

DEPARTMENT OF TRANSPORTATION



COAST GUARD

MARINE CASUALTY REPORT

**MV HOLO HOLO; DISAPPEARANCE
IN THE PACIFIC OCEAN
ON 11 DECEMBER 1978 WITH PRESUMED
LOSS OF LIFE**

**U.S. COAST GUARD
MARINE BOARD OF INVESTIGATION REPORT**

**AND
COMMANDANT'S ACTION**

REPORT NO. USCG 16732 /01280

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<p>16. Abstract</p> <p>On 9 December 1978 the M/V HOLO HOLO departed Honolulu, HI with ten persons on board for the purpose of collecting oceanographic data and deploying oceanographic equipment off the western coast of Hawaii. On 12 December the vessel was reported overdue and a ten day search effort commenced utilizing the facilities of the U. S. Coast Guard, Coast Guard Auxiliary, U. S. Navy, the Civil Air Patrol, the University of Hawaii and the U. S. Air Force. The search failed to locate the HOLO HOLO. On 9 December 1979, the NOAA Ship CROMWELL detected a sonar signal in response to a triggering signal sent from the ship. On 10 December 1979, experts aboard the CROMWELL identified these signals as coming from underwater acoustic devices known to have been on the HOLO HOLO. Based on this data, the Board concluded that the HOLO HOLO sank at 20°6'N, 156°28'N, the location of the acoustic devices.</p> <p>This report contains the U. S. Coast Guard Marine Board of Investigation and the Action taken by the Commandant to determine the proximate cause of the casualty and the recommendations to prevent recurrence.</p> <p>The Commandant has concurred with the Marine Board that the most probable cause of the casualty was that the HOLO HOLO encountered seas of sufficient height and frequency to flood the forecandle, for which drainage was grossly inadequate, to a point where stability was lost, capsizing the vessel. A probable contributing cause was the vessel's lack of watertight integrity which would have permitted progressive flooding to occur.</p>					
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M/V HOLO HOLO; DISAPPEARANCE OF IN THE PACIFIC
OCEAN NEAR THE HAWAIIAN ISLANDS ON OR ABOUT 11
DECEMBER 1978 WITH LOSS OF LIFE

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DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

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16732/HOLOHOLO

18 NOV 1981

Commandant's Action

on

The Marine Board of Investigation convened to investigate the circumstances surrounding the disappearance of the M/V HOLOHOLO in the Pacific Ocean near the Hawaiian Islands on or about 11 December 1978 with loss of life

The report of the Marine Board of Investigation convened to investigate the subject casualty has been reviewed; and the record, including the findings of fact, conclusions and recommendations, is approved subject to the following comments.

REMARKS

1. With regard to finding of fact 2, documentation, 46 CFR 67.45-1 is not considered pertinent. It should be noted however that 46 CFR 67.07-3 (b) provides that "no enrollment and license or license shall be considered in force longer than the vessel to which it is granted is owned as stated in the document, nor shall it be valid if the description of the vessel is changed, nor if the vessel engages in any business of employment other than that for which the document was granted." Moreover, 46 CFR 67.33-1 (a)(8) requires a marine document be surrendered to the Coast Guard when the vessel changes from one employment to another. Additionally, employment of a documented yacht other than for pleasure subjects the vessel to forfeiture under 46 USC 103. In the case of the HOLOHOLO a surrender was not made on or subsequent to 26 October 1978 when the vessel made its first voyage to collect data and samples for the Ocean Thermal Energy Conversion (OTEC) project. Nor, at the inception of this voyage, was the HOLOHOLO employed exclusively for pleasure.

COMMENTS ON CONCLUSIONS

1. The proximate cause of this casualty could not be determined. I concur that the most probable cause, as described in conclusion 1, was that the HOLOHOLA encountered seas of sufficient height and frequency to flood the forecastle, for which drainage was grossly inadequate, to a point where stability was lost, capsizing the vessel. It is recognized that the circumstances surrounding the loss of the HOLOHOLA could not be determined with certainty, and that other scenarios are possible. Regardless, the investigation has established that HOLOHOLA departed on its final voyage with a number of serious deficiencies which could have adversely affected the vessel's ability to survive the sea conditions encountered on 10 December 1978.
2. Conclusions 9 and 12 are not concurred with. Although the HOLOHOLA was not designated an "Oceanographic Research Vessel" in accordance with section 1 of the Oceanographic Research Vessel Act (46 USC 441 et seq) and therefore was not entitled to the exemptions contained therein, the vessel was nevertheless engaged in oceanographic research. Prior to enactment of the Oceanographic Research Vessel Act, scientific personnel aboard research vessels who carried out scientific work at sea were categorized as "other persons in the crew" on inspected vessels and "seamen" on uninspected vessels. These individuals were considered engaged in the primary mission of the vessel even though they were not concerned with navigation, and were required to carry seamen's documents. Only those scientists and technicians who were embarked for the purpose of performing research at shore locations were considered passengers. This prior administrative determination has not been rescinded and, accordingly, controls. Therefore, all scientific personnel aboard the HOLOHOLA were crew not passengers. Additionally, the HOLOHOLA was not subject to inspection during the period it was employed in the Ocean Thermal Energy Conversion project.
3. With respect to conclusion 10, it should also be noted that since the vessel was used other than exclusively for pleasure the vessel was subject to forfeiture under 46 USC 103.
4. In view of my comments in paragraph 2 above, conclusion 13 is not concurred with. The HOLOHOLA was an undocumented motor vessel under 300 gross tons not subject to inspection. Therefore, there is evidence of violation by the following laws and regulations:

- (a) Failure of the master to report seamen shipped in accordance with 46 CFR 14.05-20 and 46 USC 643(1).
- (b) All seamen aboard the HOLOHOLO were not documented as required by 46 USC 672(1); and
- (c) The HOLOHOLO being an undocumented vessel equipped with machinery did not have a number issued by the State of Hawaii as required by 46 USC 1466.

ACTION CONCERNING THE RECOMMENDATIONS

Recommendation 1:

Action: This recommendation is not concurred with. Casualty data for uninspected oceanographic research vessels does not point to a broad problem which would warrant the inspection of these vessels. Additionally, action to regulate Oceanographic Research Vessels would be in conflict with the intent of the statutes pertaining to this class of vessels (46 USC 441 et. seq.). These statutes were enacted to facilitate relaxation of inspection and manning requirements which primarily applied to these vessels.

Recommendation 2:

Action: Recommendation 2 is concurred with. New regulations are being developed which would provide for Coast Guard Officers in Charge, Marine Inspection to make the designation mandated by 46 USC 441. The regulations would also require the owner or operator of a vessel to make application for the designation and provide for a periodic renewal of such designations. These designations will be issued for a period of two years provided all operating conditions remain unchanged.

Recommendation 3:

Action: I believe that increased use of EPIRBs is desirable from a search and rescue (SAR) point of view. On 21 November 1978 Commandant Notice 2370 was issued on the use of EPIRBs by fishing vessels. This Notice explicitly directed Coast Guard District Commanders to use such means as are practicable within their districts to encourage fishing vessels (those going more than twenty miles offshore) to carry EPIRBs. This Notice has since been reissued as Commandant Instruction 2370.2 series and extended to cover other uninspected vessels. At the present time there is an ongoing international experimental program involving the use of a low-orbiting satellite system to detect and locate both aircraft electronic locator transmitters (ELT) and marine EPIRBs operating on 121.5/243 MHz. The first launch is

scheduled for 1982. This experiment will also test a new class of EPIRB's designed to operate on 406 MHz, a frequency reserved by the World Administrative Radio Conference (WARC) for maritime satellite SAR purposes.

It is hoped that this EPIRB will be capable of being detected by geosynchronous as well as low orbiting satellites. Existing ELTs and EPIRBs do not have sufficient power to be detected by geosynchronous satellites. Undoubtedly a 406 MHz satellite EPIRB system will offer many advantages for alerting and locating maritime distress cases, e.g. area coverage will be far more extensive and there will be no gaps in coverage. In addition, the Intergovernmental Maritime Consultative Organization (IMCO) is currently urging the International Maritime Satellite Organization (INMARSAT) to include an EPIRB capability in its geostationary satellite network.

The Coast Guard intends to seek legislative authority to require the satellite EPIRB system on all U. S. vessels. Presently EPIRBs are required on certain U.S. Coast Guard inspected vessels. The Coast Guard does not intend to seek legislative authority to extend the present EPIRB system to all vessels since the satellite system could be ready for implementation in the four to five year period that would be needed to obtain the enabling legislation and get the final regulations into effect, and the satellite EPIRB system is expected to render the present system obsolete. By seeking legislative authority now for the satellite system while it is still under development, the Coast Guard will be prepared to implement the system with a minimum of delay as soon as it becomes operational. In the interim we will review further measures to encourage the carriage of EPIRBs on all vessels.

Recommendation 4

Action: This recommendation is concurred with. No further action will be taken with regard to the evidence of violation of laws and regulations.

Recommendation 5:

Action: A copy of this report will be forwarded to the interested agencies mentioned.



R. H. SCARBOROUGH
Vice Admiral, U. S. Coast Guard
ACTING COMMANDANT



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Commanding Officer
Marine Safety Office
1 Embarcadero Center
Suite 309
San Francisco, CA
94111

16732/M/V HOLOHOLO

26 JUN 1980

From: Marine Board of Investigation
To: Commandant (G-MMI-1)
Subj: M/V HOLOHOLO, O.N. 294 826; disappearance of; in the Pacific Ocean near the Hawaiian Islands on or about 11 December 1978 with loss of life

FINDINGS OF FACT

1. On the morning of 11 December 1978, the M/V HOLOHOLO did not appear as scheduled at the port of Kawaihae, HI. She had sailed from Honolulu, HI at 1437 (all times HST +10 zone description) on 9 December 1978 with ten persons on board for the purpose of collecting oceanographic data and deploying oceanographic equipment off the western coast of the island of Hawaii. The vessel was last seen off Waikiki shortly after sailing. Neither the vessel nor any of the persons on board are known to have been seen or heard from since that time.

2. VESSEL

Description Obtained From Last Issued Document

Name:	HOLOHOLO
Official Number:	294826
Gross Tonnage:	134.24
Net Tonnage:	91
Register Length:	77.4 feet
Register Breadth:	25.4 feet
Register Depth:	4.6 feet
Place and Year Built:	Honolulu, HI in 1963
Register Owner:	[REDACTED]
Address:	[REDACTED]
Register Master:	[REDACTED]
Address:	(same as above)
Register Service:	Pleasure
Document:	Consolidated Certificate of Enrollment and Yacht License issued 1 July 1977



It's a law we
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16732/M/V HOLOHOLO

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Additional Data

Propulsion:	4 GM 671 diesel engines; 4 propellers
Horsepower:	660
Classification:	Unclassed
Frame Spacing:	1 foot, 10 inches
Overall Length:	90 feet
Equitable Owner:	[REDACTED]
Address:	P. O. Box 15854; Honolulu, HI
Charterer:	Research Corporation of the University of Hawaii

Ownership

On 18 September 1978, [REDACTED] and [REDACTED] entered into an agreement of sale for HOLOHOLO. This agreement permitted [REDACTED] to take immediate possession of the vessel. However, it provided that [REDACTED] was to retain title with stipulation that it would be transferred to [REDACTED] upon final payment of the purchase price.

Documentation

Coast Guard records indicated that HOLOHOLO was last documented on 1 July 1977 as a pleasure vessel. The Consolidated Certificate of Enrollment and Yacht License listed [REDACTED] as the sole owner and [REDACTED] as Master. This license was retained by the [REDACTED] family for the purpose of completing a bill of sale after the final payment for the vessel was received from [REDACTED]. The "Agreement of Sale" would not have been recordable at the Coast Guard Documentation Office, Honolulu, Hawaii to indicate a complete transfer of ownership to [REDACTED] because it was a conditional contract. The Documentation Officials at Coast Guard Marine Safety Office, Honolulu, Hawaii were unaware that the vessel had been sold and was being used for other than pleasure purposes. The vessel was not numbered by the State of Hawaii. 46 CFR 67.45-1 states that when a vessel is sold or transferred in whole or in part the vessel shall not be deemed a vessel of the U.S. until documented anew.

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Trade

Prior to the September 1978 sale, HOLOHOLO was used exclusively as a pleasure vessel. During October 1978, a contract was executed between [REDACTED] and the Research Corporation of the University of Hawaii (RCUH) permitting the University of Hawaii to use HOLOHOLO for oceanographic research purposes. Before the December 1978 voyage, the vessel was used on one occasion for oceanographic work. There is no known record of the Coast Guard or the Secretary of Transportation being requested to find (designate) HOLOHOLO an Oceanographic Research Vessel in accordance with 46 USC 441.

Charter

On 25 October 1978, a contract entitled "Bareboat Charter Agreement" was executed between [REDACTED] and RCUH, a corporation established by Chapter 307 of the Education Code of the State of Hawaii. This agreement provides for charter of the vessel for six days every other month with the charter fees set on the basis of a daily rate. [REDACTED] was required to provide liability insurance for the vessel and its operations, naming RCUH as an insured.

On the same date, a "Master's Agreement" was executed between RCUH and [REDACTED]. This agreement specified that [REDACTED] would provide a "...properly qualified captain, ships officers and crew..." and be responsible for their expenses in addition to the vessel operating and maintenance costs. [REDACTED] possessed a U.S. Coast Guard Ocean Operator's license limited to passenger vessels not over 100 gross tons.

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The Master's agreement gave him full and final authority with respect to the management and operation of the vessel including determination regarding conditions affecting the safety of the crew and scientific personnel and the safe navigation of the vessel. [REDACTED] testified that [REDACTED] had selected him to sign the master's agreements to "...satisfy requirements for insurance, that he needed to have somebody sign on as master who was not the owner..." [REDACTED] was considered qualified by RCUH officials because of the representations of [REDACTED].

Both [REDACTED] and [REDACTED] were present when the two agreements were signed. During the first voyage under these agreements (October 26 -30 1978), [REDACTED] provided the crew, and assumed responsibility for their expenses in addition to the vessel operating and maintenance costs. [REDACTED] gave the money he received from RCUH to [REDACTED] who, in turn paid [REDACTED] a previously agreed amount.

[REDACTED] was not selected by [REDACTED] to make the second voyage. [REDACTED], representing RCUH when both agreements were signed stated that he was unaware that [REDACTED] was not involved in the December voyage. He indicated that, had he received such information, he would have required that a new master's agreement be executed.

Communications and Navigation Equipment

The following electronic equipment was installed aboard HOLOHOLO:

- a. One Monrow LAA-1850 loran A receiver
- b. Two Comdel Marine OMNI receivers (installed new in October 1978)
- c. One ICOM 250 VHF transceiver (installed new in October 1978)
- d. One EBSCO Seaveyor radar, 36 mile range (installed new in October 1978)
- e. One deactivated double side band transceiver

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All of the active electronic equipment was powered by either of two battery banks installed forward on the centerline in the lower part of the engine room. Each bank consisted of two 12 volt marine batteries connected in parallel. The batteries also provided power for starting the main propulsion engines and the two diesel generators. A battery charger for converting ships service AC to DC was located in the engine room. There was no Emergency Position Indicating Radio Beacon (EPIRB) on board.

Emergency Equipment

There were three life floats or peripheral-body type buoyant apparatus fitted with drop platforms aboard the vessel. Two such 9 1/2 foot long units, estimated to be for 20 persons, were lashed securely with nylon line in the vertical position outboard of the life rails at the 13 foot level (measured from the keel) aft of the stack. A similar but smaller unit, estimated to be a 10-man size, was stowed flat on the centerline at the 13 foot level forward of the pilot house. There were an estimated 20 personal flotation devices (PFD's), some if not all of which were stenciled "HOLOHOLO", wedged between the awning and the supporting pipe structure aft of the stack or in metal boxes welded to the deck at the 13 foot level aft. Hand held and rocket flares of an unknown quantity were stowed in the pilot house. There were two ring buoys, one on either side of the pilot house bulkheads, outboard. All life saving and emergency equipment was reportedly in satisfactory condition. The manufacturer and Coast Guard approval numbers, if any, are unknown.

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Structural Characteristics

HOLOHOLO was a flat bottomed, hard chine, steel vessel. Fuel tanks, with a capacity of 7,000 gallons were incorporated into 9 inch high double bottoms from frame 14 aft, for the entire beam, to the stern. No single deck was continuous for the length of the vessel. The forecastle deck was at the 9 foot 8 inch level (above the bottom plating), terminating at frame 14, the forward bulkhead of a berthing compartment. There were two decks between frames 14 and 26, at the 5 foot, 4 inch level and the 13 foot level. The engine room, below the owner's cabin extended between frames 26 and 37 with decks at the 8 foot, 6 inch and 15 foot, 9 inch levels. Between frames 37 and 46, there were two decks, at the 5 foot, 4 inch and 13 foot levels, enclosing the galley/wet lab space. The fantail deck was at the 5 foot, 4 inch level, below which was the steering gear compartment. Figure 1 illustrates.

The entire forecastle deck was enclosed by 3 foot solid bulwarks and a thwartship bulkhead at frame 14, 3 foot 8 inches high. There were seven openings in this well; four were hawser ports for mooring lines with the lower extension of the opening approximately 2 feet above the deck; two freeing ports just forward of frame 14, one on each side at the deck level of approximately 0.88 square feet each; and a stair well opening on the port side at frame 14, 2 feet, 6 inches wide with an 8 inch coaming, leading aft and down to the midships weatherdeck. There was no corresponding stairway to the starboard weatherdeck. Instead, bulkhead 14 extended to the starboard bulwark. The total freeing port area for the forecastle was therefore approximately 0.88 square feet for each side.

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MODIFIED INBOARD PROFILE
ILLUSTRATING LOCATION OF DECKS, BULKHEADS, COMPARTMENTS

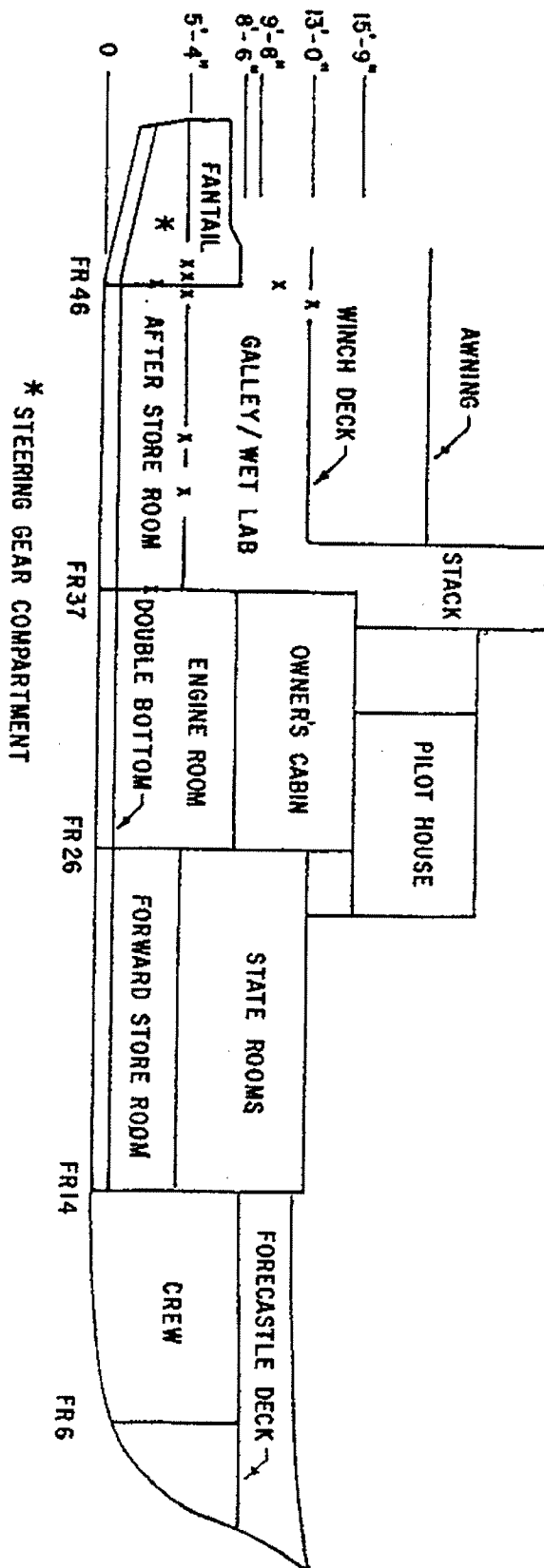


FIGURE 1

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The length of the bulwark from the bow to frame 14 is approximately 29 feet. Had the vessel required a load line, 46 CFR 43.10-97(a) would have required a minimum of 9.4 square feet of freeing port on each side for a bulwark length of 29 feet on coastwise vessels of 150 gross tons on freeboard decks and raised quarterdecks. Freeing ports are required to be as close to the deck as possible. The hawser ports and stairwell opening are not counted as freeing ports for these calculations. The two hawser ports near the top of the bulwarks provide 2.25 square feet of drainage opening for each side. An additional 3.33 square feet is provided at the stairwell opening on the port side. Calculations indicate that the forecastle could hold 34.5 long tons of sea water instantaneously.

The bulwarks enclosing the fantail and after main deck compartment measure 42 feet on each side (including one half of the transom width). 46 CFR 43.10-97(a) requires 10.7 square feet of freeing port area for that length. Calculated freeing port area is 0.8 square feet on each side. Hawser ports provide approximately 8 square feet on each side with the lowest part about 12" above the deck.

Hull Structural Alterations

Between 18 September and 9 December 1978 modifications and additions were made to HOLOHOLO which resulted in penetrations in weathertight and watertight bulkheads and decks as follows:

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a. A hatch and associated coaming were removed from the fantail by cutting flush with the main deck, leaving a 2' by 4' opening into the steering compartment.

b. A freezer box previously located on the fantail was relocated inside the galley/wet lab compartment. The freezer machinery was located in the after storeroom on the tanktop. Removal of the associated refrigerant piping left two holes (1/2" and 3/4") in the deck of the fantail and through bulkhead 46 between the steering gear room and the after storeroom. Penetrations in the main deck at the new location were required to reactivate the freezer.

c. The entire upper half of bulkhead 46 separating the galley/wet lab compartment from the fantail was removed, leaving the compartment open to the weather.

d. A hydraulic winch was installed on the winch deck (13' level) aft. The hydraulic pump was installed in the engine room. Penetrations were made in the winch deck at frame 45 1/2, the main deck at frame 45 1/2, and the after engine room bulkhead using a cutting torch. Two hydraulic lines were installed through these penetrations without stuffing tubes or other provisions for sealing them.

Approximate locations of these penetrations are illustrated in Figure 1 by X's. In addition, an uncovered access opening in the deck between the galley/wet lab and the after store room is similarly marked.

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There is no evidence that any of these penetrations were made watertight prior to the vessels departure on 9 December 1978. Many were seen on 8 December 1978 in the conditions described above. The intention of LANEY to cover the hatch opening on the fantail with plywood and to seal other penetrations was expressed. The opening on the fantail was not obvious to witnesses who were aboard on 9 December 1978.

Hull Strength

Following the January 1979 open session of this Marine Board of Investigation, the Board requested, from the Commandant of the Coast Guard, expert evaluation of hull strength characteristics and stability evaluations based on information received by the Board. The following information was provided:

- a. Witness sketches of loading arrangement on the fantail.
- b. Witness sketches of bulkheads 37 and 46 with dimensions of penetrations.
- c. Witness sketches of "A frame" and rigging.
- d. Witness sketches of the winch deck and equipment.
- e. Witness sketches of structural modifications.
- f. Drawing of stowage of the current meter array anchors outboard of the transom.
- g. A complete set of drawings.
- h. Photographs of the vessel.
- i. Fuel tank and water tank capacities and the assumption that they were full.
- j. Location of equipment with weights and sizes where known.
- k. Weather observations of LCU-1573 and S/V JEANOYCE.
- l. Wave hindcasts of "benchmark site" by Dr. [REDACTED]

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Hull strength calculations were performed by the David Taylor Naval Ship Research and Development Center (DTNSRDC) under contract to the Coast Guard during August and September 1979. Applied hull bending moments were calculated for several conditions and criteria including: deck flooding forward and aft; probable wave induced maxima; and slamming maxima. The conclusion was, "The strength of the hull girder appears adequate to sustain conservatively estimated probable combined maximum applied bending moments."

Stability

The DTNSRDC calculations indicate that the HOLOHOLO's bow would be submerged 6.6 times per hour in head seas of 9 feet significant wave height and 6.4 second significant wave period while traveling at a speed of 5 knots. Boarding seas over the fantail were predicted while the vessel was dead in the water in head seas of six or more feet.

Stability calculations were performed by a staff naval architect of the Ship Characteristics Branch (G-MMT-5), U. S. Coast Guard Headquarters in response to the Board's request. The stability calculations indicate that HOLOHOLO would either capsize or founder if both the after store room and steering compartments were flooded. They further indicate that the entrapment of 34.5 long tons of water in the forecandle area was possible. This amount of water in the forecandle, with the vessel on a 10 foot wave, crest amidship, would almost instantaneously reduce the HOLOHOLO's righting moment to zero (Figure 2 reproduces the naval architect's graph illustrating this situation). The report concluded that, "Capsizing would be inevitable", under these conditions. A twelve foot high wave with as little as 10 long tons of water in the forecandle well would produce the same result. The calculations were based on static conditions.

RIGHTING ARM FOR VARIOUS WAVE HEIGHTS
FLOODED FORECASTLE CONDITION

26 JAN 1997

CREST AMIDSHIPS
WAVE LENGTH = 84 FEET

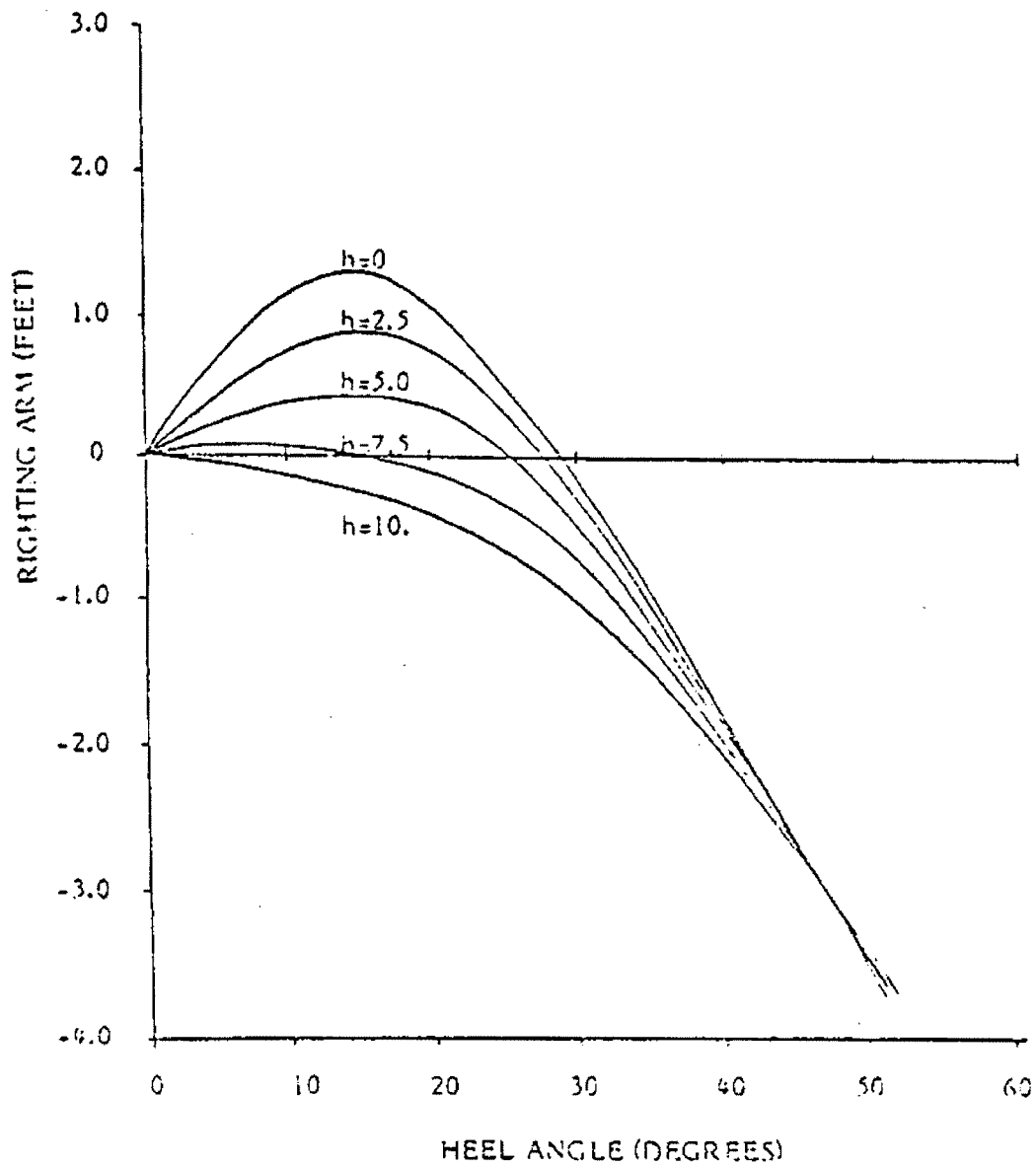


FIGURE 2

16732/M/V HOLOHOLO

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3. PERSONNEL DATA

The following relates to all persons known to have been aboard the HOLOHOLO on her last voyage, all of whom are missing:

a. Name: [REDACTED]
Address: [REDACTED]
SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: Monroe, NC
Next of Kin: HM3 [REDACTED] USN [REDACTED]
Address: NRMCM-CLMCN; Camp LeJeune, NC 28542

[REDACTED] contracted to purchase HOLOHOLO on 18 September 1978 and thereafter performed the following functions: contracting for maintenance, modifications, new equipment and provisions; signing the charter agreement as owner; and assuming the duties normally performed by a master. [REDACTED] was a professional airline pilot. He was the owner of a 40 foot sail boat.

b. Name: [REDACTED] CDR, USN (Ret)
Address: [REDACTED]
SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: San Francisco, CA
Next of Kin: [REDACTED]
Address: (same as above)

[REDACTED] was the holder of U. S. Coast Guard License # [REDACTED], endorsed as: "Master, oceanographic research vessels, any gross tons; Master uninspected motor, not over 300 gross tons, upon oceans; Master, ocean steam or motor yachts; Chief Mate, ocean steam or motor, any gross tons; Radar observer." He also held MMD # [REDACTED] endorsed as: "Any unlicensed rating in the deck department except Able Seaman; wiper." [REDACTED] license and document were not at home after 9 December 1978.

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There is no evidence that a written contract was signed concerning his employment. On 16 December 1978, Mrs. [REDACTED], during a call to the Joint Rescue Coordination Center, stated in part, "... my [REDACTED] was the one that was hired by Mr. [REDACTED] to take this HOLOHOLO out." Also, he had told a neighbor that he was, "taking the boat out." He accepted the job on 4 December 1978 and had not sailed on HOLOHOLO prior to that time. His experience in Hawaiian waters included 44 days at sea on inter-island cargo vessels during 1977. In addition, he had made a six week oceanographic voyage to Tahiti as mate on the R/V KANA KEOKI, a vessel owned by the University of Hawaii.

c. Name:
Address:

SSAN:
Date of Birth:
Place of Birth:
Next of Kin:
Address:

[REDACTED]
Worcester, MA
Mr. & Mrs. [REDACTED]
[REDACTED]

[REDACTED] was an employee of Hawaiian Fluid Power Co. doing work aboard HOLOHOLO connected with the installation of the hydraulic winch when he was offered a job by [REDACTED] as crewmember for the December 9, 1978 voyage. He was to do general mechanical work and hydraulic repairs. He was a welder and had used the vessel's welding machine during the winch installation. He had no prior seagoing experience.

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d. Name: Dr. [REDACTED]
Address: [REDACTED]
SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: Pasadena, CA
Next of Kin: [REDACTED]
Address: (same as above)

Dr. [REDACTED] was employed as a professor of oceanography by the University of Hawaii. He was assigned by the University to be the principal investigator for the Ocean Thermal Energy Conversion (OTEC) Project. As principal investigator, he selected the vessel as the platform from which to conduct the scientific experiments. Cost, lab space, accommodations and deck space are factors which he considered in making his decision. RCUH witnesses indicated that the "Bareboat Charter Agreement" was executed based mainly on Dr. [REDACTED] recommendation. His position aboard the vessel was Chief Scientist. On the vessel's previous voyage for the same project he held the same position and in addition performed duties in the pilot house as a messenger and sometime helmsman for the person in charge of the watch. There is no evidence that he had training or experience to qualify him to evaluate the seaworthiness of HOLOHOLO.

e. Name: Dr. [REDACTED]
Address: [REDACTED]
SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: Emsworth, England
Next of Kin: [REDACTED]
Address: (same as above)

Dr. [REDACTED] was employed by the University of Hawaii and was on board HOLOHOLO as a member of the scientific party.

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f. Name: [REDACTED]
Address: [REDACTED]
SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: Glen Falls, NY
Next of Kin: Mr. & Mrs. [REDACTED]
Address: [REDACTED]

[REDACTED] was employed by the University of Hawaii and was on board HOLOHOLO as a member of the scientific party.

g. Name: Dr. [REDACTED]
Address: [REDACTED]
SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: Los Angeles, CA
Next of Kin: [REDACTED]
Address: [REDACTED]

Dr. [REDACTED] was employed by Lawrence Berkeley Laboratory, Berkeley, CA and was aboard HOLOHOLO as a member of the scientific party.

h. Name: Dr. [REDACTED]
Address: [REDACTED]
SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: Indianapolis, IN
Next of kin: [REDACTED]
Address: [REDACTED]

Dr. [REDACTED] was employed by Lawrence Berkeley Laboratory, Berkeley, CA and was aboard HOLOHOLO as a member of the scientific party.

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i. Name: [REDACTED]
Address: [REDACTED]

SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: La Grande, WA
Next of Kin: [REDACTED]
Address: (same as above)

[REDACTED] was an employee of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration assigned to the Pacific Marine Environmental Laboratory (PMEL), Seattle, WA. He was aboard HOLOHOLO as a member of the scientific party.

j. Name: [REDACTED]
Address: [REDACTED]

SSAN: [REDACTED]
Date of Birth: [REDACTED]
Place of Birth: Port Angeles, WA
Next of Kin: [REDACTED]
Address: (same as above)

[REDACTED] was an employee of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration assigned to the Pacific Marine Environmental Laboratory, Seattle, WA. He was aboard HOLOHOLO as a member of the scientific party.

There is no information in Coast Guard files nor was information brought forth during the investigation, that any of the persons aboard, except as noted above, were holders of a Coast Guard issued license or Merchant Mariner Document.

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4. WEATHER

The National Weather Service broadcast four marine forecasts per day during December of 1978. They were made at 0500, 1100, 1700 and 2300. At 1100 on Saturday, 9 December 1978 the forecast cancelled existing small craft advisories and indicated, "Winds over coastal waters East Northeast 15 knots seas 4 feet... All major channels East Northeast 20 knots seas 8 ft." These same conditions were predicted for Sunday. That afternoon, a charter boat operator estimated HOLOHOLO to be operating in two to three foot seas off Waikiki. She further estimated that there were 25 knot winds with four to five foot seas further offshore in the unprotected waters of the Kaiwi Channel, one of the major channels.

The 1700, 9 December forecast stated, "Caution is advised due to marginal wind and sea conditions for all Hawaiian waters... Winds over coastal waters East Northeast 20 knots seas 8 feet... All major channels East Northeast 25 knots seas 10 feet. Other channels around Lanai variable 15 knots seas 4 feet." These conditions did not change for the two succeeding broadcasts, except that the 0500, 10 December broadcast predicted "Channels around Lanai Easterly 20 knots seas 8 feet."

The 1100, 10 December forecasts stated, "Small craft advisories are effective at 1100 for all Hawaiian waters exposed to strong gusty trades... Winds over coastal waters East Northeast 25 knots seas 10 feet... All major channels East Northeast 30 knots seas 12 feet. Other channels around Lanai Easterly 25 knots seas 10 feet."

At 1310 on 10 December, the Army LCU-1573 reported 10-12 foot seas from the East-Northeast in the Alenuihaha Channel. The next day she reported similiar seas. This condition, because of a longer period allowed a crossing with seas and wind fine on the port bow to minimize being set to the South.

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S/V JEANOYCE, crossing the Kaiwi Channel at 1845 on 10 December, estimated the wind at 35 knots from ENE with 20 foot seas. The wave period was described as "short and very sharp".

The marine weather forecasts remained the same until gale warnings were broadcast at 1700 on 11 December. This forecast stated, in part "Gale warnings are effective at 5 PM for all channels exposed (sic) to strong gusty trade winds. Small craft advisories remain in effect for other waters around the Hawaiian Islands exposed to the trades... Winds over coastal waters East Northeast 30 knots seas 12 feet...All major channels East Northeast 40 knots seas 20 feet...Other channels around Lanai Easterly 30 knots seas 12 feet."

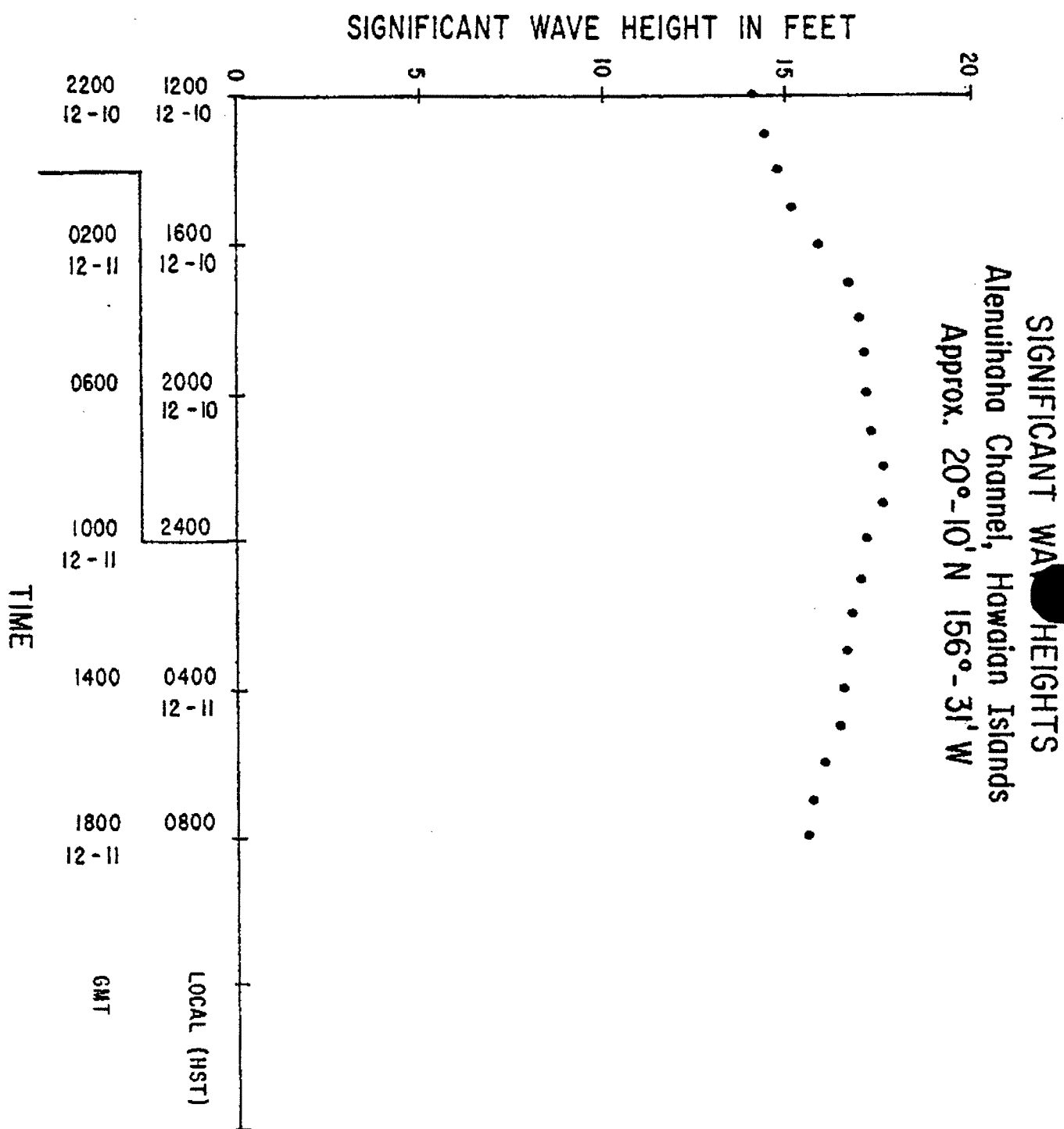
Gale warnings remained in effect thereafter until 0500 on 22 December 1978. Coastal winds reached a high of 35 knots with seas of 15 feet. Major channel weather was predicted as high as 45 knot winds with 25 foot seas.

At the request of the Board, the National Ocean Survey prepared detailed hindcasts of wave heights. Relevant calculations are set forth in Figure 3.

Marine weather forecasts predict significant wave heights, the average of the highest one-third of the waves that can be produced by certain wind conditions over a certain duration. Therefore, there are about 16 percent of the waves greater in height than the reported value and one of 100 waves will be 60 percent higher. For the purpose of these forecasts, the Alenuihaha and Kaiwi Channel's are "major" channels.

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Figure 3.



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5. PREVIOUS VOYAGES

STUBENBERG Operations

Prior to the transfer to [REDACTED], HOLOHOLO had been in possession of one owner and used solely for pleasure purposes. All voyages taken while in possession of [REDACTED] were begun under fair weather conditions. On the first sign of rough seas on any voyage, the vessel was navigated to a safe harbor. Whenever rough seas were encountered which caused an uncomfortable ride, seas were placed on the quarter to minimize the discomfort. On one occasion some water covered the fantail deck to a height no higher than the six inch hatch coaming. HOLOHOLO remained substantially the same as when she was built until the transfer. It was estimated that the vessel had about 600 hours of underway time before [REDACTED] took possession.

Purpose of Charter

The purposes of the HOLOHOLO charter and two voyages were to deploy oceanographic moorings and collect scientific bio-ecological data from the "Benchmark Site", a point west of Kawaihae on the Island of Hawaii at position 20 - 00 N, 156 - 08 W. The data was to be used in connection with the Ocean Thermal Energy Conversion (OTEC) project. During the first voyage, there were no plans to deploy moorings. Other types of data and samples were collected. There was no federal security classification assigned to this project or to any of the equipment to be utilized or carried by HOLOHOLO during her part in the project.

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First OTEC Voyage Preparations

Following the transfer of the vessel to [REDACTED], alterations were made. The after main deck stateroom was converted to a "wet lab" by removing the after thwartship bulkhead at frame 41, bunks and lockers and relocating the freezer which was previously mounted on the fantail into the space. The transverse weathertight bulkhead between the main deck and 13 foot level at frame 46 was cropped and converted to a 4 foot counter. An "A frame" was mounted on the deck (5 foot level) aft of frame 46. An electric winch was moved from the fantail to the 13 foot level, aft and rigged for use in conjunction with the "A frame". Two dinghys were removed from the vessel and replaced with two life float/buoyant apparatus on the 13 foot level outboard. Installation of electronic navigation and communications equipment previously described was completed at this time.

On 6 October 1978, HOLOHOLO was boarded by inspectors from the Marine Safety Office [REDACTED] in response to an Application for Inspection, submitted [REDACTED], requesting a Certificate of Inspection for HOLOHOLO as a small passenger vessel. The vessel was in drydock at the time. The inspectors visually examined the bottom and side shell plating, witnessed gagings of the side shell and bottom plating and reviewed x-ray reports of welds. The external examination, gagings and x-rays were considered to be within acceptable limits by the inspectors.

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Further formal inspection of the vessel, however, was terminated by Mr. [REDACTED] when he indicated that he wished to defer his application for inspection to a later date. He sighted shortage of funds as the reason. A limited cursory internal examination was made by the inspectors followed by oral discussion of some of the changes and procedures which would be required by the Coast Guard before a Certificate of Inspection could be issued. There was no information received by the inspectors regarding possible oceanographic use. There is no known record of any further contact between [REDACTED] and the U.S. Coast Guard regarding certification or additional inspections of HOLOHOLO.

First OTEC Voyage

This first voyage, originally scheduled to commence on 25 October 1978 was delayed for one day due to failure of the engines to operate properly because of water in the fuel. This problem was corrected and did not recur during the voyage..

HOLOHOLO experienced calm weather during the entire voyage. The highest sea condition encountered were swells of approximately three feet. She proceeded on a direct course from Diamond Head to the benchmark site, steering 135 degrees magnetic to make good a course of 128 degrees True. A direct route was also used on the return trip. During the voyage an alternate route was discussed by [REDACTED] and [REDACTED].

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All other personnel were on board to perform oceanographic work. Some of the oceanographic personnel stood navigational watches. In charge of one of the three watch sections was Allen CATTELL, a member of the scientific party. Verbal instructions were given to him that, in the event of the need for a course change or, if there were any problems while on watch, [REDACTED] was to notify [REDACTED].

6. THE LAST VOYAGE

Tasks Assigned

On the last voyage, it was planned to proceed to the "benchmark site" and deploy two oceanographic moorings, one at 20 - 00 N, 156 - 10 W in 650 fathoms of water, and one at 19 - 58 N, 156 - 06 W in 450 fathoms. Each mooring was to be anchored to the bottom with a 2300 lb weight, consisting of three railroad car wheels. The upper end of the mooring would be connected to two orange spherical floats which would be approximately 50 meters below the surface of the water. A 27KHz Helle Pinger was to be attached to the upper float which would be activated upon deployment. The pinger is designed to send out a signal every second for an expected life of four months. The signal is detectable for up to one mile under quiet conditions, though realistically one half mile range or less is expected.

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The mooring was to have current meters installed at various depths, as well as thermisters to measure temperature. Additionally, an Aanderaa data logger with a 16.384 KHz pinger would be attached. The pinger range is in the order of 500 meters. Recovery of a mooring is accomplished through the use of an accoustic release connected between the anchoring weight and the deepest current meter. The release was to be an AMF 322 which also acts as a transponder when the proper inquiry signals are sent to it. Its range is about 5 miles. When commanded to release, the device disconnects the mooring from its anchor and the floats bring it to the surface.

The most likely method of deployment would be to pay out the cable from the drive located on the upper deck with the winch, anchor first. When the cable is out sufficiently to install an instrument, it is stopped off at the deck level, broken by disconnecting a shackle, the instrument is inserted and the cable reconnected. Some instruments may not require breaking the cable for attachment. When all cable and instruments are deployed, the buoys and Helle pinger are connected and lowered 50 meters below the surface. If the anchor has not reached the bottom, the vessel will tow the mooring to shallower water. Upon reaching proper water depth, the gravity hook on the supporting cable disconnects it from the float thereby releasing the mooring. Deployment normally takes from one and a half to two hours and because it is deployed over the stern, results in the vessel drifting with the stern to the wind for that period of time.

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After deployment of the moorings, if time permitted, temperature profiles were to be taken from the stern by running an instrument down a cable attached to the vessel with a weight of about 100 pounds at the bottom. Each profile would take several hours, again resulting in the vessel laying with the stern to the wind since the instrumentation array would act as a sea anchor.

HOLOHOLO was then to call at Kawaihae, Hawaii, 17 miles to the east of the benchmark, on the morning of 11 December 1978 to disembark the two NOAA persons and embark three other scientific personnel. Additional experiments were to be conducted involving plankton casts and, if not previously completed, the temperature profiles would be taken.

Preparations

The second OTEC voyage under the "Bareboat Charter Agreement" was scheduled to begin on the morning of 9 December 1978. Between voyages, an additional winch was installed on the 13 foot level aft and rigged for use with the "A frame." This winch was hydraulically powered, requiring pipes to be run through two decks and a bulkhead to reach a power source in the engine room. The 50 gal. hydraulic sump for this winch was installed outboard to port of the winch. In addition a separate reel was welded to the same deck forward. This reel contained wire for deploying current meter arrays. During these preparations, the steering room hatch was cropped flush with the deck on the fantail.

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During the week of 5-9 December 1978, all scientific equipment to be used for the voyage was delivered and loaded on board. The two 2300 pound weights were loaded by means of a crane and lashed outboard to the transom bulwarks using chains and shackles through the hawser ports used for stern mooring lines as planned. One of these weights was later used for testing the newly installed hydraulic winch. At about 1000 on 9 December, one of the weights was observed on deck in the after corner of the fantail. However, both were seen secured over the transom just prior to sailing. Although witnesses who were on board on 9 December recall seeing no more than two of the orange floats on the fantail, four were shipped for use on the vessel and none were left behind on the dock. The current meters and other scientific equipment were stowed primarily in the galley/wet lab compartment and the space directly below. Some equipment was placed in racks built into the bulwarks on both sides, aft of the engine room and below the countertop and aft of the partial bulkhead at frame 46 on the main deck.

The fuel and fresh water tanks were believed to have been topped off. On 9 December, sailing time was delayed until the afternoon because some of the scientific personnel were dissatisfied with the stowage of the scientific equipment and insisted on more secure stowage prior to sailing.

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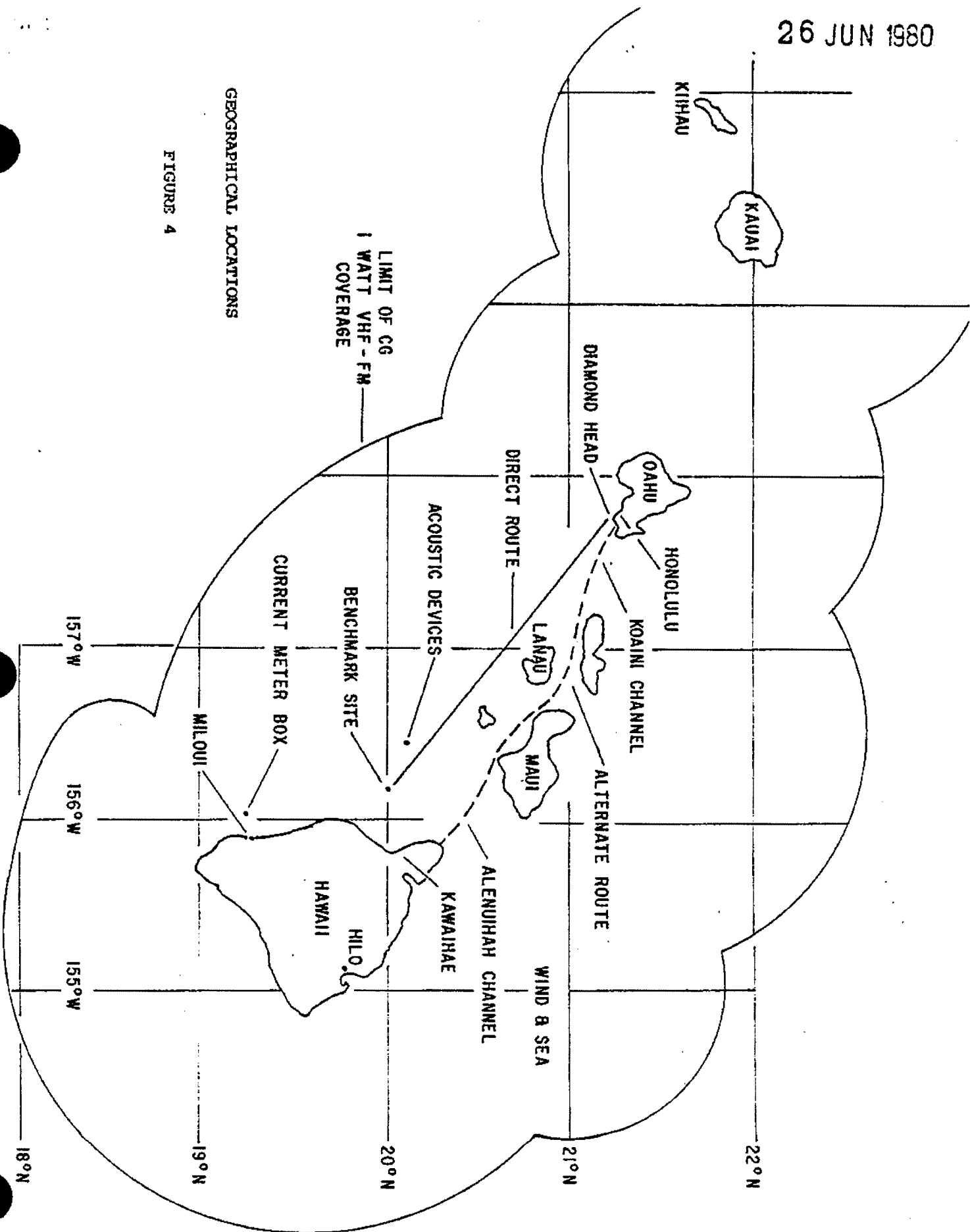
Departure

At 1437 on 9 December 1978, HOLOHOLO having requested and been granted permission, was logged as having departed pier 45, Honolulu for sea by the state of Hawaii, Department of Transportation, Harbor Division. This is the last known radio broadcast from the HOLOHOLO. During the afternoon, HOLOHOLO was seen off Waikiki heading in the general direction of Diamond Head at an estimated speed of 4 knots. She was described as pitching and taking a continuous light spray into 2 to 3 feet seas. This was the last known sighting of HOLOHOLO.

At 1005 on 9 December 1978 a "convoy" of 7 U. S. Army Landing Craft Utility (LCU) vessels departed Pearl Harbor for Hekili Point, Maui with the ultimate destination being Kawaihae. They anchored off Hekili Point at 0220 on 10 December. At 0955 the LCU's were underway for Kawaihae. At 1310, they turned back from the Alenuihaha Channel because of adverse seas and anchored at Keoneoio, Maui at 1530. They were underway again at 0655 on 11 December and arrived at Kawaihae at 1730 on the same day. The M/V HOLOKAI departed Oahu at 1500 on 9 December bound for Kawaihae using the same route but without stopping. HOLOKAI arrived at Kawaihae at 0800 on 10 December. Both vessels used the "alternate route" which had been discussed on the previous OTEC voyage and is illustrated in Figure 4. HOLOHOLO was not sighted during either of these voyages.

The three persons, who were to board HOLOHOLO, arrived at Kawaihae just before sunrise on 11 December. At about 0930, two of them drove up the mountain to the east. They returned before noon. While on the trip they were able to view the waters to the West of Kawaihae and noted the convoy of Army LCU's coming towards the harbor. The position of the convoy at 1200 was 20-16N, 156-13W, a distance of approximately 26 miles from Kawaihae. They looked for but did not see HOLOHOLO.

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GEOGRAPHICAL LOCATIONS

FIGURE 4

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At least four attempts were made by the scientist to call the HOLOHOLO through the marine operator on 11 December without success. Phone calls were made to the office of the Ocean Engineering Department of the University of Hawaii; the office of Environmental Consultants Inc., a subcontractor in the OTEC project; and the office of the University of Hawaii Marine Center (Snug Harbor). The conversations indicated that the scientist had not seen nor heard from the HOLOHOLO despite their attempts to call and that the offices in Honolulu had had no contact with the vessel. That same evening a call was made to the USCG Cutter CAPE SMALL, located at Hilo, HI, reporting HOLOHOLO overdue. The caller was requested to report the incident to Joint Rescue Coordination Center (JRCC), Honolulu, if the vessel was still missing in the morning. He was informed that harbor checks would be made during the night.

7. THE SEARCH

At 0920 on 12 December the JRCC received a call reporting HOLOHOLO overdue at Kawaihae and stating that no float plan or communications schedule had been established. A ten day search effort was commenced using the facilities of the U. S. Coast Guard, the U. S. Navy, the U. S. Coast Guard Auxiliary, the Civil Air Patrol, the University of Hawaii, and the U. S. Air Force including four USAF U-2 reconnaissance flights. Over 377,000 square miles were searched. More than 520 flight hours were flown. The search effort was suspended on 21 December 1978 with the conclusion that no significant sightings were made.

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On the morning of 18 December 1978 an empty wooden box was recovered about 6 miles West of Milolii on the South Western coast of the Island of Hawaii, a position 38 miles bearing 171 degrees True from the "Benchmark site." This box was later positively identified by serial number as having been forwarded from PMEL and containing equipment to be used in one of the OTEC current moorings scheduled to be deployed from HOLOHOLO. Scientific examination, based on barnacle growth on the box, indicated that the box was in the water for no less than three days.

As a result of the discovery of the current meter box, a U-2 reconnaissance flight was requested to cover the area west of the Island of Hawaii. A photograph taken at 1400 on 18 December 1978 by that aircraft, revealed an object at position 18-15 N, 156-44 W, approximately 69 miles, bearing 205 degrees true from the "benchmark site". Extensive air and sea searches, including another U-2 overflight, could not relocate the object.

On 20 December 1978, the R/V KANA KEOKI, while engaged in the search, sighted what was described as a "Japanese fishing vessel" about five miles from the position of the object sighted in the U-2 photograph. Since observers on board, who were familiar with HOLOHOLO, confirmed that the sighting was not HOLOHOLO, KANA KEOKI continued in its search pattern without identifying or contacting the sighted vessel, which steamed out of the area shortly after visual contact was made.

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Photo interpretation by U. S. Air Force experts indicated that the photograph taken by the U-2 was a vessel dead in the water with a length of 77 to 88 feet and a beam of 22 to 24 feet. Based on these facts, the interpreters determined that the object was possibly the HOLOHOLO. This determination of "possible" is the lowest category used by the Air Force in their evaluations. "Probable" and "confirmed" are the more positive categories. The only similarity between HOLOHOLO and the photograph was the length - beam ratio. Factors discounting the possibility were:

- a. The difference in color tone of the canopy.
- b. Safety rails, square stack, "A frame" were known to be on HOLOHOLO and should have been visible on the photograph. They were not discernable.
- c. A white cross, and a small protrusion on the port side were visible on the photograph and were not known to be on HOLOHOLO.
- d. The forecastle "raft" on the photograph was not the size of the one believed to be on HOLOHOLO. If the HOLOHOLO raft was of the same size, the photographic raft was in the wrong position.

Subsequent reevaluations by the Air Force experts in light of additional information produced by this Board have not changed their classification or produced other similarities between the photograph and HOLOHOLO.

Newspaper and electronic media extensively covered the search and the investigation. Photographs of HOLOHOLO were published. Appeals were made for anyone who may have seen the vessel to come forward. In addition, Coast Guard Marine Safety Office, Honolulu contacted all known vessels transiting Hawaiian waters during 9, 10, and 11 December 1978 concerning possible sightings which may have been HOLOHOLO. No additional relevant evidence not herein reported was obtained.

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The Fourteenth Coast Guard District maintains VHF-FM distress coverage on channel 16, 156.8MHz. The system is monitored constantly and in addition continuous tape recordings are made. The listening capability of the system to hear transmitters of one watt or more covers the trackline of HOLOHOLO during her first OTEC voyage, the main Hawaiian Islands and the location where the empty current meter box was found. See Figure 3. Following the report that HOLOHOLO was missing, Coast Guard personnel listened to all tapes for the 9th through 13th of December 1978 and heard no communications of any kind from HOLOHOLO during that period with the exception of transmissions made before she left the dock at Honolulu.

Between 10 February and 16 February 1979 the NOAA SHIP FAIRWEATHER (S-220) conducted an underwater sonar search of waters west of the Island of Hawaii in an attempt to locate HOLOHOLO or the current meter arrays. Attempts were made to trigger responses from the current meter arrays which were aboard the vessel or to listen for any devices which may have already been activated. FAIRWEATHER conducted the search while using the benchmark site and the position of the U-2 photo object as datum. The result of the search was negative.

On 9 December 1979, at about 0400, the NOAA SHIP CROMWELL detected a sonar signal in response to a signal sent from the ship. The ship was in the Hawaiian Islands conducting scientific operations in the vicinity of Penguin Banks. In addition, she was authorized to conduct underwater sonar searches in an attempt to locate equipment which had been forwarded by NOAA to be used aboard HOLOHOLO. On board CROMWELL were two men who had conducted the earlier search from FAIRWEATHER in February 1979. The area searched by CROMWELL covered areas not previously covered by FAIRWEATHER but in which HOLOHOLO may have operated.

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On the evening of 10 December 1979, CROMWELL returned to the area of the 9 December signal. At about 2000 contact was re-established. Between 2000, 10 December 1979 and 0245, 11 December 1979, extensive sonar communication between CROMWELL and the underwater equipment was conducted. It was estimated that the equipment was located at 20 degrees, 6 minutes North; 56 degrees, 28 minutes West; a position 7 miles Southwest of the rhumb line between Diamond Head and the Benchmark Site. Chart Number 19004 indicates a depth of 1395 fathoms adjacent to the estimated position.

The CROMWELL search was conducted by expert NOAA personnel who had serviced, prepared, and shipped the equipment for use aboard HOLOHOLO. They were also experts in the use of the devices. Their search consisted of efforts to contact one or more of the three AMF Acoustic Release/Transponders Model 322 units sent for use on the HOLOHOLO voyage. During the six hours and 45 minutes of communications described above, these experts identified responses in the manner predicted for two of the three units sent. There were no responses when signals were sent to obtain responses from the third unit. Nor were there any signals received which were inconsistent with the units believed to have been aboard HOLOHOLO.

8. RESEARCH VESSEL SAFETY STANDARDS

Subsequent to the loss of the Oceanographic M/V GULF STREAM, on 7 January 1975, the University National Oceanographic Laboratory System (UNOLS) developed and published Draft Research Vessel Standards in May 1975 which was adopted and published in final form in May 1976. The University of Hawaii is a member of the developing organization and participated in the development of these standards. The standards are "intended as guidelines for oceanographic research vessels owned and operated by Members and Associate Members... Adoption and use of the standards are voluntary..."

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Although the University of Hawaii did not formally adopt the standards, they were used by a segment of the University (Hawaii Institute of Geophysics), but only for vessels directly owned by them. The standards include:

a. Research vessels should strive to achieve principles of watertight integrity set forth in subchapters E and U, 46 CFR for vessel/vessels over 65 ft.

b. Lifesaving equipment, including Emergency Position Indicating Radio Beacon (EPIRB), should be carried when operating more than 20 miles from shore.

c. Emergency power for operation of a radio should be located above the main deck on vessels over 65 feet in length.

d. Filing of cruise plans containing names and capacity of persons aboard, designation of master and chief scientist, estimated time of departure, estimated time of arrival, trackline, and communications instructions should be made.

e. Radio reports should be transmitted at least daily and when deviations from the cruise plan are made.

f. Inclining experiments should be undertaken on all new and existing uninspected vessels of at least 65 feet in length to develop stability data. This data and information necessary to enable the master to accurately obtain the stability of the vessel under varying conditions of service, loading, overside operations and weather should be furnished the master.

There are other standards included which are not herein summarized. There is substantial evidence to indicate that the standards listed above were not required by RCUH of, or followed by, HOLOHOLO.

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CONCLUSIONS

1. The exact cause of the casualty is unknown. It is concluded that the most probable cause was that HOLOHOLO encountered seas of sufficient height and frequency to flood the forecastle, for which drainage was grossly inadequate, to a point where stability was lost, capsizing the vessel. In making this conclusion, the following additional presumptions are made:

a. The dynamic stability of the vessel is approximated by the static stability calculations made by the Coast Guard naval architect.

b. The acoustic devices which were located by CROMWELL are the ones which were carried by HOLOHOLO. Therefore, the casualty occurred at or near position 20° 6' N, 156° 28' W, where the devices were found, and where HOLOHOLO is now located on the bottom.

c. The casualty occurred on 10 December 1978 during the afternoon or evening. Calculating the elapsed time on a direct route between Diamond Head and the presumed location of the casualty, at the estimated speed when last seen, HOLOHOLO reached that point no sooner than 1600 on 10 December 1978.

d. Significant wave heights at the probable time and place of the casualty were 14 to 17.5 feet which were in excess of those predicted. It is therefore probable that the vessel encountered occasional wave heights of 22.4 to 28 feet. (Significant wave heights times 1.6)

e. In order to make good a course to the benchmark site, it was necessary for the vessel to correct to the left, placing the sea on the port bow.

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2. A probable contributing cause was the lack of watertight integrity which would permit the ingress of water in heavy seas and possible progressive flooding. Initial ingress of substantial quantities of water could occur into the steering gear compartment, through the non-watertight 2 foot by 4 foot opening left by the earlier removal of the fantail deck hatch. DTNSRDC calculations indicate that the fantail would take water while the vessel was stopped, with 6 foot head seas. The Marine Board concludes, that because of the substantially higher seas encountered, the fantail area would have been subjected to water while dead in the water, or while underway at slow speed, in seas from any direction.

Alternatively or concurrently, the two 2300 pound anchors secured on the transom (or possibly on the fantail) could have broken loose in the heavy seas and punctured the transom (or the after deck) permitting water to enter the steering gear compartment.

This type of flooding could have occurred unnoticed since most personnel would probably have remained inside the superstructure because of the bad weather. Even if it was noticed that there was water on the fantail, the scientific party may not have realized that there was a 2 foot by 4 foot deck opening covered by plywood. There were no electrical motors or controls located in the after two below deck compartments which would have failed if subjected to water, thereby warning navigating personnel of the ingress of water.

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Additional water may have gotten into the vessel through the opening created by the removal of the upper half of the after bulkhead of the deckhouse, at frame 46. It could have then passed down into the storage compartment below the wet lab or perhaps into the engine room through an open watertight door. Water ingress through this route is considered unlikely. It would have required substantially higher seas and would have been noticed in sufficient time to have permitted a radio distress call.

Water ingress, from whatever method, would have reduced the vessel's stability by creating a free surface.

It is considered improbable that the vessel could have been lost solely due to flooding as described above. Adequate notice would have been provided to allow a radio distress call which the Board finds was not made. Additionally, time to launch the liferafts would have been available.

3. An alternative primary cause of the casualty is possible with HOLOHOLO heading into high seas, experiencing heavy pitching. The slamming force, as the flat bottom hit the water, might have provided unusually high stresses in critical areas of the non-continuous main deck. A fracture caused in this manner can possibly produce a failure of the hull girder. A structural failure of this type is more likely to have produced additional debris and the available time for the operator to have taken steps to launch a life raft or provide some distress signal.

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4. It is concluded that the loss of the vessel, from whatever cause, was by an immediate and catastrophic event which precluded the making of a radio distress call, launching the securely tied liferafts and perhaps even obtaining lifejackets. This would account for the fact that no debris was found during the extensive search efforts.

5. The following causes were considered and rejected by the Marine Board of Investigation because of lack of debris, distress signals, and/or other evidence to support the conclusion:

Grounding	Collision	Fire
Explosion	Barratry	Sabotage
Highjacking	Piracy	Defection

6. The photographic sighting by the high altitude SAR aircraft was not that of HOLOHOLO.

7. The following persons were on board HOLOHOLO at the time of the casualty and are considered lost at sea and presumed dead:



8. Equitable ownership was given to [REDACTED] through the Agreement of Sale, executed on 18 September 1978. The "Bareboat Charter Agreement" was, in fact a time charter in that [REDACTED] hired the crew, purchased the foodstuffs, retained responsibility for maintenance, and warranted the seaworthiness of the vessel.

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There is nothing to indicate an alteration, for the last voyage, of the watch standing procedure which existed on the 25 October voyage where the person in charge of a watch notified [REDACTED], not the person possessing a U.S. Coast Guard license, when problems or requests for course changes occurred.

[REDACTED] was the defacto master, operator, and person in charge of HOLOHOLO during this last voyage.

9. It is concluded that [REDACTED] did not change his watchstanding procedures during the second OTEC voyage from those of the first where three members of the scientific party stood watches while enroute to the benchmark site. This is based on the lack of other sufficient crewmembers to stand the watches which [REDACTED] established during the first voyage. Several unidentified scientists were, therefore, aboard solely for the purpose of engaging in scientific research, instructing or receiving instruction, in oceanography or limnology and thus should be categorized as crewmember. These should therefore not be exempt from the provisions of Title 53 of the Revised Statutes by 46 USC 444.

10. At the commencement of the first oceanographic voyage, HOLOHOLO was no longer employed exclusively as a pleasure vessel in accordance with 46 USC 103. Accordingly, under 46 USC 266, the vessel ceased to be a documented vessel of the United States, in that she was employed in a trade other than that for which she was licensed.

11. HOLOHOLO was not granted an exemption from certain inspection laws as described in 46 USC 441-445 in that an "Oceanographic Research Vessel" finding was not made in accordance with 46 USC 441. However, during the October and last voyages, HOLOHOLO was an oceanographic vessel in fact. Had the vessel been properly found to be an oceanographic research vessel, the outcome of the final voyage would probably not have been altered since under existing regulations and oceanographic research motor vessel under 300 gross tons does not require a Certificate of Inspection.

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12. The Board concludes that the Motor Vessel HOLOHOLO was a passenger vessel carrying passengers who were scientific personnel. The designation set forth in 46 USC 442 of a nonpassenger vessel is not operative because the vessel did not meet the definition of an Oceanographic Research Vessel contained in 46 USC 441 (1).

13. There is evidence of violation of law or regulation on the part of [REDACTED] as follows:

- a. HOLOHOLO was not documented as required by 46 USC 67.01-13.
- b. HOLOHOLO was not in possession of a Coast Guard Certificate of Inspection as required by 46 CFR 71.01-1.
- c. HOLOHOLO was not properly manned as required by 46 USC 222.

14. The Research Corporation of the University of Hawaii (RCUH) did not adequately ascertain the seaworthiness of HOLOHOLO before entering into a contractual obligation for oceanographic research use.

15. The casualty may have been prevented or its adverse effects reduced by one or more of the following:

- a. Utilization of the recommended standards of the University National Oceanographic Laboratory System (UNOLS) in evaluating HOLOHOLO for suitability for oceanographic research projects.
- b. The inspection and certification of HOLOHOLO under passenger vessel or small passenger vessel regulations. It is recognized that the Coast Guard has not statutory authority to require inspection of oceanographic motor vessels of less than 300 gross tons.

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c. The addition of freeing ports for the forecastle and fantail bulwarks to the minimum amounts indicated in the load line or small passenger vessel regulations prior to the voyage.

d. The maintenance of watertight integrity in accordance with the standards of good marine practice on the existing decks and internal bulkheads during modifications.

16. Had HOLOHOLO carried on board a properly stowed and functioning EPIRB, the location and time of the casualty would have been known. This would have facilitated locating anyone who may have been able to survive the initial casualty.

17. There is no evidence that any act of misconduct, inattention to duty, negligence or incompetence, or willful violation of any law regulation on the part of licensed or certificated person contributed to the casualty.

18. There is no evidence that any personnel of the Coast Guard or any other Federal Government agency contributed to the casualty.

RECOMMENDATIONS

1. That the Commandant seek legislative authority to promulgate regulations to inspect and certificate Oceanographic Research Vessels of more than 15 and less than 300 gross tons in ocean and coastwise service. Such legislation should authorize the Coast Guard to regulate the following:

a. Minimum manning and qualifications of the vessel's operating crew.

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b. Maximum number of persons (including "scientific personnel") authorized to be carried based on habitability requirements for crews of inspected vessels of similiar size, area of operation, and length of voyage.

c. Structural and stability requirements.

d. Minumum number and stowage of lifesaving and emergency equipment.

e. Areas of operation.

2. That the Commandant seek appropriate delegation of authority and issue standardized procedures regarding the designation of vessels of less than 300 gross tons as "Oceanographic Research Vessels." These procedures should include the following:

a. That the designation be provided only on written request by both the organization responsible for the scientific or educational mission of the vessel and the owner or bareboat charterer (whichever will be exercising control during the projected mission). The request should contain a general description of the area of operation, projected times of the mission, the number of crew members to be carried and the maximum number of "scientific personnel" to be carried.

b. That the designation be in writing by the Officer-in-Charge, Marine Inspection, in whose zone the vessel is home ported or the principal area of operation is to be conducted. This letter of designation should recommend compliance with the UNOLS Research Vessel Standards.

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c. That the letter of designation should be issued only after the Officer-in-Charge, Marine Inspection has satisfied himself that the vessel is in compliance with applicable uninspected vessel or boating safety regulations and documentation or numbering regulations.

3. The Board feels that this casualty once again indicates a need for vessels proceeding on the high seas to carry EPIRB's. It is recommended that the Commandant review educational and regulatory programs looking toward improvements which will maximize EPIRB usage.

4. That, because of the presumed death of [REDACTED], no action be taken regarding possible violation of laws or regulations.

5. That a copy of this report be forwarded to UNOLS, IMCO, and the various federal and state agencies known to be involved in oceanographic research and/or related training.

[REDACTED]
G. K. GREINER, Jr.
Captain, U. S. Coast Guard
Chairman

[REDACTED]
A. D. UTARA
Commander, U. S. Coast Guard
Member

[REDACTED]
R. E. ISHERWOOD
Lieutenant Commander, U. S. Coast Guard
Member and Recorder