an interdisciplinary UH committee of potential users chaired by Brian Taylor, then SOEST associate dean. The "first conceptual" design (Figure 13.26) was met with great

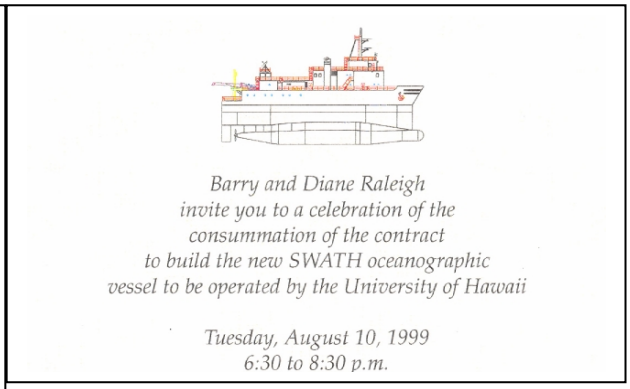
enthusiasm and pride, even if the final (as-built) design turned out to be very different. The details – at that time – did not matter; the UH AGOR-26 project was finally underway.

(note: The NOAA ship *Ronald H. Brown* – built to AGOR-23 "Thompson-class" specifications that were also identical to AGOR-24/25 – was initially identified as AGOR-26 during the construction of the vessel at Halter Marine's Moss Point shipyard where the others in this class had been built for the Navy. However, the R/V *Ronald H. Brown* was not a Navy vessel, so the "AGOR" designation was inappropriate; see *Box 13.4*. The "real" AGOR-26 – the SWATH vessel *Kilo Moana* – was eventually born during a keel laying ceremony on 9 February 2001 in Jacksonville, Florida.)



Figure 13.26: First artist's conception of the new UH research vessel – AGOR-26 – circa 1998. The vessel is shown here "comfortably" conducting research in sea state 6 in the North Pacific due to its unique SWATH design. The eventual design was substantially different from that shown here after the final design team was selected. (from SOEST archives)





Final design phase for the ONR-NavSea AGOR-26 project, circa fall 1999, was a good cause for celebration! Construction followed shortly with the award of the construction contract on 27 October 1999 to Lockheed Martin and the keel laying ceremony on 9 February 2001 at the Atlantic marine shipyard in Jacksonville, Florida.

During the ship construction phase, Robert Hinton was the on-site project manager for UH. On a weekly basis, like clockwork, from keel laying to christening and beyond, Hinton sent progress reports, posted digital photos, highlighted accomplishments, and pointed to potential problem areas as the new vessel took shape (Figure 13.27). Because the R/V *Kilo Moana* was assembled from 71 pre-fabricated "modules" the vessel's profile sometimes changed dramatically, even overnight, as new sections were added – this was especially true once the main deck was in place to connect the twin hulls (Figure 13.27).

Naming the AGOR-26 was the next task. In the tradition of most previous UH fleet assets there was a desire among many scientists and administrators to have a Hawaiian name – one that would indicate our heritage with the sea. Finally, after some debate, the name *Kilo Moana* (Hawaiian for "oceanographer") was proposed by Dean Raleigh. Because the vessel would be a navy owned asset, permission would need to come from the highest levels of the defense department. Eventually permission was so granted and the official documents indicated that AGOR-26 would henceforth be known as *Kilomoana*. Unfortunately, they had used one meaningless word, rather than two words, in their official correspondence and to get a military decision reversed appeared to be more difficult than making the decision in the first place. Suffice it to say UH was spared the exposure and embarrassment of this misuse of the Hawaiian language when the ranking authority, the secretary of the navy, agreed to the name change (Figure 13.28).

The research vessel *Kilo Moana* was christened and launched on 17 November 2001 from the Jacksonville shipyard where she had been built; Senator Inouye's wife, Margaret, was the ship's sponsor (Figure 13.29). On 24 June 2002, at approximately 1530 hrs Hawaii Standard Time, the paperwork was signed turning the R/V *Kilo Moana* over to UH according to the pre-arranged terms of the charter party agreement.

The vessel conducted sea trials off Florida and in the Gulf of Mexico before transiting the Panama Canal in August 2002 bound for its new home in the Pacific Ocean. R/V *Kilo Moana* sailed into Honolulu Harbor on 3 September 2002 (Figure 13.30), was blessed at an official ceremony at Aloha Tower on 10 September (Figures 13.31 and 13.32), and immediately entered service to the marine science community beginning with a visit to Station ALOHA – the site of the ongoing Hawaii Ocean Time-series study. The decade-long struggle to retain a major UNOLS fleet asset in Honolulu was finally over.

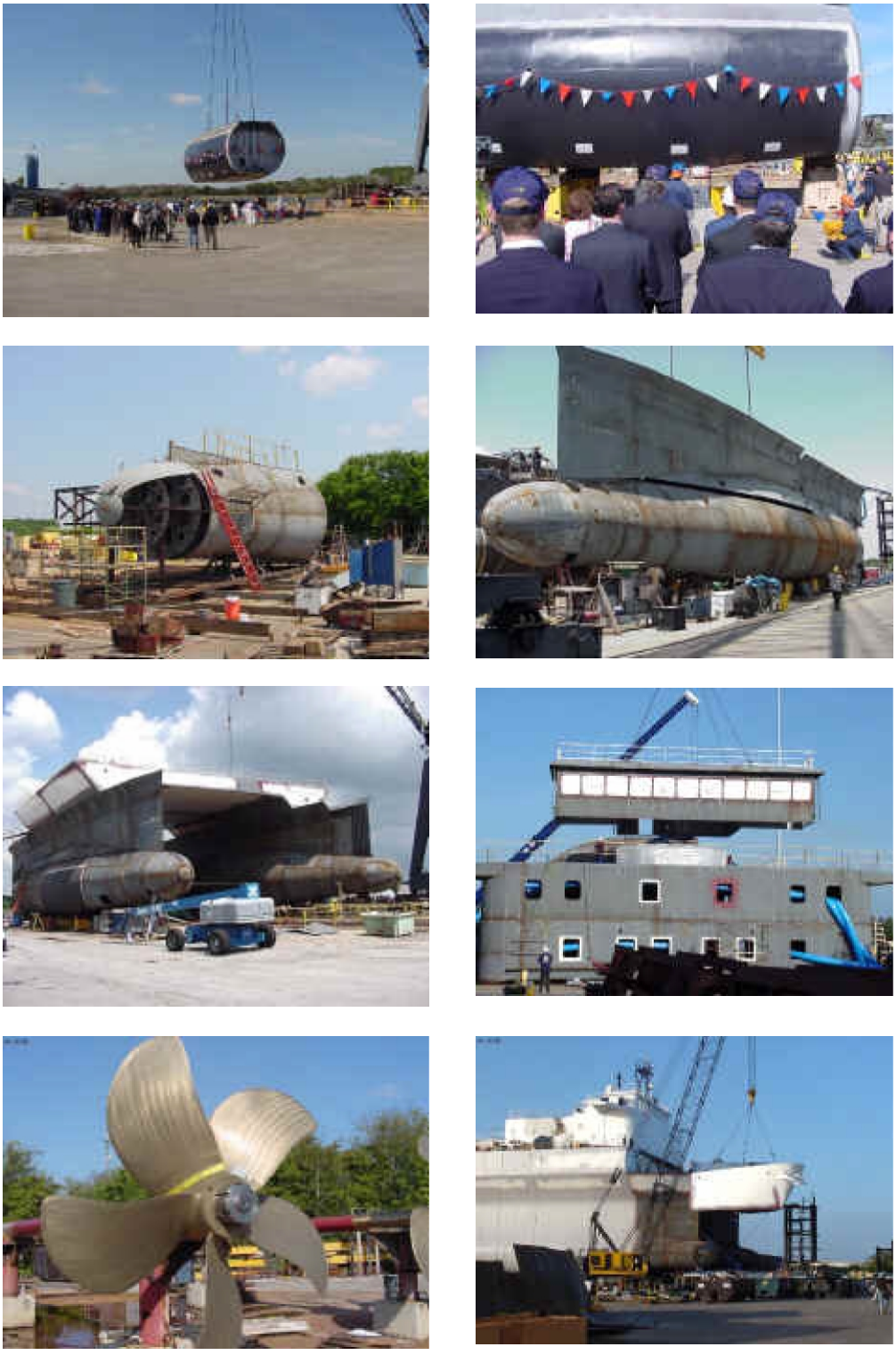
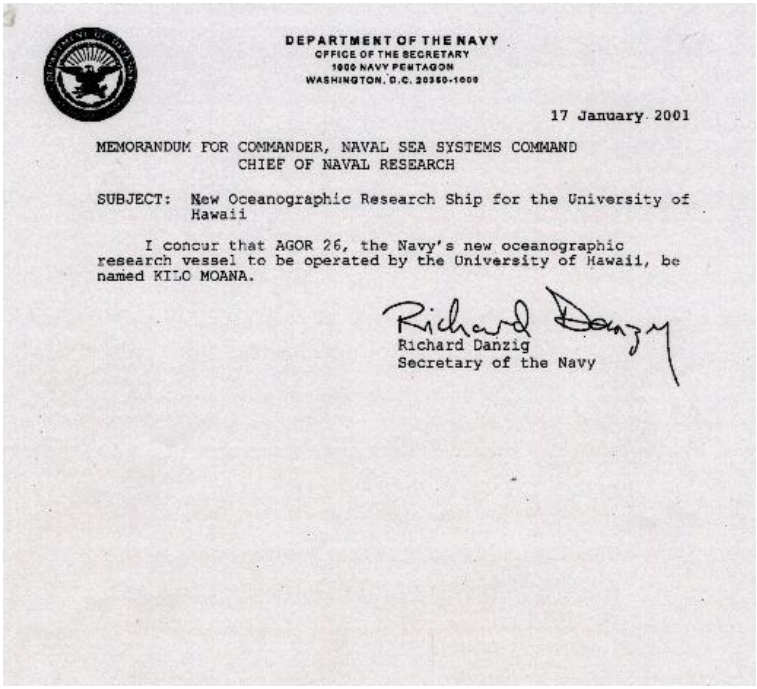


Figure 13.27: Modular construction of the R/V *Kilo Moana* at the Atlantic Marine Inc. yard in Jacksonville, Florida from landing of module #3 and formal keel laying ceremony (top) to completion – also see Figure 13.29. (photos by Robert Hinton, SOEST)



DEPARTMENT OF THE NAVY
OFFICE OF THE SECRETARY
1000 NAVY PENTAGON
WASHINGTON, D.C. 20350-1000

17 January 2001

MEMORANDUM FOR COMMANDER, NAVAL SEA SYSTEMS COMMAND
CHIEF OF NAVAL RESEARCH

SUBJECT: New Oceanographic Research Ship for the University of Hawaii

I concur that AGOR 26, the Navy's new oceanographic research vessel to be operated by the University of Hawaii, be named KILO MOANA.

Richard Danzig
Secretary of the Navy

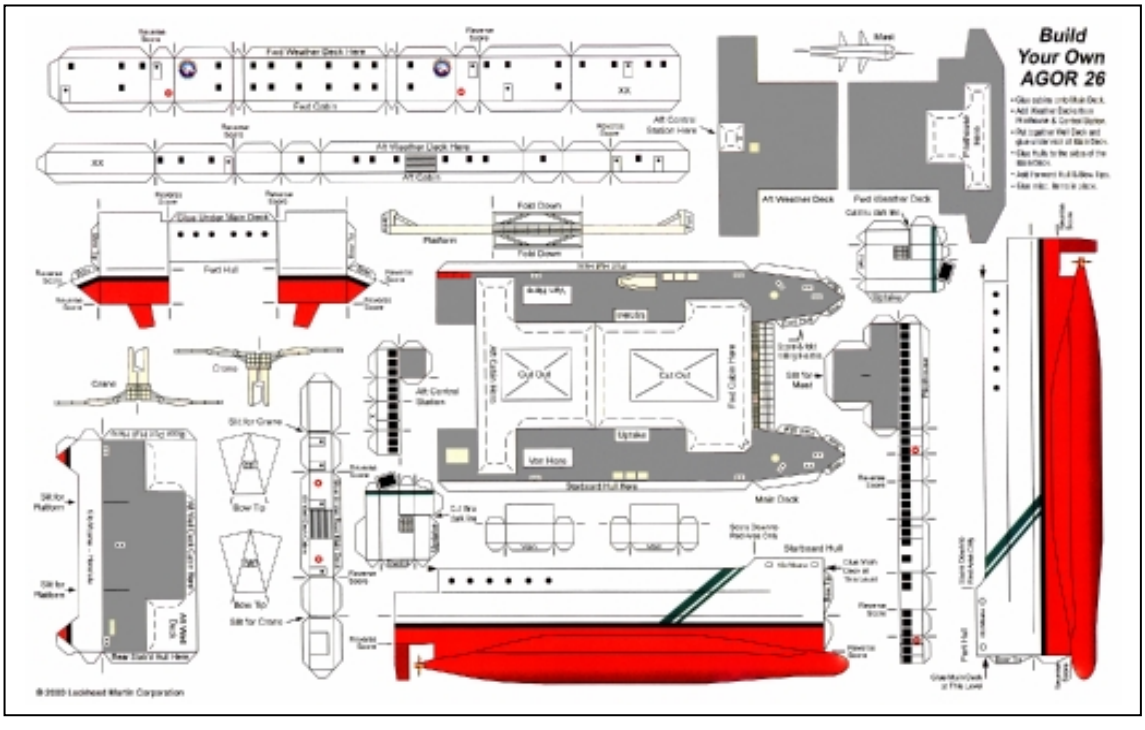


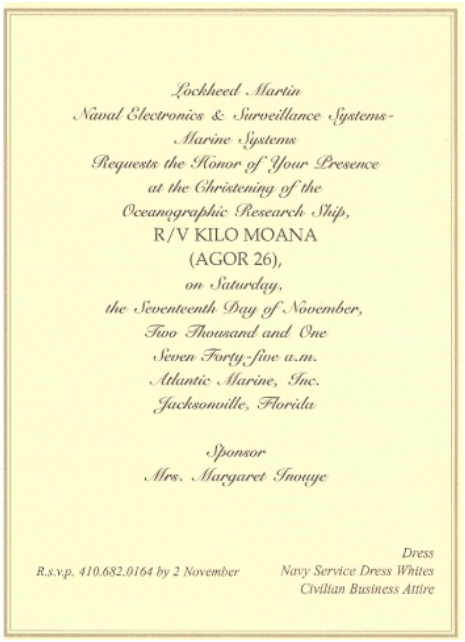
Figure 13.28: Once the vessel was officially named (left), and completely designed and model tested, Lockheed Martin Corporation prepared a clever, paper cut-out diagram titled "Build your own AGOR-26." This kept many of the UH marine scientists occupied while they awaited the construction of the "real" vessel. (from Lockheed Martin, copyrighted 2000)











Lockheed Martin
Naval Electronics & Surveillance Systems-
Marine Systems
Requests the Honor of Your Presence
at the Christening of the
Oceanographic Research Ship,
R/V KILO MOANA
(AGOR 26),
on Saturday,
the Seventeenth Day of November,
Two Thousand and One
Seven Forty-five a.m.
Atlantic Marine, Inc.
Jacksonville, Florida

Sponsor
Mrs. Margaret Inouye

R.s.v.p. 410.682.0164 by 2 November

Dress
Navy Service Dress Whites
Civilian Business Attire

Figure 13.29: R/V *Kilo Moana* christening ceremony at Atlantic Marine Industries in Jacksonville, Florida in November 2001. Shown at top left is SOEST Associate Dean Brian Taylor and Dean Barry Raleigh with the ship's sponsor, Margaret Inouye. At right, champagne breaking ritual on one of the two hulls of this unique vessel. (photos by Robert Hinton, SOEST)











Figure 13.30: ***Kilo Moana*** **arrives at its new home in September 2003 to well-deserved fanfare and celebration including an aloha hula. Shown above at right is the author posing in front of the lei-draped** ***Kilo Moana*** **on the day of its arrival at Snug Harbor. The smile on the face of Dean Raleigh (left) says it all! (SOEST archives)**

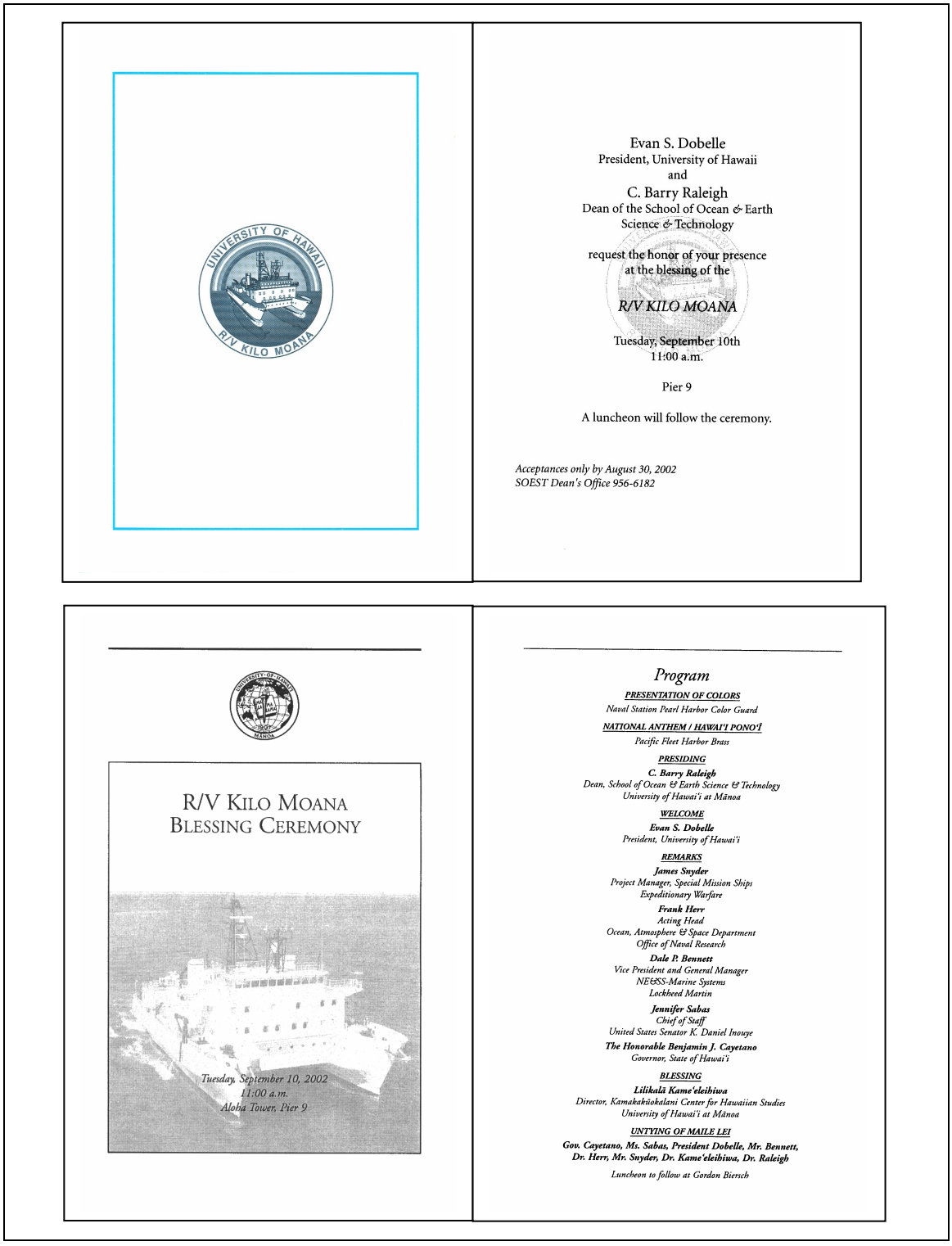


Figure 13.31: The invitation and program for the *Kilo Moana* blessing ceremony at Aloha Tower on 10 September 2002.



Figure 13.32: The blessing of the R/V *Kilo Moana* (AGOR-26) at Aloha Tower. Shown (clockwise from upper left): *Kilo Moana* at the dock at pier 9, Aloha Tower; military color guard from naval station, Pearl Harbor; Dean Barry Raleigh addressing the distinguished guests; Governor Ben Cayetano, Mayor Jeremy Harris, and UH President Evan Dobelle – a few of the distinguished guests present for this historic occasion! (photos by D. Karl)

This modern, state-of-the-art vessel is the first AGOR to be constructed on a SWATH design. The unique hull provides a comfortable, stable platform for a multi-disciplinary global ocean research mission. The vessel's overall length of 186 feet and broad 88-foot beam provide ample exterior deck space and 3,000 square feet of dedicated interior science laboratory space, including a mix of general-purpose and specialized laboratories. The vessel is equipped with both a deep-water (Simrad EM 120) and a shallow-water (Simrad EM 1002) multi-beam echo sounder capable of accurate sea-floor mapping at any ocean depth, dynamic positioning, and a complement of winches, cranes and other handling gear. The vessel has 48 berths (31 for science), a wonderful galley with excellent food, and numerous other accommodations. Powered by two diesel electric 1,500 KW Westinghouse motors, *Kilo Moana* has a range of 10,000 nautical miles at 11 knots, and an endurance of 50 days at sea. In April 2003, R/V *Kilo Moana* deployed on its first extended research mission – 6 months in the polar seas off Alaska. Initial field reports suggest that the *Kilo Moana* may have one of the most competent and user-friendly crews in the UNOLS fleet, led by Captain Gray Drewry.

13.12. Short-Term Charters and Ships of Opportunity

Other charter vessels, including the *Sitkin*, *Holokai*, *Taranui*, *California*, *El Greco*, *Pele*, and *Machias* have been used to support UH marine expeditionary research over the years (Figure 13.33). The SSP *Kaimalino*, a Navy-owned SWATH vessel, and the *Valiant Maid* had slightly more formal and enduring charter missions for work in Hawaiian waters (see *Boxes 13.7* and *13.8*). One UH-RCUH charter vessel, the *Holoholo*, was lost at sea in December 1978 with all hands, including three UH scientists (see section 14). This tragedy resulted in a comprehensive review of policies and procedures governing the use of commercial charter or private vessels for UH marine research.



Figure 13.33: The charter vessel *El Greco* at pier 45, Snug Harbor, circa 1983. (SOEST archives)



Over the years, UH marine scientists have also had access to the entire UNOLS fleet (see *Box 5.2*), Antarctic research vessels on charter to the NSF (Figure 13.34) or owned by the US Coast Guard, NOAA vessels, and even foreign flagged and operated research platforms in service worldwide (e.g., see *Box 13.9*). In 1999, Margo Edwards – a SOEST geologist – may have made one of the most unusual sea voyages. Margo and a team of researchers cruised from Honolulu to the geographic North Pole and back, mostly underwater, aboard the Sturgeon-class nuclear submarine USS *Hawkbill*.

Box 13.7*: SSP *Kaimalino

During the early 1970s, the Naval Undersea Center Hawaii Laboratory designed, and the US Navy built, a new type of ocean vessel that was uniquely suited for the rough waters of Hawaii's inter-island channels. The 190-ton prototype vessel, not an official Navy ship, was called the Semi-Submerged Platform (SSP) *Kaimalino* (note: *Kaimalino* is from the Hawaiian phrase "Malino ke kai" or "the sea is calm"). Instead of a conventional monohull, buoyancy for the *Kaimalino* derives from two large horizontal cylinders that ride below the sea surface. The result is an extremely stable platform – hence the name.



SSP Kaimalino *shown here circa 1988 at sea in support of the UH-DUMAND research program. (courtesy of J. Learned, UH Department of Physics and Astronomy)*

During FY 1975-76 the state of Hawaii Department of Transportation, through the state's marine affairs coordinator, John Craven, chartered the SSP *Kaimalino* to conduct demonstration sea trials for the possible use of the SSP hull for inter-island auto-passenger ferry service.

Many years later, the SSP *Kaimalino* was called into service to support marine expeditionary research at UH, including use by the high energy physics group for their Deep Underwater Muon and Nutrino Detection (DUMAND) program, and by the oceanographers for their support of the Hawaii Ocean Time-series program. Although the vessel was cramped (1 large stateroom, 1 head-shower, a small galley, limited laboratory space) it was extremely stable and therefore well-liked by the scientists who sailed aboard it. Portable berthing and laboratory vans provided the necessary facilities and a mid-ship's moon pool provided safe and convenient access to the sea.

When the US Navy's facility on Mokapu Peninsula ceased operations in the early 1990s, the vessel was transported to the main NOSC laboratory in San Diego where it was temporarily mothballed until a decision could be made about the vessel's future. Eventually, plans were made for the vessel to be excessed, and at that point Steven Loui, president of Navatek Ships, an affiliate of Pacific Marine and Supply Company in Honolulu, realized the potential of having an asset like SSP *Kaimalino* back in the islands.

continued

***Box 13.7*: SSP *Kaimalino* (continued)**



HOT program scientists at sea aboard the SSP Kaimalino *in 1990.*

Soon thereafter, in spring 1996, Pacific Marine entered into a Cooperative Research and Development Agreement (CRADA) with Space and Naval Warfare (SPAWAR) systems center in San Diego, a federal laboratory of the US Navy, and the Pacific Missile Range Facility (PMRF) to operate the SSP *Kaimalino* both for PMRF and other charter parties potentially including UH. Prior to delivery back to Honolulu, the vessel was fitted with two new Detroit diesel engines, generators, and other facilities to support a new open ocean mission. The reconfigured *Kaimalino* has a mission payload of 16 tons, cruising speed of 10-12 knots, and a 3,000 nautical mile range. Sea trials were completed in 2002.

In April 2003, UH at Manoa Chancellor Englert established an *ad hoc* SSP *Kaimalino* "assessment" committee, and gave them the charge to evaluate the feasibility of employing the vessel for ongoing and new research and education programs. Bob Gauldie – then special assistant to the Chancellor and faculty member in SOEST – chaired the *ad hoc* committee. Members included Chuck Helsley, Judy Rubano, Ken Kaneshiro, and Dave Karl.

In May 2003, the committee returned a recommendation that was in favor of UH operation of SSP *Kaimalino*. Chancellor Englert tasked Brian Taylor – then associate dean of SOEST – to conduct a survey of the vessel, and to prepare a report for action. In August 2003, a survey team consisting of marine superintendent Stan Winslow, UH port captain Bob Hayes, UH port engineer John Nicola, SOEST associate dean Brian Taylor, STAG manager Steve Poulos, and Dave Karl made a visit to the SSP *Kaimalino* at the Pacific Marine Facility. A final report was submitted in late November 2003. Shortly thereafter the decision was made by Chancellor Englert to move forward with acquisition, outfitting, and operation of the *Kaimalino* for UH marine science and education programs. On 15 December 2003 the vessel was moved to pier 45 where it now awaits its next mission (see below, right).





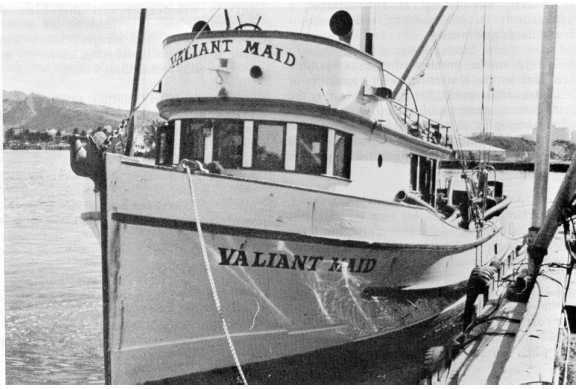


Box 13.8*: The *Valiant Maid

The 57-foot vessel *Valiant Maid* was used extensively by marine scientists from HIMB, on a charter basis, for several research projects, especially during the period 1972-1973 when UH had a nearly exclusive charter (note: Operating costs at that time, including the services of skipper Edward Bilderback, were $3,500 per month).

Originally built as a salmon purse seiner, the *Valiant Maid* worked for many years out of Cordova, Alaska before arriving in the islands to support marine research.







The Valiant Maid *working off Kahe Point circa 1978 in support of UH research. Standing at the rail, in the photo at left, is skipper Ed Bilderbacker. (photos by T. Tagami)*

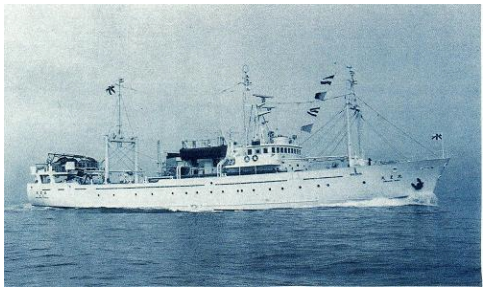




Figure 13.34: From Hawaii to Antarctica – UH scientists conduct a global research mission. (photos by D. Karl)

***Box 13.9*: The UH-Hokkaido University Connection**

In the early 1980s, the Japanese vessel *Hokusei Maru III* – a recently constructed 893 gross ton stern trawler fully equipped for her fishery oceanography education and research missions – ventured into Hawaiian waters to begin what would become a 20-year cooperative research agreement with UH marine scientists. (note: This vessel and the *Hokusei Maru I* and *II* that preceded it, mostly supported the fisheries sciences cadet training programs from Hokkaido University. Jed Hirota and Dick Young, two UH oceanographers, were the lead scientists in Hawaii.)



According to an authoritative article by John Bower, "*The Hokusei Maru: 53 years of research in the Pacific*" which appeared in *Pisces Press*, the *Hokusei Maru III* conducted a cooperative fisheries research cruise in 1981 with scientists from UH and the Honolulu Laboratory of the US National Marine Fisheries Service. This started a long-term annual tradition that lasted 20 years and involved 98 scientists from 14 universities and laboratories in the US, Canada and France. The numerous UH scientists and graduate students included John Bower who received a MS degree in oceanography at UH and a PhD degree in fisheries from Hokkaido University, thus having one foot in each culture.

The focus of the research program in Hawaii was cephalopods and the mesopelagic-boundary community of nekton. The *Hokusei III* was decommissioned in March 2002 and, apparently, will not be replaced.

13.13. Submersible Science at UH



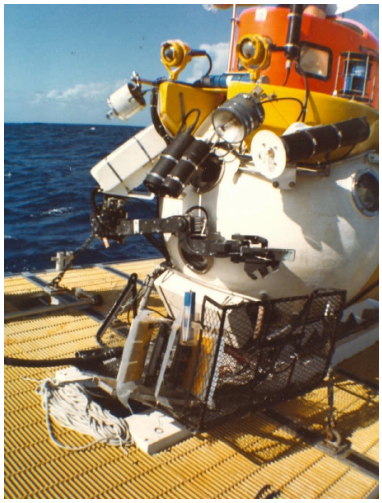
"I'd like to be…under the sea…
in an octopus' garden in the shade"
Ringo Starr
(1940-)

By 1970, UH scientists were routinely using *Naia* (Hawaiian for porpoise), a three-person Perry 3C5C submersible owned and operated by Pacific Submersibles, Inc., an affiliate of TeleCheck International. *Naia* was capable of operating at a maximum depth of approximately 400 m. However, it was not until a decade later that UH would have its own deep submergence program.

With UH marine Dean John Craven's background and expertise with the Navy's deep submergence programs, including both classified research and search-and-rescue, it came as no surprise that he would provide the leadership to initiate an academic submersible science program at UH. In 1978, the undersea habitat AEGIR – then owned by Makai Range – was given to UH; at that time it had an estimated replacement value of $3.6 M. Craven, in his capacity as state of Hawaii marine affairs coordinator (see *Box 6.2*), provided minimal funding for necessary maintenance and to help support a proposal to secure long-term research support for AEGIR. These efforts were coordinated through NOAA's Office of Manned Undersea Science and Technology (MUST), the predecessor of the National Undersea Research Program (NURP). Craven was the point person at UH. It was largely through his efforts that the Hawaii Undersea Research Laboratory (HURL) came into existence.

In January 1980, MUST was reorganized as the National Undersea Research Center (NURC) with UH being one of the four programs initially selected to participate; the others were the Caribbean Hydrolab program in the Virgin Islands, University of Southern California's Catalina Laboratory, and University of North Carolina. Dean John Craven reasoned that we had access to a manned submersible – the two-person *Makali'i*, a skilled pilot, a launch-recovery-transport (LRT) vehicle (below), and a lot of interesting research to pursue.





The Makali'i *sitting atop its unique launch-recovery-transport (LRT) vehicle, circa 1980. (photo by D. Karl)*

The *Makali'i* was built in the 1960s and was brought to Hawaii about a decade later. Then named the *Star II*, it was working in Hawaiian waters under a lease agreement between General Dynamics and the Makai Range. When Makai Range folded in February 1973, the submersible sat idle until Maui Divers began to use it for their harvest of pink coral off Makapuu. UH acquired the submersible in March 1978 and used it for their own research and on contract to Maui Divers. The coral harvesting work ceased in 1979 and there was little planned future use of the 2-person submersible until HURL was established as part of a national deep submergence science program. In August 1980 the *Star II* submersible was rechristened *Makali'i* (Hawaiian for "Little Eyes") when Craven received a grant from NOAA to establish the new laboratory at UH (Figure 13.35).







Figure 13.35: The submersible *Makali'i* (top left) at Makai Pier and (top right) with Rick Grigg displaying one of the prized coral specimens he collected. Bohdan "Bo" Bartko (left) – chief pilot. (from SOEST archives)

Use of the submersible *Makali'i* required a support vessel, which initially was the tugboat *Holokai*, owned and operated by American Work Boats (Figure 13.36). This vessel provided no functional laboratory space for at-sea sample processing or any other science accommodations. In 1981 the *Makali'i* was transported to Enewetak Atoll for a series of research dives in the craters created by the underwater nuclear bomb tests (see *Box 3.12*). At that time Rick Wilson was director of HURL's facilities and Bohdan Bartko was the primary submersible pilot (Figure 13.37).



Figure 13.36: Submersible *Makali'i* on its LRT alongside the support vessel *Holokai* in Hilo Harbor during a series of research dives on the East Rift Zone circa 1985. (photo by D. Karl)



Figure 13.37: The submersible *Makali'i* is readied for its expedition to Enewetak. Shown here are (from left): Rick Wilson, Bohdan Bartko, and Deetsie Chave as they appeared in the 29 May 1981 *Honolulu Star-Bulletin* article (reproduced with permission from *The Honolulu Advertiser*)

In the mid-1980s, the R/V *Kila* (see section 13.7) became the new support vessel for UH submersible science operations (Figure 13.38). On 4 June 1986, Al Simone – then UH president – descended to 400 m off Makapuu Point in the UH submersible *Makali'i* to get a first-hand view of the inner sea. According to newspaper reports, he thoroughly enjoyed the dive and his time aboard R/V *Kila* – even though he did get seasick.

On 18 April 1986 it was reported by Helen Altonn of the *Honolulu Star-Bulletin* that HURL had received $1.4 M in federal funds to purchase the *Pisces V* submersible from British Underwater Enterprises and a new launch and recovery system (Figure 13.39). According to the article, Alex Malahoff, then director of HURL, attributed the development to "incredible support" from Hawaii's four congressmen – especially Senator Daniel Inouye. The *Pisces V* – a 20-foot, 13-ton submersible – could carry three people (2 observers plus a pilot) to depths of 2000 m, compared to the *Makali'i* – a 2-person vehicle with a depth limit of approximately 400 m. Because many of the scientifically interesting targets were well below *Makali'i*'s range, the addition of the *Pisces V* to the UH submersible "fleet" was a significant benchmark in the development of HURL. A second, identical *Pisces* submersible, was purchased by HURL in 1999 (*Pisces IV*) which has also been certified for use in their undersea research programs (see Figure 13.39 and *Box 13.10*).







Figure 13.38: [Top] R/V *Kila* and submersible *Pisces V* aboard the LRT en route to the next dive site. [Bottom] The LRT / *Pisces V* and R/V *Moana Wave* in a 2-ship operation with the R/V *Kila* off Loihi Seamount circa 1988. On right is the LRT/*Pisces V* with snow-capped Mauna Loa in background. (photos by D. Karl)





Figure 13.39: ***Pisces V*** **(left) and** ***Pisces IV*** **(right) provided a long-awaited upgrade to the submersible science programs at UH. (from HURL/SOEST archives)**

In 1993, largely through the efforts of Malahoff, the R/V *Kila* was replaced with the 222-foot vessel, *Ka'imikai-O-Kanaloa* (see section 13.9), for use as the mother ship for the new *Pisces V* and *IV* submersibles.

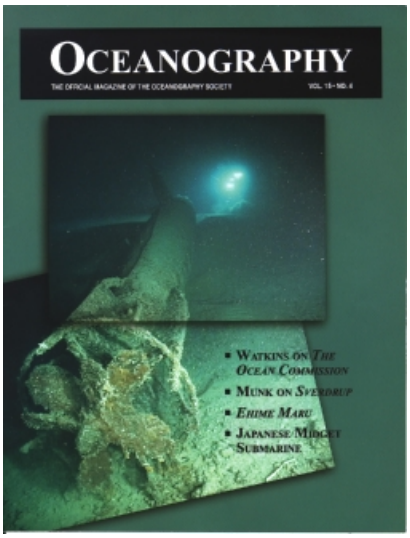
Box 13.10**: HURL discovers Japanese midget submarine**

At 12:20 pm on 28 August 2002, the *Pisces IV* and *Pisces V* located the Japanese midget submarine that was the first vessel sunk in the attack on Pearl Harbor, 7 December 1941. The HURL assets were on a "training mission" at the time and had not specifically been searching for the midget. Their discovery ranks as one of the most significant modern marine archaeological finds in the Pacific basin. In December 2002, Discovery Channel purchased UH submersible time to film the historic find, just 8 km off the mouth of Pearl Harbor. Discussions are now underway to determine who actually owns the midget submarine and what agency, if any, and for what purpose should it be salvaged.

According to a 4 December 2002 *The Honolulu Advertiser* article by William Cole, the significance of the UH discovery is that the presence of the midget submarine now has confirmed that the destroyer *USS Ward* struck the "first blow" on 7 December 1941 and raised anew the debate over the US preparedness for Japan's so-called "surprise attack." An excellent, first-hand account of the excitement surrounding the discovery can be found in an article prepared by HURL Director John Wiltshire at http://www.soest.hawaii.edu/HURL/midget.html, and in Rita Beamish's authoritative article "Midget Sub Mystery" published in the January 2003 issue of UH system magazine *Mālamalama*.

continued

***Box 13.10*: HURL discovers Japanese midget submarine (continued)**



Big-time coverage for a big-time find – the Japanese midget sub.



13.14. UH's Airborne Fleet Assets

In the mid-1960s, HIG owned a 5-passenger, twin-engine Piper aircraft (Figure 13.40). This research facility, purchased with NSF funds for use in aeromagnetic surveys over the Hawaiian Ridge, had a cruising speed of 100-173 mph, a 1,000-mile range and nearly 1-ton payload including passengers, fuel, and equipment.

For a brief period of time (1978-1983) HIG also owned and operated a research amphibious aircraft, a PBY5A Catalina seaplane. The PBY Catalina aircraft was a bit of real history and much has been written about its key role in World War II (e.g., see http://www.vpnavy.com/aircraft_pby_history.html). The Catalina was born in Buffalo, N.Y. in 1935. The amphibious PBY-5A version was perfected by Consolidated Aircraft Company in San Diego in 1938, with deliveries of more than 500 aircraft to the US Navy by 1941. Eventually these planes were used also by the USCG and the British Royal Airforce (Figure 13.41).

The UH Catalina aircraft was donated to UH in September 1978 by William Farinon and Lee Otterson and was assigned to HIG for oceanographic and survey work. Bernie Kilonsky, Marty Vitousek – then researchers in JIMAR – and John Laney – owner of the *Holoholo* (see section 14) – went to Oakland, California to bring the plane back to Honolulu. According to Kilonsky, they first had to be certified for water landing and this training was done in a large lake near Oakland. He also said that due to the limited range of the PBY5A, extra fuel tanks had to be installed for the long trip back to Hawaii. The plane was 60 feet long with a wing span of 104 feet; it weighed 29,310 pounds. Once safe and sound in Honolulu, Vitousek was appointed the "scientist in charge" of this unique but poorly subscribed asset. Due to lack of funded research missions and the high cost of maintenance, the Catalina seaplane was mostly grounded and was not flown

between December 1981 and its sale by auction in May 1983. According to Kilonsky, the aircraft was sold to the Australian Confederate Air Force. The proceeds from the sale were placed into an interest-bearing account, and the interest is still used today to support a broad spectrum of marine programs in SOEST.

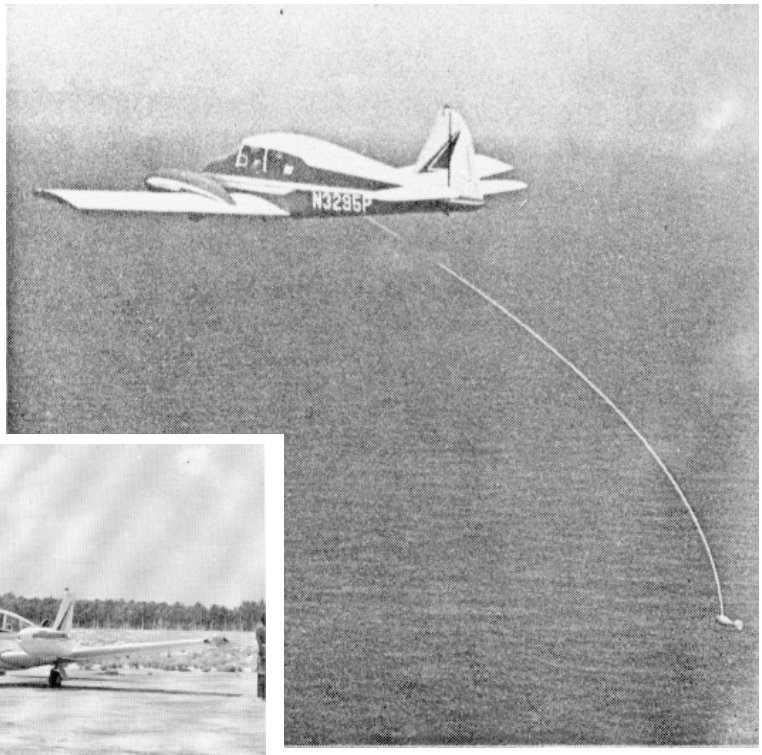




Figure 13.40: UH's twin-engine Piper Comanche aircraft towing the "bird" containing the proton magnetometer. At bottom left, the plane is shown at Fanning Island airstrip circa 1967 receiving fuel between two aeromagnetic missions. (from SOEST archives)

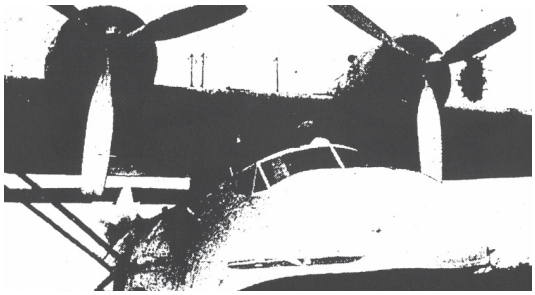




Figure 13.41: UH's 1941 PBY5A Catalina as featured in a 6 April 1983 *Honolulu Star-Bulletin* article by June Watanabe (left; photo by Craig T. Kojima reproduced with permission from *The Honolulu Advertiser*), and the same vintage plane shown at work in an artist's conception of a key WWII offensive mission.

13.15. The "Broken Screw Award"



"There is nothing so desperately monotonous as the sea, and I no longer wonder at the cruelty of pirates"

James Russell Lowell
(1819-1891)

During the first two decades at HIG, there was great pride and friendly competition for marine research excellence among the mostly geology and geophysics oriented research staff. Each group tried to raise the level of the bar of achievement and each PI, graduate student, technician, or sailor tried to push the envelope of scientific possibility – to provide effort and achievement above and beyond the call of duty. Once in a while, unfortunately, things did not go according to plan – sometimes there were setbacks, and once in a while even a major screw-up. For this collection of reasons and for the comradery that stems from field research at sea, the "Broken Screw Award" was created by Director Woollard.

The author has found little on this subject in the written archives, so the information contained in this section is largely based on interviews with past awardees or awardee wannabes. Based on this research, the first Broken Screw Award was presented to Fris Campbell – the "Unknown Explorer" – circa 1973 for his role not only in exploring the ocean's depths but in fending off those would attempt to discredit UH marine research as being dominated by classified military operations.

Since the inaugural presentation of the Broken Screw Award, other awardees have included Pierluigi Pozzi ("The Breaker"), Steve Dang ("The Sleeper"), Paul Jubinski ("The Fixer"), Richard Longfield ("The Consiliary"), Don Hussong ("The Blaster"), Bob Harvey ("The Deliverer"), Ted Jordan ("The Procuror"), and Klaus Wyrtki ("The Predictor"). The award was a large broken screw trophy engraved with the nefarious deed that earned the awardee the deserved recognition (Figure 13.42). For example, in the case of Pierluigi Pozzi, the inscription read "Anything man can make PLAP (for Pierluigi Antonio Pozzi) can break." Apparently Luigi was hard on sea gear and specialized instrumentation! In Don Hussong's case, the award was given for a shore-based, rather than sea-based, screw-up. Without going into all the details, it should suffice to say that Don screwed-up big-time when he volunteered his expertise – and his explosives – to help a group of fish physiologists working at the Kewalo Basin laboratory. The old-timers there can still recall the loss of at least one major, concrete-reinforced fish tank and the observation that full grown tuna can "fly" (and in one case, inflict severe damage to an automobile windshield if placed "in the line of fire") when exposed to an uncontrolled concussion wave! Klaus Wyrtki, a leading authority in the El Niño climate phenomenon, received the broken screw award for his public proclamation – in 1983 – that "there will be no El Niño this year." That year, 1983, had one of the most intense El Niño events on record! According to Fris Campbell, the Broken Screw

Award was generally handed out at some well attended function – such as the HIG Christmas party – where all could enjoy the endless sea stories that followed the presentation.



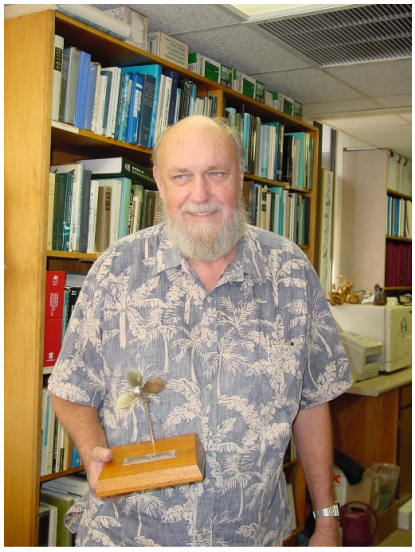






Figure 13.42: Two distinguished Broken Screw awardees. Fris Campbell [top, left] shown receiving the inaugural award circa 1973 from Ted Jordan – the design artist and manufacturer -- and with his award in the author's office in 2004 [top, right]. Shown at bottom is Pierluigi Pozzi circa 2001 with his prized award as retrieved from his closet. The inscription on Pozzi's award read, "Anything man can make, PLAP can break." PLAP was short for Pierluigi Antonio Pozzi. (photos by D. Karl)

It is not clear to the author why the Broken Screw Award is no longer given to deserving recipients. One theory is that "things are not as they were in the old days" – that is to say there are now well-enforced occupational health and safety rules and other regulations that make award-winning events less likely or, at least, less frequent. Another theory is the current preoccupation with lawsuits and political correctness. In any case, many believe that SOEST should reinstate this award – even if it is necessary to lower the bar of expectation – because it, like the international "Albatross Award" (see *Box 4.12*), is something all can strive for!