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D.W. HUSZAGH AND S. FINK

June 1976

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Abstract

The MIT/Navy buoy was loaned by Woods Hole Oceanographic Institute to BNL late in 1975 for the implimentation of meteorological studies off the south coast of Long Island. It was destructively dismembered at Woods Hole and transported overland to BNL in December, 1975.

Extensive repairs and modifications to the buoy structure were undertaken to simplify transport, improve trim control, and enhance instrument access and security. Minor modifications leading to greater personnel safety were also made.

The refurbished buoy was carried in sections to the Shinnecock inlet area by motor truck. Following dockside assembly, the buoy was launched on May 21, 1976, whereupon it was towed through the inlet and moored in 85 feet of water off Tiana Beach, New York.

OPERATIONS, ENGINEERING, AND MODIFICATION REWORK
OF THE M. I. T. (SMILE) BUOY

D. W. Huszagh and S. Fink

The lead story in the February 20, 1976 issue of the Brookhaven Bulletin described operations of dismantling of the M.I.T. (Smile) Instrument Buoy at Woods Hole, Mass., under the direction of S. Fink; and the transporting of the buoy from Woods Hole to Brookhaven National Laboratory, by a BNL riggers team, for necessary repair and modifications (Fig. 1-2).

The purpose of this effort was to provide a versatile offshore work platform for extensive meteorological studies in conjunction with simultaneous oceanographic studies.

In addition to comprehensive repairs, specific modifications were undertaken to improve the safety, integrity, security, and versatility of the buoy as an instrument platform for research studies.

Following transport to BNL, the dismantled buoy components were thoroughly sandblasted and moved to building (820) for inspection and subsequent work. A close visual examination was made of all components for damage due to corrosion, (Fig. 3), and general wear. All damaged components were repaired as appropriate. Component fasteners, gaskets, valves, and buoyancy chamber access plugs were removed and replaced with new ones. The replacement valves were pressure-checked for leak tightness prior to installation. New protective zincs were cast and installed to replace deteriorated ones. As each buoyancy chamber was resealed, it was pressure-checked for leak tightness. Following the verification of the leak-free integrity of each buoyancy chamber, an R.T.V. overseal bead was ap-

plied to each penetration fitting as a pre seal against hydrostatic (reverse) pressurization by seawater in the ocean environment.

After effecting the repairs, the major modifications were undertaken. Foremost was the insertion of a flanged joint in the lower quarter of the buoy (Fig. 4). A double weld was made on flanges (inside lip and outer shelf edge). The purpose of this is to permit the nondestructive dismemberment of the buoy into sections which can be transported overland on legal-size highway vehicles. The next modification was an extension of the central instrument well at the work platform level, and the capping of the extension with an "O" ring sealed, autoclave-style, waterproof door. The purpose of this is to simplify access and eliminate previous leakage problems which caused serious instrument damage (Fig. 5 and 6).

Former operating procedures involved the use of divers for deployment and recovery of the buoy as well as for effecting trim adjustments. To eliminate the need for divers, a major engineering modification to the flooding and trim regulating system was devised. In essence, the flooding and trim regulating controls were relocated to the above water work platform area, and an incremental displacement adjusting system was devised to permit fine trim control. The key to this modification lay in providing mechanical protection to the interconnecting links (hoses) between the flood control penetrations at the bottom of the buoy and the control valves at the top of the buoy (Fig. 7). Steel channel raceways with snap-on covers were used for this. A fine trim control tank (Fig. 8) was nested in the support structure of the large damper plate at the bottom of the buoy. This tank serves a secondary purpose of improving the towing attitude (raises the lower end) of the buoy while it is being towed to the deployment site.

Major safety improvements were added to the work platforms with the instal-

lation of hand rails and foot gratings. Several alterations and improvements relating to instrument supports completes the list of mechanical modifications effected on the buoy. These supports are generally of a removable or adjustable nature to minimize interference with future experiments using different instruments.

Even before the modifications were completed, the painting of the buoy was started. The emphasis was on environmental protection (Fig. 9). The entire buoy is made of steel, and all exposed surfaces (which had been stripped bare by initial sandblasting) were thoroughly primed with a penetrating zinc compound within four hours of blasting. The submerged portions of the buoy were given a thick coat of high-grade marine anti-fouling paint. Exposed portions were given two coats of high-grade white colored metal enamel. Following the protective coatings, vermillion color bands were painted on the exposed tower structure of the buoy up to the work platforms. A vertical index stripe of contrasting color (black above waterline and white below waterline) was painted the length of the buoy. Large numerals which depict the distance from the work platform to the bottom damper plate were painted at one foot intervals down the length of the buoy. These, like the index stripe, are black above the waterline and white below.

At 2:00 a.m. on May 20, 1976 the refurbished buoy was loaded in sections aboard three BNL trucks for transport to the public boat slip adjacent to the Shinnecock Inlet. County and town police escorts, as well as all required permits, had been obtained for the caravan. This entourage arrived at dockside without incident at sun up. After a protracted wait of several hours, the mobile crane which had been hired from Chesterfield Associates arrived to assemble the buoy adjacent to the public boat slip (Figs. 10-11-12). The assembly operation was accomplished by the BNL riggers under the direction of J. Winters with

S. Fink and D. Huszagh checking on critical details. Assembly, including mechanical inspection and final pressure tests on the buoyancy control apparatus was completed by mid-afternoon. Unfavorable sea and weather conditions had developed by the time the buoy was ready for launching and it was decided to defer this critical operation until more satisfactory conditions prevailed. Accordingly, permission was obtained from Weathampton Town to leave the buoy at dockside. The town also graciously provided police surveillance to thwart vandalism.

Ideal weather conditions were forecasted by R. Brown of Meteorology for Monday, May 24, 1976. Accordingly, he alerted Chesterfield Associates that the launching would take place on that date. The forecast was correct, and the Chesterfield Rigging crew plus the BNL research vessels began the multi-stage launching and ocean deployment operation in the early hours of May 24.

There were five distinct parts to the operation. These were: 1.- lowering the buoy from dockside into the boat slip, 2.- towing the buoy out through the Shinnecock Inlet and into the deployment area, 3.- deploying the monstrous buoy mooring tackle (2500 lb anchor, chain and mooring cable) at the pre-selected site (Fig. 13), 4.- connecting the buoy to the mooring, and 5.- readjusting the buoy attitude from horizontal (for towing) to vertical (for use as a stable instrument support system) position.

The Chesterfield crew used two motor cranes to strategically reposition the buoy for maximum clearance in the boat slip, and then lowered it gently into the water. With the aid of the Zodiac work raft, the heavy towing hawser of the LCM was connected to the towing eye at the base of the buoy. The LCM maneuvered the buoy out of the slip whereupon the BNL work skiff COBOLT took up a trailing position on the buoy to keep it from slewing wildly in the stiff

current just inside the inlet. Using his engines and rudder judiciously, Skipper W. E. Jahnig threaded the inlet with the LCM and its ungainly tow without mishap. Once out on the open ocean the tow line was extended to optimum length and the buoy with its escorts proceeded to the deployment site at a leisurely pace.

The transit time was used by the crew of the LCM to make ready for deploying the buoy mooring tackle. When the preselected anchorage was reached, the towing hawser was retrieved and the work skiff took over control of the buoy while the LCM proceeded with the buoy mooring tackle deployment.

In addition to the 2500 lb anchor, the mooring tackle included an anchor swivel and three "shots" of heavy chain (30 feet long and weighing 750 lbs), plus 110 ft. of wire rope followed by 40 ft. of light chain with twin floats attached near the bitter end. The wire rope was separated from the chain terminations with swivels to prevent twisting and kinking. All of the above were deposited safely over the starboard side of the LCM using the hydraulic crane. The LCM then steamed clear of the buoy and the deposited mooring.

S. Fink and J. McNeil, in wet suits and working from the Zodiac raft, proceeded to connect the float-supported end of the mooring chain to the mooring bail on the buoy. The mooring bail is a perpendicular arm which is located at the center of the drag of the buoy, which happens to be about one-third of the way up from the base. All shackles were then safety wired.

Upon completion of this task and after the floats had been removed from the chain, S. Fink opened the main sea cocks on the lower buoyancy chamber and then moved to the other end of the buoy, via the Zodiac, to open the air vents. Immediately, all vessels and personnel stood clear while the lower end of the buoy began to slowly submerge. Within ten minutes the buoy began to right itself, with the upper work platforms rising sharply as the buoy approached the

vertical position. Now standing vertical, the buoy slowly settled to the desired, and calculated, waterline.

In addition to the rework, meticulous physical measurements were made as well as stability calculations for documentation and future reference. These will be made available on request.

Navigation lights were installed aboard the buoy for night-time identification. The buoyancy control valves were closed and plugged for safety, and the buoy was made ready for subsequent instrument installations.

Acknowledgements

The writers extend their appreciation to Mr. B. Pade, Woods Hole Oceanographic Institute for his cooperation in the retrieval operations of the buoy from Woods Hole Harbor under extremely difficult conditions; also his suggestions at the time the modifications were being made.

Thanks are extended also to Robert M. Brown of BNL for his interest, help and support during the entire operation.

Figure 1. Disassembled buoy section being loaded onto BNL trucks at Woods Hole Oceanographic Institution.

Figure 2. Top section of MIT buoy secured on flat bed for transport to Brookhaven National Laboratory.

Figure 3. Buoy sections in Bldg. 820, BNL,
for modification and engineering changes.
Lower flanges not installed.

Figure 4. Lower sea section with flange
installation completed. Buoyancy tank
and new sea cocks installed.

Figure 5. Top section instrument well,
with autoclave-type door installed.

Figure 6. Top extension of instrument
well with cable ports (8) installed and
plugged.

Figure 7. Surface buoyancy regulator valves. Numbers at 1' intervals from surface to bottom damper plate.

Figure 8. Buoyancy chamber. 2" straight through ball-type seacock located under number 72. Note zinc added to damper plate.

#1 - Primer	Carbo-Zinc #11 - 10 gallons Mfg. Carboline Co., Nanuet, New York
#2 - Barrier Coat	Between Zinc and Copper Amacoat #33 - 10 gallons Mfg. Amacoat Corp., California
#3 - Top Coat	Below Water Line Anti-fouling - Vinyl/cap - 8 gallons Mfg. Save-Cote Chemical Lab., Lakewood, N.J.
#4 - Top Coat	Above Water Line Steel-Guard No. 8535 - 6 gallons Titanium White Mfg. Con-lux Paint Co., Edison, N.J.

Figure 9. Painting materials on MIT buoy (applied after complete unit was sandblasted).

Figure 10. Turning buoy for installation of work platforms.

Figure 11. Installation of buoyancy tower units.

Figure 12. Preparing buoy for installation of side tower unit.

Figure 13. 2500 lb. anchor and related equipment.

Figure 14. Dimensional diagram of MIT buoy.