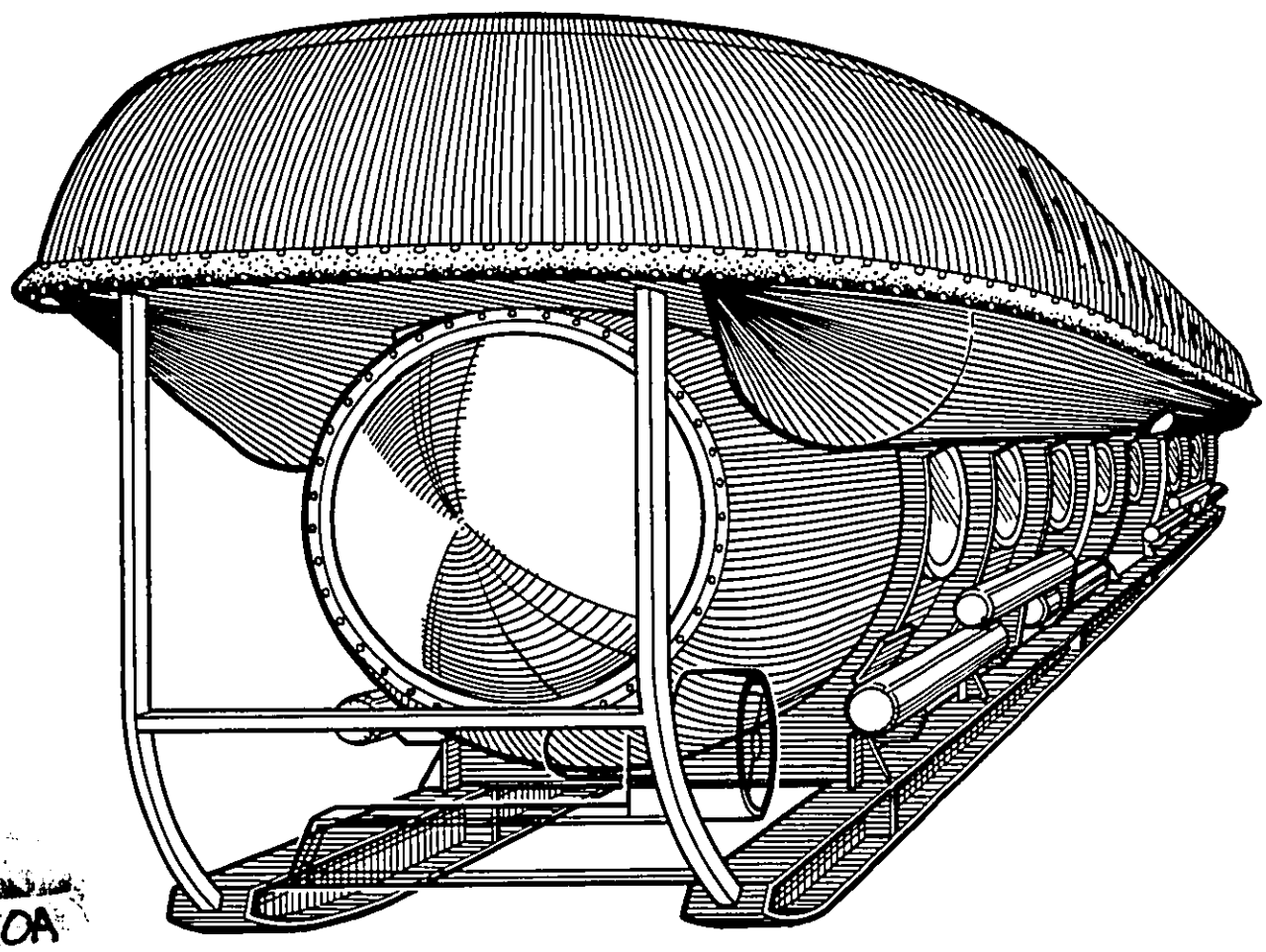
Atlantis

SUBMARINE



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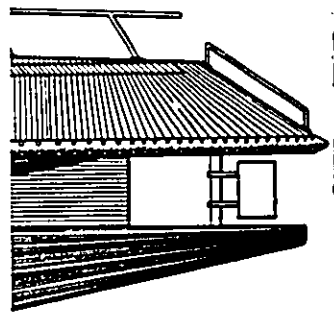

FINAL
ENVIRONMENTAL IMPACT STATEMENT

THE OPERATION OF SUBMERSIBLES
AS A PUBLIC ATTRACTION IN THE
WATERS OFF WAIKIKI, OAHU, HAWAII

George Asquith, Director
Atlantis Submarines, Inc.

Prepared By:

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December 7, 1987

FINAL
ENVIRONMENTAL IMPACT STATEMENT
7 DECEMBER 1987

PROPOSED PROJECT:	Operating Submersibles off Waikiki, Oahu
LOCATION:	Honolulu Island of Oahu
ACCEPTING AUTHORITY:	State of Hawaii Department of Land and Natural Resources
APPLICANT:	Atlantis Submarines, Inc. 900 Fort Street Mall, Suite 1777 Honolulu, Hawaii 96813
CONSULTANT:	AECOS, Inc. 970 N. Kalaheo Ave, Suite A300 Kailua, Hawaii 96734
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AECOS Report No. 466E

EXECUTIVE SUMMARY

Atlantis Submarines Inc. is proposing to operate submersibles as a public attraction in Hawaiian waters off the islands of Hawaii and Oahu. This Environmental Impact Statement addresses only the proposal to operate three submersibles off Waikiki, on the island of Oahu.

Sub Aquatics Development Corporation, the parent corporation of Atlantis Submarines, Inc., is the established world leader in the development of passenger carrying submersibles and is the first and only company in the world to design, construct, and operate submersibles specifically for the purpose of providing underwater tours. The company presently operates submersibles off Grand Cayman, Barbados and the U.S. Virgin Islands in the Caribbean. The operational plan for Hawaiian waters is based upon the company's experience in those jurisdictions.

The submersibles to be utilized in Hawaii have been designed by Sub Aquatics Development Corporation and will be manufactured in the United States. Each will accommodate 46 passengers, seated opposite 20-inch diameter view ports in an air conditioned atmosphere maintained at normal surface pressure. The design, manufacture, and operational procedures will be approved by the American Bureau of Shipping and the United States Coast Guard, and insurance coverage provided by Lloyds of London.

Passengers will purchase reservations for specific dive tours which operate each hour between 0800 and 2200 hours, seven days a week. Passengers will be ferried from shore and transferred to the submarine over the dive site for a 50 minute underwater tour. Each tour will follow a pre-defined route within a prescribed area (the dive site) at depths ranging from 85 to 250 feet.

Dive tours will be conducted within a primary operating area located approximately 4500 feet off the Waikiki shore between the Natatorium and Diamond Head. The primary dive site is in water between 85 and 120 feet deep, characterized by sand and limestone bottom. A portion of each submersible tour will include traveling across this bottom to a depth approaching -250 feet. Passengers will be shuttled to and from the submersible at the dive site by a 50-foot surface vessel. Once over the dive site, passengers will be transferred to the submersible utilizing a loading platform moored over the primary operating area.

No part of the project entails specific construction activities on land. Office and warehousing space will be leased at a location in Honolulu with adequate parking for passengers arriving in private vehicles. This parking area will act as central staging area, to and from which bus transportation will be pro-

vided to a passenger loading site, probably at Aloha Tower in Honolulu Harbor. The City and County of Honolulu, Department of Land Utilization has determined that a Special Management Area Permit will not be required for this project.

Following the final dive of each day, the submersible and the transfer platform will be towed to a moorage site in Keehi Lagoon for maintenance procedures. The below-deck space of the transfer platform will be suitably equipped for recharging the submersible's systems and the performance of routine maintenance procedures.

The dive site has been selected on the basis of criteria developed by the company through its Caribbean operating experience. The primary criteria for selection of a satisfactory dive site are a shore pick-up area in close proximity to a large tourist center, a dive site sufficiently near the shore pick-up area to permit the shuttle craft to maintain a 50-minute turnaround time, favorable sea conditions throughout the year (suitable sea state, water visibility, and underwater currents), and appropriate depth ranges for submersible operations.

Selection of a dive site offshore of and towards the eastern end of Waikiki represents a compromise from an earlier preferred site closer to Honolulu Harbor. The site proposed herein was arrived at with the endorsement of the Maritime Affairs Committee of the Chamber of Commerce of Hawaii, which includes representatives of the State Harbors Division, the U.S. Coast Guard, the Maritime Pilot's Association, and the Hawaii shipping industry.

Little or no natural viewing in the form of limestone formations or coral is present near the proposed site, and the bottom of Mamala Bay at depths exceeding 80 feet can be characterized by featureless, sand and limestone. This bottom does not provide sufficient natural viewing for an optimum level of passenger satisfaction. In order to enhance the underwater viewing, Atlantis Submarines Inc. proposes to construct several habitat structures (known as artificial reefs) utilizing sunken vessels and open-modular structures based on the latest bottom fisheries enhancement technology. Two ships will be placed on the bottom to serve as focal points for the dive tours. The purpose of the habitat structures, including the sunken vessels, will be to enhance the biological productivity of the site and add interest from the standpoints of aesthetics, marine education and scientific research. Educational aspects of the habitat structures, the scientific studies being conducted at the site, and the natural marine life will be emphasized during the dive tours.

The proposed project has no significant adverse impacts. The submersibles are non-polluting and non-destructive of natural resources. Surveys of the dive site reveal that the benthic marine environment is characterized by sandy bottom of low-relief

and a paucity of marine life. Enhancements proposed for the sites will not adversely impact existing natural resources. To the contrary, the development of habitat structures will be scientifically designed to substantially increase the local biological productivity.

The State of Hawaii has established as a priority the encouragement of the economic development of its ocean resources. This project has the potential of setting Hawaii apart from the rest of the nation in being the first state to provide the opportunity for all to experience an underwater world that is currently accessible to very few.

The direct benefits of the project to Hawaii can be readily assessed in terms of capital expenditures, employment, promotion of tourism, scientific research, and education. The indirect, and potentially more valuable, long range benefit of the project will be its contribution to increasing public awareness of the importance of the ocean's precious resources.

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SECTION A.

INTRODUCTION

Research submersibles, vehicles built and designed to explore and conduct work in the deep sea, have undergone a quiet technical evolution since the 1930's and have been utilized in Hawaiian waters for several decades. The first free-diving vessels accommodated no more than one or two people and offered very limited viewing of the deep sea realm through small ports. Early advances in the technology of these vehicles concentrated on maneuverability, reliability, safety, and operating depth. Manned vehicles have now reached the deepest parts of the oceans, descending to depths of over 35,000 feet (The "Trieste" diving in the Mariana Trench in 1959). Technological advances now enable submersibles to accomplish an expanding range of practical applications.

The "discovery" of the "Titanic", which sank in the North Atlantic in 1912, using the submersible "Alvin" and its robot "Jason" was an internationally publicized demonstration of how technically advanced undersea exploration has become. The current exploration of the volcano, "Loihi", 18 miles off the Big Island and 3000 feet below the sea surface, is an application of this advanced technology in local waters.

A natural outcome of the advances in this field is the concept of utilizing submersibles to satisfy an increasing public interest in underwater exploration. The proposed introduction of submersible vessels as a commercial tourist attraction in Hawaiian waters, presented in this Environmental Impact Statement, bring the opportunity for all to experience that which has been accessible to only the most avid divers and a relatively small contingent of professionals working in the field. The ramifications of this proposal go beyond the commercial nature of the venture, producing spin-off benefits to Hawaii by way of enhanced public awareness, education, scientific research, and provide the opportunity for Hawaii to remain in the forefront in tourism and undersea development.

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SECTION B.

PROJECT DESCRIPTION

B.1 ATLANTIS SUBMARINES, INC.

Atlantis Submarines, Inc. ("Atlantis Submarines") is a Hawaii subsidiary of Sub Aquatics Development Corporation ("Sub Aquatics") of Vancouver, Canada. Sub Aquatics was founded in 1983 to develop, manufacture, and operate "Atlantis" passenger submarines for the purpose of providing underwater tours in tropical resort areas. The company was formed by a core group with over 50 years combined expertise in commercial submersible technology and operations.

Sub Aquatics designed and built the "Atlantis" Submarine systems which are operated in the Cayman Islands and Barbados by wholly owned subsidiaries. The submersible, "Atlantis I", has been operating in Grand Cayman since January 1986. "Atlantis II", after being featured at Expo 86, has been operating in Barbados since February 1987. "Atlantis III" began operations in the U.S. Virgin Islands in July 1987. To date, more than 100,000 passengers have been carried in over 5,000 operating dives in these operations.

Atlantis submersibles operating or under construction at this time are:

-- Design Series 1 / 28 passenger --
- "Atlantis I", delivered Cayman Islands, Nov. 1985
- "Atlantis II", delivered to Barbados, Dec. 1986

-- Design Series 2 / 46 passenger --
- "Atlantis III", delivered to St. Thomas, Virgin Isl., May 1987.
- "Atlantis IV" (undergoing sea trials on West Coast) planned for Kona, Hawaii.

The delivery of "Atlantis III" to St. Thomas, Virgin Islands established the first tourist submersible operation in United States waters, with all design, construction, and operational procedures having been reviewed and approved by the U.S. Coast Guard. A similar review and approval of each

unit delivered to Hawaii will be undertaken by the U.S. Coast Guard. The proposed operation in Hawaii (AECOS, 1987b) will be the first such submersible tour outside of the Caribbean.

B.2 EQUIPMENT DESCRIPTION

Atlantis submarines (Figure 1) are special purpose, multi-passenger submersible vessels designed to provide an authentic underwater experience in an aesthetically pleasing setting with good visibility for a large number of passengers (28 in Series 1; 46 in Series 2 and 48 in Series 3). These submarines are highly maneuverable, ensuring close-up viewing of reefs and marine life. The Series 3 vessels to be used in Hawaii are self-powered submersibles, sixty-five feet long, displacing eighty tons and with a designed operating depth capability of two hundred and fifty feet. Table I is a summary "fact and specifications" sheet for the Atlantis Series submersibles.

The passenger area is air-conditioned, of interior height sufficient to stand in, and maintained at normal atmospheric pressure while submerged. Passengers sit back-to-back on molded seats (Figure 2) in two long rows down the center. They face close-set, twenty-inch diameter viewing ports, below which are tethered marine life identification charts. Navigational floodlights aid viewing at depth and during night dives.

The Atlantis submersible is a highly technical machine, with all essential operating systems duplicated. Incorporated in the design are electric and hydraulic systems, pneumatic high and low pressure systems, closed circuit life support and air conditioning systems, computerized motor controls and ballast controls, high pressure compensated mechanical assemblies, and extensive electrical systems in three power voltage ranges with over 4,800 wire terminations. This equipment is all certified by the American Bureau of Shipping and must be serviced and maintained in accordance with their rules and in accordance with extensive manuals and procedures developed by Sub Aquatics. Operating procedures are very elaborate and specific to ensure safety and reliability.

Up to 14 dives of approximately 1 hour duration can be performed daily, seven days per week, allowing for a nine hour night servicing period during every 24-hour period. Past commercial submarine operations have required extensive post-dive maintenance with the submersible recovered aboard a support ship. The design incorporates a complete in-water servicing program including battery recharging, recharging

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TABLE 1

ATLANTIS SUBMARINES

FACTS AND SPECIFICATIONS

SIZE:	Series 1	-50 ft. overall, 13 ft. beam, 8 ft. draught
	Series 2 and 3	-65 ft. overall, 13 ft. beam, 8 ft. draught
WEIGHT:	Series 1	-98,000 lbs. (49 tons)
	Series 2 and 3	-160,000 lbs. (80 tons)
OPERATING DEPTH:	Series 1 and 2	-150 feet
	Series 3.	-250 feet
CERTIFICATION:	American Bureau of Shipping	
INSURANCE:	Lloyds of London	
PASSENGER CAPACITY:	Series 1	-28 people
	Series 2	-46 people
	Series 3	-48 people
CREW NUMBER:	Series 1	- 2 people
	Series 2 and 3	- 3 people
CABIN PRESSURE:	None (air-conditioned comfort) Sealed hull is maintained at normal atmospheric pressure.	
VIEWING:	Extra large (52") front viewport. Large (20") diameter viewports,	
	Series 1:	8 on each side;
	Series 2 and 3:	13 on each side
LIGHTS: (Night dives)	Normal navigational lights, plus	
	Series 1:	12 floodlights; 4 at front and 4 on each side
	Series 2 and 3:	16 floodlights; 4 at front and 6 on each side
PROPULSION:	DC battery powered electric thrusters; two forward/reverse, two vertical, and one bow thruster.	
BUOYANCY:	Sealed water tanks are adjusted to provide slightly positive buoyancy. Vertical thrusters maintain submarine at operating depth.	
	Secondary system of air tanks supplies backup if required and submarine surfaces automatically.	
SAFETY FEATURES:	All systems are duplicated. Surface vessel travels with the submarine and is in constant contact by underwater telephone or by VHF radio.	
TRACKING AND NAVIGATION:	Navigation by buoys, visual contact and instruments.	
AIR SUPPLIES:	O_2 and CO_2 scrubber system typical of commercial and military submarines.	
COMMUNICATION:	Underwater telephone and VHF.	

of the high pressure air system, replenishment of life support materials, and preventative maintenance and repair.

The three man crew is fully qualified. In addition to the qualifications and training required by the American Bureau of Shipping and Lloyds of London, the company requires that pilots have a strong technical background and have experience in marine biology. The pilot is positioned in front of a fifty-two inch plexiglass dome in the nose of the submersible (Figure 3). A co-pilot, situated aft, conducts a running commentary of the reef and animal life being viewed by the passengers. All crew members are fully trained in the submarine's safety procedures.

The submersible submerges by filling its ballast tanks with seawater until the vessel is slightly positively buoyant. Vertically mounted thrusters then power the vessel down. Because the vessel is maintained positively buoyant when underway, the submersible will automatically rise to the surface in the event of a power failure. As a further safety feature, five thousand pounds of lead can be released mechanically to cause the vessel to rise to the surface in an emergency. In addition, Atlantis carries life support systems sufficient to enable the craft to stay submerged for up to seventy-two hours with its full complement of passengers and crew.

The precise and carefully documented operating procedures ensure that the submersible is never operating in a depth greater than its approved design capacity. The submersible has been developed under American Bureau of Shipping (ABS) and United States Coast Guard (USCG) standards, which are the highest in the world. The vessel is classified under the ABS rules for underwater equipment and vehicles which govern the design, production, and operation of submersibles. This endorsement has enabled Sub Aquatic Development Corp. to secure comprehensive insurance coverage through Lloyds of London.

While underway beneath the sea surface, the submersible is accompanied by a surface tender (Figure 4). The primary function of this support vessel is to provide surface clearance for the submersible's ascent, and to ensure constant underwater communications via the underwater telephone as well as VHF ship-to-shore communication.

B.3 OPERATION DESCRIPTION

B.3.1 Previous and On-going Experience of the Company

Grand Cayman Island in the Caribbean was chosen in 1984 as the first site of operations for Atlantis submersibles because it is a representative tropical resort area and its small size would simplify the collection of information regarding the market acceptance of the first such operation in the world. "Atlantis I" was delivered to the Cayman Islands (Caribbean) in November 1985. In December 1986 "Atlantis II" was delivered to Barbados following six months on display at Expo 86 (the Vancouver World's Fair). In May 1987, "Atlantis III" was delivered to St. Thomas, Virgin Islands.

Each of the Caribbean operations makes a total of 12 dives each day at sites located in accordance with criteria established by the company (see Section B.3.4). Operating procedures are similar to those proposed for Hawaii as detailed herein (Section B.3.2).

The underwater tours in the Caribbean take passengers to depths of up to 150 feet to view the face of the coral reefs and the abundant animal life. In Grand Cayman the tour includes a shipwreck (an accidental sinking not related to the submersible operation). In Barbados, the tour includes a sunken vessel which was placed intentionally on the bottom by the Barbados government to develop underwater viewing and enhance marine life for divers.

During each tour a surface vessel accompanies the Atlantis submersible directly overhead and maintains radio communication. Throughout the day, the pilot of the submersible alternates with the escort boat pilot, and the submersible's co-pilot interchanges with the co-pilot accompanying passengers aboard the shuttle craft.

B.3.2 General Description of Proposed Hawaii Operations

Atlantis Submarines anticipates developing an operation on each of the Hawaiian Islands of Oahu and Hawaii. A Maui operation is being studied. This EIS document presents a proposal to operate up to three submersibles off Waikiki on the Island of Oahu. Atlantis hopes eventually to introduce a total of eight submersibles to the Hawaiian Islands. An increase in the number of submersibles operating at any one location up to three will not require any change in the size of the operating area because the dive tours at that site can be staggered. If more than three submersibles operate within a dive area, the size of the primary

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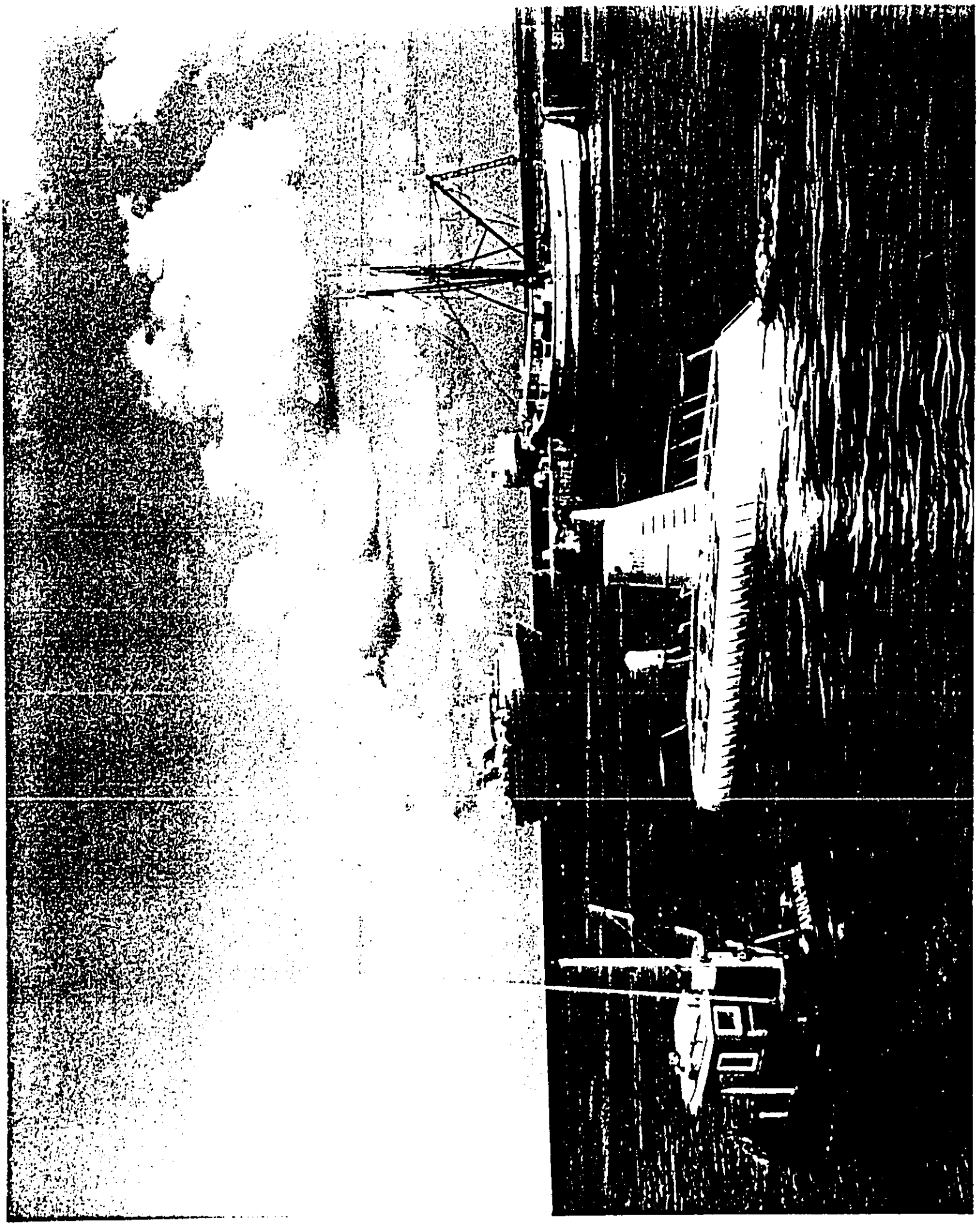

dive area and the habitat enhancement program as described herein may need to be expanded.

An elaboration of both the operation and the constraints on the operation is necessary to explain how both the proposed operations and the specific criteria for selecting operating areas were developed. These criteria are listed in Section B.3.4 and discussed further in Section G (Alternatives). A general description for a typical Hawaii operation will entail the following:

(1) Passengers holding reservations for a dive tour will arrive at a central location with ample parking for private vehicles or be brought to that location by buses or passenger vans making regularly scheduled stops at hotels and resort centers in the surrounding area;

(2) transportation by group transport will be available to a disembarkation point where the passengers will board a surface shuttle vessel making once hourly round-trips to the dive site;

(3) at the dive site, passengers will transfer to the submersible or, if required by sea conditions, transfer first to a platform moored over the site and then to the submersible. Simultaneously, passengers who have just completed a dive on the submersible will transfer to the shuttle for return to the shore;

(4) following an orientation session explaining the safety features of the submersible, the new passengers will commence a 50-minute underwater tour of the dive site, during which they will view the marine life of the reef, habitat structures and sunken vessels as discussed in Section B.4;

(5) during the 50-minute period the submersible is on an underwater tour, the shuttle vessel will return those passengers that have completed a tour and pick up and return with the next tour group; and

(6) returning passengers will be transported back to the central staging/parking area where group transportation will be provided back to hotels and resort centers for those without private vehicles.

The submersible will make 12 dives per day, with the first dive commencing at 8 am and the last dive finishing

at 11 pm. Upon completion of an operating day, the submersible will be towed back to a night moorage/maintenance site, where battery recharging, recharging of on-board pressurized air systems, and preventative maintenance will be completed prior to the start of operations the next day.

B.3.3 Proposed Operations at Honolulu, Hawaii

Until more favorable arrangements for shore facilities are secured, passengers for each dive cycle off Honolulu will be bused from a central location or perhaps several locations in Waikiki to a boarding area at Aloha Tower. Buses will be 48-passenger size, provided through contract with an existing Oahu busing company. Just prior to stopping at Aloha Tower, the bus will stop at a staging/parking area provided for passengers arriving by private vehicles. This parking area will be located in the commercial district of Honolulu and leased by Atlantis Submarines for office space, general storage, and parking.

An approximately 50-foot long shuttle boat will transport each group of passengers either directly to the submersible or to an offshore platform moored over the dive site. The shuttle boat will make one trip each hour while a single submersible is operating and two trips per hour for two submersibles. Two shuttle boats will be needed to service three to five submersibles eventually planned for this site.

An offshore platform will be available for use at the dive site to aid in the transfer of passengers between the shuttle boat and the submersible. A design is presently being considered which would functionally combine this transfer platform and a maintenance platform (see Section B.4.5). The transfer platform will need to accommodate the nearly 100 people representing arriving and departing groups of passengers at maximum capacity. Restrooms will be provided aboard the shuttle craft and on the platform. When on-site, the platform will be moored utilizing a standard four-point mooring configuration (see Section B.4.4) within the dive area.

Outside of operating hours, the submersible and the transfer platform will be towed to a night moorage in Keehi Lagoon. Here, recharging of systems and routine maintenance will be undertaken on the submersible. The floating platform will contain below deck all equipment required for servicing of the submersible. A diesel generator (120 kva) and air compressors will constitute the major equipment items. Application for a permanent mooring site in Keehi Lagoon will be made through the Harbors Division of the

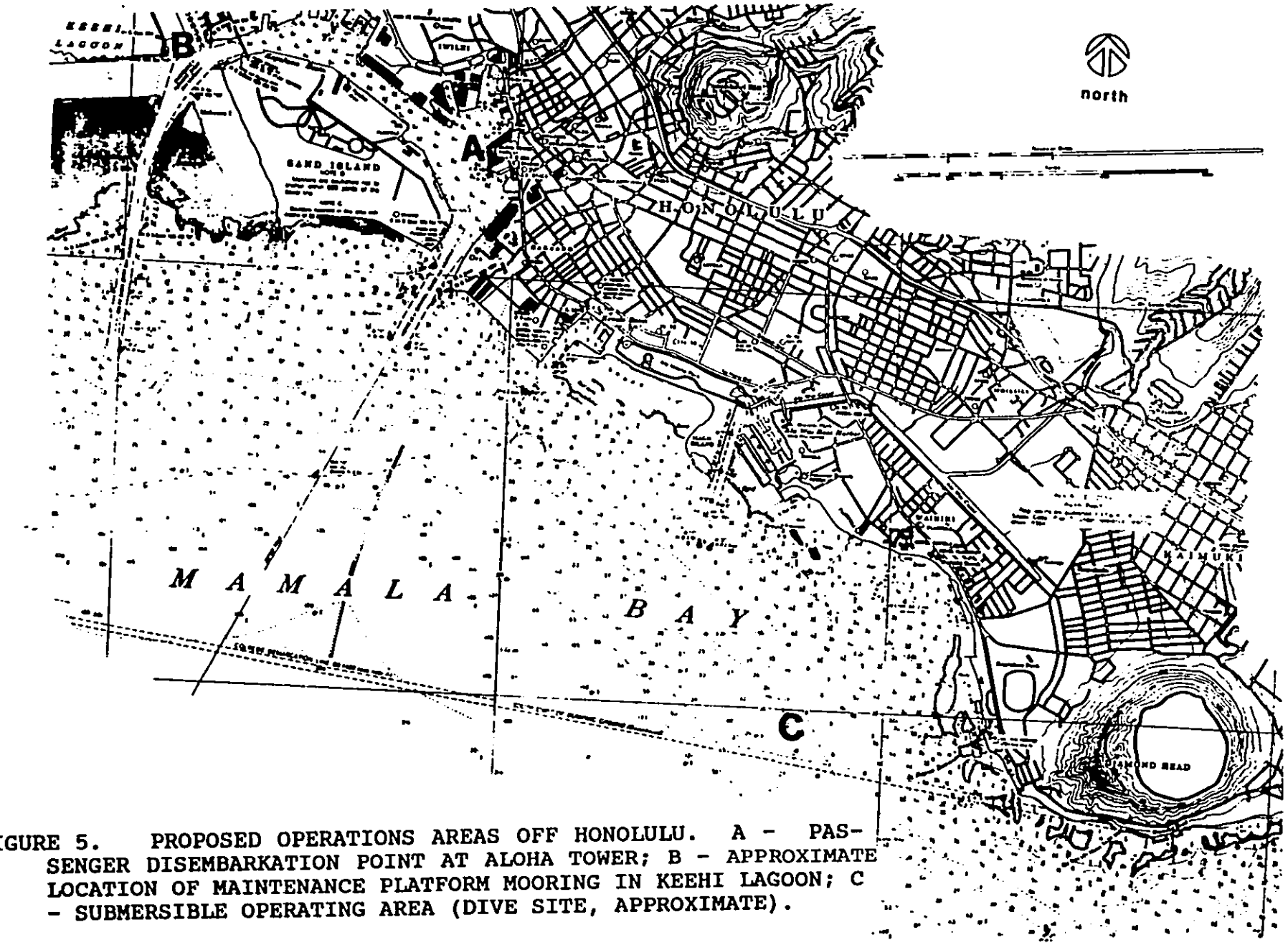

FIGURE 5. PROPOSED OPERATIONS AREAS OFF HONOLULU. A - PASSENGER DISEMBARKATION POINT AT ALOHA TOWER; B - APPROXIMATE LOCATION OF MAINTENANCE PLATFORM MOORING IN KEEHI LAGOON; C - SUBMERSIBLE OPERATING AREA (DIVE SITE, APPROXIMATE).

State of Hawaii, Department of Transportation.

B.3.4 Operating Area -- General Description

The primary criteria in the selection of an operating site for a viable, commercial submersible tour are:

(a) a shore pick-up area in close proximity to a large tourist center;

(b) an underwater dive site sufficiently near the pick-up area to permit the shuttle craft to load, travel to the submersible, exchange passengers, and return within 50 minutes;

(c) sea conditions typified by calm surfaces throughout the year;

(d) good underwater visibility and low current velocities at the dive site;

(e) depths ranging between -60 feet (below the depth of water motion from large sea swells) and no more than -250 feet (maximum certified dive depth) within the area traveled by the submersible during a dive tour; and

(f) underwater attractions providing for an interesting tour route within a relatively small area (on the order of 8 acres in extent).

The proposed dive area will consist of a primary site of approximately 4.6 acres (200,000 square feet) in a rectangular configuration. Overall dimensions will be on the order of 400 by 500 feet. With one exception, as noted below, all planned construction/modification/enhancement will be confined to this primary site. The primary site will be in water ranging from 85 to 120 feet deep. In order to provide passengers with the experience of a deeper dive, for most tours the submersible will range outside the primary site to a sunken vessel situated in water between 200 to 250 feet deep.

B.3.5 Proposed Oahu (Waikiki) Dive Site

The site proposed for operating Atlantis submersibles off Oahu will be located (see Figure 6) in 85 to 120 feet of water off Waikiki. This site is approximately 4500 feet (0.85 mile) seaward of the shore at its closest point. Distance to the site from a passenger pickup area at Aloha

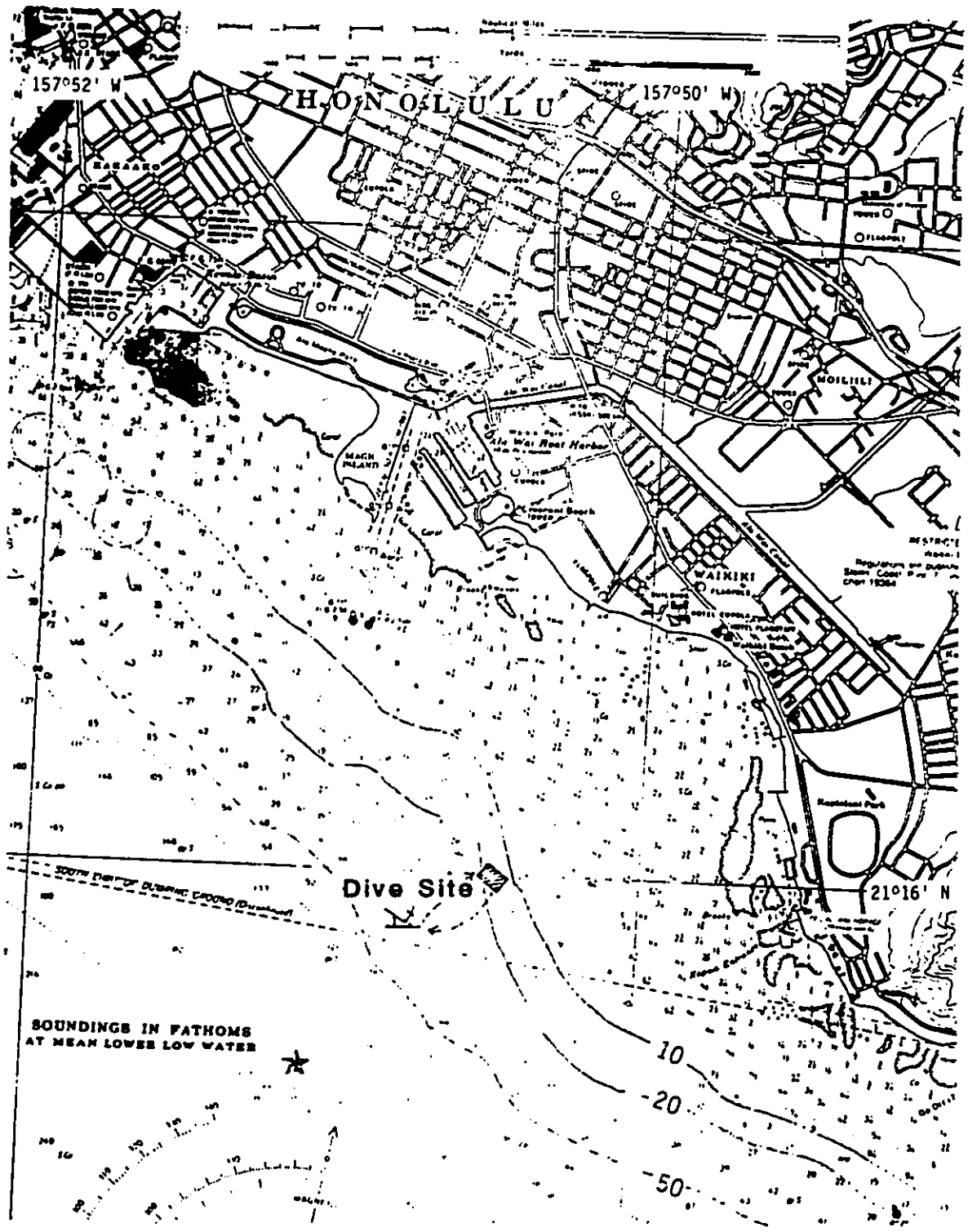

FIGURE 6. PROPOSED SUBMERSIBLE OPERATING AREA IN MAMALA BAY, WAIKIKI, OAHU.

Tower in Honolulu Harbor is approximately 3.5 miles. Distance to the proposed maintenance mooring site in Keehi Lagoon (via Kalihi Channel) is around 5.5 miles.

The bottom here is a featureless, limestone plain as is typical for this depth range seaward of the reefs off of leeward Oahu. The site does not include, nor is it near, recreational surfing or dive sites.

Site enhancements will include a shallow sunken vessel and an artificial reef. A deeper sunken vessel will be placed outside of the primary dive site at a depth between 200 and 250 feet approximately 750 to 1500 feet seaward of the primary site.

B.4 PROPOSED SITE ENHANCEMENTS IN THE MARINE ENVIRONMENT

B.4.1 Rationale

In Grand Cayman, Barbados, and the Virgin Islands, the submersible operating areas are characterized by rich bottom (benthic) assemblages of corals, sponges, fishes and the like. The naturally existing marine resources in these locations provide the basis for client interest in the underwater tours. At Grand Cayman, in addition to the spectacular "Cayman Wall", a ship wreck is present in the submersible operating area. The tour at Barbados includes a purposefully sunk vessel, the largest in the Caribbean, placed by the local government for enhancement of fishing and diving.

In Hawaii, and particularly seaward of the reef off Waikiki, the situation is vastly different. The subtropical location (i.e., somewhat cooler water) and relative isolation from the western tropical Pacific (where the Indo-West Pacific fauna is more diverse and most of Hawaii's marine organisms derive from) have resulted in a low diversity of organisms as compared with most tropical marine locations. Further, many Hawaiian coral reefs have suffered numerous disturbances including nutrient loading and pollution, runoff, infilling of shallow nursery grounds, dredging of harbors, and the introduction of exotic species. Population growth and technology have resulted in high fishing pressure on limited reef resources.

In those areas around Oahu which satisfy all of the other criteria for the selection of an operating site (see Section B.3.4), the bottom is generally featureless and inadequate for the purpose of providing a satisfactory visual experience for an underwater tour. In order to enhance the

viewing, Atlantis Submarines proposes to develop a variety of underwater attractions as described in the following section. The need for submerged habitat enhancement in State waters is a matter of increasing concern among local biologists and fishermen. The proposed project represents a substantial private sector effort in fisheries resource replenishment that will be of direct benefit to the State.

B.4.2 Artificial Reef Design

The standing crops of fishes and many other marine organisms are tied to structural complexity of the habitat (Risk 1972). The addition of structural relief to the bottom in the form of man-made habitat structures known as "artificial reefs" can produce an increase in the biomass of organisms inhabiting an area (see Klemm, 1986). Thus, construction of artificial reefs may be viewed as attempts to replicate naturally productive habitats in relatively unproductive locations (see Appendix B).

Artificial reefs have been developed and maintained by the State of Hawaii, Department of Land and Natural Resources since 1961. Their purpose is to provide enhanced fishing and diving opportunities for the public. Presently, four artificial reef sites have been constructed off Oahu: in Maunalua Bay (off Kahala), off Waianae (Maili), off Kualoa/Kaaawa, and off Ewa (presently under development). A fifth site is located off Keawakapu, Maui. All of these "reefs" are situated at depths between -60 and -120 feet. The Oahu sites are located between one and two miles from shore; the Keawakapu Artificial Reef is only a quarter mile off the west shore of East Maui. These reefs range in size between 52 and 1,727 acres and encompass a total area of nearly 2000 acres.

Until recently artificial reefs built in the United States utilized scrap materials that were often indiscriminately dumped at sea (Buckley, 1982). Reefs thus built provided some habitat improvement and increased fishery yields in otherwise barren areas, but the shape, size, long-term physical stability, and biological productivity afforded by use of such materials have been less than ideal (Sheehy, 1982). A variety of materials have been used to develop artificial reefs in Hawaii, including concrete pipe, weighted automobile tires, derelict vehicles, a large barge, the former research vessel "Mahi", etc. These reefs have demonstrated the positive aspects of artificial reef development in Hawaiian waters.

Recent advances in the technology of artificial reef development emphasize ideal shapes of components and long-

Recent advances in the technology of artificial reef development emphasize ideal shapes of components and long-term physical stability to enhance biological productivity (See Brock et al., 1985; NOAA, 1985; Appendix B of this EIS EIS). Steel, plastics, and concrete are all now widely used to fabricate an array of different structures. The concrete modules known as "dice blocks" (Figure 7), incorporate the structural features that can provide both shelter and vertical relief for adult fishes in Hawaiian waters. These blocks are stacked to form reef sets, with a number of reef sets being positioned in a pre-determined configuration to enable a scientifically designed reef to be constructed on the sea floor. A proposed design for deploying concrete modules in a submerged habitat is presented in detail as Appendix C, a report on artificial reefs prepared by Dr. Richard Brock and James Norris of the University of Hawaii.

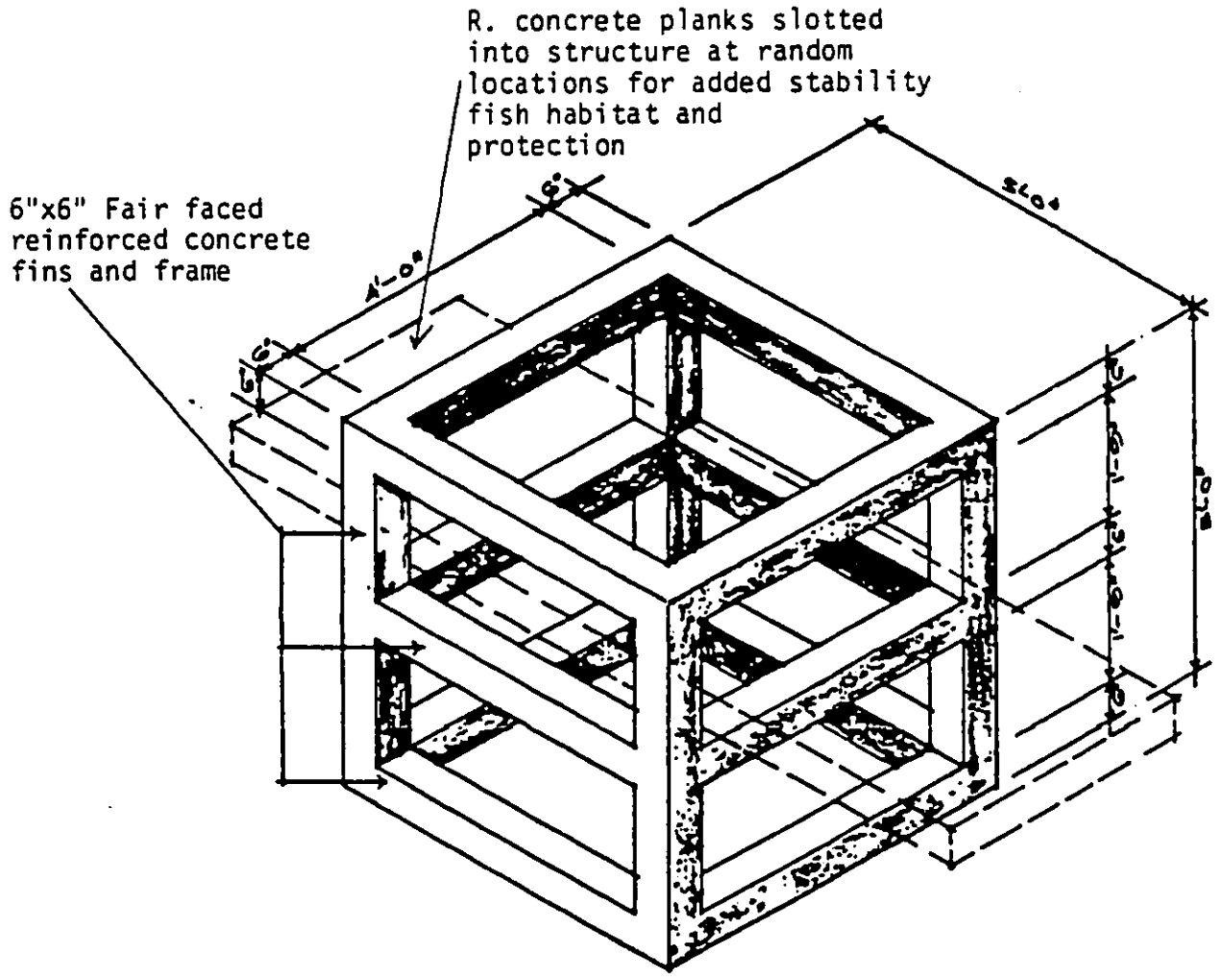

FIGURE 7. CONCRETE MODULE UNIT

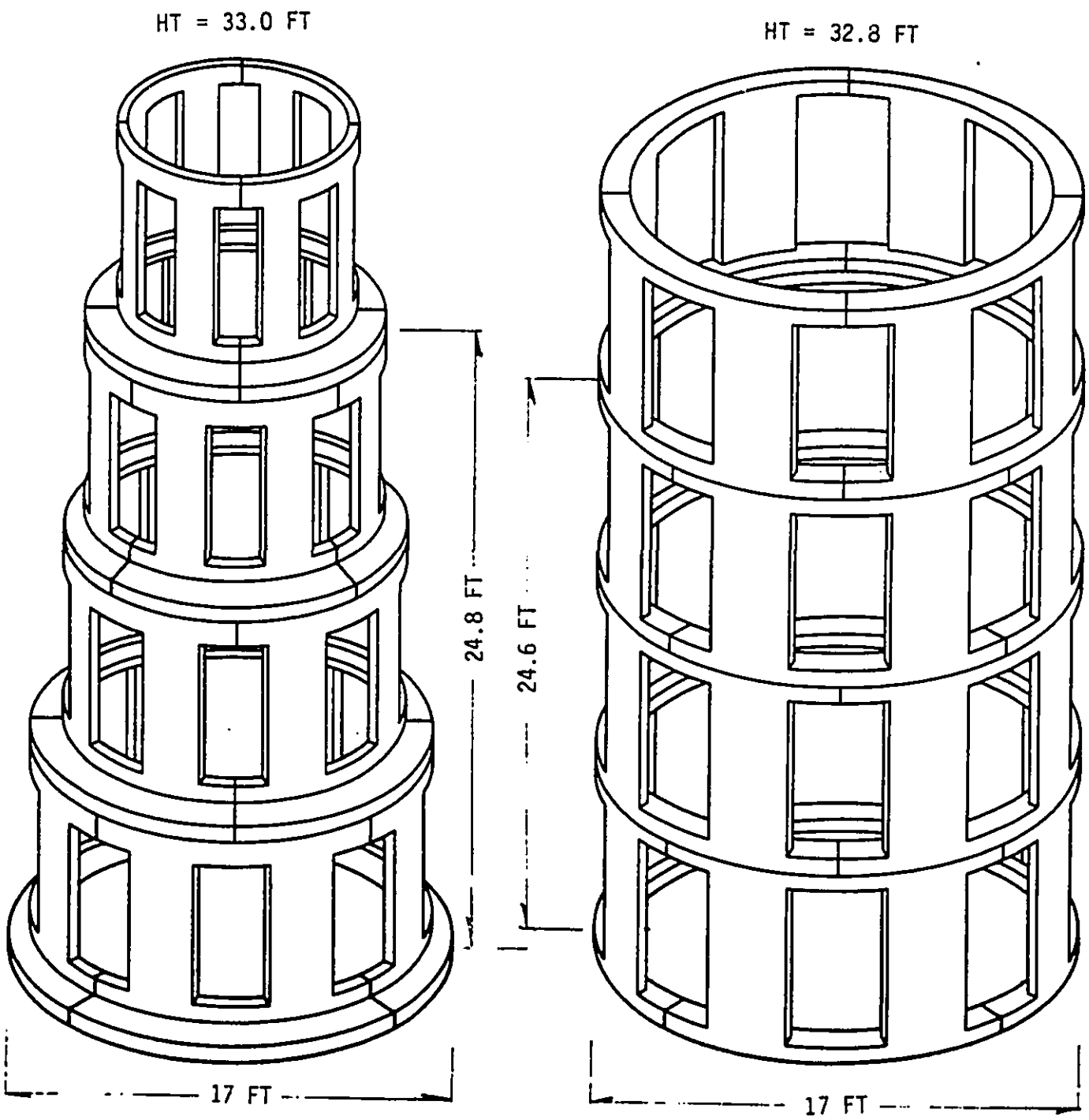

FIGURE 8. TWO DESIGNS OF MODULAR FISH HABITAT "TOWERS" OFFERED BY THE OHBAYASHI CORPORATION (JAPAN). THESE STRUCTURES ARE PRE-ASSEMBLED FROM CONCRETE, OPEN-FRAMEWORK MODULES. THEY ARE ILLUSTRATED HERE TO SHOW THE AVAILABLE TECHNOLOGY BUT ARE NOT THE FINAL DESIGNS BEING CONSIDERED BY ATLANTIS.

Advanced, commercially available structures are manufactured as modules and then fitted together prior to deployment as a unit. Structures such as the "cylinder" reefs from Ohbayashi Corporation (Figure 8) can be provided in heights which are multiples of the number of levels times the 2.5 meters (8.2 feet) unit height. Thus, a 4-unit tower is 10 meters (33 feet) from top to bottom, and a 3-unit model is 7.5 meters (25 feet) high. The diameter of these towers is 5.2 meters (17 feet). These designs are aesthetically very pleasing (an important consideration for an artificial reef set-up primarily for viewing), although the structures shown in Figure 8 would not be suitable for the Waikiki dive site because they are not designed to enhance populations of juvenile fishes and would (as pictured) be unstable in our open coastal waters. Important is the fact that these and a number of other designs have been deployed and studied in Japanese waters and have been subjected to engineering analysis for stability characteristics. Also, they illustrate a method of deployment whereby the entire structure is fabricated on land and lowered by crane into place at the artificial reef site.

Atlantis Submarines will apply an open-framework design to produce a major artificial reef at the Oahu dive site. This reef will have great scientific value (that is, can be used for research on enhancing bottom fisheries), will be of educational interest, and will provide a major attraction for the submersible tours.

The Atlantis artificial reef will be placed at a depth of around -90 feet at the proposed primary dive site. The precise form will be determined after discussions with the University of Hawaii, the Division of Aquatic Resources, the National Marine Fisheries Service, and manufacturers. The selected design will be stable (remain in place during storm swells) and chemically inert (non-polluting and nondegrading). Atlantis Submarines will cooperate with these same government entities to develop and promote studies and monitor the progress of fish enhancement around the habitat structures.

To be maximally effective and permanent, construction of the reef is best undertaken on relatively hard and level bottom at depths greater than 55 feet. A maximum depth of around 80 feet is a constraint arising from the need for divers to accurately position individual modules on the bottom as they are lowered by crane from the water surface. Connecting the modules together on land and lowering the entire structure from a large floating crane (Figure 9) will minimize the need for divers to work on the bottom during placement. However, if the structure is placed at depths much greater than 80 or 90 feet, the conducting of

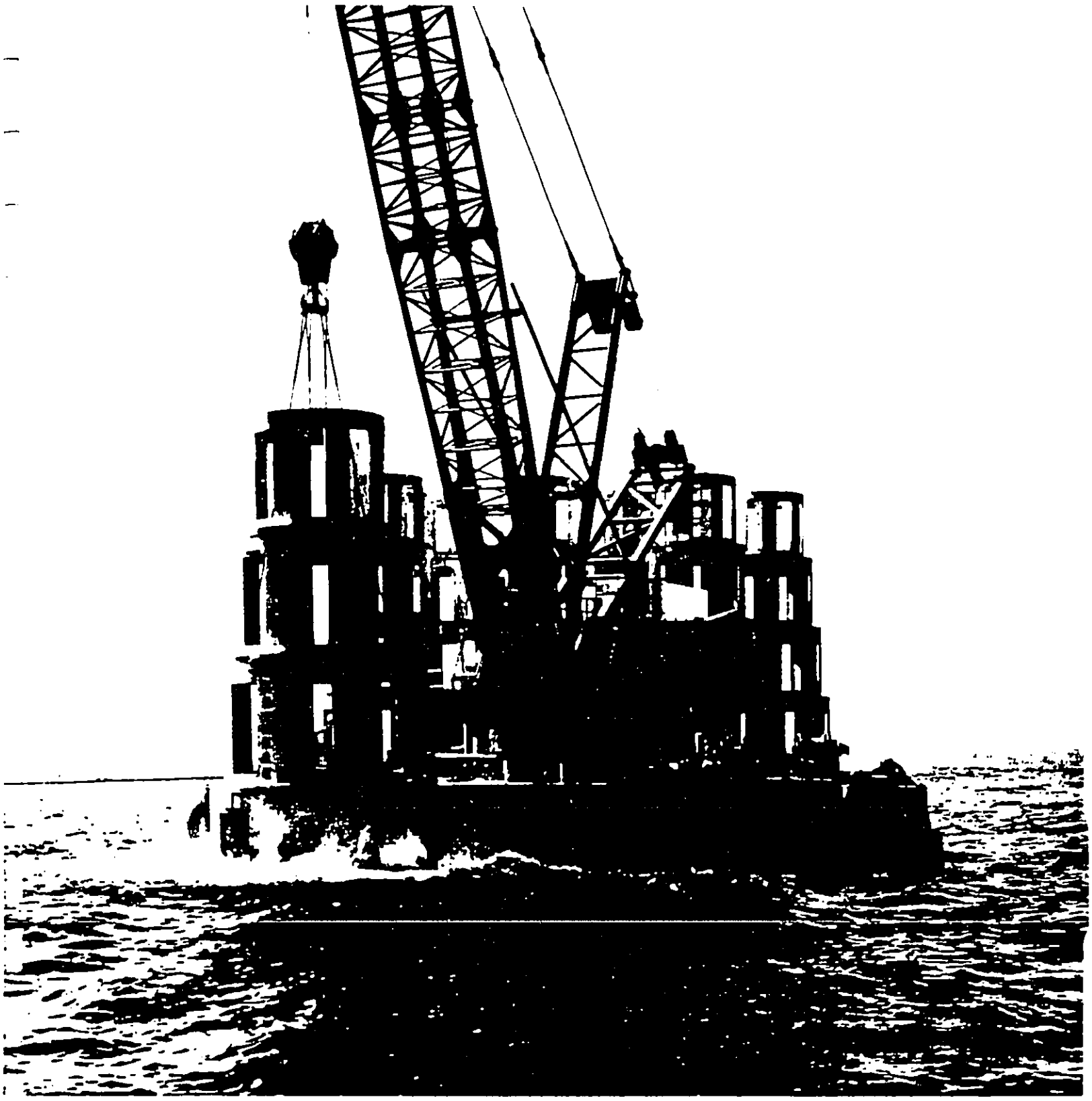

FIGURE 9. FLOATING CRANE DEPLOYING ARTIFICIAL REEFS BY OHBAYASHI CORPORATION. EACH "TOWER" IS 33 FEET HIGH.

scientific studies which require time consuming observations of fish and other biota, will be impaired. Further, placement at a depth greater than 100 feet could create a situation where unaffiliated SCUBA divers lacking experience in decompression dives might nonetheless attempt to dive the "reef". The Mamala Bay site is characterized by sand and limestone bottom of generally low relief which should be ideal for an artificial reef from both the engineering and fisheries enhancement standpoints.

B.4.3 Additional Attractions

Based upon operational experience in Grand Cayman, the company anticipates that the initial narrative and observation of the artificial reef will take approximately half of each 50 minute dive period. The balance of the dive will be devoted to viewing a sunken vessel placed at slightly greater depth and in relatively close proximity to the artificial reef and then traveling to and observing a deeper sunken vessel placed outside of the primary dive site at a depth between -200 to -250 feet.

These vessels will be prepared, prior to sinking, according to State and Federal environmental regulations pertaining to such matters. Superstructural elements (masts, etc.) will be removed or the vessel positioned so as to provide ample clearance for surface craft (the shallowest part of the wreck will be greater than 40 feet below the water surface). The ships will be modified as practical to enhance their potential in attracting fishes -- a large ship on the bottom is also an artificial reef. Holes will be cut in the hull and deck to allow fishes to enter and eliminate "dead water" spaces within the vessel. All modifications will be made, and the depth of placement selected, to insure that the submerged vessel does not constitute a hazard to curious SCUBA divers (for example, the shallow vessel will be put on the bottom at -100 feet or less). These vessels will be engineered to remain stationary under the roughest sea conditions anticipated for Mamala Bay.

B.4.4 Moorings

Three permanent moorings will be installed for operational purposes. The precise locations of the moorings will depend upon assignments made by the State of Hawaii, Department of Transportation. One mooring will be for a maintenance platform (see Section B.3.2) required for submersible systems recharging. Another mooring near the first will be for the purpose of providing overnight (or inclem-

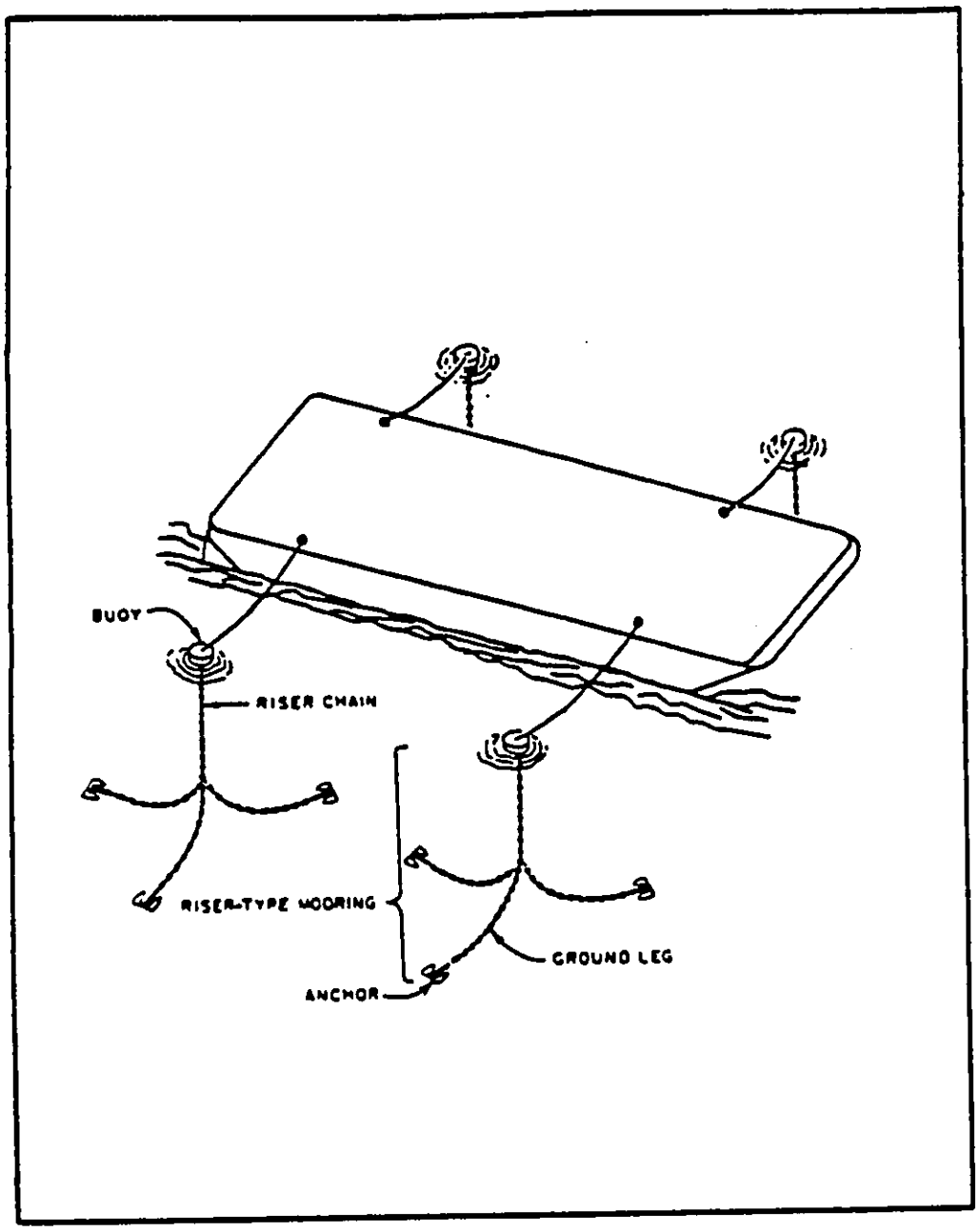

FIGURE 10. PROPOSED FOUR-POINT SPREAD MOORING

ent weather) anchorage of the submersibles. A third mooring will be placed within the submersible operating area (i.e., dive site; see Section B.3.5) to serve as a point of attachment for the passenger transfer platform. All of the moorings will be designed and constructed in accord with conventional mooring design practices. The moorings would consist of anchors, ground tackle, riser chain, and surface buoys.

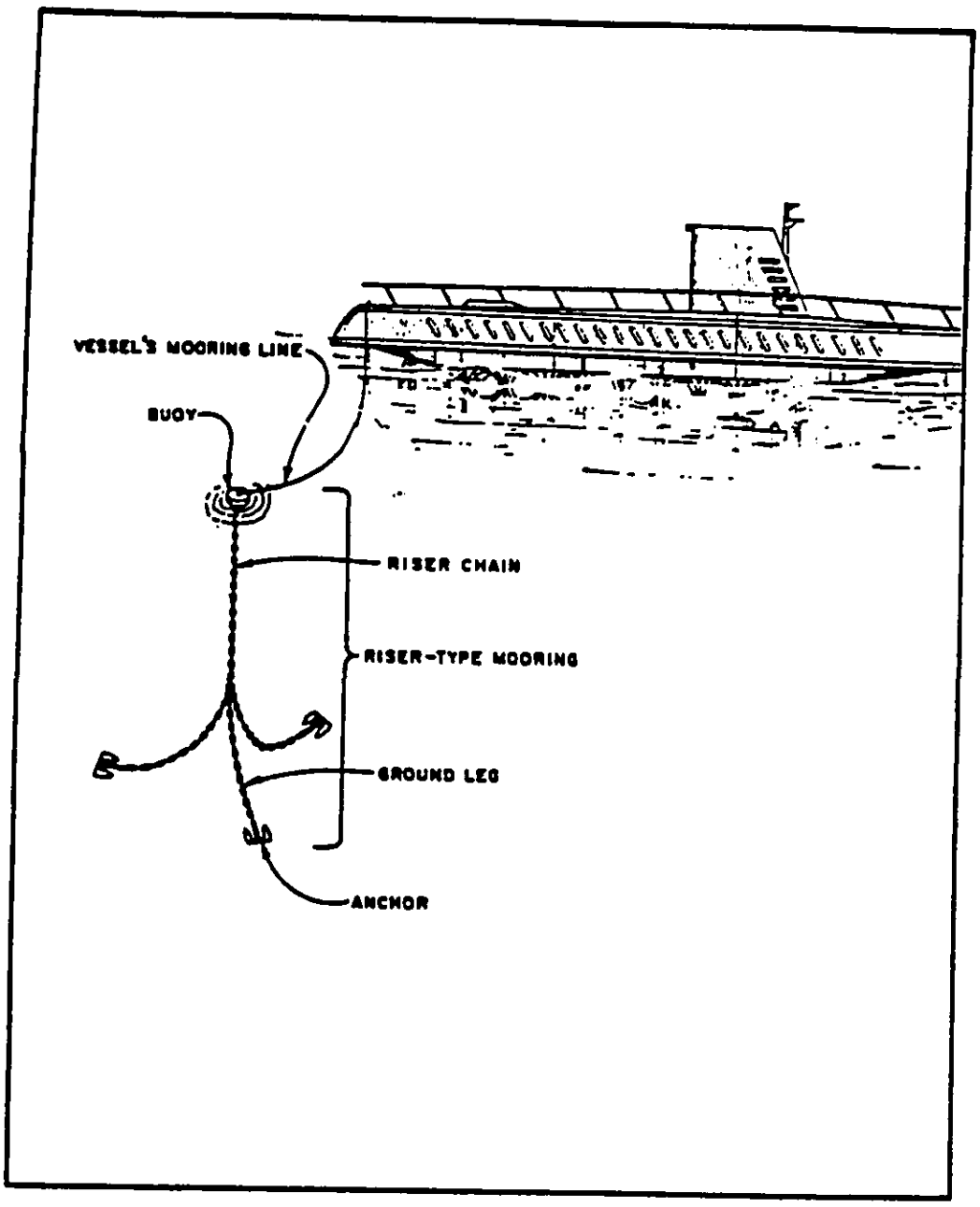

FIGURE 11. PROPOSED SINGLE-POINT, FREE SWINGING MOORING

The present program provides that the overnight moorings will be placed in the northwest corner of Keehi Lagoon ("B" in Figure 5) in water 10 to 15 feet deep. The maintenance platform mooring will be a four-point spread type (Figure 10) and the submersible anchorage will be a single-point free-swinging type (Figure 11). The offshore mooring, to be placed in water between 60 and 90 feet deep at the dive site (see Figure 6) will be a four-point spread type (Figure 10).

B.4.5 Passenger Transfer Platform

A steel hull, flat deck barge approximately 85 feet in length and 35 feet across and 12 feet high will be deployed for operational purposes (see Section B.3.3). The barge will have a flat deck covered over with a low-profile, galvanized steel roof structure, and a 42 inch railing all around the deck. Overall height will be on the order of 18 feet measured from the waterline. Four passenger stairway ramps (two on each side) will serve passenger loading and off-loading from the shuttle craft and the submersible (Figure 12). Hatch covers and other openings in the deck required for outfitting the interior (see below) will be suitably covered to provide seating facilities. Two washrooms will be located on the far rear deck. Wastewater will go into a holding tank located below deck. Low storage bins for lifejackets will provide additional on deck seating.

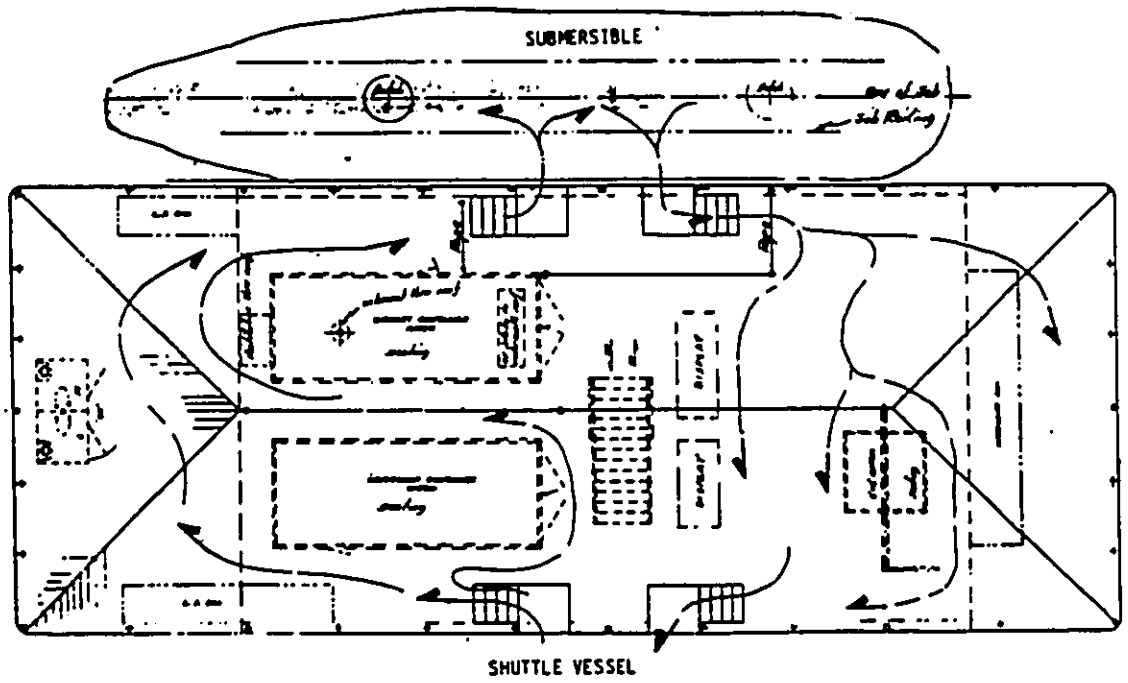

FIGURE 12. PLAN VIEW OF THE STEEL HULL, FLAT DECK BARGE PROPOSED AS AN OPERATING AND SERVICING PLATFORM.

Although a dock-side submarine maintenance facility would be preferable, the necessary harbor facilities are not presently available in Keehi Lagoon, Honolulu Harbor, or Kewalo Basin. The situation could change, however, such that over-night moorage, submersible systems recharge

and maintenance, and perhaps even warehousing and shoreside passenger loading might in part or in total be handled by one or more dock-side facilities. As an alternative reflecting present realities, Atlantis will include the maintenance facility within the interior of the flat-deck barge proposed for on off-shore passenger transfer platform.

Fore and aft freshwater tanks will occupy a portion of the space and serve as ballast. The interior (below deck space) between these tanks will have a two-foot thick concrete floor for additional, permanent ballast. The interior hull space of approximately 15,000 cubic feet (Figure 12) will be be ventilated and air conditioned. Within this area will be placed a support equipment container and a workshop container. The support trailer holds a diesel generator (120 kva) and air compressors used to recharge battery and air systems on the submersible. Two other 20 KW generators will be located in the hull to meet the on-board power needs of the barge/platform.

B.5 CONSTRUCTION AND LEASING

In implementing the proposed project, arrangements for the construction and leasing of equipment, facilities and site enhancements will be established as required with other parties, such as Hawaiian Submarines, Inc. and the particulars supplied to the appropriate departments and agencies.

SECTION C.

ENVIRONMENTAL SETTING

C.1 GENERAL SETTING

The proposed project will be located in and near the city of Honolulu, and will encompass sites in or off Keehi Lagoon, Honolulu Harbor, and Waikiki. Honolulu is located (see Figure 13) on the south or leeward shore of the Island of Oahu. Waikiki is the primary tourist destination for visitors to the Hawaiian Islands which presently attract over five million people each year. Honolulu is the major seaport, major airport, and government and commercial center of the islands. The economy of Honolulu is diverse and largely service oriented. The economy of the State as a whole is strongly dependent upon tourism, military, and agriculture.

C.1.1 Climate

The climate of Oahu is warm and semitropical. Sea conditions along the leeward coast are generally ideal for year-round operations of a submersible. Seasonal changes are mild and fairly uniform. Rainfall at the coast is between 20 and 30 inches annually. About 75 per cent of the time the wind is from the northeast (Trade Winds) and in the range from 8 to 18 mph. These winds are interrupted, particularly in the months of October to April, by southerly or "Kona" winds, which may be light and variable ("Kona weather") or particularly strong and gusty when associated with winter storm systems. These adverse "kona" storms occur on average about three times a year.

Severe storm conditions are uncommon, usually occurring in the winter months. Strong westerly to southerly winds have the greatest impact on the coastal areas of Mamala Bay and Keehi Lagoon, occurring on average 2 or 3 times a year, with gusty winds at velocities as high as 30 to 40 mph. Honolulu Harbor and Keehi Lagoon are protected from large ocean swells, but the entrance channels are not. Submersible operations would be discontinued during severe storms. Hurricanes, with wind velocities of 75 mph and higher, approach the area once or twice each decade.

C.1.2 Coastal Setting

The area selected by Atlantis Submarines as best meeting the criteria for submersible operations outlined

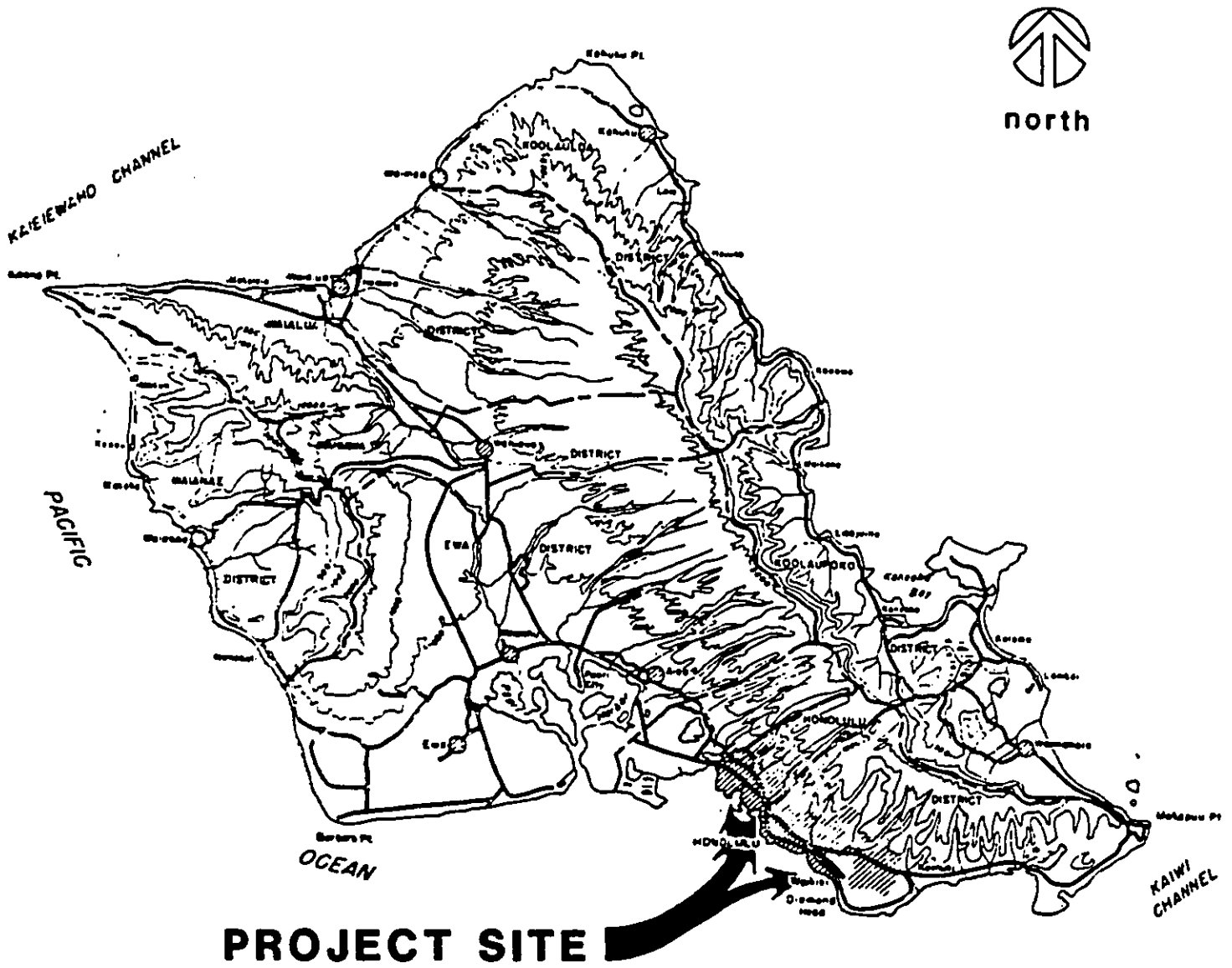

FIGURE 13. LOCATION MAP SHOWING URBAN HONOLULU (CROSS-HATCHED) ON THE SOUTH COAST OF THE ISLAND OF OAHU, HAWAII.

Section B.3.4 is in Mamala Bay off of Waikiki (Figure 6). The shoreline is mostly sand beach and man-made seawalls and a broad reef shelf extends offshore of most of this coast. The coastal zone behind the shore is urban: including high and medium density residential areas, commercial and light industrial areas, airport, harbor, and small boat facilities, and tourist development areas.

C.1.3 Oceanographic Setting

The south and southwest facing coasts in the Hawaiian Islands tend to have calmer sea surface conditions than coasts facing other directions because island land masses provide protection from the Northeast Trade Wind seas. These coasts are, however, subject to swells generated by South Pacific storms, which occur most frequently during the northern hemisphere summer. Large waves generated by local area storms or southern swell will occasionally prevent the Atlantis submersible from conducting dives. Potentially, two kinds of oceanographic conditions may limit operations on occasion: waves or sea swell which make the transfer of passengers from the shuttle craft or platform to the submersible hazardous or currents at the dive site in excess of about 2.5 knots.

Data on currents directly off Waikiki are somewhat sparse (see Bathen, 1978). It is known that currents around Diamond Head are at times strong (Wyrtki et al., 1969). Drogue studies by Laevastu, Avery, and Cox (1964) provide some indication of current regimes between Diamond Head and Sand Island. In general, these data suggest that the stronger Diamond Head currents extend westward into Mamala Bay to very roughly a line drawn southwest from the Waikiki Natatorium. This line passes south and east of the proposed submersible operating area.

C.2 MARINE BENTHIC SURVEYS

C.2.1 Marine Benthic Environment

A survey of the marine environment in the general vicinity of the proposed artificial reef site was conducted between 23 and 26 September 1987. This area is shown in Figure 14 (Stations 1 and 2) and covers the bottom between the depths of 75 and -100 feet approximately 0.87 miles from shore. On October 29, 1987 the area approximately 500 yards to the northwest of Station 2 was briefly surveyed (as Station 3) to determine if this site differed appreciably from the area surveyed earlier.

The quantitative sampling of macrofauna of marine communities presents a number of problems related to the scale. Marine communities in the study area may be spatially defined in a range on the order of a few hundred square centimeters (such as the community residing in a Pocillopora meandrina coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, the sampling program was designed to delineate major extant communities in the limits of the study area

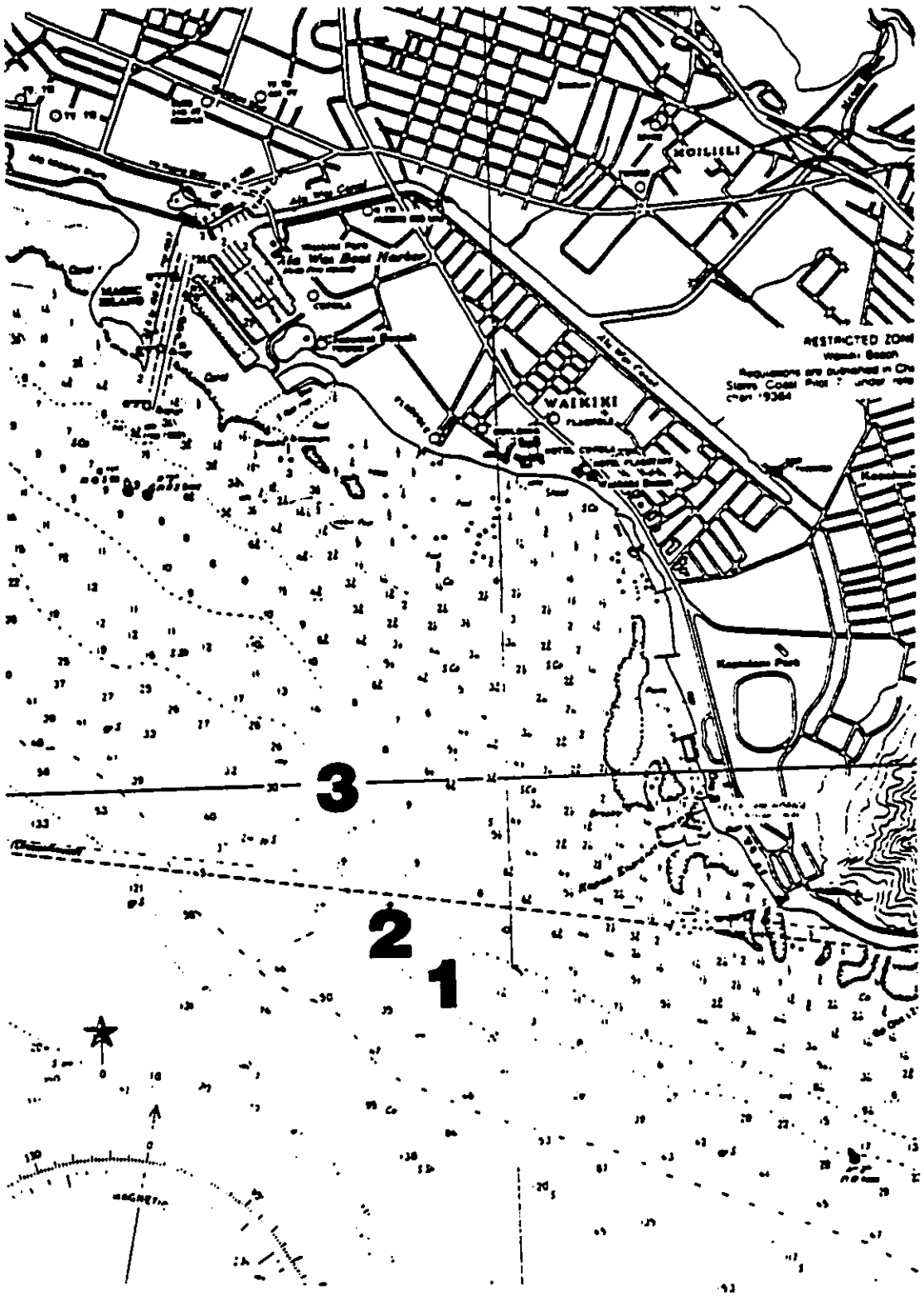

FIGURE 14. LOCATION OF BIOLOGICAL SURVEY SITES OFF OF WAIKIKI.

and quantitatively describe these communities. Thus, several different methods were used.

To obtain an overall perspective on the extent of the major communities or "zones" occurring in the study area, divers were towed behind a skiff over the area. This exercise allowed the qualitative delineation of major biotopes based partially on large structural elements (for example, amount of sand and hard substratum, fish abundance, coral coverage or dominant coral species). At this distance off Waikiki, two benthic biotopes can be differentiated. Two locations (Stations 1 and 2 in Figure 14) were selected for quantitative studies -- including visual enumeration of fishes, counts along benthic transect lines, and cover estimates from bottom quadrats. Besides these quantitative methods, a qualitative reconnaissance was made in the vicinity of each station by swimming and noting the presence of species not encountered along the transects. Additional qualitative surveys were conducted at the SCUBA dive area known as the "100-foot Hole", located over 1000 yards southeast of the proposed submersible operating area, and at Station 3, located essentially at the northern end of the proposed operating area. The purpose of a qualitative survey at the 100-foot Hole was to provide some comparative information on fish community development around a "high" topographical feature, unique for this area. In this study the work was carried out using SCUBA. Details of the surveys are given in Appendix D.

The proposed submersible dive site is located mostly on a gently sloping limestone bottom. The slope is seaward at a 5 to 10 degree angle. Across much of the limestone occurs shallow sand patches that range in dimensions from 6 by 6 feet to over 100 by 165 feet. Some of this sand forms a veneer that under heavy surf conditions moves about scouring the bottom. The sand patches are spaced from 15 to over 260 feet apart. The intervening limestone supports few corals: overall the coverage is much less than one percent. Commonly encountered are Porites lobata and Pocillopora meandrina. The largest Porites colony seen in this survey did not exceed 12 inches in diameter and the largest Pocillopora head was less than 12 inches in diameter, suggesting that high wave energy conditions must occasionally impact this area retarding coral growth and the formation of a mature coral community. This extensive limestone plain comprises the biotope of flat limestone pavement.

About 250 feet inshore of Stations 1 and 2, and at Station 3, the biotope of flat limestone pavement merges with a spur and groove system of the fringing reef. The spurs are large limestone "fingers" with long axes oriented perpendicular to shore. These fingers are from 1.5 to 15

feet in height, 30 to 100 feet in width, 65 to 165 feet in length and spaced between 50 and 165 feet apart. Some coral growth occurs on these spurs and coverage may locally attain 10 percent of the limestone surface, but is closer to 3% overall. The spur and groove system lies mostly in water to shallow for a submersible operation, although at Station 3, the spurs extend into deeper water, cutting across the northern portion of the proposed operating area. There is also more sand present on the bottom between the spurs at Station 3 than is found immediately south of Station 3. Offshore of the proposed operating area, the substratum begins to drop away to greater depths such that the 300-foot isobath lies about 1600 feet seaward. No attempt was made to examine these deeper areas.

The proposed operating area lies mostly within the biotope of flat limestone pavement. This biotope is a near continuous feature for at least 3.4 miles west along the south Oahu coast at these depths (60 to 110 feet). A qualitative reconnaissance was conducted throughout the study area over a depth range of 80 to 95 feet. Two quantitative stations were established to sample the biotope of flat limestone pavement. The first station (Station 1) was established in 85 feet of water and the second (Station 2) further to the northwest in 80 feet of water. Both stations were possibly somewhat south or southeast of the proposed submersible dive site indicated in Figure 6, but are representative of the bottom type and biological assemblages found generally throughout the area at comparable depth ranges.

The substratum at Station 1 was nearly flat limestone with a veneer of sand. The only structural relief present in the transect area was a few waterworn basalt stones. No corals were encountered in the quadrat survey (Table II), although in the vicinity of this station were seen a few colonies of Porites lobata (maximum diameter 3 inches), Pocillopora meandrina (to 8 inches diameter), and Montipora verrucosa (to 1.25 inches diameter). Only 6 fish species (19 individuals) were censused: the most common was the o'ili'uwi'uwi (Pervagor spilosoma). The dominant benthic species in the 5 square meters of substratum sampled was the alga Lyngbya majuscula. Invertebrates encountered included the solitary tunicate, Ascidia interrupta, the auger snails, Terebra maculata and T. penicillata, and the haole crab, Portunus sanguinolentus. In the vicinity of the station was seen a small he'e (Octopus cyanea), coneshell snails (Conus lividus and C. striatus), a coral (Montipora flabellata), limu (Dictyota sandvicensis), and a helmet shell (Cassis cornuta). Fishes seen in the vicinity of Station 1 include malu (Parupeneus pleurostigma), moano (P.

TABLE II. Summary of the benthic survey conducted at Station 1 in the biotope of flat limestone pavement offshore of Waikiki, Oahu. Results of the 5 square meter quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 40-point analysis is presented in Part B; counts of invertebrates appear in Part C; and a summary of the fish census is given in Part D. Water depth is 85 feet; mean coral coverage is <1 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Algae					
Lyngbya majuscula	0.5	0.75	0.5	1	0.5
Tunicata					
Ascidia interrupta		0.25		0.5	
Sand	99	99	99	98.5	99.5
Rubble	0.5		0.5		

B. 40-Point Analysis

Species	Percent of the Total
Algae	
Lyngbya majuscula	1
Sand	74
Rubble	5
Hard Substratum	20

C. Invertebrate Census (20 x 4 m)

Species	Number
Phylum Arthropoda	
Portunus sanguinolentus	1 (juvenile)
Phylum Mollusca	
Terebra maculata	1
T. penicillata	1
Phylum Chordata	
Ascidia interrupta	up to 4 individuals/100cm^2

D. Fish Census Summary (20 x 4 m)

6 Species
19 Individuals
Diversity (H') = 2.48
Standing crop (g/m2)=12.5

multifasciatus), razorfish (Novaculichthys taeniourus), kala holo (Naso hexacanthus), uku (Aprion virescens), and the parapercid (Parapercis schauinslandi).

The qualitative reconnaissance carried out in the intervening area between Stations 1 and 2 was comprised of a flat limestone substratum occasionally interrupted by sand patches. Over this substratum are scattered loose pieces of limestone as large as 3 by 3 feet and rising as high as 12 inches from the bottom. Algae seen in this survey include Enteromorpha sp., Halimeda opuntia, Neomeris annulata, Lygnbya majuscula, Dictyota acutiloba, D. bartayresii, D. sandvicensis, Sphacelaria furcigera, Desmia hornemanni, Peyssonellia rubra and Tolypiocladia glomerulata. Macroinvertebrates encountered include the miter (Mitra mitra), cones (Conus lividus and C. distans), sea urchins (Echinothrix calamaris, Pseudoboletia indiana, Echinostrephus aciculatus), the large terebellid worm (Loimia medusa), the aplysid (Notarchus lineolatus, spawning aggregations), and corals (Pocillopora meandrina, Porites lobata, Leptastrea purpurea, Montipora verrucosa and Pavona varians). Other than eels and triggerfishes all other fishes seen were either juveniles or species that only attain a small size as adults. Fishes seen on this qualtitative survey include the papio (Caranx orthogrammus), omilu (C. melampygus), maiko (Acanthurus nigroris), na'ena'e (A. olivaceus), kihikihi (Zanclus cornutus), o'ili'lepa (Cantherhines sandwichiensis, C. verecundus), o'ili'uwi'uwi (Pervagor spilosoma), humuhumu lei (Sufflamen bursa), humuhumu hi'ukole (Melichthys vidua), humuhumu ele'ele (M. niger), triggerfish (Xanthichthys auromarginatus), malu (Parupeneus pleurostigma), moano (P. multifasciatus), tobies (Canthigaster jactator and C. cornata), alo'ilo'i (Dascyllus albisella), wrasses (Cheilinus bimacula and Pseudojuloides cerasinus), malama lama (Coris ballieui), hinalea akilolo (Coris gaimard), angelfish (Centropyge fisheri), kikakapu (Chaetodon kleinii and C. auriga), lau wiliwili (C. miliaris), puhi paka (Gymnothorax flavimarginatus), puhi'oni'o (G. meleagris), puhi lau milo (G. undulatus), puhi (G. steindachneri), parapercid (Parapercis schauinslandi), ala'ihi (Adioryx lacteoguttatus), maka'a (Malacanthus hoedtii) and grouper (Caesioperca thompsoni).

The substratum at Station 2 is flat limestone sloping at about a 5 degree angle seaward. Scattered across this limestone are occasional depressions up to 13 feet in diameter and attaining a maximum depth of 12 inches. These depressions are spaced from 6 to 50 feet apart and contain sand and rubble. Other than the shelter provided by these pockets, little topographical relief is present.

TABLE III. Summary of the benthic survey conducted at Station 2 offshore of Waikiki, Oahu. Results of the 5 square meter quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 40-point analysis is presented in Part B; counts of invertebrates appear in Part C; and a summary of the fish census is given in Part D. Water depth is 80 feet; mean coral coverage is 10 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number				
Species	1	2	3	4	5
Algae					
Dictyota sandvicensis	1				
Lyngbya majuscula	7	1	6	1	2
Corals					
Porites lobata	0.5	1	0.5		1
Pocillopora meandrina	1.2		0.5		
Montipora verrucosa					0.1
Sand		45			1
Rubble		53			
Hard Substratum	90.3		93	99	95.9

B. 40-Point Analysis

Species	Percent of the Total
Algae	
Lyngbya majuscula	1
Corals	
Porites lobata	1
Sand	7
Hard Substratum	91

C. Invertebrate Census (20 x 4 m)

Species	Number
Phylum Echinodermata	
Linckia diplax	1
Echinostrephus aciculatus	2
Holothuria atra	1
Phylum Chordata	
Ascidia interrupta	up to 1 individual/100cm^2

D. Fish Census Summary (20 x 4 m)

18 Species
100 Individuals
Diversity (H') = 2.48
Standing crop (g/m2)=76.0

Table III presents a summary of the quantitative survey conducted at Station 2. Corals are not prominant: mean coverage was estimated at 0.7 percent. Three coral species were found in the quadrats: Porites lobata, Pocillopora meandrina and Montipora verrucosa. The largest corals seen in the area were P. meandrina with colony diameters not exceeding six inches and P. lobata with diameters up to four inches. The alga Lyngbya majuscula was the most conspicuous bottom inhabitant, with mean coverage of around 2 percent. Three macroinvertebrates were found in the 20 X 4 meter census area: the sea urchin, Echinostrephus aciculatus, the starfish, Linckia diplax, and the black sea cucumber, Holothuria atra. Eighteen fish species were censused in the transect area. The most abundant fishes were the o'ili' uwi'uwi (Pervagor spilosoma) and the damselfish (Chromis vanderbilti). Two non-sedentary fish species encountered in the survey were juvenile omilu (Caranx melampygus) and the papio (C. orthogrammus). The most unusual fish species seen in the census was a dragon eel (Muraena pardalis).

In the vicinity of Station 2, a number of fish, invertebrate, and algae not encountered in the 20 X 4 meter survey area were noted, including a he'e (Octopus cyanea), corals (Leptastrea purpurea and Pavona varians), limu (Neomeris annulata, Hydrolithon reinboldii and Desmia hornemannii), sea urchins (Echinothrix calamaris, E. diadema) and the sea cucumber (Holothuria nobilis). Fishes in this surrounding area include na'ena'e (Acanthurus olivaceus), o'ililepa (Cantherhines verecundus), humuhumu nukunuku apua'a (Rhinecanthus rectangulus), lau'ipala (Zebrasoma flavescens), kihikihi (Zanclus cornutus), rock-mover (Novaculichthys taeniourus), wrasses (Labroides phthirophagus and Pseudocheilinus evanidus), moano (Parupeneus multifasciatus), uhu (Calotomus zonarcha), toby (Canthigaster cornata), maka'a (Malacanthus hoedtii), blenny (Plagiotremus ewaensis), parapercid (Parapercis schauinslandi), o'opu okala (Diodon holocanthus), puhi lau milo (Gymnothorax undulatus), puhi'oni'o (G. meleagris), puhi kapa (Echidna nebulosa), umaumalei (Naso literatus) and the snake eel (Myrichthys maculosus).

The qualitative survey at Station 3 was in an area of low limestone fingers with sand bottom between. Coral cover reached 10% in local areas on the limestone, but was around 3% of the bottom overall. The most common coral is Porites lobata, and Montipora verrucosa, Pocillopora meandrina, and Porites compressa are present. Maximum colony diameters do not exceed 1.5 feet and most of the heads are encrusting or prostrate in growth form. Fish species commonly seen in this spur-and-groove zone include hinalea lauwili (Thalassoma duperry), wrasse (Pseudojuloides cerasinus), 'omaka (Stethojulis balteata), o'ili

'uwi'uwi (Pervagor spilosoma), humuhumu'ele'ele (Melichthyes niger), triggerfish (Sufflamen bursa), angelfish (Centropyge potteri), damselfishes (Dascyllus albisela and Chromis vanderbilti), o'ililepa (Cantherhines sandwichiensis), kikakapu (Chaetodon kleini, C. miliaris), piliko'a (Cirrahitops fasciatus), butterflyfish (Hemitaurichthyes zoster), moano (Parupeneus multifasciatus), malu (Parupeneus bifasciatus), puhi-paka (Gymnothorax flavimarginatus), puhi laumilo (G. undulatus), and sharpback puffer (Canthigaster jactator).

A brief qualitative survey made around the "100-foot Hole" located east of the study area provided some indication of how successful habitat enhancement efforts could be in this environment. A number of fishes of commercial importance were seen in the vicinity, including three striped marlin (Tetrapterus audax) and a school of kawakawa (Euthynnus affinis). Both of these species are open ocean or pelagic forms and were probably in the area because of a school of potential prey (the opelu, Decapterus macarellus) that were also present. Other commercially important fishes present include kumu (Parupeneus porphyreus), moano (P. multifasciatus), malu (P. pleurostigma), malu (P. bifasciatus), weke'ula (Mulloides vanicolensis), weke (M. flavolineatus), mempachi (Myripristes amenus), uku (Aprion virescens), pa'opa'o (Gnathanodon speciosus), omilu (Caranx melampygus), papio (C. orthogrammus), and uhu uliuli (Scarus perspicillatus). Other fishes present which are of lesser commercial interest include na'ena'e (Acanthurus olivaceus), taape (Lutjanus kasmira), kala lolo (Naso brevirostris), kala holo (N. hexacanthus), mamo (Abudefduf abdominalis) and the whitetip shark (Triaenodon obesus). Smaller fishes in residence around the "100-foot hole" include alo'ilo'i (Dascyllus albisella), humuhumu ele'ele (Melichthys niger), humuhumu hi'ukole (M. vidua), kikakapu (Chaetodon kleinii), lau wiliwili (C. miliaris), o'ili lepa (Cantherhines verecundus), nunu (Aulostomus chinensis), hinalea 'akilolo (Coris gaimard), malamalama (C. ballieui), hilu (C. flavovittatus), wrasse (C. venusta), damselfishes (Chromis vanderbilti and C. verator), o'ili'uwi'uwi (Pervagor spilosoma), razorfish (Novaculichthys taeniourus), lauwiliwili nukunuku'oi'oi (Forcipiger flavissimus) and butterfly fish (Hemitaurichthys polylepis).

In addition to a biological survey of the marine environment at the proposed Waikiki site, divers conducted a reconnaissance of the bottom off Kakaako (a proposed site considered as an alternate) from the shore out to the 130 foot depth contour. Results of this survey were reported in an earlier Environmental Assessment for the project (AECOS, 1987a). Three major biotopes (benthic environments) were identified in this area: (1) a dredge

spoil biotope, (2) a spur and groove biotope, and (3) a high energy shallow limestone biotope. Suitable depths for a dive area occur only in Biotope 1.

C.2.2 Protected Species

The marine waters in the proposed project area are not considered critical habitat for any protected marine species. Migratory hump-back whales (Megaptera novaeangliae) visit the waters off of Oahu between about December through March of each year. These large marine mammals generally avoid the waters off of Waikiki, although are frequently sighted off of Diamond Head, indicating that they probably traverse the Waikiki to Ewa area far offshore relative to the proposed dive site.

C.3 EXISTING LAND AND WATER USES

C.3.1 Offshore of Waikiki

The waters off Waikiki are probably among the most heavily used for recreational boating in the State. Mamala Bay is however a large, open bight, and with the possible exception of some areas nearshore and around the yacht basins, is not congested with respect to boat traffic. The dive site is located sufficiently far from shore to be out of the way of much of the casual boating that occurs inside and just outside the reef margin. The proposed site is inside of commercial shipping routes as all such traffic traveling eastward out of Honolulu would pass seaward of, a generally far outside of the Diamond Head buoy located one-half mile off the Diamond Head shore.

Sailboat races sponsored by the Waikiki Yacht Club and the Hawaii Yacht Club are held most weekends in waters to the west, from roughly off Sand Island to off Waikiki. Large yachts practice further off the shore than the proposed dive area. The Hawaii Yachting Association conducts three races each year on courses which usually begin in the vicinity of the Ala Wai channel markers and extend eastward to the Diamond Head buoy (and on around Oahu). The proposed dive site is located on this route. However, the impact of the proposed dive area on these races would be minor. Submersible operations could be suspended for the several hours when racing yachts might be on this part of the course, or the transfer of passengers to the submersible could be moved seaward to over the deep sunken vessel (which would be generally out of the way of the yachts which sail to cut close around Diamond Head). One participant in these races suggested that the presence of the

loading platform over the dive site could be marked as an obstacle on the course instructions, adding additional challenge to the race.

The general area of the proposed dive site is used by fishermen and divers to some extent. Fishermen have indicated that the waters around a dive site known as the "100-foot Hole" is used by ulua fishermen. The same area is a moderately popular offshore dive area for SCUBA divers and spearfishermen. Use of the area by these groups is light, and placement of all site enhancement well away from the 100-foot Hole, a focal point of these activities, should avoid conflicts between present users and the proposed submersible operation. Little is known about the activities of traditional "squid" (octopus) fishermen in these waters, although this activity does occur off the Waikiki reef and presumably extends as far seaward as the proposed dive site. Impacts of the submersible operation on squid fishing will be small as these fishermen will not be excluded from the area.

Cruise boats and para-sailing operations use the waters offshore of Waikiki at about the same distance offshore proposed for submersible operations. Nearshore and shoreline activities at Waikiki would not be impacted by the proposed operation.

C.3.2 Honolulu Harbor and Keehi Lagoon

Honolulu Harbor is a commercial port and assignment of use of piers is under the jurisdiction of the Harbors Division of the State's Department of Transportation. Use of Aloha Tower facilities or other disembarkation point within the Harbor will require a commercial license to operate. The available facilities are of adequate size and development to accommodate the proposed loading and unloading of passengers as proposed by Atlantis Submarines. It is expected that a separate determination of non-adverse impacts will be required by the Harbors Division in their review of the license application.

Keehi Lagoon includes areas presently used for commercial operations as well as private boat moorings and slips. The proposed use of mooring sites in Keehi Lagoon is compatible with existing uses. The Lagoon provides safe anchorage under the most severe sea and weather conditions anticipated for the Hawaiian Islands.

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SECTION D.

RELATIONSHIP OF THE PROJECT TO ENVIRONMENTAL POLICIES AND CONTROLS

A number of aspects of the project come under State and Federal environmental policies and controls. As presently conceived, neither construction nor shoreline alterations are required for land-based activities, and the City and County of Honolulu has determined that an SMA permit will not be required.

D.1.1 Permits

Operation and mooring of vessels, including submersibles, will be subject to various requirements of the State Department of Transportation (Harbors Division) and Federal Agencies, including the U.S. Coast Guard and Army Corps of Engineers. Harbor use permits will be obtained from the Department of Transportation for operations in Honolulu Harbor and Keehi Lagoon. Mooring permits will be required for the submersible operating area and the maintenance/ submersible anchorage moorings.

The proposed placement of attractions on the sea floor are subject to environmental assessment and permit requirements of the State Department of Land and Natural Resources and the Department of the Army. The proposed operating site is within the State Conservation District, and under the jurisdiction of the Department of Land and Natural Resources. The proposed project will require a Conservation District Use Permit. The placement of submerged habitat structures (artificial reefs and sunken vessels) and permanent moorings will require a Section 10 (Rivers and Harbors Act) permit from the U.S. Army, Corps of Engineers, and be subject to review by EPA and the U.S. Coast Guard. The Corps of Engineers, in processing these permits, may coordinate reviews with other Federal agencies, including Fish and Wildlife Services, National Marine Fisheries, and the U.S. Advisory Council on Historic Preservation. In addition, an Army Corps permit requires certification from the Coastal Zone Management program (DPED) and the Department of Health ("401" certification).

D.1.2 Hawaii State Plan

The proposed project is in keeping with a number of the objectives and policies of the Hawaii State Plan (Chapter 226, Hawaii Revised Statutes), particularly those sections relating to the visitor industry (Sec. 226-8).

The proposed project promotes steady growth of the visitor industry, provides new job opportunities and steady employment for Hawaii's people, and provides opportunities for job training and education allowing for upward mobility within the visitor industry (See EIS Sections E.5.1 and E.5.4). The project is consistent with the Plan's objectives of improving the quality of existing visitor destination areas, encouraging cooperation between public and private sectors in developing and maintaining visitor industry attractions and, through its marketing efforts, contributing to the overseas promotion of Hawaii as a tourist destination.

The project will directly and indirectly promote investment and employment in marine-related industries and enhance research and education in ocean related technologies (HRS Sec. 226-10). The project is designed in keeping with the State Plan's objectives and policies for marine resources (HRS Sec. 226-11). A joint resolution of the 1987 State legislature supports the concept of submersible tours and the Atlantis Submarines, Inc. project specifically.

D.1.3 National Artificial Reef Plan

The National Fishing Enhancement Act of 1984 has the purpose of promoting and facilitating responsible and effective efforts to establish artificial reefs in U.S. waters. The Act specifies that a National Artificial Reef Plan be developed to further these goals (see NOAA, 1985). The habitat enhancements proposed by Atlantis Submarines are the type of activity which the National Artificial Reef Plan was intended to foster.

SECTION E.

PROBABLE IMPACTS OF THE PROPOSED ACTION ON THE ENVIRONMENT

E.1 IMPACTS ON THE MARINE ENVIRONMENT

E.1.1 Water Quality

The Atlantis submersibles are non-polluting. Contamination of the surrounding water by petroleum hydrocarbons is not possible as the vessels are battery powered and utilize direct electric drive thrusters rather than hydraulic units.

Toilet facilities will be provided aboard the transfer platform and the shuttle vessel. These facilities will empty into holding tanks and will comply with Department of Health requirements for vessels operating in State harbors. Waste water will be transferred and pumped into appropriate shoreside systems for disposal and treatment by existing wastewater treatment plants. Pumps on the platform will transfer waste water to the shuttle craft's tanks for transfer to a mobile unit (private contractor) at dockside.

The proposed habitat structure will be constructed of concrete or other materials deemed suitable by the National Artificial Reef Plan (NOAA, 1985) and will pose no threat to water quality. All structures to be placed on the sea floor (for example, derelict ships) will be prepared to comply with State of Hawaii water quality criteria and Environmental Protection Agency requirements for ocean dumping. All toxic and potentially hazardous materials will be removed. A monitoring study was stipulated by EPA and the State Department of Health for the Department of Land and Natural Resources (DLNR) Zones-of-Mixing permits for the dumping of car bodies at three artificial reef sites off Oahu. This study, undertaken by the Hawaii Institute of Geophysics (1974), looked at the impact of the disposal activity on water quality, particularly with respect to metals. Results showed no increase in toxic metals in the water columns around the DLNR's artificial reefs, although materials which today would not be suitable from a water quality standpoint were used in some of the State's early artificial reef efforts.

E.1.2 Marine Life

The Atlantis submersible is non-polluting and designed to avoid adverse impacts on marine biota. Underway, the submersible is quiet, slow, and maneuverable -- interactions with turtles or whales would be extremely unlikely. Thrusters power the vessel downward, but are not used to raise the vessel off the bottom or during ascent because the vessel is positively buoyant. Thus, sediments on the bottom are not disturbed by the passing of the submersible; a fact of obvious environmental benefit, designed primarily to avoid reducing underwater visibility at the dive site.

The operation of shuttle boat between the shore and submersible operating areas would pose minimal or no threat to protected marine life. The offshore site is near existing boat harbors and regularly used vessel routes.

Placement and/or construction of various habitat structures at the site (see Section B.4) will have no or minimal adverse impacts on marine biota. The siting of all objects will be made to avoid destruction of living coral. Reconnaissance dives (see Section C.2) indicate that coral cover is sparse in the designated area off Waikiki. This site is characterized by mostly featureless, sandy, limestone bottom with little or no coral growth or diverse fish populations. Construction of habitat structures would be for the purpose of enhancing biological resources in the submersible operating area, providing a positive impact in terms of fisheries stock replenishment and regeneration. Placement of objects on a bottom already characterized by high biological productivity would be counter-productive to the intent of Atlantis Submarines, Inc.

E.2 NOISE IMPACTS

Only Chapter 43 of Title 11, Administrative Rules of the Department of Health (encompassing community noise control for Oahu) has statutory authority over maritime activities of the project. Boats operating in harbors are specifically exempt under this Chapter (§11-43-4 (5)), and presumably by intent boats operating offshore are likewise exempt. Equipment on board the moored servicing/maintenance platform may be covered by these rules.

The proposed operations will not generate excessive or unusual noise. Whether or not specific noise regulations apply to a moored platform, the issue of noise generation will be carefully addressed by Atlantis Submarines. Maintenance and system recharging will occur between the hours of 11 pm and 6 am, when background noise levels

(other than that generated by the surf) are minimal and sensitivity to extraneous noise is highest. Atlantis Submarines will engineer all installed equipment on the platform with sound suppression devices to insure that disturbing sound levels will not emanate from the maintenance operations.

E.3 VISUAL IMPACTS

Visual impacts of the proposed project derive principally from the shuttle boat, transfer platform, and surface tender boat. The submersibles have a low profile and will be submerged most of the time. The proposed site enhancements will be submerged in over 80 feet of water and not visible from the shore. The vessels and transfer platform will be located nearly 0.9 mile off the closest shore or will be in transit between the offshore dive site and Honolulu Harbor. The visual impact of the platform and vessels will be minor at this distance and against the background and foreground of numerous other vessels constantly present in Mamala Bay. The operation will be visible from Waikiki, but not noticeable.

E.4 IMPACTS ON WATER USES

Impacts on existing water uses encompass two aspects, particularly within the submersible operating area where some constraints on public activities would result largely for safety reasons. Existing or potential activities which would be limited by the project include boat passage and fishing. Sites have been selected with a view to minimizing these negative impacts.

E.4.1 Surface Traffic

Vessel traffic across the primary dive site will be limited somewhat by virtue of the continuous use of the site during submersible operating hours. Even though the submersible will spend a majority of the time when on site at a depth sufficient to avoid hazardous interactions with surface craft, the escort vessel, shuttle boat, and transfer platform will be present on or near this area throughout the day and evening. The purpose of the escort vessel is to maintain communications between all these elements and to insure a safe ascent to the surface by the submersible. It is not the intent of Atlantis Submarines to exclude pleasure, sport, or fishing craft from the submersible operating area. However, because the proposed operation entails more or less continuous presence at a

fixed site (the permanent mooring) and activities around this site, the impact is one of limiting use by others of the site. This limitation is not the same as exclusion, however, because the dive area is large relative to the combined area of the surface vessels.

The site selected off Waikiki is in the general area of routes taken by commercial cruises which travel out of Kewalo Basin and Honolulu Harbor towards Diamond Head. Private and charter fishing vessels may now occasionally cross over the proposed site. Course alterations necessary to pass either inshore or offshore of the operating submersible, its escort boat, the loading platform, and the shuttle boat will be minor -- no greater than if two or three fishing or pleasure craft were stationary in the area. Similarly, the shuttle vessel, escort boat, and submersible will be required to observe all of the rules, conventions, and courtesies applicable to vessels underway and, when necessary for reasons of safety or otherwise, will make appropriate course alterations to accommodate other craft traversing the area. U.S. Coast Guard requirements with respect to markings and lighting will be adhered to for all craft and fixed moorings.

Mamala Bay, while a large area and not generally congested, is nonetheless heavily used by a wide variety of surface vessels including sail craft, cruise boats, fishing boats, and a variety of commercial shipping vessels calling at Honolulu Harbor. Surveys were conducted to assess the boat traffic situation at various alternative locations off of Honolulu. site. These surveys consisted of positioning a small craft over the shallow end of a potential site (see Figure 15) in about 60 to 80 feet of water and recording data on all ships and boats passing within 500 (or, in one case, 1,000) yards. The survey at each site included at least one weekday and one weekend day between the hours of 9 AM and 6 PM (or later) each day. The general weather and sea conditions were noted for each survey day, and the following information logged for each vessel passing the survey boat: time, type of craft, length, make or name, commercial or private, apparent use or activity, where coming from or going to, and closest point of approach (CPA). Data sheets are included in Appendix E and the data are summarized and discussed here.

Figure 16 is a summary of vessel counts from Appendix E, adjusted to vessel counts per 12-hour day (survey period) for each survey site. Differences in the types of craft passing within 500 yards of each survey site and differences between week day versus weekend day traffic are tabulated below. Vessel types have been categorized as follows:

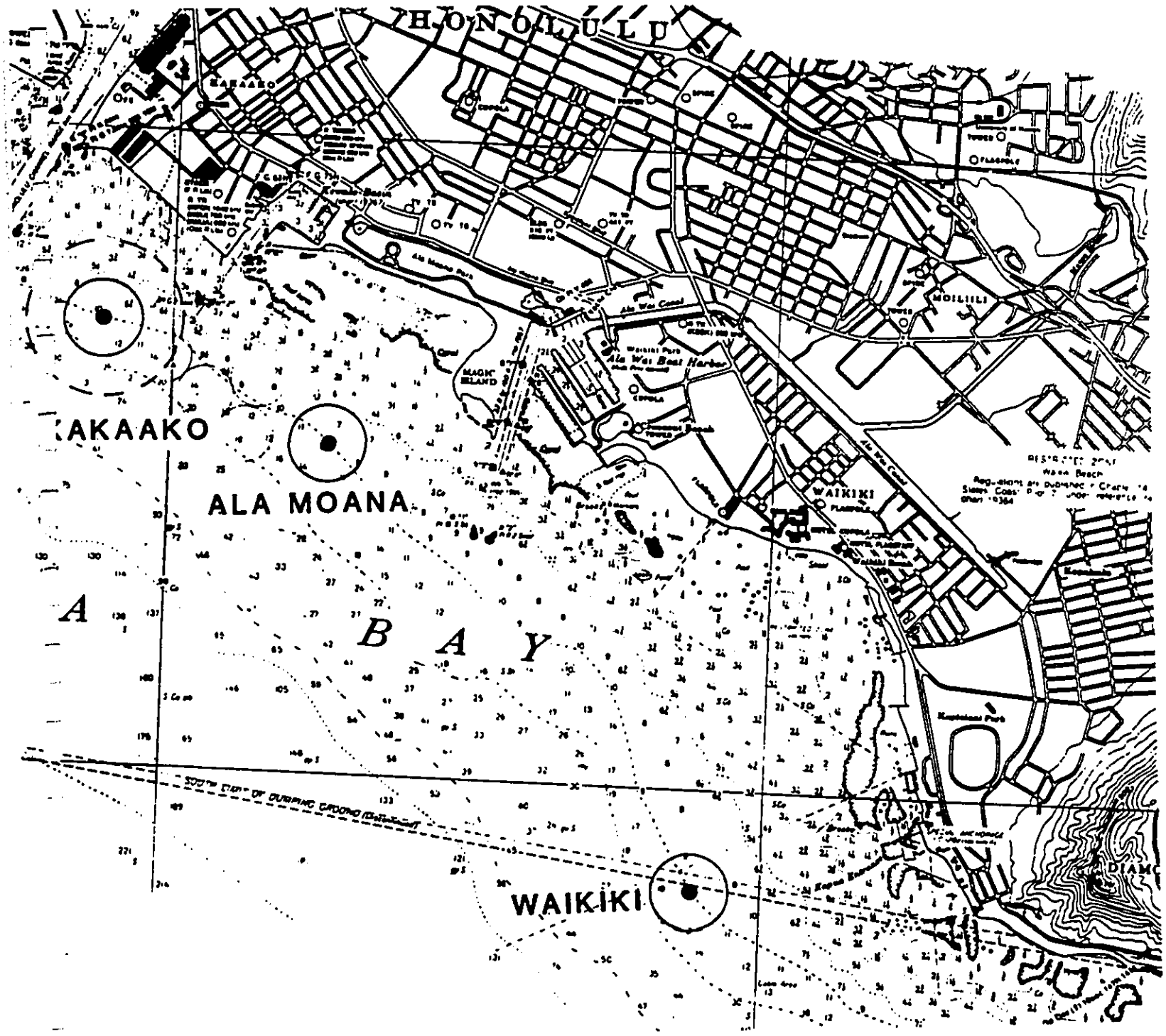

FIGURE 15. POSITIONS AND SCOPES OF OBSERVATION AREA USED FOR THE VESSEL TRAFFIC SURVEYS OFF HONOLULU.

CATEGORY		
	1	Commercial and military ships
	2	Commercial cruise vessels, tour boats
	3	Commercial fishing vessels
	4	Private sailboats
	5	Private motor boats, recreational fishermen
	6	Canoes, kayaks, surfboards

Counts within 1000 yds of the proposed site off Kakaako are included as dashed-line extensions of the bars. However, for analysis and discussion purposes, only vessels passing within 500 yards of the Kakaako station are considered herein.

With respect to average number of vessels per 12-hour day (Figure 16), about the same number of commercial boats (categories 1, 2 and 3) pass the Kakaako and Ala Moana survey sites while somewhat fewer (about 12%) private recreational and sport craft (categories 4, 5, and 6) pass off Kakaako than off Ala Moana. The site off the eastern part of Waikiki had about 25% more commercial boats and only about half the number of small private boats as compared with the other two sites. Of course, extending the Kakaako Site observations to 1000 yds, thereby encompassing the Honolulu Harbor and Kewalo Basin channels, increases the commercial traffic numbers observed from the Kakaako station. It is important to note also, that the greater volume of essentially larger vessels to the east represents tour boats (category 2) and not commercial or military shipping (category 1).

Some major differences between the sites in the types of craft observed (Tables IV) are demonstrated. Thus, the site off Kakaako is generally characterized by a higher percentage of commercial shipping than either of the other two sites, and a lower percentage of sport and recreational craft as compared with off Ala Moana. The site off Ala Moana is distinctive perhaps only by its great similarity to the Kakaako location, differing in having a lower proportion of larger ships and slightly greater proportion of cruise vessels and small recreational boats. The Waikiki site is most distinguishable by its substantially higher proportion of cruise vessels, presumably reflecting its greater distance offshore as regards all other categories except commercial and military craft which, at this distance from the harbors would be expected to be passing well outside the site.

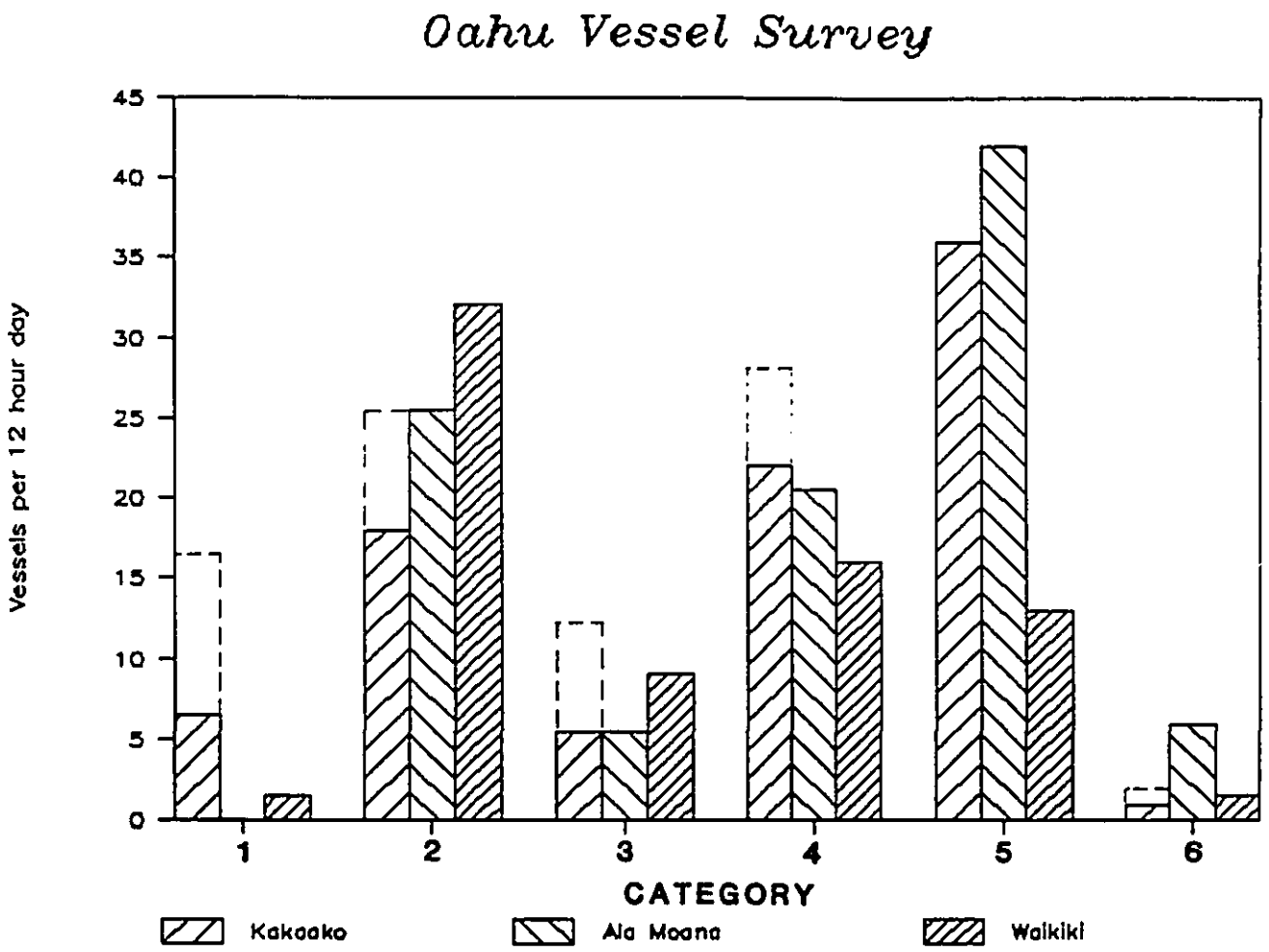

FIGURE 16. AVERAGED NUMBER OF VESSELS PER 12-HOUR DAY BY TYPE CATEGORIES WITHIN 500 YARDS OF THE SURVEY SITES OFF HONOLULU. (*Dashed line shows averaged vessel counts within 1000 yards of the position off Kakaako).

On the weekend as compared with weekdays (Table V) there is a decrease in the percentage of vessel traffic which is commercial and a corresponding increase in the percentage of vessel traffic which is essentially recreational (off Kakaako and Waikiki but not off Ala Moana). At least off Kakaako, this shift reflects an increase in the numbers of recreational craft on the weekend compared with week days, as the actual amount of commercial traffic decreases only slightly. Off Ala Moana, the weekday versus weekend proportions show mostly only an increase in cruise

TABLE IV. RELATIVE PROPORTIONS (PERCENT) OF TYPES OF VESSELS OBSERVED AT THREE POTENTIAL DIVE SITES OFF HONOLULU FOR ALL OBSERVATION DAYS COMBINED.

CATEGORY (TYPE)	SITE		
	KAKAAKO	ALA MOANA	WAIKIKI
1	7	<1	2
2	20	26	44
3	6	6	12
4	24	21	22
5	41	42	18
6	1	6	2

TABLE V. RELATIVE PROPORTIONS (PERCENT) OF TYPES OF VESSELS OBSERVED AT THREE POTENTIAL DIVE SITES OFF HONOLULU SEPARATED BY WEEKDAYS AND WEEKENDS (in parentheses).

CATEGORY (TYPE)	SITE		
	KAKAAKO	ALA MOANA	WAIKIKI
1	13 (5)	<1 (<1)	5 (1)
2	26 (18)	24 (28)	53 (40)
3	11 (28)	5 (6)	14 (12)
4	16 (28)	21 (20)	12 (26)
5	34 (44)	42 (43)	14 (19)
6	<1 (1)	8 (3)	2 (2)

vessels on the weekend. Absolute numbers, as well as proportions or percentages, for all other categories hardly changed at this location comparing a Tuesday and a Sunday observation periods. As the Waikiki results suggest, a Saturday sample at the Ala Moana location probably would

have yielded somewhat different results. Off Waikiki, the weekend (Saturday) vessel counts more than double. Proportional increases are shown in nearly all categories, but most particularly in the numbers of sailboats and small fishing craft. A major difference in the "within-weekend" sampling results off Kakaako was a doubling (from 36 to 72) of small motorized craft (category 5) on a Saturday as compared with a Sunday.

The surveys were intended to roughly quantify vessel traffic in waters within the depth range useful for submersible operations. It is easily understood and observed that a submersible operating area anywhere in navigable waters off Honolulu will impact on surface vessel traffic patterns. Reference to the 1000-yard observation area results off Kakaako (dashed extensions of the bars in Figure 16) can be interpreted to indicate the increase in (mostly) commercial type vessels that would pass by or through a site located further offshore from the proposed one. Despite the proximity of the proposed site to Honolulu Harbor and Kewalo Basin, the vessel traffic volume was 10% less here than off Ala Moana. The average number of boats passing near the site off the eastern part of Waikiki was 8% less than that off Kakaako.

Both the Ala Moana and Waikiki observations are similar with respect to numbers, and therefore probably representative of the waters at comparable depth and distance anywhere offshore of Waikiki with respect to sail boat traffic (the mean of all four sample days at both sites is 18 craft per 12-hour day). The waters off Ala Moana, however, are more crowded with respect to small motorized boats and canoes.

Cruise or tour vessels which regularly travel from Honolulu Harbor and Kewalo Basin towards Diamond Head (eastward) and back would set courses passing the proposed site, particularly when turns are made in deep water but inside the outer channel markers. Minor course adjustments in the established routines by these vessels might be necessary to facilitate a safe pass of the submersible operations. The inconvenience to cruise operators would be offset by the benefit of the submersible operation becoming an item of visual interest to cruise passengers.

These vessel counts lack the sophistication of comparable type vehicular traffic counts on city streets -- understandable given the costs and logistical difficulties inherent in gathering these data at sea. They do, however, provide a means of assessing the magnitude of the impact of the proposed submersible operation on vessel traffic. Further, for both safety reasons and ease of operations, a

site characterized by a greater proportion of commercial type vessels (manned by licensed pilots and captains) and the lower proportion of recreational craft, particularly craft under sail, would be preferable. Additional discussion of the results as they pertain to alternate sites is presented in Section G.1.1.

E.4.2 Site Utilization

It is the intention of Atlantis Submarines to develop the marine resources needed for a successful venture of the kind proposed. The placement of man-made habitat structures represents an investment in time and materials, but the resulting resource is the sum of this investment plus the biological life which becomes established on and around the "reef" structure. This creative activity enhances the potential use of the site and, in turn, will result in interest in the site where none existed before. Specifically, this interest is likely to come from fishermen and divers attracted to the enhanced site.

The evidence from studies conducted on artificial reefs demonstrates that these features attract and support a variety of fishes, including species of commercial and recreational value (see Appendix B). The submersible operating site has been selected to minimize or avoid potential conflicts with other user groups. One characteristic of the site is a paucity of marine resources and a corresponding low level of interest in the specific location selected. The situation could change once the reefs become populated. The central purpose of the reefs is to provide a focus of interest for submersible passengers and a major aspect of the visual setting will be the abundance of marine life.

Excessive fishing pressure would interfere with the research potential of the artificial reef habitat. Investigations of fish populations around those artificial reefs already developed in Hawaii demonstrate the tremendous potential for this approach to fisheries enhancement. These artificial reefs were developed by the State government to increase fishing and diving opportunities in areas of low natural resources. Nonetheless, the full potential of the concept cannot be evaluated if an unknown number of fishes (and mostly commercially valuable species) are being withdrawn from the reef area.

In the interest of safety of operations and the protection of the fish stocks developed around the habitat structures, Atlantis Submarines submitted applications for an ocean lease under the provisions of the Hawaii Ocean and

Submerged Lands Leasing Act. After reassessing its position as regards to the need for a lease, Atlantis Submarines withdrew its applications for such lease.

E.5 OTHER IMPACTS

E.5.1 The Tourist Industry

The unique nature of Atlantis and the public interest it generates makes the submersible operation a valuable component for tourism promotion (see Appendix A). For example, the Cayman Island government has used Atlantis extensively in press releases and promotional work throughout Europe, the Caribbean, and North America and in all their tourism offices. Measuring or predicting the direct impact of Atlantis submersibles on the number of tourists coming to Hawaii or each of the islands having submersible tours would be difficult. Visitors to the islands come for a complex variety of reasons, and expect a wide range of experiences. However, the visitor satisfaction demonstrated in post-tour surveys conducted in Grand Cayman suggests that a professionally operated submersible tour will contribute to the overall positive impression of the island as a tourist destination.

E.5.2 The Water Sports Industry

The water sports sector of the tourist industry has experienced exceptionally rapid growth in recent years, particularly in the area of SCUBA diving. Within the industry, Atlantis is unique in that it introduces high technology, high volume passenger service, and access to an underwater experience, regardless of age or physical condition of the participant. The experience in Grand Cayman shows that submersible tours actually compliment and stimulate the business of dive shops and dive tour operators. Specifically, persons who are experienced divers use the Atlantis submersible to experience a dive to greater depths than would ordinarily be practical without decompression. Novice and non-divers gain from a ride aboard the submersible an interest in exploring the undersea on their own, with the result that they become new customers of dive gear suppliers and dive tour operators. Because the submersible operates in a fixed area, it cannot begin to offer the range of underwater experiences available from snorkel and SCUBA dive concessions. Thus, Atlantis is complimentary to, not competitive with, other businesses in the dive industry.

E.5.3 Public Facilities and Resources

Atlantis Submarines intends to utilize existing facilities for all land-based parts of the proposed operations. In Honolulu, existing warehouse/office space will be leased to suit operational requirements. Arrangements for space providing ample parking for a passenger staging area will be undertaken as described in Section B.3.2. Land transportation will be contracted to existing local firms. Presently available, public pier facilities will be utilized for passenger pick-up. Restroom facilities are available at the selected disembarkation point (Aloha Tower), but also would be provided aboard the shuttle craft and transfer platform.

In as much as the proposed project does not affect or change existing constraints on visitor numbers (i.e., number of hotel rooms, available seats on interisland airlines, number of rental vehicles, etc.), the impact of attracting visitors to Oahu would be minor. That is, even if it could be demonstrated that the operation of a submersible off Waikiki were having a measurable affect on the number of visitors to Honolulu, the increase could not exceed the existing constraints imposed by other components of the tourist industry outside the control of Atlantis Submarines. Thus, an impact might be to increase the utilized percent of capacity of hotel rooms, rental vehicles, air passenger seats, etc., but predicting this increase, or attributing a measurable increase to the submersible operation would not be possible.

It is anticipated that local increases in traffic and numbers of persons utilizing shore facilities will be minor. A diving tour lasts approximately one hour, and at maximum capacity involves 46 people. A parking area away from the pier area will be provided for passengers arriving by private vehicle. Arrangements will be made with local bus operators to deliver customers to the staging area. A single bus will transfer passengers for a given dive tour from the staging area to the pier. This means that for each submersible operating off Waikiki, one bus will arrive (and depart from) the shoreline transfer point each hour.

Use of an available docking space at the public pier may require cooperation between Atlantis Submarines and any present users of this area. Although the Atlantis shuttle craft will be making relatively frequent tie-ups (hourly), the Atlantis shuttle vessel will be maintaining a tight schedule, thus requiring close coordination between the arrival of the embarking tour group and the tie-up of the shuttle vessel at the pier.

E.5.4 Employment and the Economy

The Atlantis operation requires a highly organized administration and marketing staff to ensure the 12 one-hour turnaround tours per day. The high cost of equipment, large staff, and overhead costs dictate a high volume operation. The special procedures in administration, ticketing, and marketing that have been developed will be introduced into each location and local residents will be trained in these methods and procedures.

The Atlantis submersible is a highly technical machine. In the sophistication of its systems it is more similar to an aircraft than a boat (see Section B.2). Atlantis represents a new level of technical sophistication in the water sports industry and, as such, will be a significant employer in the areas of management and technical personnel. Atlantis will provide attractive and challenging career opportunities for local residents with the appropriate technical background, people skills, and the ability to learn the specifics of this new tourist product.

Each full scale Atlantis operation requires three full shifts of operating, mechanical, and clerical staff to ensure the 12 daily dives, 7 days per week and employs approximately 30 people. The planned introduction to the Hawaii market of six Atlantis submersibles will directly employ approximately 180 people, the majority of which will be professional technical and marketing personnel based in Honolulu. These people will be trained and supervised initially by a core group of operational personnel.

Operation of the diving tours will create a steady demand for qualified submersible pilots in Hawaii and in other areas where Atlantis submersibles operate. This demand will be met by an in-house training program. Because of the number of submersible units proposed for Hawaiian waters, Hawaii would be a possible choice for locating a company training center to service world-wide operations.

The indirect employment generated by ticket sales, which will use a large number of agents, and in ground transportation, which will be contracted to local operators, will significantly increase the employment benefits realized by the State of Hawaii. Additional impacts or benefits to the local economy include a $3 to $4 million investment in operating sites development and construction.

E.5.5 Education

Atlantis provides opportunities for (1) ocean environment awareness programs; (2) specialized educational programs; and (3) scientific research. The increased public access to the marine undersea environment provided by Atlantis tours will promote the development of artificial reefs, ocean monitoring systems, and other scientific and commercial activities underwater by increasing public awareness of and experience with this environment.

In Grand Cayman over 1,000 school children from the total approximate population of 18,000 have been carried on "Atlantis I" under special educational programs. Similar programs will be developed in Hawaii.

Research scientists and their students will be encouraged to utilize the artificial reefs to conduct studies. A central theme of the tour narration will be the educational and practical benefits of the unique and on-going research at the sites, and the contribution of this research to our understanding of the oceans.

The purpose of creating undersea habitat structures and placing sunken vessels at the dive sites is to provide a focus of interest for submersible passengers. Emphasis of the tour will be on the educational value of these features in combination with whatever extant natural elements occur at the site. Atlantis Submarines, Inc. is not attempting to create an artificial setting to "thrill" its customers. Offering dives on an authentic submersible will provide that aspect of the tour. The site enhancements will be designed in keeping with the authenticity of the submersible vessel by emphasizing, in design, deployment, and long-term use, the scientific and educational value of the structural additions.

SECTION F.

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

The environmental impacts of this project will be minimal. Adverse impacts which cannot be avoided relate to the use of public facilities and operations on public lands and waters (see Section D). Use of a State pier at Honolulu, use of moorings in Keehi Lagoon, and more or less continuous use of a small but fixed area seaward of the reef off Waikiki cannot avoid limiting to some extent the use of these areas/facilities by others and increasing the level of human activity in these areas.

Impacts associated with limitations on vessel traffic in the submersible operating area cannot be avoided without compromising safety and efficiency of the operation. It is not intended to exclude other vessels from the pier, mooring area, or dive site, but to ask that other vessels, like those of the Atlantis Submarines' operation, observe standard conventions and courtesies to insure safe interactions between vessels underway, moored, or anchored at sea.

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SECTION G.

ALTERNATIVES

G.1 ALTERNATIVE SITES

A survey of the coastline of the Hawaiian Islands was made prior to selection of sites for operating the Atlantis submersibles. The factors considered critical to site selection are discussed in Section B.3.4 and summarized as follows:

(a) a shore pick-up area in close proximity to a large tourist center;

(b) an underwater dive site sufficiently near the pick-up area to permit the shuttle craft to load, travel to the submersible, exchange passengers, and return within 50 minutes;

(c) sea conditions typified by calm surfaces throughout the year;

(d) good underwater visibility and low current velocities at the dive site;

(e) depths ranging between -60 feet (below the depth of water motion from large sea swells) and -250 feet (maximum certified dive depth) within the area traveled by the submersible during a dive tour; and

(f) underwater attractions providing for an interesting tour route within a relatively small area.

G.1.1 Other Hawaiian Island Sites

Given the nature of this project, a proximity to resort areas is understandably a primary requirement in selection of an operating site. A proposal to operate submersibles off any island in the Hawaiian Chain is based on consideration of the existing market for this attraction on that island. The number of submersibles proposed to be operated at each site is based on predictions from similar considerations, whereas the number eventually operated will depend upon operational experience at each site.

G.1.2 Oahu Island Alternate Sites

Sea conditions off the north and windward coasts of Oahu are typically rough and ocean currents generally strong much of the time, circumstances which would limit the number of dives which could be accomplished annually. Kaneohe Bay, although a protected marine environment, does not provide the depth range required for the kind of diving experience being offered by Atlantis Submarines. Further, it is doubtful that site enhancements could or should be made within Kaneohe Bay. Thus, a submersible tour within the Bay would offer little more than the existing glass-bottom boat tour at a substantially higher operating cost.

Tours must be conducted within a mile or two of a shore loading point and submersible maintenance facility. On the north and windward coasts, this requirement would limit operations to the vicinity of Haleiwa, Heeia, or possibly Makapuu pier. As noted, sea conditions offshore of these areas (for Heeia, conditions outside of Kaneohe Bay) would frequently preclude operations. Financial viability of the project would be jeopardized by both the limitations on a year-round operation and the reduced number of passengers that could be expected given the distance of windward and particularly north shore sites from the major tourist concentration area in Waikiki.

The leeward (Waianae) coast of Oahu offers generally better operating conditions than the north or windward coasts, particularly the more southerly portion of the Waianae coast. Shore disembarkation would be limited to either Waianae Small Boat Harbor, Pokai Bay, or Barbers Point Harbor. Available space, docking facilities, and harbor depth at Waianae (including Pokai Bay) are not adequate at this time. Docking facilities are presently not available at Barbers Point, although presumably this will change in the future. A major drawback to operating off the leeward coast is the distance involved in transporting passengers from the Waikiki area. The long ride to a shore disembarkation site would discourage many potential customers and require a doubling of the number of transport buses since the round-trip could not be made in under one hour. The distance would thus increase operating costs and reduce revenues, jeopardizing the financial viability of the project.

The south coast of Oahu potentially offers a number of disembarkation points concentrated within Honolulu proper between Pearl Harbor and the Ala Wai, and eastward to Hawaii Kai. Facilities at Koko Marina (Hawaii Kai) are presently inadequate for Atlantis Submarine needs and sea conditions (primarily current velocities) outside Maunalua

Bay exceed suitable operating conditions for the submersible. Use of Pearl Harbor is restricted by U.S. Navy control, and the Ala Wai is a marina dedicated primarily to yacht berthing. Realistically, only Keehi Lagoon, Honolulu Harbor, or Kewalo Basin can provide adequate shore facilities for the proposed project. Selection of a submersible operating area off Honolulu must be considered in light of the distances involved from these potential shore facilities.

G.1.3 Alternative Operating Areas

This environmental impact statement addresses the area off Waikiki between the -80 and -250 foot depth contours, where acceptable operating conditions and suitable bottom characteristics exist for the development of a viable site for the submersible operation. This area is labeled "Potential Operating Area" in Figure 17. The selection of the specific site (see Section B.3.4) within this area takes into account the environmental and operational factors identified below.

An eastward limit for a potential operating site is reached near Diamond Head where sea surface conditions and current velocities (Bathen, 1978) tend to become unsuitable for continuous submersible operations. Placement of the dive area further eastward from Diamond Head would increase the time and fuel costs for shuttling passengers between the site and the dockside facility. Maintaining a one hour turn-around time with the surface shuttle boat between either Kewalo Basin or Honolulu Harbor and points off or east of Diamond Head would be difficult, necessitating the addition of a second shuttle craft and a concomitant increase in operating costs. Currents seaward of the reef are, on occasion, in excess of 2 knots west of Diamond Head, but diminish significantly westward of a line drawn southwest from the Waikiki Natatorium (see Laevastu, Avery, and Cox, 1964). However, even in the vicinity of the 100-foot Hole, current velocities are excessive more often than is suitable for a viable operation.

A westward limit based on consideration of shuttle turn-around time would be in the vicinity of Ewa Beach. However, the waters west of about the middle of the Honolulu International Airport reef runway are restricted (entrance to Pearl Harbor -- a submersible operation would not be allowed). Sea conditions and particularly water clarity west of Honolulu Harbor are frequently very poor.

First consideration was given to a site off Kakaako (midway between the Honolulu Harbor entrance and Kewalo

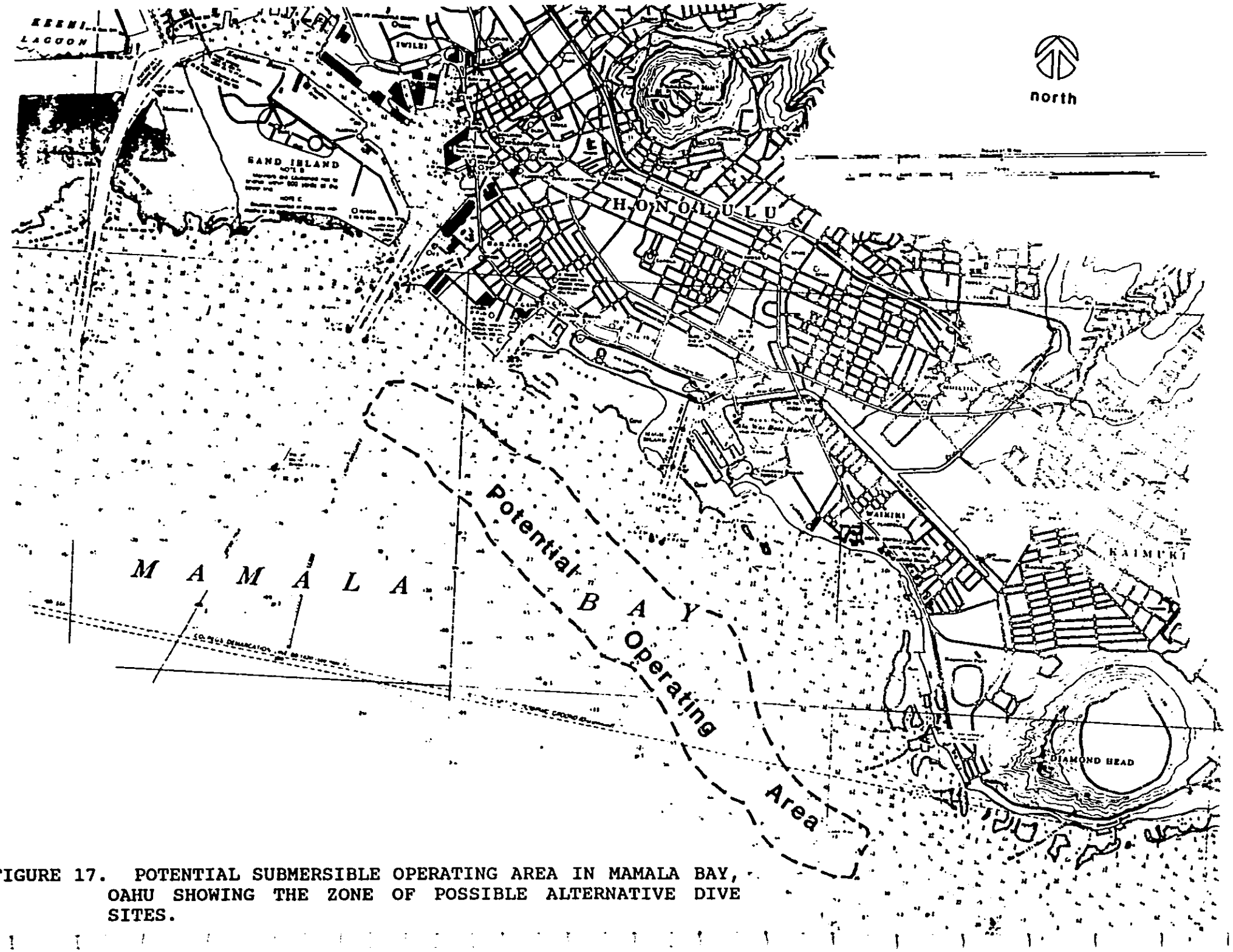

FIGURE 17. POTENTIAL SUBMERSIBLE OPERATING AREA IN MAMALA BAY, OAHU SHOWING THE ZONE OF POSSIBLE ALTERNATIVE DIVE SITES.

Basin entrance (AECOS, 1987a). This site was the subject of some concern to the maritime industry represented by the Maritime Affairs Committee of the Chamber of Commerce of Hawaii. At the request of Atlantis Submarines, a special subcommittee composed of representatives of the State Harbors Division, U.S. Coast Guard, Marine Pilot's Association, and the maritime industry was established to deal with relocation of the site. The relocated site proposed in this EIS (Section B.3.5) represents a compromise in ideal operating conditions in the interest of minimizing impacts on the activities of the commercial shipping industry. At a meeting held on August 12, 1987, the Maritime Affairs Committee was receptive to the proposed location off Waikiki "...because it will not involve any interference with existing activities" and a motion was approved for "...a resolution in support of Atlantis' operations and the responsible consideration given to safety and commercial shipping concerns."

Much of the boat and ship traffic west of Kewalo is characterized by commercial vessels handled by licensed pilots. Eastward from the vicinity of Kewalo Basin are areas where sail boats and small pleasure craft concentrate in Mamala Bay. The ideal depth contours for submersible dives move farther offshore opposite Waikiki until off Diamond Head. However, underwater currents tend to increase in strength and frequency as the Diamond Head area is approached. While a variety of vessels utilize the waters three-quarters of a mile seaward of Waikiki Beach, this area is outside of the heavy use area for small recreational craft and well inside the sea lanes used by ships moving between Honolulu Harbor and points east.

G.2 ALTERNATIVE OPERATIONS

The ideal approach to handling passengers on the submersible tour is to load directly from a dock, travel a short distance to a dive site, and return to the dock to unload and load the next tour group. Maintenance and overnight mooring of the submersible would best be accomplished at a shoreside facility within a protected harbor. Neither of these scenarios for conducting underwater tours or submersible systems recharging and maintenance are presently possible at Honolulu.

The proposed plan calls for mooring a transfer platform over the dive site and utilizing the same platform for night-time maintenance in Keehi Lagoon. As an alternative, two platforms could serve these diverse purposes. Using separate barge hulls might allow for the platforms to be each smaller than the proposed design: a standard barge

hull size of 40 x 60 feet would be suitable. However, both barges would need to be moored in Keehi Lagoon at least some of the time, entailing use of a larger mooring area. If a shoreside maintenance facility became available, only the transfer platform would be necessary. Under present circumstances, however, the environmental impact would seem to be less for operating a single (combination) transfer/ maintenance platform than for operating two barges.

G.3 ALTERNATIVE OF NO ACTION

Ordinarily the alternative of no action has little relevance to a privately funded project except where compelling alternative uses of resources would be pre-empted by proceeding with the project. The Atlantis proposal, however, is one for which the operational aspects ordinarily might not be subjected to an environmental impact assessment under Chapter 343, HRS. Conceivably, conducting of submarine tours in Hawaiian waters could be undertaken strictly under the jurisdiction of the State Department of Transportation with an assessment of significant impact, even in any cumulative sense, difficult to demonstrate.

The EIS requirement for the Atlantis proposal stems primarily from the proposal to enhance the dive site by placing artificial reefs on the bottom, engendering the requirement for a CDUP. Indeed, The Atlantis approach of selecting a dive site with little resource value as measured by the level of existing use and modifying that site by funding construction and research on artificial reef structures to suit its needs is one of the positive aspects of the project in terms of public benefit. An approach could be taken to utilize an area of intrinsic natural beauty and, depending upon shoreside activities, carried out without need for county, state, or federal (with the exception of vessel certification) permits.

As with any project, the identified impacts would not occur if Atlantis elected not to operate a submersible out of Honolulu. However, numerous other groups are presently considering operating submersibles in the Hawaiian Islands. Presently, these groups lack a certified submersible vessel and/or operational experience. Any one of these groups could elect to operate off of Oahu, conduct tours off Waikiki, in Kaneohe Bay, or at some popular dive location, and do so without significant public input to the assessment process. Underwater tours conducted in this manner would have many of the same impacts on the community as identified in this document, but would provide little to the community in return. The operations would compete directly for ocean resources presently valued by cruise

boats, commercial dive operators, recreational divers, and fishermen.

The benefits to Hawaii's future and the economics of the Hawaii tourist market are such that underwater submersible tours will come to the Islands. The cliche of "an idea whose time has come" may be worn but is clearly apt. Thus, the very real impact of an alternative of no action for the Atlantis proposal is not that identified impacts will be avoided or even significantly delayed. These impacts will certainly occur anyway, probably without benefit of public debate, public input to site selection, or the positive impact of private funding for artificial reef development and research.

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SECTION H.

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The increased activity around public facilities and on submerged lands represents the primary impact of the proposed project on the environment. The presence of the operation in the area will result in some limitation on future, if not present use of the area by others. On the other hand, the submersible will substantially increase the access and utilization of the submerged lands by providing large numbers of people the opportunity to view the habitat structures and their associated marine life, contributing both recreational and educational benefits.

To whatever extent the proposed site enhancements act as fish aggregation devices (FADs), an impact would be associated with the attraction of fishes from surrounding areas. However, a properly designed and located artificial reef provides substratum and shelter for a biological community (including juvenile fishes) and enhances fishery resources in the area of deployment. The result is that some fishes migrate away thereby increasing the common resources elsewhere. Thus, in the long-term it can be expected that the submerged habitat structures will have a positive impact on fisheries resources beyond the boundaries of the structures themselves.

Given that any negative impact of the project on existing fisheries and fishing would be slight or absent, that the beneficiaries of the research to be conducted on the artificial reefs would be Hawaii's fishing community, and that enhancement of fisheries in nearby areas will occur, it would appear that any minor negative impacts on the fisheries or fishing in the area would be offset by the significant long term benefits of the undertaking.

Hawaii's fishermen, both commercial and recreational, will benefit in the long term if studies on the Atlantis' artificial reefs yield encouraging results. The positive demonstration of fisheries enhancement in the first several years after placement will promote other private and/or government sponsored projects. Excessive fishing of these reefs will produce ambiguous conclusions as to the value of an artificial reef program, particularly if commercially valuable species are removed and yields not reported to the research scientists. It is hoped that fishermen will become partners with the fisheries biologists in this experiment.

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SECTION I

MITIGATION MEASURES PROPOSED TO MINIMIZE IMPACT

I.1.1 Dive Site Enhancements

Proposed modifications at the submersible operating sites are intended to be enhancements -- not just in the sense of enhancing by making more suitable to man's interest (economic or otherwise), but also in the sense of increasing biological richness. The operating area has been selected primarily on the basis of proximity to tourist markets, suitability of oceanographic conditions to the operating parameters of the submersibles, and minimizing impacts on existing resources and resource utilization. The addition of habitat structures, including sunken ships, is necessary to improve the attractiveness of the dive tours to potential customers. These modifications to the sea floor can be undertaken in an environmentally sound manner. The success of the substantial investment in making these modifications is determined by the same criteria as would be used to judge the project's impact on the environment: that is, an increase in the abundance of marine life inhabiting the area. If the modifications are not successful in this regard -- the biological impact is not a positive one -- then the monetary investment in enhancing the sites is wasted.

I.1.2 Impacts on Public Use of the Waters Off Waikiki

The Atlantis underwater tours are scheduled around a reservations system and not dependent upon open ticket sales at the dock. This provides Atlantis with flexibility in short and long term scheduling of dives. When unforeseen delays occur, schedules can be shifted or loads adjusted without creating congestion at the pier. Blocks of time coinciding with community events such as the Molokai to Oahu canoe race can be removed from the schedule without adversely affecting sales. Further, a certain percentage of the total number of dives conducted each year by the Atlantis submersible involve crew training, systems testing, and the like. These non-passenger dives can be scheduled to coincide with major events in Mamala Bay when the shuttle craft or dive operation might interfere with such events.

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SECTION J

ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

A designation of the dive site for use by Atlantis Submarines does not represent an irreversible or irretrievable commitment of the resource represented by the several acres of water surface or associated water column and submerged lands. Placement of proposed habitat structures, including sunken vessels, would not be irreversible, as all of the structures can be removed utilizing available marine salvage equipment. The development of permanent and semi-permanent habitat structures for fisheries enhancement (NOAA, 1985) is presently an on-going activity in many parts of the the world, including Hawaiian waters. If Atlantis Submarines were to abandon use of the proposed site enhancements, the value of the artificial reefs to the fishing and diving community would not be diminished.

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SECTION K

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APPENDIX A

COMMENTS AND SUPPORTING LETTERS

Agencies, Organizations, and Individuals Responding to the Department of the Army Permit Application Public Notice with Comments:

Federal Agencies

Fish and Wildlife Service, Ernest Kosaka, May 12, 1987.
National Marine Fisheries Service, John Naughton, May 20, 1987.
U.S. Coast Guard, R.W. Brandes, May 29, 1987.

State of Hawaii

Dept. Land and Natural Resources, William W. Paty, May 19, 1987.
University of Hawaii, Environmental Center, John Harrison, May 28, 1987
Dept. Planning & Economic Development, Roger Ulveling, June 15, 1987.

County Agencies

Dept. General Planning, C & C of Honolulu, Donald Glegg, November 12, 1987.

Private Individuals and Organizations

Sause Bros., Inc., J.J. Robertson, May 13, 1987.
The Outdoor Circle, Betty Crocker, May 15, 1987.
Matson Navigation Co., J.W. Landregan, May 21, 1987.
TheoDavies Marine Agencies, K.H. Bowman, May 26, 1987.
The Sierra Club, Phyllis Ha, May 28, 1987.

Agencies, Organizations, and Individuals Responding to the Environmental Assessment and/or CDUA with "No Comment":

Federal Agencies

Army Corps of Engineers, John G. Emmerson, October 22, 1987.

County Agencies

Waikiki Neighborhood Board No. 9, Jack Denton, November 5, 1987.

Agencies, Organizations, and Individuals Responding to the Environmental Assessment, EIS Preparation Notice, or CDUA with Comments:

Federal Agencies

Army Corps of Engineers, John G. Emmerson, May 26, 1987.
Fish and Wildlife Service, Allan Marmalstein, May 27, 1987.

State Agencies

Dept. of Health, John C. Lewin, May 12, 1987.
Dept. Land & Natural Resources, Ralston Nagata, May 21, 1987.
Dept. of Health, John C. Lewin, May 29, 1987.
Office Environmental Quality Control, John C. Lewin, May 29, 1987.
Dept. of Transportation, Edward Y. Hirata June 4, 1987.
Dept. Planning & Econonic Development, Roger A. Ulveling, June 17, 1987.
University of Hawaii, Environmental Center, John Harrison, June 19,1987
Office of Hawaiian Affairs, Kamakiu A. Kanahele, June 23, 1987.
Dept. of Health, John C. Lewin, June 29, 1987
House of Representatives, 14th Legislature, Representative Danial J. Kihano, October 28, 1987.

County Agencies

Dept. Land Utilization, City & County of Honolulu, John P. Whalen, May 27, 1987

Private Individuals and Organizations

Hawaii Visitors Bureau, Stanley Hong, April 6, 1987.
Honolulu Elks Lodge, Percy K. Mirikitani, November 2, 1987.

Agencies, Organizations, and Individuals Responding to the Draft Environmental Impact Statement with "No Comment":

Federal Agencies

Soil Conservation Service, Richard Duncan, October 9, 1987
U.S. Navy, R.M. Gallen, October 23, 1987

State Agencies

Dept. Accounting and General Services, Russel S. Nagata, October 14, 1987.
Dept. of Defense, Jerry M. Matsuda, October 23, 1987.
Dept. of Agriculture, Suzanne Peterson, October 20, 1987.
Dept. Business & Economic Development, Roger Ulveling, October 20, 1987.
Dept. Business & Economic Development, Russel Fukumoto, November 6, 1987.

City & County of Honolulu

Building Department, C & C Honolulu, Herbert K. Muraoka, October 15, 1987.
Board of Water Supply, C & C Honolulu, Kazu Hayashida, October 16, 1987.
Dept. Land Utilization, C & C Honolulu, John P. Whalen, November 12, 1987.

Private Individuals and Organizations

Hawaiian Electric Company, Inc., Environmental Department, Brenner Munger, October 27, 1987.

Agencies, Organizations, and Individuals Responding to the draft Environmental Impact Statement with Comments:

Federal Agencies

National Marine Fisheries Service, Richard S. Shomura, October 9, 1987.
Fish and Wildlife Service, Ernest Kosaka, October 19, 1987.

State of Hawaii

Dept. of Health, John C. Lewin, October 27, 1987.
University of Hawaii, Marine Options Program, Sherwood Maynard, November 4, 1987.
Department of Transportation, Edward Hirata, November 12, 1987.
Dept. Land & Natural Resources, William W. Paty, November 23, 1987.
University of Hawaii, Environmental Center, Jacquelin N. Miller, November 23, 1987.
Department of Transportation, Edward Hirata, November 24, 1987.

City and County of Honolulu

Dept. of Housing and Community Development, C & C Honolulu, Mike Moon, October 26, 1987.
Honolulu Fire Department, Frank K. Kahoohanohano, November 3, 1987.
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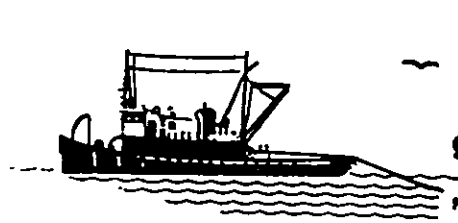
Waikiki Residents Association, Georgia Miller, November 22, 1987



SAUSE BROS., INC.

PIER 20 • HONOLULU, HAWAII 96817 • TELEPHONE (808) 521 5082

May 13, 1987

District Engineer (PODCO-O)
U.S. Army Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858

Subject: Public Notice No. PODCO-O 1988-5 - Applicant Atlantis Submarines, Inc. permit to locate a mooring offshore midway between Kewalo Basin and Honolulu Harbor in approximately 90' of water.

Gentlemen:

We do not feel that subject permit should be issued without further consideration for the following reasons.

1. The application requests a permit for a third bouy in approximate terms of location and water depth and does not specify limits with respect to either.

2. While the approximate location requested was obviously selected for convenience of Atlantis quick access to either Kewalo Lagoon or Honolulu Harbor, the site as proposed is immediately adjacent to or in a navigable area of water which is utilized daily by traffic diverting out of the Honolulu Harbor entrance channel toward Diamond Head in order to expedite the flow of inward traffic. Any obstruction in the area requested may well obstruct navigation and will at least cause further congestion to an already congested traffic flow in the Honolulu Harbor entrance channel.

For these reason's, we hereby respectively request that the U.S. Army Engineers hold a public meeting to consider subject application.

Very truly yours,

SAUSE BROS., INC.

J.D. Robertson
Vice President - Hawaii

THE OUTDOOR CIRCLE

200 No. Vineyard, Suite 506, Honolulu, Hawaii 96817
808-521-0074

May 15, 1987

District Engineer
U. S. Army Corps of Engineers
Building 30
Fort Shafter, Hawaii 96858

SUBJECT: Public Notices No. PODCO-O 1988-S
PODCO-O 1989-S
PODCO-O 1990-S

Regarding the Public Notice for a permit by Atlantis Submarines, Inc. for submarine activity in waters off Kakaako, Lahaina, Kailua-Kona.

The Outdoor Circle questions:

1. How traffic and fishing will be limited in the vicinity of the artificial reefs (paragraph 5)?

2. How will the Kakaako site mesh with proposed America's Cup site development?

3. What are the concerns of local fisherman?

Thank you for the opportunity to address these proposed activities.

Sincerely,

Betty Crocker

Mrs. Theodore Crocker
President

AECOS
970 N Kalaheo Avenue, Suite A'300 • Kailua, Hawaii 96734
Telephone: (808) 254-5884

June 3, 1987

John C. Lewin, M.D.
Director
Department of Health
P.O. Box 3378
Honolulu, HI 96801

RE: Your file # EPHSD

Dear Dr. Lewin,

We have received a copy of your letter to Mr. William Paty, Chairman of the Department of Land and Natural Resources, regarding the Atlantis Submarines, Inc. proposal to operate submersibles in Hawaiian waters. Following is a response to the comments made in this letter:

1. Exclusive Use Issue

We agree that the "exclusive use" issue must be addressed and resolved. In reading Chapter 54 of the State of Hawaii, Department of Health, Administrative Rules (AR), the only wording which appears to pertain to the applicant's proposal is (Section 11-54-03(c)(1) in part):

> To the extent practicable, the wilderness character of these areas shall be protected."

Clearly, the construction of artificial reefs by State and Federal agencies at a number of offshore locations has previously been found compatible with this section of the Rules. We fail to understand how the applicant's proposal violates the sections of the Rules cited in your letter considering that the proposed action will not degrade water quality in either Class A or Class AA waters and the cited regulations are clearly intended to protect against infringements on designated uses caused by water quality degradation. If conflict exists between the AR (and the Hawaii Revised Statutes upon which the Rules are based) and Act 91, SLH 1986 (providing for ocean leasing), such conflict would be beyond the scope of the applicant's responsibilities under Chapter 342, HRS.

2. Wastewater Disposal

All toilet facilities will be provided aboard the surface transfer vessels and will comply with Department of Health requirements for vessels operating in State harbors. Waste water will be transferred and pumped into appropriate shoreside systems for disposal and treatment by existing treatment plants. Trucks may be used to haul wastewater to existing treatment plants if no shoreside systems exist.

We would appreciate receiving rules and regulations regarding wastewater disposal for vessels operating in harbors and nearshore waters, and any practical advice for disposal at harbors where pumping facilities are unavailable.

3. Artificial Reef

Vessels, vessel parts, or any other material which may contain toxic or potentially hazardous material will not be used to construct artificial reefs. Monitoring for microalgae known or implicated in producing ciguatera in fish populations could be conducted in conjunction with studies of biological enhancement planned for the proposed artificial reefs.

4. Other Health Concerns

The submarines will be built according to the American Bureau of Shipping and US Coast Guard standards. Air will be supplied by an O2 and CO2 scrubber system typical of commercial and military submarines. Potable water will not be supplied on the submarine.

The submarines are in operation in Barbados, Grand Caymans, and U.S. Virgin Islands and details concerning the ventilation system, for example, can be provided upon request.

Please feel free to contact Eric B. Guinther or Snookie Mello, if you have further comments or questions regarding the CDUA, Environmental Assessment or your Dept. of Health requirements.

Sincerely,

Eric B. Guinther

cc: Gail Harrigan, DLNR
John Emmerson, USArmy CoE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P.O. BOX 50167
HONOLULU, HAWAII 96850

CG
ES
Room 6307

MAY 12 1987

Colonel Francis W. Wanner
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Re: PODCO-O 1988-S, PODCO-O 1989-S, PODCO-O 1990-S; Commercial operation of submersible tours on State-owned submerged lands at Keehi Lagoon, Oahu; Lahaina, Maui; and Kailua-Kona, Hawaii.

Dear Colonel Wanner:

We have reviewed the referenced applications and offer the following comments for your consideration.

This report has been prepared under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and other authorities mandating Department of the Interior concern for environmental values. It is also consistent with the intent of the National Environmental Policy Act.

We have no objections to the proposed projects provided the following special conditions are included in the permit:

a. All oil and waste petroleum products from the ships and airplanes should be removed from the vessels prior to sinking. Disposal of waste petroleum should be coordinated with the State Department of Health and Environmental Protection Agency.

b. Scuttling a ship and accurately placing the vessel on a specific site on the sea floor presents several technical problems. The scuttling of any ship should be closely coordinated with the U.S. Coast Guard.

c. The placement of the concrete cubes and boulders within the project site should avoid areas supporting locally high live coral coverage.

d. The artificial reefs should be monitored to document the development of fish and coral communities.

e. The structural stability of the artificial reefs to withstand storm surges should be determined by qualified engineers. We are concerned that the artificial reefs may break apart and scour and damage coral communities during storm surge conditions.

We appreciate the opportunity to comment.

Sincerely,

for Ernest Kosaka
Project Leader, Environmental Services
Pacific Islands Office

cc: NMFS - WPPO
EPA, San Francisco
U.S. Coast Guard
DOH

CONSERVE AMERICA'S ENERGY

MARYKNOLL HIGH SCHOOL
• 1402 PUNAHOU STREET • PHONE 946-1577 • HONOLULU, HAWAII 96822
SCIENCE DEPARTMENT

William Paty, Land Board Chairman
State Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, Hawaii 96813

November 5, 1987

TESTIMONY FOR Atlantis Submarines, Inc, to operate off Waikiki, Oahu.

Last Spring when I saw my first presentation about ATLANTIS SUBMARINES, I got very excited. Being a Marine Science Teacher, I'm always looking for new ways to stimulate my students to get involved with this beautiful marine environment we call home. And a submarine trip would certainly get them involved!!!

The area the submersibles want to operate in is now only covered with rubble.

ATLANTIS SUBMARINES' proposal to construct ARTIFICIAL REEFS would benefit many of our local "communities": research, education, diving and fishing, as well as our tourist industry. Artificial reefs have proven their worth in other areas. Since the University of Hawaii's Dr. Brock will be involved, it surely will be done well for our islands.

The tourists certainly will love submarine rides, thus supporting the economics necessary for ATLANTIS to operate: thereby enabling ATLANTIS to give educational discounts. I await the opportunity to have my students see what surrounds us, to help them better understand the vital relationship of sea and land, and to care more for our environment. After all, our children are our future!

Sincerely interested,

Alice P. S. Roberts
Marine Science Teacher, Maryknoll High School

cc: Andrew Corcoran, Principal, Maryknoll High School
Atlantis Submarines, Inc.
AECOS

TESTIMONY SUPPORTING ATLANTIS SUBMARINES INC.
PROPOSAL TO OPERATE SUBMERSIBLES
AS A PUBLIC ATTRACTION OFF WAIKIKI

Donald S. Bowman III
SCUBA Diver and active ocean user

CHAIRMAN PATY AND MEMBERS OF THE BOARD OF LAND AND NATURAL RESOURCES

I am Scotty Bowman, and for years now I have been involved in ocean activities in Hawaii. These include SCUBA Diving, Snorkeling, Surfing, Water Skiing, Sailing and Deep Sea Fishing.

These activities have provided me with the opportunity to learn first hand, that the ocean is a finite resource, and to share the concern of so many others about the steady depletion of that resource.

In recent years, I learned the advanced technology of artificial reef construction offers a potential solution to this problem of marine resource depletion. The modern design of artificial reefs can significantly enhance the marine environment, and can be the basis for the eventual regeneration of our marine resource.

Unfortunately, we have not seen a major effort in Hawaii to construct artificial reefs. There are several reasons for this, not the least of which is money. Some of the other problems revolve around design characteristics and site selection.

Enter Atlantis Submarines Inc.

When they first arrived last year, and requested exclusive use of a portion of our ocean, I joined countless others in opposing their proposal. Rather than accepting defeat and sulking off to another part of the world, Atlantis Submarines, Inc. began meeting with locals to see what they could do to overcome our objections.

I am, frankly, very impressed with the changes they have made to their proposal, and to their willingness to become working partners in the effort to improve our ocean resource. Their plan to deploy a major artificial off Waikiki, and to work with the University of Hawaii and your Department is a fabulous one. Their infusion of private sector funds into a program that has already been funded by your department, should be a tremendous boost for the artificial reef program in Hawaii.

I see the area off Waikiki proposed for use by this operation, becoming a testing ground for numerous artificial reef designs and deployment methods. When the test determines that a certain design works, then state funds can be used to deploy similar reefs throughout the entire state.

In addition, the operation of submersibles in Hawaii will provide non-divers with the opportunity to experience the beauty and serenity of the sea. This experience will have far reaching impacts, because, over time, a broad range of people in our state will begin to understand how fragile the vast ocean really is.

I fully support this proposal and encourage your department to approve the operation of Atlantis Submarine, Inc.

Thank you for allowing me to testify on this proposal. Enclosed for your review, are four articles on artificial reefs.

350 WARD AVE. SUITE 204 HONOLULU, HI.

HONOLULU MOSQUITO TROLLING CLUB
HAWAII

MR. WILLIAM PATY
STATE OF HAWAII
DEPT. OF LAND AND NATURAL RESOURCES

DEAR MR. PATY,

THE MEMBERS OF THE HONOLULU MOSQUITO TROLLING CLUB, A SMALL BOAT TROLLING CLUB ESTABLISHED OVER 20 YEARS AGO, WOULD LIKE TO EXPRESS THEIR APPROVAL OF THE PROPOSED ATLANTIS SUBMARINE UNDERWATER TOURS OFF OF WAIKIKI. WE FEEL THAT THIS UNIQUE SUBMARINE OPERATION WILL LEAD TO AN INCREASE IN SPENDINGS OF THE VISITORS TO OUR STATE. THIS WILL IN TURN, GREATLY HELP THE ECONOMY OF HAWAII AND THE RESIDENTS OF OUR STATE. MOST OF THE MEMBERS OF OUR CLUB ARE NOT DIRECTLY INVOLVED WITH TOURISM, BUT WE ALL DO REALIZE THAT TOURISM AFFECTS OUR LIVELIHOOD IN SOME WAY OR ANOTHER.

WE DO NOT FEEL THAT THE CONSTRUCTION OF AN ARTIFICIAL REEF BY ATLANTIS SUBMARINES WILL IN ANY WAY REDUCE OUR ABILITY TO FISH AND, IN FACT, MAY INCREASE THE PRODUCTIVITY OF THE WATERS OFF OF WAIKIKI. ALL OF THE PRESENT ARTIFICIAL REEFS AROUND OUR STATE HAVE UNDOUBTEDLY HELPED TO INCREASE THE FISH POPULATIONS AND WE CAN SEE NO REASON WHY A NEW REEF OFF OF WAIKIKI WOULD BE ANY DIFFERENT. WE HAVE ALSO CONSIDERED THE FACT THAT THE OPERATIONS OF THE SUBMARINE WILL IN ALL LIKELIHOOD MAKE FISHING OVER THE NEW REEF NEARLY IMPOSSIBLE, BUT WE DO ALSO REALIZE THAT AN ARTIFICIAL REEF IN THE WAIKIKI AREA MAY HELP TO REVITALIZE THE FISH POPULATIONS IN ADJACENT AREAS.

WE ARE ACUTELY AWARE THAT ANY INCREASE IN THE COMMERCIAL USAGE OF OUR NEARSHORE AREAS WILL HELP TO CREATE MORE JOBS, REQUIRE BETTER ON-SHORE MARINE FACILITIES (IE. LAUNCHING RAMPS, REPAIRSHOPS, FUEL DOCKS, HARBORS, ETC.) AND INCREASE THE INCOME TO OUR STATE. THIS IS SOMETHING WE ARE IN FAVOR OF AND WE FEEL THAT THE SUBMARINE IS A MUCH MORE LOGICAL BUSINESS FOR THE STATE TO SUPPORT RATHER THAN THE ILL CONCEIVED IDEAL OF ATTRACTING THE AMERICA'S CUP RACES TO HAWAII.

WE CAN FORESEE THAT THE SUBMARINE OPERATIONS WILL BECOME A MAJOR ATTRACTION FOR VISITORS RIVALING THE PEARL HARBOR AND EVENING DINNER CRUISES. IT WILL PROBABLY HELP TO INCREASE THE DIVE INDUSTRY'S BUSINESS GREATLY BY INCREASING AN AWARENESS AND INTEREST IN OUR STATE'S GREAT MARINE RESOURCES. ALL OF THIS IN TURN WILL EMPHASIZE THE NEED TO MANAGE OUR MARINE ENVIRONMENT PROPERLY.

IT IS A FACT THAT THE VISITORS TO OUR STATE COME TO HAWAII BECAUSE OF OUR CLIMATE AND MARINE RESOURCES...SUNSHINE, BEAUTIFUL BEACHES, AND CLEAR WARM OCEANS...AND WE WOULD BE REMISS IF WE FAILED TO PROPERLY UTILIZE OUR MARINE RESOURCES AND OUR NUMBER ONE INDUSTRY, TOURISM, TO THEIR FULL POTENTIALS.

THEREFORE, THE MEMBERS OF THE HONOLULU MOSQUITO TROLLING CLUB, ASKS THAT THE ATLANTIS SUBMARINE TOURS BE GRANTED THE NECESSARY PERMITS TO BEGIN CONSTRUCTION AND OPERATIONS IN HAWAII.

SINCERELY,

Calvin Nakagawa

CALVIN NAKAGAWA, PRESIDENT

Clayton K. Yamada

CLAYTON YAMADA, SECRETARY

CC: ATLANTIS SUBMARINE, INC.
MARK SUISO

OCEAN INNOVATORS
P.O. Box 88121 Honolulu, Hawaii 96[redacted] (808) 533-6434
96830

November 5, 1987

Mr. William Paty
and Members of the Land Board
Department of Land and Natural Resources
State of Hawaii

Gentlemen,

I am an ocean engineer in private practice, a research affiliate at the University's Look Laboratory of Oceanographic Engineering, and a boat owner at the Ala Wai Yacht Harbor. In all these capacities I wish to testify in favor of your granting a permit to Atlantis Submarines to establish an artificial reef site off Waikiki.

As a recreational Scuba diver I support any effort to create additional dive sites within easy travel distance from Ala Wai or Kaahi harbors.

As an ocean engineer I have been involved as a consultant to the University of Hawaii on two artificial reef research projects in which unique designs for reef modules were formulated and field tested. These have demonstrated to me the impressive ability of artificial reefs to markedly increase fish populations in otherwise barren areas. Designs can be tailored to attract large fish or to create nurseries to foster juvenile recruitment.

The State should welcome private investment in reef construction especially if the site is to be open to the public. I feel the private sector and community groups can make a great contribution to artificial reef development in Hawaii to supplement the work being done by the DLNR. This is a resource that is currently being ignored and sometimes even thwarted. Other states have more cooperative policies. In Florida, for example, most of their nearly 200 artificial reefs were created by fishing clubs and other private organizations.

Hopefully, if this permit is granted, this site will become a proving ground for some of the designs developed here in Hawaii, and that the success of this venture will prompt the State to voluntarily designate additional artificial reef zones around the island and encourage participation in reef construction at the community level. Certainly the dive tour industry and our recreational divers, as well as research, education and conservation concerns would all benefit from additional properly designed and conveniently located artificial reefs.

Sincerely,

Frederick M. Casciano

Ocean Equipment Development

November 5, 1987

Mr. William Paty, Chairman
DEPARTMENT OF LAND AND NATURAL RESOURCES
Kalanimoku Building
Honolulu, Hawaii 96813

Chairman Paty and Members of the Board:

I am fully in support for allowing the submarine project to go ahead.

There will be a greater awareness of our ocean environment.

A greater number of people will be able to enjoy our underwater world.

We will get an artificial reef system build at no cost to the TAXPAYER.

The knowledge, expertise and skill of building these ARTIFICIAL REEFS will be shared in cooperation with people at the University of Hawaii, who are working also in artificial reef projects.

I'd like to see it, because I want to go down in a submarine and take the kids. I think it would be great!

Thank you for the opportunity to comment.

Stan Wright

Stan Wright
TV-2 "Let's Go Fishing"

November 5, 1987

Testimony Expressing Support for Operating *Atlantis* Submersibles Off Waikiki, Oahu by Atlantis Submarines, Inc.
Presented to: Land Board Hearing for Conservation District Use Application

My name is BARBARA KLEMM. I am testifying as a concerned citizen in support of Atlantis Submarines, Inc. to operate *Atlantis* submersibles in Hawaiian waters. My testimony is particularly in support of the unparalleled educational opportunity that this submersible operation would provide for school children and for the general public to learn about the undersea world.

As a doctoral-level educator, I have worked for almost two decades in this state developing environmental and marine science curricular materials for elementary and secondary children. I have also worked with hundreds of teachers in the islands helping them to teach about the oceans. Last year I served also as president of the Hawaii Science Teachers Association. I am thoroughly familiar with both the formal school programs related to the oceans and other nonformal programs in our state. Furthermore, for more than 15 years I have been an active scuba diver with the Hawaii Divers Association, a group of local divers whose recreational dives are mostly in the coastal waters off Waikiki.

The ultimate goal of all the marine education programs in this state is marine literacy so that our citizens can make informed decisions regarding the wise use of our oceans. The ideal educational experience has always been to be able to provide first-hand experiences for our school children and others as they learn about the oceans. Thus far teacher-led field trips to the ocean have not proven the answer. My research data show that even among the teachers who teach a full one-year of marine science, the average number of field trips per year to coastal marine sites is one or less. Safety regulations governing school field trips preclude snorkeling or diving. The closest experience available now to school children in Hawaii are two shipboard cruise programs. These give students a view of the ocean only from the surface, and only in terms of much earlier marine technologies used by oceanographers to study the oceans. From an environmental conservation point of view, my reservation about the two existing programs is the damage that they cause with anchor dropping and bottom sampling activities conducted repeatedly within the same offshore coastal areas. The *Atlantis* submersible, by contrast, provides a safe, yet environmentally sound way to conduct underwater oceanic field trips and excursions.

I saw one of the *Atlantis* submersibles when I was an invited participant at the EXPO '86 in Vancouver, Canada. I also had the opportunity to talk with its developers and to learn about its educational and tourist uses in the Cayman Islands. I have reviewed the Draft Environmental Impact Statement describing proposed operation of the submersible off Waikiki. As a scuba diver I am familiar with the proposed site of operations and know it to be a featureless area that at present is relatively devoid of marine life. I have also had the opportunity to scuba dive on two experimental artificial reefs set up within Hawaiian waters and have seen how effectively these attract fish and other marine life. I am convinced that the proposed construction of underwater habitats would enhance the site. I am further convinced that operation of the submersible would demonstrate sound environmental management and at the same time provide an interesting, reliable site for educational purposes.

In the *Atlantis* submersible I see an underwater vehicle that can provide an ideal means for teaching about coral reef ecology, volcanic geology, and ocean physics. Submarine field trips would not only open the deeper ocean frontier to our students, but also provide opportunities for them to learn more about ocean research, technology, and related economic opportunities in Hawaii. This is particularly important in view of the need to attract and retain Hawaii's talented youth for high-technology careers here in Hawaii. Being the first to have such a program in our nation would send clear signals to others about our state as well.

Moreover, the proposed *Atlantis* program would serve to enlighten large numbers of adults and their children through tourist-orientented, nonformal educational opportunities. Without needing any special water-related skills, parents and their children can view underwater habitats. The effectiveness of firsthand learning experiences in developing awareness of and committment to the environment is thoroughly documented in educational research. Thus, the proposed submersible program would in the long run contribute to engaging citizens in learning about conservation and wise use of ocean resources.

In conclusion, I am thoroughly convinced that on the grounds of its educational potential, the Atlantis Submarine Inc. proposal should be supported.

Thank you.

E. Barbara Klemm

E. Barbara Klemm, Ed. D.
227 Uilama St
Kailua, HI 96822 263-4556

Testimony relating to proposal by Atlantis Submarines

Date: November 5, 1987

Prepared by: Bruce A. Carlson

I would like to confine my testimony to issues I am most experienced with, in particular, those relating to the potential effects of this project on the reef environment. I have reviewed the EIS for this project and I understand it will involve the development of an artificial reef on the seafloor at a depth of about 85+ feet, and a distance of about 4,500' offshore. I am fairly familiar with this area having dived on numerous occasions at the nearby "100 Foot Hole". Most of the topography in this area is flat, featureless, and "fish-less".

It is a well known fact that the numbers of fishes increase dramatically as the number of available hiding places increase. Given the present environment, which can best be described as barren, the artificial reef proposed for this area would undoubtedly enhance the fish population.

The proposed artificial reef is no more objectionable than birdhouses are in someone's backyard. With the provision that this project will not infringe upon divers who wish to dive around the nearby "100-Foot Hole" dive site, I see no reason to oppose this project from the point of view of any potential negative impacts on the reef environment.

November 5, 1987

Mr. William W. Paty, Chairperson:
Board of Land and Natural Resources

RE: Testimony for the Offshore Waikiki Atlantis Submarine Project.
Presented to the Land Board Hearing for Conservation District Use Application

I am Dorothy Wendt, testifying in favor of the Atlantis Submersible operations in the state of Hawaii. The submersible project would provide Hawaii's citizens of all ages the unique experience of seeing the underwater part of their island world. Onsite observation of a scientific project in progress is a privilege seldom granted the general public. First hand experience is a prime motivator in the life-long process of learning. Especially so when it's safe, unique, repeatable, and close to home.

I made my first scuba dive in November 1952 and taught the first scuba course for civilians in Hawaii the following spring. I have dived throughout the Pacific, as well as in Hawaii. It is satisfying to know that one of my favorite underwater haunts, the "ole 100ft. HOLE" will be visited by so many so comfortably

The advent of Sputnik moved me from swimming pool to a high school classroom, where I "marinated" every biology subject I taught, with the official backing of the principal. I have been actively involved in most high school marine oriented projects initiated locally. I'm currently involved in development of Harbor and shoreline cruises for students and eventually, adult community groups.

Introducing youngsters to the ocean world is not enough. The adult population needs opportunities to learn about their oceanic connections too. After all, they're voting today, and certainly some oceanic concerns will be decided by voting in the near future. Except for scuba diving, adult marine education courses are minimal. I believe the Atlantis submarine experience will initiate demand for adult courses and field trips.

I'm certain the Atlantis Company has done its homework well, and I am enthusiastic about the educational potential of the project for students of all ages, from six to ninety six, or more.

Thank you
Ms Dorothy Wendt

Ms Dorothy Wendt
389 Kailua Rd #110
Kailua Hi, 96734

cc Atlantis Submarine Corp
cc AECOS

University of Hawaii at Manoa

Marine Option Program
1000 Pope Road, Room 229 • Honolulu, Hawaii 96822
Telephone: (808) 948-8433

03 November 1987

Comments* on the Potential Educational Value
of the Proposed Operation of Submersibles
off Waikiki by Atlantis Submarines, Inc.

Without addressing potential environmental concerns or ocean user conflicts, I wish to endorse the concept of operating a submersible capable of safely carrying a number of observers into Hawaii's nearshore ocean. The applicant recognizes the significant potential for developing educational programs for college and pre-college students as well as for community groups. It is commendable that the needs and concerns of residents have been addressed in addition to the more profitable aspects of the tourist market; a greater appreciation of the ocean can only enhance the quality of life in Hawaii. Hopefully a tangible commitment would be evidenced by such actions as publication of a teacher's guide and student materials for class tours, sponsorship of teachers' workshops, and reduced ticket fees for classes. Beyond educational tours in the submersible, this operation could provide an excellent opportunity for undergraduate University of Hawaii Marine Option Program students to acquire first hand ocean experience through research projects, internships, and part time employment. Overall I believe this project has a balance of benefits which favor its approval.

Sherwood D. Maynard, Ph.D.
Director

*This statement does not represent an endorsement by the State of Hawaii, the University of Hawaii, or the University of Hawaii Sea Grant College Program with which the Marine Option Program is affiliated.

Testimony of Peter Hallewas, Chairman of the Maritime Affairs Committee of the Hawaii Chamber of Commerce

Mr. Chairman and Members of the Board, my name is Peter Hallewas and I am the Chairman of the Maritime Affairs Committee of the Chamber of Commerce of Hawaii.

The Maritime Affairs Committee first became involved with Atlantis in relation to their original proposal for site location in the area between the entrances to Kewalo Basin and Honolulu Harbour. That site posed some operational concerns to a number of our members and a Sub Committee was formed to work with Atlantis in identifying a site which our members could support.The sub commitee included representatives of the Pilot's Association, the United States Coast Guard, the State Harbours Division, and the commercial operators using the Port of Honolulu. The Committee worked with Atlantis' operational people throughout last summer in reviewing other options and ultimately settled upon a site location within the area proposed in the application before you.

At a general membership meeting held on August 12 ,1987 the work of the Sub Commitee was reported to the Maritime Affairs Committee and a resolution of the Commitee was passed endorsing the site proposed in this hearing as one "which will not interfere with existing activities" and passed a resolution in support of the Atlantis operation and the responsible consideration given to safety and commercial shipping concerns. Attached to my testimony is a copy of the August 12 1987 minutes of the Maritime Affairs Committee for the record of this hearing.

Thankyou Mr Chairman.

University of Hawaii at Manoa

A Sea Grant College
Sea Grant Extension Service
1000 Pope Road, Room 205 • Honolulu, Hawaii 96822
Telephone (808) 948-8191 • Cable Address: UNIHAW

November 5, 1987

Board of Land and Natural Resources
1151 Punchbowl St.
Honolulu, HI 96813

Dear Chairman Paty and Members of the Board,

My name is Jan Auyong and I am here to testify in support of application 2025 in the absence of Dr. Richard Brock, UH Sea Grant Fisheries Specialist, who is out of town at the International Artificial Reefs Conference.

The Sea Grant Program at the University of Hawaii has long been interested in artificial reef development for the state of Hawaii. We continue to support and cooperate with the Department of Land and Natural Resources in their efforts to perpetuate artificial reef development and deployment as a major form of habitat enhancement. This approach is particularly critical in the waters off the island of Oahu which suffers the most of the major islands from serious stock depletion.

We are particularly supportive of the effort being made by Atlantis Submarines to engage the University's capabilities in the design and deployment of the artificial reefs referred to in the environmental assessment submitted to DLNR as part of their CDUA application. Atlantis Submarines is presently finalizing terms with the University for research, design, deployment and monitoring of the proposed artificial reefs which will be wholly funded by Atlantis. The information gathered will be made available to the public as well as become a welcome addition to the University's artificial reef research database.

We wish to note that while the state has gone on record as strongly supporting habitat enhancement, our progress in this area has been hampered by the lack of available resources. We welcome the opportunity to cooperate with the first private sector financing of artificial reef research in Hawaii. We believe this effort will greatly enhance our knowledge of artificial reefs as applied to Hawaiian waters and provide us with valuable information which can be applied to the public sector effort to enhance submerged habitat.

I thank you for the opportunity to comment on this proposal.

Sincerely,

Jan Auyong

Jan Auyong, Ph.D
Ocean Recreation & Tourism Specialist
Assistant Director

cc: President Albert Simone
Dr. Richard Brock, Specialist
Dr. Bruce Miller, Director

PHONE 9-0667
CABLE "VERDANTY" OR "NATURE" GRAND CAYMAN

PLEASE ADDRESS ALL CORRESPONDENCE
TO THE DIRECTOR AND CLERK

CAYMAN ISLANDS GOVERNMENT

&
Natural Resources Study
P.O. Box 486, Grand Cayman
Cayman Islands, W.I.

...12th November.....19 86.

Mr. Barry Bellchambers
Atlantis Submarine Ltd.
P.O. Box 1043
Grand Cayman

Dear Mr. Bellchambers,

As you requested, I am writing to comment on the effects the Atlantis submarine has had on the marine environment of Grand Cayman. The Natural Resource Laboratory has not conducted any specific studies to investigate possible impacts from the submarine. However, based upon subjective observations, the Atlantis has not disturbed the reef or its associated organisms in any way.

Since the submarine began operating in November 1985 staff from the Natural Resource Laboratory have periodically ridden in the Atlantis as observers. Numerous Scuba dives have been made in the area in which the Atlantis regularly dives and the submarine has passed us underwater while we were conducting other studies. Fishes do not appear to react to the submarine and we have never seen the vessel hit or break any reef structure. After the first few dives, sediment displacement appears to have been eliminated by maintaining the submarine further off the bottom in sandy areas.

It is my opinion that with continued cautious operation, the Atlantis poses no threat to the marine life of Grand Cayman. Likewise, I do not think the submarine would create any disturbance in most other tropical reef environments.

Yours sincerely,

Stephen H. Smith
Scientific Officer

c.c. Principal Secretary (D & NR)

SHS:jm

SEEN & APPROVED

Dr. J. E. Davies

HAWAII VISITORS BUREAU

THE PRESIDENT

April 6, 1987

Mr. Barry Bellchambers
Atlantis Submarines, Inc.
Pioneer Plaza
900 Fort Street, Suite 1777
Honolulu, Hawaii 96813

Dear Barry:

Thank you for the briefing on Atlantis Submarines Inc. and its planned operations in Hawaii. Based on our discussion, I'm of the opinion that Atlantis Submarines is a reputable company that will provide a new and exciting attraction for Hawaii's visitors.

It is especially comforting to know that Atlantis has a track record of operations in Grand Cayman and Barbados, with glowing reports from visitors and government officials alike.

In order for Hawaii to remain a world-leader in tourism it is necessary to provide visitors with a mix of attractions and experiences. The experience of viewing Hawaii's colorful undersea world by submarine would offer a unique blend of 20th century adventure, enjoyment and education. The thrills of Jacques Cousteau experienced first hand!

Certainly the Hawaii Visitors Bureau would enthusiastically welcome such an addition to our visitor industry.

Best wishes with your plans and please keep me apprised of your progress.

Stanley Hong

KON TIKI TOURS
P.O. BOX 862
GRAND CAYMAN
CAYMAN ISLANDS
B.W.I.

September 12th, 1986

TO WHOM IT MAY CONCERN

As General Manager of the "KON TIKI PARTY RAFT - . GLASS BOTTOM BOAT" , Grand Cayman, B.W.I., I hereby confirm that the Atlantis Submarine operation has not in any way had an adverse effect on our operation.

In fact, as Atlantis is such a unique tourist attraction, the operation enhances the island as a tourist destination and thereby benefits are realized by the overall Caymanian community.

Mike Henderson
General Manager
Kon Tiki Tours Ltd.

THE FOLLOWING REFERENCE NUMBER SHOULD BE QUOTED IN ANY REPLY

NO

TELEPHONE 87900
EXTENSIONS 2212 2213 2214

EDUCATION DEPARTMENT
P.O. BOX 910
GRAND CAYMAN
CAYMAN ISLANDS

..11..November.....198 6.....

TO WHOM IT MAY CONCERN

I should like to take this opportunity to write in support of the Atlantis Submarine company which hopes to start operating in your country in the near future.

In March 1986 the company instituted a programme to expose as many school children and their teachers as possible, to our underwater environment. The programme has been extremely successful, and has made a valuable contribution to the teaching of marine conservation. The students enjoyed themselves immensely and their experience has been positively reflected in their writing and drawing on the importance of our marine environment.

J Basdeo
Chief Education Officer

JB/ms

809-947-4224
717-346-6382
800-468-1708

surfside watersports ltd.

14 September 1986

RE: ATLANTIS SUBMARINE CAYMAN OPERATION

To Whom It May It May Concern:

As one of the larger scuba diving and watersports operations in the Caribbean, we are very aware of the impact which various attractions have on an operation such as ours. We have found that the addition of the Atlantis Submarine ride has enhanced our business in a number of ways. In addition to being an attraction for the island itself, we have found that individuals who have taken the trip have an increased desire to participate in other activities which we offer, such as scuba diving, snorkeling, glass bottom boat trips, etc. The submarine ride tends to wet the tourists appitite and is most certainly a memory which they take with them from the island. I am certain that the tourists tell their friends about the ride and that may be the little edge which makes them select Cayman rather than somewhere else for their vacation. This increased exposure is most certainly an asset to the island tourism trade.

I do strongly recommend the addition of such an attraction to any island. I can attest that their impact has been a positive one from our point of view.

Sincerely,

Joseph P. Donahue
Director

USA Sales Office
330 S Main Avenue
Scranton, PA 18504

P.O. Box 891
Grand Cayman
British West Indies

THE FOLLOWING REFERENCE NUMBER SHOULD BE QUOTED IN ANY REPLY.

NO. _____

CAYMAN ISLANDS

DEPARTMENT OF TOURISM
Government Administration Building
Grand Cayman
Cayman Islands, B.W.I.

Telephone : 9-7900

September 15th, 1986.

Barbados Board of Tourism,
Government of Barbados,
Harbour Road,
Bridgetown, St. Michael,
Barbados.

Dear Sirs:

We understand that Sub Aquatics Development Corp., of Canada, is considering Barbados as the location for its second recreational submarine, Atlantis II, when it is no longer required at Expo '86.

As Atlantis has been operating here in Grand Cayman for the past ten months, I would like to make you aware of the response to this operation.

First, as a tourist attraction, the general response to the concept - the ability to experience the underwater world in an air-conditioned, spacious, high-tech vehicle - has been extremely positive, and the Department has been using Atlantis as a very effective marketing tool. Second, as a tourist operation, our visitors are greatly impressed by the quality of the expedition and professionalism of the personnel. And last, as a local corporation, Atlantis has proven to be an asset to the community by assisting in charitable functions, fund raisings and promotions, as well as providing a marine life educational program for all students.

The Cayman Islands have greatly benefitted from being chosen as the location for Atlantis I. I believe that an Atlantis Submarine operation will enhance a country as a tourist destination.

Sincerely,

Eric Bergstrom, M.B.E.,
Director of Tourism.

AECOS
970 N. Kalaheo Avenue, Suite A300 • Kailua, Hawaii 96734
Telephone: (808) 254 5884

June 8, 1987

Mrs. Betty Crocker, President
The Outdoor Circle
200 N. Vineyard Blvd., Suite 506
Honolulu, HI 96817

Dear Mrs. Crocker,

We have received a copy of your letter addressed to the Army Corps of Engineers regarding the Atlantis Submarines proposal to operate submersibles in Hawaiian waters.

We have submitted Conservation District Use Applications and an environmental assessment for each island to the Department of Land and Natural Resources (DLNR). The DLNR has required an EIS for each island and public hearings will be held on each island. The EIS process has been started and it is currently in the consulting stage. The EIS will cover in detail the questions and concerns being raised by private individuals, agencies and groups such as yours.

Following are preliminary responses to some of your questions:

1. Traffic and fishing will be limited through signs and buoys marking the boundaries of the sites. Details of enforcement procedures have not been worked out. The applicant is in touch with the Department of Transportation's Harbors Division and the US Coast Guard.

2. The relationship between the proposed America's Cup Site Development and Atlantis Submersible's proposed Kakaako site is not known because the former has yet to be determined. We understand that the actual race course will likely be offshore between Waikiki and Koko Head (i.e., west of the submersible operating area).

3. We have not heard from local fishermen. The DLNR and possibly other agencies will be holding public hearings on each island. Concerns of local fishermen will be heard then, if not before.

We appreciate hearing your concerns and questions. We are sorry that we cannot be more specific in responding to your questions, but will give them consideration in preparing the draft EIS. We are in the process of meeting with different agencies, individuals and groups to work out the details of the project and to answer significant concerns.

Sincerely,

E. B. Guinther

Eric B. Guinther

cc: John Emmerson, Army Corps of Engineers
Gail Harada, DLNR

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P O BOX 621
HONOLULU HAWAII 96809

WILLIAM W PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LIBERT B LANDGRAF
DEPUTY

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

May 19, 1987

Colonel F. W. Wanner
District Engineer (PODCO-O)
U.S. Army Corps of Engineers
Building 230
Ft. Shafter, Hawaii 96858

Dear Colonel Wanner:

SUBJECT: National Historic Preservation Act Compliance --
PODCO-O 1989-S (Lahaina), 1988-S (Kakaako, Oahu),
1990-S (Kailua-Kona) -- Atlantis Submarines, Inc.
Multiple, State-wide

We believe that the undertaking, as currently planned, will have "no effect" on significant historic sites.

Departure areas will use existing piers and buildings (EA: iii), and maintenance moorings seem unlikely to impact any significant historic sites given their minimal ground disturbance. Also, the proposed artificial reef locations do not appear to have underwater historic sites based on the location studies (App. B-D). Additionally, the Maui project area has been placed outside the Lahaina National Historic Landmark's borders (p. 62-3).

We do have three concerns, however:

1. If alternative locations for artificial reefs are considered, the presence/absence of historic sites should be determined and their significance established, with the findings submitted to our office.

2. If ships or planes are sunk as visitor attractions, information on the ships and planes (types and locations) must be provided to our office, so public inquiries on their historical nature can be answered.

3. If ships or planes are sunk as visitor attractions, visitors should not be told that they are actual wrecks. Such a presentation would not supply visitors with an accurate picture of the state's past and historic sites.

Sincerely yours,

WILLIAM W. PATY
Chairperson and State
Historic Preservation Officer

AECOS
970 N. Kalaheo Avenue, Suite A300 • Kailua, Hawaii 96734
Telephone: (808) 254 5884

June 9, 1987

William W. Paty
Chairperson and State
Historic Preservation Officer
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty,

We have been provided with a copy of your letter dated May 19, 1987 to the District Engineer, U.S. Army Corps of Engineers concerning National Historic Preservation Act Compliance for proposed submersible tours by Atlantis Submarines, Inc. We appreciate your comments and will incorporate them in the draft EIS's being prepared for this project. We wish here to respond to the concerns expressed in your letter.

(1) Given the applicant's need to establish control over use of the artificial reef sites, the presence of an item or site of significant historic value would be incompatible with the proposal. That is to say, a site of historic significance would not be selected for locating the artificial reefs.

(2) The applicant will comply with this request.

(3) It is not the applicant's intention in placing vessels on the bottom to represent these vessels as "ship wrecks". While this might be the visual impression to a passenger when the submersible approaches a sunken vessel, the narrative of the tour will emphasize the biological life inhabiting this "artificial reef".

Thank you for the opportunity to respond.

Sincerely,

Eric B. Guenther

cc: Col. F.W. Wanner, Army Corps of Engineers

AECOS
970 N. Kalaheo Avenue, Suite A300 • Kailua, Hawaii 96734
Telephone: (808) 254-5884

June 3, 1987

Colonel Francis W. Wanner
US Army Engineer District, Honolulu
Building 230
Fort Shafter, HI 96858-5440

RE: US Fish and Wildlife response to PODCO-O 1988-S, 1989-S and 1990-S; operation of submersibles in Hawaiian waters.

Dear Colonel Wanner.

We have received a copy of the letter sent to you from Ernest Kosaka, Project Leader, Environmental Services, US Fish and Wildlife Service. We have no objections to the conditions requested by USFWS for inclusion in a Department of Army Permit for the subject project.

Atlantis Submarines, Inc. has been in contact with the US Coast Guard, State Department of Health and many other agencies regarding the concerns expressed in this letter.

Please feel free to contact Eric B. Guinther or Snookie Kelio, if you have further comments or questions.

Sincerely,

Eric B. Guinther

cc: Gail Harada, DLNR

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPHSD

May 12, 1987

MEMORANDUM

To: Mr. William W. Paty, Chairperson
Board of Land and Natural Resources

From: Director of Health

Subject: Conservation District Use Application
File No.: SH-4/15/87-2005
Request: Operation of Commercial Submersible Tours, Lahaina, Maui; Kailua-Kona, Hawaii; Keehi Lagoon, Oahu
Atlantis Submarines, Inc.

Thank you for allowing us to review and comment on the subject CDUA application. We provide the following comments:

1. Exclusive Use Issue

The proposal calls for the exclusive use of the artificial reef sites by excluding other vessels, fishing activities and other recreational activities during the hours of 0800 to 2200 hours.

The waters at Kailua-Kona are classified Class AA according to the State of Hawaii, Department of Health, Administrative Rule (AR), Section 11-54-03(c), Water Quality Standards. Keehi Lagoon and Lahaina are classified Class A waters according to the AR. Section 11-54-03(c)(1) states in part for Class AA waters that:

> "The uses to be protected in this class of waters are oceanographic research, the support and propagation of shellfish and other marine life, conservation of coral reefs and wilderness areas, compatible recreation, and aesthetic enjoyment. The classification of any water area as Class AA shall not preclude other uses of the waters compatible with these objectives and in conformance with the criteria applicable to them."

For Class A waters Section 11-54-03(c)(2) states in part that:

> "It is the objective of this class of waters that their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters."

The applicant's ~~"exclusive use"~~ proposal will ~~infringe on the waters to be protected" as stated above~~, regardless of whether or not the barren flora or fauna selected sites are being used for recreational purposes. This issue must be addressed and resolved.

2. Wastewater Disposal

The applicant states that wastewater will be pumped and disposed of on land. At this time there are a limited number of, or no land facilities at the piers to receive and transfer wastewater from ocean vessels to wastewater treatment plants. The applicant must address this issue in detail as more detailed plans are developed.

3. Artificial Reef

Vessels, vessel parts or any other material which may contain toxic or potentially hazardous material should not be used to construct the aritificial reefs.

Certain ocean disturbing activities (such as artificial reef construction) influences the growth of microalgae which may be involved in the ecosystems food chain and results in ciguatera fish poisoning episodes in humans. Sporadic cases have been reported in areas around such activities.

4. Other Health Concerns

As more detailed plans are developed, the applicant should specify their design and procedures relating to the provision of potable water and air ventilation aboard the vessels.

JOHN C. LEWIN, M.D.

cc: DHO, Hawaii
DHO, Maui

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region • Western Pacific Program Office
2570 Dole St. • Honolulu, Hawaii 96822-2396

May 20, 1987 F/SWR1:JJN

Colonel Francis W. Wanner
District Engineer
U.S. Army Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858

Dear Colonel Wanner:

Subject: PODCO-O 1988-S, 1989-S, 1990-S;
Commercial operations of submersible tours on State-owned submerged lands off Honolulu, Oahu; Lahaina, Maui; and Kailua-Kona, Hawaii.
Application by Atlantis Submarines, Inc.

The National Marine Fisheries Service (NMFS) has reviewed the subject three (3) applications for commercial operations of submersible tours off Honolulu, Oahu; Lahaina, Maui; and Kailua-Kona, Hawaii. The subject permits would be for moorings, floating platforms and artificial reefs at the proposed sites. We offer the following comments for your consideration.

NMFS participated in the project scoping meeting; numerous meetings and discussions with the applicant, consultant groups and your Operations Branch; and in site inspections of the proposed project areas. We concur with the proposal and feel the project will have several major benefits to the people of Hawaii. The tours will offer an educational opportunity for non-diver residents and tourists alike to gain an appreciation for our nearshore marine environment. Secondly, the artificial reefs, if properly designed and carefully constructed and placed on bottom substrate of relatively depauperate benthic communities, will enhance fishery resources in these three areas. NMFS feels that acceptable artificial reefs will be sufficient mitigation to compensate for any adverse impacts which may occur from other aspects of the project, such as placing moorings and floating platforms.

In our review of the Environmental Assessment (EA) for the project and in discussions with the consultant for the artificial reef portion of the proposal, we feel confident that the best sites for artificial reef construction have been identified and acceptable reef designs and materials selected. NMFS will continue working closely with the applicant as the project progresses, particularly during preparation and placement of both the concrete and boulder artificial reefs as well as the deeper sunken ship and aircraft reefs.

Our major concern is the development of a monitoring program to identify the potential impacts, both positive and negative, of the artificial reefs at each site. This project offers a unique opportunity to quantify the productivity of artificial reefs in that under the Hawaii Ocean and Submerged Lands Leasing Act there will be no public taking of fish from those artificial reefs placed on leased ocean bottom.

Another area of concern to this agency is potential impacts from project construction and operation on certain threatened and endangered species which fall under NMFS jurisdiction. Consequently, we will be consulting with your office in accordance with Section 7 of the Endangered Species Act. Our report will be submitted shortly under separate cover.

In conclusion, NMFS will have no objection to your issuing the subject three permits once Section 7 consultation has been concluded and providing the following condition is made part of the permit:

"That a monitoring program to assess the impacts of the artificial reefs shall be developed and implemented. The program should be developed in consultation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and State of Hawaii Department of Land and Natural Resources".

Sincerely yours,

John J. Naughton
Acting Administrator

cc: F/SWR, Terminal Is., CA
F/M4, Washington, D.C.
EPA, Region 9 (P-5)
FWS, Honolulu
Hawaii State Div. of Aquatic Resources
Atlantis Submarines, Inc.

Matson
Navigation Company
Sand Island Access Road
P O Box 899
Honolulu
Hawaii 96808
(808) 848-1211

May 21, 1987

District Engineer (PODCO-O)
U.S. Army Corps of Engineers
Building 230
Ft. Shafter, Hawaii 96858

Gentlemen:

RE: PUBLIC NOTICE NO. PODCO-O 1988-S
APPLICANT: ATLANTIS SUBMARINES, INC.

It appears that the location of the proposed area "C", Kakaako, Oahu, 600 yards southeast of Honolulu Harbor Channel entrance buoy number "2" lies directly on a track that some vessels and most barge operators take when departing Honolulu Harbor for Diamond Head and points eastward.

The applicant states in the permit that "safety problems with surface vessel may arise" and that he intends to apply for a lease from the State "in order to limit vessel traffic over the site".

In view of the fact that Honolulu Harbor (with one entrance channel) often experiences delays to vessel traffic of one hour or more, we respectfully request that the U.S. Army Corps of Engineers hold a public meeting to consider this application, where vessel and barge operators, as well as the applicant, may express their views on this important undertaking.

Very truly yours,
MATSON NAVIGATION COMPANY

Captain J. W. Landregan
Manager, Marine Operations
Hawaii Area

JWL/11

THEODAVIES
MARINE AGENCIES

606 Fort Street Mall
P O Box 3047
Honolulu, Hawaii 96802
(808) 537-6271

May 26, 1987

District Engineer (PODCO-O)
U.S. Army Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858

RE: PUBLIC NOTICE PODCO-O 1988-S
Atlantis Submarine, Inc.

Gentlemen:

TheoDavies Marine Agencies are General Steamship Agents primarily engaged in handling vessels in the port of Honolulu. The vessels we represent call here to discharge cargo and passengers or for fuel, repairs and stores. We handle about 40 vessels per month.

We have read the proposal by Atlantis Submarines and feel that a public hearing is in order to fully explore the possibility of an alternate operating site to the one they have proposed. The area between Honolulu Harbor and Kewalo Basin is a heavy traffic area for large cargo vessels as well as inter-island tugs.

We do not oppose an operation of the type proposed by Atlantic Submarines, but strongly feel an operating area ewa of Honolulu Harbor entrance would be safer and less congested.

Very truly yours,

THEO DAVIES MARINE AGENCIES, INC.

K. H. Bowman
President

KHB:hn

JOHN WAIHEE
GOVERNOR OF HAWAII

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LIBERT G. LANDGRAF
DEPUTY

AGRICULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF STATE PARKS
P. O. BOX 621
HONOLULU, HAWAII 96809

May 21, 1987

MEMORANDUM

TO: Roger Evans, OCEA

FROM: Ralston H. Nagata, State Parks Administrator

SUBJECT: Atlantis Submarines -- CDUA SH-2005 Changed to 3 Separate CDUAs (HA-2024, OA-2025, MA-2026) Statewide

We reviewed this CDUA application for your office on March 23, 1987 and on May 5, 1987, when it was circulated for comments related to the Chairman's signature and then circulated for comments again. We believe the undertakings on each island will have "no effect" on significant historic sites. However, we did have three general concerns which apply equally to each project. Please refer to the March 23, 1987 memorandum in your files for those comments.

RALSTON H. NAGATA

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

May 26, 1987

Operations Branch

STATE OF HAWAII

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

This is in response to your letter, dated May 19, 1987, regarding Conservation District Use Application (CDUA) Nos. HA-5/7/87-2024, OA-5/7/87-2025, and HA-5/7/87-2026, from AECOS, Inc., 970 Kalaheo Avenue, Kailua, Hawaii. The applications are for the operations of commercial submersible tours on State-owned submerged lands at Kailua-Kona, Hawaii; Kewalo Basin, Oahu; and at Lahaina, Maui.

The Corps of Engineers is processing applications from AECOS, Inc. for Department of the Army (DA) permits for the constructions of moorings, floating platforms and artificial reefs at each of the proposed sites. We will notify you of any decisions we make on these applications.

We note that as part of the CDUA, the applicant requests your authorization for exclusive use of the proposed sites. For your information, DA permits do not grant any property rights or exclusive privileges to permittees. Therefore, the Corps will defer to the State of Hawaii any decision made on this matter under the Hawaii Ocean and Submerged Lands Leasing Act.

Thank you for this opportunity to review the CDUA. Please call the Corps Operations Branch at 438-9258 if you have any questions on AECOS' DA permit applications or on our regulatory procedures.

Sincerely,

John G. Emmerson
Chief, Operations Branch
Construction-Operations Division

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

FRANK F. FASI
MAYOR

JOHN P. WHALEN
DIRECTOR

LU4/87-2005(BWM)

May 27, 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Atlantis Submarines, Inc.
Application for the Operation of
Commercial Submersible Tours on
State-Owned Submerged Land at
Keehi Lagoon, Oahu (Offshore Tax Map Key 2-1-16)

The proposed project has been reviewed. We find that it is not within the Special Management Area (SMA). We also understand that the activities landward of the certified shoreline will not involve any construction nor any shoreline alterations, and that State of Hawaii Harbor Use Permits will be required for the proposed operations within Honolulu Harbor. No SMA permit will be required for these land activities.

We have reviewed the Environmental Assessment for the project and have the following questions:

1. Will the addition of the "sunken ship, plane, and props, etc." create any navigational problems?

2. What type of batteries will be used to power the submersible? Is there any possibility that these batteries may leak dangerous fumes or fluids within the cabin or into the surrounding waters?

Thank you for the opportunity to comment. If you have any questions, please contact Bennett Mark of our staff at 527-5038.

Very truly yours,

John P. Whalen

JOHN P. WHALEN
Director of Land Utilization

JPW:sl
1004B

cc: Eric B. Guinther, AECOS

AECOS
970 N. Kalaheo Avenue, Suite A300 • Kailua, Hawaii 96734
Telephone: (808) 254-5884

'87 JUN 15 AM 8 33
DEPT. OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

June 5, 1987

John P. Whalen, Director
Department of Land Utilization
650 South King St., 7th Floor
Honolulu, HI 96813

Dear Mr. Whalen,

We have received a copy of your letter to Mr. William Paty regarding Atlantis Submarines Conservation District Use Application. Following are the answers to the questions outlined in your letter.

1. Before sinking ships, planes, and props they will be prepared according to State and Federal regulations pertaining to such matters. All superstructurl elements (masts, etc.) will be removed or the vessel positioned so as to provide ample clearance for all surface craft. The shallowest part of the wreck will be more than 40 feet below the water surface. Modifications (if necessary) will be made to the sunken vessel(s) to insure that it does not constitute a hazard to curious divers and boat traffic.

2. Propulsion of the submarine will be by DC powered batteries. It is not probable that these batteries would leak dangerous fumes or fluids within the cabin or into the surrounding waters.

We are currently in the consulting stage of the EIS process. More detailed answers to your questions will be covered in the draft EIS that will be published by the end of June or beginning of July.

We appreciate receiving your comments. If you have any more questions or comments please contact Eric B. Guinther or Snookie Mello.

Regards,

Eric B. Guinther

cc: Department of Land and Natural Resources, Gail Harada

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

May 28, 1987
RP:0073

District Engineer (PODCO-O)
U.S. Army Corps of Engineers
Building 230
Ft. Shafter, Hawaii 96858

Dear Sir:

Corps of Engineers Permit Application
PODCO-O 1988-S, 1989-S, 1990-S
Atlantis Submarines, Inc.
(Commercial Submarine Tour Operation)
Kakaako, Oahu; Lahaina, Maui; Kailua-Kona, Hawaii

We have conducted a review of the above noted documents with the assistance of Keith Chave, Oceanography; Steven Dollar, Hawaii Institute of Marine Biology; and Pamela Bahnsen, Environmental Center. Principal activities in each of the noted locations include the establishment of permanent mooring facilities and the deployment of artificial reef structures.

Our reviewers find few environmental concerns associated with the proposed activities as described. However, we are unable to comment on the adequacy of the various designs, because insufficient structural criteria for the component elements of the project are provided. Thus, questions relating to the stability of the artificial reefs and the various moorings remain unanswered. From the descriptions of the proposed depth ranges of operation, it is clear that considerable water motion will be felt at the artificial reef sites. Environmental damage resulting from the shifting of the reefs and moorings under storm conditions remains a distinct possibility. Additionally, it is not apparent whether an artificial reef is necessary or could be built near the old airport at Kailua-Kona because of the steepness of the slope in that area.

The applicant is aware that artificial reefs will attract fish and fishermen. However, if the operators wish to prevent fishing in these areas, this must be accomplished by the operators themselves with authority vested in them by the State, unless the State is specifically paid to provide this protection. At present, the State is not equipped to undertake such a policing function.

Finally, the site of the artificial reef off Kakaako is very close to a former dumping ground noted on navigational charts. The presence of relict cables, structures, and debris poses hazards to the safe navigation of the submersible.

We appreciate the opportunity to provide comments on this public notice.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
L. Stephen Lau
Keith Chave
Steven Dollar
Pamela Bahnsen

May 28, 1987

Phyllis Ha
The Sierra Club
Hawaii Chapter
P.O. Box 11070
Honolulu, Hawaii 96828

District Engineer (PODCO-O)
U.S. Army Corps of Engineers
Building 230
Ft. Shafter, HI 96858

To the District Engineer:

I am writing to you with respect to Public Notice No. PODCO-O 1988-S, dated April 30, 1987, which is an application for a Dept. of the Army Permit to establish a commercial submarine tour operation in the Kakaako District.

The Sierra Club is a national conservation group which is dedicated to the conservation and protection of the environment through sound management practices. The Honolulu Group's Conservation Committee, under the auspices of the Hawaii Chapter, has taken issue with the proposed activity because it involves the leasing of 140,000 square feet of ocean floor and the column of water above it. The Committee objects very strongly with ocean leasing as it involves the fencing-off of common public domain. The ocean is a resource that the people should have access to. This proposed leasing would set a precident for further infringement upon public access to the natural resources in the ocean.

The area and activity under consideration would also interfere with on-going uses in the area such as recreation, marine transport, commercial and public fishing, as well as with endangered species of marine life such as the humpback whale and the green sea turtle.

In conclusion, the Conservation Committee of the Honolulu Group, Hawaii Chapter of the Sierra club has determined that the proposed Dept. of the Army permit for the establishment of a commercial submarine tour operation is inconsistent with its management and conservation concerns, and therefore opposes the current proposal.

Respectfully submitted,

Phyllis Ha
Member, Sierra Club

US Department of Transportation
United States Coast Guard

Commander (oan)
Fourteenth Coast Guard District

Prince Kalanianaole Federal Building
300 Ala Moana Blvd
Honolulu, Hawaii 96850-4982
Phone (808) 541-2315

16500.8
Serial 32205
JUN 03 1987

From: Commander, Fourteenth Coast Guard District
To: District Engineer, U. S. Army Engineer District, Honolulu

Subj: ATLANTIS SUBMARINES PERMIT APPLICATIONS (PODCO-O 1988, 1989, 1990-S)

1. I have grouped the three subject permits together since the Coast Guard comments are generally the same for all three applications. Coast Guard concerns relating to the safe operation of passenger vessels are being addressed directly to the applicant.

2. The Honolulu barge would be located adjacent to a main shipping channel and an active anchorage area. This site is also on the route frequently transited by tour boats between Kewalo Basin and Pearl Harbor. I expect that the maritime industry and possibly the State Harbors Division will voice concerns about the safety of the operation. The Maui and Kona operations would be safer, but still involve nighttime navigation. All three barges may be classed as obstructions and require lighting under 33 CFR 64.

3. The Coast Guard will specify detailed operating procedures for the submarine, and may require that the entire operating area be marked by buoys. Since these buoys may duplicate the markings required for the barges, the applicant should coordinate a single marking plan with this office. Coast Guard Private Aids to Navigation Applications will be required for all these sites.

R. W. BRANDES
By direction

Copy: State Harbors Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

Room 6307

MAY 27 1987

Mr. William W. Paty
Chairperson, Board of Land and
Natural Resources
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809-0621

Re: Conservation District Use Applications HA-2024, OA-2025, MA-2026, Commercial operation of submersible tours on State-owned lands at Keehi Lagoon, Oahu; Lahaina, Maui; and Kailua-Kona, Hawaii

Dear Mr. Paty:

We have reviewed the referenced applications and offer the following comment for your consideration.

We request that the recommendations described in the Service's May 12, 1987 letter for Conservation District Use permit SH-2005 (enclosed) be included in the Conservation District Use permits for HA-2024, OA-2025, and MA-2026.

We appreciate this opportunity to comment.

Sincerely,

Allan Marmelstein
Pacific Islands Administrator

Enclosure

cc: CE
NMFS

CONSERVE AMERICA'S ENERGY

John Waihee
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

TELEPHONE NO
548-6915

May 29, 1987

Honorable William Paty, Chairman
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Three New Conservation District Use Applications for Atlantis Submarines, Inc. Commercial Submersible Tours at Kailua-Kona, Hawaii; Kewalo Basin, Oahu; and Lahaina, Maui (CDUA #2024, #2025, #2026)

Our comments regarding the CDUAs are as follows:

1. The submerged lands which will be leased by Atlantis Submarines Inc. should be located where it will not constitute a navigation hazard. That area should be clearly defined by buoys or other markers.

2. If a ship will be sunk to provide a viewing attraction for the submersible tour, it should be situated at a depth sufficient to allow unobstructed passage of surface vessels.

Thank you for providing us the opportunity to review the applications.

Sincerely,

for John C. Lewin, M.D.
Director of Health
for Director, OEQC

JOHN WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI

IN REPLY REFER TO

STP 8.2079

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

June 4, 1987

TO: The Honorable William W. Paty, Chairperson
Board of Land and Natural Resources

FROM: Director of Transportation

SUBJECT: CONSERVATION DISTRICT USE APPLICATIONS
ATLANTIS SUBMARINES, INC.
COMMERCIAL TOURS AT KAILUA-KONA, HAWAII,
KEWALO BASIN, OAHU, AND LAHAINA, MAUI

We have the following comments to offer on the subject applications:

1. Kewalo Basin, Oahu

Although we find moorings A and B satisfactory, they may be subject to further control and modification, depending upon the circumstances relating to the use of the areas, during the permitting process. The mooring design is acceptable. While mooring C near Point Panic should not interfere with the body surfing area, we and the Maritime Affairs Committee of the Chamber of Commerce are concerned that the mooring will interfere with the navigation of commercial vessels, tug boats, and other craft, both incoming and outgoing.

2. Lahaina, Maui and Kailua-Kona, Hawaii

The proposed moorings should be coordinated with the respective Harbors District Managers to determine acceptable locations. On Maui, contact Mr. Harold Campbell (Phone: 877-6051) and on Hawaii, contact Mr. Ian Birnie (Phone: 935-4877). The moorings at Mala and Kona should be installed on sandy or rubble bottoms to avoid damaging live coral. These moorings may also pose a hazard to navigation and this concern will be more fully addressed during the permitting process.

3. General

We recommend that the proposal be also coordinated with the U.S. Coast Guard. Since mooring permits will be required, applications can be obtained at and submitted to the following Harbors Division Offices:

Oahu - Harbors Division
79 South Nimitz Highway
Honolulu, Hawaii 96813

Phone: 548-2838

Maui - Harbors Division
Maui District Office
P. O. Box 216
Kahului, Maui, Hawaii

Hawaii - Harbors Division
Hawaii District Office
Port of Hilo
Hilo, Hawaii 96720

Thank you for this opportunity to provide comments.

Edward Y. Hirata

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
MURRAY E. TOWILL
DEPUTY DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR

DIVISIONS
BUSINESS AND INDUSTRY DEVELOPMENT DIVISION
ENERGY DIVISION
335 Merchant St. Room 110 Honolulu Hawaii 96813
FOREIGN-TRADE ZONE DIVISION
Pier 2 Honolulu Hawaii 96813
LAND USE DIVISION
PLANNING DIVISION
RESEARCH AND ECONOMIC ANALYSIS DIVISION
OFFICES
ADMINISTRATIVE SERVICES OFFICE
INFORMATION OFFICE

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

KAMAMALU BUILDING, 250 SOUTH KING ST., HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359, HONOLULU, HAWAII 96804 • TELEX 7430250 HIDPED

Ref. No. P-6566

June 15, 1987

Mr. Eric B. Guinther
AECOS Inc.
970 North Kalaheo Avenue
Suite A300
Kailua, Hawaii 96734

Dear Mr. Guinther:

Subject: Hawaii Coastal Zone Management (CZM) Program Federal Consistency, Atlantis Submarine Tour Operation, Kakaako and Keehi Lagoon, Honolulu (FC/87-024)

This is to inform you that we have reviewed your amended assessment of the subject activity's consistency with the Hawaii CZM Program and concur with your finding that it is consistent. By copy of this letter, we are informing the U.S. Army Corps of Engineers that CZM consistency review requirements have been met.

In conducting our review, we were concerned with the potential coastal hazard impacts of the proposed artificial reef. We understand that the reef has been redesigned to reduce potential movement from storm waves and, as a result, will reduce its potential as a coastal hazard.

Our finding of consistency does not preclude your compliance with any regulations administered by the State Departments of Health, Transportation, and Land and Natural Resources. We appreciate your cooperation in complying with our CZM program consistency requirements.

Sincerely,

Roger A. Ulveling

cc: U.S. Army Corps of Engineers
Department of Transportation, Harbors Division
Department of Health
Department of Land and Natural Resources

DEPARTMENT OF PLANNING
AND ECONOMIC DEVELOPMENT

KAMAMALU BUILDING 250 SOUTH KING ST, HONOLULU HAWAII
MAILING ADDRESS P.O. BOX 2359 HONOLULU HAWAII 96804 • TELEX 723250 HIDPED

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
MURRAY E. TOWILL
DEPUTY DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR

DIVISIONS
BUSINESS AND INDUSTRY DEVELOPMENT DIVISION
ENERGY DIVISION
FOREIGN TRADE ZONE DIVISION
LAND USE DIVISION
PLANNING DIVISION
RESEARCH AND ECONOMIC ANALYSIS DIVISION

OFFICES
ADMINISTRATIVE SERVICES OFFICE
INFORMATION OFFICE

Ref. No. P-6582

June 17, 1987

Mr. Eric Guinther
AECOS, Inc.
970 N. Kalaheo Avenue
Suite A300
Kailua, Hawaii 96734

Dear Mr. Guinther:

Subject: Environmental Assessment for the Operation of Submersibles as a Public Attraction in Hawaiian Waters

We have reviewed the subject environmental assessment and have the following comments to offer.

The document provides information on proposed project activities at three locations. While overall project activities in each of these locations are similar, ambient conditions and, therefore, potential impacts differ. As a result, many of our comments are site-specific.

Recreational Resources

The Draft Environmental Impact Statement (DEIS) should discuss the potential impacts of the ultimate operation on the established recreational uses in the Lahaina area. Lahaina Harbor and the shoreline to Kaanapali are presently experiencing expanding and at times conflicting ocean recreational and commercial uses. The DEIS should discuss project impacts on recreational fishing and boating, boat tours presently operating in the area, as well as other ocean recreational and commercial uses. Mitigating measures that address recreational and commercial use impacts should be provided.

Coastal Ecosystems

The DEIS should discuss the project's potential impacts on humpback whales whose habitat extends along the Lahaina coast. In this regard, the applicant may wish to consult the National Marine Fisheries Service, which is preparing a habitat management plan for this endangered species.

Historic Resources

Project location for the Lahaina site should include to-scale drawings of the proposed artificial reef, mooring, and floating platform in relation to the established Lahaina Historic District boundary.

Coastal Hazards

The proposed artificial reefs as presently designed for the Kakaako and Lahaina sites may not withstand wave action during seasonal storms. Movement of these structures during such storms may represent a hazard along the adjacent coastline. We understand that the reefs are being redesigned in response to this concern. Drawings of the new design should be included in the DEIS.

Hawaii State Plan

Section E.1.2 (pages 61-62) contains a brief review of the project's relationship to the objectives and policies of the Hawaii State Plan (Chapter 226, HRS, as amended). The DEIS should significantly expand this discussion to include the project's relationship to all pertinent objectives, policies and priority guidelines, including those for economy, the physical environment, land, air and water quality. The State Functional Plans should be reviewed to determine relevance to the proposed activity and important relationships should be identified and discussed.

Thank you for the opportunity to comment on the subject document.

Sincerely,

Roger A. Ulveling

cc: Office of Environmental Quality Control
Department of Land and Natural Resources

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

June 19, 1987
PN:0054

Mr. Eric B. Guinther
AECOS, Inc.
970 North Kalaheo Avenue, Suite A300
Kailua, Hawaii 96734

Dear Mr. Guinther:

Environmental Impact Statement Preparation Notice
Atlantis Submarines, Inc.
(Commercial Submarine Tour Operation)
Kakaako, Oahu; Lahaina, Maui; Kailua-Kona, Hawaii

We have conducted an in-house review of the above-noted documents, pursuant to the attached review of the U.S. Army Corps of Engineers Permit Application (5/28/87) pertinent to the same proposed activities. Principal activities in each of the noted locations include establishment of commercial submarine tour operations, installation of artificial reef structures and permanent mooring facilities, and restriction of public access to tour sites under the Hawaii Ocean and Submerged Lands Leasing Act.

It is our policy to confine our comments at the Preparation Notice stage to identification of concerns or topics which we feel may require specific treatment in the Draft EIS. Most of the issues which we perceive to be potentially significant in this case are adequately addressed in the unusually comprehensive Environmental Assessment. However, additional information on current and surge conditions would help evaluate questions of structure stability and submersible operational characteristics. We note Dr. Brock's description of surface currents off Lahaina of 30 cm/s. In view of the intended continuous operation schedule, it would be useful to provide records of tidal and seasonal current patterns at each of the proposed sites. In addition, our own experiences with submersibles suggest that considerable surge frequently will be felt at the relatively shallow depths of the proposed artificial reefs.

Our other major concern addresses the necessity for enforcement of public exclusion from operation sites. At present, the State Department of Transportation (DOT) Marine Police has three full time staff personnel and two vessels, one of which is an 18-foot skiff, with which to patrol the entire island of Oahu. Similarly, on Maui, they have one employee and one vessel. It would be unrealistic to expect consistent enforcement when this

agency is already overburdened with other responsibilities. Considering days off, shift scheduling, and other patrol requirements, at least two ocean-going vessels and 12 to 14 people would be required on each island to insure the safety of the tour operation. Furthermore, the DOT Marine Police do not have full fleet powers, and the limits of their jurisdictional authority may not include all situations which could arise in the course of exclusionary enforcement. While we agree that regulation of public access to the dive sites is essential, we feel that careful thought must be given to an appropriate means of implementing such regulation.

We appreciate the opportunity to comment on this EIS Preparation Notice.

Sincerely,

John T. Harrison, Ph.D.
Environmental Coordinator

Attachment

cc: OEQC
L. Stephen Lau
Jacquelin Miller
Pamela Bahnsen

RECEIVED

'87 JUN 25 AM 8:40

RECEIVED

87 JUN 25 A8:21

DLNR
OCEA

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

June 23, 1987

Mr. William Paty, Chairperson
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Paty,

Thank you for the opportunity of offering our comments to the

CONSERVATION DISTRICT USE APPLICATION FOR OPERATION OF COMMERCIAL SUBMERSIBLE TOURS OFFSHORE HONOLULU, LAHAINA, AND KAILUA-KONA

popularly known as the "Atlantis Submarines" tours.

As indicated, our comments are relevant to each of the proposed tour sites. The concerns which we have are not, with noted exceptions, directly affected by the site-specific nature of the submersible operations. Rather, our reservations pertain to the operation and its proposals overall.

First, we are deeply troubled by the possible granting of an "exclusive" ocean lease to this operation.

As noted in their descriptions of proposed artificial reef design, construction, and expectation, there would be a significant increase in marine life. Such an enhancement of the marine view is vital to their operation -- and, presumably, would also be very attractive to fishing operations.

While we can appreciate their impulse to guard such a resource as a "return on investment" -- such an action would set an unwise precedent for Hawai'i. State actions in the area of artificial reef development as an encouragement of both recreational and commercial fishing argue persuasively for a continuation of this pattern in the use and development of our submerged lands.

As public lands, they should have a public dimension to their use.

Otherwise, a competition for such resources -- and an active disregard for the proposed exclusivity -- could result in a very unfortunate situation. Particularly as the competition would be between resident and tourist activities.

This competition is also a factor in the access needs of the

1600 Kapiolani Blvd., Suite 1500
Honolulu, Hawaii 96814
(808) 945-2OHA

submersibles. The proposed shuttle boat and permanent moorings will both require a clear berth from other boats.

Related to these concerns is the explicit acknowledgment from the Atlantis reports that without such exclusive use, tour safety would be compromised.

It is our understanding that AECOS is considering a withdrawal of their application for an exclusive ocean lease. If that is done -- what are the additional safeguards they propose for tour safety? And lacking such additional protections, do they intend to proceed with what even they concede would then be unsafe conditions?

We cannot support such possible irresponsibility.

On another level, we are also concerned over the apparent lack of compliance with HRS, Chapter 171 constraints on the leasing of submerged lands. It is our belief that this project would -- by virtue of the plans for artifical reefs, shipwrecks, and seaserpents -- qualify for legislative review.

We are also leary of what appears to be a jurisdictional division between the Department of Transportation and your Department in the full review of this application. Anticipated arrangements for docking facilities and parking are apparently under the purview of the DOT, while submerged lands development and the CDUA are handled by DLNR.

In the past, such a division of responsibility has often been resolved in favor of the DOT. As our Office indicated in testimony regarding the transfer of Malu Wharf, such a resolution results in a loss of revenues to the OHA trust.

We would like some clarification and assurance that such a transfer would not occur on this project.

Lastly, we have the following site-specific concerns regarding this project:

- As offered in Lahaina testimony, the peace and safety of the migrating humpback whales must be protected from the underwater harassment which would be possible with submersibles;
- The adverse impact and competition on fishing in the Kailua-Kona area could be greater than at any of the other sites; and
- The use of Aloha Tower in Honolulu poses parking and traffic problems more intense than elsewhere.

In an effort to learn first-hand about the Atlantis responses to these concerns, Mr. Barry Bell Chambers has been invited to attend our Programs Committee meeting of July 6th.

It is our hope that he can clarify some of these issues. However, certain of our concerns can only be addressed by you. And we are aware that the timeliness of this response will not allow for a postponement of this letter until after our meeting with Atlantis.

However, OHA representatives will, in all likelihood, be attending the re-scheduled public hearing on this matter. At that time, it will be possible to refine our response.

Again, thank you for allowing us to share our concerns.

Sincerely,

Kamaki A. Kanahele, III
Administrator

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:
EPHSD

June 29, 1987

MEMORANDUM

To: The Honorable William W. Paty, Chairperson
Board of Land and Natural Resources

From: Director of Health

Subject: Three New Conservation District Use Applications
File Nos.: HA-5/7/87-2024, OA-5/7/87-2025, MA-5/7/87-2026
Request: Atlantis Submarines, Inc. Commercial Submersible Tours, Kailua-Kona, Hawaii; Kewalo Basin, Oahu; Lahaina, Maui

Thank you for allowing us to review and comment on the subject CDUA applications. Our comments to the original CDUA application (SH-4/15/87-2005) dated May 12, 1987 are still applicable except that the exclusive use issue is recognized to be a Department of Land and Natural Resources matter since the applicant will be paying a lease rental for whatever ocean and submerged lands restricted from other nonwater quality eroding compatible uses:

In addition, we would like to submit the following noise comments:

1. On Oahu, noise from activities associated with the operation and maintenance of the submersible tours must comply with the allowable noise limits as specified in Title 11, Administrative Rules Chapter 43, Community Noise Control for Oahu.

2. With regards to the Lahaina, Maui and Kailua-Kona, Hawaii sites, the allowable noise levels as specified in Chapter 43 of Title 11, Administrative Rules should be used as a guideline to limit the noise from the project operations.

JOHN C. LEWIN, M.D.

cc: Chief Sanitarians, Hawaii, Maui

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center Honolulu Laboratory
2570 Dole St. • Honolulu, Hawaii 96822-2396

'87 OCT 13 A8:31

October 9, 1987 F/SWC2

STATE OF HAWAII

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
Department of Land and Natural Resources
P. O. Box 621
Honolulu, HI 96809

Dear Mr. Paty:

In my letter of 14 September we submitted our comments on the Review of Draft EIS on the Conservation District Use Application for the Atlantis Submarine Tour Operation Offshore of Kona.

The only additional comment one of our experts on artificial reefs has on the Review of Draft EIS on the Conservation District Use Application for the Atlantis Submarine Tour Operation Offshore of Kewalo Basin is "I question whether a vessel even at 250 ft can be made 'stable' when the next hurricane comes."

Sincerely,

Richard S. Shomura
Director, Honolulu Laboratory

RECEIVED
'87 OCT 14 AM 7:58
DLNR
OCEA

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. BOX 50004
HONOLULU, HAWAII
96850

October 9, 1987

'87 OCT 14 P12:47
STATE OF HAWAII

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Attn: Mr. Dean Uchida
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, HI 96813

Dear Mr. Paty:

Subject: Draft Environmental Impact Statement for Operation of Submersibles as a Public Attraction in the Waters Off Waikiki

We have no comments to offer at this time, but appreciate the opportunity to review the draft EIS on this project.

Sincerely,

RICHARD N. DUNCAN
State Conservationist

cc:
Mr. Eric B. Guinther, AECOS Inc., 970 N. Kalaheo Ave., Suite A300
Kailua, HI 96743

RECEIVED
'87 OCT 15 AM 11:01
DLNR
OCEA

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

October 16, 1987

Mr. William W. Paty, Chairperson
Board of Land and Natural
Resources
Office of Conservation and
Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Dean Uchida

Dear Mr. Paty:

Subject: Draft Environmental Impact Statement for Operation of Submersibles as a Public Attraction in the Waters Off Waikiki

We have no comments on the draft environmental impact statement. The proposed operation will have no impact on our water system.

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Eric B. Guinther

RECEIVED [illegible]

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
ES
Room 6307

OCT 19 1987

STATE OF HAWAII

Mr. William W. Paty
Chairperson, Board of Land and
Natural Resources
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809-0621

Re: Draft Environmental Impact Statement, Atlantis Submarine tour operation offshore of Kewalo Basin, Oahu

Dear Mr. Paty:

We have reviewed the referenced Draft Environmental Impact Statement and offer the following comments for your consideration.

We have no objections to the proposed project provided the following special conditions are included in the permit:

a. All oil, waste petroleum, and other toxic materials should be removed from the ships prior to sinking.

b. Scuttling a ship and accurately placing the vessel on a specific site on the sea floor presents several technical problems. We recommend that the scuttling of any ship be closely coordinated with the U.S. Coast Guard.

c. Concrete cubes should not be placed in areas supporting locally high coral coverage.

d. The artificial reefs should be monitored to document the development of fish and coral communities.

e. The structural stability of the artificial reefs to withstand storm surges should be determined by qualified ocean engineers. We are concerned that the artificial reefs may break apart and damage coral communities during storm surge conditions.

We appreciate the opportunity to comment.

Sincerely,

Ernest Kosaka

Ernest Kosaka, Field Supervisor
Environmental Services
Pacific Islands Office

CONSERVE AMERICA'S ENERGY

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P. O. BOX 119, HONOLULU, HAWAII 96810

RUSSEL S. NAGATA
COMPTROLLER

BEN KIYABU
DEPUTY COMPTROLLER

LETTER NO. (P)1857.7

OCT 14 1987

Honorable William Paty
Chairman
Department of Land and
Natural Resources
State of Hawaii
Honolulu, Hawaii

Attention: Mr. Dean Uchida

Dear Mr. Paty:

Subject: Operation of Submersibles
as a Public Attraction in
the Waters Off Waikiki

We have reviewed the subject document and have no comments to offer.

Very truly yours,

RUSSEL S. NAGATA
State Comptroller

RECEIVED
'87 OCT 15 PM 3:56
OEA
CLNR

BUILDING DEPARTMENT
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

PB 87-1010

'87 OCT 15 P3:57
STATE OF HAWAII

October 15, 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Attn: Mr. Dean Uchida
Office of Conservation and
Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Paty:

Subject: Draft EIS - The Operation of
Submersibles as a Public Attraction
in the Waters off Waikiki

We have reviewed the subject draft EIS and have no comments.

Thank you for the opportunity to review the document.

Very truly yours,

HERBERT K. MURAOKA
Director and Building Superintendent

cc: E. Guinther (AECOS, Inc.)
J. Harada

RECEIVED
'87 OCT 19 AM 11:4
OEA
CLNR

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
MURRAY E. TOWILL
DEPUTY DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR

KAMAMALU BUILDING, 250 SOUTH KING ST., HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359, HONOLULU, HAWAII 96804 TELEX: [illegible]

Ref. No. P-7465

October 20, 1987

'87 OCT 21 P1:35
STATE OF HAWAII

MEMORANDUM

TO: The Honorable William W. Paty, Chairperson
Department of Land and Natural Resources

FROM: Roger A. Ulveling

SUBJECT: Draft Environmental Impact Statement (DEIS) Operation of Submersibles as a Public Attraction, Waikiki, Oahu, Hawaii

We have reviewed the statement and find that the DEIS has adequately addressed our previously filed concerns. We do not have any other comment to offer at this time.

We appreciate this opportunity to review the DEIS.

Mary E. Tomiel
for Director

RECEIVED
'87 OCT 22 PM 4:51
DLNR
OCEA

JOHN WAIHEE
GOVERNOR

SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

TADASHI TOJO
DEPUTY TO THE CHAIRPERSON

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

October 20, 1987

MEMORANDUM

To: Mr. William W. Paty, Chairperson
Board of Land and Natural Resources

Subject: Draft Environmental Impact Statement (DEIS) for Operation of Submersibles in Waters Off Waikiki
Atlantis Submarines, Inc.
TMK: 2-1-15 and 2-6 Waikiki, Oahu

The Department of Agriculture has reviewed the subject DEIS and has no comments to offer.

Thank you for the opportunity to comment.

Suzanne D Peterson

SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: Mr. Eric B. Guinther, AECOS, Inc.

RECEIVED

DEPARTMENT OF THE ARMY
U S ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF
Operations Branch

October 22, 1987

'87 OCT 22 A9:31
STATE OF HAWAII

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

This is in response to your letter, dated October 7, 1987, regarding Conservation District Use Application (CDUA) No. OA-5/7/87-2025 from Atlantis Submarines, Inc. This application is for the operation of submarine tours in the offshore waters of Waikiki, Oahu, Hawaii.

The Corps of Engineers is currently processing a permit application for the construction and operation of structures related to the tour operation. We will keep you apprised of our permit decision when it is reached.

We appreciate this opportunity to comment on the CDUA.

Sincerely,

John G. Emmerson
Chief, Operations Branch
Construction-Operations Division

'87 OCT 28 AM 9:15
RECEIVED

JOHN WAIHEE
GOVERNOR

ALEXIS T. LUM
MAJOR GENERAL
ADJUTANT GENERAL

DEPUTY ADJUTANT GENERAL

RECEIVED
'87 OCT 27 PM 1:10
LNR
SCEA

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

October 23, 1987

Engineering Office

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
ATTN: Mr. Dean Uchida
Office of Conservation and
Environmental Affairs
1150 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Paty:

Operation of Submersibles as a
Public Attraction in the Waters Off Waikiki

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Yours truly,

Jerry H. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

cc: Mr. Eric B. Guinther, AECOS Inc.

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF
Operations Branch

October 22, 1987

'87 OCT 22 A9:31
RECEIVED
STATE OF HAWAII

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

This is in response to your letter, dated October 7, 1987, regarding Conservation District Use Application (CDUA) No. OA-5/7/87-2025 from Atlantis Submarines, Inc. This application is for the operation of submarine tours in the offshore waters of Waikiki, Oahu, Hawaii.

The Corps of Engineers is currently processing a permit application for the construction and operation of structures related to the tour operation. We will keep you apprised of our permit decision when it is reached.

We appreciate this opportunity to comment on the CDUA.

Sincerely,

John G. Emmerson
Chief, Operations Branch
Construction-Operations Division

'87 OCT 28 AM 9:15
RECEIVED
OFFICE OF CONSERVATION AND ENVIRONMENTAL AFFAIRS

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

ALFRED T. LUM
MAJOR GENERAL
ADJUTANT GENERAL

DEPUTY ADJUTANT GENERAL

RECEIVED
'87 OCT 27 PM 1:10
LNR
DCEA

October 23, 1987

Engineering Office

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
ATTN: Mr. Dean Uchida
Office of Conservation and
Environmental Affairs
1150 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Paty:

Operation of Submersibles as a
Public Attraction in the WAters Off Waikiki

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Yours truly,

Jerry M. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

cc: Mr. Eric B. Guinther, AECOS Inc.

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO
5090 (0018C)
Ser N5B/2369
23 OCT 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Attn: Mr. Dean Uchida
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Paty:

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
OPERATION OF SUBMERSIBLES AS A PUBLIC ATTRACTION
IN THE WATERS OFF WAIKIKI

The Draft EIS for the Operation of Submersibles as a Public Attraction in the Waters off Waikiki has been reviewed and we have no comments to offer.

Thank you for the opportunity to review the Draft.

Sincerely,

[illegible]
[illegible] U.S. Navy
[illegible] Engineer
[illegible] of
[illegible]

Copy to:
Mr. Eric B. Guinther
AECOS Inc.
970 N. Kalaheo Ave., Suite A 300
Kailua, Hawaii 96743

Office of Environmental Quality Control

RECEIVED [illegible] 1987

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 523-4181

FRANK F. FASI
MAYOR

MIKE MOON
DIRECTOR

ROBERT MIYASATO
DEPUTY DIRECTOR

October 26, 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Mr. Dean Uchida

Dear Mr. Paty:

Subject: Operation of Submersibles as a Public Attraction in the Waters off Waikiki

Thank you for the opportunity to review and comment on the subject proposal in waters off Waikiki.

The project is consistent with the objectives of the Hawaii State Plan of improving the quality of visitor destination areas and also promotes and provides new job opportunities and steady employment for Hawaii's people.

We have no objections to the proposal to operate submersibles for the purpose of providing underwater tours in waters off Waikiki.

Sincerely,

Robert Miyasato
for MIKE MOON
Director

cc: Mr. Eric B. Guinther
AECOS, Inc.
970 N. Kalaheo Ave., Suite A300
Kailua, Hawaii 96743

RECEIVED [illegible] 1987

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

ENV 2-1
JA/G

Brenner Munger Ph.D., PE
Manager
Environmental Department
(808) 548 6880

October 27, 1987

Mr. William W. Paty, Chairman
Board Of Land and Natural Resources
Attn: Mr. Dean Uchida
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Uchida:

Subject: Draft Environmental Impact Statement for the Operation of Submersibles as a Public Attraction in the Waters Off Waikiki, Oahu, Hawaii

We have reviewed the subject document and have no comments.

Sincerely,

Brenner Munger

cc: Mr. Eric B. Guinther
AECOS, Inc.

RECEIVED

JOHN WAIHEE
GOVERNOR OF HAWAII

RECEIVED
87 NOV 3 P12:31
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPHSO

87 NOV 2 8:01
OFFICE OF ENVIRONMENTAL AFFAIRS

October 27, 1987

MEMORANDUM

To: The Honorable William W. Paty, Chairperson
Board of Land and Natural Resources

From: Director of Health

Subject: Conservation District Use Application
File No: OA-5/7/87-2025
Request: Review of Draft Environmental Impact Statement (EIS) on the Conservation District Use Application (CDUA) for the Atlantis Submarine Tour Operation Offshore of Kewalo Basin, Oahu, Hawaii

Thank you for allowing us to review and comment on the CDUA. We provide the following comments:

Noise Pollution

Noise from the proposed activities should be monitored to insure that the levels are within the allowable limits specified in the Administrative Rules, Title 11, Chapter 42, Vehicular Noise Control for Oahu, and Chapter 43, Community Noise Control for Oahu.

Water Pollution

We have contacted the agent of the applicant and requested the submittal of a 401 Water Quality Certification for this project.

JOHN C. LEWIN, M.D.

DANIEL J. KIHANO
SPEAKER

P 1: 09

HOUSE OF REPRESENTATIVES
THE FOURTEENTH LEGISLATURE
STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

10: 05

October 15, 1987

OCEA

Mr. William Paty
Chairman
Board of Land & Natural Resources
Kalanimoku Building
1151 Punchbowl Street
Honolulu, Hawaii 96813

RE: CDUA Application by Atlantis Submarines, Inc. for Construction of Artificial Reefs

Dear Mr. Paty:

It is my understanding that Atlantis Submarines, Inc. has applied for a Conservation District Use Permit for the purpose of constructing artificial reefs in the offshore waters of Kona and Waikiki.

I further understand that Atlantis Submarines has elected to drop their request for an exclusive lease of the subject offshore waters which seemed to have been the only major objection to the project.

I wish to encourage you to give this application every consideration in the CDUA process for a permit to construct artificial reefs off Kona and Waikiki.

I am attaching HOUSE CONCURRENT RESOLUTION 133, H.D. 1, which passed both Houses of the 1987 Legislature in expression of support for the project as being consistent with the State General Plan and those policies relating to economic diversification and our desire to develop our ocean resources.

Please be advised that I have placed a very high priority on economic development with respect to interim work engaged in by members of the House. I believe that the Atlantis proposal is an example of the kind of economic high-tech diversification that we seek to encourage as a new industry for Hawaii.

Sincerely,

Daniel J. Kihano

DJK/wlg
cc: Rep. Peter Apo

HOUSE OF REPRESENTATIVES
FOURTEENTH LEGISLATURE, 1987
STATE OF HAWAII

H.C.R. NO. 133

HOUSE CONCURRENT RESOLUTION

EXPRESSING LEGISLATIVE SUPPORT FOR PROPOSED SUBMARINE TOUR OPERATIONS IN HAWAIIAN WATERS BY ATLANTIS SUBMARINES INC.

WHEREAS, Sub Aquatics Development Corporation is the first and only company in the world to complete the development, manufacture and operation of specially-designed passenger submarines for the purpose of providing underwater tours in tropical resort areas; and

WHEREAS, Sub Aquatics was established in 1983 by a group of experienced engineering and submarine operations experts representing more than 45 years combined experience in commercial submarine technology and operations; and

WHEREAS, Sub Aquatics is interested in introducing state-of-the-art world class submarine tour operations in Hawaiian waters for the benefit of visitors and residents alike; and

WHEREAS, Atlantis Submarines Inc., a local subsidiary of Sub Aquatics, is in the process of applying for ocean leases with the State for Kailua-Kona, Lahaina, Maui, and Honolulu, Oahu, to build artificial reefs as part of its comprehensive proposal to conduct submarine tours in Hawaiian waters; and

WHEREAS, the first technologically innovative aspect of Atlantis' proposal centers around the submarines; and

WHEREAS, the Atlantis submersible is the first submarine designed and constructed for recreational undersea discovery; and

WHEREAS, the Atlantis submersible is a free-swimming, non-polluting, self-powered submarine with an operating depth capability of 150 feet and a capacity for 48 passengers and two crew members; and

WHEREAS, the Atlantis and her support equipment system were designed by Sub Aquatics based on years of applied underwater technology targeting the visitor industry; and

WHEREAS, the Atlantis is reliable and safe according to the highest engineering standards and was designed specifically to not disturb or harm the environment; and

WHEREAS, this design was certified by the American Bureau of Shipping, a private institution universally recognized as a foremost authority on manned underwater equipment, and is now pending final approval by the U.S. Coast Guard as the first passenger submersible for use in Hawaiian waters; and

WHEREAS, the second high technology component of the project is the proposed construction of artificial reefs for each of the submarine tour dive sites; and

WHEREAS, these artificial reefs will be constructed in accordance with designs developed by the University of Hawaii, and will enhance and increase the local biologic productivity at the sites and serve as the focus of ongoing scientific research studies after their completion; and

WHEREAS, educational aspects of the artificial reefs and benthic environment will be emphasized during the dive tours; and

WHEREAS, these reefs will be the first undertaking by the private sector in Hawaiian fisheries resource enhancement and will provide the State its first introduction to modern reef technology without any expenditure of public funds; and

WHEREAS, immediate plans include six submersibles operating 6.5 days per week with three shifts of operating, mechanical and clerical personnel to provide 12 one-hour dives per day; and

WHEREAS, the initial operations of six submersibles will include direct employment of approximately 180 people, approximately 30 at each site, the majority of whom will be technical and marketing personnel hired locally and professional trained in programs established within the State; and

WHEREAS, Atlantis hopes to go into operation by September 1987 at Kailua-Kona, by December 1987 at Honolulu, and by early 1988 at Lahaina; and

WHEREAS, Atlantis Submarines is already successfully operating underwater discovery tours with submersibles in the Grand Cayman Island and Barbados in the Caribbean, and is also in the process of establishing similar operations at St. Thomas in the Virgin Islands; and

WHEREAS, this company has clearly demonstrated its technological knowledge and commercial expertise for an innovative undertaking of this kind; and

WHEREAS, the proposed operations by Atlantis Submarines provide a unique opportunity for the State to venture upon a new industrial horizon and to diversify its economic base in support of tourism, its major industry; and

WHEREAS, the State General Plan provides that the State plan for the development and expansion of potential growth activities that serve to diversify and strengthen Hawaii's economy; and

WHEREAS, the Plan further states that the State should facilitate investment and employment in economic activities with growth potential, including marine-related industries; and

WHEREAS, the Hawaii Ocean and Submerged Lands Leasing Act of 1986 allows the Department of Land and Natural Resources to manage and develop ocean resources by defining rights of usage and tenure and providing protection for approved activities; and

WHEREAS, the Permit Facilitation Act of 1985 authorizes the Department of Planning and Economic Development to facilitate, expedite and coordinate state agency and inter-governmental permit processes through a consolidated application procedure; and

WHEREAS, this Act also authorizes and establishes procedures by which federal, state and county agencies and authorities may consolidate their review and action on permit applications for projects in the State; and

WHEREAS, state agencies are mandated to comply with tne provisions of this Act upon written request by an applicant; and

WHEREAS, the proposed operations by Atlantis Submarines are compatible with all the above articulated policies and statutes relating to marine-related activities; and

WHEREAS, the dual application of the two technology areas of ocean marine science and industrial design within Atlantis' proposed operations will provide an opportunity to position the State as the nation's leader in both fields; and

WHEREAS, this project would also help Hawaii gain recognition for its high technology innovativeness and to thrust it into the forefront of current and future developments in the ocean; and

WHEREAS, through such a project Hawaii may be the first state to afford public access to the deep ocean environment, particularly for people who lack the special skills required to get there such as the elderly and school children; and

WHEREAS, the goal of marine literacy, an inherent feature of Atlantis' proposal, is to educate citizens on how to make informed decisions regarding the wise use of our ocean; and

WHEREAS, the ultimate educational experience is first-hand; and

WHEREAS, the experiences which would be offered by Atlantis Submarines would be similar to the successful Teacher in Inner Space Program conducted last year as a first for Hawaii and the nation, and would further open up the deeper ocean frontier for students to learn more about ocean research,

technology and available related economic opportunities in Hawaii; and

WHEREAS, there is a critical need for the State to encourage and assist constructive efforts to attract and retain its talented youth for high technology careers in Hawaii; and

WHEREAS, submarine operations would also afford passengers from the more than five million tourists in Hawaii deeper visitor satisfaction, a need stated by the Hawaii Visitors Bureau and the State to ensure frequent returns to the islands by satisfied visitors; and

WHEREAS, the positive ramifications of this project in terms of capital expenditure, employment of residents and promotion of tourism evidently extend far beyond its commercial and economic aspects to support the State's longstanding objective of promoting scientific research, education and general public awareness of ocean resources; now, therefore,

BE IT RESOLVED by the House of Representatives of the Fourteenth Legislature of the State of Hawaii, Regular Session of 1987, the Senate concurring, that legislative support is expressed for the proposed submarine tour proposal by Atlantis Submarines and for its successful implementation on a timely basis; and

BE IT FURTHER RESOLVED that the Department of Planning and Economic Development, the Department of Transportation and the Department of Land and Natural Resources are hereby encouraged to expedite the hearings and other requirements for the processing of permits and application of an ocean lease by Atlantis Submarines under the provisions of the Permit Facilitation Act of 1985; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the Director of Land and Natural Resources, the Director of Planning and Economic Development, the Director of Transportation, and the Mayors of the Counties of Honolulu, Maui and Hawaii.

OFFERED BY:

FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

1455 S. BERETANIA STREET, ROOM 305
HONOLULU, HAWAII 96814

FRANK F. FASI
MAYOR

FRANK K. KAHOOHANOHANO
FIRE CHIEF

JOSEPH E. CAMARA
DEPUTY FIRE CHIEF

November 3, 1987

RECEIVED
'87 NOV 5 PM 4:04
STATE OF HAWAII
OCEA

Mr. William W. Paty, Chairman
Board of Land & Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Mr. Dean Uchida

Dear Mr. Paty:

SUBJECT: OPERATION OF SUBMERSIBLES AS A PUBLIC ATTRACTION IN THE WATERS OFF WAIKIKI

Thank you for the opportunity to review the EIS for the above subject. The proposed operation would receive fire and rescue protection from our Fireboat and two rescue companies, with possible assistance from the U.S. Coast Guard and the Navy in a worst possible situation.

We have no objections to the proposed operations. We are concerned that the submarine's design and operating plan take into account the following:

1. The risk of fire, particularly electrical, while the submarine is underwater.

2. Rescue considerations in the event, albeit unlikely, that the submarine were to sink with people on board.

Should you have any questions, please contact Battalion Chief Kenneth Word at 943-3838.

Sincerely,

FRANK K. KAHOOHANOHANO
Fire Chief

FKK/CAM:sb

cc: Mr. Eric B. Guinther
AECOS Inc.

AECOS

970 N. Kalaheo Avenue, Suite A-901 • Kailua, Hawaii 96734
Telephone (808) 254-5884

November 28, 1987

Fire Department
City and County of Honolulu
1455 S. Beretania Street, Rm 305
Honolulu, Hawaii 96814

Attn.: Mr. Frank Kahoohanohano
Fire Chief

Dear Mr. Kahoohanohano,

This letter is in response to your comments on the draft EIS entitled "Operation of Submersibles as a Public Attraction in the Waters off Waikiki". The design, construction, and operation of the Atlantis submersibles has been thoroughly reviewed and certified by the U.S. Coast Guard and the American Bureau of Shipping. The insurer, Lloyds of London, has reviewed these certifications. Note that daily operating and maintenance procedures, in addition to safety features and replication of life support systems, are included in these certifications.

Atlantis Submarines will be arranging to meet with appropriate members of your staff, the Honolulu Police Department, and other agencies concerned with rescue operations at sea, to acquaint you more thoroughly with their operation and to establish procedures for handling emergency situations. The Police Department has requested that an emergency response plan be developed.

Thank you for your comments,

Eric B. Guinther

cc: DLNR

PERCY K. MIRIKITANI
ATTORNEY AT LAW
SUITE 2118, DAVIES PACIFIC CENTER
841 BISHOP STREET
HONOLULU, HAWAII 96813
TELEPHONE (808) 536-1702

CABLE ADDRESS
PERCOUNSEL-HONOLULU

RECEIVED NOV 12 1987

RECEIVED NOV 1987

November 2, 1987

William W. Paty
Chairman
Board of Land and
Natural Resources
State of Hawaii
Dept. of Land and
Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

RECEIVED
'87 NOV 6 PM 3:08
DLNR
OCEA

Re: Conservation District Use Application
for the Atlantis Submarine Tour Operation
Offshore of Waikiki, Oahu, Hawaii
File No: OA-5/7/87-2025
Document No.: 1462E

Dear Mr. Paty:

This is in response to your letter of October 9, 1987 regarding application # OA-5/7/87-2025 filed by Atlantis Submarines, Inc., for the operation of Atlantis Submarine Tour Operation Offshore of Waikiki, Oahu, Hawaii.

The Honolulu Elks Lodge #616, B.P.O.E. at a meeting held recently, is in strong opposition to such an operation outside of Waikiki and particularly in the area of the ocean fronting the Elks Lodge property.

In the over 85 years of operations of the Elks Lodge in that particular area, hundreds of deceased Elks members have been buried outside of the reef. Their ashes have been scattered as a tradition in formal Hawaiian religious ceremonies and their urns have been dropped into the sea. The members of the Lodge strongly feel that it is a sacred ground which should not be disturbed in any manner, especially in this instance by a touring submarine. This would be considered a serious disrespect for the deceased. Therefore, this operation is considered objectionable by the Lodge. The burial grounds

should not be disturbed by a submarine for tour sight-seeing purposes. Furthermore as you are probably aware, others such as beachboys have also been buried in the same manner, outside of Waikiki.

These circumstances are very unique to Hawaii. Usage of the area is a tradition and is permissible because of the love for our beautiful ocean. It is one of the reasons why many wish to be buried at sea. This is a tradition that has been carried on from ancient times to the present in the Waikiki area which is the center of such ceremonies. Like all sacred grounds, it has always been the belief that normal usage and enjoyment does not disturb the sanctity of the sacred grounds.

Accordingly it is the feeling of the Elks Lodge that any other type of usage that disturbs this sanctity purely for tourism, literally interferes with the long-accepted tradition of peace and privacy and that the area not be disturbed by this type of activity. The tours would in fact be trespassing and disturbing the peace of the departed individuals, purely for monetary reasons. Disturbing this sacred grave site could cause strong resentment from the families of the deceased, which may cause repercussions.

Under the circumstances the Honolulu Elks Lodge #616, B.P.O.E. herewith objects to the application and hopes that the Board will reject the application as there are many other places where such usage may be granted.

Very truly yours,

PERCY K. MIRIKITANI
Attorney for
Honolulu Lodge
B.P.O.E #616

PKM:pg

cc Richard E. Owen
Paul E. Ferrara
Melvin E. Mossman

AECOS
970 N. Kalaheo Avenue, Suite A401 • Kailua, Hawaii 96734
Telephone (808) 254-5884

November 30, 1987

Percy Mirikitani, Attorney for
Honolulu Lodge B.P.O.E #616
Suite 2118, Davies Pacific Center
841 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Mirikitani,

We thank you for your letter presenting the concerns of the Honolulu Elks Lodge #616 regarding the proposal by Atlantis Submarines to conduct dive tours off of Waikiki. You are not specific in your description of how far offshore the Elks claim, but we point out that the proposed dive site is located nearly a mile off the Lodge. None of the site survey dives we conducted revealed any suggestion of urns, artifacts, or indicia of human burials at the proposed dive site.

It is our understanding that DLNR, in permits such as those being sought by Atlantis, imposes the following standard condition: "If any unanticipated sites or remains of historic or prehistoric interest (such as shell, bone, or charcoal deposits, human burials, rock, or coral alignments, paving, or walls) are encountered during construction, the applicant shall stop work and contact the historic preservation office immediately."

Sincerely,

Eric B. Guinther

cc: DLNR

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

FRANK F. FASI
MAYOR

JOHN P. WHALEN
DIRECTOR

LU10/87-5415(BWM)

November 12, 1987

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Draft Environmental Impact Statement (EIS)
Atlantis Submarines, Inc.
CDUA No. OA-5/7/87-2025
for Commercial Submersible Tours Offshore
of Kewalo Basin, Oahu (offshore of Tax Map Key 2-1-16)

We have previously reviewed the Environmental Assessment for this project on May 27, 1987. A copy of our comments and the consultant's response are attached.

We have no further comments to add. We note that our comment and concerns were adequately addressed in the DEIS.

Very truly yours,

JOHN P. WHALEN
Director of Land Utilization

JPW:sl
1446B

attach.

University of Hawaii at Manoa

Marine Option Program
1000 Pope Road, Room 229 • Honolulu, Hawaii 96822
Telephone: (808) 948-8433

4 November 1987

Mr. William Paty, Chairman
Board of Land and Natural Resources
Attn. Mr. Dean Uchida
Office of Conservation and Environmental Affairs
1151 Punchbowl Street Room 131
Honolulu, HI 96813

Dear Mr. Paty:

I have reviewed the "Draft Environmental Impact Statement, The Operation of Submersibles as a Public Attraction in the Waters off Waikiki, Oahu, Hawaii" submitted by Atlantis Submarines, Inc. and dated 5 October 1987. My major concerns relate to educational programs, but my comments cover other areas as well.

In general, I believe that the addition of such a submersible operation to Hawaii's ocean community would be desirable--the vehicle could provide access to the ocean for students, scientists, and the public which would otherwise not be readily available. The applicant's proposal shows an admirable sensitivity to both environmental and social concerns. It is unfortunate that the proposed tours will not showcase Hawaii's "natural" undersea beauty, but that economic dictates require construction of an artificial environment.

Clearly the operation's priority is to generate a profit from service to tourists. A reasonable mitigation of the environmental and social impacts would be to offer special educational access for residents, especially students. The applicant's commitment to such programs should include a more concrete plan to consult with marine educators in the Department of Education and in the University of Hawaii system to develop training programs for the tour guides, special tours for all levels of college and pre-college classes, teacher workshops, teacher guides, student workbooks/guides, internships, student employment, and similar undertakings. A specific allocation of time should be devoted for educational dives designed for our resident students and community groups. A provision to make these tours available at a discounted fee should also be stipulated. The educational component of the overall operation conceivably could grow to a size requiring a "classroom" of some sort either shoreside or at sea to provide pre- and post-dive activities and instruction.

Although the exclusive lease provisions of earlier proposals have now been dropped. It would seem that de facto operations of tours between the hours of 0800 and 2200 would preclude anyone else, divers or fishermen, from using the area. Thus any benefits of environmental enhancement would accrue only to the applicant and its patrons. Wider solicitation of opinions should be sought from current users of the proposed dive site.

Have all the safety aspects been considered? What are the contingency plans for the sea-going equipment in the event of a tsunami or hurricane? Could a helicopter land on the transfer platform for the emergency evacuation of one or two seriously ill people?

In sum, I support the proposal and find no major flaws in the DEIS, but would like to see a stronger educational program.

Sincerely,

Sherwood D. Maynard, Ph.D.
Director

xc AECOS
S

AECOS
[illegible] Kalanianaole Avenue, Suite A401 • Kailua, Hawaii 96734
Telephone (808) 261-3887

November 28, 1987

Marine Options Program
University of Hawaii
1000 Pope Road, Room 229
Honolulu, Hawaii 96822

Attn: Sherwood D. Maynard, Director

Dear Dr. Maynard,

I believe that all of the ideas you have expressed concerning the educational benefits and potential programs for the Atlantis Submarine in your letter dated 4 November 1987 have merit and are consistent with the goals of Atlantis Submarines, Inc.

Although the "structure" or habitat at the dive site will be man-made, the environment will be naturally populated by marine organisms. Thus, the educational value will not be compromised by an "artificial environment". Further, if Atlantis and the University can develop research plans for the artificial reefs, this research will enhance the educational value for persons and groups touring the dive site aboard the submersible.

At all of its Caribbean operations, Atlantis has developed special educational access programs for students. Atlantis will do the same in Hawaii. The details as to what student groups will be targeted have yet to be worked out -- understandable considering that the project is still in the process of obtaining permits. Your idea of a special "classroom" or display room has merit.

Use of the dive site by the Atlantis submersible will not "preclude anyone else...from using the area" unless you are referring specifically to the several thousand square feet of ocean surface covered by the platform and vessels involved in transferring passengers to and from the submersible. Atlantis would hope that other users of the "benefits of environmental enhancement" will work cooperatively with Atlantis in using the dive site, but area will be large enough for shared use.

Basic safety procedures and safety systems aboard the submersible have been developed under certification procedures of the U.S. Coast Guard and the American Bureau of Shipping. Site specific details of emergency response procedures will be worked out with the Honolulu Fire Department, Honolulu Police Department, and other groups involved in responding to emergency situations at sea. Given that these groups often perform transfers of seriously ill persons from ships at sea or from the water, the need for a helicopter landing pad on the transfer platform seems unnecessary.

Thank you for your comments.

Sincerely,

Eric B. Guinther

cc: DLNR

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU HAWAII 96813

FRANK F. FASI
MAYOR

JOHN E. HIRTEN
DIRECTOR

JOSEPH M. MAGALDI JR.
DEPUTY DIRECTOR

PL1.0826
TE-8689

November 6, 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Office of Conservation and
Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Mr. Dean Uchida

Dear Chairman Paty:

Subject: Operation of Submersibles in the Waters off Waikiki
Draft EIS

This is in response to OEQC's letter of October 7, 1987.

We have reviewed the draft EIS and have the following concerns:

1. Busses transporting the passengers should load and unload in an area where normal traffic would not be affected; and

2. Passengers waiting to be picked up must not obstruct any public sidewalk area.

Should you have any questions, please call Wayne Nakamoto of my staff at 523-4190.

Sincerely,

JOHN E. HIRTEN

cc: Mr. Eric B. Guinther

AECOS

970 N. Kalaheo Avenue, Suite A-188 • Kailua, Hawaii 96734
Telephone (808) 261-5884

November 30, 1987

Department of Transportation Services
City and County of Honolulu
Honolulu Municipal Building
650 South King Street
Honolulu, Hawaii 96813

Attn: John E. Hirten, Director

Dear Mr. Hirten,

Thank you for your comments on the draft EIS for the Operation of Submersibles in the Waters off Waikiki. Atlantis will comply with your suggestions regarding loading and unloading of passengers from buses. Atlantis anticipates that if mass transport (buses) is used for their project, they would contract with an existing bus company for this service.

Sincerely,

Eric B., Guinther

cc: DLNR

WAIKIKI NEIGHBORHOOD BOARD NO. 8
c/o NEIGHBORHOOD COMMISSION OFFICE
CITY HALL, 4TH FLOOR
HONOLULU, HAWAII 96813-3014

5 November 1987

Hon. William W. Paty, Chairperson
and Members
Board of Land and Natural Resources
State of Hawaii
Kalanimoku Building, 1151 Punchbowl St.
Honolulu, Hawaii 96813

Dear Chairperson Paty and Board Members:

The Waikiki Neighborhood Board appreciates having received from your office a copy of the draft Environmental Impact Statement on the proposed Atlantis Submarine public attraction in the waters offshore of Waikiki, and we appreciate the invitation, in your letter of 19 October 1987, to testify before the Board of Land and Natural Resources on Atlantis Submarine's Conservation Use Application No. UA-5/7/87-2025.

Inasmuch as the draft Environmental Impact Statement has not yet been accepted, and considering certain unresolved questions on matters under the purview of the U.S. Coast Guard and the U.S. Army Corps of Engineers (e.g., regarding the safety of the proposed transfer of passengers from a transfer boat to a mooring platform and then to the submarine, and regarding the proposed mooring platform itself), the Waikiki Neighborhood Board believes that it would be premature for the Neighborhood Board to offer substantive comments or a definitive recommendation on the Conservation District Use Application at this time.

THE WAIKIKI NEIGHBORHOOD BOARD

Jack Denton, Chairperson

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
Department of Business and Economic Development
Housing Finance and Development Corporation
P. O. BOX 17907
HONOLULU, HAWAII 96817

RUSSELL N. FUKUMOTO
Acting Executive Director

IN REPLY REFER TO:
87:PLNG/4814JT

November 6, 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Mr. Dean Uchida

Dear Mr. Uchida:

Re: Draft Environmental Impact Statement (dEIS) for the Operation of Submersibles as a Public Attraction on the Waters Off Waikiki

Thank you for the opportunity to review the subject dEIS. We have no comments at this time.

Sincerely,

RUSSELL N. FUKUMOTO
Acting Executive Director

cc: Dr. Eric B. Guinther
AECOS Inc.

RECEIVED NOV 12 1987

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

MM/DGP 11/87-3777

November 12, 1987

District Engineer (PODCO-O)
U.S. Army Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858

Dear District Engineer:

Application for Department of the Army Permit
Atlantis Submarines, Inc.,
for Commercial Submarine Tour Operation

This is in response to your request for comments regarding the application identified above.

The Development Plan for the Primary Urban Center designates submerged areas at Keehi, off Kakaako and off Waikiki for Preservation use. The Aloha Tower area is designated for Commercial use.

Our major concern regarding this proposal is its location. For example, the dive site utilizes an area that is heavily used by sunset cruisers, sail boat races, day sailing, para-sailing, diving, trolling, etc. The impact of the operation on these uses should be carefully considered before a decision is made on the application. It may be appropriate to contact surfing, fishing, and boating organizations for their comments.

We are also concerned about mooring locations which have yet to be determined. Previous plans submitted by Atlantis Submarine indicated platform mooring that would have displaced boats utilizing an anchorage area in Keehi Lagoon.

The idea of a commercial submarine tour operation that would enhance our natural reefs has considerable merit provided that negative impacts on sailing, fishing, cruising, and surfing operations can be minimized.

Sincerely,

DONALD A. CLEGG
Chief Planning Officer

AECOS
970 N. Kalaheo Avenue, Suite A301 • Kailua, Hawaii 96734
Telephone (808) 254-5884

December 2, 1987

Department of General Planning
City and County of Honolulu
650 So. King Street
Honolulu, Hawaii 96813

Attn: Donald Clegg, Chief Planning Officer

Dear Mr. Clegg,

The draft EIS does address the use of the proposed dive site off Waikiki by others and includes on-site surveys of boat traffic in several areas off Honolulu and Waikiki. A number of organization involved in sailing, fishing, and other recreational activities have participated in discussions with Atlantis and testified before the Land Board on November 5, 1987.

The Environmental Assessment for the project and the draft EIS have not indicated any specific location for a mooring sought in Keehi Lagoon, stating that the location would be dependent upon assignment made by the Harbors Division of the Department of Transportation. It would seem unlikely that the mooring would displace anyone presently assigned an anchorage in the Lagoon. Atlantis would prefer to locate in Honolulu Harbor if and when space for their operation becomes available there.

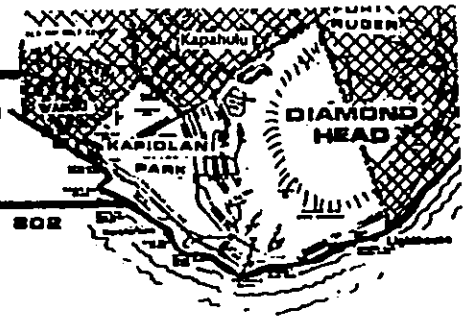
Thank you for responding to the Army's request for comments on the Atlantis permit application.

Sincerely,

Eric B. Guinther

cc: U.S. Army Corps of Engineers
DLNR

WEST DIAMOND HEAD
COMMUNITY
ASSOCIATION
3015 KALAKAUA AVENUE, APT 802
HONOLULU, HAWAII 96815



November 10, 1987

Mr. William Paty, Chairman
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii, 96813

ATLANTIS SUBMARINE OPERATION

Dear Mr. Paty,

There are several questions that deserve to be answered before approval is granted to the Atlantis Submarine Operation off the Natatorium. Some revolve about the question of "exclusive use".

While it is recognized that applicant has retracted the request for exclusive use, it is true that his equipment will occupy the site from an early hour to a late hour, resulting in a "I was here first" position of occupancy. Any casual user will be hard pressed to share the use of this area once the operation begins.

The EIS states the transfer platform and the submarine will be towed to Keehi Lagoon for overnight battery charge and maintenance. The submarine carries passengers until 2200. It takes time to break the platform out of its moor. It is 6 miles from the dive site to Keehi Lagoon. They can't get there, moor, and hook up to charge batteries before 2400. They need 8 hours to recharge the submarine battery. Then another 2 hour tow to return to the dive site and be ready for the 0800 passenger run. There just aren't that many hours in the day! I expect the operators will elect to recharge right where they are, without the long tow to Keehi Lagoon, unless you require them to vacate the moor for at least 6 hours each night. Without that requirement, they really will have "exclusive use".

Assuming a "shared use" concept, will fishermen and pleasure boats be permitted to anchor in the area of operations? Or will they be required to keep clear at all times? What about the rough water swim, the paddle board,. kayak and canoe races which pass directly through the operating area?

I will appreciate learning the answers to these questions.

Sincerely,

David S. Sterrett
David S. Sterrett
President

AECOS
970 N. Kalaheo Avenue, Suite A 301 • Kailua, Hawaii 96734
Telephone (808) 254-5884

December 1, 1987

West Diamond Head Community Association
3015 Kalakaua Ave., Apt. 802
Honolulu, Hawaii 96815

Attn: David S. Sterrett, President

Dear Mr. Sterrett,

This letter is in response to your questions regarding the proposed Atlantis Submarine Operation off Waikiki. You indicate that the presence of the operation will preclude sharing of the area. To the extent that only a finite number of boats can occupy a given limited area of water, this may be true. However, the dive site described in the dEIS for the project would not be fully occupied by the submersible or ancillary craft. Thus, others will be able to use this area.

Some of the races you mention do not involve waters near the proposed dive site. The roughwater swim, for example is about one-half of a mile inshore of the dive area. Atlantis has discussed their project with some of the groups which conduct races in these waters. Because of the need to conduct a certain amount of crew training dives and the like, the submersible will not be conducting tours every day of the year. Flexibility in the tour schedule will permit Atlantis to avoid interference with major community events.

The preferred approach to submersible systems recharging and maintenance is to utilize a shore-based facility (purchasing electrical power from HECO). Atlantis will continue to seek permanent dockside space in Honolulu Harbor.

I trust the above answers your concerns about the proposed project. Thank you for providing input to the EIS process.

Sincerely,

Eric B. Guinther

cc: DLNR

JOHN WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO:

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

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DLNR

November 12, 1987

HAR-ED 1848

MEMORANDUM

TO: The Honorable William W. Paty, Chairperson and Member
Board of Land and Natural Resources

FROM: Director of Transportation

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) ON THE CONSERVATION DISTRICT USE APPLICATION (CDUA) FOR THE ATLANTIS SUBMARINE TOUR OPERATION OFFSHORE OF KEWALO BASIN, OAHU

We have reviewed the Draft EIS on the CDUA for Atlantis Submarine Tour Operation Offshore of Kewalo Basin, Oahu, and offer the following comments relating to the proposed areas of operation designated A, B and C, as shown on the attached plan.

1. We do not have any objections to areas A and B; however, the use of the areas must be closely coordinated with our Harbors Division.

2. Dive site area C will not interfere with the navigation of commercial vessels, both incoming and outgoing, due to the normal practice of providing one (1) nautical mile clearance to the Diamond Head Buoy. However, this site is in the middle of the most frequently used westbound route for recreational traffic destined for Ala Wai Boat Harbor and Keehi Lagoon.

While we would expect recreational operations within the vicinity of the site to be reasonably alert to this operation once it got started, we do not have the same confidence with

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DLNR

respect to recreational craft that originate from out-of-state or off-island or those which may not be radio-equipped. The on-site tender would have to be vigilant, especially during night operations, to warn off all incoming craft.

We appreciate this opportunity to provide comments.

Edward Y. Hirata

Attachment

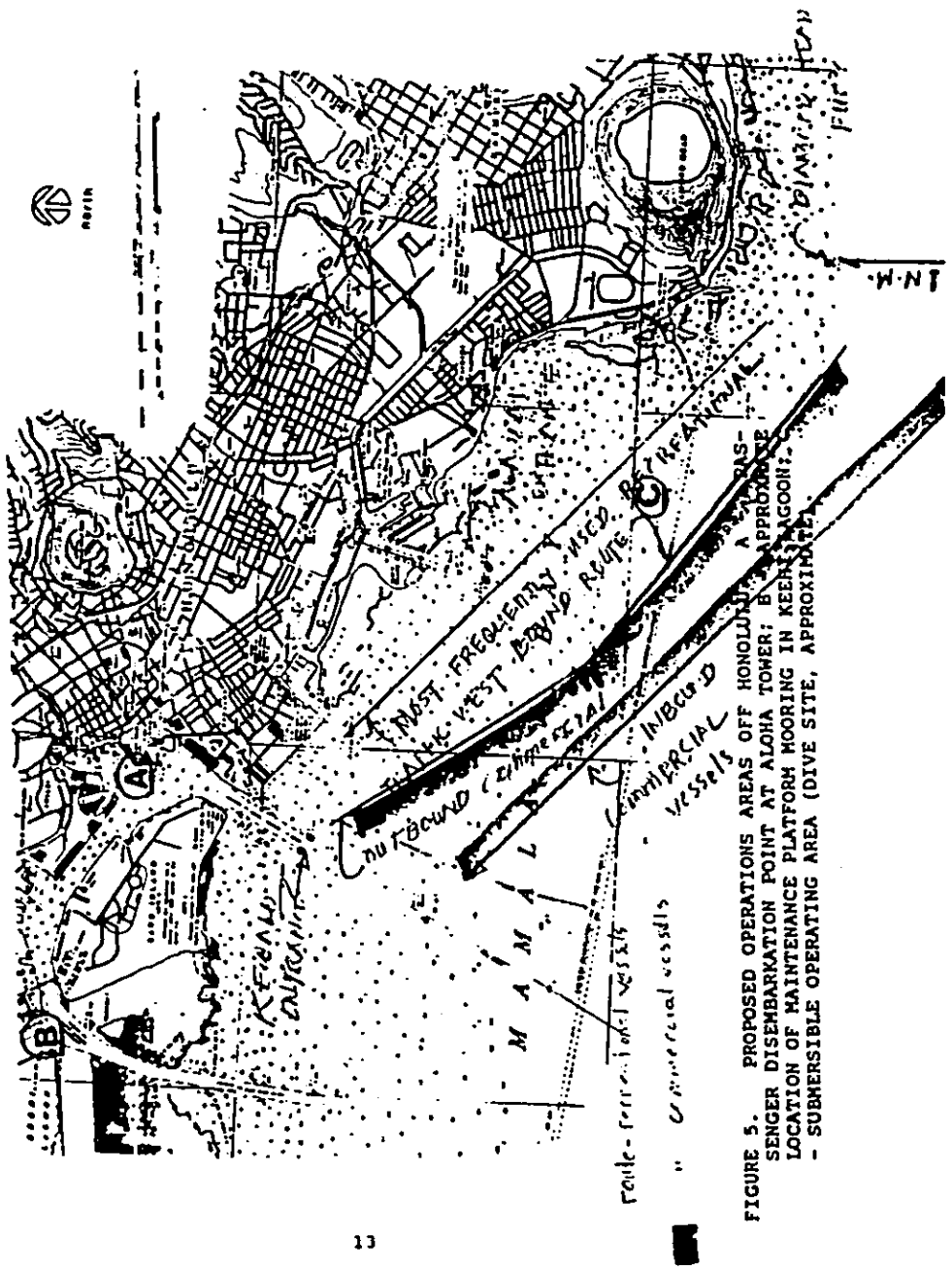

FIGURE 5. PROPOSED OPERATIONS AREAS OFF HONOLULU HARBOR; BASE SENGER DISEMBARKATION POINT AT ALOHA TOWER; BASE LOCATION OF MAINTENANCE PLATFORM MOORING IN KEEHI LAGOON; - SUBMERSIBLE OPERATING AREA (DIVE SITE, APPROXIMATELY

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November 24, 1987

MEMORANDUM

TO: The Honorable William W. Paty, Chairperson
Board of Land and Natural Resources

Attention: Mr. Dean Uchida

FROM: Director of Transportation

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
OPERATION OF SUBMERSIBLES AS A PUBLIC ATTRACTION
IN THE WATERS OFF WAIKIKI, OAHU

Since the proposed operations will be located within an area generally traversed by commercial cruise, private, charter, and other vessels, it is imperative that close coordination be maintained with our Harbors Division regarding the location of the mooring site and type of mooring facility to be installed. In addition, a more detailed plan should be submitted indicating the operator's intent and commitment to ensure safe interaction between the submersibles and other users of the area.

The land-based activities should also be coordinated with that division if the State's harbor facilities are expected to be utilized, in which case a commercial permit will be required. In this regard, the actual site will need to be determined and an evaluation of the traffic circulation and traffic impacts generated by the passenger transfer vehicles must be conducted.

We appreciate this opportunity to provide comments.

Edward Y. Hirata

DT:ko

cc: HAR, STP(dt)

Mr. Eric Guinther, AECOS Inc.

AECOS
970 N. Kalaheo Avenue, Suite A300 • Kailua, Hawaii 96734
Telephone (808) 254-5884

December 12, 1987

State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Attn.: Edward Y. Hirata
Director

Dear Mr. Hirata,

Thank you for providing comments on the draft EIS entitled "Operation of Submersibles as a Public Attraction in the Waters Off Waikiki, Oahu." Your letters dated November 12 and November 24, 1987 provide suggestions which will be considered by Atlantis Submarines, Inc. As you indicate, close coordination with Harbors Division is an essential element in the procedure as comercial permits from Harbors Division are required.

Sincerely,

Eric B. Guinther

cc: DLNR

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 - AREA CODE (808) 955-3111

FRANK F. FASI
MAYOR

DOUGLAS G. GIBB
CHIEF

MARNIE FERMELINA
DEPUTY CHIEF

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STATE OF HAWAII

OUR REFERENCE SS-LK

November 16 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Mr. Dean Uchida

Dear Mr. Paty:

Subject: Draft Environmental Impact Statement (EIS),
Operation of Submersibles as a Public Attraction in the
Waters off Waikiki

We have reviewed the EIS for the above project and offer the following suggestions:

1. Plan and design the boarding area so as to minimize traffic and parking congestion and to insure passenger safety.

2. Work on detailed plans for emergencies and accidents. Communications equipment and procedures for contacting the Coast Guard, fire, police and ambulances are essential.

3. Continue to consult with appropriate agencies on the use patterns of commercial and cruise vessels, fishermen, divers and other ocean users in order to avoid conflicts.

4. Defer operation of the submersibles during evening hours until after a trial period. Darkness may increase the risk of danger or accidents and would require additional lighting, safety and emergency measures.

Thank you for allowing us to comment on the EIS draft.

Sincerely,

DOUGLAS G. GIBB
Chief of Police

By
WARREN FERREIRA
Deputy Chief of Police

cc: Mr. Eric B. Guinther

AECOS
970 N. Kalaheo Avenue, Suite A-900 • Kailua, Hawaii 96734
Telephone (808) 254-5884

November 30, 1987

Police Department
City and County of Honolulu
1455 So. Beretania Street
Honolulu, Hawaii 96814

Attn: Warren Ferreira
Deputy Chief of Police

Dear Mr. Ferreira,

This letter is in response to your suggestions related to the proposed "Operation of Submersibles as a Public Attraction in the Waters off Waikiki" from your review of the draft EIS prepared by AECOS, Inc. for Atlantis Submarines, Inc.

1. The submarine tours are conducted on a reservations system. Initially, there would be no more than 47 passengers at one time boarding for a tour and all would hold reservations purchased prior to the start of the tour. Thus, it should be possible to plan and design the boarding area for efficiency and passenger safety and comfort.

2. Atlantis Submarines will be arranging to meet with appropriate members of your staff, the Honolulu Fire Department, and other agencies concerned with rescue operations at sea, to acquaint you more thoroughly with their operation and to establish procedures for handling emergency situations.

3. Atlantis will continue to maintain contact with other users of the harbor and offshore waters.

4. Atlantis Submarines has over two years of experience in operating both day and night dives at its Caribbean locations. There will be a period of several weeks prior to the start of passenger service for crew training and working out of operational details at the Honolulu site.

Sincerely,

Eric B. Guinther

cc: DLNR

CLASSIC SURFBOARDS
1856 Kalakaua Avenue
Honolulu, Hawaii 96815

Mr. Eric B. Guinther
AECOS Inc.
970 N. Kalaheo Avenue
Suite A 300
Kailua, Hawaii 96734

Dear Mr. Guinther:

Classic Surfboards has become aware of your proposal to provide a submersibles operation as a public attraction in the waters off of Waikiki.

We are interested to know what, if any, impacts you have determined this project will have on the numerous surfing areas along the Waikiki shoreline. Approximately how far from shore will the units travel? Do you have a tentative route map that we could review? How are the units to be propelled? Is there a danger of surfers, divers or swimmers being pulled into the equipment?

The sport of surfing is vital to our State as a recreational outlet, a tourist attraction, and as a viable aspect of our business community. We hope that you will give due consideration to the impact of your proposed operation on this sport, and will inform us of your findings.

If I can be of assistance in the discussion or determination of any areas that might be affected, please feel free to call to arrange a meeting. The number is 941-9621. Thank you.

Sincerely,

Ginny Cabato
Ginny Cabato

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AECOS
970 N. Kalaheo Avenue, Suite A 300 • Kailua, Hawaii 96734
Telephone (808) 254-5884

December 2, 1987

Classic Surfboards
1856 Kalakaua Avenue
Honolulu, Hawaii 96815

Dear Ginny Cabato,

In response to your concerns about the impact of the proposed Atlantis Submarines project off Waikiki, I offer the following:

The dive site will be located between 0.85 and 1 mile offshore of Waikiki Beach in water between 90 and 120 feet deep. The submersibles will travel within the dive area of about 4 acres. Future plans call for a deeper dive site situated a little further offshore in deeper water. Thus, the distances from shore given above represent the closest the submersible would get to the beach during a dive tour. A map of the dive area is presented in the draft EIS for the project (copy of Figure 6, enclosed). The site is far seaward of surfing areas, and the project will have no impact on surfing sites or swimming areas. The submersible is powered by horizontal and vertical thrusters.

Atlantis has talked with various individuals and groups representative of the assortment of recreational interests in the waters off of Waikiki to identify concerns and avoid negative impacts on other users of the area.

Thank you for your response to the request for comments and your offer of assistance in determining if sites are affected.

Sincerely,

Eric B. Guinther

encl: map
cc: DLNR

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU

1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 - AREA CODE (808) 943-3111

FRANK F. FASI
MAYOR

DOUGL-
I

WARR.-
DEP.

OUR REFERENCE SS-LK

November 16 1987

Mr. William W. Paty, Chairman
Board of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Mr. Dean Uchida

Dear Mr. Paty:

Subject: Draft Environmental Impact Statement (EIS),
Operation of Submersibles as a Public Attraction in the
Waters off Waikiki

We have reviewed the EIS for the above project and offer the following suggestions:

1. Plan and design the boarding area so as to minimize traffic and parking congestion and to insure passenger safety.

2. Work on detailed plans for emergencies and accidents. Communications equipment and procedures for contacting the Coast Guard, fire, police and ambulances are essential.

3. Continue to consult with appropriate agencies on the use patterns of commercial and cruise vessels, fishermen, divers and other ocean users in order to avoid conflicts.

4. Defer operation of the submersibles during evening hours until after a trial period. Darkness may increase the risk of danger or accidents and would require additional lighting, safety and emergency measures.

Thank you for allowing us to comment on the EIS draft.

Sincerely,

DOUGLAS G. GIBB
Chief of Police

By Warren Ferreira
WARREN FERREIRA
Deputy Chief of Police

cc: Mr. Eric B. Guinther

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

November 23, 1987
RE:0479

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
Attn: Mr. Dean Uchida
Office of Conservation & Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Paty:

Draft Environmental Impact Statement
Atlantis Submarines, Inc.
(Operation of Submersibles as a Public Attraction
in the Waters Off Waikiki)
Waikiki, Oahu

The Environmental Center has reviewed the above referenced Draft Environmental Impact Statement (EIS) with the assistance of Frans Gerritsen, Ocean Engineering; Steven Dollar, Oceanography; Edwin Murabayashi and Yu Si Fok, Water Resources Research Center; and Jennifer Crummer, Environmental Center. The principal activities of this project include establishment of commercial submarine tours and installation of artificial reef structures and mooring facilities.

In general, the document provides most of the information on which an assessment of the potential environmental impacts of the project can be evaluated. There are a few points, however, which should be analyzed in more detail to assure an environmentally safe operation.

Weather and current conditions

The Draft EIS does not address the operations of the submarine under adverse weather and current conditions and lacks detailed information on current and surge that could affect the loading, unloading, and transport of passengers, as well as the stability of the artificial reef. Though Mamala Bay is considered to be relatively calm, operations under various sea states need to be considered. What are the wave and current conditions under which operations would be cancelled? It is our understanding that currents off of Waikiki can be highly variable. A thorough understanding of the potential current regime is essential to the designs of an adequate mooring system for the barge and submersible and of the artificial reef. A more detailed description of the moorings, including specifics on riser

chain lengths, should be provided so as to assess their stability during storms or in the event of tsunamis. It is important that anchors and riser chains are not dragged into shallow reef areas during high surf periods. While we can assume that the mooring design will hold the submersible and its tender barge under all weather conditions, it must also be sufficient to avoid scouring bottom communities.

There is inadequate discussion of the design specifications for the artificial reef structures in terms of stability under 30, 50, or 100 year storms or tsunami events. Parameters for such estimates are available for most regions in the Hawaiian Islands and should be accounted for in consideration of the expected lifespan of artificial reef structures.

Although the Draft EIS provides some specifications on the design and construction of the submersible, insufficient details are provided to assess safety margins for planned operations. The maximum depth certification is defined and operations are projected to that depth. What is the maximum depth of water of operation and at what depth would the vessel sustain hull damage?

The proposal to operate after dark should be carefully evaluated in terms of passenger safety particularly in embarking and disembarking from the barge and submarine.

Thank you for the opportunity to comment on this document. We look forward to your consideration and response to our comments.

Sincerely,

Jacquelin N. Miller
Associate Environmental Coordinator

cc: OEQC
Eric Guinther, AECOS Inc.
L. Stephen Lau
Frans Gerritsen
Edwin Murabayashi
Yu-Si Fok
Steven Dollar
Jennifer Crummer

AECOS
[illegible] • Kailua, Hawaii 96734

December 1, 1987

University of Hawaii at Manoa
Environmental Center
Crawford 317 - 2550 Campus Road
Honolulu, Hawaii 96822

Attn: Jacquelin N. Miller
Associate Environmental Coordinator

Dear Ms. Miller,

We have reviewed your comments on the draft EIS for Atlantis Submarines, Inc., Operation of Submersibles as a Public Attraction in the Waters Off Waikiki and offer the following:

For operational purposes, a site must be typified by calm seas much of the time because the submarine itself and the process of delivering passengers to the dive site and transferring them to and from the submarine could be constrained by sea conditions. In the absence of operational experience in Hawaiian waters, it cannot be stated at the present time precisely what set of sea conditions will prevent operations. With respect to currents, the submersible can make 3 knots under water. Current velocities over 2 knots would cause a change in operational procedures with respect to approaching the artificial reefs, and currents in excess of 2.5 knots would probably result in discontinuation of dive operations. Atlantis Inc. has started collecting current data from the proposed dive area, because site-specific data do not exist for this area. These data will be used to design the mooring.

Once the artificial reef moves into design phase, a major consideration will be stability under storm surge conditions. Given the planned investment in this structure, it would be imprudent not to make every effort in design and construction to insure structural longevity (development of a diverse biological community on and around the structure is expected to be a slow process). In a commercial situation where harvesting of resources from an artificial reef or Fish Aggregating Device is the intended purpose, it might be possible to make a return on investment in several years such that longevity of the structure is not of primary concern. In the Atlantis Submarine situation, the resource IS the longevity of the structure, and thus must be of primary concern.

The assessment of safety margins for the submersible has been thoroughly addressed by such competent authorities as the U.S. Coast Guard, American Bureau of Shipping, and Lloyds of London, and their certification of the vessel and the Atlantis operating procedures is related in the EIS. Safety margins in the construction and operation of submersibles are understandably conservative. The theoretical depth at which hull damage would be sustained is several times the certification depth.

Thank you for your thoughtful comments on the project. I apologize for not being able to provide more details on the engineering of various aspects of the project as these details are presently being formulated. However, consideration of your concerns will certainly be incorporated into the design process as part of the specifications for such items as the moorings and artificial reefs.

Sincerely,

Eric B. Guinther

cc: DLNR

WAIKIKI NEIGHBORHOOD BOARD NO. 9
c/o NEIGHBORHOOD COMMISSION OFFICE
CITY HALL, 4TH FLOOR
HONOLULU, HAWAII 96813-3014

23 November 1987

Mr. William W. Paty, Chairman
Board of Land & Natural Resources
State of Hawaii
1151 Punchbowl Street
Honolulu, Hawaii 96813

Attn: Mr. Dean Uchida
Office of Conservation & Environmental Affairs

RE: Environmental Impact Statement, Atlantis Submarines, Inc.,
Operation of Submersibles as a Public Attraction in the Waters Off Waikiki

Dear Chairman Paty:

Thank you for the opportunity to review and comment on the subject draft EIS. In lieu of a single official position by the Neighborhood Board as a body, the following individual questions and comments by individual Board members are provided, with copies to the Applicant and the Applicant's agent, AECOS Inc.

1. The relationship between the "permanent mooring" at the dive site and the "passenger transfer platform" requires clarification. (EIS, p. 23). Exactly what will be a permanent (i.e., 24 hrs/day) fixture at the dive site, as opposed to the transfer platform which will return to Keehi Lagoon each night (EIS, p. 12)?

2. The Applicant should address in greater detail the issue of passenger safety involved in the transfer of passengers from the surface shuttle vessel to the transfer platform, and then to the submersible. What data is available on the ocean swells at the dive site which would affect this two-stage passenger transfer? What has been the experience in this regard at the Grand Cayman and Barbados operations by the Applicant?

3. The Waikiki site represents a compromise from an earlier preferred site closer to Honolulu Harbor. This suggests that the Applicant sees problems with the Waikiki site. Uppermost has to be the costly, time-consuming and cumbersome chore of returning each night to Honolulu Harbor for necessary maintenance. It can be anticipated that once the project is in operation, there will be a request to perform this maintenance (including noisy battery recharging) at the dive site, rather than returning to the harbor.

4. Similarly, it can be anticipated that the Applicant will subsequently seek to embark/disembark passengers from a point closer to the dive site, possibly somewhere in the vicinity of Kapiolani Park. To what degree will the proposed operation be used as a "fait accompli" justification for substantial subsequent modifications to the operation, modifications which are not acceptable at this time?

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5. Interference with present recreational activities: once the operation is in place, it cannot help but monopolize the area. Little can be done after the fact.

6. To what extent will the artificial reefs attract fish which will in turn attract sharks? What has been the experience regarding the attraction of sharks in other locations? If sharks are thus attracted to the dive site, how likely are they to venture closer to the shore?

7. This project is an open invitation to other commercialization spilling over into Kapiolani Park.

8. It would be more compatible for a project such as this to be located off of Sea Life Park, so as not to interfere with the present UH submarine activities.

9. Under the Federal Rivers and Harbors Act of 1899, the Corps of Engineers has responsibilities in this project. What are their comments?

10. Why is the project limited to a maximum of 3 submersibles? If the number of submersibles is increased, and the "size of the primary dive area...may need to be expanded" (EIS, pp. 10-11), will another EIS and further permits be required?

11. What is the number, size, location and anchorage of the artificial reefs.

12. The applicant should address in greater detail the disposal and handling of liquid fuel, lubricants, sanitation and sewage.

13. What Coast Guard approvals are required, and what is the status of such approvals?

14. More detailed information is required on the plans for handling emergencies.

15. What is the scope of the "comprehensive insurance coverage through Lloyds of London"? (EIS, p. 7)

16. What is the approximate order of magnitude of the investment? What happens to the permanent moorings and other equipment if the company ceases operations? Are the Applicant's permits assignable to another party at the Applicant's discretion?

For the Waikiki Neighborhood Board

Jack Denton
Chairperson

cc: Atlantis Submarines, Inc, 900 Fort Street Mall, attn: George Asquith
AECOS, Inc., 970 North Kalaheo Avenue, #A100, Kailua 96734, attn: Eric Guinther

AECOS

[illegible] • Kaneohe, Hawaii 96744
[illegible]

November 25, 1987

Waikiki Neighborhood Board No. 9
c/o Neighborhood Commission Office
City Hall, 4th Floor
Honolulu, Hawaii 96813-3014

Attn.: Jack Denton, Chairperson

Dear Mr. Denton and Members of the Board,

On behalf of Atlantis Submarines let me thank you for providing input by way of questions and comments to our draft EIS entitled "The Operation of Submersibles as a Public Attraction in the Waters off Waikiki, Oahu". I will attempt to answer each of the questions posed either directly by this letter or by reference to the appropriate section of the draft EIS. Additionally, where indicated, your comments will be used to modify the draft EIS as we prepare the final EIS for submittal to DLNR.

1. An Army Corps permit application has been filed for a permanent mooring buoy at the dive site (EIS, Figure 10). Army Corps policy requires that when a mooring site involves a platform, even if not a permanent part of the mooring, the buoy and platform must be considered together as a unit for permit purposes. However, the platform will be towed to the site each morning from a mooring in Keehi Lagoon whenever sea conditions require its use to affect safe transfer of passengers between the shuttle boat and the submersible. Without experience in these waters, it cannot now be determined how often the platform will be needed. Potentially, it could be required most operating days.

2. In the Caribbean, passengers are transferred directly to the submersible without a platform. Ocean swells off of Waikiki can be considerably larger than what is normally experienced in the Caribbean. Further, at some of the Atlantis sites in the Caribbean, the dive operation can be moved to another side of the island when swells impinge adversely on the primary dive site. Atlantis anticipates that it can expect a number of days in each year when conducting dive tours will not be possible. Clearly, there will occur sea conditions that will require suspension of operations off Waikiki because of storms, storm surf, or unusually large south swell. Knowledge of sea conditions generally around Oahu have been used to predict that the waters off Waikiki will provide a sufficient number of operating days to insure the venture's success. But the impact on operations of sea conditions is very site specific. Until experience is gained, reference to past data on sea conditions off the leeward coast cannot be used to accurately predict the number of good or bad days expected in any given year.

3. As you point out, the biggest problem with the Waikiki site is the distance to a maintenance area in Keehi Lagoon and passenger embarkation point in Honolulu Harbor. However, a far more cost effective operation would utilize a land-based maintenance facility (buying power from HECO). The applicant will continue to seek a permanent maintenance and mooring area in Honolulu Harbor. The assertion that battery charging is "noisy" is untrue (see EIS, Section E.2). The generator is enclosed in a container (similar to the containers used in transoceanic shipping). On a maintenance barge, this container would be placed below the deck and further sound-proofed to meet OSHA regulations.

4. Atlantis has presented its operations thoroughly and completely in the draft EIS which, in Section G.2, includes potential modifications of operating procedures. On the basis of existing conditions (including recreational uses), water depth, and the absence of docking facilities, there has been no consideration given to embarking/disembarking passengers in the vicinity of Kapiolani Park. Nor would consideration be given to this idea in the future. Existing Honolulu docks capable of handling a shuttle boat (which for safety reasons imposed by the U.S. Coast Guard must have a capacity of twice the number of passengers carried on a dive tour) might be considered as alternatives to the proposed Aloha Tower area. However, any modification in the project as proposed will require consideration by the appropriate State and Federal agencies.

5. Interaction between Atlantis and other potential users of the dive area constituted a primary point of interest at the Land Board hearing held on November 5, 1987. Most of the testimony presented in this regard was positive (favorable to the proposal) and demonstrated that the project would not monopolize the area.

6. Sharks already occur in the waters seaward of the reef off of Waikiki. The site will not attract sharks in the sense of increasing their numbers in these waters. The site is too far offshore to influence shark occurrences inside the reef. The artificial reef will be a research tool (dEIS, p. 56) and not designed or operated to attract sharks.

7. The project is too far from, and in no way involves activities in Kapiolani Park. The project will have no impacts on Kapiolani Park.

8. The waters off Sea Life Park are too rough for too many days of the year for a submersible operation, although water quality would be excellent for a dive tour. The University of Hawaii has no on-going or planned submarine activities at the proposed At-

JOHN WAIHEE
GOVERNOR OF HAWAII

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LINNET A. LANDGRAF
DEPUTY

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P O BOX 621
HONOLULU HAWAII 96809

FILE NO.: OA-5/7/87-2025
180-Day Exp. Date: 2/2/88
(With 90-Day Extension)
DOC. NO.: 1953E

Mr. Eric Guinther
AECOS, Inc.
970 N. Kalaheo Ave., Suite A300
Kailua, Hawaii 96734

Dear Mr. Guinther:

SUBJECT: Draft Environmental Impact Statement (EIS) on the Conservation District Use Application (CDUA) for the Atlantis Submarine Tour Operation Offshore of Waikiki, Hawaii

We have completed our review of the subject document and offer the following:

HISTORIC SITES

As no archaeological resources or significant historic sites have been recorded in the offshore lagoon areas of Oahu, we believe that this project will have "no effect" on significant historic sites.

STATE PARKS

This report acknowledges the potential of the proposed artificial reefs to attract recreational divers and fishermen, but does not address management of possible conflict with the submersible operation. This possibility should be either addressed or noted as an unresolved issue.

CONSERVATION AND RESOURCES ENFORCEMENT

After reviewing the Draft EIS for the underwater submarine tours offshore of Waikiki, Oahu, we find that there will be minimal effect on the operations of the Division of Conservation and Resources Enforcement.

It appears that the Department of Transportation (DOT), Harbors Division, will be more involved with the enforcement of their rules and regulations if the application is approved.

The placement of artificial reefs and shipwrecks to attract various species of marine life in the area of the tour may also attract fishermen to the area. This congregation of marine vessels may pose a problem with safety and boating accidents. This would be a DOT problem.

AQUATIC RESOURCES

The Division of Aquatic Resources has no objection to the concept of the project nor with the means described. The site selected does not appear to displace fishing or scuba diving activities. Construction of the reefs inevitably would destroy some sedentary organisms, but the new reef habitat proposed would improve net productivity. Surrounding public waters may benefit from productivity of new artificial reefs and observation of undersea resources would improve appreciation of people who do not dive or fish.

Reef and wreck components should be fabricated on land as much as possible, to minimize potential for accidental release of construction material into the sea. Objects fabricated with volatile, potentially toxic materials, or treated with preservatives, should be cured or dried before they are placed in the water.

Although the artificial reefs and "wrecks" would be designed, constructed and installed to withstand waves and currents, the responsibility for any cleanup or other restoration which may be necessary as a result of movement of project (artificial reef or "wreck") materials more than 100 yards from their original location, even if by accident or natural forces, should be fixed explicitly to the applicant by condition of approval.

The State should be protected from liability for any accident in the dive area, whether or not persons involved are authorized to be there.

LAND MANAGEMENT

We have no objections provided that the submerged area is not leased exclusively for the Atlantis; others can use the area whether it be divers, fishermen, waters, etc.; and, Atlantis obtains a non-exclusive easement for the mooring of the platform.

We understand that the general method of operation for the proposed Waikiki tour operation will be similar to that which is proposed offshore of Kona. Our general comments on the Kona operation and your response is attached. We again would like to emphasize our concern over the future potential for conflict among competing uses at the artificial reef sites. By their very nature, users who harvest and/or "take" the propagated marine resource (i.e. fishing, spearing, traps, etc.) are directly competing with the interests of viewing users (i.e. dive groups, submersibles, etc). We realize the problems with insuring compatibility among the various users; however, we hope that Atlantis will, as represented in their Kona EIS, continue to work with the various interest groups toward an amenable solution for all.

Finally, we suggest that you keep in close contact with our staff to coordinate prompt responses to comments made on the Draft EIS. Should you have any questions regarding this matter, please feel free to contact Dean Uchida of our Office of Conservation and Environmental Affairs at 548-7837.

Very truly yours,

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

lantis dive site off Waikiki.

9. An application was submitted for a Department of the Army permit. A revised permit has just completed the public notice/public comment phase. I believe the Army Corps does not comment on permit applications while they are being processed, instead reserving its comments until a decision is made on the application.

10. The number of submersibles eventually using the site will depend upon market demand; this is presently projected at three submersibles. If Atlantis determines later that more than three submersibles can be supported, the size of the dive area would need to be enlarged. Enlarging the dive area will require a CDUP and satisfaction of all EIS requirements under HRS Chapt. 343.

11. Preliminary design of the artificial reef is presented in the draft EIS (particularly look at Appendix C). Also consider that the two sunken vessels proposed are artificial reefs. All items, except the "deep" sunken vessel will be placed within the described dive area (see EIS Sections B.3.4 and B.3.5).

12. The submersible is electric powered and sealed to prevent leakage of lubricants. Other aspects of the project using fuel (shuttle boat, maintenance platform) will handle this as does any ship on the water, subject to close scrutiny by the U.S. Coast Guard. These aspects are treated in the EIS (see Section E.1.1), but will be considered further in preparation of the final EIS.

13. The U.S. Coast Guard has been involved in extensive approvals of design, construction, and operating procedures, originally with the St. Thomas (U.S. Virgin Isl.) Atlantis operation. In addition, the Coast Guard dictates safety requirements, crew size and qualifications (on the submersible as well as the shuttle boat), and placement and navigational markings and lights on fixed buoys and moored platforms. The American Bureau of shipping inspects and classifies all of the vessels under their equally demanding and prestigious rules and regulations. All approvals, classifications, and inspections have been completed with the exception of local, site-specific operational matters that will be addressed by the U.S. Coast Guard office in Honolulu during the start-up phase of the operation.

14. The request for emergency procedures has also been made by the Honolulu Police and Fire Departments. Atlantis will be meeting with representatives of these departments, and other agencies in the State involved in rescue and emergency operations, to formalize contingency plans for the Atlantis project.

15. Lloyds of London provides insurance on hull and machinery to full replacement value, and public liability for the operation in the amount of $15 million per vessel.

16. Each submersible costs nearly $3 million to build. Site development costs are also at this order of magnitude. It is likely that DLNR will impose terms providing the Department with discretion in requiring the applicant to remove whatever items it feels constitute a burden to the State as these submerged lands are State-owned lands. It should be noted however, that local fisheries scientists (as well as fishermen) have expressed considerable enthusiasm for the private funding of an artificial reef project in Hawaiian waters (see dEIS p. 18). If the company ceases to operate, the usefulness of the artificial reefs will not diminish.

The idea of assigning the permits to another party has not even been considered by the applicant. Presumably, DLNR would have something to say about this, so it is fair to say this matter would not be at the applicant's discretion.

We trust the above will satisfy at least most of the Board's concerns. We remain available to amplify these responses at your request and answer any additional questions raised by your deliberations. Thank you again for a most thorough review of the draft EIS. Your letter and our response will be incorporated into the Final EIS for the Atlantis project.

Sincerely,

Eric B. Guinther

WAIKIKI RESIDENT S ASSOCIATION

Suite B 4 c 1720 Ala Moana Honolulu, Hi 96815 942-3961

November 22, 1987

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STATE OF HAWAII

Chair William Paty
Dept. Land & Natural Resources
Punchbowl Street
Honolulu, Hi 96813

Dear Chair Paty

At the Waikiki Residents Association meeting of Nov. 16, 1987 there was considerable discussion regarding the pollution of Kuhio and Queen Surf Beach areas. This developed as a result of the story in the Monday, November 16 Advertiser by Terry Lawhead entitled Water off Oahu causing infection.

Having been a victim of staph infection in my leg which required injections of penicillin and a brief stay in Kaiser Hospital I am very concerned in this connection.

Regarding the Atlantis Submarines's Conservation Use Application No. OA-5/7/88 - 2025, the Residents Association does wish to register its concern over beach pollution caused by nutrients of providing food for fish&(a build up in the Queen Surf area). We would like to see this issue resolved before a permit is granted to the Atlantis Submarines.

Thank you for considering this issue confronting the Land Board and our Association.

Sincerely yours

Georgia E. Miller

President Waikiki Residents Association

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DLNR
OCEA

AECOS

970 N. Kalaheo Avenue, Suite A301 • Kailua, Hawaii 96734
Telephone (808) 261-3861

December 2, 1987

Waikiki Residents Association
Suite B 4 C
1720 Ala Moana
Honolulu, Hawaii 96815

Attn: Georgia E. Miller, President

Dear Georgia,

In response to your letter voicing concern that the proposed submersible tour operation of Atlantis Submarines off Waikiki might adversely impact water quality, permit me to provide the following information. The artificial reefs will be designed, constructed, and utilized without causing adverse impacts on water quality at the dive site. This site is located over 0.8 mile offshore and in water greater than 90 feet deep. Any effect of the operation on water quality parameters which is in compliance with State Water Quality regulations, would not be measurable at the beach. Thank you for providing input to the EIS.

Sincerely,

Eric B. Guinther

cc: DLNR

APPENDIX B

Biological Assessment of a Site Proposed for Habitat Enhancement Offshore of Waikiki, Oahu.

Section 1. Introductory Information

By
Dr. Richard E. Brock
Environmental Assessment Co.
1804 Paula Drive
Honolulu, Hawaii 96816

September, 1987

PREFACE AND STATEMENT OF PURPOSE

This report has been assembled in response to a permit application to develop and deploy an artificial reef in the nearshore waters offshore of Waikiki, Oahu as a submarine dive tour destination. This document addresses the general question of "what impact(s) does the deployment of a high tech artificial reef have on the surrounding fishery resources of a given locality?" To answer this question, I draw on information being generated by my ongoing research and that of others; thus conclusions are based on less than a full complement of data and the reader should recognize this shortcoming at the onset. I only address the question of local enhancement of fish resources; nowhere in the recommended designs do I consider any liability that could be incurred in building, deploying or utilizing these proposed structures underwater. I have left such considerations to others.

Much of the introductory information given below has appeared under my authorship in the scientific and popular literature. These sources include Brock and Buckley (1984), Brock et al. (1985) and Brock and Norris (1986). Other literature sources that provide general information on designed artificial reefs includes Mottet (1985), Grove and Sonu (1985) and D'Itri (1985).

This section first presents some general information on how coral reefs function, then covers degradative forces that act on natural reefs and introduces the concept of artificial reefs as mitigative tools to this degradation. A short description of Japanese artificial reef technology is given and is followed by an outline of artificial reef development in Hawaii. I conclude this section with a discussion of the impact of artificial reefs on natural reef communities; this discussion draws on the information presented above.

INTRODUCTION

Coral reefs have attracted the attention of researchers since the time of Darwin yet quantitative studies of reef structure and function have appeared in the literature only in the last 30 years. World reef fisheries potential have been estimated at 6 x 10^9 kg/yr (Smith 1978). This amounts to about 9 percent of the world's total fisheries landings. The importance of coral reef fisheries is particularly evident in many tropical insular areas where reefs supply much of the protein consumed; and due to the labor intensive methods of harvest, the fisheries may employ

a large segment of the population. However, many of these fisheries are declining (Saila and Roedel 1979, Johannes 1981).

Declines in coral reef fisheries are due to a multitude of factors including overfishing, pollution and the dredging and infilling of reefs. Many aspects of these changes are beyond the scope of this report (e.g., the impact of western values and cash economy on tropical insular cultures or damage to reefs due to storms and will not be pursued here. Irrespective of the causal factor, man and his activities are responsible for many declines in reef fisheries.

Hawaiian coral reefs have suffered numerous perturbations including nutrient loading and pollution, runoff, infilling of shallow nursery grounds, dredging of harbors, and the introduction of exotic species. Population growth and technology have allowed high fishing pressure to occur, and have given the fisherman the capability to effectively exploit many coral reef fish species through their entire vertical range. In recent years the number of commercial and recreational fishermen have increased markedly as manifested through the number of registered vessels (Figure 1). Reported landings from the Hawaiian inshore and deep handline fisheries decreased through the 1950s to a low point in the 1960s but have since increased slightly (Figure 2). This recent increase may be due to greater effort (i.e., more individuals becoming involved in the fishery), however, the catch per licensed commercial fisherman is down (Figure 2), suggesting that inshore stocks are declining.

One of the trends apparent in Hawaii is the increasing utilization of inshore fishery resources by recreationally oriented users. Not only does the increasing number of registered vessels suggest a larger recreational sector (Figure 2) but recent economic studies of local marine enterprise (e.g., Van Poolen and Obara 1984, Miller 1984, Markrich 1984, 1986a, 1986b, Samples 1986) confirm that recreational and nonconsumptive uses of inshore fishery resources are of greater value than traditional commercial exploitation. A recent study conducted by the NMFS (Honolulu Laboratory) concluded that Hawaiian recreational fishing produces some 4545 metric tons of fish per year. The value of this mixed (i.e., inshore and pelagic) fishery is estimated at $239 million.

Traditional methods of management in Hawaii disappeared long ago (Titcomb 1952; Kosaki 1954). Applying modern management techniques to these fisheries is difficult; catch and effort data are lacking and the multitude of species exploited complicates the matter. As a result inshore fisheries in Hawaii and many other geographical localities are stagnant or diminishing (Johannes 1978). There are numerous problems to the rational manage-

ment of these resources and a much better understanding of coral reef ecosystems is needed if they are to remain viable in the present cultural context (Bevan et al. 1979, Johannes 1981).

Yields of finfish from reef ecosystems have been summarized (Stevenson and Marshall 1974; Munro 1978, Stevenson 1979, Brock et al. 1979) and range from 2 to about 4.5 tons/km^2/yr. Localized and intensive gleaning on American Samoan reefs yield up to 27 tons/km^2/yr (Wass, in preparation). Such high yields are not representative of production over large areas for they do not include adjacent deeper waters from which there is considerable recruitment and little fishing.

Coral reefs function as relatively closed systems and thus in the pristine situation may represent the accumulation of carbon over a considerable period of time (Johannes et al. 1972). Much of this is tied up in the living biomass of the reef of which fishes are only a part. Goldman and Talbot (1975) have suggested that a reasonable maximum biomass of coral reef fish is approximately 2,000 kg/ha. Space and cover are important agents governing the distribution of coral reef fishes (Sale 1977). Similarly the standing crop of fishes on a reef is correlated with the degree of vertical relief of the substratum. Thus Brock (1954) using visual techniques on Hawaiian reefs estimated the standing crop of fishes to range from 40 kg/ha on sand flats to a maximum of 1,860 kg/ha in an area of considerable vertical relief.

The large variation seen in standing crop of fishes on coral reefs is tied to the structural diversity of the habitat (Risk 1972). If structural diversity, hence fish biomass, are low in a given locality, the addition of structural relief in the form of artificial reefs usually results in an increase in the biomass of fish. Construction of artificial reefs may be viewed as attempts to replicate naturally productive habitats in relatively unproductive locations. Artificial reefs lead to an increase in the amount of productive habitat in both temperate and tropical marine communities. It has been proven that this technology provides more fish and artificial structures have been used by Japan, the United States, and other fishing nations for more than 200 years (Sheehy 1982a). Historical accounts and literature reviews concerning the development of artificial reefs in Japan and the United States are covered elsewhere (Iwasaki 1973, Steimle and Stone 1973, Stanton 1985).

Until recently the technology of artificial reefs in the U.S. utilized scrap materials that were often indiscriminately dumped at sea. In many cases the primary justification for artificial reef construction was perceived and promoted as the disposal of wastes rather than as a resource enhancement tool

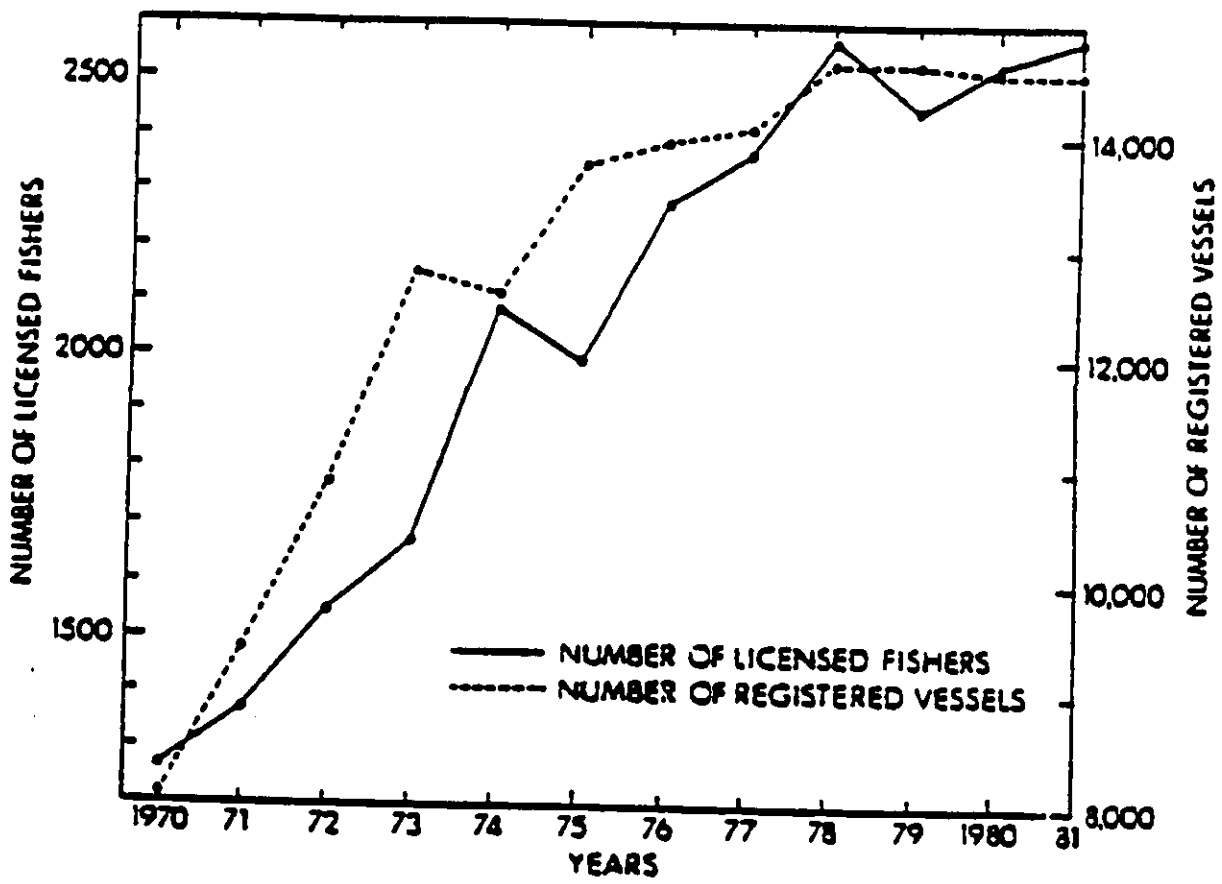

Figure 1. The number of licensed commercial fishermen in Hawaii since 1970. The number of recreational and part-time commercial fishermen is unknown but may be inferred by the number of registered vessels in the state since 1970. (Data from Department of Planning and Economic Development 1982; figure from Brock and Buckley 1982).

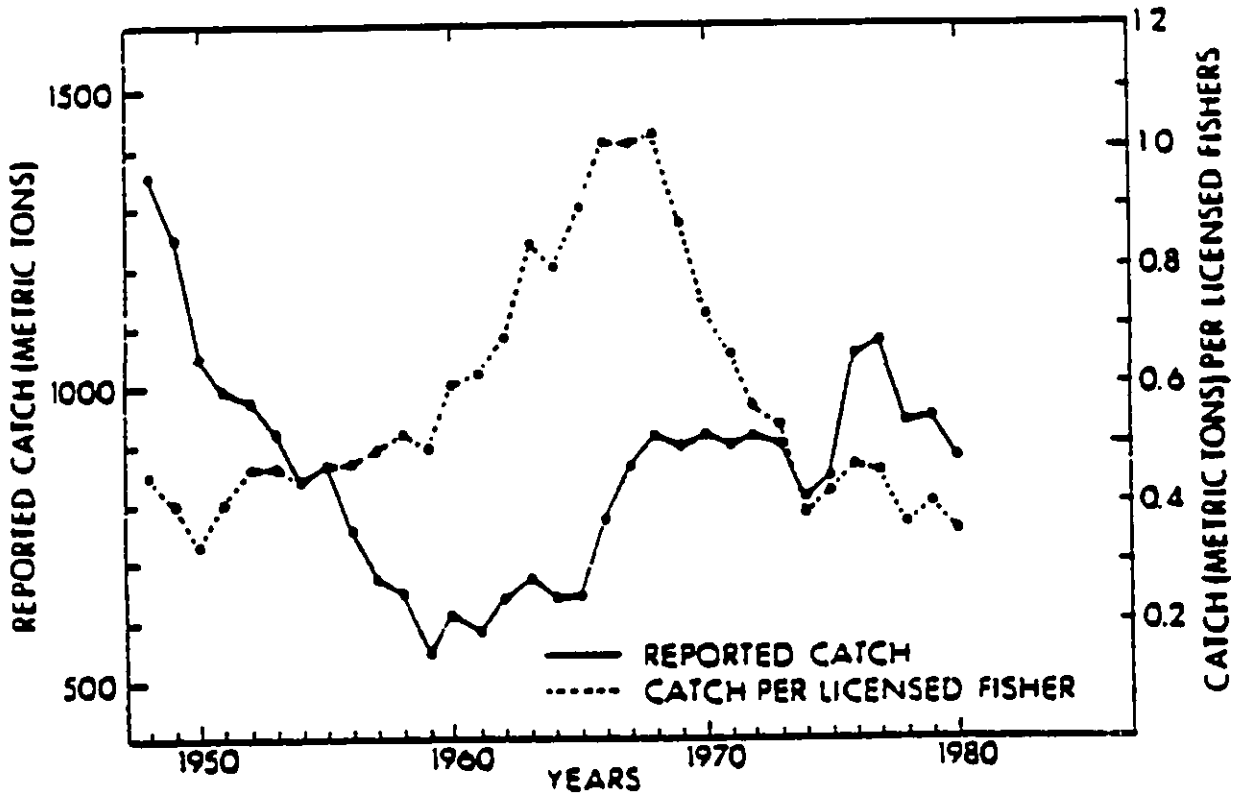

Figure 2. Reported catch (metric tons) from the inshore and deep handline fisheries of Hawaii 1948-80. Also shown is the catch per licensed fisherman over the same period. (Catch data from the Hawaii Division of Aquatic Resources; figure from Brock and Buckley 1982).

(Buckley 1982). Reefs thus built provided some habitat improvement and increased fishery yields in otherwise barren areas, but the shapes, size, long-term physical stability, and biological productivity afforded by use of such materials are less than ideal (Sheehy 1982b). Clearly, artificial reefs have a secondary capacity to recycle specific types of solid wastes under ecologically acceptable and resource beneficial conditions, but this habitat enhancement technology is primarily a valid fishery management technique for marine waters which combines benefits of increased resource production and efficiently targets fishing locations (See also Brock et al. 1985).

ARTIFICIAL REEEFS IN JAPAN

Japan is a nation heavily dependent on the sea for food production and has historically sought ways to improve its fisheries. These efforts have resulted in fishing and aquaculture industries which rank the highest in the world in terms of value and governmental support (Mottet 1985). The Japanese government instituted a national coastal fisheries program in response to the 1973 oil crisis, the growing impact of the 200-mile extended jurisdiction statutes, and to development-related coastal environmental degradation. Since 1976 artificial reef programs in Japan have received federal subsidies of about $100 million per year (Nakamura 1985). The investment in artificial reef research and development is projected to develop 5 percent of Japan's coastal waters into fishing zones with the placement of reefs at 2,500 sites. These reefs are expected to yield 4.8 million tons of fishery products annually (Mottet 1985). This large undertaking by the government, universities, and private industry has resulted in dramatic new developments in reef module designs.

Modern modules used in Japanese artificial reef structures are engineered for stability, durability, and economy, and they are designed for biological effectiveness. Chambered structures that increase the complexity of the local habitat emphasize vertical relief for the attraction of fish. Artificial reefs built with chambered structures have proportionally more void space (70 to 98 percent) relative to exposed surface area permitting the construction of large module units with a minimum of material. Many chambered designs are usually placed in deeper, more protected environments because they lack stability characteristics for use in high energy environments.

Among the more intriguing designs for chambered structures are those built of fiberglass reinforced plastic (FRP modules). Many of these are made of bands of fiberglass woven into cylinders that typically may be 1.5 x 7 m in dimensions. Cylinders are strapped together forming reef modules. Concrete poured

into the base lends stability to the unit and the entire module is assembled on land, then floated and towed to the artificial reef site, and deployed with reusable air lift bags. Fiberglass reinforced plastic is expensive, however its strength permits the building of large units that are relatively inexpensive to deploy (Mottet 1985).

One of the most popular module designs in Japan are concrete "dice blocks." These are open framework cubes made of concrete; they have considerable void space. Their simplicity in design makes them easy to construct and their weight lends high stability to the design. Dice blocks are popular and are used in many artificial reefs; they were among the first designs to be sanctioned by the government (Mottet 1985). Government approved designs must meet a number of criteria: 30 year life expectancy, reasonable cost, non-polluting, biological effectiveness and low breakage rate on deployment. Dice blocks have been used in government sponsored reefs since 1954.

Studies conducted in Japan on the effectiveness of artificial reefs show that catches range from 0.2 to 113 kg/m^3 of enclosed space (Miyazaki and Sawada 1978). Small 1 to 2 m^3 chamber modules average about 20 kg/m^3 (Mottet 1985). Sato (1985) calculated that a break even yield on Japanese artificial reefs is about 12 kg/m^3 (this is with many assumptions). Catches will vary on reefs according to fishing strategy (Mottet 1985), module design utilized, management techniques employed and obviously by the fauna (temperate or tropical).

It is not known whether the Japanese research efforts have been adequate to justify the large scale marine enhancement program undertaken by them or that these efforts will be able to predict any long-term ecosystem effects of such an endeavor (Nakamura 1985). The fact that these projects are funded suggests that Japan is determined to increase its own fisheries production so that it will have less dependence on the fishery resources in the 200-mile economic zones of other nations (Mottet 1985). In any case, Japan's concentration on utilizing a variety of designed and fabricated artificial reef modules in preference to dumping less effective and less stable scrap materials has resulted in a wealth of information of considerable potential for application in U.S. fisheries (Sheehy 1982a). The current transfer of this technology into the U.S. through the National Marine Fisheries Service Saltonstall-Kennedy Fishery Development grant program has led to successful demonstration projects using Japanese FRP modules off Florida (Sheehy 1982b) and Hawaii, and concrete dice block in Hawaii (Brock and Norris 1986).

EARLY ARTIFICIAL REEFS IN HAWAII

In response to declining inshore fishery resources the Hawaii Division of Aquatic Resources (formerly Division of Fish and Game) undertook preliminary artificial reef studies in 1957. These studies suggested that a reasonable increase in the standing crop of fishes could be achieved by the placement of artificial shelters in otherwise barren habitats. Subsequently, three areas around Oahu and one on Maui were designated as artificial reef sites and scrap materials were used in the construction of artificial reefs at these sites (Kanayama and Onizuka 1973).

On Oahu the Maunalua Bay Artificial Reef was initiated in 1961. During a 12-year period this reef received almost 1,600 stripped car bodies and 2,116 metric tons of damaged concrete pipe placed at depths from 25 to 30 m. The Waianae Artificial Reef off leeward Oahu was started in 1963 and over the next 9 years received 94 car bodies, 3,802 metric tons of concrete pipe, about 100 cement-filled tires, and a 52 m barge (623 metric tons). In 1982 a 50 m ship was scuttled at the site. These materials were dropped in waters from 9 to 37 m in depth. Recent SCUBA surveys at the Waianae and Maunalua Bay sites show that many of the concrete pipes have been widely dispersed due to currents and wave action. The Kualoa Artificial Reef is located in a 4.1 km band paralleling the shore at Kaaawa, Oahu, in water from 18 to 30 m in depth. This reef was established in 1972 with dumping of 342 car bodies. Surveys conducted 6 months after deployment showed that the car bodies had disappeared into deeper waters probably due to strong currents (Kanayama and Onizuka, 1973). The artificial reef off Maui was established in August 1962 with the placement of 150 car bodies in 24 to 26 m of water at Keawakapu. Neither the Kualoa or Keawakapu artificial reef sites have received any additional reef materials; thus only two of the sanctioned sites are in regular use today.

Assessment of Hawaiian artificial reefs was made by Kanayama and Onizuka (1973) and McVey (1971). The enhancement effects as measured by the increase in biomass of fish present following reef deployment showed large increases; Kanayama and Onizuka (1973) found a mean increase in standing crop from 10.9 to 110.7 kg/ha. At Maunalua Bay pre-deployment inventories noted a standing crop of 7 kg/ha. Following reef deployment the biomass was 154 kg/ha. Brock (unpublished) sampled the scattered concrete pipes at the Maunalua Bay site in 1986 and found a standing crop of fishes of 240 kg/ha suggesting a long-term stability to the enhancement. However, only a very small part of the original reef remained; additionally, not all of the biomass measured in these studies is made up of desirable or culturally acceptable species; Brock (unpublished) noted in his study that only 20 percent of the standing crop were species of commercial or rec-

reational importance.

These early efforts at establishing artificial reefs in Hawaii used the technology then available as did other reef programs in the U.S. Initially these reefs worked well, but over a long period of time they have proved to be relatively poor fish attractants because of the common practice of using unmodified scrap materials (here car bodies and concrete pipe) that are just dumped at sea.

The resulting reefs have had low profiles, little refuge space, poor stability characteristics (pipes roll and crush benthic organisms), and short life expectancies. If they remain in one location, car bodies usually corrode away in 3 to 5 years (Shepard 1974). The lack of stability in the materials used means that benthic communities which serve as a food source to many fish cannot become permanently established. The lack of refuge space provided by the materials used allows spear and net fishermen to overexploit resident fishes; the absence of adequate topographical relief, translates into less than maximal enhancement.

RECENT ARTIFICIAL REEF ACTIVITIES IN HAWAII

The State Division of Aquatic Resources (DAR) has in recent years developed a multifaceted program for the enhancement of inshore fisheries; artificial reefs are a major part of their program. Other aspects include improvement of fishery regulat ions, better enforcement, and updating the State Fishery Development Plan. The State artificial reef program continues to deploy materials of opportunity in two sites, Maunalua Bay and Pokai Bay. Recent deployments include surplus barges and experimental deployments of midwater fish attractors. In 1986 the state legislature appropriated funds for the development of a new artificial reef offshore of Ewa Beach. This reef is to be constructed of boulders from sugar cane fields and possible graded concrete rubble from the demolition of buildings. The approved site is in 50 to 80 m of water thus the reef will target bottomfish.

Only in the last 5 or 6 years have western fishery biologists become aware of the artificial reef technology developed in Japan over the last 50 years. About 1982 preliminary studies on the feasibility of transferring the Japanese technology commenced in Hawaii with projects carried out by three agencies, the NMFS, the State DAR and the University of Hawaii.

The NMFS is exploring the direct transfer of Japanese technology by utilizing an artificial reef module designed and fab-

ricated in Japan. The design chosen is the fiberglass reinforced plastic (FRP) module; a single unit was purchased in Japan (at a cost of about $10,000) and was deployed in 117 m of water on Penguin Bank in October 1985. The reef has been monitored by Dr. J. Polovina using a submarine; in the May 1986 survey he found 17 species of fish on the reef (Honolulu Star Bulletin, 28 August 1986). No standing crop estimates are presently available but photographs taken from the submarine suggest that the module is providing appropriate habitat for adult fishes.

The State DAR initiated a program to produce a low cost, highly stable module design in 1985. This design utilizes 6 to 8 scrap automobile tires placed side by side forming a tunnel which is embedded in a concrete base (6'x 2'x 1'). Approximately 20 units were deployed in the Maunalua Bay site at a depth of 20 m in September 1985. Brock (unpublished) sampled these modules in March 1986 using visual census techniques and found a mean standing crop of fish at 61 g/m^2. A second drop of about 35 modules was made at the same location in mid-1986; we have no fishery enhancement data from this expanded reef. The DAR must have sufficient information on the effectiveness of the design for they have embarked on an ambitious program of building, stockpiling and deploying these modules in Oahu locations.

The University of Hawaii artificial reef research program commenced in 1983 with state funding to make a preliminary assessment of the feasibility of transferring Japanese artificial reef technology to Hawaiian reef habitats. The preliminary results were encouraging and further funding was made available through federal sources. These monies were used to design, build, deploy and monitor a small experimental Japanese style artificial reef. An open framework steel reinforced concrete cube module design was selected in this study. The design was modified from the Japanese dice block; modules were designed (1) to remain stable in high energy environmental conditions which are prevalent in Hawaiian waters, (2) to meet the biological requirements for the enhancement of a wide range of local fishes and (3) to appropriately interface with prevailing fishing techniques. Modules were 1.2m on a side and weighed up to 1140 kg (there were 3 minor design variations).

Forty-two modules were deployed in September 1985 in the Maunalua Bay Artificial Reef site. Once deployed the modules were assembled on the bottom into a reef covering 60 m^2 and enclosing a bulk volume of 70 m^3 Over the first 10 months the fish community on the experimental artificial reef attained a maximum standing crop of 2700 g/m^2 with persistent heavy fishing pressure commencing after the first 180 days following deployment, the reef has maintained a standing crop of 1400 g/m^2 or a biomass about 7 times greater than the most productive

natural reefs. Fully 85 percent of this standing crop is comprised of commercially valuable fish species in sizes appropriate for market. By contrast in a nearby natural reef control area, the mean biomass of fish during this period of time has been 53 g/m^2. Prior to reef deployment the mean standing crop of fish at the deployment site was 61 g/m^2.

Besides the local enhancement of adult stocks, the experimental reef has been the site of enhanced juvenile fish recruitment relative to adjacent natural reef area. Recruitment rates to the artificial reef have been several times greater than on natural surrounding reefs but many of these newly recruited juveniles have rapidly disappeared presumably due to intense predation by resident adults because of the lack of adequate shelter and refuge space for the juveniles. It should be remembered that this reef was designed and built to target adult fish and not juveniles.

HOW ARTIFICIAL REEFS WORK

As stated previously artificial reefs may be viewed as attempts to replicate naturally productive habitats in relatively unproductive locations. The use of artificial reefs then is predicated on the premise that their deployment leads to an increase in the amount of productive habitat. Given that their deployment usually results in dramatic local increases in fishery resources, dogma states that artificial reefs "work."

A major issue to persist from early applications of artificial reef enhancement to more recent projects has centered around the question of whether the reefs add to the production of fish resources, or simply aggregate stocks from surrounding areas. A number of studies suggests that artificial reefs do both as an integral part of fishery enhancement (Ogawa 1979, Stone et al. 1979, Buckley 1982, Buckley and Hueckel 1985). The current status of the question was well summarized by Sheehy (1982a, p. vi): "Although most American reef researchers continue to debate whether artificial reefs actually increase productivity or merely attract and concentrate organisms from surrounding areas, Japanese scientists generally have little doubt that artificial reefs when properly designed, sited, and placed, can be used to increase the production of desired species."

The production versus aggregation question can be examined using the data from the concrete cube open framework module reef in Maunalua Bay. Within 180 days this reef had attained a standing crop about 14 times greater than most productive natural reefs known to man. Most of the fishes on the reef were adults or subadults. Clearly the reef during this period was aggregat-

ing fishes that came from elsewhere. Through data collected from weekly visual censuses there was no evidence to suggest that the experimental reef had drawn any fish from the nearby natural control reef; recruits had come from elsewhere. The resident fishes to the newly constructed reef appeared to have considerable site fidelity suggesting that the reef was providing necessary shelter and the surrounding "open" substratum (i.e., with low coral coverage) served as appropriate forage grounds for the fishes. This period of exponential growth in biomass is probably caused by the immigration of itinerant individual fishes. This suggests for many inshore fish species that, as adults are considered as sedentary, may have some proportion of their population that is constantly migratory seeking appropriate habitat. Thus the addition of habitat may serve to locally increase the carrying capacity of the environment.

The phase of rapid growth in the Maunalua Bay experimental artificial reef fish community was arrested when fishermen "discovered" the reef and commenced fishing it. Popularity of the reef as a productive fishing location grew and by 200 days after deployment fishermen were using traps, spears, nets and "Clorox" to make their catches. The impact of fishermen has manifested itself with a lower overall standing crop of fishes on the experimental reef but it has been maintained at a level about 5 to 7 times greater than the most productive natural reefs. The above information suggests that appropriate shelter is limiting in the vincity of the reef and that forage grounds for many of the species may be sufficient.

The Maunalua Bay experimental open framework concrete cube reef was deployed in September 1985 thus the fish community of the reef is in the preliminary stages of succession. Studies of Hawaiian artificial reef fish communities (Kanayama and Onizuka 1973, McVey 1971) have shown that these preliminary successional stages are characterized by a rapid growth in biomass. Obviously recently deployed reef materials do not provide the food resource base needed to support the recruiting fishes; it merely serves as a source of shelter for fishes that must feed elsewhere.

Published information on Japanese reefs (e.g., Sato 1985) show a similar fish community response (e.g. rapid increase in biomass) to deployed materials (Figure 3). Japanese researchers note first a period of exponential growth, an asymptote, and then a slow delcine to a point 5 to 15 years after deployment where the fish community rapidly declines and eventually levels off at a point similar to productive coral reef fish communities (see Figure 3). The standing crop in the latter phase suggests that the artificial reef may be self-supporting; prior to this point it probably is not. Thus considerable time is needed for artificial reefs (or any man-made object deployed in shallow waters)

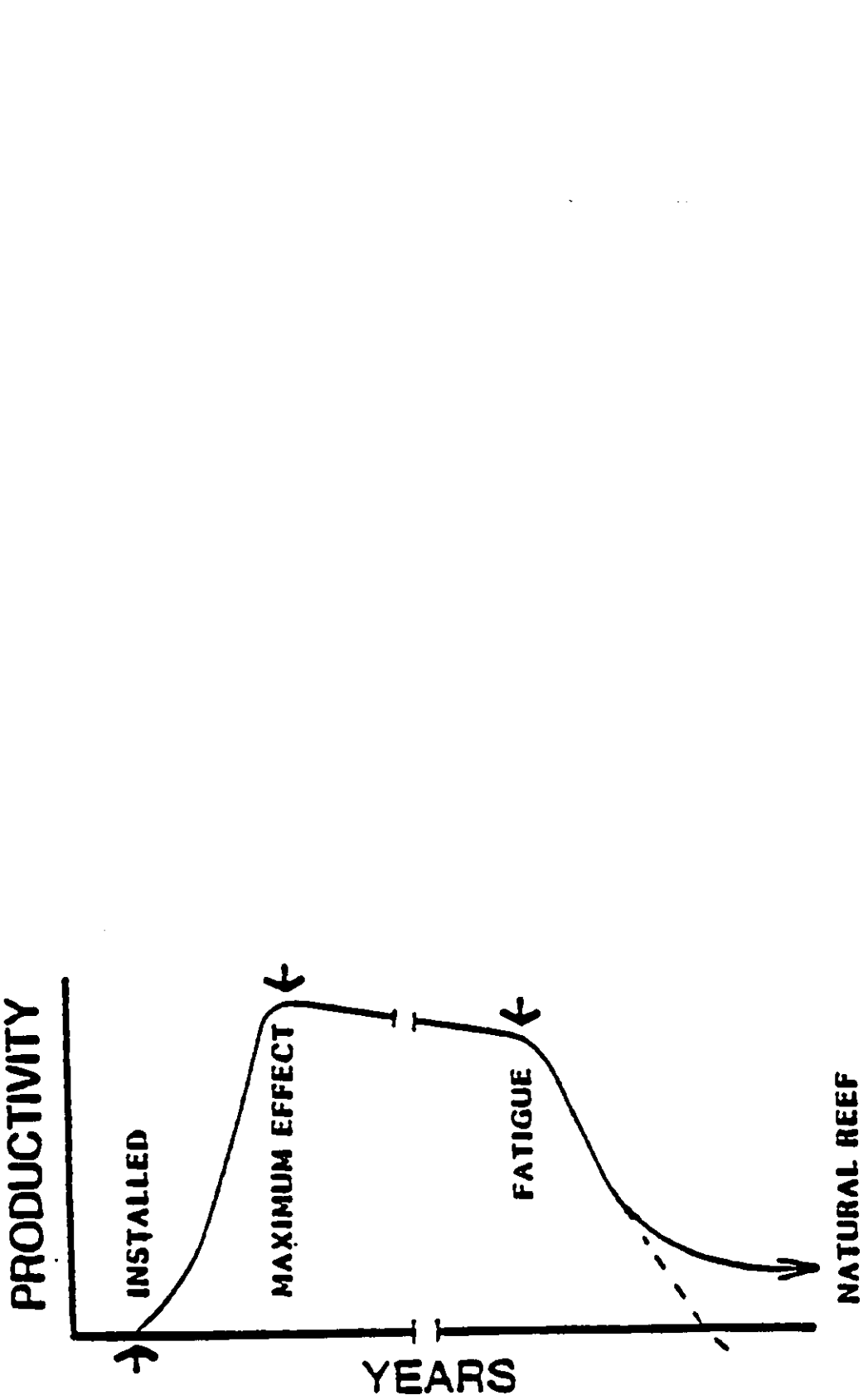

Figure 3. Hypothetical life cycle of an artificial reef (from Sato 1985).

to develop the complexity of food webs needed to support a given standing crop of fish. Nowhere, however, have researchers quantitatively documented these changes probably because the cycle takes 20 or more years to complete.

The qualitative observation that an artificial reef takes years to attain self-sufficiency suggests that prior to that time, the reef only aggregates fish and does not contribute to the overall productivity of the area. This argument is not correct. The deployment of an artificial reef which provides shelter in an area of low cover allows immigrant adult fish to more fully exploit food resources in the area surrounding the reef. The immigration of these fishes from areas removed from the artificial reef allows other fish to take up residence in the previously vacated sites. If this scenario is correct, then appropriate shelter rather than food resources may be the limit ing resource for many Hawaiian reef fish communities. If correct, the addition of shelter in the form of reefs will increase the productivity of an area.

In summary, there is circumstantial evidence to suggest that if properly sited, artificial reefs do enhance local fishery stocks. This enhancement occurs because these systems are probably shelter limited rather than food limited.

APPENDIX C

Biological Assessment of a Site Proposed for Habitat Enhancement Offshore of Waikiki, Oahu.

Section 2. Proposed Reef Design

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INTRODUCTION

This section presents some design options for the artificial reef proposed for deployment offshore of Waikiki, Oahu. The objective of this construction is to locally enhance the fish resources for viewing by submarine.

Initially this section describes the types of materials to be used in the construction of reefs and the rationale for their use. We then discuss the design of modules to be built and the uses of materials of opportunity that will be utilized; the deployment of these materials and subsequent underwater reef construction are next covered. This section concludes with a discussion of reef maintenance and the possible recovery of deployed materials in the event this must occur.

We propose that a number of different materials be used in developing the proposed artificial reef. These materials include flowable concrete for the construction of open framework concrete cube modules or "dice blocks", surplus concrete sheets and piles, surplus vessels and possibly aircraft.

Ideally the materials to be utilized in the construction of the proposed artificial reef will conform to several basic criteria. Materials must be stable in the high energy habitats characteristic of nearshore Hawaiian waters. This can be achieved either by using materials with a high mass to volume ratio or by specifically designing reefs that produce low drag coefficients. The most effective design employs both; concrete used in the "dice blocks" and surplus "spandex" and piles proposed for use in the "high tech" reef are both heavy and are designed to produce low drag. By design, ships and planes present surfaces that should not produce high drag underwater - if they are oriented properly, i.e., "head first" into the prevailing surge. These objects, however have a lower mass to volume ratio and will be most stable in deeper habitats. Materials should also be chemically inert underwater in order to increase their life expectancy. Again concrete meets this criterion well, however the service life of metals used in ships and planes will be reduced over the years as a result of corrosion and electrolytic reactions. This degradation depends on the thickness and types of metals used as well as the degree of biofouling the reef experiences. The life expectancy of such a reef can be increased by utilizing vessels that have been constructed of a thick metal, preferrably of one single grade of steel. Materials selected for reefs must also be non-polluting; vessels will be cleaned of all

petroleum products, toxic paints and plastics, etc. Finally, reef surfaces should not inhibit the growth of corals, algae and other benthic organisms. Concrete and metal are ideal in this respect.

The design of each of the reef proposed for deployment is as follows. This so-called "high tech" reef will utilize the basic open framework concrete cube module design. Each module (cube) measures a minimum of 1.5 m on a side. Modules will be assembled to form reef sets and reef sets will be grouped to form the overall reef. Figure 1 is a sketch of a single reef set comprised of 36 modules. Within a set, these modules will be placed about 45 cm apart, yielding a larger reef at no added expense. The set is 3 modules high (4.6 m); three rows of eight modules form the basal layer on which are centered two rows of 5 modules each that make up the second layer. Twenty of the bottom layer modules will be outfitted with horizontally placed concrete "shelves" that are situated opposite the center horizontal module crossmember. Five of the ten modules on the second layer will similarly be outfitted with these shelves. The reef is topped with two modules that are centered on the second layer. An alternative method is to pour all 36 modules in a reef set as a single unit. Construction on land would be more difficult but subsequent deployment and undersea building would be simplified. A single reef set (36 modules) will have an enclosed bulk volume of about 186 m^3 At a minimum one would need three such reef sets spaced no more than about 10m apart. This minimum design would be most effective within an area off limits to any fishing activity.

Figure 2 depicts 7 such reef sets deployed in a linear fashion across the bottom; seven sets is a reasonable maximum. As defined, four sets are in one row each spaced end on end about 6 m from each other. The linear arrangement will allow the passengers greater viewing time as the submersible moves along. The first group (most shallow) of four reef sets is about 61 meters in length. The overall orientation of the reef should be perpendicular to shore so that impinging storm waves would impact the smaller cross sectional areas presented by the ends of the reef sets. The two groups will be connected (from the fish's perspective) by a section of limited low cover which would not exceed 45 cm in height. This cover will be created by surplus concrete "planks" or "spandex." Spandex usually comes in 10 to 20 cm thick pieces 0.6 m to 1.2 m x 3 m in dimensions; damaged or reject sheets should be quite inexpensive. Prior to deployment of the spandex, surplus reject) concrete piles (30 cm diameter with varying lengths) will be scattered through the area and the spandex placed on top. The pilings will keep the spandex off of the substrate and provide shelter for fishes.

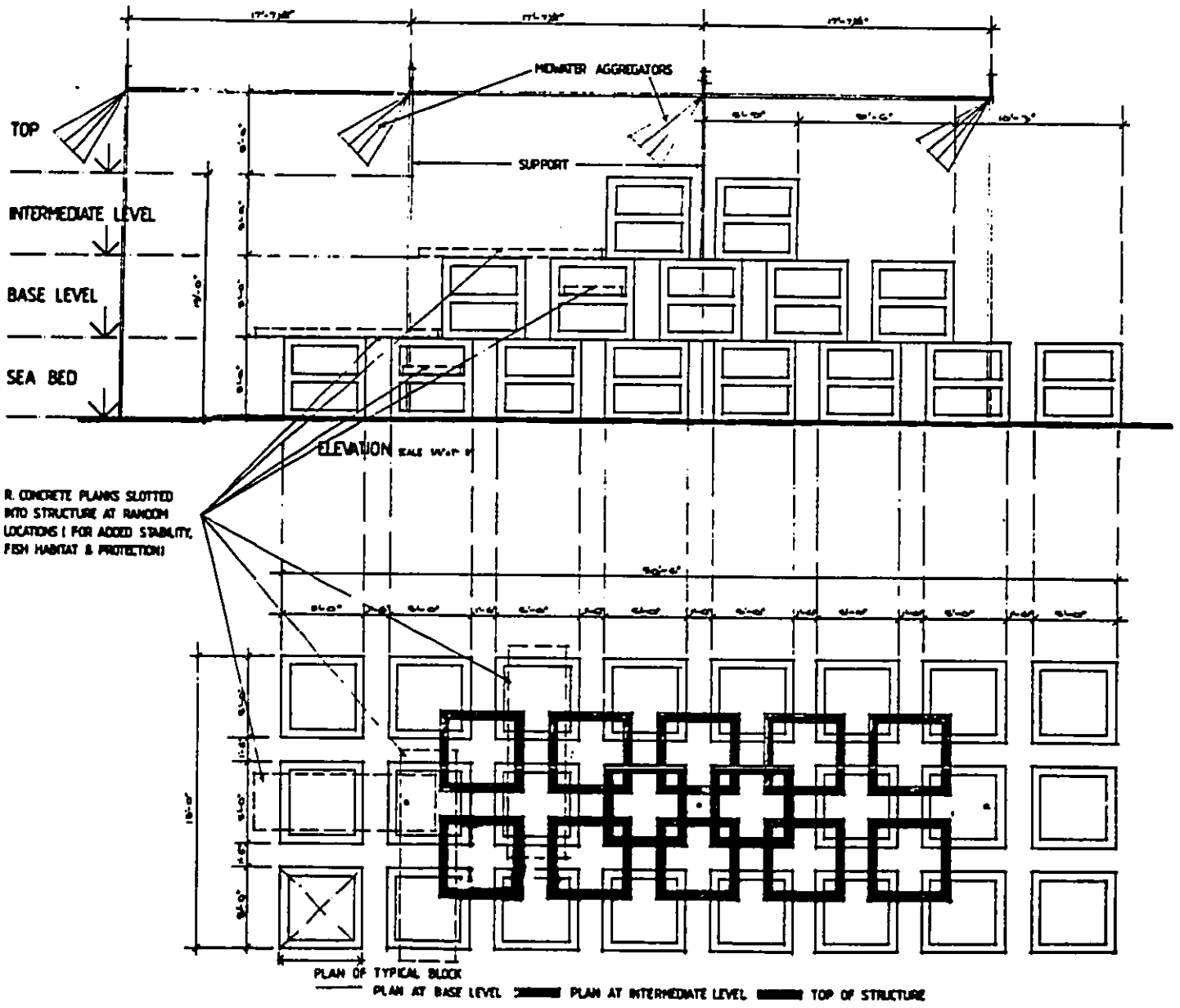

Figure 1. Layout for a single reef set comprised of 36 concrete cubes stacked in three layers and having a total bulk volume of 186 cubic meters.

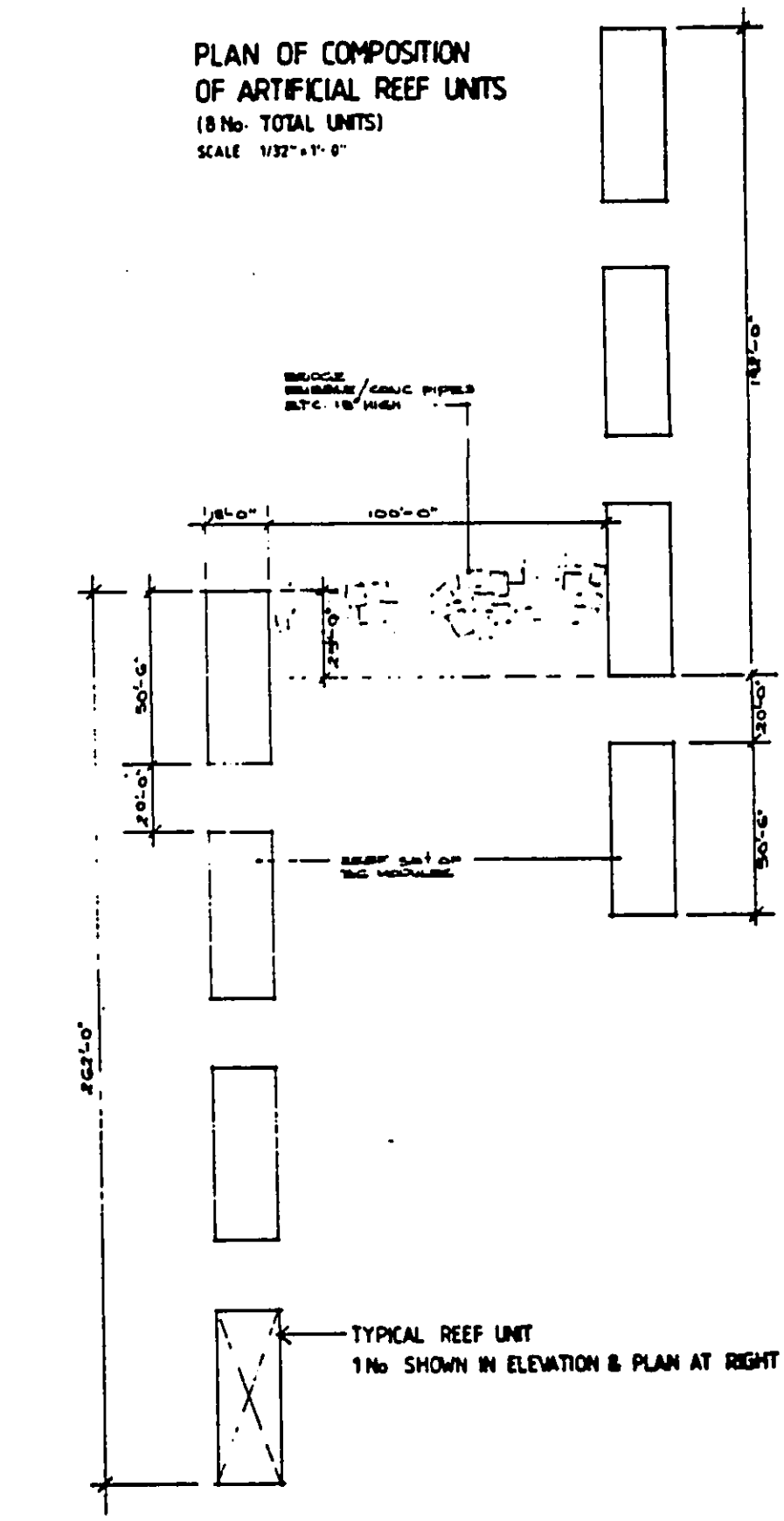

Figure 2. Approximate layout for the "high tech" reef.

Small inexpensive midwater fish attractors can be tautline moored from the reef--approximate locations for these are shown in Figure 2 as circles. Note that each reef set has 3 attractors and one is anchored between adjacent reef sets in a row. These midwater aggregators are an optional item.

Since the assembly of the high tech reef underwater necessitates extensive assistance by divers using SCUBA, the maximum depth of the reef is limited. This problem can be alleviated somewhat by constructing clusters of modules on land, assuming that a crane operator could position the module clusters accurately. With these constraints, the most efficient deployment depth probably lies somewhere between 17 and 24 m. This type of reef also requires a relatively hard and level substratum for maximum stability.

Sandy or unconsolidated substrata present a problem for deployed reefs. Heavy materials that have a relatively small surface area in contact with the substratum such as the "high tech" reef would tend to sink over time. Thus sand areas should be avoided for the deployment of high tech modules; hard flat substratum is preferred. In more open areas of unconsolidated substratum such as on large sand flats, a vessel or a plane could safely be placed. These materials contact the substratum with a large surface area, reducing the probability that they will sink into the sand. In the unlikely event that deployed materials move due to storm surf, initial placement of the artificial reef well away from natural reefs would minimize damage to local natural substrata. Ships and planes would require modification to allow free access of fishes and other organisms to interior spaces. Holes (1 to 2 m in diameter) could be cut strategically along the hull and deck of a ship to allow fishes entry and eliminate "dead water" spaces within the reef. This effort should increase the productivity of the reef by allowing light to enter its inner reaches and also permit viewers to see fish species that are typically cryptic.

Reef materials such as concrete modules, spandex and piles would necessarily be deployed from a barge. Since careful placement of modules on the bottom is critical to the performance and stability of the reef and such placement is costly using SCUBA divers, it is important that modules be lowered to the seafloor with a crane. In Japan cubes or "dice blocks" as they are called in the trade, are deployed by pushing them off of the side of the deployment vessel. This leads to a haphazard distribution on the bottom that is not as biologically effective as it should be; there is also a certain amount of loss due to breakage. In this proposal, the appearance of the reef is important so a careful deployment with divers placing the modules is suggested. Assuming that deployment was carried out during calm weather with flat

seas, the crane operator could lower modules close to their final position, minimizing damage to the modules and effort expended by divers in moving the modules with lift bags. Depending on the level of accuracy of the crane operator (without being able to "see" where the load is going), modules could require some positioning underwater by divers using lift bags. Midwater fish attractors can be easily installed on tautline moorings by divers at any time with little or no disturbance to the reef community. Scrap concrete (spandex and piles) can be dumped from the barge and positioned between reef sets by divers for maximum enhancement. Deploying an airplane from a barge presents less of a problem, however the object should probably be lowered with a crane to ensure proper positioning and minimize damage to the plane.

Deployment of a ship in deep water (i.e. 50m or more) would be accomplished by towing the vessel out to the desired location and sinking it on site. Preparation and modification of the vessel such as removing the engines and cutting holes in the deck and hull (above the waterline) would be completed prior to deployment.

Maintenance of all deployed reefs should be minimal. Tautline moorings for midwater fish aggregators will be changed approximately every six months to one year and the parasols themselves will be replaced as needed with little effort. In the unlikely event that modules or other reef components are moved by a storm, re-positioning materials will be necessary. A potential also exists for the need to recover reef materials. Concrete modules could easily be recovered with the use of a barge and a crane, however retrieval of ships or planes are beyond our level of expertise. This event seems highly unlikely however, since materials even if abandoned will impose no negative impacts on the environment or human activities (see Section 3).

APPENDIX D

Biological Assessment of a Site Proposed for Habitat Enhancement Offshore of Waikiki, Oahu.

Section 3. Site Specific Studies and Biological Impact

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INTRODUCTION

The proposed site for artificial reef development is located about 1.4 km offshore of Waikiki between the Natatorium and Diamond Head on Oahu. This section first presents the results of field studies carried out at the site. We describe the extant biological communities present; we then utilize these quantitative data and qualitative observations as well as draw on information provided in the first two sections of this report to synthesize and delineate probable impacts and changes created by the proposed deployment of reef materials.

MATERIALS AND METHODS

The fieldwork which provided the data base for this survey of the marine macrobiota of the proposed artificial reef site was conducted between 23 and 26 September 1987. The area encompassed in these surveys is given in Figure 1 and covers an area from 23 to 30 m in depth about 1.4 km from shore.

The quantitative sampling of macrofauna of marine communities presents a number of problems; many of these are related to the scale on which one wishes to quantitatively enumerate organism abundance. Marine communities in the study area may be spatially defined in a range on the order of a few hundred square centimeters (such as the community residing in a Pocillopora meandrina coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, we designed a sampling program that attempted to delineate major extant communities in the limits of the study area and quantitatively describe these communities. Thus, a number of methods were used.

To obtain an overall perspective on the extent of the major communities or "zones" occurring in the study area, divers were slowly towed behind a skiff over the study site. This exercise allowed the qualitative delineation of major biotopes based partially on large structural elements (e.g., amount of sand, hard substratum, fish abundance, coral coverage or dominant coral species). In the present study site, only one biotope was recognized; in most assessments of this nature more than one will be found. Within each biotope in a study site, stations are erected and quantitative studies conducted, including visual enumeration of fish, counts along benthic transect lines and cover estimates in benthic quadrats. Besides these quantitative measures, a qualitative reconnaissance is made in the vicinity of each sta-

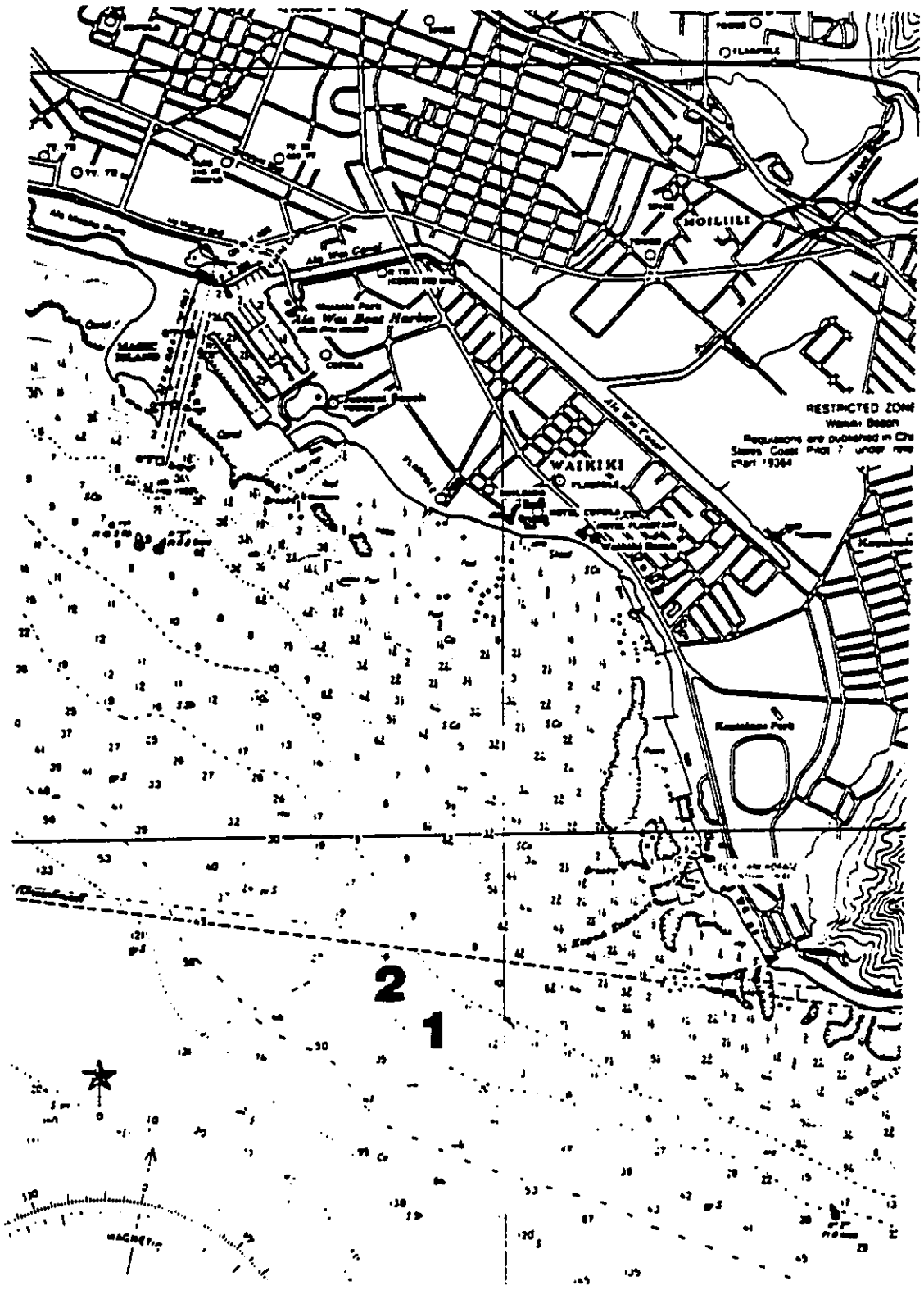

Figure 1. Location of qualitative and quantitative biological surveys (Stations 1 and 2) conducted offshore of Waikiki.

tion by swimming and noting the presence of species not encountered in the transects. In this study all assessments were carried out using SCUBA.

The location of stations were subjectively chosen as being representative of the biotope. Immediately following site selection, a visual fish census was undertaken to estimate the abundance of fishes. These censuses were conducted over a 20 x 4 m corridor and all fishes within this area to the water's surface were counted. A single diver equipped with SCUBA, transect line, slate and pencil would enter the water, count and note all fishes in the prescribed area (method modified from Brock 1954). The 20 m transect line was paid out as the census progressed, thereby avoiding any previous underwater activity in the area which could frighten wary fishes.

Fish abundance and diversity is often related to small-scale topographical relief over short linear distances. A long transect may bisect a number of topographical features (e.g., cross coral mounds, sand flats, and algal beds), thus sampling more than one community and obscuring distinctive features of individual communities. To alleviate this problem, a short transect (20 m in length) has proven adequate in sampling many Hawaiian benthic communities (see Brock 1982).

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels (family Muraenidae) and nocturnal species, e.g., squirrelfishes (family Holocentridae), aweoweo (family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage that afford numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus, family Scorpaenidae; the flatfishes, family Bothidae) might still be missed. Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous may be difficult to count. Additionally, bias related to the experience of the diver conducting counts should be considered in making any comparisons between surveys. In spite of these drawbacks, the visual census technique probably provides the most accurate nondestructive assessment of diurnally active fishes presently available (Brock 1982).

After the assessment of fishes, an enumeration of epibenthic invertebrates (excluding corals) was undertaken using the same transect line as established for fishes. Exposed invertebrates usually greater than 2 cm in some dimension (without disturbing the substratum) were censused in a 20 x 4 m area. As with the fish census technique, this sampling methodology is quantitative

for only few invertebrate groups, e.g., some of the echinoderms and holothurians. Most coral reef invertebrates (other than corals) are cryptic or nocturnal in their habits making accurate assessment of them in areas of topographical relief very difficult. This, coupled with the fact that the majority of these cryptic invertebrates are small, necessitates the use of methodologies beyond the scope of this survey (e.g., see Brock and Brock 1977). Recognizing constraints on time and the scope of this survey, the invertebrate censusing techniques used here attempted only to assess those few macroinvertebrate species that are diurnally exposed.

Exposed sessile benthic forms such as corals and macrothalloid algae were quantitatively surveyed by use of quadrats and the point-intersect method. The point-intersect technique only notes the species of organism or substratum type directly under a point. Along the previously set fish transect line, 40 such points were assessed (once every 50 cm). These data have been converted to percentages. Quadrat sampling consisted of recording benthic organisms, algae and substratum present as a percent cover in five one-meter-square frames placed at five-meter intervals along the transect line established for fish censusing (at 0, 5, 10, 15 and 20 m). If macrothalloid algae were encountered in the 1 x 1 m quadrats or under one of the 40 points, they were quantitatively recorded as percent cover.

During the course of the fieldwork, notes were taken on the number of turtles and porpoises seen within the study area.

Simple methods of data reduction and analysis have been used and are described where met with in the text. Diversity (H′) is calculated as described by Pielou (1966), where:

$$H' = -\sum p_i \ln p_i$$

where p_i is that proportion of the individuals censused belonging to species i. This is the Shannon-Wiener index.

RESULTS

The proposed 4.05 ha Waikiki submersible operating site is located on a broad gently seaward sloping limestone flat between 23 to more than 30 m in depth about 1.4 km offshore of the beach between the Natatorium and Diamond Head (see Figure 1). The limestone flat occurring through much of the proposed site slopes seaward at a 5 to 10 degree angle; its origin is probably Pleistocene. Across much of the limestone flat are shallow sand

patches that range from 2 X 2 m to over 30 X 50 m in dimensions. Some of this sand forms a veneer that under heavy surf conditions must move about and scour the substratum. These sand patches are spaced from 5 to over 80 m apart. The intervening limestone supports few corals: overall the coverage is much less than one percent. Common species encountered include Porites lobata and Pocillopora meandrina. The largest Porites colony encountered in this survey did not exceed 30 cm in diameter and the largest Pocillopora head seen was less than 30 cm in diameter suggesting that occasional high energy conditions must impact this area retarding coral growth and the formation of a mature coral community. This large limestone flat comprises the biotope of flat limestone pavement.

About 75 m shoreward of the proposed operating site the biotope of flat limestone pavement coalesces with a large spur and groove system. The spurs are large limestone "fingers" whose long axes are oriented perpendicular to shore. These fingers are from 0.5 to 5 m in height, 10 to 30 m in width, 20 to 50 m in length and spaced from 15 to 50 m apart. Some corals may be found on these spurs and coverage may locally attain 3 to 5 percent. The spur and groove system lies outside of the proposed operating area and thus was not surveyed in detail. Offshore of the proposed operating site, the substratum begins to drop away to greater depths such that the 100 m isobath lies about 500 m seaward. No attempt was made to examine these deeper areas outside of the proposed site.

The proposed operating site lies wholly within the biotope of flat limestone pavement. This biotope is a near continuous feature for at least 5.5 km west along the south Oahu coast at these depths (18 to 33 m). A qualitative reconnaissance was conducted through the site moving from east to west in a depth range of 24 to 29 m. In this survey major topographical features and macrobiota were noted; a second qualitative survey was carried out at the nearby popular dive destination, the "100 foot hole". The "100 foot hole" is located to the east of the proposed submarine operating area. The purpose of a qualitative survey at this latter location was to provide some comparative information on fish community development around the only known nearby high topographical relief area. Two quantitative stations were established to sample the biotope of flat limestone pavement. The first station (Station 1) was established on the east end of the proposed site in 26 m of water and the second (Station 2) on the west end of the site in 24 m of water.

The substratum at Station 1 was near flat limestone with a thin veneer of sand over it. The only structural relief present in the 20 X 4 m transect area were a few waterworn basalt stones (8 to 30 cm in diameter). No corals were encountered in the

Table 1. Summary of the benthic survey conducted at Station 1 in the biotope of flat limestone pavement offshore of Waikiki, Oahu (Figure 1). Results of the 5 square meter quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A summary of the fish census is given in Part D. Water depth is 26 m; mean coral coverage is 0 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5
Algae					
Lyngbya majuscula	0.5	0.75	0.5	1	0.5
Tunicata		0.25		0.5	
Ascidia interrupta	99	99	99	98.5	99.5
Sand	0.5		0.5		
Rubble					

B. 40-Point Analysis

Species	Percent of the Total
Algae	
Lyngbya majuscula	1
Sand	74
Rubble	5
Hard Substratum	20

C. Invertebrate Census (20 x 4 m)

Species	Number
Phylum Arthropoda	
Portunus sanguinolentus	1 (juvenile)
Phylum Mollusca	
Terebra maculata	1
T. penicillata	1
Phylum Chordata	
Ascidia interrupta	up to 4 individuals/100cm^2

D. Fish Census (20 x 4 m)

6 Species
19 Individuals
Diversity (H') = 2.48
Standing crop (g/m2)=12.5

quadrat survey (Table 1) but in the vicinity of this station were seen a few colonies of Porites lobata (maximum diameter 8 cm), Pocillopora meandrina (to 20 cm diameter) and Montipora verrucosa (to 3 cm diameter). Only 6 fish species (19 individuals) were censused and the most common was the o'ili'uwi'uwi (Pervagor spilosoma). The most important benthic species in the 5 square meters of substratum sampled was the alga Lyngbya majuscula. Invertebrates encountered included the solitary tunicate Ascidia interrupta, the augers (Terebra maculata and T. penicillata) and the haole crab (Portunus sanguinolentus). In the vicinity of the station was seen a small he'e (Octopus cyanea), cones (Conus lividus and C. striatus), the coral (Montipora flabellata), limu (Dictyota sandvicensis) and a helmet shell (Cassis cornuta). Fishes seen in the vicinity of Station 1 include malu (Parupeneus pleurostigma), moano (P. multifasciatus), razorfish (Novaculichthys taeniourus), kala holo (Naso hexacanthus), uku (Aprion virescens) and the parapercid (Parapercis schauinslandi).

The qualitative reconnaissance carried out in the intervening area between Stations 1 and 2 was comprised of a flat limestone substratum occasionally interrupted by sand patches. Over this substratum are scattered loose pieces of limestone as large as 1 X 1 m in area and rising as high as 30 cm from the substratum. Algae seen in this survey include Enteromorpha sp., Halimeda opuntia, Neomeris annulata, Lyngbya majuscula, Dictyota acutiloba, D. bartayresii, D. sandvicensis, Sphacelaria furcigera, Desmia hornemannii, Peyssonellia rubra and Tolypiocladia glomerulata. Macroinvertebrates encountered include the miter (Mitra mitra), cones (Conus lividus and C. distans), sea urchins (Echinothrix calamaris, Pseudoboletia indiana, Echinostrephus aciculatus), the large terebellid worm (Loimia medusa), the aplysid (Notarchus lineolatus - aggregated for spawning) and few corals (Pocillopora meandrina, Porites lobata, Leptastrea purpurea, Montipora verrucosa and Pavona varians). Other than eels and triggerfishes all other fishes seen were either juveniles or species that only attain a small size as adults. Fishes seen on this qualtitative survey include the papio (Caranx orthogrammus), omilu (C. melampygus), maiko (Acanthurus nigroris), na'ena'e (A. olivaceus), kihikihi (Zanclus cornutus), o'ili'lepa (Cantherhines sandwichiensis, C. verecundus), o'ili'uwi'uwi (Pervagor spilosoma), humuhumu lei (Sufflamen bursa), humuhumu hi'ukole (Melichthys vidua), humuhumu ele'ele (M. niger), triggerfish (Xanthichthys auromarginatus), malu (Parupeneus pleurostigma), moano (P. multifasciatus), tobies (Canthigaster jactator and C. cornata), alo'ilo'i (Dascyllus albisella), wrasses (Cheilinus bimacula and Pseudojuloides cerasinus), malamalama (Coris ballieui), hinalea akilolo (Coris gaimard), angelfish (Centropyge fisheri), kikakapu (Chaetodon kleinii and C. auriga), lau wiliwili (C. miliaris), puhi paka (Gymnothorax flavimarginatus), puhi'oni'o (G. meleagris), puhi

lau milo (G. undulatus), puhi (G. steindachneri), parapercid (Parapercis schauinslandi), ala'ihi (Adioryx lacteoguttatus), maka'a (Malacanthus hoedtii) and grouper (Caesioperca thompsoni).

Station 2 was carried out at the east end of the proposed operating site in 24 m of water. The substratum at this site is flat limestone sloping at about a 5 degree angle seaward. Scattered across this limestone are occasional depressions up to 4 m in diameter and attaining a maximum depth of 30 cm. These depressions are spaced from 2 to 15 m apart and are filled with sand and rubble. Other than the shelter provided by these pockets, little topographical complexity is apparent.

Table 2 presents a summary of the quantitative survey conducted at Station 2. Corals are not an important contributor to the coverage at this station; mean coverage was estimated at 0.7 percent. Three coral species were found in the quadrats: Porites lobata, Pocillopora meandrina and Montipora verrucosa. The largest corals seen in the area were P. meandrina with colony diameters not exceeding 15 cm and P. lobata with diameters up to 10 cm. The alga Lyngbya majuscula was the most conspicuous benthic component present (mean coverage = 2 percent). Three macroinvertebrates were found in the 20 X 4 m census area; these were the sea urchin (Echinostrephus aciculatus), the starfish (Linckia diplax) and the black sea cucumber (Holothuria atra). Eighteen fish species were censused in the 20 X 4 m area. The most abundant fishes were the o'ili'uwi'uwi (Pervagor spilosoma) and the damselfish (Chromis vanderbilti). Two non-sedentary fish species encountered in the survey were juvenile omilu (Caranx melampygus) and the papio (C. orthogrammus); probably the most unusual fish species seen in the census was a dragon eel (Muraena pardalis).

In the vicinity of Station 2 were seen a number of fish, invertebrate and algal species not encountered in the 20 X 4 m survey area including a he'e (Octopus cyanea), corals (Leptastrea purpurea and Pavona varians), limu (Neomeris annulata, Hydrolithon reinboldii and Desmia hornemannii), sea urchins (Echinothrix calamaris, E. diadema) and the sea cucumber (Holothuria nobilis). Fishes in this surrounding area include na'ena'e (Acanthurus olivaceus), o'ililepa (Cantherhines verecundus), humuhumu nukunuku apua'a (Rhinecanthus rectangulus), lau'ipala (Zebrasoma flavescens), kihikihi (Zanclus cornutus), rockmover (Novaculichthys taeniourus), wrasses (Labroides phthirophagus and Pseudocheilinus evanidus), moano (Parupeneus multifasciatus), uhu (Calotomus zonarcha), toby (Canthigaster cornata), maka'a (Malacanthus hoedtii), blenny (Plagiotremus ewaensis), parapercid (Parapercis schauinslandi), o'opu okala (Diodon holocanthus), puhi lau milo (Gymnothorax undulatus), puhi'oni'o (G. meleagris), puhi kapa (Echidna nebulosa), umauma

Table 2. Summary of the benthic survey conducted at Station 2 offshore of Waikiki, Oahu (Figure 1). Results of the 5 square meter quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 40-point analysis is presented in Part B and counts of invertebrates in Part C. A summary of the fish census is given in Part D. Water depth is 24m ; mean coral coverage is 10 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number				
Species	1	2	3	4	5
Algae					
Dictyota sandvicensis	1				
Lyngbya majuscula	7	1	6	1	2
Corals					
Porites lobata	0.5	1	0.5		1
Pocillopora meandrina	1.2		0.5		
Montipora verrucosa					0.1
Sand		45			1
Rubble		53			
Hard Substratum	90.3		93	99	95.9

B. 40-Point Analysis

Species	Percent of the Total
Algae	
Lyngbya majuscula	1
Corals	
Porites lobata	1
Sand	7
Hard Substratum	91

C. Invertebrate Census (20 x 4 m)

Species	Number
Phylum Echinodermata	
Linckia diplax	1
Echinostrephus aciculatus	2
Holothuria atra	1
Phylum Chordata	
Ascidia interrupta	up to 1 individual/100cm^2

D. Fish Census (20 x 4 m)

18 Species
100 Individuals
Diversity (H') = 2.48
Standing crop (g/m2)=76.0

lei (Naso literatus) and the snake eel (Myrichthys maculosus).

A short qualitative survey was made of the fish community in the vicinity of the "100 foot hole". The 100 foot hole is a popular dive spot and fishermen regularly utilize the area. Apparently, the hole itself was filled in by Hurricane Iwa in November 1982 leaving a small (about 30 X 50 m) area of eroded limestone caves and boulders shoreward of the old hole. Our qualitative reconnaissance of the proposed operating area and environs found no other nearby area with comparable cover. The fish community in this relatively high natural cover area could be indicative of how successful habitat enhancement efforts could be in the operating site thus a short survey was undertaken.

A number of fishes of commercial importance were seen in the vicinity of the 100 foot hole; among these were three striped marlin (Tetrapterus audax) and a school of kawakawa (Euthynnus affinis). Both of these species are high seas pelagic forms and were probably in the area because of a school of potential prey - opelu (Decapterus macarellus) that were present at the 100 foot hole. Other commercially important fishes present include kumu (Parupeneus porphyreus), moano (P. multifasciatus), malu (P. pleurostigma), malu (P. bifasciatus), weke'ula (Mulloides vanicolensis), weke (M. flavolineatus), mempachi (Myripristes amenus), uku (Aprion virescens), pa'opa'o (Gnathanodon speciosus), omilu (Caranx melampygus), papio (C. orthogrammus), and uhu uliuli (Scarus perspicillatus). Other fish species present of lesser commercial interest include na'ena'e (Acanthurus olivaceus), taape (Lutjanus kasmira), kala lolo (Naso brevirostris), kala holo (N. hexacanthus), mamo (Abudefduf abdominalis) and the whitetip shark (Triaenodon obesus). Other smaller fish species in residence around the 100 foot hole include alo'ilo'i (Dascyllus albisella), humuhumu ele'ele (Melichthys niger), humuhumu hi'ukole (M. vidua), kikakapu (Chaetodon kleinii), lau wiliwili (C. miliaris), o'ili lepa (Cantherhines verecundus), nunu (Aulostomus chinensis), hinalea 'akilolo (Coris gaimard), malamalama (C. ballieui), hilu (C. flavovittatus), wrasse (C. venusta), damselfishes (Chromis vanderbilti and C. verator), o'ili'uwi'uwi (Pervagor spliosoma), razorfish (Novaculichthys taeniourus), lauwiliwili nukunuku'oi'oi (Forcipiger flavissimus) and butterfly fish (Hemitaurichthys polylepis).

SITE SPECIFIC IMPACTS AND RECOMMENDATIONS

The rationale for the applicant's proposal to build and deploy an artificial reef offshore of Waikiki is to locally enhance fish communities for a better dive tour experience. Utilizing the information presented above, what enhancement effects if any might be expected from the development and deploy-

ment of an artificial reef in this area? The answer will partially depend on the design and size of the reef as well as the placement of the reef in relation to immigration sources and water motion characteristics present in this area.

To be successful an artificial reef must be situated on an appropriate substratum; for most reefs this means a firm or solid substratum. A second prerequisite is that the artificial reef should not directly compete with natural reefs, thus the deployment site should not have high natural cover. The proposed site examined in this study has very little in the way of appropriate shelter for adult coral reef fishes. Indeed, other than the natural cover present at the "100 foot hole" some distance away, very little shelter exists within or adjacent to the proposed enhancement site.

The open framework concrete cube artificial reef that has been established in Maunalua Bay, Oahu is biologically successful (see Section 1). This design is appropriate for hard substratum areas; if deployed on a soft or shifting substrate, the internal void spaces may be filled up with loose material. Unconsolidated material is transported by currents or wave energy. If this energy is dissipated or decreased, these materials will winnow or settle out. This may occur where currents impinge on a reef resulting in a buildup of unconsolidated materials in and around the reef. This eventually may lead to reef burial, thus the choice of substrates for deployment is important.

The large open expanse of flat limestone present in the proposed deployment site is ideal for the placement of an open framework concrete cube artificial reef. This substratum is physically similar to that present at the open framework concrete cube artificial reef in the nearby (9 km) Maunalua Bay Artificial Reef Site. Benthic communities between these two areas are similar. The Maunalua Bay experimental reef has been very successful in locally enhancing fishery resources (see above); the diverse fish community present at the 100 foot hole (the only nearby site known to us with high cover) further suggests that a designed artificial reef placed offshore of Waikiki in the biotope of flat limestone pavement will support a high biomass, diverse fish community.

The reef design proposed for deployment has good stability characteristics and utilizes concrete as the construction material. The durability afforded by concrete, its high mass to volume ratio and the proven stability of the module design are probably the most important factors contributing to a long life expectancy in the deployed reef. The potential impact of storm surf on deployed materials situated in 25 to 35 m of water is dependent on the magnitude of the given storm, its course (direc-

tional heading), the coefficient of friction, drag forces, and the weight as well as the design of the reef materials.

Besides the use of a specifically designed artificial reef as a primary means of enhancing the fishery resources in the shallower part of the proposed operating site, we reccommend that a surplus ship (or ships) be modified and deployed in the deeper part of the operating area to improve fish populations. Prior to placement, these ships should be cleared of all possible sources of pollution (i.e., oil, fuel, engines, etc.) and holes cut through the hull (and deck) above the waterline to make easy access for marine life. A ship that has not been "opened up" does not have the enhancement characteristics of one that has. Dark "dead water" areas such as seen in the interiors of the WW II wrecks in Truk Lagoon have very few fish (R.B. personal observations); holes should be from 1 to 3 m in diameter and be cut to allow adequate light penetration and water circulation through the hull. When deployed the ship should be oriented with the bow facing offshore into the usual direction of wave impact to minimize exposed surfaces and possible movement during storms. Advantages to the use of modified surplus vessels for enhancement at this site are that minimal diver assistance is needed for deployment and that the costs of materials are low.

A number of impacts may be expected if these activities are carried out. Negative impacts include (1) coverage of the substratum and extant communities by the deployed objects, (2) possible leaching of toxic substances from these materials and (3) the potential for storm induced movement of the deployed reef components. Potential positive impacts include (1) the local enhancement of fish resources and (2) the increased availability of hard substratum for benthic community development.

The deployment of these reef materials will destroy communities on which they are placed. If a surplus vessel is deployed, it will probably be situated on deep water sand substratum offshore of the high tech artificial reef. This sand flat is a near continuous feature at depths between 36 to 55 m affronting Waikiki, Ala Moana and Kewalo. The addition of this hard substratum in an area otherwise comprised of sand will provide habitat for the establishment of hard bottom benthic communities which may serve as food resources for many coral reef fish species. It is proposed that the high tech artificial reef be placed on a limestone substratum in the biotope of flat limestone pavement. Our quantitative surveys found this biotope to be depauperate; mean coral coverage is less than one percent and the diversity of fishes, invertebrates and algae are relatively low. The data suggest that deployment of a reef in this biotope will have little negative impact to the extant macrobenthos.

If the surplus vessel(s) to be deployed in the Waikiki site is properly prepared by the removing all sources of potentially toxic materials, there should be no leaching of such materials subsequent to their placement. Likewise the concrete modules may be considered inert; ongoing studies being carried out on the experimental reef in Maunalua Bay show that concrete is a superior substrate for the settlement and growth of corals relative to metal or automobile tire rubber.

The biomass estimates made at Stations 1 and 2 were: Station 1 = 12.5 g/m^2 and Station 2 = 76 g/m^2 (see end of Appendix D). These estimates further substantiate the lack of fishes presently in the proposed operating area. Prior to the placement of the experimental reef in Maunalua Bay, the mean standing crop of fishes was estimated to be 61 g/m^2. Deployment of the reef brought this mean up to over 1400 g/m^2 (even under heavy fishing pressure) while a nearby control area maintained an average standing crop of 53 g/m^2. The predevelopment standing crop estimates in the proposed Waikiki site are similar to those in Maunalua Bay prior to reef placement. The data from the Maunalua Bay experimental reef suggest that with the addition of shelter in the Waikiki site, we should expect an enhancement of fish species diversity and biomass. At a minimum, the standing crop should increase by a factor of 30 (to about 1500 g/m^2) in and around the newly created high tech reef. The maximum standing crop that may be expected could approach 3500 g/m^2; in contrast, the maximum on natural reefs is about 200 g/m^2 (see also Section 1). If appropriately modified with holes allowing adequate light and water circulation, any vessel placed on the deep sand flat offshore of the proposed reef at Waikiki should result in a large local increase in fish. Presently the standing crop of fishes probably does not exceed 10 g/m^2 (note: biomass on the deep sandflat was not measured in this study).

Most of man's activities that impact marine systems do so in a negative way. Thus construction activities that are of benefit to man (such as the development of a harbor or the disposal of sewage) may lead to permanent changes in nearby marine communities. These changes frequently involve the local loss of species (community simplification) and/or changes in the energy flow through the community.

Manipulations involving habitat enhancement are among some of the few of man's activities that result in the improvement and/or restoration of marine communities. The establishment of appropriately designed artificial reefs is a proven means of habitat enhancement (see Section 1). If allowed to occur, a program developing and deploying designed artificial reefs in the Waikiki site as proposed in this document will lead to substantial local increases in the abundance and diversity of fishes.

Once established, this locus of high fish concentration (the deployed reef) will serve as a point source for the production and recruitment of larvae and/or immigration of adults to other locales, thus increasing the biological diversity and abundance over an area much larger than just the reef itself. The establishment of carefully designed artificial reefs as proposed herein will enhance reef fish and fisheries over a much greater area than might be initially realized. If established in no-fishing zones, these reefs concurrently foster the conservation of marine resources.

Not only would appropriately designed artificial reefs benefit fish communities as noted above but the same benefits would accrue to benthic communities. Designed reefs provide appropriate stable substratum for recruitment and growth of corals and other benthos. These benthic components may serve as forage or forage sites for fishes thus the reefs may locally enhance the food webs utilized by some fish species.

"High tech" artificial reefs as we propose are expected to have a 30 to 50 year life expectancy; in conclusion the development of a program of habitat enhancement as outlined in this proposal will lead to long-term positive benefit over areas much larger than just the proposed sites themselves and thus to many other user groups besides the applicant.

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FIELD DATA

Results of the quantitative 20x4 m visual fish censuses conducted at stations 1 and 2 (the biotope of flat limestone pavement) in the proposed Oahu artificial reef site. Numbers in the body of the table represent counts of individual fishes. Totals and a diversity index (H') are given at the end of the appendix. Depths measured during the two surveys ranged from 24 to 26 m.

FAMILY and Species	Station 1	Station 2
ACANTHURIDAE		
Acanthurus nigroris		1
Acanthurus olivaceus		2
BALISTIDAE		
Melichthys niger		2
Melichthys vidua	1	2
Sufflamen bursa		1
CARANGIDAE		
Caranx melampygus		1
Carangoides orthogrammus		2
CHAETODONTIDAE		
Chaetodon kleini		9
LABRIDAE		
Pseudojuloides cerasinus	3	3
Coris gaimard		1
Coris ballieui	2	
Stethojulis balteata		1
Hemipteronotus pavoninus	1	
MONACANTHIDAE		
Pervagor melanocephalus		1
Pervagor spilosoma	11	51
Cantherhines sandwichiensis	1	
MURAENIDAE		
Gymnothorax flavimarginatus		1
Muraena pardalis		1

DATA (cont'd)

FAMILY and Species	Station 1	Station 2
POMACANTHIDAE		
Centropyge potteri		1
POMACENTRIDAE		
Chromis vanderbilti		19
TETRAODONTIDAE		
Canthigaster jactator		1
Total Number of Species	6	18
Total Number of Individuals	19	100
Diversity (H')	1.31	1.75
Standing Crop (g/m^2)	12.5	76.0

APPENDIX E

BOAT TRAFFIC SURVEYS CONDUCTED OFF HONOLULU, OAHU

By

Sea Engineering, Inc.
Makai Research Pier
Waimanalo, Hawaii 96795

Boat Traffic Surveys

The boat traffic surveys were conducted in potential submersible operating areas to determine the frequency and types of boat traffic which presently occurs. Survey sites included an earlier proposed operating area off Kakaako, a site off Ala Moana undertaken for comparative purposes, and a site off Waikiki. At each site, the survey boat was anchored at the approximate 60 to 90 foot depth and all boat traffic logged for a 12 hour period between 9 AM and 9 PM (except the surveys off of Waikiki which were terminated at sunset). The general weather and sea conditions were noted each survey day. The following information was logged for each vessel passing within approximately 500 yards (1,000 yards off Kakaako) of the survey boat: time, type of craft, length, make or name, commercial or private, apparent use or activity, where coming from or going to, and its closest point of approach (CPA). The information logged is based on the surveyors best guess or estimate of the vessel's length, use, and activity.

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 09/22/87 TIME BEGIN: 0900 TIME END: 1115
SEA:SWELL, 1-2' SURF:1-3' WIND SPEED: 5 WIND DIRECTION: VAR. CLOUD COVER: 100% CLOUDY W/SHOWERS
1 PM WIND SHIFT TO S.

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
0900	X	X		70'	HILTON CAT	X		TOURISM	SHORE TO D.H. & BACK-	100
0920	X			30'	"SKYRIDER"	X		TOURISM	PARASAILING	40
1000	X			19'	FIBERFORM		X	PLEASURE	DRIFTING EWA TO D.H.	300
1012	X			80'	TRAWLER	X		FISHING	EWA TO D.H. O.B.	200
1015	X			17'	BOSTON WHALE		X	PLEASURE	EWA TO D.H. I.B.	300
1017	X			40'	CABIN CRUISE	X		FISHING	EWA TO D.H. I.B.	60
1026	X			19'	8L FIBR FORM		X	PLEASURE	DRIVING BACK TO ALA MOANA	100
1033	X			20'	"SKYRIDER"	X		TOURISM	PARASAILING	60
1052		X		40'	"MEANDER"		X	PLEASURE	SAILNG D.H. TO EWA	20
1105	X			70'	"ANI ANI"	X		TOURISM	KEWALO TO WAIKIKI	400
1119			X	11'	CANOE		X	PADDLING	D.H. TO EWA I.B.	400
1125	X			15'	MCKEE CRAFT		X	FISHING	EWA TO D.H. I.B.	100
1209	X			80'& 200'	TUG & BARGE	X		TOWING	D.H. TO EWA O.B.	60
1222	X			60'	TUNA BOAT	X		FISHING	D.H. TO EWA I.B.	200
1225		X		40'	SAILBOAT		X	PLEASURE	TACK JUST EWA OF BOAT OB	150
1230		X		30'	CAT (RED)	X		TOURISM	SAILING AROUND WAIKIKI	300
1240	X			30'	"SKYRIDER"	X		TOURISM	PARASAILING	50
1246		X		50'	"SKYRIDER"	X		TOURISM	SAILING AROUND WAIKIKI	250
1300	X			50'	"SKYRIDER"	X		TOURISM	PARASAILING	60
1400	X			50'	"SKYRIDER"	X		TOURISM	PARASAILING	50
1400		X		40'	CATAMARAN	X		TOURISM	SAILING AROUND WAIKIKI	100
1415		X		30'	SAILBOAT/RED	X		TOURISM	SAILING AROUND WAIKIKI	200
1418		X		50'	CATAMARAN KEPOIKAI II	X		TOURISM	SAILING AROUND WAIKIKI	40
1422		X		50'	"SKYRIDER"	X		TOURISM	PARASAILING	100
1430		X		50'	KEPOIKAI II	X		TOURISM	SAILNG BACK TO SHORE	20
1435	X			17'	BOSTON WHALR		X	PLEASURE	D.H. TO EWA I.B.	400
1438	X			60'	TUNA BOAT "LUZON"	X		FISHING	EWA TO D.H. I.B.	40
1446	X			19'	8L FIBERFORM		X	PLEASURE	EWA TO D.H. I.B.	300
1452	X			19'	8L FIBERFORM		X	PLEASURE	DROVE AROUND BUOY I.B.	300
1505	X			70'	"ANI ANI"	X		TOURISM	KEWALO TO WAIKIKI & BACK	400
1530		X		40'	CAT (YELLOW)	X		TOURISM	WAIKIKI TO D.H. & BACK	100
1533		X		22'	PRINDLE CAT		X	PLEASURE	WAIKIKI TO D.H. O.B.	500
1553		X		35'	CHARTER BOAT	X		FISHING	D.H. TO EWA O.B.	500
1607		X		40'	CAT (PINK)	X		TOURISM	EWA TO D.H. I.B.	150
1607		X		40'	CAT (WHITE)	X		TOURISM	EWA TO D.H. I.B.	150
1610		X		40'	CAT (BLUE)	X		TOURISM	D.H. TO WAIKIKI I.B.	200
1619		X		40'	CAT (PINK)	X		TOURISM	D.H. & BACK TO WAIKIKI	40
1640		X		40'	CAT (WHITE)	X		TOURISM	D.H. & BACK TO WAIKIKI	50
1650	X			30'	FISHING BOAT	X		FISHING	EWA TO D.H. I.B.	100
1700	X			80'&200'	TUG & BARGE	X		TOWING	HON HABOR TO D.H. O.B.	400
1730		X		40'	CAT (PINK)	X		TOURISM	WAIKIKI TO D.H.	50
1750		X		40'	CAT (PINK)	X		TOURISM	D.H. & BACK	80
1755		X		50'	SAILBOAT		X	PLEASURE	D.H. & BACK	100

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 09/26/87 TIME BEGIN: 0900 TIME END: 1115
SEA:CALM;LT.CHOP SURF:1-3' WIND SPEED:10-15 WIND DIRECTION: NE TRADECLOUD COVER: CLEAR

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1355		X		30'	PATRIOT		X	PLEASURE	ALA WAI TO D.H.B. O.B.	50
1356		X		30'	CATAMARAN	X		TOURISM	WAIKIKI TO SOUTH I.B.	100
1400		X		20'	KIALUA		X	PLEASURE	ALA WAI TO SOUTH O.B.	50
1409	X			30'	BLUE MAX	X		FISHING	ALA WAI TO D.H. I.B.	50
1412	X			18'	GLASS PLY		X	FISHING	D.H. TO ALA WAI I.B.	100
1417		X		14'	SUNFISH		X	PLEASURE	WAIKIKI TO D.H.B. I.B.	100
1420		X		20'	CATAMARAN	X		TOURISM	WAIKIKI TO SOUTH I.B.	50
1470		X		30'	MANAKAI	X		TOURISM	WAIKIKI TO SOUTH O.B.	50
1423		X		30'	ROYAL HAWN	X		TOURISM	WAIKIKI TO SOUTH O.B.	50
1427	X			40'	PARASAIL	X		TOURISM	ALA WAI TO D.H.B. O.B.	300
1430		X		30'	MANAKAI	X		TOURISM	SOUTH TO WAIKIKI I.B.	100
1431		X		30'	ROYAL HAWN	X		TOURISM	SOUTH TO WAIKIKI I.B.	100
1435		X		28'	SAILBOAT		X	PLEASURE	SOUTH TO WAIKIKI O.B.	300
1437		X		16'	HOBIE CAT		X	PLEASURE	WAIKIKI TO D.H.B. I.B.	50
1438	X			40'	PARASAIL	X		TOURISM	ALA WAI TO SOUTH O.B.	100
1444		X		40'	ENDEVOR		X	PLEASURE	WAIKIKI TO SOUTH I.B.	50
1453	X			40'	PARASAIL	X		TOURISM	ALA WAI TO SOUTH O.B.	100
1459	X			12'	ZODIAK		X	PLEASURE	ALA WAI TO D.H.B. O.B.	50
1501		X		30'	ADONAIS		X	PLEASURE	D.H.B. TO ALA WAI I.B.	50
1503		X		30'	SAILBOAT		X	PLEASURE	ALA WAI TO D.H.B. O.B.	200
1509		X		26'	SAILBOAT		X	PLEASURE	D.H.B. TO WAIKIKI I.B.	300
1521	X			30'	BLUE MAX	X		FISHING	D.H.B. TO ALA WAI O.B.	50
1524		X		26'	SAILBOAT		X	PLEASURE	WAIKIKI TO D.H.B. I.B.	200
1543	X			18'	SPEEDBOAT		X	PLEASURE	ALA WAI TO WAIKIKI I.B.	400
1551	X			50'	ILIMA 5	X		FISHING	ALA WAI TO D.H.B. I.B.	150
1552		X		30'	MANAKAI	X		TOURISM	WAIKIKI TO SOUTH O.B.	100
1602		X		24'	SAILBOAT		X	PLEASURE	D.H.B. TO WAIKIKI I.B.	440
1607	X			22'	FISH BOAT	X		FISHING	D.H.B. TO WEST O.B.	500
1609		X		30'	MANAKAI	X		TOURISM	SOUTH TO WAIKIKI I.B.	400
1612		X		14'	HOBIE CAT		X	PLEASURE	SOUTH TO WAIKIKI I.B.	350
1636	X			21'	WHALER		X	PLEASURE	ALA WAI TO D.H.B. I.B.	350
1638	X			26'	BERTRAM	X		FISHING	D.H.B. TO WIAKIKI I.B.	500
1646		X		30'	CATAMARAN	X		TOURISM	WAIKIKI TO D.H.B. I.B.	450
1650	X			19'	POWER BOAT		X	PLEASURE	WAIKIKI TO D.H.B. I.B.	500
1652	X			22'	MAKO		X	PLEASURE	ALA WAI TO D.H.B. I.B.	100
1659		X		40'	MALULANI		X	PLEASURE	D.H.B. TO ALA WAI I.B.	80
1700	X			19'	KAYAK		X	WORK	WAIKIKI TO STATION I.B.	0
1718		X		35'	SAILBOAT		X	PLEASURE	ALA WAI TO D.H.B. O.B.	100
1719	X			30'	SANPAN	X		FISHING	ALA WAI TO D.H.B. O.B.	100
1725		X		35'	SAILBOAT		X	PLEASURE	D.H.B. TO ALA WAI I.B.	200
1750		X		30'	CATAMARAN	X		TOURISM	ALA WAI TO D.H.B. I.B.	400
1756	X			85'	PEARLKAI	X		TOURISM	ALA WAI TO D.H.B. I.B.	100
1805		X		45'	HILTON RAINBOW	X		TOURISM	ALA WAI TO D.H.B. I.B.	300
1805	X			60'	AIKANE	X		TOURISM	HONO. TO D.H.B. I.B.	200
1810	X			18'	WHALER		X	PLEASURE	D.H. TO ALA WAI I.B.	500
1814	X			60'	HOKUNANI	X		TOURISM	HONO. TO D.H. O.B.	120
1820	X			90'	ROYAL PRINCE	X		TOURISM	HONO. TO D.H. O.B.	300
1822		X		35'	CATAMARAN	X		TOURISM	D.H. TO ALA WAI I.B.	500
1823		X		28'	SAILBOAT		X	PLEASURE	ALA WAI TO D.H. I.B.	400

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 09/26/87 TIME BEGIN: 0900 TIME END: 1115
SEA:CALM;LT.CHOP SURF:1-3' WIND SPEED:10-15 WIND DIRECTION: NE TRADECLOUD COVER: CLEAR

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
0930	X			40'	"SKYRIDER"	X		PARASAIL	ALA WAI TO D.H. I.B.	500
0958	X			17'	WHALER		X	ESCORT	TO ALA WAI I.B.	400
0958	X			40'	CANOE		X	TRAINING	TO ALA WAI I.B.	400
1000		X		20'	CAL 20		X	SAILING	TO D.H.B. I.B.	75
1009		X		26'	SAILBOAT		X	PLEASURE	ALA WAI SOUTHEAST	300
1016	X			18'	GLASS PLY		X	FISHING	D.H.B. TO ALA WAI O.B.	100
1020		X		60'	NA HOKU	X		TOURISM	WAIKIKI TO D.H. I.B.	400
1024	X			14'	WHALER		X	FISHING	WAIKIKI TO D.H. I.B.	300
1026	X			24'	PARASAIL	X		TOURISM	ALA WAI TO WAIKIKI I.B.	250
1028	X	X		40'	"SKYRIDER"	X		TOURISM	ALA WAI TO D.H. I.B.	50
1042		X		30'	SAILBOAT		X	PLEASURE	ALA WAI TO D.H. I.B.	200
1040		X		20'	CATAMARAN		X	PLEASURE	ALA WAI TO D.H. I.B.	400
1045	X			19'	GLASS PLY		X	FISHING	WAIKIKI TO D.H. I.B.	100
1047	X			40'	"SKYRIDER"	X		TOURISM	SOUTH TO WAIKIKI O.B.	100
1047		X		30'	CATAMARAN	X		TOURISM	WAIKIKI TO D.H. I.B.	250
1048	X			24'	PARASAIL	X		TOURISM	ALA WAI TO WAIKIKI I.B.	300
1056	X			20'	OUTBOARD	X		FISHING	ALA WAI TO D.H. I.B.	200
1102	X			12'	THREE SURFBOARDS		X	FISHING	WAIKIKI TO SOUTH I.B.	100
1116	X			45'	COM'L FISHER	X		FISHING	ALA WAI TO EAST O.B.	500
1123	X			40'	"SKYRIDER"	X		TOURISM	ALA WAI TO D.H. O.B.	50
1131		X		30'	SAILBOAT		X	PLEASURE	ALA WAI TO SOUTH O.B.	200
1144	X			20'	PLEAS CRAFT		X	PLEASURE	SOUTH TO WAIKIKI I.B.	100
1155		X		30'	SAILBOAT		X	PLEASURE	D.H. TO WAIKIKI I.B.	200
1205		X		60'	NA HOKU	X		TOURISM	WAIKIKI TO SOUTH I.B.	100
1206		X		30'	CATAMARAN	X		TOURISM	WAIKIKI TO SOUTH O.B.	100
1211		X		60'	NA HOKU	X		TOURISM	SOUTH TO WAIKIKI O.B.	25
1215	X			19'	GLASS PLY		X	FISHING	D.H. TO ALA WAI I.B.	100
1219	X			22'	GLASS PLY	X		FISHING	ALA WAI TO D.H. I.B.	400
1223	X			60'	SUNRISER	X		FISHING	ALA WAI TO D.H. I.B.	100
1225		X		35'	KEPOIKAI	X		TOURISM	WAIKIKI TO SOUTH O.B.	250
1238	X	X		40'	MOTOR SAIL CATAMARAN	X		TRAVEL	WAIKIKI TO EAST O.B.	400
1239	X			25'	SANPAN	X		FISHING	ALA WAI TO D.H. I.B.	75
1240		X		30'	SAILBOAT		X	PLEASURE	WAIKIKI TO SOUTH I.B.	200
1255	X			24'	GLASS PLY		X	FISHING	D.H. TO ALA WAI I.B.	100
1258		X		26'	SAILBOAT		X	SAILING	D.H. TO ALA WAI I.B.	300
1301	X			20'	GLASS BOAT		X	FISHING	EWA TO D.H. O.B.	400
1302		X		30'	MANAKAI	X		TOURISM	SOUTH TO WAIKIKI O.B.	50
1305		X		30'	PINK CAT	X		TOURISM	WAIKIKI TO SOUTH O.B.	100
1306		X		16'	CATAMARAN		X	PLESURE	WAIKIKI TO SOUTH O.B.	100
1317		X		26'	CAL 26		X	PLEASURE	SOUTHEAST TO ALA WAI O.B.	200
1318	X			40'	SANPAN	X		FISHING	D.H. TO ALA WAI I.B.	350
1319		X		60'	NA HOKU	X		TOURISM	WAIKIKI TO D.H. I.B.	50
1320		X		26'	GLASS PLY	X		PLEASURE	D.H. TO ALA WAI O.B.	100
1330		X		30'	TWIN MAST		X	PLEASURE	ALA WAI TO D.H. O.B.	100
1331	X			40'	DEEP SEA FISHER		X	PLEASURE	D.H. TO ALA WAI I.B.	300
1345	X			28'	FISH BOAT		X	FISHING	D.H.B. TO ALA WAI O.B.	50
1354		X		30'	MANAKAI	X		TOURISM	WAIKIKI TO SOUTH I.B.	150
1353		X		20'	SAILBOAT		X	PLEASURE	SOUTH TO WAIKIKI O.B.	100

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 09/26/87 TIME BEGIN: 0900 TIME END: 1115
SEA:CALM;LT.CHOP SURF:1-3' WIND SPEED:10-15 WIND DIRECTION: NE TRADECLOUD COVER: CLEAR

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1823	X			90'	ROYAL PRINCE	X		TOURISM	D.H. TO HON. HARBOR O.B.	100
1825		X		45'	HILTON RAINBOW	X		TOURISM	D.H. TO ALA WAI I.B.	250
1827		X		30'	SAILBOAT		X	PLEASURE	ALA WAI TO D.H. I.B.	500
1830		X		30'	SHOREBIRD	X		TOURISM	D.H. TO ALA WAI I.B.	50
1832		X		35'	CATAMARAN	X		TOURISM	D.H. TO ALA WAI I.B.	500
1835	X			60'	AIKANE	X		TOURISM	D.H. TO ALA WAI I.B.	150

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/27/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-0,5 SURF:0-1 WIND SPEED: 0-4 WIND DIRECTION: VAR. CLOUD COVER: NONE

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1539		X		40'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	300
1545	X			17'	MCKEE		X	FISHING-TROLL	DIAMOND H. TO EWA, I.B.	100
1550	X			30'	FIBER FORM		X	PLEASURE	DIAMOND H. TO EWA, O.B.	200
1600	X			150'	ANI ANI	X		TOURISM	EWA INTO KEW., O.B.	300
1600	X			60'	CAB. CRUISER	X		TROLL-FISH	SOUTH INTO KEW., O.B.	200
1602		X		25'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	400
1603		X		20'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, I.B.	50
1610	X			25'	PARA SAIL	X		TOURISM	TOW PARACHUTE	400
1612	X			17'	FIBER FORM		X	PLEASURE	DIAMOND H. TO EWA, I.B.	300
1620	X			1000'	PAD	X		TRADE	HON. H. TO DIAMOND H.	300
1625	X			20'	GLASS PLY		X	PLEASURE	DIAMOND H. TO HON. H.	200
1630	X			17'	B. WHALER		X	FISHING	DIAMOND H. TO EWA, I.B.	200
1635	X			40'	CAB. CRUISER	X		FISHING-TROLL	SOUTH INTO KEW., O.B.	300
1645	X			35'	SAN PAN	X		FISHING-TROLL	HON. H. TO KEW., O.B.	400
1646	X			25'	PARA SAIL	X		TOURISM	DIAMOND H. TO EWA, I.B.	30
1650	X			17'	B. WHALER	X		FISHING	DIAMOND H. TO EWA, I.B.	200
1651	X			35'	CAB. CRUISER	X		FISHING	DIAMOND H. TO EWA, O.B.	100
1700	X			35'	CAB. CRUISER	X		FISHING	SOUTH INTO KEW. O.B.	200
1705	X			80'	AIKANE	X		TOURISM	KEW. HEADED SOUTH, O.B.	400
1706	X			22'	PARA SAIL	X		TOURISM	DIAMOND H. TO EWA, O.B.	20
1710	X			25'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	300
1715	X			80'	AIKANE	X		TOURISM	KEW. HEADED SOUTH, O.B.	400
1730	X			100'	ALII KAI	X		TOURISM	H.H. TO DIAMOND H., I.B.	50
1740	X			22'	PARA SAIL	X		TOURISM	D.H. TO EWA & BACK, O.B.	20
1745	X			100'	ALII KAI	X		TOURISM	H.H. TO DIAMOND H., O.B.	
1745	X			17'	FIBER FORM		X	PLEASURE	DIAMOND H. TO EWA, I.B.	300
1747	X			100'	E. EXPLORER	X		TOURISM	H.H. TO DIAMOND H., O.B.	300
1750	X			80'	ALII KAI	X		TOURISM	H.H. TO DIAMOND H., O.B.	500
1757	X			100'	ROYAL PRINCE	X		TOURISM	H.H. TO DIAMOND H., O.B.	20
1860	X			200'	WIND JAMMER	X		TOURISM	H.H. TO DIAMOND H., O.B.	200
1815		X		40'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	300
1820		X		25'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	200
1820		X		30'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	200
1820		X		30'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	250
1910	X			80'(?)	AIKANE	X		TOURISM	DIAMOND H. INTO H.H., O.B	300
1912	X			100'(?)	ALII KAI	X		TOURISM	DIAMOND H. INTO H.H., O.B	300
1930	X	X		40'(?)	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, I.B.	100
1937	X			70'	TRAWLER	X		FISHING	KEW. TO EWA, O	80
1940	X			200'	WIND JAMMER	X		TOURISM	DIAMOND H. INTO H.H., O	100
1945	X			250	ROYAL PRINCE	X		TOURISM	DIAMOND H. INTO H.H., O	100
1950	X			200'	EXPLORER	X		TOURISM	DIAMOND H. INTO H.H., O	200
2015	X			100'	ANI ANI	X		TOURISM	EWA INTO KEW., O	150
2050	X			200'	WIND JAMMER	X		TOURISM	H.H. TO DIAMOND H., O.B.	200

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE:12/28/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-0,5 SURF:1-2 WIND SPEED: 0-5 WIND DIRECTION: S/SE CLOUD COVER: HEAVY COVERAGE

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
0914	X			18'	FIBER FORM	X		PARASAIL		100
0914	X			60'	AIKANE	X		TOURISM	KEWALO TO WAIKIKI, I.B.	50
0923	X			35'	SAN PAN	X		BOTTOM FISH	ALA WAI TO EWA, I.B.	50
0932	X			15'	WHALER		X	TROLLING	EWA TO ALA WAI, I.B.	150
0949	X			13'	SKIFF		X	TROLLING	KEW. TO ALA MOANA, I.B.	300
0954	X			35'	SAN PAN	X		BOTTOM/TROLL	KEWALO TO DIAMOND H., I.B	100
0957	X			50'			X	TROLLING		
0959		X		30'	SAIL BOAT		X	PLEASURE	WAIKIKI TO EWA, O.B.	300
1042	X			50'	ANI ANI	X		TOURISM	KEW. TO WAIKIKI, O.B.	150
1047	X			40'	CHARTER	X		TROLLING	WAIKIKI TO KEW., O.B.	400
1057	X			16'	GLASS PAR		X	TROLLING	WAIKIKI TO EWA, O.B.	150
1058	X			20'	SPEED BOAT		X	PLEASURE	WAIKIKI TO EWA, O.B.	300
1118	X			50'	ANI ANI	X		TOURISM	WAIKIKI TO KEW., O.B.	150
1126	X			40'	CHARTER	X		TROLLING	KEW. TO WAIKIKI, O.B.	200
1127	X			17'	SKI BOAT		X	PLEASURE	WAIKIKI TO EWA, O.B.	200
1128		X		40'	SAIL BOAT		X	PLEASURE	WAIKIKI TO EWA, O.B.	100
1139		X		40'	NA HOKU	X		TOURIST CAT	WAIKIKI TO EWA, O.B.	100
1145	X			50'	ANI ANI	X		TOURISM	KEW. TO WAIKIKI, O.B.	100
1147	X			60'	AIKANE	X		TOURISM	WAIKIKI TO KEW., I.B.	100
1157	X			90'	ADVENTURER	X		TOURISM	KEW. TO WAIKIKI, O.B.	300
1225	X			50'	ANI ANI	X		TOURISM	WAIKIKI TO KEW., O.B.	400
1226		X		30'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, O.B.	400
1232	X			20'	GLASS PRO		X	FISHING	ALA WAI TO EWA, O.B.	250
1241		X		25'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, O.B.	300
1242	X			18'	FIBER FORM		X	TROLLING	EWA TO ALA WAI, O.B.	150
1240		X		40'	SAIL BOAT	X		SAIL/CHART	EWA TO WAIKIKI, O.B.	500
1249			X	42'	CANOES		X	PRACTICE	ALA WAI TO EWA, I.B.	300
1249			X	42'	CANOES		X	PRACTICE	ALA WAI TO EWA, I.B.	300
1249			X	42'	CANOES		X	PRACTICE	ALA WAI TO EWA, I.B.	300
1259	X			15'	WHALER	X		FISHING	ALA WAI TO EWA, I.B.	75
1303	X			18'	BAYLINER		X	PLEASURE	ALA WAI TO EWA, O.B.	50
1308		X		50'	HILTON/CAT	X		TOURISM	WAIKIKI TO EWA, O.B.	500
1220	X			20'	GLASS PRO	X	X	DIVING	EWA TO ALA WAI, I.B.	100
1330		X		30'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA O.B.	250
1330	X			10'	ZODIAC		X	PLEASURE	ALA WAI TO EWA, I.B.	100
1339	X			17'	WHALER		X	FISHING	ALA WAI TO EWA, I.B.	100
1332		X		30'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, O.B.	500
1335	X			18'	ZODIAC		X	FISHING	ALA WAI, I.B.	200
1335	X			17'	SKI BOAT		X	PLEASURE	ALA WAI, I.B.	100
1337	X			24'	MOSKITO	X		DIVING	KEW. TO WAIKIKI, I.B.	200
1338		X		20'	SAIL BOAT		X	PLEASURE	EWA TO ALA WAI, O.B.	200
1340	X			50'	ANI ANI	X		TOURISM	KEW. TO WAIKIKI, O.B.	150
1347		X		30'	SAIL BOAT		X	PLEASURE	EWA TO ALA WAI, O.B.	300
1405	X			30'	BAYLINER		X	TROLLING	EWA TO ALA WAI, O.B.	200
1415	X			13'	WHALER		X	TROLLING	EWA TO ALA WAI, I.B.	100
1416	X			10'	ZODIAC		X	PLEASURE	EWA TO WAIKIKI, I.B.	100
1417	X			20'	SAN PAN	X		DIVING	EWA TO WAIKIKI, I.B.	150
1418	X			16'	ZODIAC		X	PLEASURE	EWA TO WAIKIKI, I.B.	200
1420	[redacted]		X		SAILBOAT		X	PLEASURE	EWA TO WAIKIKI O.B	300

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE:12/28/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-0.5 SURF:1-2 WIND SPEED: 0-5 WIND DIRECTION: S/SE CLOUD COVER: HEAVY COVERAGE

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1436	X			12'	SKIFF		X	TROLLING	EWA TO WAIKIKI, I.B.	100
1437	X			50'	SAN PAN	X		FISHING	WAIKIKI TO KEW., O.B.	100
1454	X			16'	GLASS PAR		X	PLEASURE	WAIKIKI TO EWA, I.B.	150
1456	X			70'	SAN PAN	X		TROLLING	WAIKIKI TO KEW., O.B.	150
1457	X			20'	WHALER		X	PLEASURE	WAIKIKI TO EWA, O.B.	200
1502	X			17'	TRI-HULL		X	PLEASURE	EWA TO WAIKIKI, I.B.	200
1522	X			17'	TRI-HULL	X		PLEASURE	WAIKIKI TO EWA, I.B.	250
1530	X			40'	CHARTER	X		TROLLING	WAIKIKI TO KEW., O.B.	200
1539	X			70'	NEPTUNE	X		AKU BOAT	DIAMOND H. TO KEW., O.B.	200
1544	X			17'	MCKEE		X	TROLLING	ALA WAI TO EWA, I.B.	75
1545	X			16'	BAYLINER		X	SKI BOAT	HONOLULU TO ALA WAI, I.B.	50
1548		X		45'	SAIL BOAT		X	PLEASURE	EWA TO ALA WAI, O.B.	300
1548		X		20'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, I.B.	50
1551		X		10'	SUNFISH		X	PLEASURE	ALA WAI TO EWA, O.B.	75
1554		X		40'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, O.B.	100
1554	X			45'	SAN PAN	X	X	TROLLING	DIAMOND H. TO KEW., O.B.	500
1600	X			24'	MOSKITO	X		DIVERS	WAIKIKI TO KEW., I.B.	150
1600	X			24'	RADON		X	DIVERS	WAIKIKI TO KEW., O.B.	50
1611	X			13'	TRI-HULL		X	PLEASURE	ALA WAI TO EWA, O.B.	200
1616	X			13'	TRI-HULL		X	PLEASURE	EWA TO ALA WAI, O.B.	150
1634	X			18'	BAYLINER		X	PLEASURE	WAIKIKI TO KEW., I.B.	100
1643	X			18'	BAYLINER		X	PLEASURE	KEW. TO WAIKIKI, I.B.	100
1706		X		20'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, O.B.	150
1706		X		60'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, O.B.	400
1710		X		50'	SAIL BOAT	X		CHARTER	KEW. TO ALA WAI, I.B.	100
1730		X		35'	MANU KAI	X		TOURISM	WAIKIKI TO KEW., O.B.	70
1750		X		100'	ALII KAI	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	150
1755	X			70'	SIA QUEEN	X		AKU BOAT	DIAMOND H. TO KEW., O.B.	150
1758	X			80'	ADVENTURE IV	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	100
1758	X			200'	RHELLA MAE	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	200
1803	X			70'	AIKANE	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	400
1810	X			100'	PRINCE KUHIO	X		DINNER CRUISE	HONOLULU TO WAIKIKI, O.B.	300
1816	X			70'	SAN PAN	X		AKU BOAT	DIAMOND H. TO KEW., O.B.	200
1818	X			30'	SAN PAN		X	TROLLING		
1834		X		14'	SAIL BOAT		X	PLEASURE	KEW. TO AL WAI, I.B.	100
1859	X			70'	AIKANE	X		DINNER CRUISE	WAIKIKI TO KEW., O.B.	200
1910	X			60'	CHRIS CRAFT	X		PARTY	ALA WAI TO EWA, I.B.	100
1914	X			100'	ALII KAI	X		DINNER CRUISE	WAIKIKI TO KEW. O.B.	400
1914	X			100'	PRINCE KUHIO	X		DINNER CRUISE	WAIKIKI TO HONOLULU, O.B.	300
1926	X			200'	RHELLA MAE	X		DINNER CRUISE	WAIKIKI TO HONOLULU, O.B.	200
1929	X			80'	PEARL KAI	X		PLEASURE	WAIKIKI TO KEW., O.B.	400
1936	X			80'	ADVENTURE IV	X		DINNER CRUISE	WAIKIKI TO KEW., O.B.	100
1943	X			60'	CHRIS CRAFT	X		PARTY	EWA TO ALA WAI, O.B.	75
1950	X			90'?	AIKANE I	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	100
1950		X		30'	SAIL BOAT		X	PLEASURE	EWA TO ALA WAI, O.B.	150
2012	X			70'	AIKANE CAT	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	200
2026	X			70'	AIKANE CAT	X		DINNER CRUISE	WAIKIKI TO KEW., O.B.	200
2055	X			200	RHELLA MAE	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	200
2055	X			70'	AIKANE CAT	X		DINNER CRUISE	WAIKIKI TO KEW., O.B.	200

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/23/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-1 SURF:0-1 WIND SPEED: 0-5 WIND DIRECTION: VAR. CLOUD COVER: NONE

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1929	X				RELLA MAE			DINNER CRUISE	DIAMOND H. TO KEW., O.B.	400
1929	X			100'	PRINCE KUHIO	X		DINNER CRUISE	DIAMOND H. TO HONOLULU, O	500
1934	X			100'	PEARL KAI(?)	X		DINNER CRUISE	DIAMOND H. TO KEW., O.B.	100
1937	X			35'	SPORTS FISHING		X	TROLLER	DIAMOND H. TO KEW., O.B.	200
1943	X			90'	SAN PAN	X		AKU BOAT	DIAMOND H. TO KEW., O.B.	300
1950	X			60'	CHRIS CRAFT		X	PARTY CRUISE	EWA TO ALA WAI, I.B.	150
1951	X			150'	ALII KAI	X		DINNER CRUISE	KEW. TO WAIKIKI, O.B.	400
2045	X			150'	RELLA MAE	X		DINNER CRUISE	HONOLULU TO WAIKIKI, O.B.	400

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/27/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-0,5 SURF:0-1 WIND SPEED: 0-4 WIND DIRECTION: VAR. CLOUD COVER: NONE

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1226	X			30'	RADON		X	PLEASURE	DIAMOND H. TO EWA, I.B.	200
1230	X			17'	B. WHALER		X	DIVING	H.H. TO DIAMOND H., I.B.	50
1230	X			13'	SKIFF		X	BOTTOM FISHING	D.H. TO EWA, DRIFTING	25
1230	X			13'	SKIFF		X	BOTTOM FISHING	D.H. TO EWA, DRIFTING	25
1233		X		17'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	50
1233		X		25'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	50
1235	X			13'	SKIFF		X	FISHING	ANCHORED OUTSIDE	70
1236	X			35'	CAB. CRUISER	X		TROLLING	SOUTH INTO KEW.	300
1238	X			20'	SPEED BOAT		X	PLEASURE	DIAMOND H. TO EWA, I.B.	400
1240	X			40'	SAIL BOAT		X	PLEASURE	ANCHORED OUTSIDE	50
1241	X			17'	SAIL BOAT		X	PLEASURE	CAME ABOUT TO DIAMOND H.	200
1250	X			25'	M. M. WHALER	X		TEST DRIVE	EWA TO DIAMOND H., O.B.	100
1255	X			20'	SPEED BOAT		X	PLEASURE	DIAMOND H. TO EWA, I.B.	60
1300	X	X		40'	CATAMARAN	X		TOURISM	EWA TO DIAMOND H., O.B.	100
1305	X			20'	SPEED BOAT		X	PLEASURE	EWA TO DIAMOND H., I.B.	200
1312	X			20'	FIBER FORM		X	FISHING	EWA TO DIAMOND H., I.B.	200
1313	X	X		70'	SCHOONER		X	PLEASURE	DIAMOND H. TO EWA, O.B.	400
1315	X			13'	MCKEE		X	PLEASURE	EWA TO DIAMOND H., I.B.	100
1315	X			10'	SKIFF		X	FISHING	DIAMOND H. TO EWA, I.B.	350
1320		X		25'	CATAMARAN	X		PLEASURE	SQ. RIGG D.H. TO EWA, O.B	100
1330	X			25'	FIBER FORM		X	PLEASURE	EWA TO DIAMOND H., O.B.	50
1330	X			21'	B. WHALER		X	PLEASURE	EWA TO DIAMOND H., I.B.	50
1340	X			35'	CAB. CRUISER	X		FISHING TROLL	SOUTH INTO KEW., O.B.	300
1350	X	X		25'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	200
1400	X	X		35'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, I.B.	300
1410	X			17'	B. WHALER		X	FISHING	ANCHORED OUTSIDE	500
1410	X			13'	SKIFF		X	DIVING	ANCHORED OUTSIDE	400
1420	X			35'	CAB. CRUISER	X		TROLL-FISHING	SOUTH INTO KEW., O.B.	300
1425	X			13'	SKIFF		X	FISHING	KEW. TO OUTSIDE	100
1430	X			35'	CAB. CRUISER		X	FISHING	KEW. TO SOUTH	100
1435	X			60'	JAPAN FISHER "PROSPERITY"	X		FISHING	SOUTH INTO KEW.	50
1440		X		25'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H., O.B.	300
1440		X		45'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	500
1440		X		35'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	500
1444		X		30'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H., O.B.	200
1450		X		80'	AIKANE	X		TOURISM	KEW. INTO HON. H., I.B.	300
1500	X			35'	CAB. CRUISER	X		TROLL-FISHING	SOUTH INTO KEW.	400
1505	X	X		60'	CATAMARAN	X		TOURISM	DIAMOND H. TO EWA, I.B.	50
1506		X		40'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H., I.B.	100
1512	X			21'	FIBER FORM		X	FISHING	EWA TO DIAMOND H., O.B.	50
1513	X			17'	SKI BOAT		X	PLEASURE	DIAMOND H. TO EWA, I.B.	80
1515		X		25'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, I.B.	100
1520	X			20'	FIBER FORM		X	PLEASURE	DIAMOND H. TO EWA, I.B.	50
1525		X		30'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H., I.B.	100
1530	X			17'	B. WHALER		X	FISHING-DIVING	EWA TO DIAMOND H., I.B.	50
1531	X			13'	AVON		X	PLEASURE	DIAMOND H. TO EWA I.B.	50
1532	X			35'	CAB. CRUISER	X		TROLL-FISHING	EWA INTO KEW., O.B.	100
1538		X		30'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA, O.B.	200

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/23/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-1 SURF:0-1 WIND SPEED: 0-5 WIND DIRECTION: VAR CLOUD COVER: NONE

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
0906	X			30'	PARASAIL	X		PARASAILING	KEW. TO WAIKIKI, I.B.	100
0916		X		35'	CAT	X		SAIL CHARTER	KEW. TO WAIKIKI, I.B.	150
0947	X			26'	WHITE/BLUE "MOSKITO"	X		DIVING	EWA TO ALA WAI, I.B.	150
0955	X			22'	SAN PAN	X		DIVING	DIAMOND H. TO EWA, O.B.	50
1013	X			22'	SAN PAN	X		TRAPPING	DIAMOND H. TO EWA, I.B.	20
1024			X	44'	CANOES		X	PRACTICE	ALA WAI TO KEW., I.B.	200
1024			X	44'	CANOES		X	PRACTICE	ALA WAI TO KEW., I.B.	200
1024			X	44'	CANOES		X	PRACTICE	ALA WAI TO KEW., I.B.	200
1024			X	44'	CANOES		X	PRACTICE	ALA WAI TO KEW., I.B.	200
1024			X	44'	CANOES		X	PRACTICE	ALA WAI TO KEW., I.B.	200
1028	X			18'	SPEED BOAT		X	SKI BOAT	EWA TO ALA WAI, O.B.	400
1032	X			15'	SKIFF		X	FISHING	KEW. TO WAIKIKI, I.B.	200
1032	X			22'	SAN PAN	X		TRAPPING	KEW. TO HAWAII KAI, I.B.	250
1035	X			60'	ANI ANI	X		TOURISM	KEW. TO WAIKIKI, O.B.	50
1047	X			20'	LANDING PAD	X		TOURISM	LEFT KEW. ANCHORED, O.B.	400
1047	X			20'	LANDING PAD	X		TOURISM	ANCHORED OFF ALA MOANA, O	400
1116	X			10'	ZODIAC		X	PLEASURE	ALA WAI TO EWA, I.B.	200
1120	X			50'	ANI ANI	X		TOURISM	WAIKIKI TO KEW., O.B.	100
1122			X	18'	KAYAK		X	PLEASURE	KEW. TO WAIKIKI, I.B.	250
1130	X			20'	NAUTIC		X	PLEASURE	WAIKIKI TO AIRPORT, I.B.	200
1132	X			15'	WHALER		X	TROLLING	ALA WAI TO EWA, I.B.	250
1135	X			18'	WHALER		X	TROLLING	ALA WAI TO EWA, I.B.	300
1130	X			26'	MOSKITO	X		DIVE BOAT	WAIKIKI TO KEW., I.B.	250
1140	X			60'	ANI ANI	X		TOURISM	KEW. TO WAIKIKI, O.B.	50
1155		X		40'	SAIL BOAT		X	PLEASURE	EWA TO KEW., I.B.	150
1158	X			18'	SAN PAN		X	TROLLING	KEW. TO WAIKIKI, I.B.	400
1207		X		30'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, I.B.	150
1211		X		30'	SAIL BOAT			PLEASURE	EWA TO ALA WAI, I.B.	150
1220	X			25'	WELCRAFT		X	TROLLING	EWA TO ALA WAI, O.B.	100
1222	X			18'	SKIFF		X	TROLLING	ALA WAI TO EWA, I.B.	250
1223	X			60'	ANI ANI	X		TOURISM	WAIKIKI TO KEWALO, O.B.	50
1228	X			26'	MOSQUITO	X		DIVE BOAT	KEWALO TO WAIKIKI, I.B.	200
1233	X			17'	GLASS-PAR		X	PLEASURE	WAIKIKI TO EWA, O.B.	150
1235	X			18'	WHALER		X	TROLLING	EWA TO WAIKIKI, I.B.	250
1300		X		35'	SAIL BOAT		X	PLEASURE	EWA TO WAIKIKI, I.B.	150
1310		X		60'	CAT. (HILTON	X		TOURISM	WAIKIKI TO EWA, O.B.	300
1335	X			10'	SKIFF		X	TROLLING	WAIKIKI TO EWA, I.B.	200
1338	X			10'	ZODIAC		X	TROLLING	EWA TO WAIKIKI, I.B.	300
1339	X			40'	CAB. CRUISER	X		TROLLING	EWA TO WAIKIKI, O.B.	200
1340	X			50'	ANI ANI	X		TOURISM	EWA TO WAIKIKI, O.B.	50
1400	X			26'	MOSQUITO	X		DIVE BOAT	WAIKIKI TO KEWALO, I.B.	150
1406	X			50'	MAGGIE JOE	X		TROLLING	KEWALO TO DIAMOND H., I.B	70
1409	X			35'	SAN PAN	X		LONG LINE	EWA TO DIAMOND H., I.B.	100
1420		X		30'	SAIL BOAT		X	PLEASURE	EWA TO ALA WAI, I.B.	400
1422	X			50'	ANI ANI	X		TOURISM	WAIKIKI TO KEWALO, O.B.	75
1424	X			17'	WHALER		X	PLEASURE	WAIKIKI TO EWA, I.B.	30
1425	X			15'	GLASS PAR		X	DIVING	EWA TO WAIKIKI, I.B.	50

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/23/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-1 SURF:0-1 WIND SPEED: 0-5 WIND DIRECTION: VAR. CLOUD COVER: NONE

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1432	X			45'	GOLDEN EAGLE	X		TROLLING	DIAMOND H.TO KEW., O.B.	200
1434		X		40'	MONO HULL		X	PLEASURE	DIAMOND H. TO EWA, O.B.	350
1434		X		50'	MONO HULL	X		FISHING	DIAMOND H. TO EWA, O.B.	200
1438		X		20'	CAL		X	PLEASURE	ALA WAI TO EWA, I.B.	100
1440	X			35'	CAB. CRUISER		X	TROLLING	DIAMOND H. TO EWA, O.B.	200
1442				18'	KAYAK		X	WORKOUT	KEWALO TO ALA WAI, I.B.	300
1444	X			60'	ANI ANI	X		TOURISM	KEWALO TO WAIKIKI, O.B.	100
1454	X			50'	MAGGIE JOE	X		TROLLING	WAIKIKI TO KEWALO, O.B.	75
1503	X			15'	GLASS PAR		X	DIVERS	ALA WAI TO EWA, O.B.	100
1517	X			45'	SAN PAN	X		TROLLING	DIAMOND H. TO KEWALO, O.B	200
1518		X		25'	MONO		X	PLEASURE	ALA WAI TO EWA, O.B.	300
1519	X			60'	ANI ANI	X		TOURISM	WAIKIKI TO KEWALO, O.B.	150
1524	X			35'	PARASAIL	X		TOURISM	CIRCLED, O.B.	100
1540	X			25'	SAN PAN	X		DIVING	EWA TO ALA WAI, I.B.	100
1541		X		40'	SAIL BOAT		X	PLEASURE	ALA WAI TO EWA, I.B.	50
1545	X			13'	WHALER		X	TROLLING	EWA TO ALA WAI, I.B.	30
1546	X			15'	SKIFF		X	PLEASURE	ALA WAI TO EWA, I.B.	100
1550	X			40'	CHARTER	X		TROLLING	WAIKIKI TO KEWALO, O.B.	100
1551	X			50'	SAN PAN	X		TROLLING	WAIKIKI TO KEWALO, O.B.	200
1556	X			18'	BOAT RAFT	X		TOURISM	BACK INTO KEWALO, O.B.	400
1606		X		40'	CAT MANN KAI	X		SAIL/CHARTER	WAIKIKI TO KEWALO, O.B.	200
1618		X		40'	CAT MANN KAI	"		SAIL/CHARTER	KEWALO TO WAIKIKI, O.B.	500
1626		X		25'	CATAMARAN	X		SAIL/CHARTER	WAIKIKI TO EWA, O.B.	350
1630			X	18'	KAYAK		X	WORKOUT	WAIKIKI TO EWA, O.B.	100
1642		X		20'	CAL		X	PLEASURE	EWA TO ALA WAI, I.B.	200
1648				18'	KAYAK		X	WORKOUT	EWA TO ALA WAI, I.B.	100
1653		X		12'	SUNFISH		X	PLEASURE	ALA WAI TO EWA, O.B.	300
1702	X			17'	WHALER		X	UNKNOWN	EWA TO ALA WAI, O.B.	300
1710		X		30'	CATAMARAN	X		SAIL/CHARTER	RTN KEW. FROM WAIKIKI, O.	150
1713	X			45'	SAN PAN	X		TROLLING	DIAMOND H. TO KEW., O.B.	50
1712	X			15'	SKIFF		X	FISHING DIVE	EWA TO ALA WAI, I.B.	250
1729	X			80'	AIKANE CAT	X		DINNER CRUISE	KEWALO TO WAIKIKI, O.B.	100
1736	X	X		40'	MANU KAI CAT	X		TOURISM	WAIKIKI TO KEWALO, O.B.	100
1741		X		30'	MONO HULL		X	PLEASURE	ALA WAI TO EWA, O.B.	150
1746	X			100'?	PEARL KAI	X		DINNER CRUISE	KEWALO TO WAIKIKI, O.B.	500
1755	X			150'	RELLA MAE			DINNER CRUISE	HONOLULU TO WAIKIKI, O.B.	500
1806		X		12'	SUNFISH		X	PLEASURE	EWA TO ALA WAI, O.B.	25
1757	X			30'	SAN PAN	X		BOTTOM FISHING	KEWALO TO WAIKIKI, O.B.	75
1802	X			100'	PRINCE KUHIO	X		DINNER CRUISE	HONOLULU TO WAIKIKI, O.B.	200
1810	X			150'	ALII KAI	X		DINNER CRUISE	HONOLULU TO WAIKIKI, O.B.	70
1845	X			80'	AIKANE	X		DINNER CRUISE	WAIKIKI TO KEWALO, I.B.	100
1848	X			60'	CRIS CRAFT		X	PARTY	ALA WAI TO EWA, O.B.	75
1855	X			90'	SAN PAN	X		AKU BOAT	DIAMOND H. TO KEW., O.B.	100
1911		X		45'(?)	HUNA KAI	X		SAIL/CHARTER	WAIKIKI TO KEW., O.B.	70
1916	X			100'	PEARL KAI	X		DINNER CRUISE	WAIKIKI TO KEW., O.B.	500
1924	X			100'	ALII KAI	X		DINNER CRUISE	DAIMOND H. TO KEW., O.B.	75

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/21/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-1 SURF:0-1 WIND SPEED: 5-8 WIND DIRECTION: W CLOUD COVER: 100%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1534	X	X		70'	SAIL BOAT	X		TOURISM	DIAMOND H. INTO KEW.	800
1540	X			100'	PEARL KAI	X		TOURISM	DIAMOND H. INTO KEW.	800
1541		X		65'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	300
1545	X			50'	CAB. CRUISER	X		FISHING	SOUTH INTO KEW.	200
1546		X		35'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	300
1550	X			100'	ADVENTURER	X		TOURISM	EWA INTO KEW.	300
1552		X		45'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	400
1559	X	X		60'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	300
1600		X		60'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	200
1601		X		15'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	300
1602	X			60'	ALENTIAN	X		FISHING	OUT OF KEW. TO EWA	200
1609		X		50'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	400
1610		X		50'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	500
1620		X		60'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	300
1621		X		50'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	200
1621	X			40'	SAN PAN	X		FISHING	DIAMOND H. INTO KEW.	800
1625	X			21'	FIBOR FORM		X	PLEASURE	SOUTH INTO KEW.	600
1630		X		25'	CATAMARAN	X		TOURISM	DIAMOND H. TO EWA	20
1632	X			30'	CAB. CRUISER	X		FISHING	SOUTH INTO KEW.	800
1650		X		50'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	500
1655	X			13'	B. WHALER		X	PLEASURE	EWA TO DIAMOND H.	100
1658	X			25'	PARASAIL	X		TOURISM	DIAMOND H. TO EWA	300
1714	X	X		80'	AIKANE	X		TOURISM	LEFT KEW. TO DIAMOND H.	800
1715	X			13'	SPEED BOAT		X	PLEASURE	DIAMOND H. TO EWA	5
1716		X		20'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	200
1717	X			60'	SAN PAN	X		FISHING	TUNA BOAT RTN TO KEW.	300
1717	X			65'&300'	TUG & BARGE	X		TRADE	HON. H. TO DIAMOND H.	500
1718		X		65'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	700
1730	X			65'&300'	TUG & BARGE	X		TRADE	DIAMOND H. TO HON. H.	500
1733		X		70'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	700
1735		X		70'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	500
1740	X			150'	CRUISE SHIP ROYAL PRINCE	X		TRADE	HON. H. TO DIAMOND H.	100
1745	X			100'	PEARL KAI	X		TOURISM	KEW. TO DIAMOND H.	800
1746	X			150'	WIND JAMMER	X		TOURISM	HON. H. TO DIAMOND H.	100
1747	X			100'	AIKANE	X		TOURISM	HON. H. TO DIAMOND H.	50
1748	X			17'	FIBOR FORM		X	PLEASURE	EWA TO DIAMOND H.	300
1755		X		45'	SCHOONER		X	PLEASURE	DIAMOND H. TO EWA	500
1756		X		45'	SCHOONER		X	PLEASURE	DIAMOND H. TO EWA	500
1756		X		45'	SCHOONER		X	PLEASURE	DIAMOND H. TO EWA	400
1800	X			30'	CAB. CRUISER	X		FISHING	SOUTH INTO KEW.	500
1802	X			50'	HEPTUNE	X		FISHING	EWA INTO KEW.	300
1815	X	X		80'	AIKANE	X		TOURISM	HON. H. TO DIAMOND H.	300
1805	X			80'	ANI ANI	X		TOURISM	KEW. TO DIAMOND H.	800
1815		X		45'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	500
1835	X			50'	SAN PAN	X		FISHING	EWA INTO HON. H.	800
1845		X		45'?	SAIL BOAT		X	PLEASURE	EWA INTO HON. H.	800
1900	X			50'?	SAN PAN	X		FISHING	EWA INTO KEW.	300
1915	X	X		80'	AIKANE(?)	X		TOURISM	DIAMOND H. INTO HON. H.	400

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/21/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-1 SURF:0-1 WIND SPEED: 5-8 WIND DIRECTION: W CLOUD COVER: 100%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1930	X			40'?	SAN PAN	X		FISHER	KEWALO TO DIAMOND H.	800
1930	X			80'	AIKANE	X		TOURISM	DIAMOND H. INTO HON. H.	300
1930	X			150'	WIND JAMMER	X		TOURISM	RTN TO HON. H.	200
1745	X			150'	P. ROYALE	X		TRANSPORTATION	DIAMOND H. INTO HON. H.	30*
1755	X			65'&300'	TUG & BARGE	X		TRADE	HON. H. TO DIAMOND H.	200
1800	X			500'	OIL SHIP(?)	X		UNKNOWN	EWA TO DIAMOND H.	30*
1815	X			500'	MATSON SHIP	X		TRADE	EWA INTO HON. H.	800
1820	X			500'	OIL SHIP(?)	X		UNKNOWN	DIAMOND H. TO EWA	400
1845	X			65'&300'	TUG & BARGE	X		TRADE	HON. H. TO DIAMOND H.	300
1850	X			100'	WIND JAMMER	X		TOURISM	HON. H. TO DIAMOND H.	200

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/21/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-1 SURF:0-1 WIND SPEED: 5-8 WIND DIRECTION: W CLOUD COVER: 100%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
0910	X	X		45'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	300
0915	X			100'	PEARL KAI	X		TOURISM	KEW. TO DIAMOND H.	300
0915	X			80'	ANI ANI	X		TOURISM	KEW. TO DIAMOND H.	300
0930	X			17'	B. WHALER		X	FISHING	DIAMOND H. TO EWA	800
0933	X			13'	AVON		X	FISHING	DIAMOND H. TO EWA	500
0935	X			13'	B. WHALER		X	FISHING	BOTTOM FISHING	200
0940	X			10'	FLAT BOTTOM		X	FISHING	BOTTOM FISHING	300
0953	X			65'&100'	TUG & BARGE	X		TRADE	HON. H. TO EWA	800
0958	X			30'	FIBER FORM		X	PLEASURE	EWA TO DIAMOND H.	800
1015	X			35'	SAN PAN	X		TRAPPER	EWA INTO HON. H.	800
1030	X			100'	JAPAN SHIP	X		FISHING	HON. H. GOING SOUTH	300
1032	X			50'	TUNA BOAT	X		FISHING	KEW. TO EWA	
1040	X			60'	TUNA BOAT	X		TRANS	KEW. TO HON. H.	300
1040	X			60'	TUNA BOAT	X		TRANS	KEW. TO HON. H.	300
1045		X		40'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	800
1053	X			50'	TUNA BOAT	X		FISHING	SOTH INTO KEW. BASIN	200
1120	X			17'	FIBER FORM		X	FISHING	LEFT KEW. TO EWA	300
1123	X			17'	B. WHALER		X	FISHING	LEFT KEW. TO EWA	300
1130	X			80'	ANI ANI	X		TOURISM	DIAMOND H. INTO KEW.	800
1130	X			35'	CAB. CRUISER	X		FISHING	DIAMOND H. INTO KEW.	800
1130	X			25'	B. WHALER		X	FISHING	DIAMOND H. INTO KEW.	800
1130	X			100'	PEARL KAI	X		TOURISM	PEARL HARBOR TO DIAMOND H	300
1134	X			13'	B. WHALER		X	PLEASURE	EWA TO DIAMOND H.	200
1140	X			30'	RADON		X	FISHING	DIAMOND H. TO EWA	300
1142	X			30'	CAB. CRUISER		X	FISHING	DIAMOND H. TO EWA	300
1145	X			100'	PEARL KAI	X		TOURISM	DIAMOND H. INTO KEW.	800
1145	X			80'	ANI ANI	X		TOURISM	LEFT KEW. TO DIAMOND H.	800
1148	X			100'	ADVENTURER	X		TOURISM	EWA INTO DIAMOND H.	500
1150	X			50'	L.L. BOAT	X		FISHING	HON. H. TO KEW.	300
1150		X		45'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	800
1200	X			100'	ADVENTURER	X		TOURISM	DIAMOND H. INTO KEW.	500
1200	X			21'	B. WHALER	X		PLEASURE	EWA TO DIAMOND H.	300
1205		X		15'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	300
1215	X			20'	PARASAIL	X		TOURISM	DIAMOND H. INTO KEWALO	800
1220	X			20'	PARASAIL	X		TOURISM	KEW. TO DIAMOND H.	800
1230	X			80'	ANI ANI	X		TOURISM	DIAMOND H. TO KEW.	800
1230	X			65'&300'	TUG & BARGE	X		TRADE	INTO HON. H.	800
1240		X		45'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	600
1245		X		30'	SAIL BOAT		X	PLEASURE	DIMAOND H. TO EWA	400
1250	X			13'	B. WHALER		X	FISHING	ANCHORED NEAR KEWALO	300
1250	X			13'	B. WHALER		X	FISHING	ANCHORED NEAR KEWALO	300
1300		X		20'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	300
1300		X		25'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	800
1305		X		25'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	700
1310	X			13'	B. WHALER		X	PLEASURE	DIAMOND H. TO KEW. & BACK	800
1314	X			25'	CAB. CRUISER	X		FISHING	RTN TO KEWALO FROM SOUTH	800
1316	X	X		80'	CATAMARAN	X		TOURISM	WAIKIKI TO EWA	400
1320	X			100'	PEARL KAI	X		TOURISM	KEW. TO P. HARBOR	300

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/21/86 TIME BEGIN: 0900 TIME END: 2100
SEA:CALM, 0-1 SURF:0-1 WIND SPEED: 5-8 WIND DIRECTION: W CLOUD COVER: 100%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1330	X			50'	BLUE FIN	X		FISHING	DIAMOND H. TO KEW.	800
1330	X			50'	BLUE FIN II	X		FISHING	DIAMOND H. INTO KEW.	800
1330	X			100'	ADVENTURER	X		TOURISM	KEWALO TO EWA	300
1336		X		16'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	100
1337		X		16'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	300
1340	X			80'	ANI ANI	X		TOURISM	KEWALO TO DIAMOND H.	800
1345	X			22'	B. WHALER		X	PLEASURE	OUT OF KEW. & BACK	800
1350		X		45'	CHYSALIS		X	PLEASURE	EWA TO DIAMOND H.	50
1350		X		45'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	70
1400	X			17'	FIBER FORM		X	FISHING	SOUTH INTO KEW.	800
1401	X			13'	MCKEE		X	FISHING	SOUTH TO DIAMOND H.	300
1405	X			35'	CAB. CRUISER	X		FISHING	DIAMOND H. TO EWA	400
1406		X		30'	CATAMARAN		X	PLEASURE	EWA TO DIAMOND H.	600
1407	X			21'	B. WHALER		X	PLEASURE	DIAMOND H. INTO KEW.	800
1409	X			35'	CAB. CRUISER	X		FISHING	KEW. TO DIAMOND H.	800
1010	X			35'	RADON	X		FISHING	DIAMOND H. TO KEW.	800
1411		X		15'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	400
1412	X			35'	CAB. CRUISER	X		FISHING	KEWALO TO DIAMOND H.	800
1417		X		70'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	400
1435	X			60'	CAB. CRUISER	X		FISHING	TROLLING SOUTH INTO KEW.	800
1340	X			13'	MCKEE		X	FISHING	DIAMOND H. TO EWA	300
1342		X		70'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	600
1343		X		70'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	600
1343		X		70'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	600
1344		X		65'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	600
1345		X		65'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	600
1346	X			50'	CAB. CRUISER	X		FISHING	LEFT KEW. TO EWA	200
1347		X		16'	HOBIE CAT		X	PLEASURE	DIAMOND H. TO EWA	300
1350		X		60'	KALANI		X	PLEASURE	DIAMOND H. TO EWA	50
1355		X		20'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	300
1356		X		50'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	700
1357		X		20'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	500
1358		X		30'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	100
1357		X		70'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	200
1500	X			13'	B. WHALER		X	FISHING	DRIFTING IN FRONT OF HON.	800
1504	X			20'	SPEED BOAT		X	PLEASURE	EWA TO DIAMOND H.	300
1505	X			60'	SAN PAN	X		FISHING	SOUTH INTO KEW.	800
1507		X		45'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	300
1515	X			13'	DINGHY		X	FISHING	DIAMOND H. TO EWA	300
1520		X		45'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	300
1521		X		50'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	200
1521	X			17'	MCKEE		X	PLEASURE	EWA TO DIAMOND H.	300
1522	X			17'	B. WHALER		X	FISHING	KEW. TO DIAMOND H.	800
1523	X			100'	PEARL KAI	X		TOURISM	EWA TO DIAMOND H.	300
1525	X			70'&300'	TUG & BARGE	X		TRADE	LEFT HON. H. TO DIAMOND H	300
1530	X			70'&300'	TUG & BARGE	X		TOWING	SOUTH INTO HON. H.	800
1532		X		80'	CATAMARAN	X		TOURISM	EWA TO DIAMOND H.	200
1533	X			13'	B. WHALER		X	FISHING	DIAMOND H. TO EWA	800
1533	X			80'	ANI ANI	X		TOURISM	DIAMOND H. INTO HON. H.	800

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/17/86 TIME BEGIN: 0900 TIME END: 2100
SEA:S.C.W.,CHOP SURF:1-2 WIND SPEED: 10-22 WIND DIRECTION: NE CLOUD COVER: 60-70%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1333		X		16'	HOBIE		X	PLEASURE	EWA TO HON. H.	800
1340	X			100'	ANI ANI	X		TOURISM	KEWALO TO DIAMOND H.	800
1348	X			60'&150'	TUG & BARGE	X		TRADE	MATSON FROM MAINLAND	800
1420	X			50'	SAN PAN			TRAPPERS	HON. H. HEADED SOUTH	300
1423		X		65'	SLOOP		X	PLEASURE	DIAMOND H. TOWARDS EWA	800
1430		X		12'	SAIL BOAT		X	PLEASURE	FROM EWA TO DIAMOND H.	400
1430	X			100'	ANI ANI	X		TOURISM	FROM DIAMOND H. INTO KEW.	800
1433	X			60'	PILOT BOAT	X		TOWING/HARBOR	FROM HON. H. TO KEW.	300
1435		X		200'	SLOOP		X	PLEASURE	TURNED AROUND TO DIAMOND	300
1440	X			200'	JAPAN FISH.	X		FISHING	LEFT HON. H. TO SOUTH	800
1440	X			65'	C.G. VESSEL	FED.		MILITARY	LEFT HON. H. HEADED DIAMO	300
1448	X			90'	B/W TUG BOAT	X		TOWING/HARBORS	HON. H. TO EWA	500
1450	X			65'	C.G. VESSEL	FED.		MILITARY	RETURNING TO HON. H.	300
1455		X		80'	SCHOONER	X		TOURISM	DIAMOND H. TOWARDS EWA	25
1505	X			25'	PARASAIL	X		TOURISM	DIAMOND H. TOWARDS EWA	800
1506	X			60'	KAHUNA KAI			TROLLING	RTN TO KEW. BASIN	100
1523	X			1000'	PACIFICA EMC	X		CARGO SHIP	LEAVING HON. H.	800
1525	X			17'	B. WHALER		X	PLEASURE	LEFT KEW. BASIN	800
1525	X			40'	PILOT BOAT	STATE		HARBORS	CAME OUT OF HON. H.& BACK	800
1530	X	X		80'	HILTON RAINB	X		TOURISM	EWA TOWARDS WAIKIKI	100
1532	X			17'	FIBER FORM	X		TOURISM	PARASAIL 2ND BOAT	700
1540	X			13'	SKIFF		X	PLEASURE	DAIMOND H. TO KEW. BASIN	800
1542	X			25'	PARASAIL	X		TOURISM	TOWED PARACHUTE W/PERSON	100
1545	X			65'	B/W TUG	X		HARBORS	HON. H. TO GUIDE SHIP	800
1600	X			17'	REC. BOAT		X	PLEASURE	EWA INTO KEW. BASIN	400
1610	X			25'	PARASAIL	X		TOURISM	TOWING PLATFORM IN	800
1620	X			25'	PARASAIL	X		TOURISM	LEFT KEW. TO DIAMOND H.	800
1625			X	15'	CANOE		CLUB	SPORT	PRACTICE	800
1640		X		30'	SAIL BOAT		X	PLEASURE	DIAMOND H. GOING EWA	300
1641	X			22'	B. WHALER		X	PLEASURE	DIAMOND H. GOING EWA	400
1648	X	X		35'	SAIL BOAT		X	PLEASURE	DIAMOND H. GOING EWA	800
1655	X			60&150'	TUG & BARGE	X		TRADE	TUG TAKING MATSON	800
1655		X		70'	SAIL BOAT		X	PLEASURE	INTO HON. H. FROM EWA	800
1658	X			30'	PILOT BOAT	STATE		HARBORS	GREET IN COMING SHIP	800

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/17/86 TIME BEGIN: 0900 TIME END: 2100
SEA:S.C.W.,CHOP SURF:1-2 WIND SPEED: 10-22 WIND DIRECTION: NE CLOUD COVER: 60-70%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1702	X			65'&300'	TUG & BARGE	X		TRADE	TOWING BARGE INTO HON. H.	800
1702	X			65'&300'	TUG & BARGE	X		TRADE	TOWING BARGE FROM HON. H.	800
1703		X		70'	CATAMARAN	X		TOURISM	DIAMOND H. INTO KEW. BASI	800
1704	X			200'	JAPAN FISHING			FISHING	INTO HON. H.	800
1704	X			65'	PILOT BOAT	STATE		STATE	ACCOMPANY JAPAN VESSEL	500
1705		X		21'	BAYLINER		X	PLEASURE	EWA TO DIAMOND H.	400
1710		X		65'	AIKANE IV	X		TOURISM	KEW. TO DIAMOND H.	800
1520	X			65'	AIKANE	X		TOURISM	KEW. TO DIAMOND H.	800
1530			X	50'	SANPAN	X		LONG LINE	KEW. TO HON. H.	300
1530			X	8'	KAYAKS		X	SPORT	ALA MOANA TO KEW.	800
1530			X	8'	KAYAKS		X	SPORT	ALA MOANA TO KEW.	
1530			X	8'	KAYAKS		X	SPORT	ALA MOANA TO KEW.	
1540	X			8'	KAYAKS		X	SPORT	ALA MOANA TO KEW.	
1545	X			70'	MARLIN	X		TUNA BOAT	FISHING, RTN TO KEW.	200
1646		X		150'	WIND JAMMER	X		TOURISM	LEFT HON. H. TO DIAMOND H	500
1648		X		23'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA	200
1650	X			65'	AIKANE IV	X		TOURISM	DIAMOND H. TO EWA	300
1700	X			150'	PEARL KAI	X		TOURISM	KEW. TO DIAMOND H.	800
1700	X			100'	ALII KAI	X		TOURISM	HON. H. TO DIAMOND H.	400
1702	X			35'	CAB. CRUISER	X		TROLLING	RTN. TO KEW.	800
1702	X	X		50'	C.G. VESSEL	FED.		MILITARY	LEFT HON. H. TO DIAMOND H	800
1705	X			65'	SCHOONER		X	PLEASURE	HON. H. TO EWA	800
1810	X			65'	SAN PAN	X		LONG LINE	LEFT HON. H. TO DIAMOND H	400
1835	X			65'	AIKANE	X		TOURISM	DIAMOND H. TO EWA	300
1840	X			50'(?)	SAN PAN(?)	X		FISHING(?)	EWA TO DIAMOND H.	600
1850	X			400'(?)	BATTLESHIP	FED.		MILITARY	EWA TO DIAMOND H.	800
1900	X			65'	AIKANE	X		TOURISM	EWA TO DIAMOND H.	200
1905	X			65'	AIKANE	X		TOURISM	DIAMOND H. TO KEW.	800
1906	X			65'	AIKANE	X		TOURISM	FROM DIAMOND H. TO HON. H	300
1910	X			150'	PEARL KAI	X		TOURISM	EWA TO DIAMOND H.	500
1910	X			105'	AIKANE	X		TOURISM	DIAMOND H. TO HON. H.	300
1930	X			300'	(?)BARGE	X		(?)	HON. H. HEADED SOUTH	800
1930	X			150'	PEARL KAI	X		TOURISM	DIAMOND H. RTN TO KEW.	800
1935	X			500'(?)	EMC PACIFICA	X		TRADE	LEFT HON. H.	800
2040	X			150'	WIND JAMMER	X		TOURISM	DIAMOND H. TO HON. H.	400
2050	X			150'	WIND JAMMER	X		TOURISM	HON. H. TO DIAMOND H.	800
				65'&300'	TUG & BARGE	X		TRADE	HON. H. TO DIAMOND H.	800

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/15/86 TIME BEGIN: 0900 TIME END: 2100
SEA: CALM, 1-2' WIND SPEED: 6-10 WIND DIRECTION: NE CLOUD COVER: 20%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
0915	X			100'	C.G. CUTTER	FED		MILITARY		800
0930	X			145'	TUG & BARGE	X		TRANSPORTATION		100
0930	X			100'	PEARL KAI	X		TOURISM	LEFT HON. H.	
0935	X			100'	PEARL KAI	X		TOURISM	PEARL HARBOR	
0940	X			50'	"EI"	X		TUNA BOAT	ENTERING KEWALO	270
1000	X			10'	AVON		X	PLEASURE	LEFT KEWALO TO P.H.	300
1015	X			65'	TUG & BARGE (MANUKOI)	X		TRANS/TRADE	ENTERING HON. H.	
1020	X	X		30'	SAIL BOAT		X	PLEASURE	ENTERING HON.HAR	20
1020	X			50'	SAN PAN	X		TUNA BOAT	SOUTH KEW/BASIN	500
1045	X			10'	AVON		X	PLEASURE	RTN TO KEWALO	100
1045	X			13'	SKIFF		X	BOTT. FISHER	RTN TO KEWALO	50
1100	X			55'	BARBERA ANN	X		COMM. FISHER	RTN TO KEWALO	50
1110	X			50'	YELLOW PILOT	STATE		TUG BOAT	GREET INCOMING SHIP	700
1115	X			17'	BOSTON WHALER		X	PLEASURE	HEADING EWA (INSIDE)	200
1120	X			60'	SAN PAN	X		TUNA BOAT	HEADING INTO KEW. H.	100
1118	X			60'	BLACK TUG	X		TUG BOAT	HEADING INTO HON. H.	800
1120	X			100'	PEARL KAI	X		TOUR	HEADING INTO KEWALO	500
1125	X			13'	FIBER FORM		X	DIVER	ANCHOR 100YDS AWAY	100
1130	X			25'	RADON		X	SCUBA	PASSING	300
1130	X			17'	RAD SKIFF		X	BOTTOM FISHER	ANCHOR 150YDS AWAY	100
1140	X			50'	YELLOW PILOT	STATE		PILOT BOAT	RTN TO HON. HARBOR	300
1140	X			17'	B/W BOAT		X	PLEASURE	PASSING TO KEWALO	800
1143	X			300'	PACIFICA FA	X		TRANSPORTATION	CONTAINER SHIP HON. H.	800
1145	X			17'	NONE	X		TOURISM	TOWING PARACHUTE PASS.	100
1145	X			100'	PEARL KAI	X		TOURISM	RTN TO KEWALO	100
1150	X			17'	B/W BOAT		X	PLEASURE	RETURN PASSENGERS	35
1155	X			150'	JAPAN/KOREAN	X		FISHING	HEADING INTO HON. H.	800
1155	X			17'	NONE	X		TOURISM	TOWING PARA/PASS.	100
1200	X			20'	TRAPPER	X		TRAPPER	HEADING INTO HON. H.	300
1200		X		30'	KETCH		X	PLEASURE	HEADING DIAMOND HEAD	300
1240	X			15'	SKIFF		X	TRAPPER	HEADING EWA	70
1223	X			50'	O/WHITE SANP	X		TUNA BOAT	KEWALO TO DIAMOND H.	800
1230	X			50'	O/WHITE SANP	X		TUNA BOAT	KEWALO TO DIAMOND H.	800
1230	X			100'	TOUR BOAT	X		TOURISM	RTN TO KEWALO	500
1240	X			80'	C.G. CUTTER	FED		MILITARY	OUT OF HON. H. TO D.H.	300
1300	X			80'	C.G. CUTTER	FED		MILITARY	RTN TO HON. HARBOR	500
1305	X			17'	WHALER		X	PLEASURE	LEFT KEW. BASIN TO D.H.	800
1308	X			50'	BLUE SAN PAN	X		TUNA BOAT	LEAVE KEW. TO DIAMOND H.	800
1308	X			50'	O/W SAN PAN	X		TUNA BOAT	RTN TO KEWALO	800
1311		X		50'	W/SLOOP	X		PLEASURE	PASSING, HEADING EWA	400
1317	X	X		40'	CATAMARAN	X		TOURISM	HEADING EWA	800
1317	X			17'	CATAMARAN	X		DIVING	ANCHORED NEAR SHORE	500
1312	X			17'	FIBER FORM	X		TOURISM	TOWING PARACHUTE	70
1330	X			100'	GLASS BOTTOM	X		TOURISM	LEFT KEWALO TO PEARL H.	100
1330	X			50'	BLUE SAN PAN	X		TUNA BOAT	RTN TO KEWALO	500
1330	X			17'	FIBER FORM	X		TOURISM	TOWING PARACHUTE	100

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/15/86 TIME BEGIN: 0900 TIME END: 2100

SEA: CALM, 1-2' WIND SPEED: 6-10 WIND DIRECTION: NE CLOUD COVER: 20%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1335	X			17'	AVON C.G.	FED	X	MILITARY	LEFT HON. TO DIAMOND H.	35
1340	X			100'	GLASS BOTTOM	X		TOURISM	LEFT KEWALO TO DIAMOND H.	500
1343	X			17'	FIBER FORM	X		TOURISM	TOWING PARACHUTE	16
1345	X			70'	B/W SANPAN	X		TUNA BOAT	HEADING INTO HON. H.	500
1352	X			19'	FIBER FORM		X	PLEASURE	EWA TO DIAMOND HEAD	50
1354		X		60'	SCHOONER		X	PLEASURE	EWA TO DIAMOND HEAD	50
1355	X			17'	FIBER FORM		X	PLEASURE	EWA TO DIAMOND HEAD	50
1405	X			150'	R/V	X		UNKNOWN	LEFT HON. H. TO DIAMOND H	800
1420	X			100'	GLASS BOTTOM	X		TOURISM	RTN TO KEWALO	800
1425	X			30'	CAB. CRUISER	X		FISHING	RTN TO KEWALO	800
1430	X			35'	CAB. CRUISER	X		FISHING	RTN TO KEWALO	800
1445	X			100'	GLASS BOTTOM	X		TOURISM	LEAVE KEW. TO DIAMOND H.	800
1500	X			30'	PARASAILING	X		TOURISM	PASSING, D.H. TO EWA	100
1515		X		25'	SLOOP		X	SAILING	PLEASURE CRUISING	16
1530	X			100'	GLASS BOTTOM	X		TOURISM	RTN TO KEWALO	500
1540	X	X		40'	CATAMARAN	X		TOURISM	GOING WAIKIKI FROM EWA	1000
1550	X			35'	B/W SAN PAN	X		TRAPPING	CAME FROM EWA INTO HON. H	800
1555	X			30'	B/W CAB. CRUISER		X	FISHING	INTO KEWALO	500
1600	X	X		45'	SAILBOAT		X	SAILING	FROM D.H. GOING EWA	300
1605	X			35'	RADON	X		FISHING	FROM D.H. GOING EWA	800
1605	X	X		30'	CATAMARAN	X		TOURISM	PASSING FROM WAIKIKI	300
1607	X			100'	GLASS BOTTOM	X		TOURISM	RTN FROM DIAMOND HEAD	300
1608		X		15'	SAIL BOAT		X	PLEASURE SAIL	FROM EWA, GOING DIAMOND H	200
1610	X			150'	KOREAN VESSEL	X		FISHING	LEAVING HON. HARBOR	800
1615	X			150'	B/W SEA SPRAY	X		UNKNOWN	RTN TO HON. HARBOR	200
1625	X			150'	KOREAN VESSEL	X		FISHING	LEAVE HON. HARBOR	800
1630	X			17'	FIBER FORM	X		TOURISM	TOW PARACHUTE	100
1630	X			75'	C.G. CUTTER	FED		MILITARY	RTN TO HON. H.	800
1635	X			35'	CAB. CRUISER (PACIFIC BLUE)	X		FISHING	RTN TO KEWALO	200
1700	X			13'	B. WHALER		X	PLEASURE	DIAMOND HEAD TO EWA	200
1702		X		30'	SAIL BOAT		X	SAILING	LEFT HONOLULU HARBOR	300
1705	X			22'	POWER BOAT		X	UNKNOWN	LEFT KEWALO TO D.H.	800
1710	X	X		40'	SAIL BOAT		X	PLEASURE	PASSING DIAMOND H. TO EWA	900
1711	X	X		40'	SAIL BOAT		X	PLEASURE	PASSING DIAMOND H. TO EWA	800
1715	X			50'	ALII KAI	X		TOURISM	FROM KEWALO TO DIAMOND H.	500
1730		X		30'	SAIL BOAT		X	PLEASURE	FROM P.H. INTO KEWALO	800
1735	X	X		50'	ALII KAI	X		TOURISM	OUT HON. H. TO DIAMOND H.	100
1737		X		30'	SAIL BOAT		X	PLEASURE	FROM P.H. INTO KEWALO	800
1738		X		35'	SAIL BOAT		X	PLEASURE	FROM EWA TO DIAMOND HEAD	1000
1739	X			40'	TRAWLER ALI-	X		FISHER	FROM HON.H., ANCHORED	250
1740		X		35'	CATAMARAN	X		TOURISM	FROM DIAMOND HEAD	300
1740		X		50'	CATAMARAN	X		TOURISM	FROM HON. H. TO DIAMOND H	100
1740	X			180'	WIND JAMMER	X		TOURISM	HON. H. TO DIAMOND HEAD	100
1740	X			100'	PEARL KAI	X		TOURISM	FROM KEWALO TO P.H.	800
1745	X			35'	CAB. CRUISER	X		FISHING	LEFT KEWALO TO P.H.	500
1800		X		75'	SCHOONER		X	PLEASURE	P.H. TO EWA PIER	1000

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/15/86 TIME BEGIN: 0900 TIME END: 2100
SEA: CALM, 1-2' WIND SPEED: 6-10 WIND DIRECTION: NE CLOUD COVER: 20%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
1800		X		75'	SCHOONER		X	PLEASURE	DIAMOND H. TO EWA DIREC.	1000
1800		X		35'	SAIL BOAT		X	PLEASURE	DIAMOND H. TO EWA DIREC.	1000
1900	X	X		50'?	ALII KAI(?)	X		TOURISM	DIAMOND H. RTN TO KEWALO	800
1913	X			35'?	CAB. CRUISER		X	ANCHOR(FISH)	EWA	800
1915	X			17'?	SKIFF		X	FISHING	KEWALO, ANCHORED	85
1925	X	X		80'?	ALII KAI	X		TOURISM	DIAMOND H. RTN TO HON. H.	35
1930	X			100'?	PEARL KAI	X		TOURISM	DIAMOND H. RTN TO HON. H.	300
1930	X			100'	PEARL KAI	X		TOURISM	DIAMOND H. RTN TO KEWALO	800
1935	X			150'	WIND JAMMER	X		TOURISM	DIAMOND H. RTN TO HON. H.	800
1945	X			100'	PEARL KAI(?)	X		TOURISM	DIAMOND H. RTN TO KEWALO	800
2015	X			30'?	UNKNOWN	(?)	(?)	(?)	OUT OF HON. H.	300
2043	X			150'	WIND JAMMER	X		TOURISTS	HON. H. TO DIAMOND H.	35
2048	X			38'	PILOT BOAT	STATE		(?)	HON. H. TO DIAMOND H.	35
2100	X	X		80'	ALII KAI	X		TOURISM	HON. H. TO DIAMOND H.	35

SUBMERSIBLE OPERATING AREA
BOAT TRAFFIC SURVEY

DATE: 12/17/66 TIME BEGIN: 0900 TIME END: 2100

SEA:S.C.W.,CHOP SURF:1-2 WIND SPEED: 10-22 WIND DIRECTION: NE CLOUD COVER: 60-70%

TIME	TYPE OF CRAFT POWER	SAIL	OTHER	APPROX LENGTH	VESSEL MAKE/NAME	COMM.	PRIVATE	ACTIVITY	NOTES	CPA (YDS)*
0912	X			35'	W/CAB. CRUISER		X	FISHING	FROM HON. H. TO DIAMOND H	1000
0915	X			1000'	BATTLE SHIP MILITARY			MILITARY	FROM EWA TO DIAMOND H.	500
0918		X		25'	CATAMARAN	X		TOURISM	EWA TO DIAMOND H.	500
0930	X			25'	CAB. CRUISER		X	FISHING	FROM H. H. TO P.H.	300
0930	X			100'	PEARL KAI	X		TOURISM	FROM KEW. TO DIAMOND H.	800
0945	X			30'	PARASAIL	X		TOURISM	FROM KEW. TO DIAMOND H.	800
1005	X			35'	W/CABIN CRUISER		X	FISHING	FROM EWA TO DIAMOND H.	400
1020	X			17'	FIBER FORM		X	PLEASURE	FROM HON. H. TO KEW.	800
1040	X			100'	ANI ANI	X		TOURISM	FROM KEW. TO DIAMOND H.	800
1042	X			35'	CAB. CRUISER	X		FISHING	FROM KEW. TO DIAMOND H.	800
1056	X			35'	CAB. CRUISER	X		FISHING	ANCHORED OUTSIDE	300
1105	X			40'	CAB. CRUISER	X		FISHING	FROM EWA TO KEW.	200
1105	X	X		40'	SAIL BOAT		X	PLEASURE	EWA TO DIAMOND H.	1000
1110	X			22'	FIBER FORM		X	PLEASURE	KEW. TO HON. H.	800
1112	X			45'	PILOT BOAT	STATE		STATE	GREET HON/S & RTN	800
1115	X			17'	FIBER FORM		X	FISHING	DIAMOND H. TO EWA	300
1116	X			50'	CORSAIR	X		FISHING	EWA TO KEW. BASIN	200
1130	X			100'	ANI ANI	X		TOURISM	DIAMOND H. INTO KEW. BASI	500
1131		X		18'	SAIL BOAT		X	PLEASURE	SAILING	300
1132	X			1000'	HONDA SHIP	X		FROM JAPAN	DELIVERING CARS	800
1145	X			12'	SKIFF		X	PLEASURE	EWA TO DIAMOND H.	300
1148	X			100'	ANI ANI	X		TOURISM	KEW. TO DIAMOND H.	800
1150	X			100'	PEARL KAI	X		TOURISM	RTN TO KEWALO	800
1153	X			50'	LONG LINE BO	X		FISHING	LEFT HON. H.	800
1155	X			13'	B. WHALER		X	FISHING	DIAMOND H. INTO KEW.	800
1156	X			35'	CAB. CRUISER	X		FISHING	TROLLING RTN TO KEW	800
1223	X			50'	SEA QUEEN	X		FISHING	TUNA BOAT	200
1230	X			100'	ANI ANI	X		TOURISM	DIAMOND H. TO KEW.	800
1232	X			50'	B/W TUG	STATE		STATE	GUIDE SHIP	800
1305		X		18'	SAIL BOAT		X	PLEASURE	SAILING	20'
1315		X		40'	SAIL BOAT	X		TOURISM	SAILING EWA TO DIAMOND H.	800
1320	X	X		80'	CATAMARAN	X		TOURISM	WAIKIKI TOWARD EWA	800
1323	X			100'	PEARL KAI	X		TOURISM	LEFT KEW. TO DIAMOND H.	300