RICHARD COLE

400161 139

Ref. W.B. Heidt, Jr., LCDR, et al, Nature, Intensity, and Distribution of Fall-out from Mike Shot, Project 5.4a, April 1953 Operation Ivy, WT-615/ USNRDL, S.F., Calif., Unclass.

The general objective of the project was to extend the documentation of fall-out data. The yield from this shot was to exceed by many times that from any previous detonation, and consequently the cloud and associated debris were expected to rise to much greater heights. The additional fact that the shot was to be a surface explosion indicated the possibility of serious fall-out over large areas.

One of the specific objectives was to: Calculate from the intensities of radiation from fall-out the radiation field levels which would have been observed if the fall-out had occurred over extended land areas.

Twenty lagoon stations consisting of standard Navy 60-man life floats were placed. The life floats were fastened to moorings, empty 55-gal drums, anchored with 4000-lb concrete blocks. A 1 inch wire cable, which was one-third greater in length then the depth of the water, was shackled to the anchor and made fast to the float by passing it through two pad eyes welded to the drum and then secured by clamping on itself. The floats were secured to the pad eye on top of the drum with 100 ft of 3-in. manila line.

Free-floating stations were employed in the deep waters outside the lagoon to the supplement the lagoon array.

RICHARD COLE

5001312

As first conceived, the plan called for the use of a raft which would be large enough to support theinstrumentation and provide a working platform for personnel agter the raft was in the water. Because of the lack of support vessels for the placement of such stations, the plans were modified to provide for a float smaller than a raft and one which could be pladed over the sidein a minimum of time without the use of a crane or special rigging. Operationally this plan presented another advantage because the number of collection station which could be placed depended almost entirely on the number and speed of the ships available rather than on space and weight limitations imposed by the float.

The free-floating stations employed were standard Navy type 3 Dan buoys. The buoy weighed less than 75 lb when completely assembled with identification and collection devices. The reserve buoyancy of the float was about 80 lb.

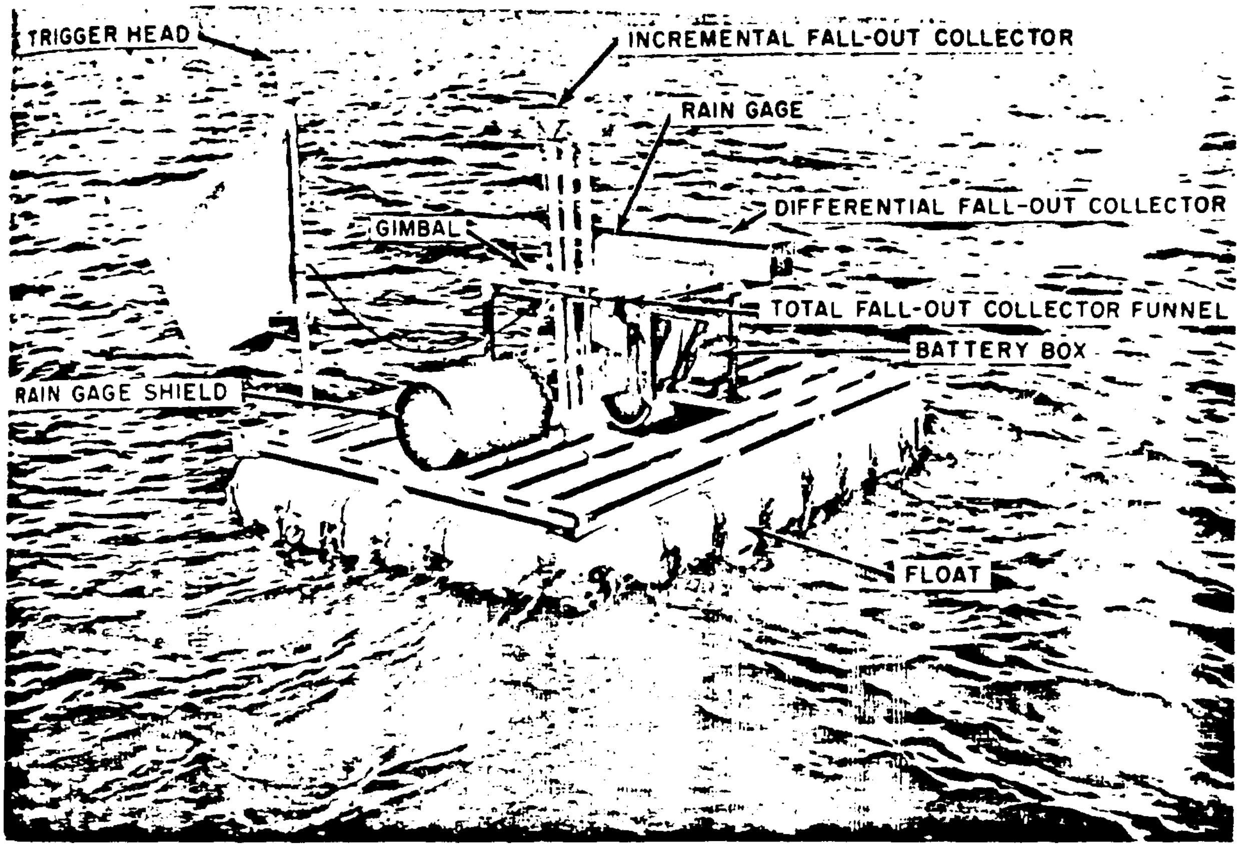


Fig. 3.9—A typical lagoon station.

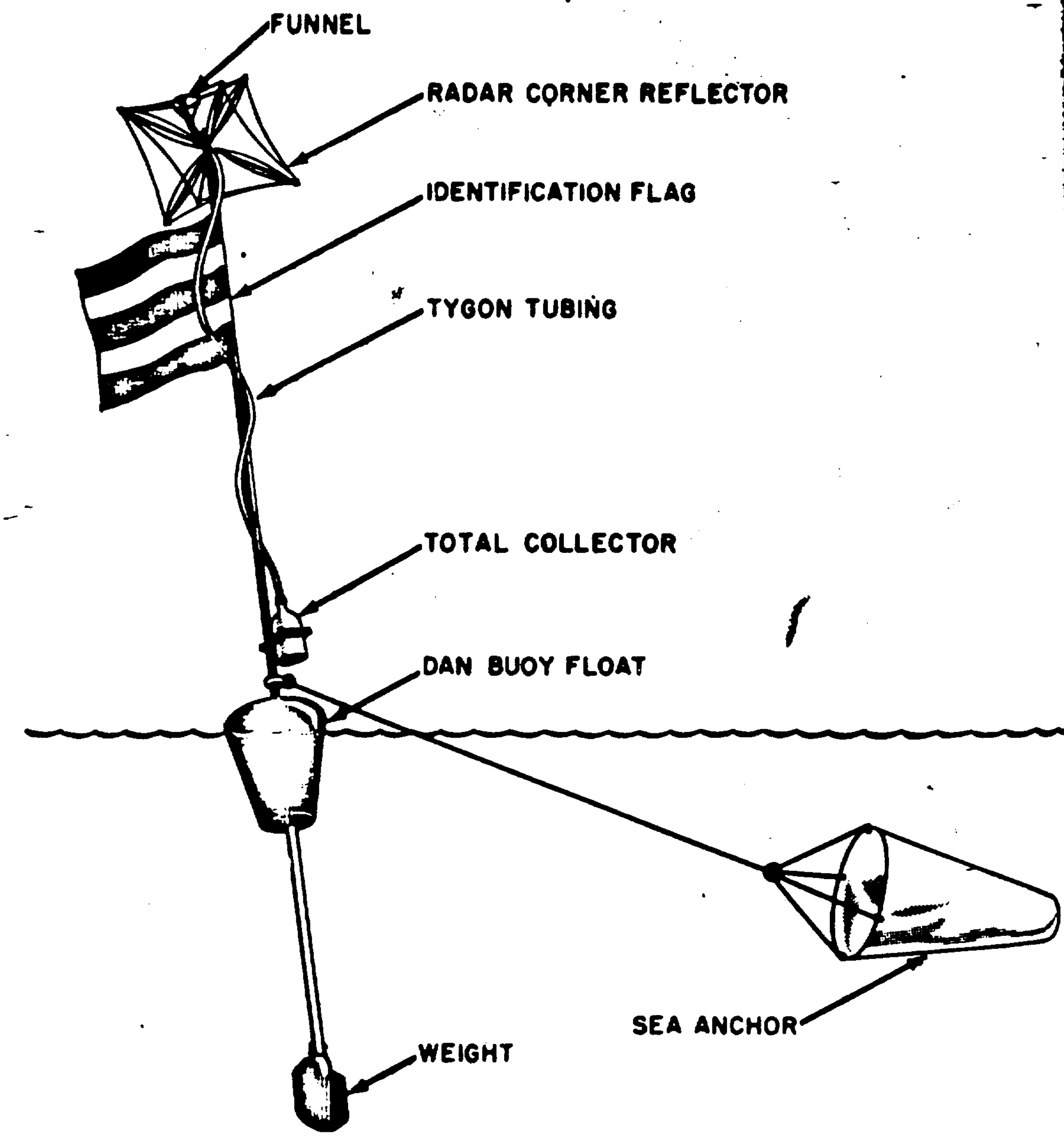


Fig. 8.10—Free-floating sea station.

23 Jan 1962

Ref. T. Triffet, et al, Characterization of Fallout, Project 2.63, Operation Redwing - Preliminary Report, April 17, 1957, USNRDL, S.F., Calif., Secret

In this project, one of the specific objectives was to:

> Provide correlation points for aerial and oceanographic surveys at large distances from ground zero by measurement of the rate of penetration of activity in the ocean, variation of activity with depth, and time variation of the gamma radiation field above the water.

Various water-sampling measurements were made to make possible the interpretation of aerial- and water-survey results. Both project vessels, the YAG-40 and YAG-39, were equipped with probes, decay tanks (YAG-39 only) monitoring devices, and surface-sampling equipment. The probe (SIO-P) contained a multiple G-M tube sensing element and a pressure gage for measuring the variation of gamma dose rate with depth at a given time or with time at a given depth. It was raised and lowered both during and after fallout from an outrigger projecting 25 feet over the bow of the ship by means of a remotely controlled winch; and its output was automatically recorded on an X-Y recorder located in the ship.

The decay tank was 6 ft in diameter and 6-3/4 ft deep and contained a multiple G-M tube sensing element. The tank was filled with sea water treated with nitric acid to retard plating out of the radioactivity on the walls. The water was stirred continuously by a rotor located at the bottom of the tank.

The monitoring device (NYO-M) contained a plastic phosphor sensing element for measuring the variation of the gamma radiation field above the surface of the ocean. This instrument was mounted in a fixed position of the end of the 25 ft bow outrigger at approximately 20 ft above the water surface. During the period of fallout the sensor was protected with a plastic bag.

Surface water samples were taken with a bucket (5 gal) and hand line. Half gallon samples were retained for measurement.

Standard Stations - minor arrays.

In addition to the shipboard instrumentation, minor arrays of equipment were placed on raft and skiff stations. Rafts were anchored inside Bikini Lagoon. From 13 to 17 skiffs were deep-moored in the open ocean near the atoll. These stations were instrumented with total collectors, time-of-arrival detectors, and film-badge dosimeters. The time-of-arrival detectors consisted of ionization-chamber radiation detecotrs, which triggered an 8-day chronometric clock. This instrument was designed to give the time of arrival of fallout by subtraction of the clock reading from the time at collection referenced to detonation time.

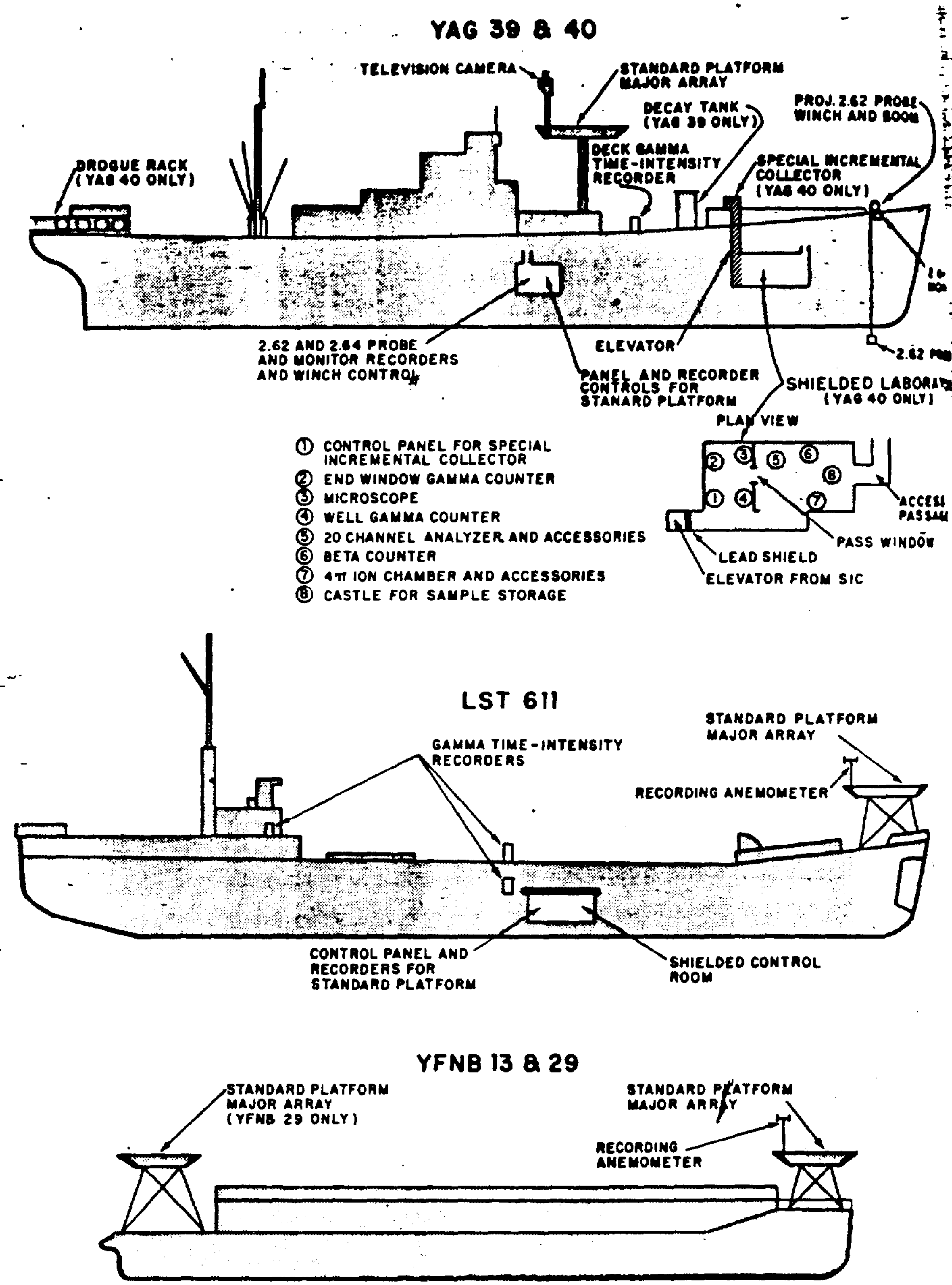


Figure 2.7 Schematic drawings of ship and barge stations.

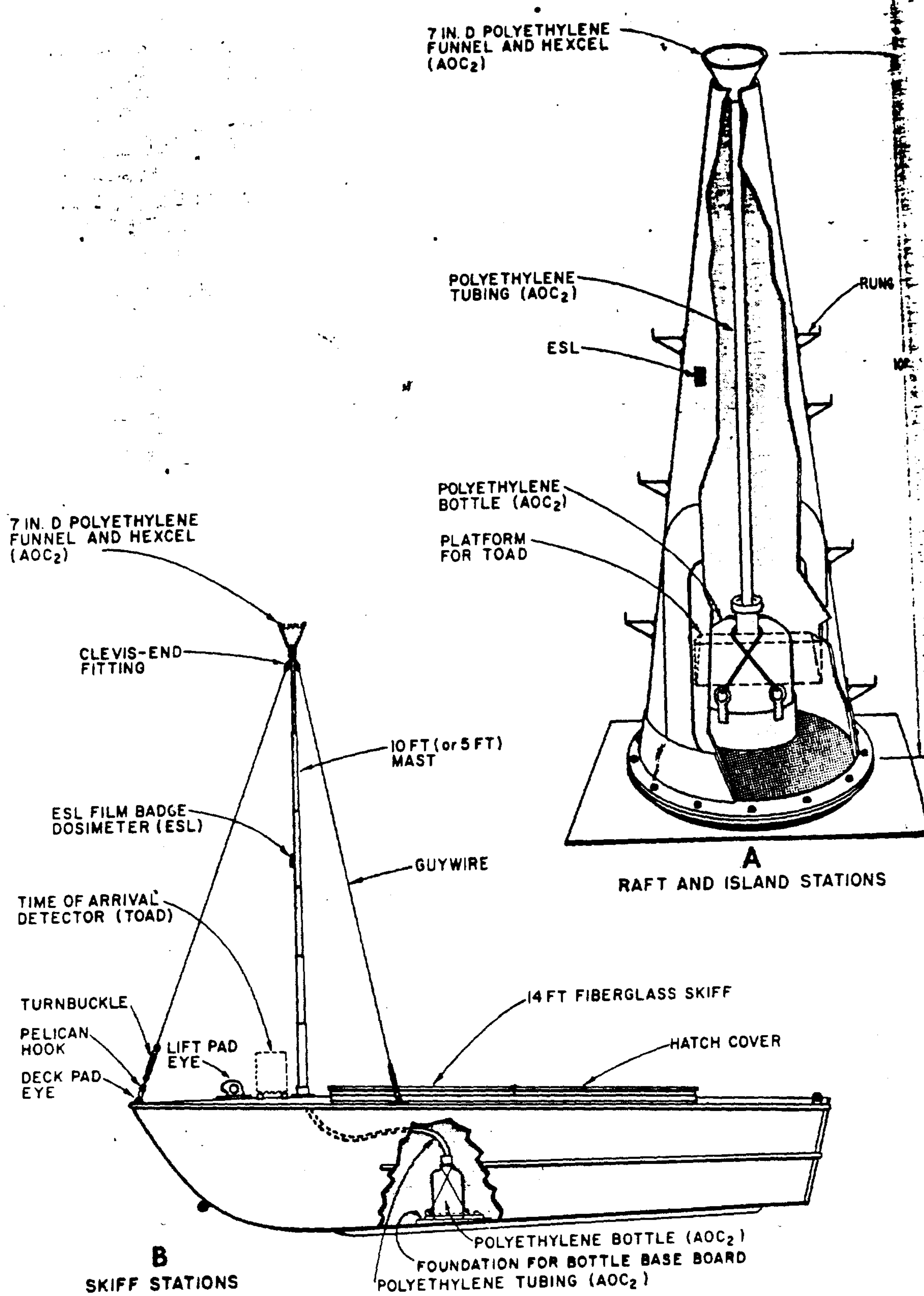


Figure 2.6 Standard-station minor array.

Ref. E.C. Evanz, III, et al, Characteristics of the Radio-active Cloud from Underwater Bursts (U), Project 2.3, Operation Hardtack, WT-1621, 15 January 1962, USNRDL, S.F. 24, Calif., Confidential

One of the general objectives of this project was to measure the complex gamma field at a number of positions within 10,000 yards of each of two underwater detonations.

The total gamma field was measured by means of gamma-intensity-time recorders installed on floating platforms located within a radius of 10,000 yards from surface zero. Surface water activity was measured both by detectors mounted above the surface and also by similar detectors lowered into the water afger passage of the underwater shock waves. Gamma dose was measured also by film dosimeters.

Two different types of floating film pack stations were employed to measure surface water activity. Sealed packets of film dosimeters were attached to 3 ft square floats which were either flèating with the contaminated waters, usigg a drogue to control its drift rate, or which were anchored to the bottom, remaining in a fixed position during passage of the contaminated waters.

Ref. L.E. Egeberg, Taut-Wire Mooring for Open Ocean Anchoring, USNRDL-TR-402, 11 Dec 1959, USNRDL, S.F. 24, Calif., Unclassified.

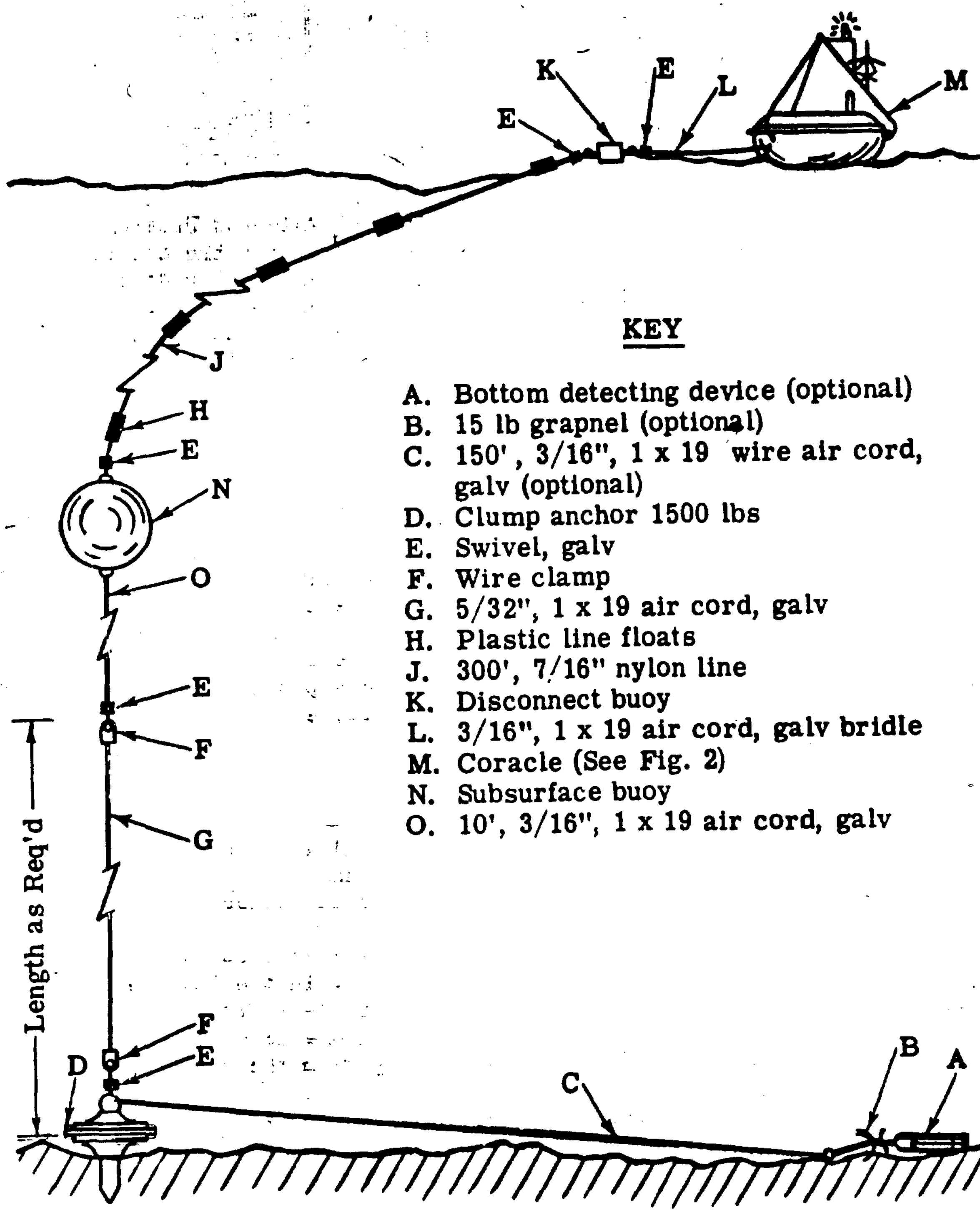
Taut-wire moorings were deisnged and placed to hold instrument buoys for the deep underwater detonation, Shot Wahoo, of Operation HARDTACK. The water depths varied from 300 to 1000 fathoms and the majority of the stations were exposed to open sea conditions.

Each mooring consisted of a 1500-lb anchor connectied by a 5/32-in, 1 x 19 galvanized steel cable to a 36 to 41 in. diameter buoy 150 ft below the surface. A floated 7/16 in diameter nylon pennant 300 ft long connected this buoy to the surface instrument buoy.

Failures resulted from undetermined effects of the detonation. The cause for these failures were tension breaks at the lower end of the cables. The survival of two moorings at 4800 ft from surface zero indicates that the wire size chosen, though marginal, would have been statisfactory for open sea conditions alone. For the combined sea and detonation conditions that did prevail, an increase to ¼ in diameter cable for stations within 8000 ft of surface zero probably would have been sufficient to maintain all moorings.

Although the placement of these moorings and coracles was for a special purpose, the extension of the same ~~thm~~

anchoring theory and system of placement could make possible the placement of semipermanent deep moored oceanographic stations. The simplicity and lightness of the gear makes the placement and maintenance of such an ocean station well within the capability of even the smallest oceanographic vessel.



KEY

A. Bottom detecting device (optional)
B. 15 lb grapnel (optional)
C. 150', 3/16", 1 x 19 wire air cord, galv (optional)
D. Clump anchor 1500 lbs
E. Swivel, galv
F. Wire clamp
G. 5/32", 1 x 19 air cord, galv
H. Plastic line floats
J. 300', 7/16" nylon line
K. Disconnect buoy
L. 3/16", 1 x 19 air cord, galv bridle
M. Coracle (See Fig. 2)
N. Subsurface buoy
O. 10', 3/16", 1 x 19 air cord, galv

Fig. 1 Tautwire Mooring System

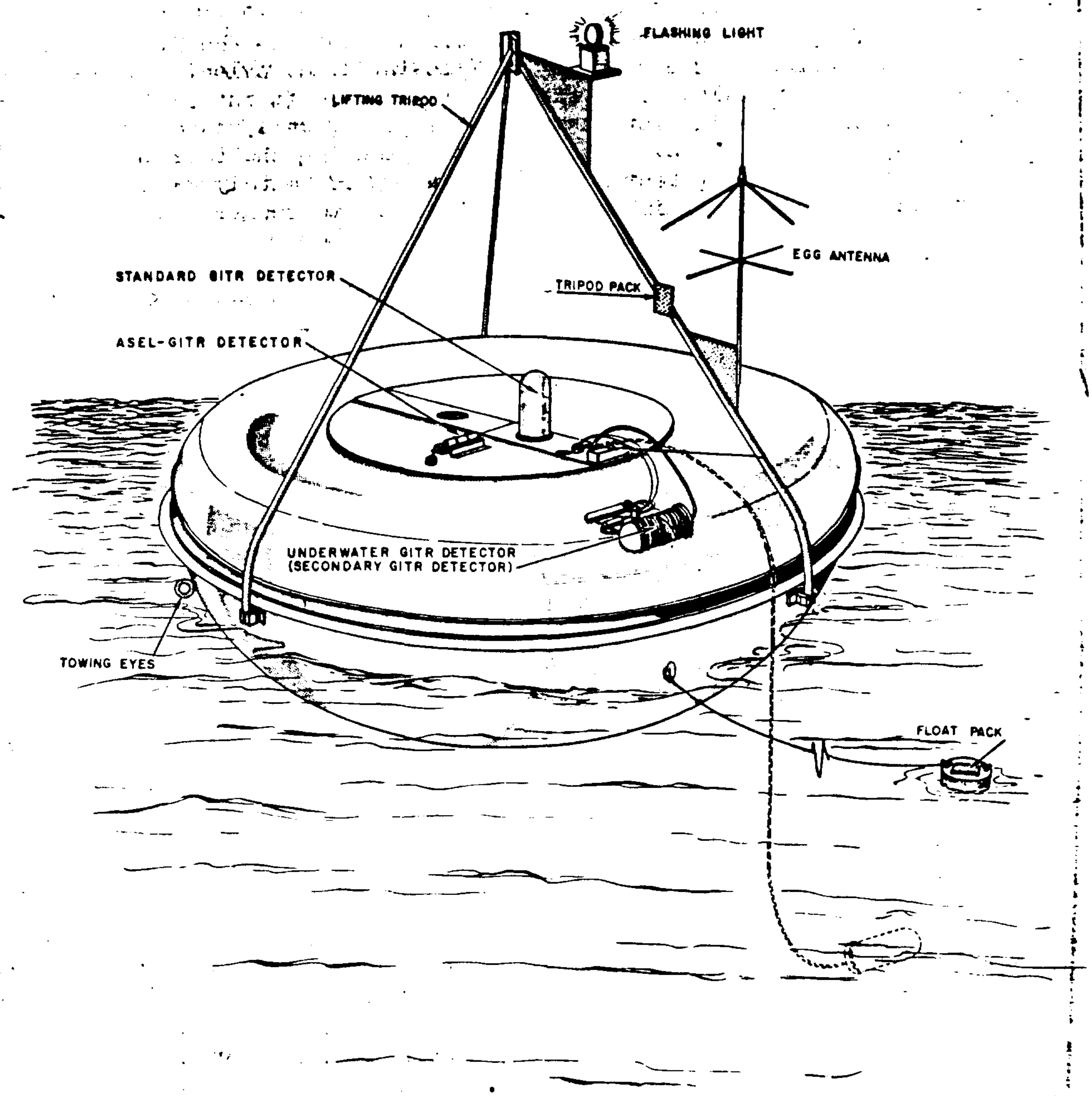


Fig. 2 Coracle

5001325

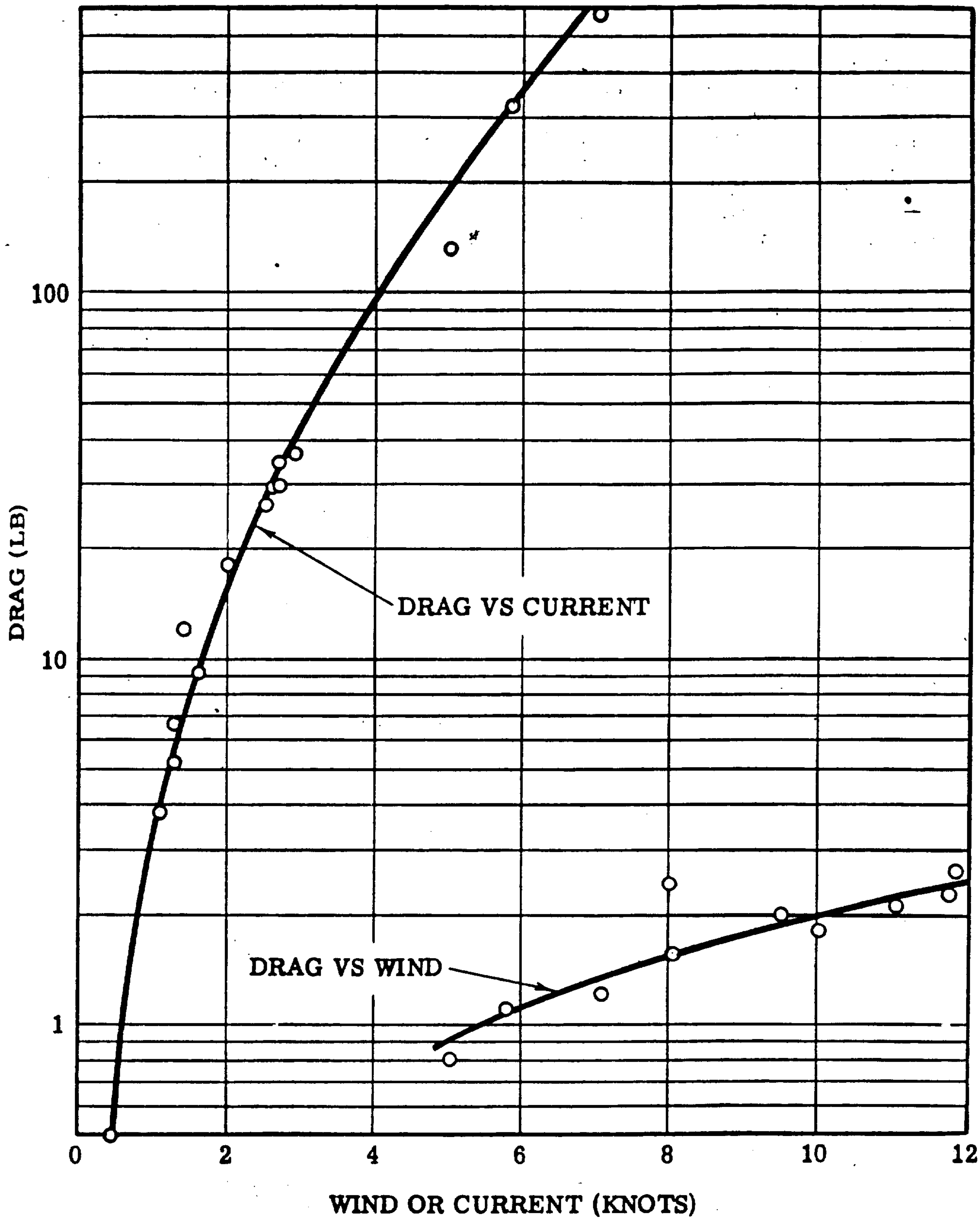


Fig. 5 Coracle Drag Curves

5001326

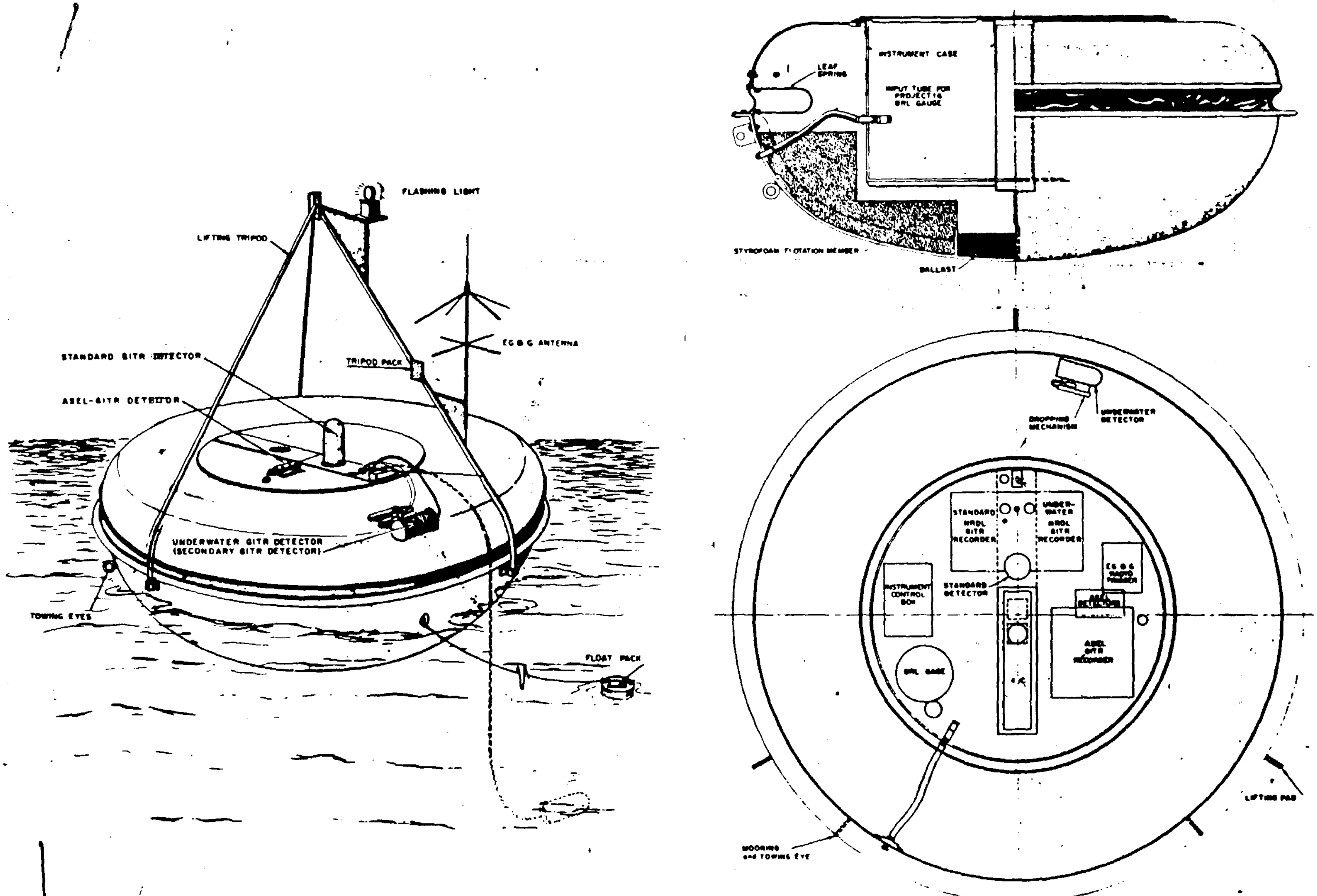


Figure 1.3 Simplified elevation, cross section,

5001328

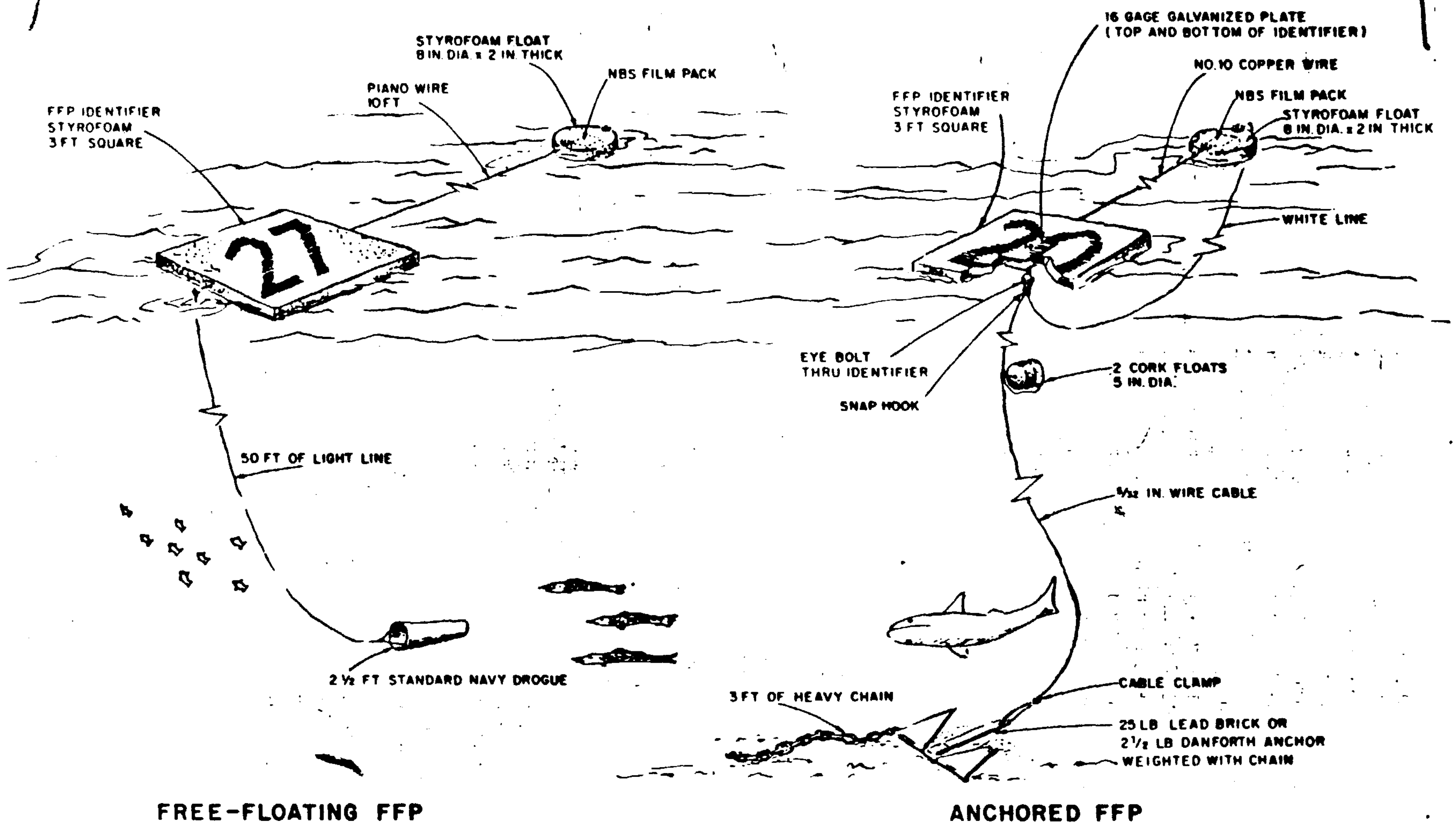


Figure 2.6 Various types of floating film packs.

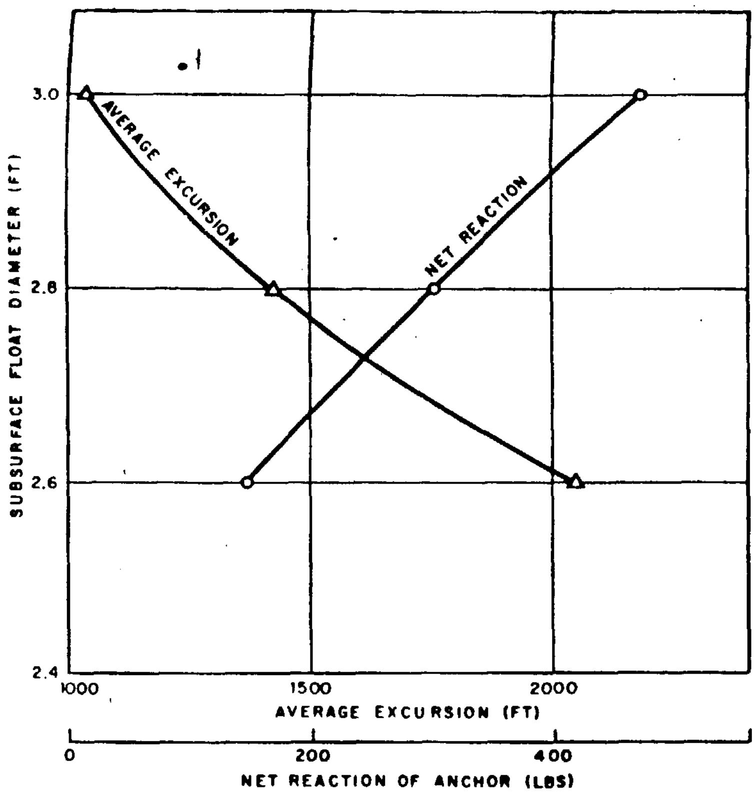


Figure 2.14 Comparison of float excursion and net reaction of anchor on the bottom as a function of subsurface float size ($^5/_{32}$-inch cable, 1,200-fathom moor).

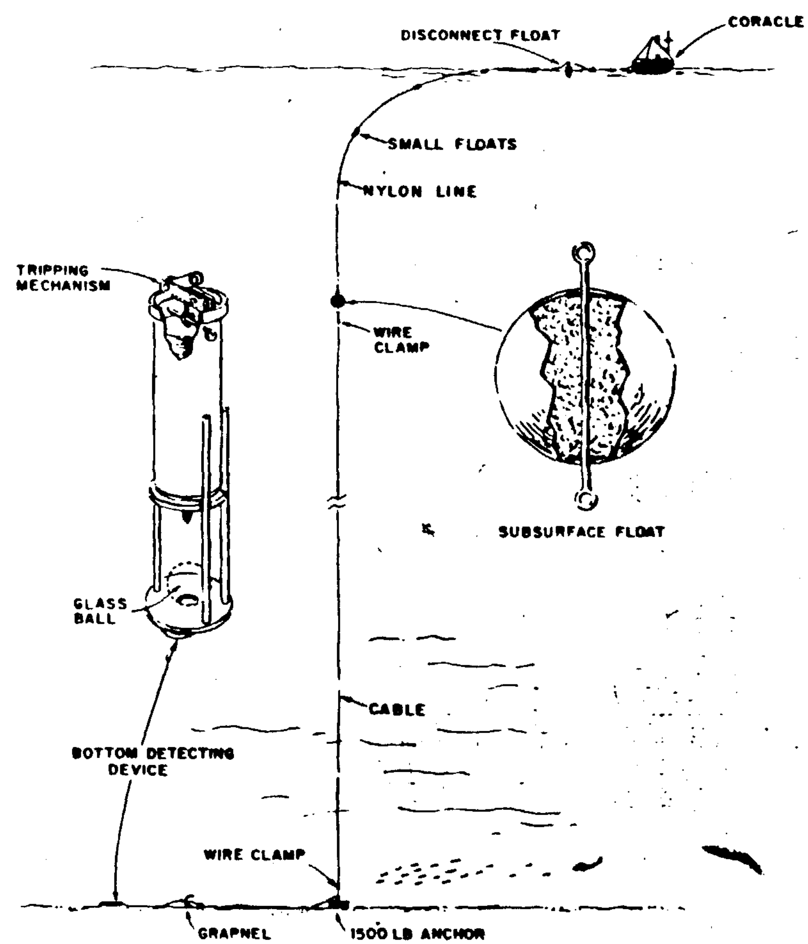


Figure 2.15 Deep-anchoring system.

Ref. M.M. Bigger, et al, Sipboard Radiation from Underwater Bursts, Project 2.1, Operation Hardtack, ITR-1619, USNRDL, S.F. 24, Calif. , Confidential.

One of the specfic objectives of this project was to estimate the gamma radiation fields in the water adjacent x to the ships. The ships were moored destroyers exposed to radiological environments at locations pf possible operational interest .

The gamma radiation dose rates and doses in and about the target destroyers were measured by means of gamma-intensity-time recorders (GITR's) developed at USNRDL. The same instrument was used in several different types of installations.

The undewater GITR station was suspended from a boom extending over the ship's fantail. The instrument was meant to be submerged after the passage of the underwater shock waves. The instrument container was submerged xx to a depth of 11 feet by means of a winch-release-and-braking mechanism activated by a delayed relay closure from the GITR starting circuit. The whole GITR unit, consisting of a detector chamber and a recording unit, was firmly padded with expanded polystyrene and placed into the instrument container. (see attached figure)

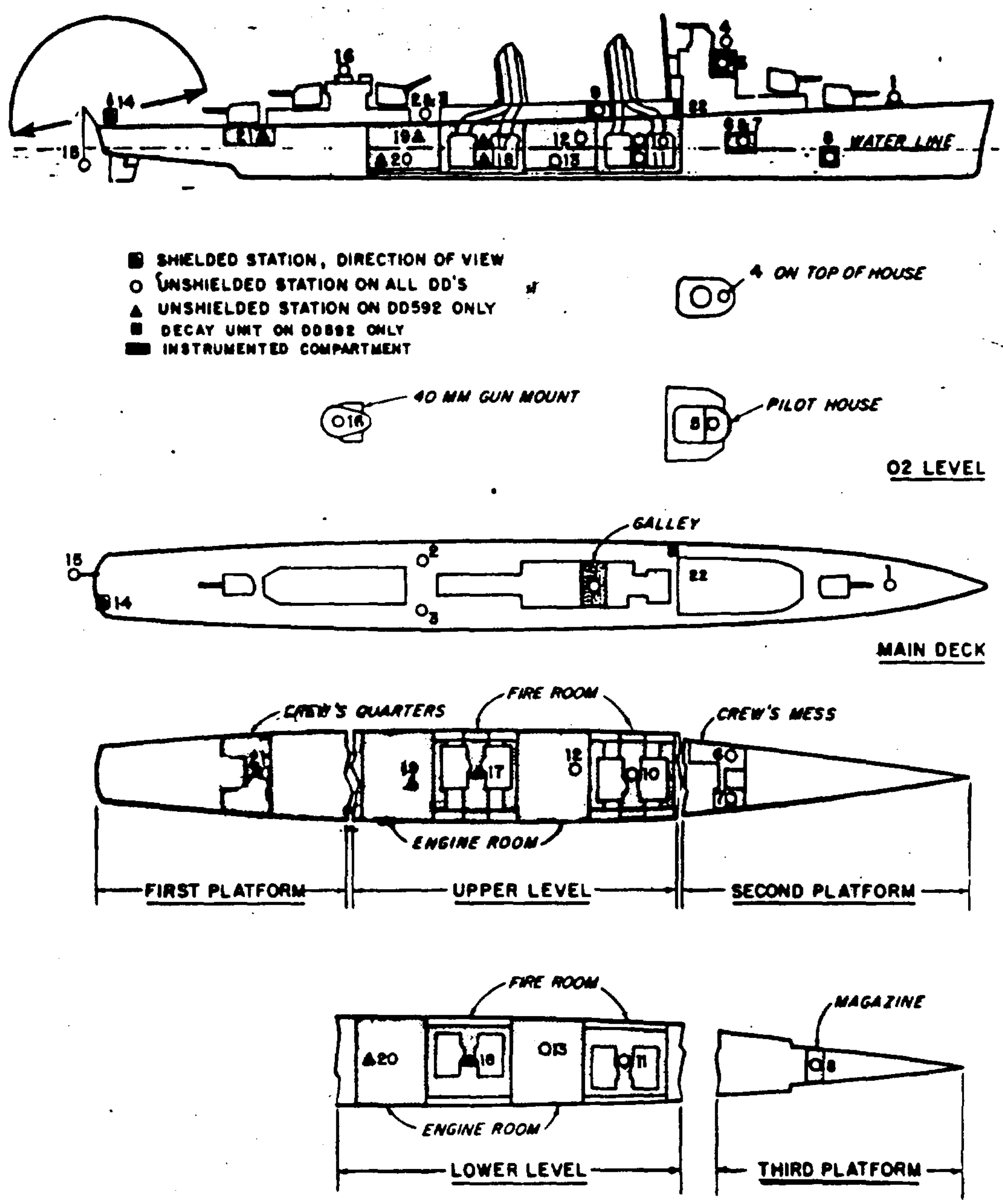


Figure 2.3 Location and designation of GITR stations on target destroyers.

5001332

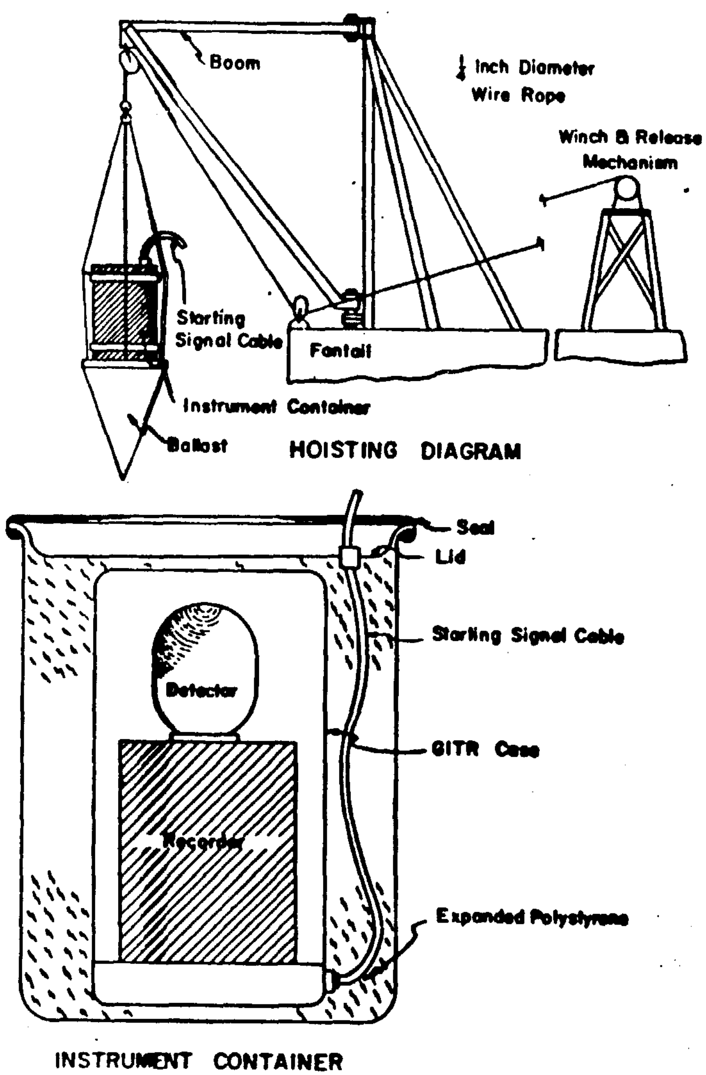


Figure 2.6 Underwater GITR station.

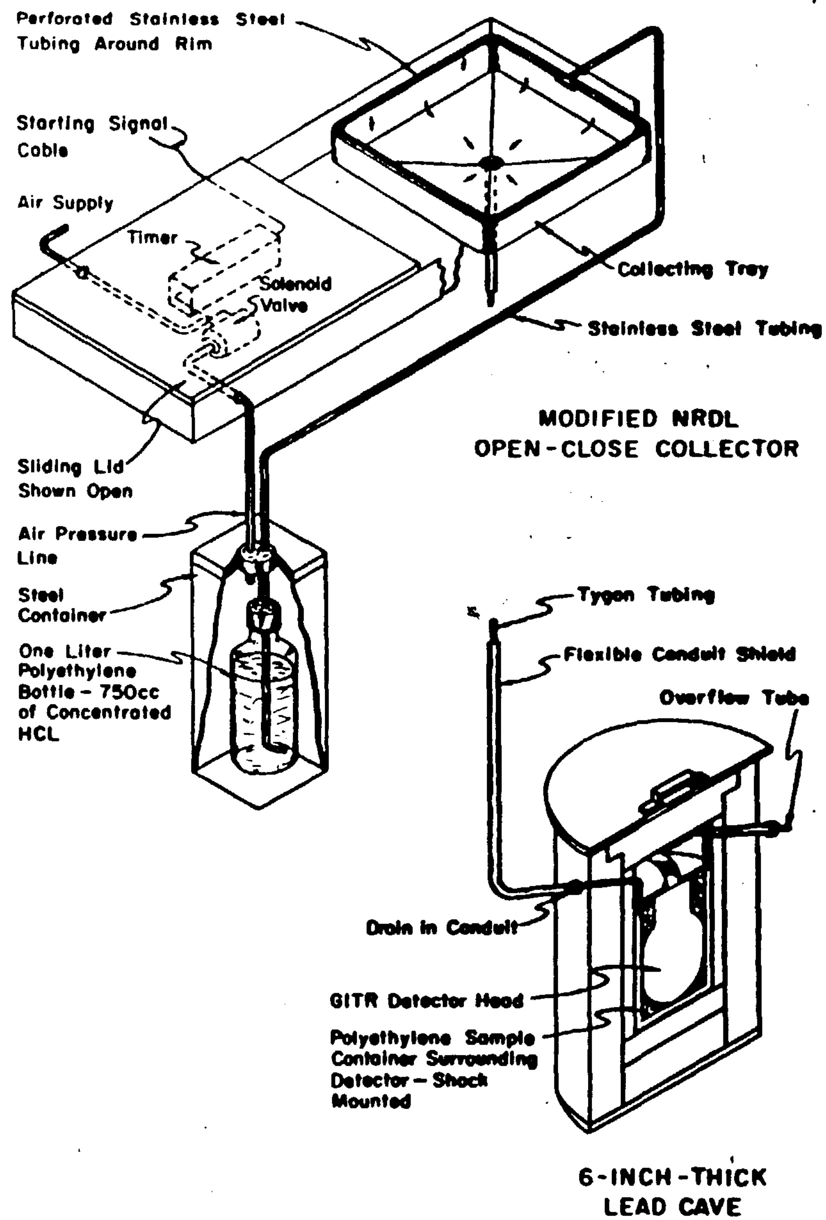


Figure 2.7 Gamma-ionization decay unit.

Ref. R.R. Soule, et al, An Investigation of the Radiological Effects from Underwater Nuclear Explosions Using 10,000-Pound High-Explosive Charges as Models (U), Hydra Program - Hydra IIA Interim Report, 23 August 1962, USNRDL, S.F. 24, Calif., Confidential

Thirteen 10,000-pound, uncased shperical charges of HBX-1 were fired underwater at HYDRA IIA to investigate the radiological effects from underwater nuclear explosions using high explosive charges as models. Various types of instrumentation were used to obtain such information as underwater pressure histories, subsurface radioactive tracer distributions, and hydrodynamic flow near the explosion point.

The test site array consisted of the primary station, a Navy YC Barge, and eight raft stations. These stations were moored in water depths ranging from 40 to 150 fathoms. Because of the water depth and the rocky sloping sea floor at the barge location, the weight, rather than the dynamic holding power, of the ground tackle was utilized to hold the barges in position. The arrange ment of the ground tackle is shown in the accompanying figure. Instead of the peg-top buoys shown in the figure, 17-ft diameter telephone buoys were used. The additional buoyancy provided by the telephobe buoys was needed to support the added weight of chain required by the deeper water.

5001333

The moorings for the raft stations consisted of 2500-lb Navy stockless anchors connected to a length of ½ inch cable equal to the depth of the water and held up by a 36 inch diameter buoy. The short scope of the cable restricted the excursion of the raft about the anchor. The raft stations were fastened to the buoys with a 3/8 in. wire pendant.

A special charge support system and accompanying tackle were designed and used to pull the charge in its suspension to the proper depth. A clump was constructed from a 4000-lb mushroom anchor. Though the clump weight was enough to counteract the vertical force of the downhaul cable, an additional, 2500-lb steckless anchor was placed opposite the barge from the clump to counteract the horizontal force component.

The charge support itself consisted of three xkx spherical buoys formed into an equilateral triangle separated by pipe spreaders. The charge rests on a padded ring at the center of the support. Its center of gravity was about 24 inches above the centerline of the support.

The underwater radioactivity measurements were made using specially designed scintillation detectors. One was fixed at a depth of 6 feet, and the other, a variable depth meter, was attached to a motorized reel and cable. A survey vessel, LCM, was used to transport this equipment. A gas engine generator provided power for the operation of all electrical and electronic equipment.

Other radiation detectors were mounted on rafts and the barge station. Floating cables served as the power and signal cables to these array stations.

The hydrodynamic flow of water around the point of detonation was followed through the use of dyes in the water. Based on experience gained from studies with one-lb. shots, Uranine and Rhodamine-B were selected as the most readily identifiable. It was known that about 2 grams of dye per pound of explosive is required for adequate marking of the column. To color a proportional volume of water, the weight of dye was scaled directly with the charge weight. Thus 50 lb of each dye was used in glass carboys. The containers were strong enough to withstand reasonable handling, yet brittle enough to shatter when struck by the shock waves. The carboys were placed at depths of 50 ft or more, suspended by nylon rope from surface floats.

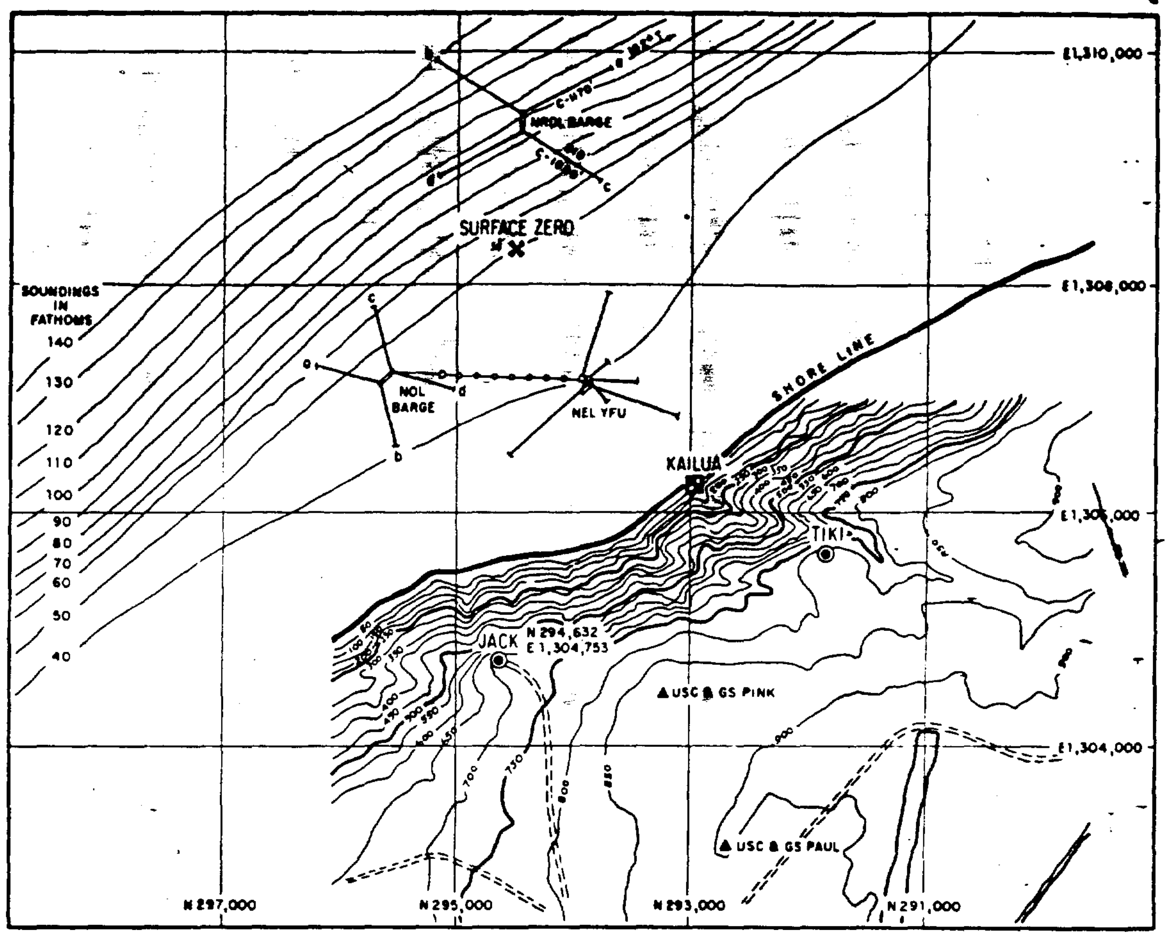
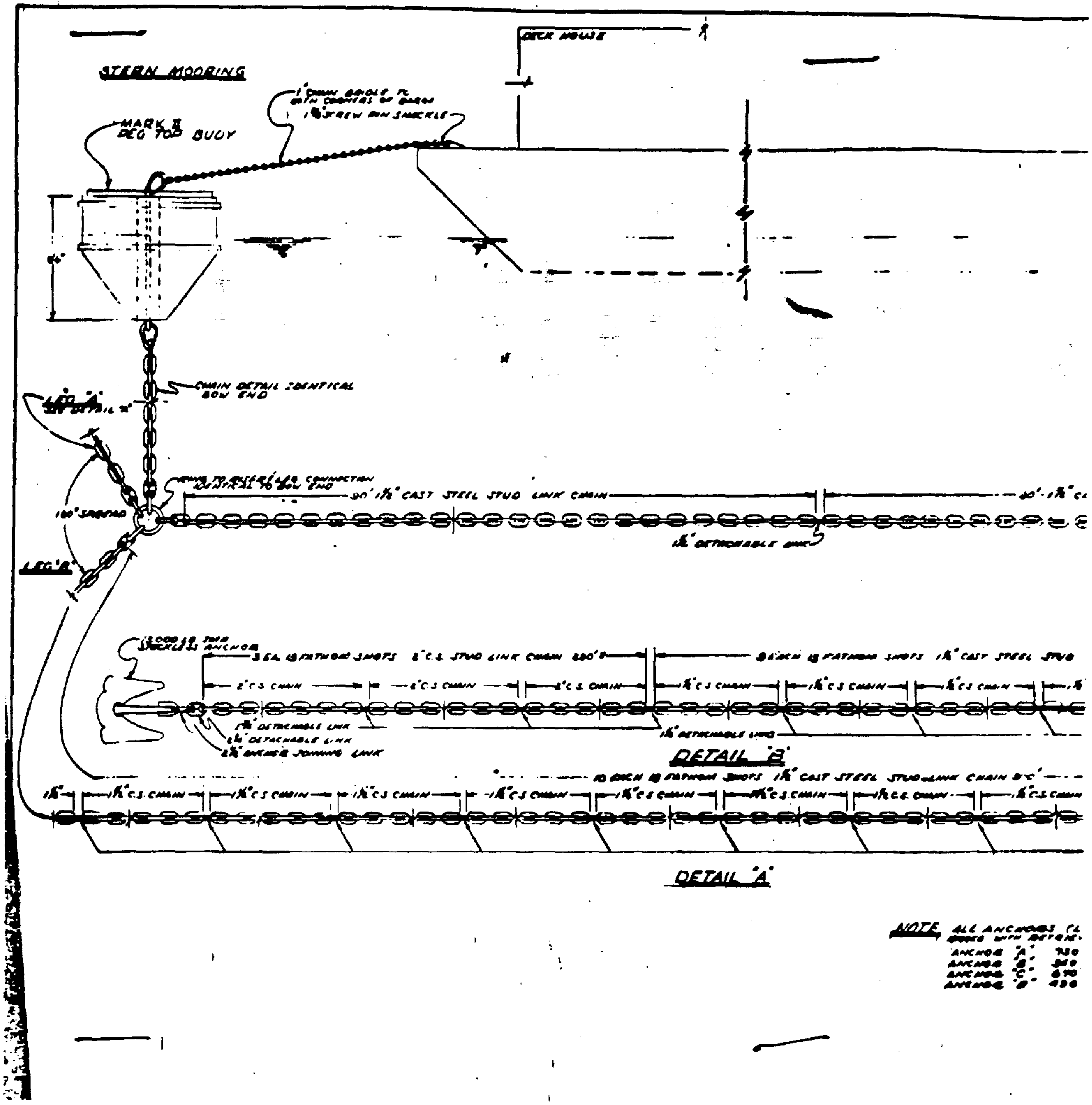


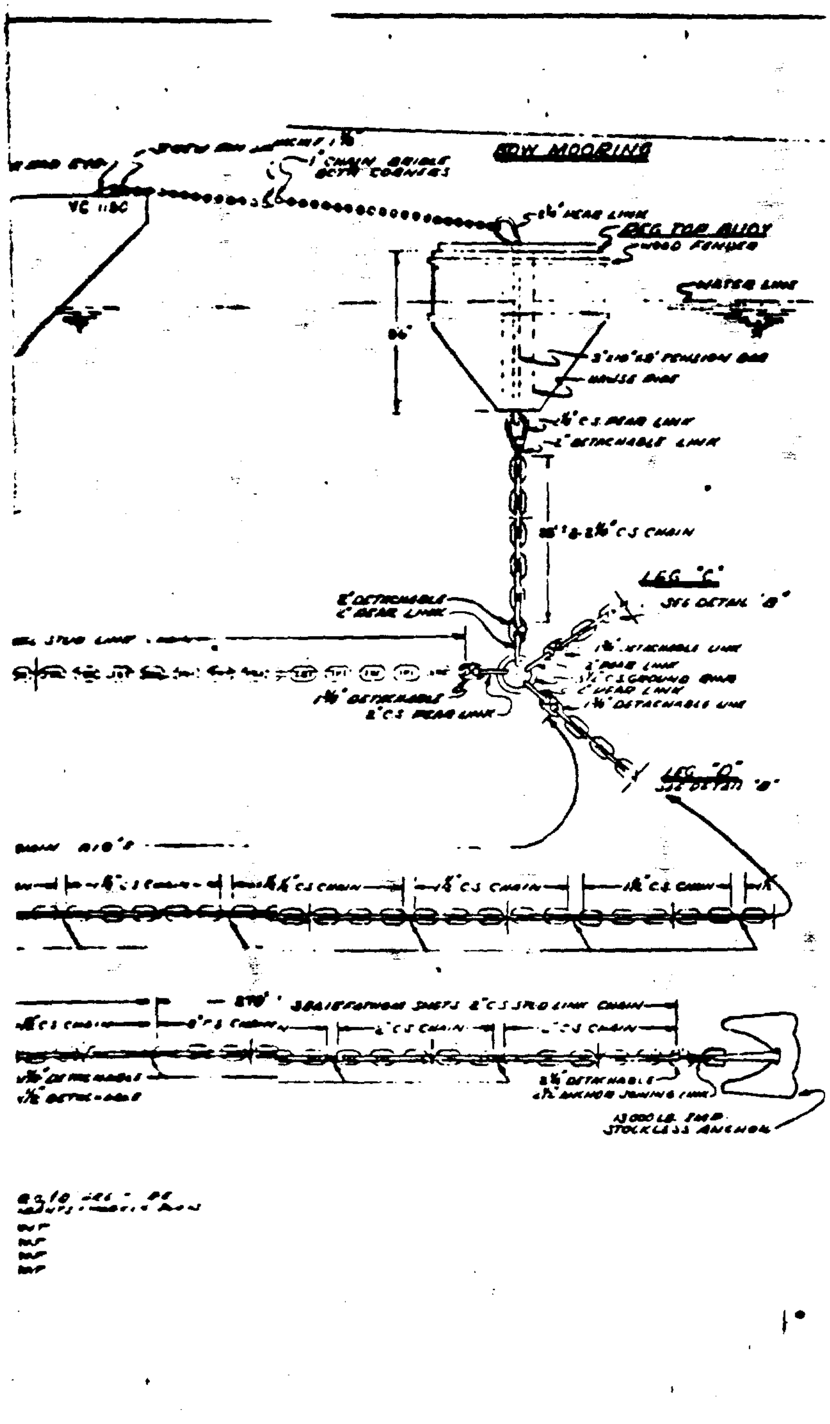
Fig. 2.2 Test Site

500133b



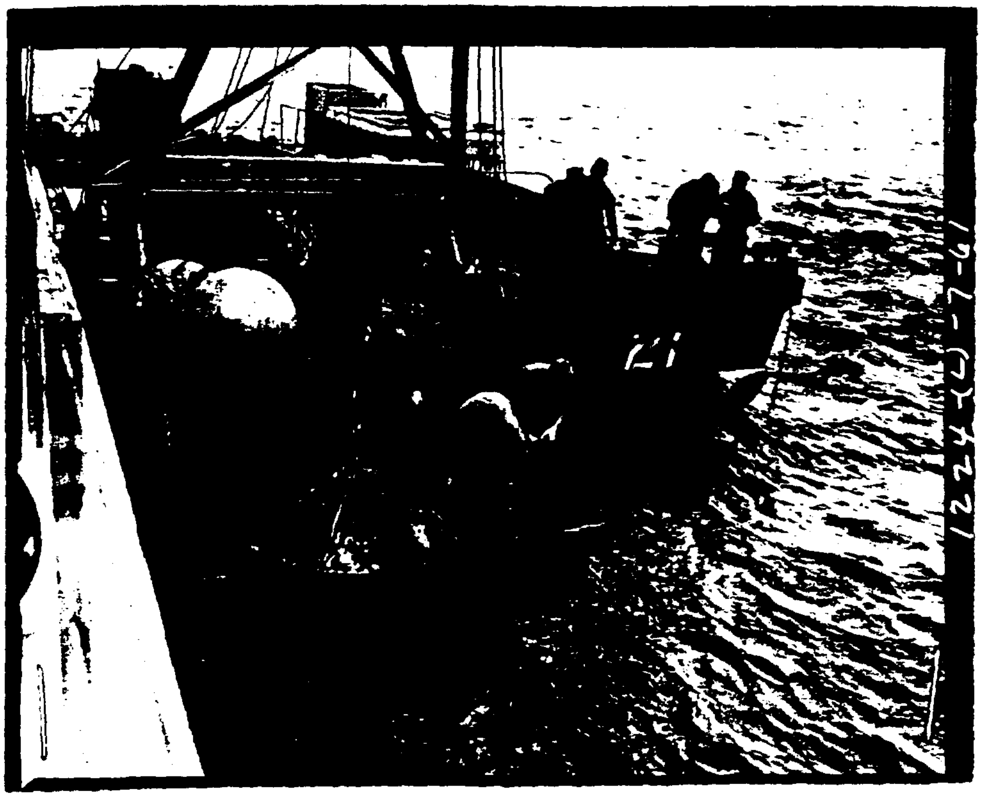
Arrangement of Ground Tackle for YC Barge Mooring

5001337



BOW MOORING
WOOD FENDER
WATER LINE
HAWSE PIPE
LEG "C"
SEE DETAIL "B"
LEG "D"
13000 LB. SHIP
STOCKLESS ANCHOR

5001338



Placement of Downhaul Clump

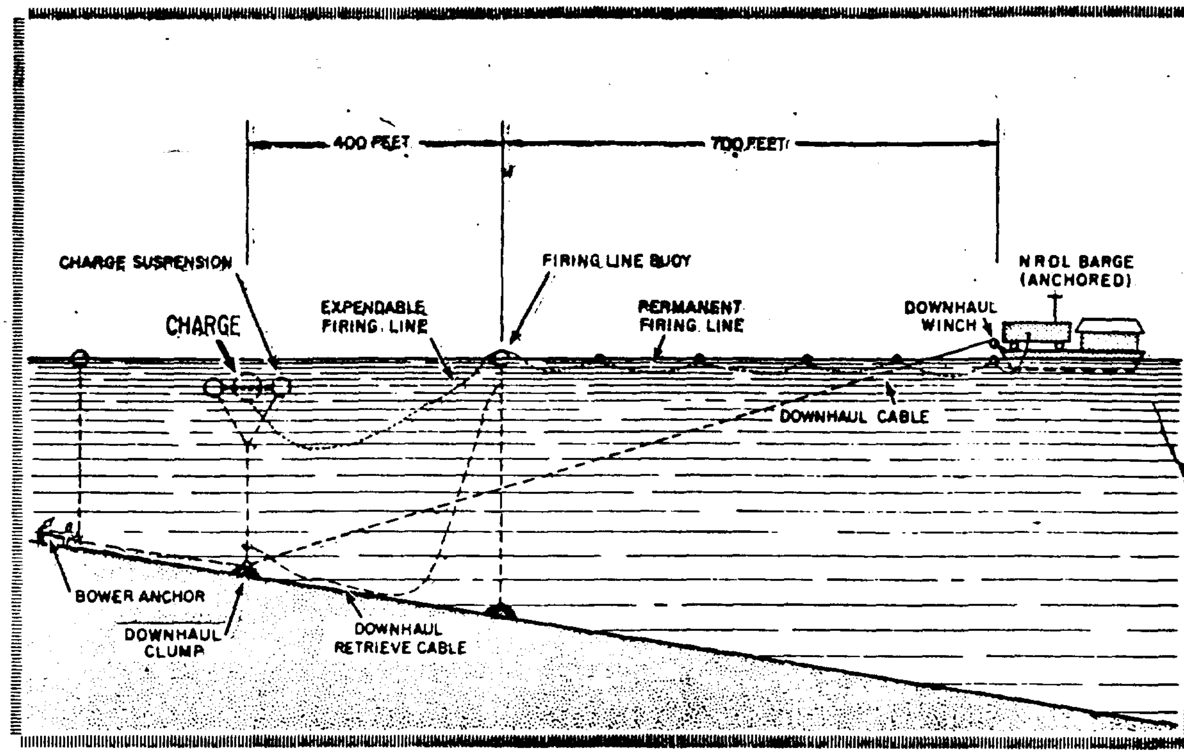


Fig. 2.20 Downhaul and Firing Line Arrangement

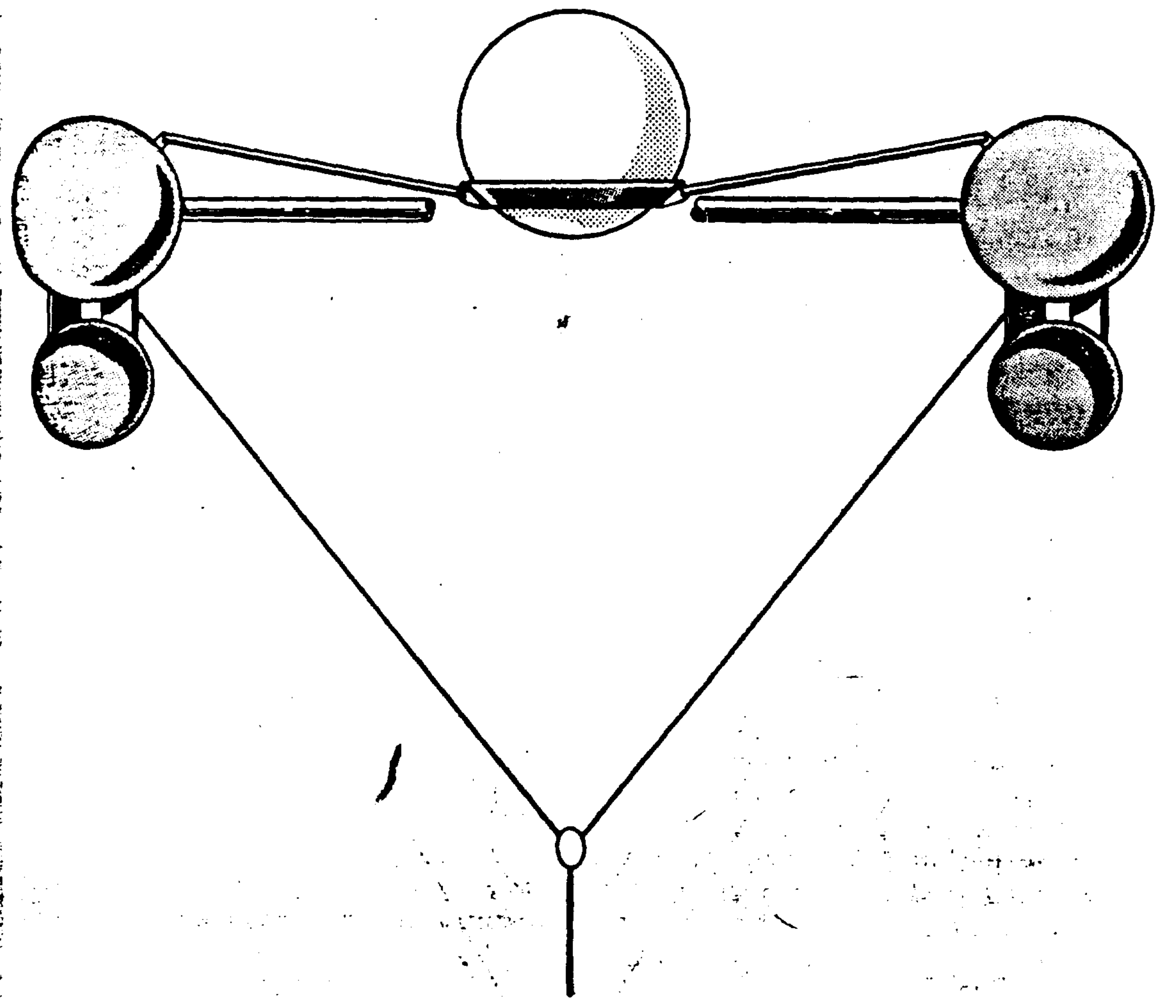
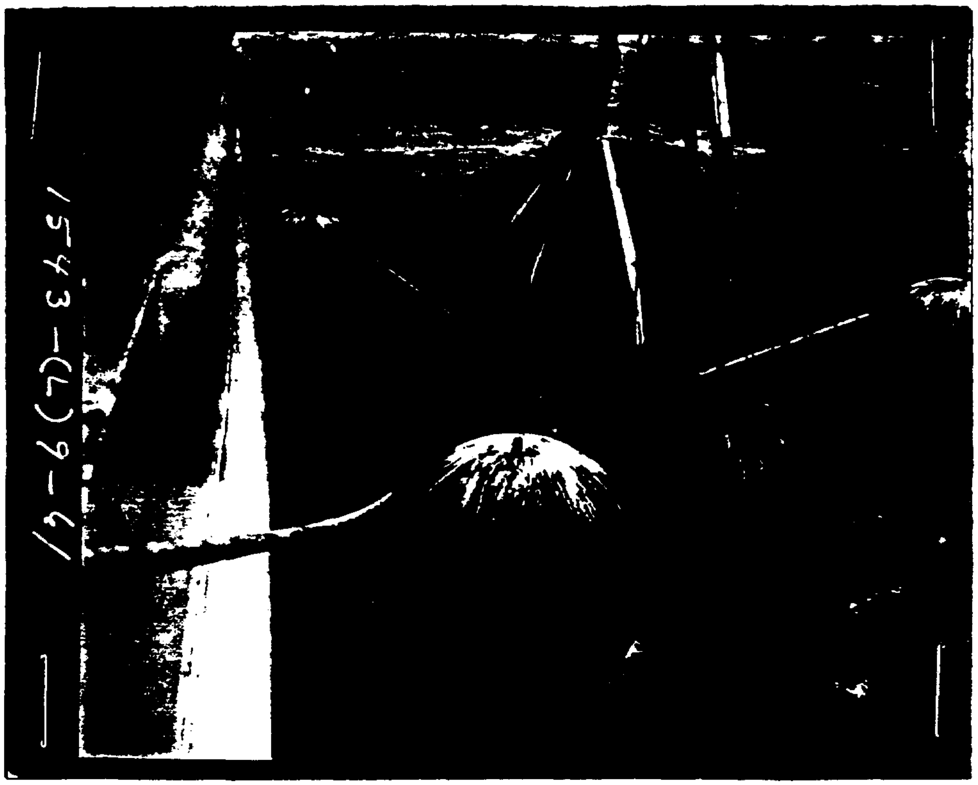
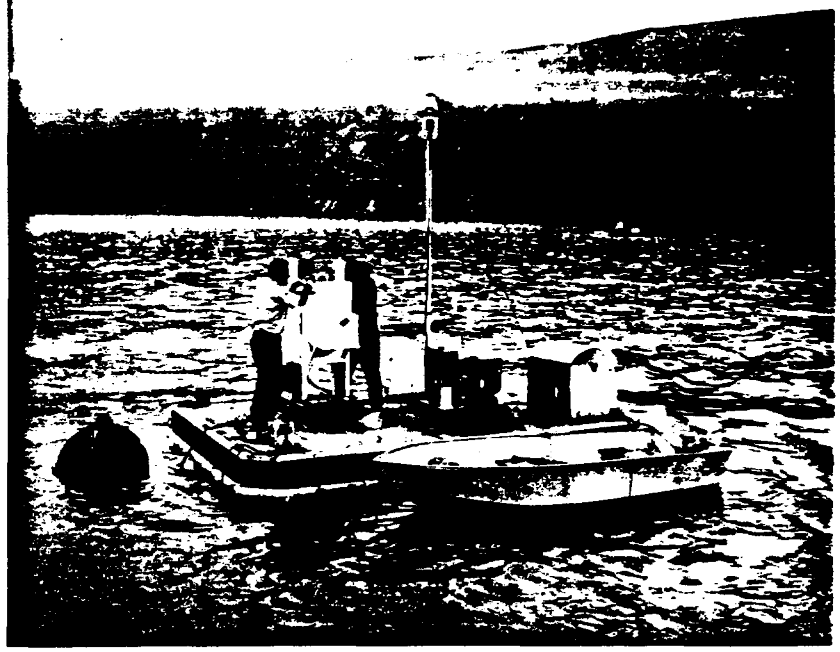


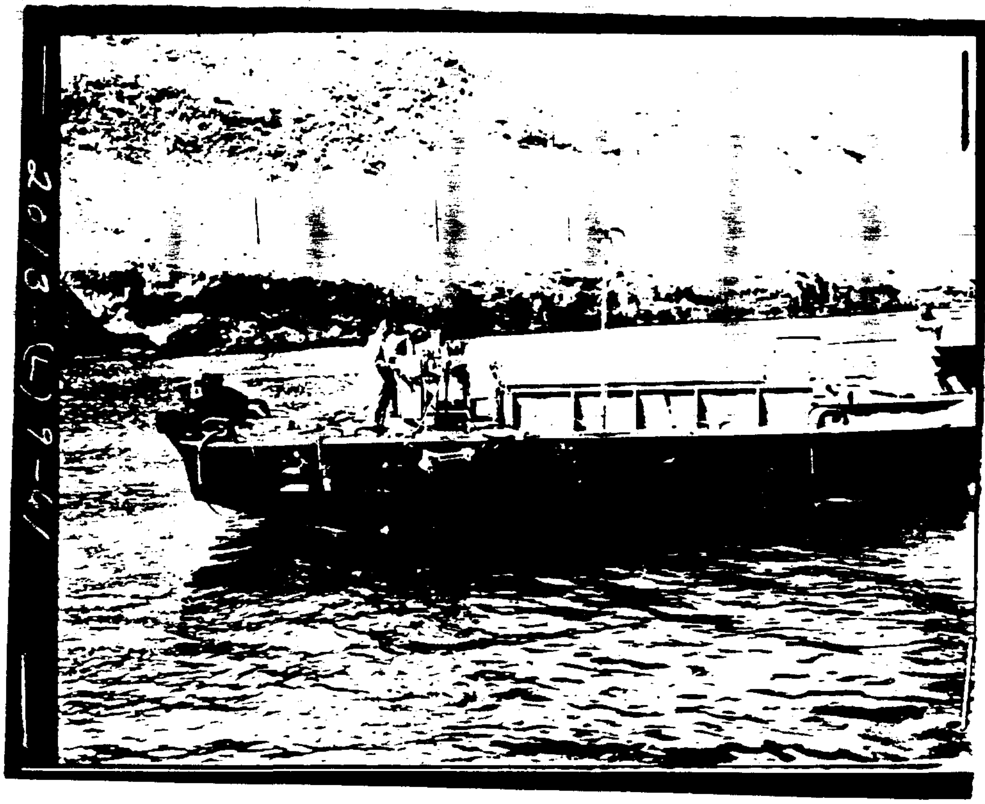
Fig. 2.26 Revised Charge Support



Placement of Charge in Charge Support

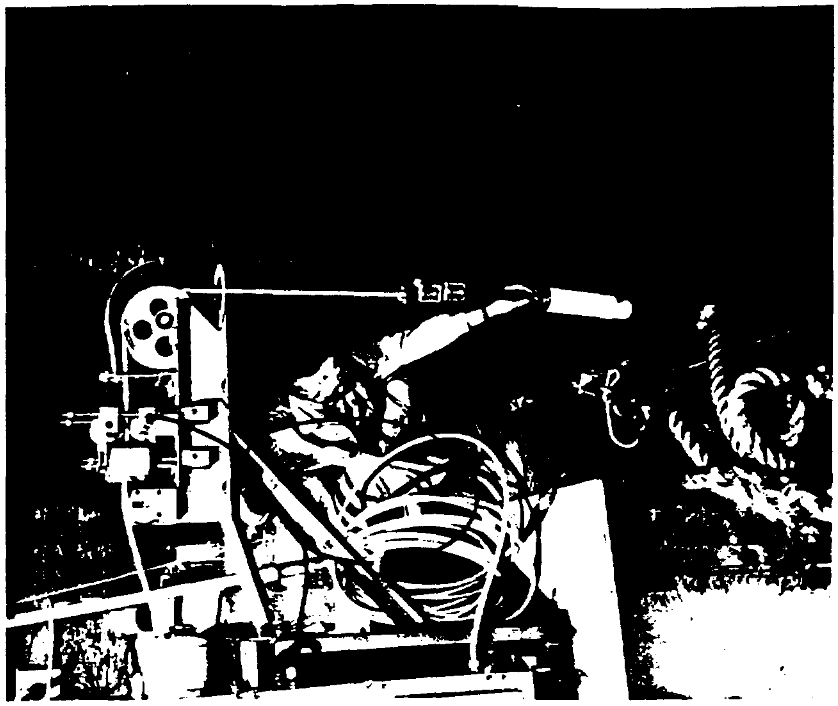


5001343



Tracer Survey Vessel, Showing Fixed Underwater Probe in Upright Position

5001345



5001346

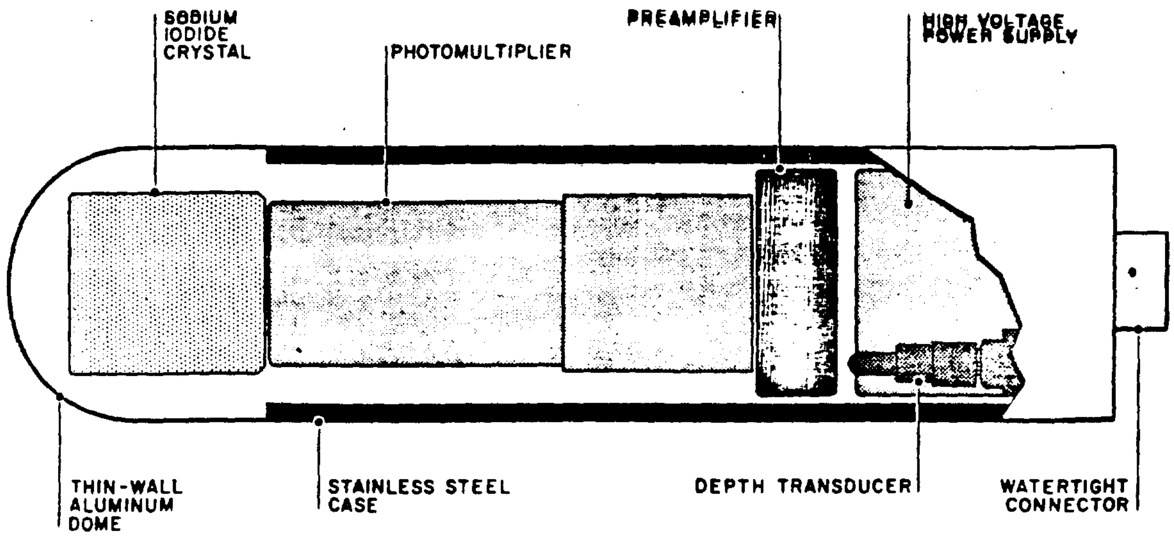


Fig. 2.44 Cutaway View of Gamma Detector

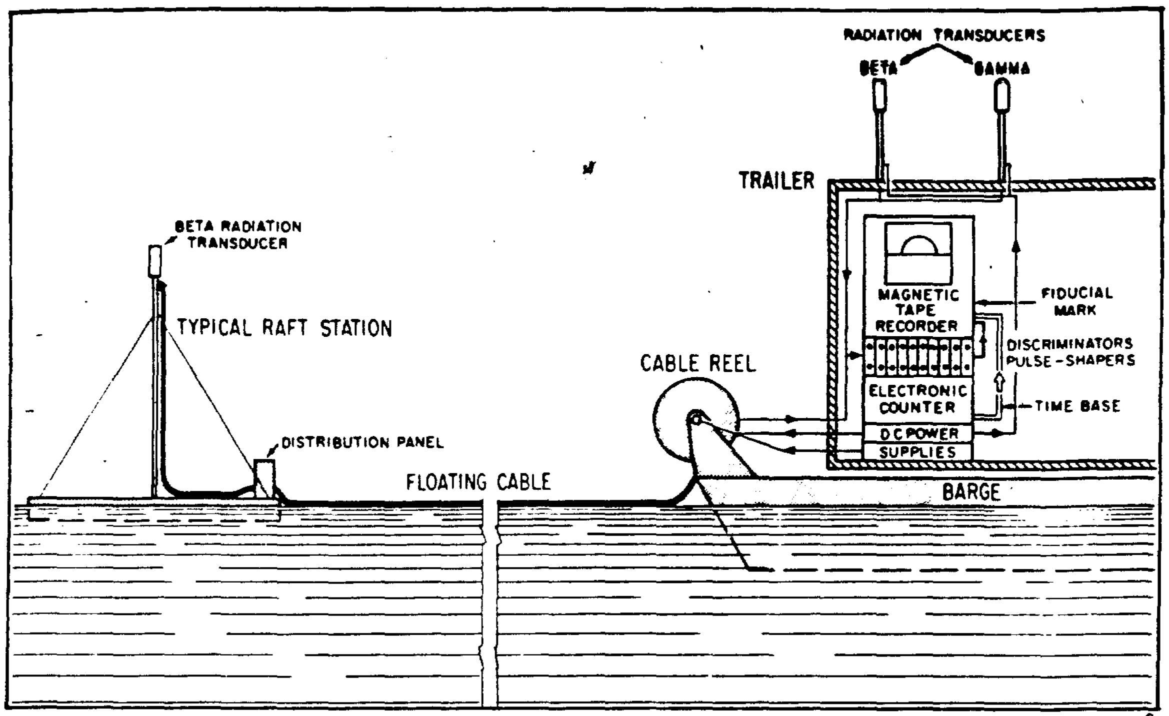


Fig. 2.55 Diagram of Radiation Transducer Recording System

5001348

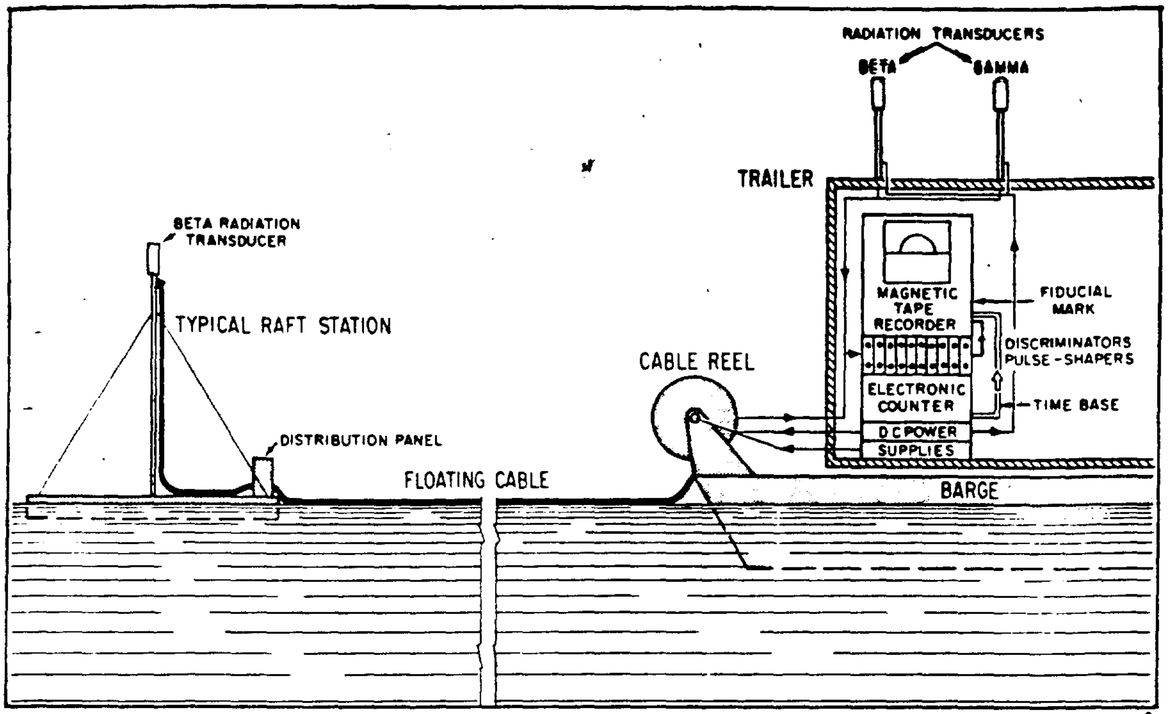
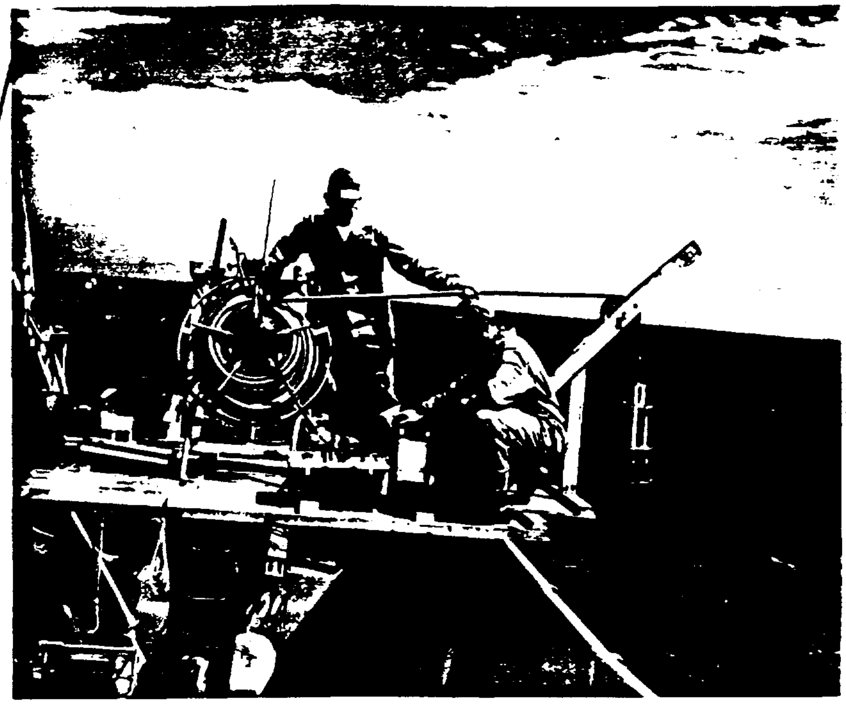
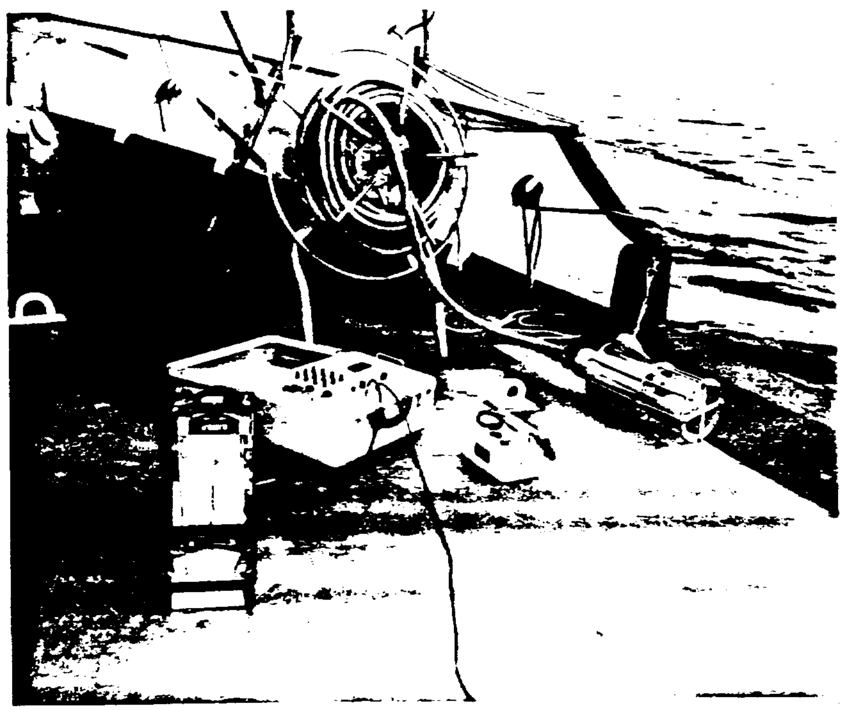


Fig. 2.55 Diagram of Radiation Transducer Recording System





The Franklin System
Used to Monitor Sea-Water

5001349

Ref. L.E. Egeberg, L.D. Johnson, and N.H. Farlow, Radiological Effects from an ASROC Delivered Weapon, Project 2.1, Operation Dominic, POIR-2004, M 14 June 63, USNRDL, S.F. 24, Calif., Secret RD.

The basic objective was to measure the gamma fields at a limited number of stations. In addition, water samples were collected for use in the radiochemical yield determinations.

The station array for this project consisted of eight coracle stations. The coracle stations were assembled in a single line (with the rest of the test array) and towed in an upwind direction at a speed just sufficient for the towing vessel to maintain steerageway. All coracles were secured to the towline by a short pendant, to allow their removal or addition to the line ~~xxx~~ without breaking its continuity.

Prior to burst time, the downwind string of five coracles were cut free from the rest of the tow. The 3,000 ft of line was an effective drogue to confine drift rate to the velocity of the current. The remaining three stations proceeded upwind with the main towline at minimum speed.

The water samples were collected by the project vessel. The USS Sioux was modified by burning a hole in the skin of the ship 5 feet below the water-line in the shaft alley.and installing a 2½ inch valve and plastic piping. With this arrangement, it was possible to draw sea water samples without spillage.

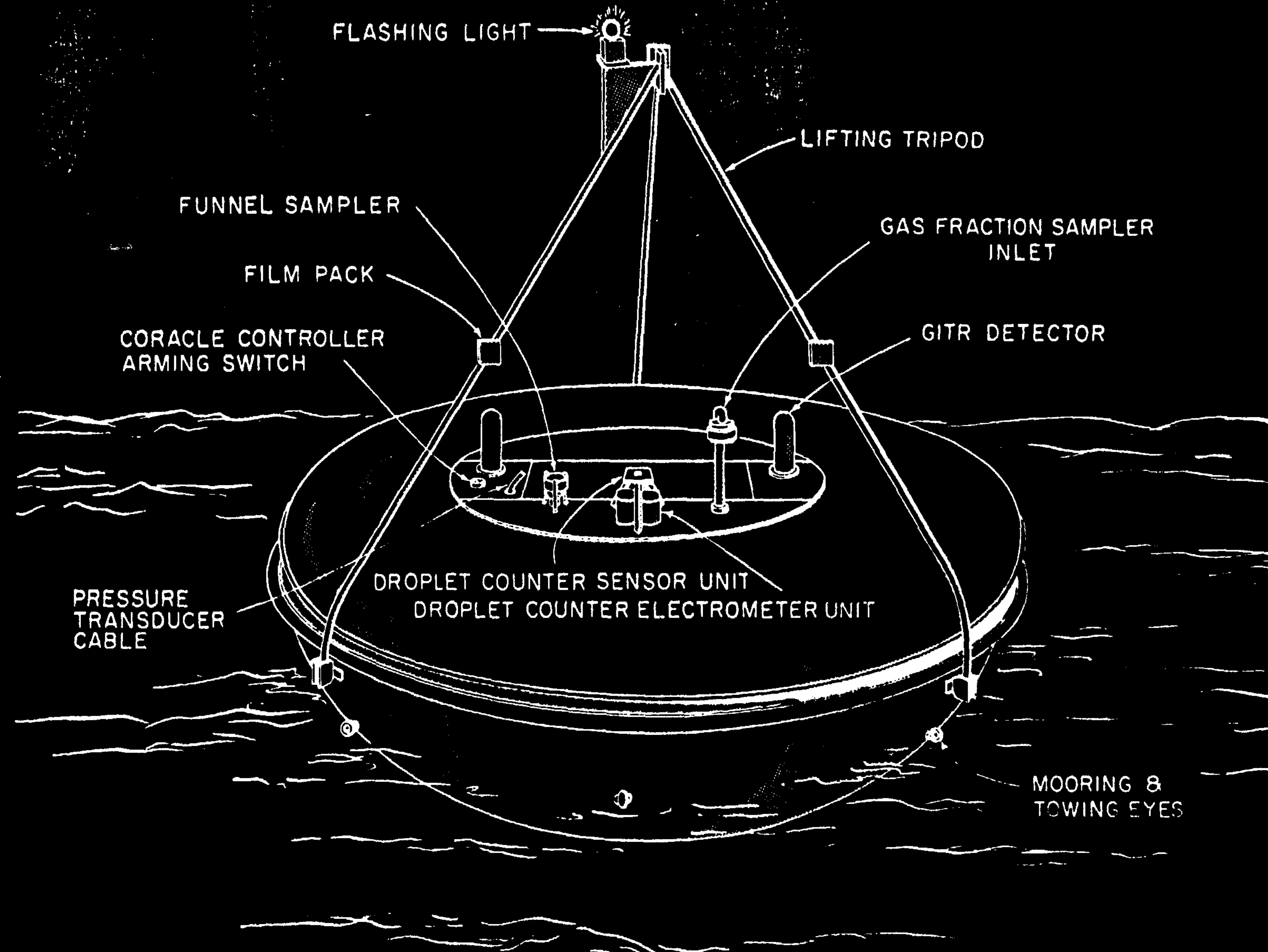


Figure 2.2 Coracle.

Ref. Report in preparation

T.H. Shirasawa, Early Dimensions and Intensity of the Radioactive Pool Resulting From Shot Sword Fish, Operation Dominic, USNRDL - TR ___, USNRDL, S.F. 24, Calif., Confidential.

The radioactive pool resulting from the underwater detonation was followed for approximately 24 hrs. Contact with the pool was maintained on the basis of gamma radiation measurements.

From initial contact with the pool post shot, the project vessel, carrying various types of gamma detectors, traversed the areas of interest continuously. Measurements were taken both from positions above the surface of the pool, and also underwater. Standard USNRDL gamma-~~xxxxx~~ intensity-time recorders were encased in water-tight housings for their use underwater. One detector remained at a fixed depth throughout all maneuvers of the vessel, while another was used intermittently to make depth soundings. The deep probe mechanism permitted the lowering of the detector to a depth of approximately 500 ft. A electrically operated cable winch was used with the depth probe.

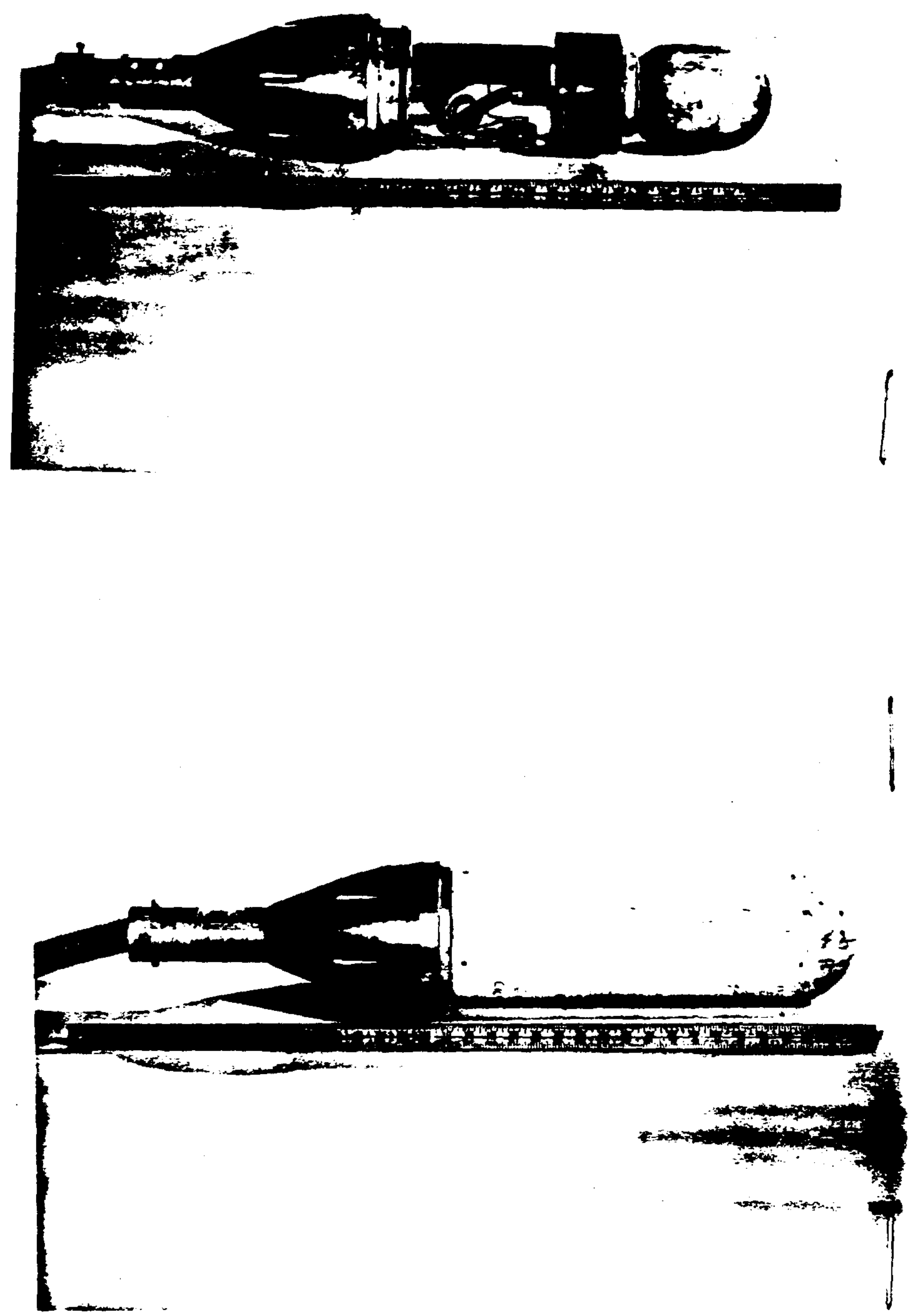
Similar detectors were used in positions above the water to take correlative measurements. The detectors above water were also compared with standard Navy Radiacs.

Bathythermographic measurements were taken to relate the depth of radioactivity penetration with the depth of the thermocline. The BT measurements were taken simultaneously with the deep probings.

The horizontal locations of the measurements were established through the location of the vessel. Both the DRT of the project vessel and continuous radar sightings from another vessel were used to establish locations as a function of time.

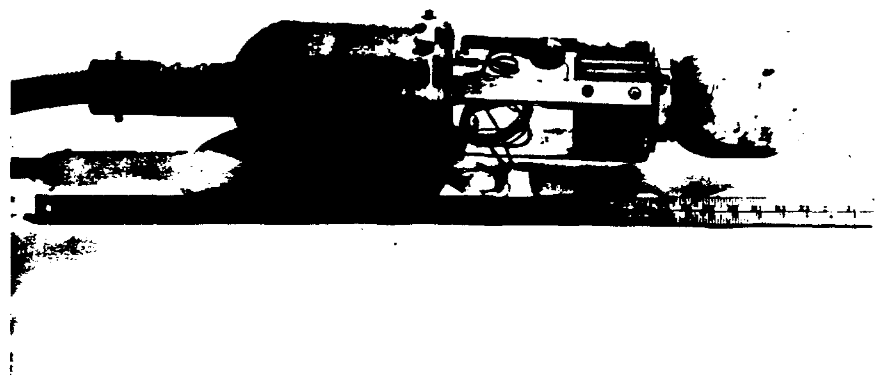
The vertical positions of the underwater measurements were determined by pressure transducers. The pressure transducers were located within the water-tight housings designed for the detectors.

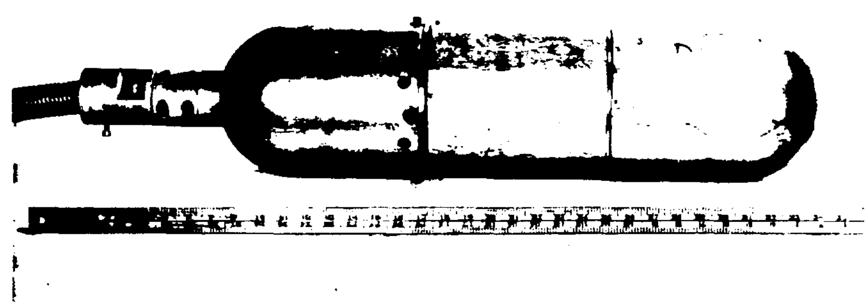
During the operational activities at sea, a transportainer tied down on the aft deck served as the project control center. All recording systems and visual read-out display panels were located in the transportainer. Direct telephone connections were established with the pilot house so that radiation readings could be coordinated with the navigational charts.



NRDL Standard GITR adapted to Underwater Use.
(Fibreglas Housing)

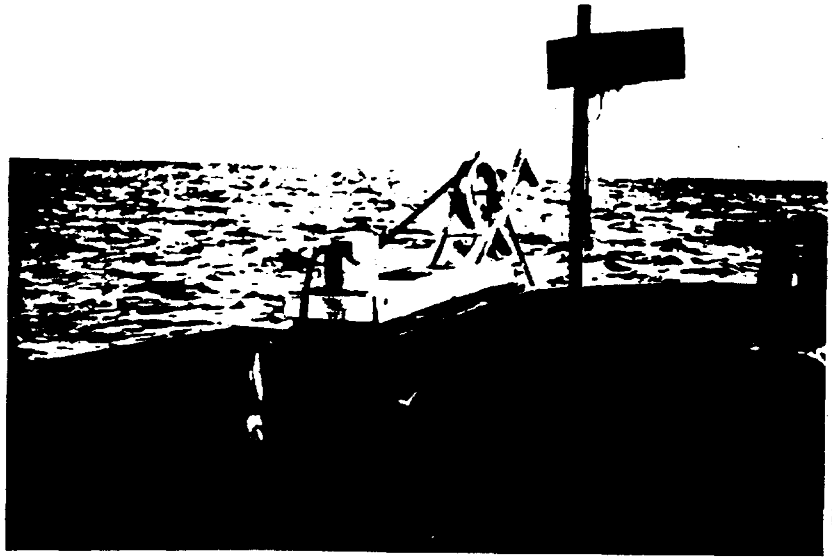
5001354





NRDL Standard GITR Adapted to Underwater Use.
(Aluminum Housing)

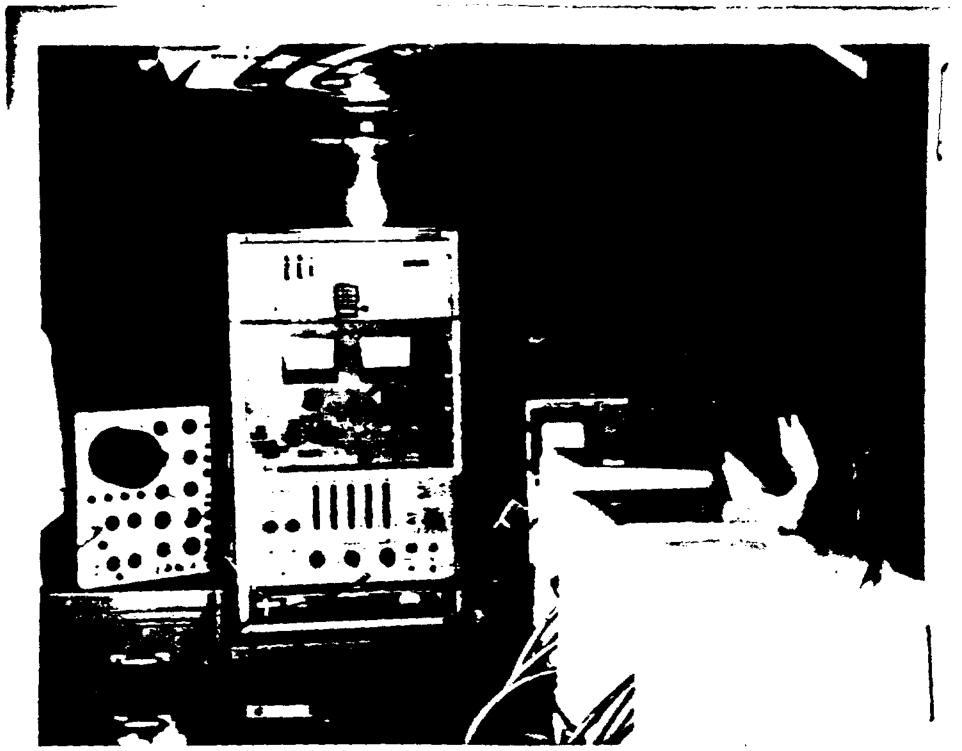
5001355



Sheave andCable Used For the Fixed Underwater Detector

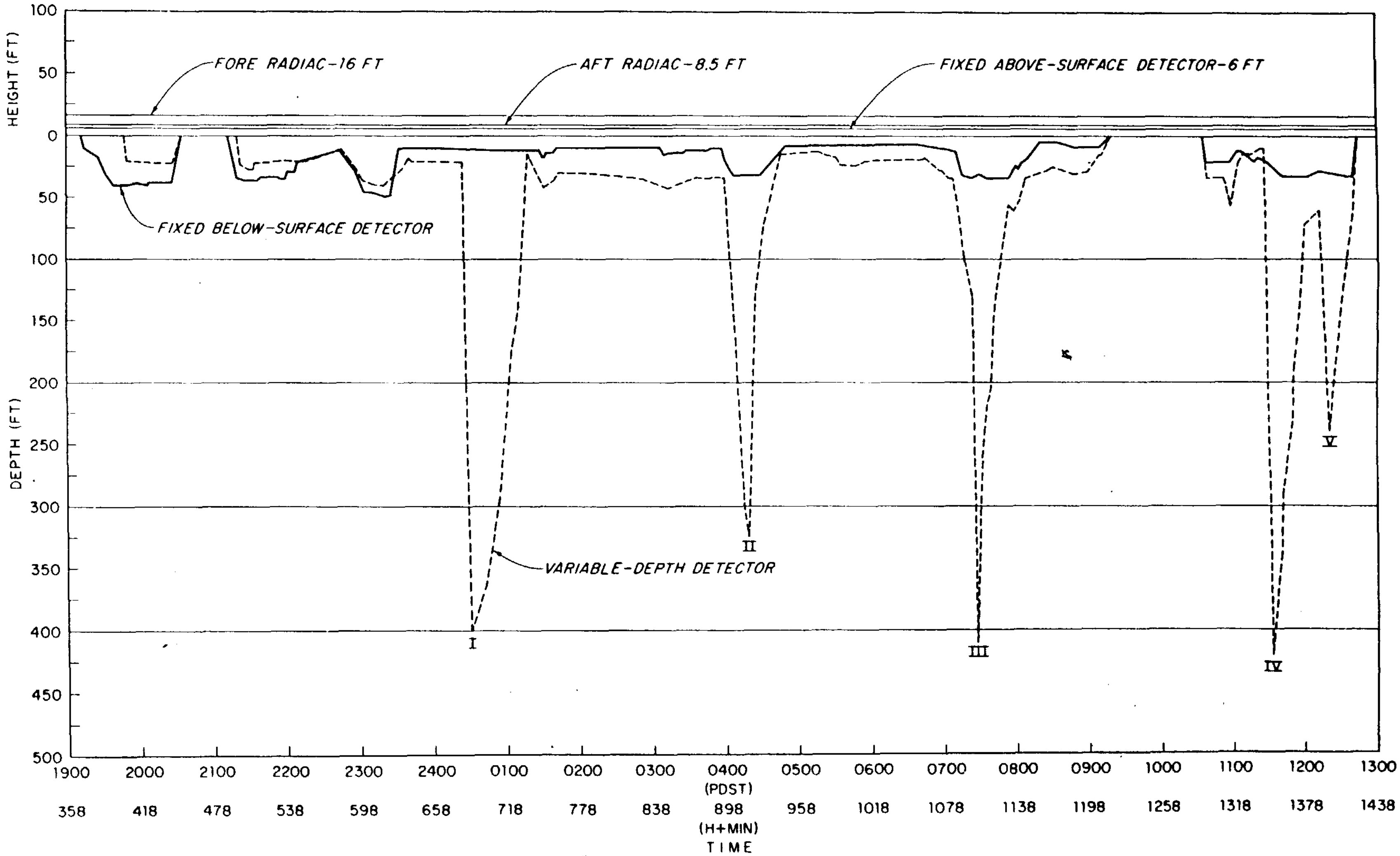
Motorized Cable Winch Used for the Deep Probe

Underwater Detector Used for Above Surface Measurements



Inside View of Project Transportainer Showing Visual Readout and Recording Systems

5001359



Vertical Position ofDetectors as a Function of Time (Based on Pressure Transducer Data)