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COMPLETION REPORT INTERIM MEASURE FOR AREA OF CONCERN 502 (AOC502) WITH  
TRANSMITTAL CNC CHARLESTON SC  
8/19/1998  
CNC CHARLESTON



# COMPLETION REPORT

INTERIM MEASURE FOR  
AOC 502

NAVAL BASE CHARLESTON  
CHARLESTON, SC



Prepared for:

DEPARTMENT OF THE NAVY  
SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON SC



Prepared by:

Supervisor of Shipbuilding, Conversion and Repair,  
USN, (SUPSHIP) Portsmouth Va.,  
Environmental Detachment Charleston, S.C.  
1899 North Hobson Ave.  
North Charleston, SC 29405-2106

August 18, 1998



Scan Date 4-30-09  
Operator RL  
Location Code BINDER 326



**DEPARTMENT OF THE NAVY**  
SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, USN  
PORTSMOUTH, VIRGINIA, ENVIRONMENTAL DETACHMENT CHARLESTON  
1899 NORTH HOBSON AVENUE, BUILDING 30  
NORTH CHARLESTON, SOUTH CAROLINA 29406-2106

IN REPLY REFER TO:

Ser: 719

AUG 19 1998

Mr. G. Randall Thompson, Director  
Division of Hazardous and Infectious Waste Management  
Bureau of Solid and Hazardous Waste Management  
South Carolina Department of Health and Environmental Control  
2600 Bull Street  
Columbia SC 29201

Dear Mr. Thompson:

The enclosed interim measure completion report for Area of Concern (AOC) 502 is submitted to fulfill the requirement of Permit Condition IV.D.6 for Permit Number SCO 170 022 560. If the Department of Health and Environmental Control should have any questions, please contact Reece Batten of Southern Division Naval Facilities Engineering Command (NAVFAC) at (803) 820-5578.

Sincerely,

  
E.R. Dearhart  
Director

Encl:

(1) AOC 502 Completion Report

Copy to:

SCDHEC (Mr. Tapia, Mr. Bergstrand)  
USEPA (Mr. Spariosu)  
CSO Naval Base Charleston (H. Shepard)  
NAVFAC (Mr. Batten)  
EA&H (Ms. Maddux)  
DDESB (Klinghoffer)

# COMPLETION REPORT

Interim/Stabilization Measure for

AOC 502

Charleston Naval Complex, Charleston, SC

Engineering Branch Head:

*M. J. [unclear]*

Date: 8/19/98

Prepared By:

*J. T. [unclear]*

Date: 8/18/98

**REPORT GENERATED BY:  
ENVIRONMENTAL DETACHMENT CHARLESTON**

1899 NORTH HOBSON AVENUE  
NORTH CHARLESTON, SC 29405



# COMPLETION REPORT

INTERIM MEASURE FOR  
AOC 502

NAVAL BASE CHARLESTON  
CHARLESTON, SC



Prepared for:

DEPARTMENT OF THE NAVY  
SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON SC



Prepared by:

Supervisor of Shipbuilding, Conversion and Repair,  
USN, (SUPSHIP) Portsmouth Va.,  
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## ACRONYM LIST

ACGIH	American Council of Governmental Industrial Hygienists
AFOL	Automated Ferrous Ordnance Locator
AOC	Area of Concern
AOE	Automated Ordnance Excavator
CEERD	Charleston Environmental Engineering and Remediation Detachment
CFR	Code of Federal Regulations
CHASP	Comprehensive Health and Safety Plan
CSAP	Comprehensive Sampling and Analysis Plan
CRZ	Contamination Reduction Zone
DDESB	Department of Defense Explosive Safety Board
DET	Environmental Detachment Charleston
DOT	Department of Transportation
EIS	Environmental Impact Statement
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ERT	Emergency Response Team
EZ	Exclusion Zone
HAZWOPER	Hazardous Waste Operations and Emergency Response
HW/HM	Hazardous Waste/Hazardous Material
IDLH	Immediately Dangerous to Life and Health
IM	Interim Measure
LEL	Lower Explosive Limit
MARAD	Maritime Administration
MSDS	Material Safety Data Sheet
NIOSH	National Institute of Occupational Safety and Health
NPDES	National Pollution Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
POTW	Charleston Publicly Owned Treatment Works
PPE	Personal Protective Equipment
PPM	Parts Per Million
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	Facility Investigation
SHSO	Site Health and Safety Officer
SOUTHDIV	Southern Division Naval Facilities Engineering Command
SSHSP	Site-Specific Health and Safety Plan
SZ	Support Zone
TLV	Threshold Limit Values
TNT	2,4,6-trinitrotoluene
UXO	Unexploded Ordnance

## **1. INTRODUCTION**

**1.1 INSTALLATION RESTORATION PROGRAM.** The purpose of the Department of the Navy (DON) Installation Restoration Program (IRP) is to identify, assess, characterize and clean up or control contamination from past hazardous waste disposal operations and hazardous material spills at Navy and Marine Corps activities. The Defense Environmental Restoration Program (DERP) is codified in the Superfund Amendments and Reauthorization Act (SARA) Section 211 (10 USC 2701).

**1.1.1 Naval Base Charleston IRP.** At Charleston Naval Base Complex, a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was prepared which divided the Naval Complex into zones and identified Solid Waste Management Unit (SWMUs) and Areas of Concern (AOCs) within each zone. The RFA evaluated each SWMU and AOC and determined which sites required further investigation. Based on the RFA, a RCRA Facility Investigation (RFI) work plan has been or is being prepared for each zone containing SWMUs and AOCs requiring further investigation. Upon completion of the RFI for each Zone, an RFI report will be prepared for that zone. The RFI reports will identify SWMUs and AOCs containing hazardous wastes requiring remediation. Eventually, Corrective Measures Studies (CMSs) will be prepared to determine the best means of remediating each site.

**1.2 INTERIM MEASURES.** Interim Measures (IM) performed as part of the IRP are intended to eliminate sources of environmental contamination or limit the spread of environmental contaminants and eliminate hazards prior to the completion of the RFI CMSs.

**1.3 AREA OF CONCERN 502.** AOC 502 is identified as an area expected to contain unexploded ordnance (UXO). This site is identified on Charleston Naval Base Map H606-284 at coordinates K-35, as depicted in Figure 1, at a depth varying from 5 to 40 feet. The affected area at AOC 502 consists of 78,506 ft<sup>2</sup> area in the Cooper River at the southwest end of Pier G in Zone J (see Figure 2

and Section 2.4). The ordnance at AOC 502 consists of three 5 inch shells, which were dropped in September, 1944.

**1.4 AREA OF CONCERN 502 INTERIM MEASURE.** During the interval between the RFI and the completion of the CMS, it was decided by Southern Division Naval Facilities Engineering Command (SOUTHDIV) that an IM would be performed by Supervisor of Shipbuilding, Conversion and Repair, Portsmouth Va., Environmental Detachment Charleston (SPORTENVDETCHASN). The objective of this IM was to locate, excavate, and remove identified anomalies/ UXOs and any associated contaminated soil. If the UXOs were not found, the secondary objective was to perform a due diligent search and verify via a geophysical survey that the ordnance was either previously removed or is located several feet below the river bottom to allow for unrestricted release of the property.

## **2. INTERIM MEASURE EXECUTION.**

**2.1 ACTIONS REQUIRED BY INTERIM MEASURE WORK PLAN.** The actions performed at AOC 500 consisted of searching a 78,506-ft<sup>2</sup> area, which is bordered by the pier on the north side and the wharf on the west side. Safe Environment Inc. was contracted to perform the search and diving operations. The Jackstay Search Method, which consists of an underwater line attached to the south 300-foot baseline, was used. The divers searched on one side of the line towards the pier and on the other side back towards the baseline. The baseline had marker clips every ten feet; and, the pier was also marked in increments every ten feet. The line was moved in ten-foot increments once the diver reached the baseline. The divers used the White Surfmaster PI, which is a watertight hand held instrument with headphones. The White Pulse PI uses the detection principle of pulse induction and is capable of detecting metal objects to a depth of four feet below the river bottom. The divers completed the search area in three and a half days. Items found included: paint shack, piece of metal, wire, welding rods, flange, pipe, sheet metal, and cans. No ordnance was discovered during the search of the 78,506-ft<sup>2</sup> area.

**2.2 PERFORMANCE OF QUALITY ASSURANCE/ QUALITY CONTROL.** A Jackstay Search Method of AOC 502 was used as the preferred method of quality control (QC) for this area. The area chosen was a rectangular area from 70' to 120', which was marked on the pier and 10' to 35' out from the pier. A crumpled soda can and a "D" cell battery was discovered during the QC check.

**2.3 Observations Noted** The divers were reporting a very silty bottom and they also noticed the deep cut from previous dredge operations. This particular area was last dredged in October of 1997 where 15 feet of silt and mud was removed.

**2.4 PROBLEMS ENCOUNTERED.** A Maritime Administration Ship, Cape Domingo was docked over a small portion of the southeast corner of the proposed search area. This was not identified until the two 300' baselines on the pier and wharf were positioned to mark the area. The

project engineer adjusted the proposed search area from 66,303-ft<sup>2</sup> to 78,506-ft<sup>2</sup> as shown in Figure 2.

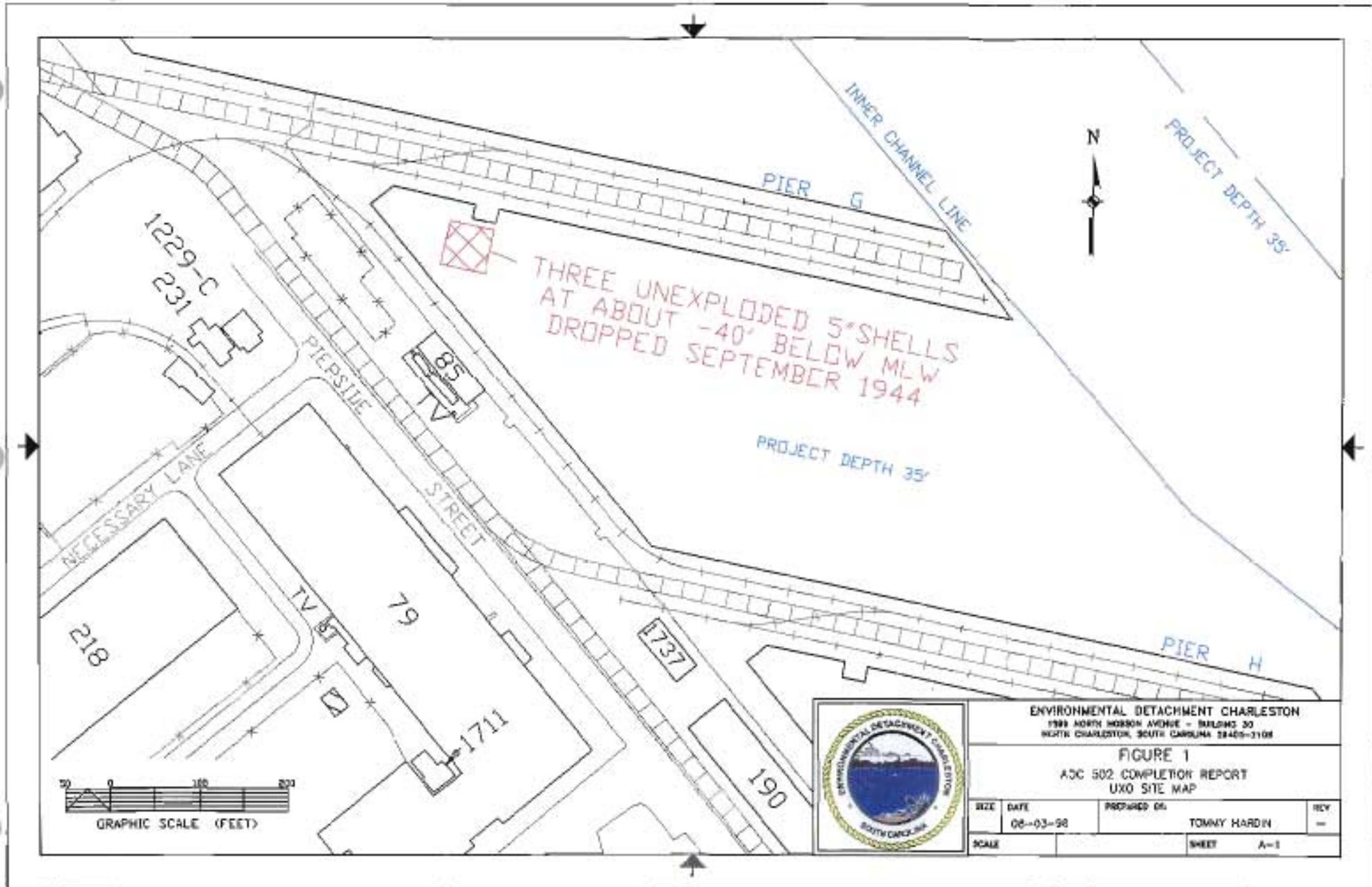
### **3. INTERIM MEASURE OUTCOME.**

**3.1 SITE CONDITIONS FOLLOWING COMPLETION OF WORK.** Following the completion of all site work and data review on June 1, 1998, the Detachment had investigated all potential UXO targets and proved through geophysical surveys that no other potential UXOs exist within four feet from the river bottom at AOC 502. Therefore, the Detachment has met the intent of performing a due diligent search and verifying via a geophysical survey that the ordnance was either previously removed or located at least four feet below the river bottom.

#### **4. WASTE GENERATION.**

**4.1 NON-HAZARDOUS WASTE.** No waste was generated during AOC 502.

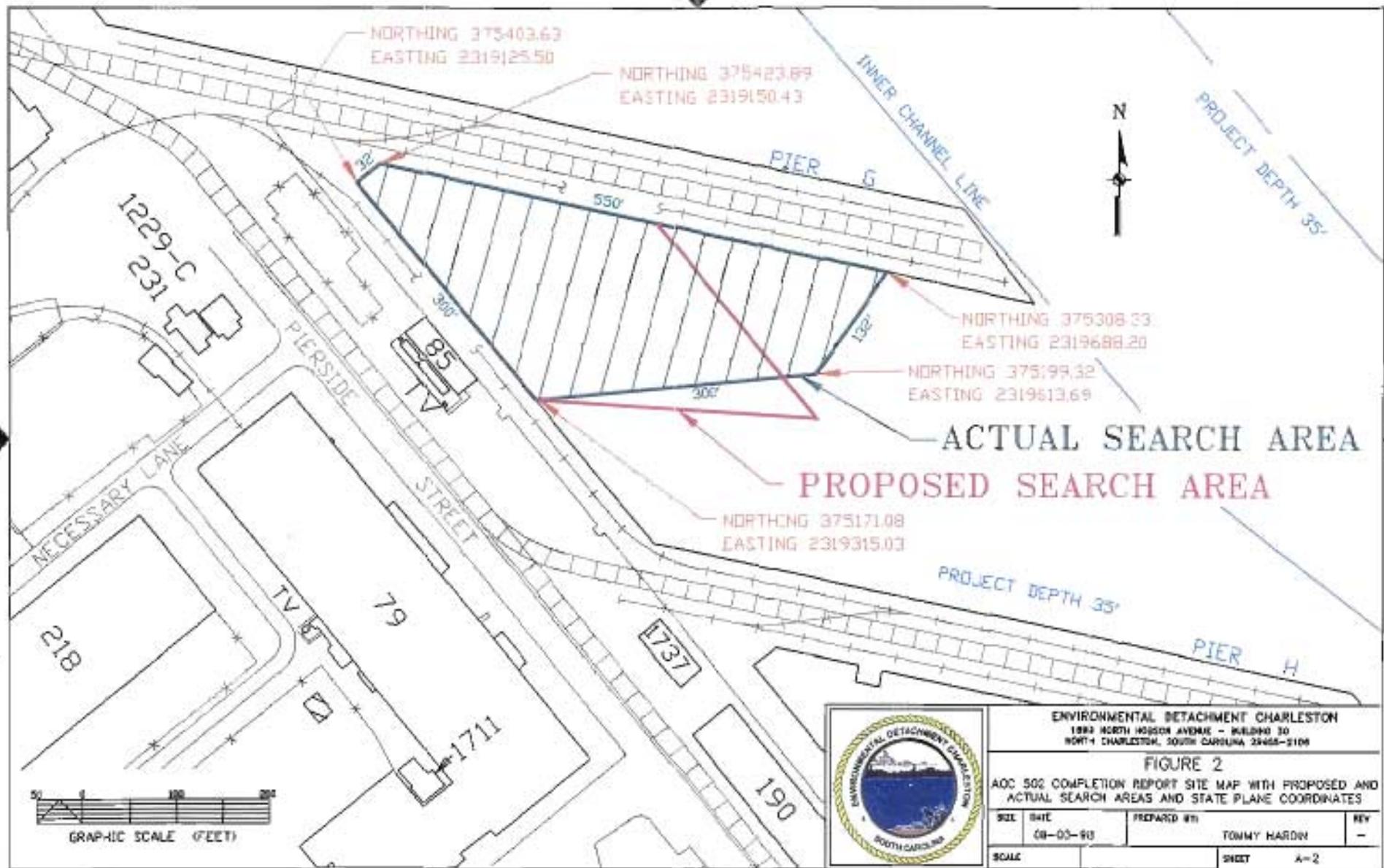
**APPENDIX A**  
**Site Maps**



ENVIRONMENTAL DETACHMENT CHARLESTON  
 1989 NORTH MORRISON AVENUE - BUILDING 30  
 NORTH CHARLESTON, SOUTH CAROLINA 29405-2108

FIGURE 1  
 ADC 502 COMPLETION REPORT  
 UXO SITE MAP

SIZE	DATE	PREPARED BY	REV
	08-03-98	TOMMY HARDIN	-
SCALE		SHEET	A-1



ENVIRONMENTAL DETACHMENT CHARLESTON 1883 NORTH HIGSON AVENUE - BUILDING 30 NORTH CHARLESTON, SOUTH CAROLINA 29405-5108			
FIGURE 2			
AOC 502 COMPLETION REPORT SITE MAP WITH PROPOSED AND ACTUAL SEARCH AREAS AND STATE PLANE COORDINATES			
SIZE	DATE	PREPARED BY	REV
	08-03-93	TOMMY HARDY	-
SCALE		SHEET	A-2

**APPENDIX B**  
**Photographs**



**Standing on Pier G looking at the Search Area towards the Wharf**



**Standing at the Northwest corner of AOC 502**



**Standing at the 550' Mark on Pier G**



**The Southeast corner buoy that was moved due to the Cape Domingo**



**Diver holding one of the baselines**



**Diver holding the White Pulse PI Detector**

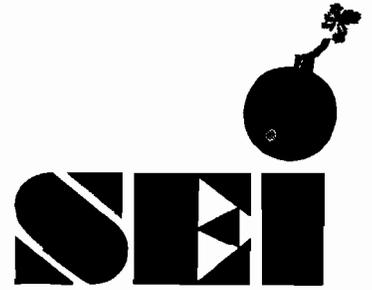


**Removing a Paint Shack that was found in AOC 502 search area**



**The Divers returning to the boat after a search evolution**

**APPENDIX C**  
**Safe Environment Inc. Dive Plan**



**Safe Environment Inc.**

November 11, 1997

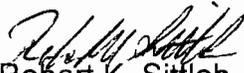
Mr. Tommy Hardin  
Environmental Detachment Charleston  
1899 North Hobson Avenue  
North Charleston, SC 29405-2106

Re: Unexploded Ordnance (UXO) Search, Excavate, & Disposal  
Charleston Naval Shipyard, Charleston, SC

Dear Tommy,

Enclosed is the diving plan for the referenced UXO support at Naval Base Charleston. If you have any questions please call me at (703) 392-7200.

Sincerely,

  
Robert K. Sittloh  
Project Manager

**Appendix A**  
**Emergency Contact Numbers**

## EMERGENCY CONTACT NUMBERS

<b>RECOMPRESSION CHAMBER</b>	(803) 743-0537/0539/40
<b>EODMU SIX OPERATIONS</b>	(803) 743-0525, EXT. 118
<b>EODMU SIX RESPONSE DETACHMENT</b>	(803) 743-0356
<b>*HARBOR CONTROL</b>	***_***_****
<b>*MARINE WEATHER FORECAST</b>	***_***_****
<b>*HOSPITAL</b>	***_***_****
<b>*AMBULANCE</b>	***_***_****
<b>NAVY EXPERIMENTAL DIVE UNIT</b>	(904) 234-4351
<b>NAVAL MEDICAL RESEARCH INSTITUE</b>	(301) 295-1839
<b>NAVBASE Charleston Environmental Detachment</b>	(803) 743-6777, ext. 222
<b>Safe Environment, Inc.</b>	(703) 392-7200

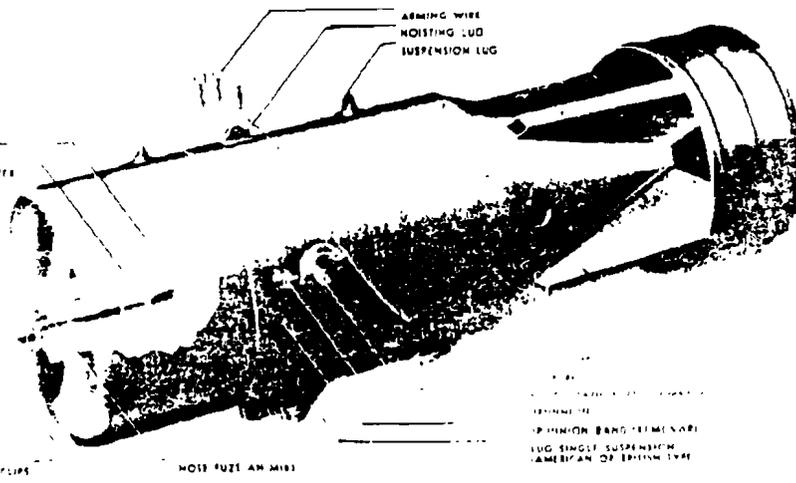
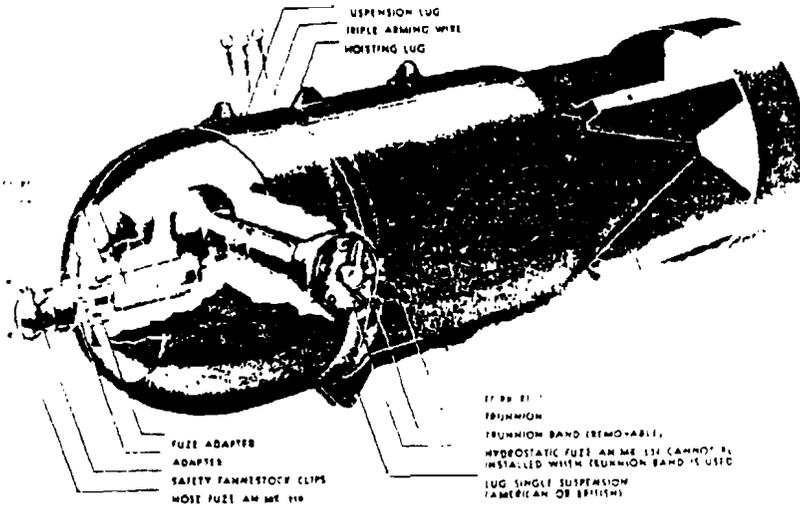
\*These services will be investigated during project mobilization. Current phone numbers and points of contact will be obtained on site.

**Appendix B**  
**Target UXO Description**

# MK 17 MOD 1, MK 17 MOD 2, MK 44 DEPTH BOMB

AN MAKE 17 MOD 1 OR AN MAKE 17 MOD 2 THE LOADED WEIGHTS 125 LBS

AN MAKE 44 TORPEE LOADED WEIGHTS 125 LBS



# MK 41, MK 47 DEPTH BOMB

AN MAKE 41 THE LOADED WEIGHTS APPROXIMATELY 125 LBS

AN MAKE 47 TORPEE LOADED WEIGHTS APPROXIMATELY 125 LBS

DATA:			ARMY-NAVY BOMBS	
	Mk 17-2 Mk 44	Mk 41 Mk 47		
OVERALL LENGTH	32.8 in.	49.9 in.	<b>325, 350 LB. DEPTH</b>	
BODY LENGTH	31.1 in.	27.8 in.		
BODY DIAMETER	15.0 in.	15.0 in.		
WALL THICKNESS	0.06 in.	0.06 in.		
TAIL LENGTH	20.2 in.	24.6 in.		
TAIL WIDTH	20.6 in.	15.4 in.		
TAIL WEIGHT			Mk 17	(T.N.T.)
			Mk 17-1	(T.N.T.)
			Mk 17-2	(T.N.T.)
			Mk 44	(Torped)
			Mk 41	(T.N.T.)
			Mk 47	(Torped)
<b>NOTE:</b> Mk 17-2 & Mk 44 have round nose, can use flat nose attachment; Mk 41, Mk 47 are flat nosed; Mks 44, 47 weigh 350#, use TFX.				
<b>WEIGHTS:</b>				
	<u>Mk 17-2</u>	<u>Mk 44</u>	<u>Mk 41</u>	<u>Mk 47</u>
Type of Filling	T.N.T.	Torped	T.N.T.	Torped
Weight of Filling	224 lbs.	249 lbs.	227 lbs.	252 lbs.
Total Weight	325 lbs.	350 lbs.	347 lbs.	355 lbs.
Chg / Wt. Ratio	68.9%	71.1%	65.4%	70.8%
<b>FUZING:</b>				
Because of numerous instances in water crash landings where depth bombs fused with the AN-Mk 224 or AN-Mk 234 exploded, these two fuzes have been suspended from use. As a consequence, the Mk 17, Mk 41 and Mk 44 may be used only if a nose impact fuze is installed.				
<b>Note:</b> AN-Mk 219 will not arm if dropped from below 2500 ft. when used on bomb with flat nose attachment or flat nose. Requires auxiliary booster and Mk 219 adapter ring. Givee instantaneous action.				
Mk 221, Mk 239, delay of .01 seconds; will not arm on flat nose if dropped from below 2500 ft.				
AN-M103, AN-M103A1 (Instantaneous only); special vanes for flat nose bombs.				
<b>BODY CONSTRUCTION:</b>				
Mk 17-2 and Mk 44: These depth bombs are made with round noses welded to a cylindrical steel tube. There is a strengthening disc around the nose and a steel strip along the suspension lugs to reinforce the body. The transverse fuze pocket is 11.9 in. aft of the nose. To prevent ricochet and improve under-water trajectory a flat nose attachment is made for these bombs, the attachments being in the shape of a bucket which fits down over the nose and is filled with plaster of paris, increasing the weight of the bomb by 44 lbs. Bomb case extremely thin.				
Mk 41 and Mk 47: These bombs constructed with a flat nose, there being a slight taper from the walls to the nose. The body is in three pieces, the sides being tubular with a transverse fuze pocket tube welded in place 15 in. aft of the nose.				
<b>SUSPENSION:</b>				
Suspension of these bombs is by the usual dual or single lugs, the lugs being welded to the bomb. The single lug is actually somewhat different than is usually found, being in the form of a bracket rather than a lug. Trunnions on a band are for displacement gear in dive bombing.				
<b>TAIL CONSTRUCTION:</b>				
Instead of employing the box type tail these bombs use a drum tail. Looking at it from the after end, it is circular and has four fins extending at right angles to each other. The fins are spot welded to a cone which fits over the after end of the bomb. The fins are also spot welded to the drum shroud. The tail is bolted onto the base of the bomb.				
<b>COLOR &amp; MARKINGS:</b>				
Olive drab overall with 1" yellow band around nose, 1" band on each side around athwartship fuze well, and 1/4" band around center of gravity. TNT loaded bombs have weight and Mark number stencilled in yellow; Torped loaded have items stencilled in blue.				
<b>REMARKS:</b>				
The Mk 17 - 325 lb. bomb is TNT loaded but has a light tail assembly; the Mk 17-1 is the same except a sturdier tail assembly is used; the Mk 17-2 is similar to the Mod 1 but has a larger filling hole.				
The Mk 17 is obsolete; the Mk 17-1-2, the Mk 44, 47, and 41 are obsolescent.				

targets or areas for tactical and training purposes. The Mk 25 projectile is fitted with an MTF (Mk 51). The projectile has a Mk 4 or Mk 12 illuminating load and a small (10.6 grams) black powder explosive charge sealed within the projectile body by a base plate. When the fuze functions, it ignites the black powder which shears the base plate shear pins and expels the illuminating load. The illuminating composition is a powdered magnesium mixed with an oxidizer which burns for approximately 25 seconds with a candlepower of 120,000 (Mk 4) or 250,000 lumens (Mk 12).

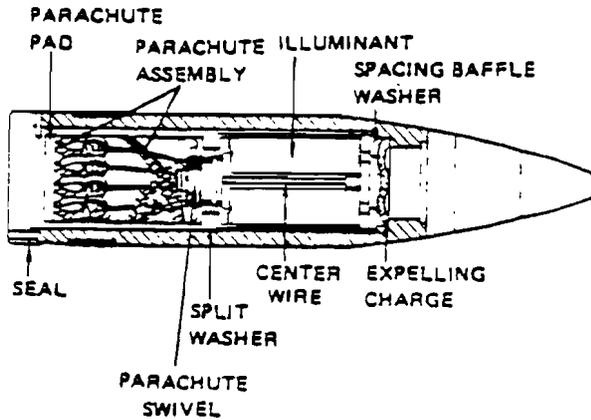


Figure 3-32. 3-Inch, 50-Caliber Illuminating Projectile

3-20.1.6. Nonfragmenting Target Practice (TP). The non-fragmenting TP projectile (figure 3-33) is designed for use in antiaircraft target practice, particularly against expensive drone targets, for observing the firing results, frequently without loss of the drone. A standard projectile body is filled with inert material around the color burst unit to obtain the desired weight. The nose of the projectile is fitted with a variable-time, radio-frequency proximity fuze, supplemented either by a fuze booster or an ADF. A self-destruct capability is incorporated in nose Fuze Mk 72 Mods 2, 4, 6, 8, 10, and 12 (C162, C319, and C373 cartridge). The self-destruct feature is omitted in nose Fuze Mk 72 Mods 3, 5, 7, 9, 11, and 13 (C164, C320 and C375

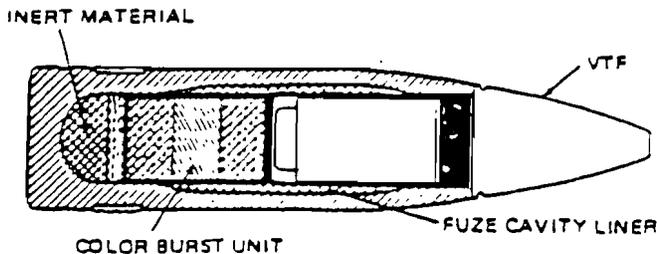


Figure 3-33. 3-Inch, 50-Caliber Nonfragmenting, Target Practice Projectile

cartridge). A fuze cavity liner separates the fuze from the color burst unit and the inert filler. The color burst is ignited through the action of the nose fuze and the black-powder pellets. The base of the projectile is solid.

3-20.1.7. Blind Loaded and Plugged/Tracer (BL-P/T). The standard thin-walled projectile (Mk 27) is filled with inert material to bring them within the weight tolerance of the service projectile. The nose of the projectile is fitted with a dummy nose plug, while the base is plugged flush. Tracers are no longer assembled in new production. These cartridges are for target practice, ranging, and proving ground test.

3-20.2. Propelling Charge. The 3-inch, 50-caliber propelling charge (figure 3-34) consists of the following: a Mk 7 brass or a Mk 9 steel cartridge case of a necked-down mouth design, a Mk 14 or Mk 41 percussion (slow fire) or a Mk 42 electric (rapid fire) primer, and either a nonflashless propellant (SPDN) or a flashless propellant (SPDF or SP'G). A cardboard wad and a distance piece are placed on top of the propellant, and a lead foil (decoppering agent) is fitted inside the triangular distance piece. The amount of lead foil for each propelling charge is  $30 \pm 3$  grams for flashless propellant, except for the ILLUM projectile which is  $15 \pm 2$  grams, and  $45 \pm 5$  grams for the nonflashless propellant. The distance piece is cut to the required length as governed by the propellant production packing depth (PPD).

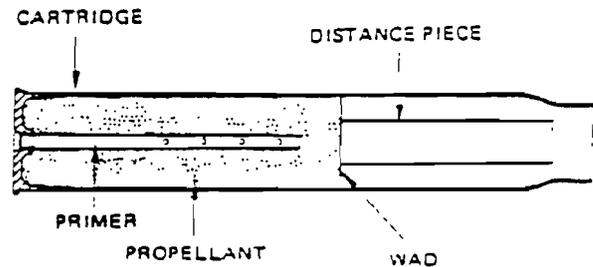


Figure 3-34. 3-Inch, 50-Caliber Propelling Charge

NOTE

Cartridges with percussion primed propelling charges are only for use in slow fire gun mounts, while electric primed propelling charges are for rapid fire gun mounts.

3-20.3. Clearing Charge. The clearing charge uses components common to the standard 3-inch, 50-caliber propelling charge assembly, with the major difference being that the Mk 7 or Mk 9 cartridge case is shortened by approximately

<u>Projectile</u>	<u>Abbreviation</u>	<u>DODIC</u>
Common, base detonating spotting dye	COM	D237
Illuminating, mechanical time	ILLUM	D244/D255
Illuminating, mechanical time/point detonating	ILLUM	D256
White phosphorus (smoke), mechanical time	WP w/MTF	D247/D281
White phosphorus (smoke), point detonating	WP w/PD	D246
Target practice (puff), point detonating	TP-Puff w/PDF	D220
Target practice (puff), mechanical time	TP-Puff w/MTF	D221
Target practice-nonfragmenting, variable time	VT-NONFRAG	D248/D249/ D250/D251
Chaff dispensing, mechanical time	Chaff	D286/D287
Blind loaded and plugged/tracer	BL-P/T	D267
Dummy	-	D252/D263

3-23.1.2. Propelling Charge. The basic configurations of 5-inch, 38-caliber propelling charges in the inventory are as follows:

<u>Propelling Charge</u>	<u>DODIC</u>
Full charge, universal, cork or foam plug	D264
Full charge, nonflashless, cork or foam plug	D272
Full charge, flashless, cork or foam plug	D274
Reduced charge, nonflashless, cork plug	D282
Clearing charge, flashless, cork or foam plug	D227/D296/D306

3-24. AMMUNITION/INTERFACE. The 5-inch, 38-caliber ammunition is used in the following gun mounts:

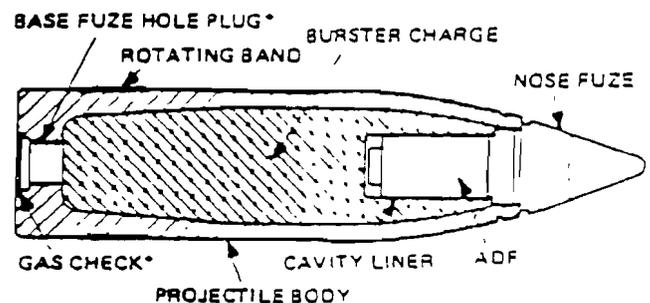
<u>Mount</u>	<u>Type</u>	<u>Gun</u>
Mk 24	Single (open)	Mk 12
Mk 28	Twin (enclosed)	Mk 12 (2)
Mk 30	Single-light (open)	Mk 12
Mk 30	Single-heavy (enclosed)	Mk 12
Mk 32	Twin (enclosed)	Mk 12 (2)
Mk 37	Single (open)	Mk 12
Mk 38	Twin (enclosed)	Mk 12 (2)

This system can be fired at a rate of 15 rounds per minute, per barrel.

3-25. AMMUNITION CHARACTERISTICS. The 5-inch, 38-caliber ammunition contains great versatility and many projectile and fuze combinations as shown in table 3-7.

3-25.1. Projectiles. The projectiles used in the 5-inch, 38-caliber ammunition are described in the following subordinate paragraphs.

3-25.1.1. High Explosive (HE). These general purpose projectiles (figure 3-36) are used primarily to provide blast and fragmentation. The projectile can be fuze with either an impact, a time, or a proximity fuze. The proximity-fuzed projectiles are fitted with fuze liners to permit interchanging nose fuzes without remote equipment (ashore, only). In all cases where proximity fuzeing is used, no fuze is used in the base. In addition, those assemblies designated below as HE-CVT, HE-MT, HE-PD, HE-MT/PD, HE-IR, and HE-VT do not have base fuzes. The weights of the projectiles will vary slightly depending upon explosive/fuze combinations used. The bodies for each of these projectiles are essentially the same except for the base. The Mk 35, Mk 47, and Mk 49 have a 1.5-inch base fuze hole, whereas the Mk 52 and Mk 56 have a 2.0-inch base fuze hole. The Mk 51 and Mk 66 projectiles have a solid base. The bodies for the Mk 56 and Mk 66 are made of a high-fragmentation steel, whereas the other projectile bodies are made from a ductile steel with low-fragmentation characteristics. The principal variations in these projectiles are described below.



\*NOT REQUIRED FOR MARK 51 OR 66 WITH SOLID BASE

Figure 3-36. 5-Inch, 38-Caliber High Explosive Projectile

3-25.1.1.1. High Explosive, Controlled Variable Time (HE-CVT). This projectile is available with either a high-fragmentation steel (obsolescent) (D225) or a conventional low-fragmentation steel (D289) body. The high-

Table 3-7. 5-Inch, 38-Caliber Projectile Data—Continued

Type	Projectile			Fuze			Total weight (lb) (approx.)	DODIC
	Assembly	Body	Filler	Nose	ADF	Base		
ILLUM	Mk 87/2	Mk 50	Mk 11	Mk 61/1	Mk 384	—	54.3	D244
	—	Mk 30	Mk 4 or 11	Mk 61	—	—	54.3	D244
	—	Mk 44	Mk 4 or 11	—	—	—	54.3	D244
	—	Mk 50	Mk 4 or 11	Mk 61	—	—	54.3	D244
	Mk 87/0	Mk 50	Mk 11	Mk 349/0.1	Mk 384	—	54.3	D255
	—	Mk 30	Mk 4 or 11	Mk 50 or 349	—	—	54.3	D255
	—	Mk 44	Mk 4 or 11	Mk 50 or 349	—	—	54.3	D255
	—	Mk 50	Mk 4 or 11	Mk 50 or 349	—	—	54.3	D255
	Mk 87/3	Mk 50	Mk 11	Mk 403	Mk 384 Mk 413	—	54.3	D256
WP	Mk 73/0	Mk 50	M5 Canister	Mk 66/0	—	—	54.5	D246
	—	Mk 30	M5 Canister	Mk 29/3 or 66	—	—	54.5	D246
	—	Mk 44	M5 Canister	Mk 29/3 or 66	—	—	54.5	D246
	—	Mk 50	M5 Canister	Mk 29/3 or 66	—	—	54.5	D246
	Mk 73/1	Mk 50	M5 Canister	Mk 29/3	Mk 384	—	54.5	D246
	Mk 74/1	Mk 50	M5 Canister	Mk 349	Mk 384	—	54.5	D247
	—	Mk 30	M5 Canister	Mk 50 or 349	—	—	54.5	D247
	—	Mk 44	M5 Canister	Mk 50 or 349	—	—	54.5	D247
	—	Mk 50	M5 Canister	Mk 50 or 349	—	—	54.5	D247
—	Mk 50	M5 Canister	Mk 61	—	—	54.5	D231	
TP-Puff	—	Mk 52	E	Mk 29/3.5	Mk 54/2	—	54.5	D220
	—	Mk 52	E	Mk 349/0	Mk 54/2	—	54.5	D221
	Mk 103/0	Mk 52	E	Mk 349/0	Mk 379/0	—	54.5	D221
	Mk 104/0	Mk 52	E	Mk 29/5	Mk 379/0	—	54.5	D221
	Mk 138/0	Mk 52	E	Mk 403/0	Mk 379/0	—	52.7	D221
VT-NONFRAG-SD	Mk 95/0	Mk 51	Mk 2	Mk 71/12	Mk 30 bstr	Solid	54.6	D248
	—	Mk 35	Mk 2	Mk 71/12	Mk 30 bstr	Plug	54.6	D248
	—	Mk 47	Mk 2	Mk 71/12	Mk 30 bstr	Plug	54.6	D248
	—	Mk 49	Mk 2	Mk 71/12	Mk 30 bstr	Plug	54.6	D248
	—	Mk 31	Mk 2, 3, or 3/1	Mk 71/6, 8,10	Mk 44	Plug	54.6	D249
	—	Mk 35	Mk 2, 3, or 3/1	Mk 71/6, 8,10	Mk 44	Plug	54.6	D249
	—	Mk 49	Mk 2, 3, or 3/1	Mk 71/6, 8,10	Mk 44	Plug	54.6	D249
	—	Mk 51	Mk 2, 3, or 3/1	Mk 71/6, 8,10	Mk 44	Solid	54.6	D249
	—	Mk 35	Mk 2	Mk 71/11	Mk 30 bstr	Plug	54.6	D250
VT-NONFRAG-NSD	—	Mk 47	Mk 2	Mk 71/11	Mk 30 bstr	Plug	54.6	D250
	—	Mk 49	Mk 2	Mk 71/11	Mk 30 bstr	Plug	54.6	D250
	Mk 135/0	Mk 51	Mk 2	Mk 71/11	Mk 30 bstr	Solid	54.6	D250
	—	Mk 52	Mk 2	Mk 71/11	Mk 30 bstr	Plug	54.6	D250
	—	Mk 31	Mk 2, 3, or 3/1	Mk 71/5, 7.9	Mk 44	Plug	54.5	D251
	—	Mk 35	Mk 2, 3, or 3/1	Mk 71/5, 7.9	Mk 44	Plug	54.6	D251
	—	Mk 49	Mk 2, 3, or 3/1	Mk 71/5, 7.9	Mk 44	Plug	54.6	D251
	—	Mk 52	Mk 2, 3, or 3/1	Mk 71/5, 7.9	Mk 44	Plug	54.6	D251
	—	Mk 51	Mk 2	Mk 71/15	Mk 30 bstr	Solid	54.0	D251
Chaff	Mk 78/0	Mk 50	Mk 21	Mk 349	Mk 384	—	54.6	D236
	—	Mk 44	Type A	Mk 61	—	—	54.6	D236
	—	Mk 50	Type A	Mk 61	—	—	54.6	D236
	—	Mk 44	Mk 15	Mk 50 or 349	—	—	54.6	D237
	—	Mk 50	Mk 15	Mk 50 or 349	—	—	54.6	D237

the self-destruct feature was determined to be no longer required for modern warfare tactics and will eventually be phased out. The self-destruct feature is omitted in projectiles D228 and D233. The nose fuze is separated from the Composition A-3 explosive load by a cavity liner to permit fuze replacement without remote equipment. The base of the projectile is either plugged or solid.

3-25.1.2. High Capacity (HC). These low-fragmentation, thin-walled, steel body projectiles (figure 3-37) are designed for use against unarmored surface targets or shore installations that are vulnerable to impact burst. The projectile nose and base are threaded internally to receive nose and base fuzing. The projectile cavity is filled with either Explosive D or Composition A-3. HC projectiles are issued with either a dummy nose plug (D242) or with a PDF (D235) installed. A point-detonating or mechanical-time nose fuze may be installed in the D242 projectile prior to use if the approved equipment is used. All HC projectiles are issued with ADFs and base fuzes installed and normally with a PDF.

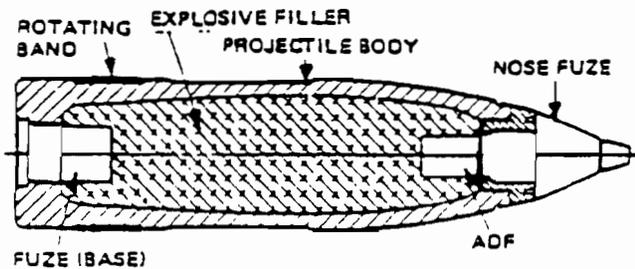


Figure 3-37. 5-Inch, 38-Caliber High Capacity Projectile

3-25.1.3. Antiaircraft Common (AAC). This low-fragmentation steel body projectile (figure 3-38) is designed for use against airborne or surface targets that are vulnerable to airburst. The projectile body nose and base are threaded internally fitted with nose and base fuzing to provide increased detonating reliability. The nose is fitted with a fuze adapter to receive a mechanical-time and

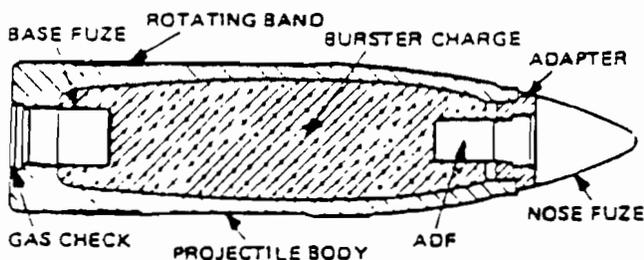


Figure 3-38. 5-Inch, 38-Caliber Antiaircraft Common Projectile

auxiliary detonating fuze. The projectile cavity is filled with either Explosive D or Composition A-3.

3-25.1.4. Rocket Assisted Projectile (RAP).

**WARNING**

During handling of a RAP, a drop in excess of 24 inches on the base of the projectile in which a deck pin (rivethead), bolt, or miscellaneous object strikes the center hole of the igniter, sufficient striking energy could be provided to actuate the igniter. In this event, ignition of the rocket motor may be delayed 20 to 30 seconds. All personnel should immediately evacuate the area. Do not attempt disposal prior to rocket motor ignition. If rocket motor burns in a closed compartment, insure that the area is clear of fumes prior to re-entry. Dispose of the projectile in accordance with standard explosive ordnance disposal practice.

The projectile (figure 3-39) is made up of a solid propellant rocket motor (Mk 62) with a delayed ignition element and a CVT fuzed warhead (Mk 74), designed for use against personnel and light material targets. The rocket motor is ignited when the gas pressure generated by the propelling charge propellant flexes a bellville spring which strikes a percussion primer assembly, initiating the pyrotechnic delay column. After a 23-second delay, the delay column burns the ignition charge, which ignites the propellant grain in the rocket motor. When the motor is ignited the igniter, which is sealed into the motor case base with a gas check gasket, is blown out. The RAP can be handled, stowed, and fired almost identically to the conventional 5-inch projectiles now in use and is propelled by the same charge. The 5-inch, 38-caliber Mk 57 RAP has the same shape as the standard Mk 49 projectile except that the length has been increased 2-1/8 inches and the base has been boattailed to provide additional range. To insure ignition reliability, the 5-inch, 38-caliber RAP must be fired with cartridge having a

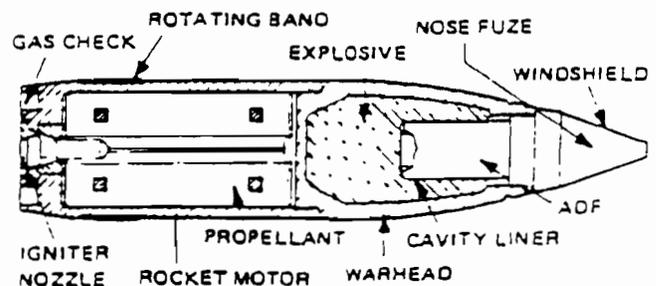


Figure 3-39. 5-Inch, 38-Caliber Rocket Assisted Projectile

obtain the desired weight. The nose of the projectile is fitted with a variable-time, radio-frequency, proximity fuze, which is supplemented either by a fuze booster or an ADF. A self-destruct capability is incorporated into the nose fuze of projectiles D248 and D249. The self-destruct feature is omitted in projectiles D250 and D251. A fuze cavity liner separates the fuze from the color burst unit and inert filler. The color burst is ignited through the action of the nose fuze and the black-powder pellets. The base of the projectile is either plugged or solid.

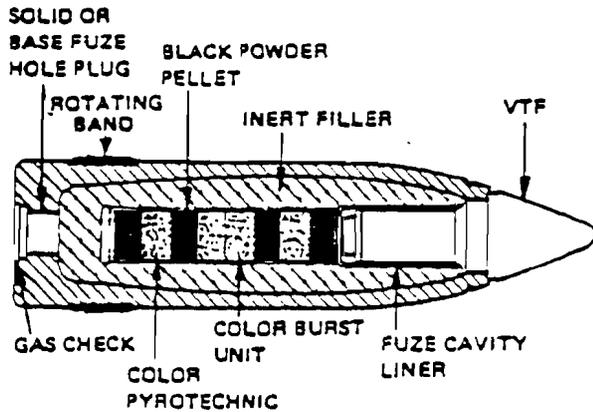


Figure 3-43. 5-Inch, 38-Caliber Nonfragmenting Target Practice Projectile

center, with one metal can or two Teflon bottles of smoke agent potted at the base end with epoxy. The inert load of the projectiles is Smoke E, comprised of stearic acid, barium sulfate, dead burned gypsum, and wood resin. The smoke producing chemicals, a 50/50 mixture of vanadium oxytrichloride and titanium tetrachloride, are contained in the Teflon bottles or metal cans. The base plug has been modified by removing all but one and one-half threads so that, on fuze function, the threads shear and the base plug and chemicals are expelled through the base of the projectile. The chemicals from the ruptured bottles or metal cans react with the moisture in the air producing a dense yellowish smoke cloud which approximates the size of the smoke cloud from a high explosive round.

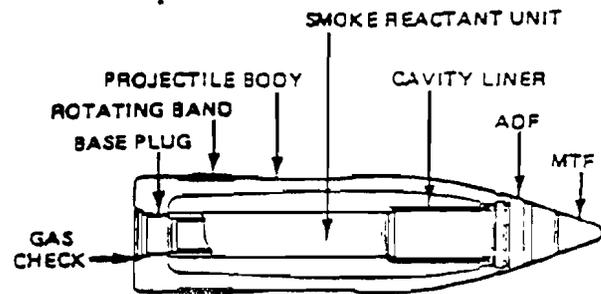


Figure 3-44. 5-Inch, 38-Caliber Target Practice (Puff) Projectile

3-25.1.9. Target Practice (Puff) (TP-Puff).

**WARNING**

The smoke produced by the chemical mixture used in a Target Practice (Puff) projectile contains hydrochloric acid which is extremely irritating to the lungs, eyes, and mucous membranes. In the event smoke is discovered coming from a puff projectile, the round should be disposed of safely. The hazards associated with the smoke can be reduced with a water spray. On-board ship the round can be disposed of at sea. On land the round can be moved to an open area for disposal by explosive ordnance disposal personnel.

This is a nonexplosive, smoke producing projectile (figure 3-44), which is used as a practice (spotting) round. A standard projectile body is filled with inert material around the smoke agent containers. The nose of the projectile is fitted with an MTF or a PDF and an ADF. The inert filled body has a 2-inch-diameter aluminum tube down the

3-25.1.10. Chaff Dispensing. This projectile (figure 3-45) is used to confuse enemy radar. They may be employed to provide a reflecting screen behind which ships may maneuver without being tracked or they may be used to provide a

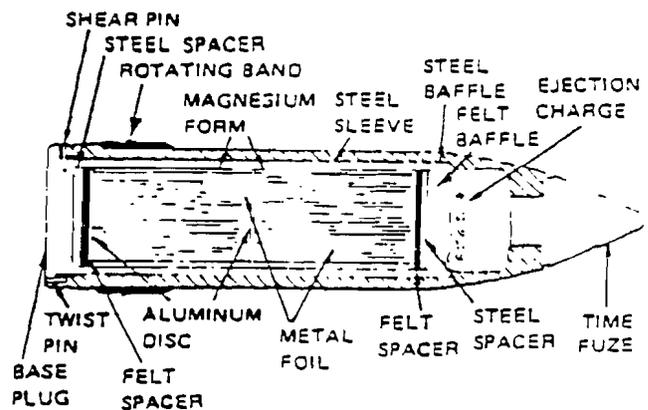


Figure 3-45. 5-Inch, 38-Caliber Chaff Dispensing Projectile

manufacturing, method of assembly, or specialized application.

3-25.2.1. Full or Reduced Charge. The propelling charge, full or reduced, (figure 3-46) consists of a brass or steel cartridge case of a straight taper design. The propelling charge is assembled with a Primer Mk 13 (combination) or Primer Mk 48 (electric). It is loaded with 15.5 (SPD) or 17.0 (SPCF) pounds of smokeless powder in the full-service charge and 4 pounds of propellant in the reduced charge. A cardboard wad and a distance piece, secured by a cork or polyurethane foam closure plug, serve to hold the propellant in place and complete the unit. The distance pieces are cut to the required length as governed by the propellant production packing depth.

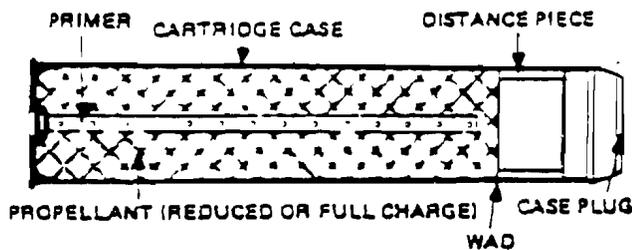


Figure 3-46. 5-Inch, 38-Caliber Propelling Charge

3-25.2.2. Clearing Charge. The clearing charge (short charge) is similar to the full and the reduced charges, the major difference being that the cartridge case is 6.7 inches shorter. Clearing charges are used to clear guns by firing out projectiles after a propelling charge misfires or loading jams. The D296 charge differs from the D227 and the D306 charges in that it has a coned polyurethane or elastomeric foam closure plug instead of the flat cork closure plug and it uses a polyethylene wad and bonds the wad to the cartridge case sidewall instead of using a cardboard wad and a distance piece. The D296 clearing charge is identified and

issued as a common 5-inch (5-inch, 38-caliber/5-inch, 54-caliber) clearing charge.

3-26. PACKING. The ammunition is handled and shipped in accordance with OP 4 and OP 5. The ammunition is painted, marked, and lettered in accordance with WS 18782, and an ammunition data card (MIL-STD-1167) is placed in each container or under the waterproof protecting cap. The following palletizing requirements apply:

<u>Projectile</u>	<u>Requirement</u>
Standard	MIL-STD-1323-4
Rocket assisted	MIL-STD-1323/136C

<u>Propelling Charge</u>	<u>Requirement</u>
Tanking	OR-68/42
Palletizing	MIL-STD-1323/3-1

3-27. BALLISTIC DATA. The ballistic data for the 5-inch, 38-caliber projectile is as follows:

3-27.1. Muzzle Velocity. The average muzzle velocity is:

<u>Projectile</u>	<u>Propelling Charge</u>	<u>Muzzle Velocity</u>
Mk 49 or Mk 51	Full-service	2500 feet per second
Mk 49 or Mk 51	Reduced	1200 feet per second
RAP	Full-service	2500 feet per second

3-27.2. Range. The maximum range is:

<u>Projectile</u>	<u>Propelling Charge</u>	<u>Range</u>
Mk 49 or Mk 51	Full-service	17,393 yards
Mk 49 or Mk 51	reduced	8,874 yards
RAP	Full-service	26,657 yards

### Section VIII. 5-INCH, 54-CALIBER AMMUNITION

3-28. GENERAL. The 5-inch, 54-caliber ammunition described in this chapter fits within the separated ammunition category since the projectile and the propelling charge are two separate components, but they are loaded with the gun chamber in a single operation (i.e., one-ram cycle). A complete round of ammunition consists of the projectile and a propelling charge which is packed, shipped, and issued separately. This system is used as a tactical weapon against surface and air targets and for shore bombardment. In a load-and-fire operation the ammunition is handled

somewhat differently by the three types of 5-inch, 54-caliber gun mounts (Mk 39, Mk 42, and Mk 45).

3-28.1. Projectiles. The basic configurations of projectiles in the 5-inch, 54-caliber ammunition inventory are as follows:

<u>Projectile</u>	<u>Abbreviation</u>	<u>DODIC</u>
High explosive, controlled variable time	HE-CVT	D350/D295

Table 3-9. 5-Inch, 54-Caliber Projectile Data

Projectile			Explosive		Fuze			Total weight (lb) (approx.)	DODIC
Type	Assembly	Body	Filler	Wt (lb)	Nose	ADF or booster	Base		
HE-CVT	—	Mk 41	A-3	8.64	Mk 360 (M514A1)	Mk 52	Plug	68.60	D350
	—	Mk 55	A-3	8.64	Mk 360 (M514A1)	Mk 52	Plug	68.60	D295
	—	Mk 64	A-3	8.64	Mk 360 (M514A1)	Mk 52	Solid	68.60	D295
	—	Mk 65	A-3	8.64	Mk 360 (M514A1)	Mk 52	Solid	68.60	D295
	Mk 81	Hi-Frag	PBXN-106	6.37	M732	—	Solid	68.49	—
	Mk 127	Mk 64	A-3	8.64	Mk 360/1 (M728)	—	Solid	68.02	D295
HE-PD	—	Mk 41	A-3/D	7.87	Mk 30	Mk 43	Plug	68.17	D330
	—	Mk 41	A-3/D	7.87	Mk 30	Mk 52/3	Plug	68.17	D330
	—	Mk 41	A-3/D	7.87	Mk 30	Mk 54	Plug	68.17	D330
	—	Mk 61	Expl-D	7.87	Mk 30	Mk 52/3	Plug	68.17	D330
	—	Mk 61	Expl-D	7.87	Mk 30	Mk 54	Plug	68.17	D330
	—	Mk 64	A-3/D	7.87	Mk 30	Mk 52/3	Solid	68.17	D330
	—	Mk 64	A-3/D	7.87	Mk 30	Mk 54	Solid	68.17	D330
	Mk 80	Mk 64	A-3	7.87	Mk 30/5	Mk 395	Solid	68.17	D330
	Mk 83	Hi-Frag	PBXN-106	6.37	Mk 407	—	Solid	68.83	D330
	—	Mk 64	A-3	7.87	Mk 407/1	—	Solid	68.17	—
HE-MT/PD	Mk 115	Mk 64	A-3	8.74	Mk 393	—	Solid	68.39	D338
	Mk 82	Hi-Frag	PBXN-106	6.37	Mk 393	—	Solid	67.68	D340
HE-IR	—	Mk 41	A-3	8.76	Mk 91	—	Plug	70.40	D327
	Mk 107	Mk 64	A-3	7.61	Mk 91	—	Solid	70.40	D327
	Mk 84	Hi-Frag	PBXN-106	6.37	Mk 404	—	Solid	70.40	D342
HE-VT-SD	—	Mk 41	A-3	7.76	Mk 73/2,4	Mk 44/8/30	Plug	69.71	D316
	—	Mk 41	A-3	7.76	Mk 73/3,5	Mk 44/8/30	Plug	69.71	D317
	—	Mk 64	A-3	7.76	Mk 73/4	Mk 30 bstr	Solid	69.71	D331
	—	Mk 64	A-3	7.76	Mk 73/8,10	Mk 39 bstr	Solid	69.71	D331
	—	Mk 64	A-3	7.76	Mk 73/5	Mk 30 bstr	Solid	69.71	D332
	—	Mk 64	A-3	7.76	Mk 73/9,11	Mk 39 bstr	Solid	69.71	D332
	—	Mk 64	A-3	7.76	Mk 73/13	Mk 39 bstr	Solid	69.71	D332
	Mk 116/0	Mk 64	A-3	7.76	Mk 73/13	Mk 39 bstr	Solid	69.71	D332
	Mk 116/1	Mk 64	A-3	7.76	Mk 73/13	Mk 39 bstr	Solid	69.71	D332
	Mk 86	Hi-Frag	PBXN-106	6.37	Mk 418	—	Solid	68.61	—
	Mk 117/0	Mk 64	A-3	8.64	Mk 73/2,4,8,10	—	Solid	69.59	D331
HC	—	Mk 41	Expl-D	8.74	Mk 30	Mk 43/1	Plug	69.63	D320
	—	Mk 41	Expl-D	8.74	Mk 30	Mk 44/2	Plug	69.63	D320
	—	Mk 41	Expl-D	8.74	Mk 30	Mk 52/3	Mk 31/2	69.63	D320
	—	Mk 41	Expl-D	8.74	Mk 30	Mk 54/2	Mk 31/2	69.63	D320
	Mk 108/0	Mk 61	Expl-D	8.74	Mk 30/5	Mk 395	Mk 83	69.63	D320
	Mk 108/1	Mk 64	A-3	8.74	Mk 399/0	—	Solid	69.63	D339
	Mk 108/2	Mk 64	A-3	8.74	Mk 407/1	—	Solid	69.63	D339
AAC	—	Mk 41	Expl-D	7.38	Mk 25 or 342	Mk 43 or 54	Mk 28 or 31	67.31	D319
	—	Mk 41	Expl-D	7.38	Mk 25 or 342	Mk 43 or 54	Mk 28 or 31	67.31	D319
	—	Mk 41	A-3	7.38	Mk 342	Mk 52/3 or 54	Mk 31/2	67.31	D319
	Mk 121	Mk 61	Expl-D	7.38	Mk 342	Mk 395	Mk 83	67.31	D319
RAP	Mk 58	Mk 78	A-3	3.74	M514A1	Mk 52/0	—	62.00	D325
COM	—	Mk 42	Expl-D	2.14	—	—	Mk 64	70.00	D322

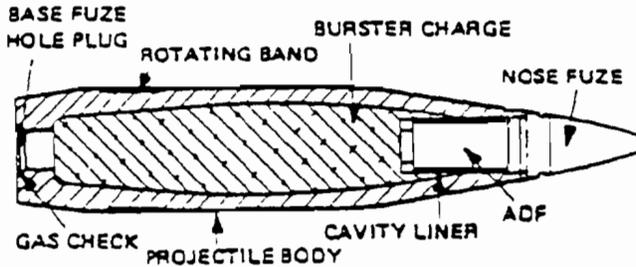


Figure 3-47. 5-inch, 54-Caliber High Explosive Projectile

**3-30.1.1.1. High Explosive, Controlled Variable Time (HE-CVT).** This projectile is available with either a high-fragmentation steel body (D346) or a conventional low-fragmentation steel body (D350 or D295). The high-fragmentation body projectile was designed primarily for use against personnel and light surface targets. The HE-CVT can be used in the antiaircraft role in an emergency; however, the reliability is lower than VT or IR fuzed projectiles in this mode. The nose of the projectile body is threaded internally and fitted with a conventional, variable-time radio-frequency proximity and auxiliary detonating fuze. The fuze is separated from the Composition A-3 explosive load by a cavity liner to permit fuze replacement without remote equipment. The base of the projectile is either plugged or solid.

**3-30.1.1.2. High Explosive, Point Detonating (HE-PD).** This projectile is also available with either a high-fragmentation steel body (D343) or the conventional low-fragmentation steel body (D330). The nose of the projectile body is threaded internally for an auxiliary detonating fuze adapter which is fitted with a point-detonating and auxiliary-detonating fuze, with or without a cavity liner. The low-fragmentation steel body with a Composition A-3 explosive-loaded projectile was designed for use against surface targets vulnerable to an impact burst. The high-fragmentation projectile is explosive loaded with PBXN-106. The base of the projectile is either plugged or solid.

**3-30.1.1.3. High Explosive, Mechanical Time/Point Detonating (HE-MT/PD).** This high-fragmentation projectile (D340) or low-fragmentation projectile (D338) is fitted with a nose fuze that has the capability of functioning in either a mechanical time or a point detonating mode. The point detonating mode acts as a backup mode if the fuze impacts before the preset time has elapsed. The body is filled with either PBXN-106 (D340) or Composition A-3 (D338). The base of both types are solid.

**3-30.1.1.4. High explosive, Infrared (HE-IR).** This low-fragmentation, Composition A-3, explosive loaded projectile (D327) or the high-fragmentation, PBXN-106, explosive loaded projectile (D342) is designed exclusively for use

against "hot" airborne targets. The nose of the projectile body is threaded internally and fitted with a variable-time, infrared proximity fuze which has an integral ADF. A point detonating feature is also incorporated into the nose fuze in the event the target is missed. The fuze is separated from the explosive load to permit fuze replacement without remote equipment. The base of the projectile is either plugged or solid.

**3-30.1.1.5. High Explosive, Variable Time (HE-VT).** This low-fragmentation steel body projectile (figure 3-46) is designed for use against targets that are vulnerable to air-burst. The nose of the projectile body is threaded internally and fitted with a variable-time, radio-frequency proximity fuze, which is supplemented by a booster. A self-destruct capability is incorporated into the nose fuze of projectiles D316 and D331. Beginning in the mid 1970s, the self-destruct feature was determined to be no longer required for modern warfare tactics and will eventually be phased out. The self-destruct feature is omitted in projectiles D317 and D332. The nose fuze is separated from the Composition A-3 explosive load by a cavity liner to permit fuze replacement without remote equipment. The base of the projectile is either plugged or solid.

### 3-30.1.2. High Fragmentation (HI-FRAG).

#### WARNING

HI-FRAG projectiles dropped less than 5 feet shall be examined carefully for joint separation and damaged rotating bands. Projectiles dropped more than 5 feet shall be disposed of in accordance with OP 5. Accidental drop of a projectile often results in widening of the mid-body joint between the forward and aft projectile halves. If a projectile is found with a joint opening exceeding 1/16 inch (the thickness of a U.S. penny), the round should be set aside for return to an ammunition activity. Accidental drop of a projectile may result in a cracked or broken rotating band. These projectiles warrant close band inspection. If a cracked or broken rotating band is found, the round should be set aside for return to an ammunition activity.

The HE-CVT Mk 81, HE-PD Mk 83, the HE-MT/PD Mk 82, and the HE-IR Mk 84 HI-FRAG projectiles (figure 3-48) are general purpose rounds, designed for a multitude of tasks including antiaircraft fire, shore bombardment, and use against unarmored or lightly armored ships and vehicles. These projectiles combine high lethality, extended range, tighter dispersion, and greater freedom from disastrous premature firings. Each projectile consists of

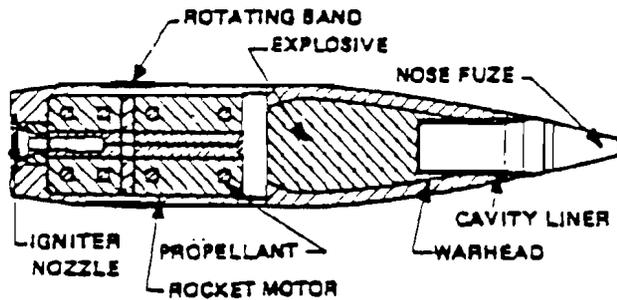


Figure 3-51. 5-Inch, 54-Caliber Rocket Assisted Projectile

be fired with a cartridge having a 1-inch-diameter by 2-5/8-inch-deep hole centered in the front face of the plug. Cartridges equipped with either cork or plastic plugs with holes will normally be supplied by a depot. The rocket motor is ignited when the gas pressure generated by the propelling charge propellant flexes a bellville spring which strikes a percussion primer assembly, initiating the pyrotechnic delay column. After a 23-second delay, the delay column burns the ignition charge, which ignites the propellant grain in the rocket motor. When the motor is ignited the igniter, which is sealed into the motor case base with a gas check gasket, is blown out. The rocket assistance extends the projectile range by approximately 6300 yards.

3-30.1.6. Common (COM). The COM projectile (figure 3-52) is designed to penetrate approximately one-third of its caliber of armor. This projectile has both a base plug and a BDF. Once inside the target, the delayed-action base fuze functions to detonate the explosive filler. Prior to modern gun fire control system technology, various colored spotting dyes were used to identify firing accuracy. Dyes are no longer required, and issues may or may not have dyes included. The projectile, which is made of forged steel, is loaded with 2.14 pounds of Explosive D.

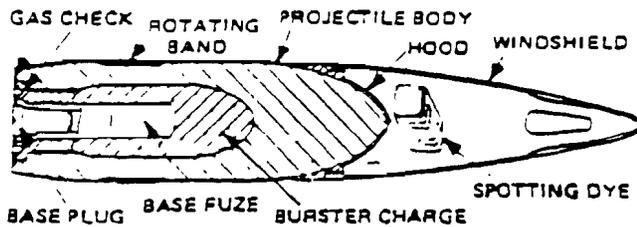


Figure 3-52. 5-Inch, 54-Caliber Common Projectile

3-30.1.7. Illuminating (ILLUM). The ILLUM projectile (figure 3-53) is designed to deploy a parachute-suspended pyrotechnic candle for target illumination. The projectile illuminating load and a small black powder explosive charge are sealed within the mechanical time fuzeed projectile by a

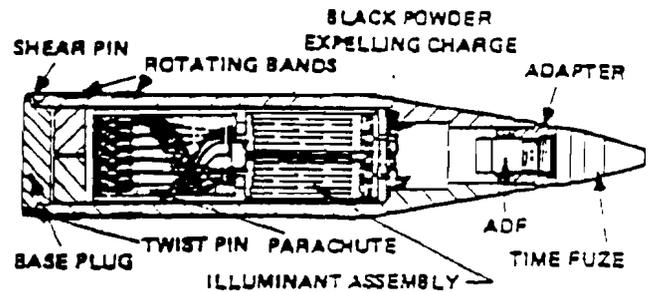


Figure 3-53. 5-Inch, 54-Caliber Illuminating Projectile

base plate. When the MTFs and the ADFs function, the ADF ignites the black powder which expels the projectile illuminating load. The illuminating composition is a powdered magnesium mixed with an oxidizer which burns for approximately 50 seconds with a candlepower of 600,000 lumens.

3-30.1.8. White Phosphorus (WP) (Smoke). The intended use of the WP projectile (figure 3-54) is to provide spotting, antipersonnel screening, and limited incendiary effects. It may be used with a PDF (D314) or with an MTF (D313). When the fuze functions, it sets off the expelling charge which ignites the delay element and forces the canister (Mk 14) from the rear of the projectile. The burster tube of the canister detonates and disperses a cloud of white phosphorus approximately 50 yards in diameter and lasts 7 minutes in still air. The tendency of white phosphorus to break into very small pieces that burn rapidly and its low melting point led to coating white phosphorus with synthetic rubber. This coated product is called plasticized white phosphorus (PWP).

NOTE

Both WP and PWP can be extinguished by immersion in water. To prevent reignition after drying, copper sulfate can be used.

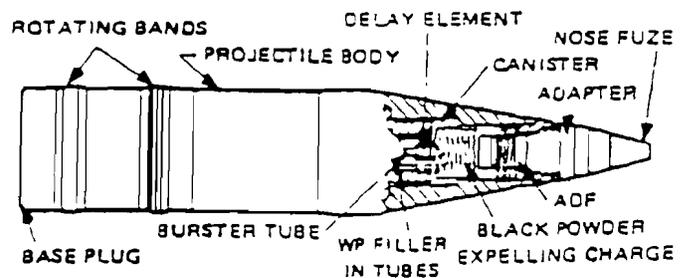


Figure 3-54. 5-Inch, 54-Caliber White Phosphorus Projectile

of black powder. Ignition of the expelling charge by the fuze discharges a payload of foil strips which reflects the radar beams. The useful lifetime of a chaff cloud is generally 10 minutes, provided that: (a) the cloud attains maximum size 15 seconds after the chaff is dispensed at a selected fuze time, (b) the fall rate factor is 2 feet per second, and (c) the wind turbulence is at a minimum.

3-30.1.12. Blind Loaded, Plugged (BL-P). Various conventional projectile bodies are filled with inert material to bring them within the weight tolerance of the service projectile. The high fragmentation body is loaded with beakers filled with inert material. Noses are fitted with dummy nose plugs. Bases are either plugged or solid, as applicable.

3-30.1.13. Dummy. The conventional projectile bodies are filled with inert material to bring them within the weight tolerance of the service projectiles. Before filling the projectile bodies, the rotating bands of the projectiles are machined so that projectile surfaces are flush. Either a

dummy nose plug or an inert MTF Mk 342 Mod 1 is used for the nose fuze. Bases are plugged or solid, as applicable.

3-30.2. Propelling Charge. The propelling charge is that component of the complete round that provides the force to propel the projectile from the gun to the target. Assembly of the propelling charge in a single, rigid protective case increases the ease and rapidity of loading and reduces the danger of flare-backs. Also, case-loaded ammunition prevents the escape of gases toward the breech of the gun. The case expands from the heat and pressure of the exploding propellant and forms a tight seal against the gun barrel chamber. Table 3-10 is a listing of variations that are available, either through material change, means of manufacturing, method of assembly, or specialized application.

3-30.2.1. Full or Reduced Charge. The propelling charge, full or reduced (figure 3-58), consists of a brass or steel cartridge case of a straight taper design. The propelling charge is assembled with Primer Mk 153 or Mk 45 (electric) and loaded with 17.5 (SPD) or 20.0 (SPCF) pounds of smokeless powder (propellant) in the full service charge and

Table 3-10. 5-Inch, 54-Caliber Propelling Charge Data

Type	Cartridge case	Primer	Propellant		Closure plug	DODIC
			Type	Weight (lb)		
Full charge, nonflashless	Mk 7 Brass or Mk 9 Steel	Mk 45 Electric	SPD	17.5	Mk 9 Cork	D304
Full charge, flashless	Mk 7 Brass or Mk 9 Steel	Mk 45 Electric	SPDF	17.5	Mk 9 Cork	D305
Full charge, universal	Mk 9 Steel	Mk 45 Electric	SPCF	20.0	Mk 9 Cork	D324
Full charge, universal	Mk 9 Steel	Mk 45 Electric	SPCF	20.0	Mk 12 Polyurethane	D326
Reduced charge, flashless	Mk 9 Steel	Mk 153 Electric	SPDF	6.2	Mk 9 Cork	D297
Clearing charge	Mk 9 Steel Modified	Mk 48/2 Electric	SPCF	10.0	Elastomeric or Cured Polyurethane	D296
Dummy charges	Brass or Steel	—	—	—	Bronze or Steel	D308
Test cartridge	Mk 5 Brass Modified	Mk 15 Lock	—	—	—	DW46
<u>Special Charges</u>						
Full charge, flashless	Mk 9 Steel	Mk 45 Electric	M26	20.0	Mk 9 Cork	D300
<u>Unserviceable-NAR-15-74</u>						
Full charge, nonflashless	Mk 6 Brass	Mk 13 Combination	SPD	17.5	Mk 3 or Mk 6 Cork	D309
Full charge, flashless	Mk 6 Brass	Mk 13 Combination	SPDF	17.5	Mk 3 or Mk 6 Cork	D310

## **Appendix C**

### **Dive Brief**

## DIVE BRIEF

### 1. Diving Conditions

- Water Temperature
- Weather for the Day
- Current
- Visibility in Water
- Recompression Chamber Status
- Scheduled Water Traffic
- Expected Depth of Dive
- Dive Profile
- Underwater Hazards (entanglement, bottom debris, etc.)

### 2. Diving Operations

- Purpose of Dive
- Progress Update
- Progress Expected Today
- Dive Team Assignments
- Diving Support Assignments
- Diver Recall Procedures
- Diver Communication
- Diver Casualty Procedures

### 3. UXO

- UXO Recon
- Safety Precautions for Target Ordnance

### 4. Safety

- Diving Support Safety
- Diving Safety (Diving Supervisor covers topic from Navy Diving Manual each morning.)
- Emergency Transport Routes

**Safe Environment, Inc.**

**Diving Plan**

**For**

**Naval Base Charleston**

**AOCs 500 and 502**

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## Section One -- Introduction

### A. Applicability

This Diving Plan, as an annex to the client-provided work plan, is intended to be used solely by Safe Environment, Inc. (SEI) divers. SEI divers have received their diving training through the U.S. Navy and hold U.S. Navy Diver Identification Cards. Additionally, they are all graduates of the Naval School, Explosive Ordnance Disposal, Indian Head, MD.

### B. Background

Naval Base Charleston has two underwater sites where unexploded ordnance (UXO) items are known to exist. AOC 500 is located at the northwest end of Pier T in Zone J, where two MK 47 depth bombs were dropped in 1945. It is a 90,000 square foot area (2.1 acres) with depths ranging from 5 to 30 feet. Appendix B provides an illustration and sufficient information to identify the MK 47 depth bomb.

AOC 502 is located at the southwest end of pier G in Zone J, where three 5 inch projectiles were dropped in 1944. It is also a 90,000 square foot area (2.1 acres) with depths ranging from 5 to 35 feet. Appendix B provides an illustration and sufficient information for positive identification of 5 inch projectiles of WWII vintage.

### C. Site Conditions

The water current at both locations is anticipated to be less than one knot, with typical harbor sediment accumulations, metallic debris other than UXO, and limited visibility. The underwater investigation of both AOCs are planned for late spring to allow for warmer water temperatures to maximize bottom time.

### D. Procedures

The White Pulse Induction 2000 is no longer in production and will not be available for the geophysical search. This instrument has been superseded by the White Surfmaster PI, which uses the same detection principle of pulse induction, has improved discrimination between metal types, and same detection capability. The water tight integrity depth limit is 100 feet, which should not become a factor at either of the AOCs.

Standard U. S. Navy diving procedures will be followed using Volume 1. U.S. Navy Diving Manual. The underwater search will utilize the jack stay search grid procedure to ensure overlapping coverage in the anticipated limited visibility.

Standard U. S. Navy underwater UXO reconnaissance procedures will be followed using EODB60A-1-1-37, **less confidential pages**.

## Section Two -- Dive Plan

### A. Dive Station Assignments

SEI divers assigned to this investigation are senior personnel, and are qualified to rotate through all dive station positions. This will ensure all divers have adequate surface intervals and equal time in the water. The SEI Site PM for this project, Mr. Lee Dickson, will also rotate through all dive station positions as well as manage contract and day-to-day operations. Mr. Dickson will initiate and maintain a daily site log detailing field operations.

Diving Supervisor - will obtain daily marine weather forecast, call recompression chamber for status and inform chamber of the day's dive schedule, call harbor control to notify that divers are in the water and their location and inquire of ship and sonar activity in the immediate area. The Diving Supervisor will brief the dive station on the schedule and make diving assignments the day before the dive. Contents of the dive brief are contained in Appendix C.

Standby Diver - will be fully dressed and ready to enter the water on command by the Diving Supervisor; maintain daily dive log; assist the Diving Supervisor in monitoring divers' position and watching for surface hazards such as incoming vessels or small boats.

Red Diver - will be physically ready and mentally alert to dive the plan and perform geophysical investigations in jack stay grid; check out diving equipment prior to entering water; check out Surfmaster PI prior to dive; assist in jack stay placement and advancement prior to diving; review and sign his dive log and complete a repetitive dive sheet prior to entering the water for a second dive in the same work day.

Green Diver - will be physically ready and mentally alert to dive the plan and perform anomaly investigation and marking in jack stay grid; check out diving equipment prior to entering water; change positions with Red Diver at start of each new search leg to prevent operator tone fatigue on Surfmaster PI; assist in jack stay placement and advancement prior to diving; review and sign his dive log and complete a repetitive dive sheet prior to entering the water for a second dive in the same work day.

Diver Tender (2 each) - will assist in jack stay placement and advancement; assist in monitoring divers' position and watching for surface hazards; maintain line pull communication by **receiving** and **returning** only then verbally relaying signal to Diving Supervisor. Diver Tender will not initiate diver pull signals which may cause diver to inadvertently move UXO; prepare and maintain boats for daily work.

Shore Logistics Supervisor - will ensure dive tanks are filled and ready prior to each dive; assist in dive station setup and dismantling; assist in loading and unloading jack stay rigging; maintain first aid kit in readiness; maintain and position vehicle for emergency transport of diver if necessary; become familiar with route to recompression chamber and hospital. Maintain daily supply of fuel and oil for boats and set up refueling station with spill prevention and containment equipment; standby for other assignments from Diving Supervisor.

## B. Dive Station

The dive station will be transported and stored in a 16-20 foot cargo truck, removed and staged on the pier at a point giving access to and visibility of the portion of the AOC being investigated. The dive station will be disassembled and loaded into the truck for safe overnight storage and may be taken off base if desired. The dive station shall consist of the following equipment:

### 1. Dive Gear - All divers will be responsible for their personal dive gear:

#### a) Personal Dive Gear

- Mask, one per diver and one spare.
- Fins, one pair per diver and one extra pair.
- Dive Knife, one per diver and one spare.
- Watch, one per diver and one spare.
- Depth Gage one per diver and one spare.
- Buoyancy Compensating Device (BCD), one per diver.
- Regulator, one per diver and one spare.

#### b) Scuba Cylinders, 10 each.

#### c) Diving Supervisor Box.

### 2. Safety Equipment:

- Stretcher
- PFDs, 7 each
- Cellular
- Oxygen bottle w/valve, hose, and mask
- Blankets
- EMT Kit
- Flash lights
- Liquids, hot and cold

### 3. Support Equipment:

- Saw
- Tape
- Tarp, 10'x20'
- Buoys, 40 each
- General Tool Box
- Shackles, various sizes
- Pulleys, small and large sizes
- Clumps (concrete blocks), 40 each
- Line, 1800 feet 0.5 inch dia polypropylene
- Leather work gloves, 1 pair per diver, and 3 extra pairs

**APPENDIX D**  
**Safe Environment Inc. Final Report**

## **FINAL Report**

**Search, Locate and Destroy  
Ordnance**

**Contract #N62467-97-M-4503**

**Prepared for:**

**Navy Public Works Center  
Charleston Naval Shipyard  
Charleston, South Carolina**

**Prepared by:**

**Safe Environment, Inc.  
11005 Edgepark Circle, Suite 102, Manassas, VA 20109  
Ph: 703-392-7200 •\* Fax: 703-392-6620  
E-mail: nobombs@erols.com**

**May 5, 1998**

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Appendix A – Scope of Work

Appendix B – Photographs

Appendix C -- Search Grid Summary

Appendix D – Site Logs

## **1.0 Introduction**

### **1.1 General**

Safe Environment, Inc. (SEI) was awarded a contract by the Navy Public Works Center, Charleston Naval Shipyard, Charleston, South Carolina to search, locate, and destroy ordnance at Area of Concern (AOC) 500 and Area of Concern (AOC) 502 that were dropped into the water of the Cooper River from Naval war ships. The work was performed under Contract #N62467-97-M-4503. This effort was mandated in accordance with the requirements of the South Carolina Department of Environmental Control, the United States Environmental Protection Agency, and the Department of Defense Explosive Safety Board (DDESB) Ammunition and Explosive Safety Standards for real property contaminated with ammunition and explosives.

### **1.2 Location**

AOC 500 and AOC 502 are located in the Cooper River, Charleston Naval Shipyard, Charleston, South Carolina. AOC 500 is located at the northwest end of Pier T in Zone J, which is located in the Cooper River (see Appendix A, Figure 1). AOC 502 is located at the southwest end of Pier G in Zone J, which is located in the Cooper River (see Appendix A, Figure 2).

## **2.0 Scope of Work Execution**

### **2.1 Personnel Training**

SEI divers received their diving training through the U.S. Navy and hold U.S. Navy Diver identification cards. Additionally, they are all graduates of the Naval School, Explosive Ordnance Disposal, Indian Head, MD.

### **2.2 Equipment**

The dive station was transported and stored in a 15 foot cargo truck, removed and staged on the pier at a point giving access to and visibility of the portion of the AOC being investigated. The dive station was disassembled and loaded into the truck for safe overnight storage. The dive station consisted of the following equipment:

1. **Dive Gear** - All divers will be responsible for their personal dive gear:
  - a) Personal Dive Gear
    - Mask, one per diver and one spare.
    - Fins, one pair per diver and one extra pair.
    - Dive Knife, one per diver and one spare.
    - Watch, one per diver and one spare.
    - Depth Gage one per diver and one spare.
    - Buoyancy Compensating Device (BCD), one per diver.
    - Regulator, one per diver and one spare.

- b) Scuba Cylinders, 10 each.
- c) Diving Supervisor Box.

## **2. Safety Equipment:**

- Stretcher
- PFDs, 7 each
- Cellular
- Oxygen bottle w/valve, hose, and mask
- Blankets
- EMT Kit
- Flash lights
- Liquids, hot and cold

## **3. Support Equipment:**

- Saw
- Tape
- Tarp, 10'x20'
- Buoys, 40 each
- General Tool Box
- Shackles, various sizes
- Pulleys, small and large sizes
- Clumps (concrete blocks), 40 each
- Line, 1800 feet 0.5 inch dia. polypropylene
- Leather work gloves, 1 pair per diver, and 3 extra pairs
- G-881 magnetometer (2)
- 18 ft. wide beam work boat

### **2.3 Procedures**

Standard U.S. Navy diving procedures were followed using the U.S. Navy Diving Manual, Volume 1. The underwater search utilized the jackstay search grid method to ensure overlapping coverage in the AOCs.

Standard U.S. Navy underwater UXO reconnaissance procedures were followed using EODB 60A-1-1-37, less confidential pages.

## **3.0 Scope of Work Completion**

### **3.1 Exposure Data**

- Total dive time = 45 hours
- Total dive support time = 465 hours
- Total equipment/logistics time = 98 hours

### **3.2 Search Area Investigation**

Refer to Appendix C, Search Grid Summary.

## **4.0 Summary**

### **4.1 Conclusions**

A thorough search of AOC 500 and AOC 502 was conducted using the "jackstay" search method. This method was used because it provides excellent search coverage in waters with poor visibility and it permits overlapping coverage of the search area. The "jackstay" is the most effective diver search technique for murky water when a relatively large area must be covered with any degree of thoroughness. The target ordnance at AOC 500 and AOC 502 was not found at a search depth of 4 feet below the river bottom. The items are either several more feet below the river bottom in the soft silt and sediment or the items were dredged up and deposited on land at some point in time.

### **4.2 Quality Control (QC) Checks**

The results of Quality Control checks for each AOC are listed below. A circle search of AOC 500 was used as the preferred method of QC check for this area. The jackstay method was used as the preferred method of QC check for AOC 502.

- **AOC 500 – QC of "T" Pier U/W Search**

Wednesday, 29 April 1998

Executed circle search of "T" pier U/W search.  
Measured 50' from beginning of pier and 60' out in the water for center of circle search.  
Circled at 6', 12', 18', 24' and 30' radii.

Results: Found piece of net but no metals.

- **AOC 502 – QC of "G" Pier U/W Search**

Wednesday, 29 April 1998

Executed jackstay search of "G" pier.  
Searched a rectangular area from 70' to 120' mark on the pier and from 10' to 35' out in the water.

Results: Found crumpled soda can and "D" cell battery.

## **5.0 Waste Generation**

No hazardous waste was generated during this project. No waste was generated other than household type refuse, all of which was removed from the job site at the end of each work day and disposed of in proper trash bins. No pier side refueling was done during the operation.

**Appendix A**  
**Scope of Work**

OFFICER IN CHARGE OF CONSTRUCTION  
BUILDING 30, NAVAL BASE  
CHARLESTON, SOUTH CAROLINA

SPECIFICATION FOR: UNEXPLODED ORDNANCE (UXO) SEARCH, EXCAVATE,  
& DISPOSAL

1. INTRODUCTION: NAVBASE Charleston has two waterborne sites where exploded ordnance (UXO) are known to have existed. These areas are listed as Areas of Concern (AOC) numbered 500 and 502. These sites are identified in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Zone J dated June 9, 1995 provided by Ensafe/Allen and Hoshall of Memphis TN. The only documentations of the description and location of these UXOs are Charleston Naval Base maps. A description and location of each of these sites are listed below:

1. AOC 500: The scope of work for Area of Concern (AOC) 500 consist of searching, locating and destroying ordnance that has been dropped into the waters of the Cooper River from naval war ships. The ordnances at AOC 500 consist of two Mark 47 Torpex loaded depth bombs, which were dropped on January 28 1945. AOC 500 is located at the northwest end of Pier T in Zone J, which is located in the Cooper River identified on map H606-285 at coordinates M-16, at a depth varying from 5 to 30 feet (See Figure 1). The area to be searched has been defined to an area approximately 300 feet by 300 feet adjacent to the end of Pier T on the Charleston Naval Base. Explosive disposal of unexploded ordnance (UXO) is to be performed by the active duty Navy EOD unit with cognizant EOD response authority for the Charleston Naval Base. A geophysical investigation will need to be performed with a Whites Pulse Induction 2000 Underwater Metal Detector or an equivalent instrument. The objective of the subsurface geophysical survey is to accurately locate and record the location of target anomalies ( potential UXO) for excavation, investigation and removal actions. Once anomalies are located, they will need to be excavated to the point that positive identification can be determined and large enough to permit placement of an explosive charge by the Navy EOD Team. This effort is mandated in accordance with the requirements of the South Carolina Department of Environmental Control, the United States Environmental Protection Agency, and the Department of Defense Explosive Safety Board (DDESB) Ammunition and Explosive Safety Standards for real property contaminated with ammunition and explosives. All proposed on-site personnel shall have received Hazardous Waste Operations and Emergency Response (HAZWOPER) training, in accordance with Title 29 Code of Federal Regulations (CFR) 1910.120(e) and be enrolled in a medical surveillance program, per 29 CFR 1910.120(f).

2. AOC 502: The scope of work for Area of Concern (AOC) 502 consist of searching, locating and destroying ordnance that has been dropped into the waters of the Cooper River from naval war ships. The ordnances at AOC 502 consist of three 5 inch shells, which were dropped in September 1944. AOC 502 is located at the southwest end of pier G in Zone J, which is located in the Cooper River identified on map H606-284 at coordinates K-35, at a depth varying from 5 to 35 feet (See Figure 3). The area to be searched has been defined to an area approximately 300 feet by 300 feet adjacent to Pier G on the Charleston Naval Base. Explosive disposal of unexploded ordnance (UXO) is to be performed by the active duty Navy EOD unit with cognizant EOD response authority for the Charleston Naval Base. A geophysical investigation will need to be performed with a Whites Pulse Induction 2000 Underwater Metal Detector or an equivalent instrument. The objective of the subsurface geophysical survey is to accurately locate and record the location of target anomalies ( potential UXO) for excavation, investigation and removal actions. Once anomalies are located, they will need to be excavated to the point that positive identification can be determined and large enough to permit placement of

an explosive charge by the Navy EOD Team. This effort is mandated in accordance with the requirements of the South Carolina Department of Environmental Control, the United States Environmental Protection Agency, and the Department of Defense Explosive Safety Board (DDESB) Ammunition and Explosive Safety Standards for real property contaminated with ammunition and explosives. All proposed on-site personnel shall have received Hazardous Waste Operations and Emergency Response (HAZWOPER) training, in accordance with Title 29 Code of Federal Regulations (CFR) 1910.120(e) and be enrolled in a medical surveillance program, per 29 CFR 1910.120(f).

2. **CURRENT CONDITIONS:** The waterborne UXOs (AOCs 500 and 502) have had no previous investigation to date. These sites have not been previously investigated by Ensafe/Allen and Hoshall of Memphis, TN., due to these sites' special nature. An Explosive Ordnance Disposal (EOD) subcontractor has been selected to conduct these investigations.

3. **INTERIM MEASURES OBJECTIVE:** The objective of this interim measure (IM) for sites AOC 500 and 502 is to locate, excavate and expose UXO to the point that permits the placement of an explosive counter charge by a Navy EOD Unit.

4. **DESCRIPTION OF EXECUTION:**

4a. **SEARCH AREA:** The search area of AOC 500 and 502 will both consist of a 300' x 300' area as shown in Figures 1 and Figure 3. A "Jack Stay" search method will be used to ensure complete coverage of each AOC. The Jack Stay method is proposed because it provides excellent search coverage in waters with poor visibility and it permits overlapping coverage of the search area.

4b. **UXO SUBSURFACE GEOPHYSICAL SURVEY:** The objective of the subsurface geophysical survey is to accurately locate and record the location of target anomalies (potential UXO) for excavation, investigation and removal actions. Ordnance subcontractors proposes to use the White Pulse Induction 2000 Underwater Metal Detector. The instrument maintains water tight integrity to a depth of 200 feet of sea water and is capable of detecting 5-inch projectiles at a depth of 4 feet.

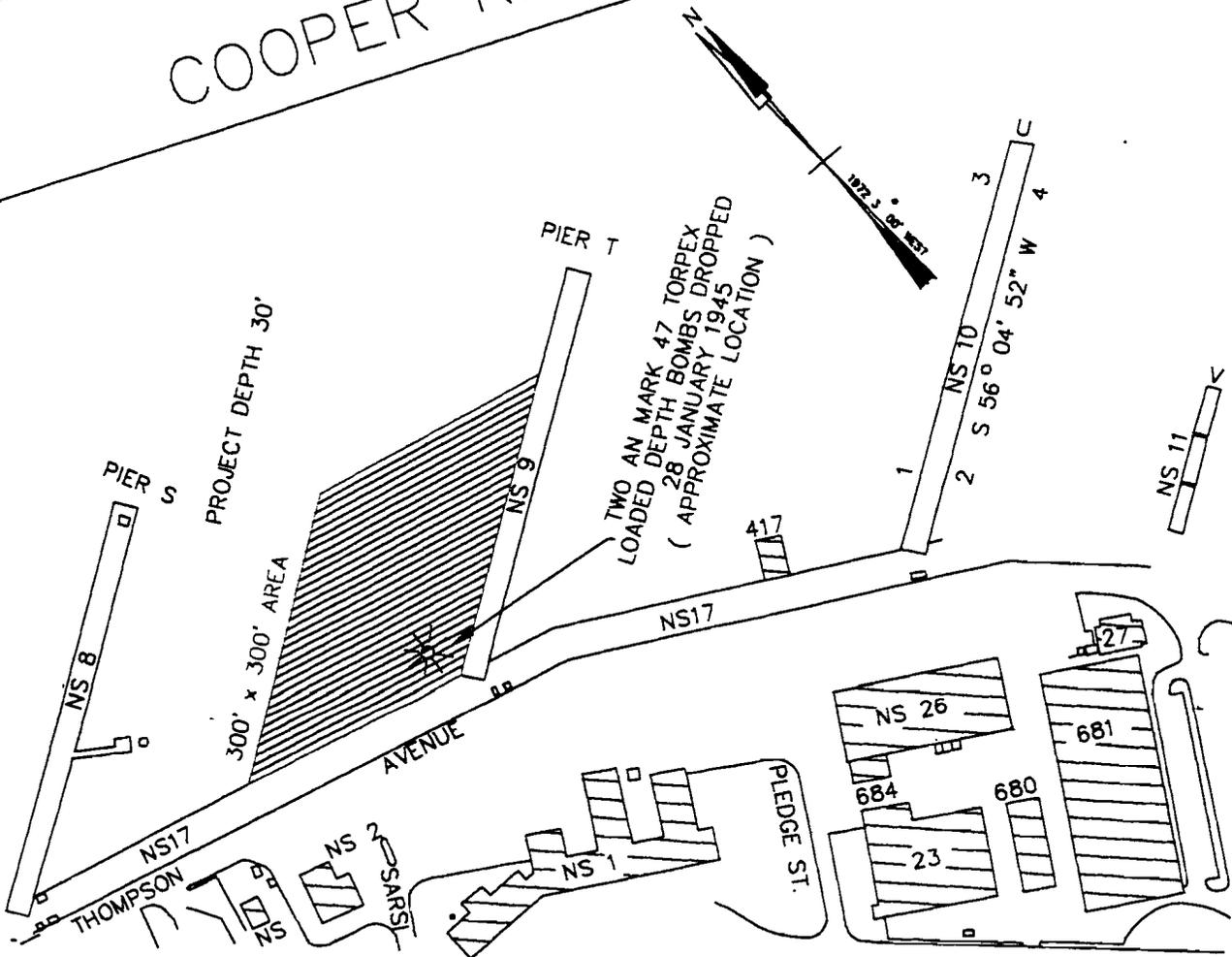
4c. **EXCAVATION:** Ordnance subcontractors will perform minor dredging operations and/or physical removal of soil to determine the profile of the anomaly by depth, size, relative shape to ascertain if the anomaly is representative of a target item. Due to the deep silt anticipated, cofferdams may be constructed from 55-gallon drums with the ends removed to facilitate excavation of the site. Anomalies will only be excavated to the point that permits positive identification. In the case of UXO, excavations will be expanded to permit placement of an explosive charge by the Navy EOD Team.

4d. **DISPOSAL OF ORDNANCE:** Charleston Navy Weapons Station Mobile Unit Six Detachment 14 will be contacted to dispose of any recovered UXO. Detachment 14 will perform disposal actions with standard operating procedures.

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AOC 500

COOPER RIVER



GRAPHIC SCALE



**Appendix B**

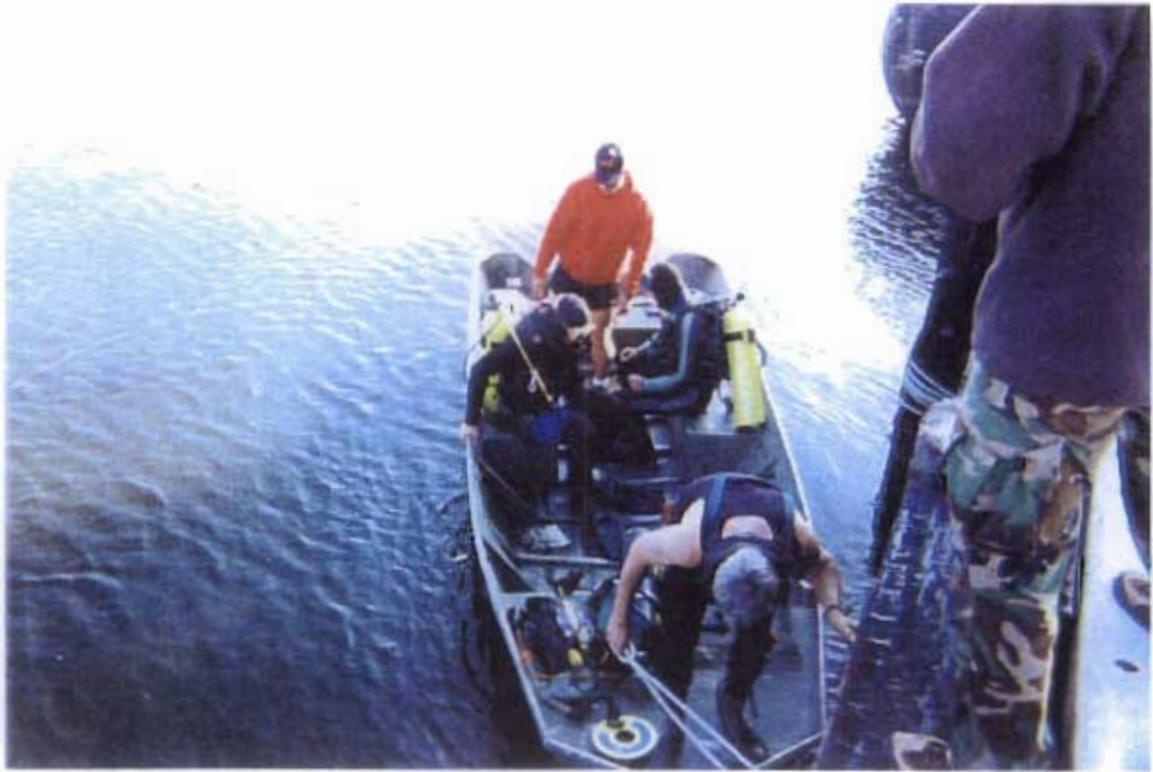
**Photographs**



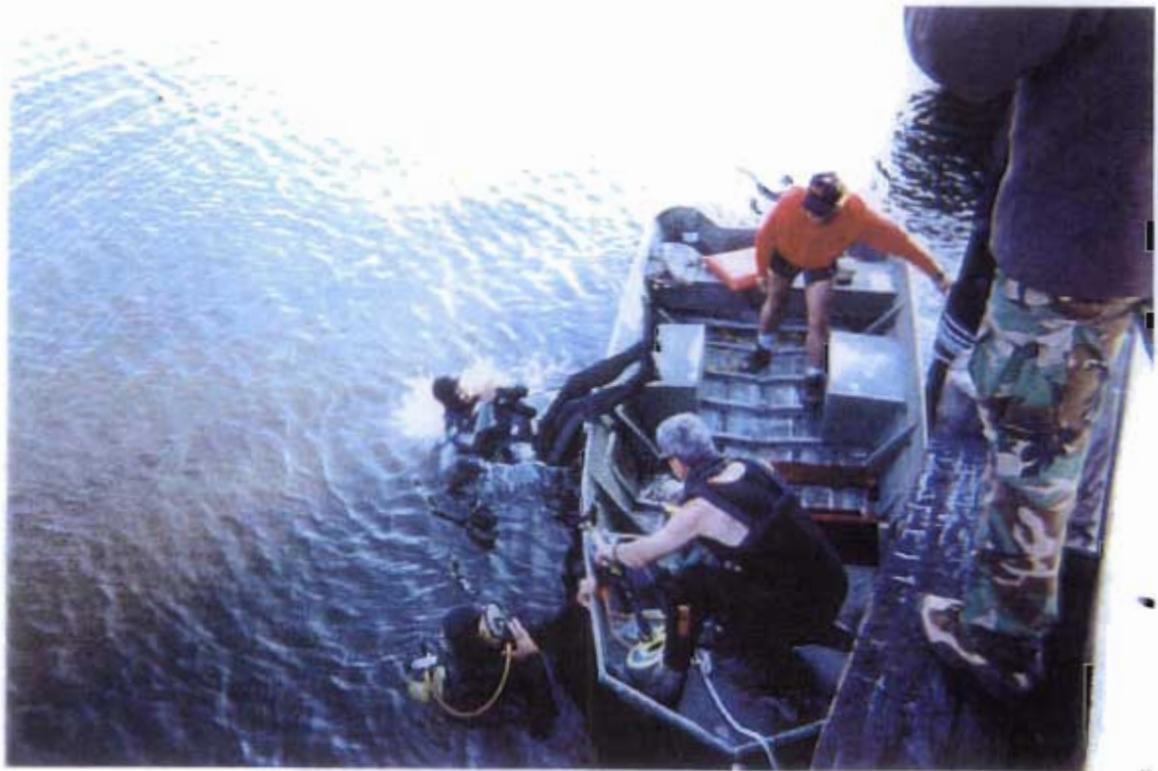
Dive Station Preparation



Crew en route to job site



Preparing to dive



Entering the water



Divers en route to search area



Diver on water surface in search area



Divers entering boat after concluding search



Crew returning from job site

**Appendix C**  
**Search Grid Summary**

**AOC 502: Diver progress at "G" Pier, Charleston Naval Station**

Monday, 20 April 1998

- 0 Sheet metal, welding rods, wire. Oyster shells & mud bottom.
- 10 Sheet metal, metal object, welding rods. Oyster shells & mud bottom.
- 20 Flange, welding rods, woods & wire. Oyster shells & mud bottom.

Tuesday, 21 April 1998

- 30 Welding rods, pc. metal. Mud & silt bottom.
- 40 Rescue buoy stand, welding rods. Mud & silt bottom.
- 50 Pc pipe, 3' diameter pipe running across lane. Mud & silt bottom.
- 60 Paint can, welding rods. Mud & silt bottom.
- 70 Welding rods. pc metal. Mud & silt bottom.
- 80 Tin can, "D" cell batteries, welding rods. Mud & silt bottom.
- 90 Welding rods, deep cut on bottom from dredge operations.
- 100 Welding rods. Mud & silt bottom.
- 110 Mud & silt bottom.
- 120 Mud & silt bottom.
- 130 Found paint shack. Mud & silt bottom.
- 140 Paint shack in lane. Mud & silt bottom.
- 150 Paint shack in lane. Mud & silt bottom.
- 160 Soda can. Mud & silt bottom.
- 170 Mud & silt bottom.
- 180 Mud & silt bottom.
- 190 Mud & silt bottom.

Wednesday, 22 April 1998

- 200 Mud & silt bottom.
- 210 Mud & silt bottom.
- 220 Mud & silt bottom.
- 230 Mud & silt bottom.
- 240 Mud & silt bottom.
- 250 Mud & silt bottom.
- 260 Mud & silt bottom.
- 270 Mud & silt bottom.
- 280 Mud & silt bottom.
- 290 Mud & silt bottom.

**AOC 502: Diver progress at "G" Pier, Charleston Naval Station**

Thursday, 23 April 1998

- 300 Mud & silt bottom.
- 310 Mud & silt bottom.
- 320 Mud & silt bottom.
- 330 Mud & silt bottom.
- 340 Mud & silt bottom.
- 350 Mud & silt bottom.
- 360 Metal beam. Mud & silt bottom.
- 370 Metal beam. Mud & silt bottom.
- 380 Mud & silt bottom.
- 390 Soda can. Mud & silt bottom.
- 400 Light bulb. Mud & silt bottom.
- 410 Mud & silt bottom.
- 420 Mud & silt bottom.
- 430 Mud & silt bottom.
- 440 Mud & silt bottom.
- 450 Mud & silt bottom.
- 460 Mud & silt bottom.
- 470 Pc of flexible hose. Mud & silt bottom
- 480 Mud silt bottom.
- 490 Crumpled soda can. Mud & silt bottom.
- 500 Small pc metal. Mud & silt bottom.
- 510 Flange. Mud & silt bottom.
- 520 Mud & silt bottom.
- 530 Mud & silt bottom.
- 540 Mud & silt bottom.
- 550 Mud & silt bottom.
- 550 End of AOC 502 search area.

**AOC 500: Diver progress at "T" pier, Charleston Naval Station**

Friday, 24 April 1998.

300 First lane. Mud & silt.  
290 Mud & silt bottom.  
280 Mud & silt bottom.  
270 Mud & silt bottom.  
260 Mud & silt bottom.  
250 Mud & silt bottom.  
240 Mud & silt bottom.  
230 Mud & silt bottom.  
220 Mud & silt bottom.

Monday, 27 April 1998

210 Mud & silt bottom.  
200 3 bottle caps. Mud & silt bottom.  
190 Mud & silt bottom.  
180 Mud & silt bottom.  
170 Mud & silt bottom.  
160 Mud & silt bottom.  
150 Mud & silt bottom.  
140 Mud & silt bottom.  
130 Mud & silt bottom.  
120 Mud & silt bottom.

Tuesday, 28 April 1998

110 Mud & silt bottom.  
100 Mud & silt bottom.  
90 Old broken piling. Mud & silt bottom.  
80 Old broken piling. Mud & silt bottom.  
70 Short piece of cable. Mud & silt bottom.  
60 Small can. Mud & silt bottom.  
50 Small piece of sheet metal & welding rods.  
40 Welding rods & 10' piece of pipe. Mud & silt bottom.  
30 Welding rods & pc sheet metal. Steep drop from dredging operations.  
20 Welding rods & broken piling.  
10 Welding rods, can, pieces of angle iron & pipe.  
00 Cans, welding rods, pieces of angle iron & pipe, broken piling.  
00 End of AOC 500 search area.

## **Appendix D**

### **Site Logs**

4-20-98 CHARLESTON ADCs 500 AND 502 Monday

0630 SET DIVE TEAM ARRIVED AT PASS OFFICE, FORMER NAVAL STATION

CHARLESTON, SC.

0700 MET TOM HARDIN FROM CHARLESTON ENVIRONMENTAL DETACHMENT, OBTAINING

BADGES AND VEHICLE PASS FOR TRUCK. DISCUSSED PARKING AND ACCESS TO SHIPYARD AREA FOR ADC

0730 DEPARTED PASS OFFICE, PARKED POVS; DROVE TRUCK TO G PIER AREA;

LAUNCHED SET BOAT; TOOK CHARGE OF BOAT PROVIDED BOAT. CIVILIAN BARGE

BLOCKED SIGNIFICANT PORTION OF SEARCH AREA. BARGE WAS RELOCATED BY 11:30.

11:00 HOLD SAFETY BRIEFING AND OPS BRIEFING WITH TOM HARDIN ATTENDING

11:30 BEGAN JACKSTAY PREPARATION AND CORNER REFERENCE BUOY PLACEMENT

14:20 DIVERS IN THE WATER RUNNING JACKSTAY LATERALLY BETWEEN

PIERS. COMPLETED 2 JACKSTAY LANES. ITEMS FOUND:

WELDING RODS, SCRAP IRON, SLAG, PIPE SECTIONS, RUST SCALE,

AND FLANGE SECTIONS. DIVERS OUT AT 16:05, DIVE DEPTH 10'.

16:15 CLEANED GEAR, BROKE DIVE STATION AND LEFT G PIER AT

16:30/16:30.

16:55 RETRIEVED BOATS & CLEANED REMAINING GEAR

4-21-98

Charleston ROCC 500 and 502

Tue

0630 Departed Motel in two groups one group to launch boat and transit to pier G. The other group to pier G to set up dive station.

0700 Tailgate Safety Brief

0815 Dive Sup Brief

0830 First Divers in water (Jenkins - Skip) B-T 122

1044 2nd set of Divers in water (Blansard - Dickson) B-T 1:10

1100 Phil went to Dive Shop to change empty tanks and to buy more weights.

1250 3rd Divers in water (Jaks - Beers) B-T 1:24

1448 4th Divers in water (Kate - Skip) B-T .51

Dive Sup & Standby	Can 1st Dive	<sup>03</sup> Jaks - Beers
	2nd	Jaks - Kate
	3rd	Jenkins Skip
	4th	Blansard Jaks

1550 Secured diving ops. Started gear clean up

1630 Recouered Boat, Took all hand on tour of next dive site at pier T

1645 Washdown boat with fresh water, took empty tanks to Dive Shop

1700 Secured for the Day

4-21-98 CONT

1330 Divers found yards lost dog house in LANE 10 mid way  
put MARKER ON IT.

Divers found same items as the day before.

4-22-98 Wed Sunny + mild with Bad weather forecast  
0630 Departed motel, 2 men to launch and transport boats to  
dive site. Rest of the crew to set up Dive station.  
0800 SAFETY BRIEF  
0830 Dive Sup made phone calls and gave Dive Brief  
0845 1st Dive pair left surface  
0945 Divers returned to surface  
1022 2nd set of Divers left surface  
1115 Divers back on the surface  
1120 Secured diving operations while yard tug moved &  
Barge out of the target area. Use down time to rig  
and place a new 300' Jack stay base line. Phil  
Charged empty tanks.  
1345 Replaced Dive flags and started Dive ops again  
1402 The days third set of Divers left the surface  
1445 Returned to surface.  
1521 4th pair of Divers left surface  
1608 Divers returned to surface - Secure Dive ops  
1630 2 men returned boats to ramp then transport them to  
compound and wash with fresh water. Rest of the  
crew to wash and check gear store in truck, then  
fill bottles.

GO ON NEXT PAGE

1700 Secure for the day.

NOTE:1 DIV2 TARGET AREA HAS A NEW SHAPE BUT THE SAME SQUARE FOOTAGE, CHANGE WAS MADE AT TODAY HANDINI REQUEST. (MORE SHIPS IN AREA)

NOTE:2 LAST DIV2 PAIR FINISHED LAZ 300 APPROX.  $\frac{2}{3}$  OF AREA COMPLETED.

4-23-98 Thur Cool and cloudy AIR Temp 62 WATER 68

0700 Launched SSI Boat and set up Dive Site.

0745 Safety Brief.

0755 Dive Sup. Brief START DIVE OPERATIONS

0832 1st Dive pair LEFT SURFACE

0924 1st Pair back on SURFACE

0945 2nd Dive Pair LEFT SURFACE

1025 2nd Pair back ON SURFACE.

1100 3rd Pair LEFT SURFACE

1140 3rd Pair BACK ON SURFACE

1224 4th Pair LEFT SURFACE

1315 4th Pair BACK ON SURFACE AFTER FINISHING LAWE 550

Which was the LAST LAWE IN ADC 502.

1320 Secured from Diving operations AT Pier G

picked up Jackstay Base Lines, ~~to~~ CLEARED AND

PACK ALL EQUIPMENT INTO TRUCK

1430 Moved to Pier T established Jackstay Base Lines

AND MARKED OUT LANES ON Pier. Recovered boat

WASHED AND STORED SAME. FILLED TANKS.

1700 SECURED FOR DAY

4-24-98 Fri Cool & Sunny Very nice

0700 SET up DIVE STATION AT END of Pier T, LAUNCHED BOAT

0730 SAFETY BRIEF

0745 DIVE SUP BRIEF

0809 1st DIVE PAIR LEFT SURFACE, WATER 68° TIDE IS HIGH

DEPTH IS 40' BOTTOM IS VERY SOFT MUD. DIVERS HAD PROBLEMS GETTING BASS LIVE CHUMPS OUT OF THE MUD BUT WITH MUCH EFFORT AND A LITTLE TIME THEY GOT EVERYTHING WORKING AS PLANNED. STARTED @ THE 300' MARK WORKING INLAND

0905 DIVERS ON SURFACE - BOTTOM 2000 SOFTER THAN OTHER SITES

0945 2ND SET OF DIVERS LEFT SURFACE

1015 2ND SET ON SURFACE ONE DIVER HAD SMALL AIR LEAK FROM O RING. REMOVED 2 DIVERS FROM WATER

1100 FILLED BOTTLES

1300 3RD SET OF DIVERS LEFT SURFACE

1342 3RD PAIR OF DIVERS RETURNED TO SURFACE

1350 SECURED FROM DIVING OPERATIONS, CLEANED GEAR STOWED IN TRUCK, RECOVERED BOAT AND WASH WITH FRESH WATER, FILLED EMPTY TANKS, FILL OUT TIME SHEETS

1700 SECURED FOR WEEK. TODAY WE SHOWED THE PACE DOWN A BIT DUE TO THE FACT WE ARE AHEAD AND GETTING

4-27-98 Monday Sunny & Mild 70° AIR 70° WATER

0730 Safety Brief after setting up Dive Station and packing the boat.

0745 Dive Sup Brief, waiting for Chamber to come on line.

0800 Chamber on line.

0817 1st Set of Divers left Surface

0850 Divers on the Surface.

0933 2nd pair of Divers left Surface

1005 Divers back on surface

1040 3rd Set of Divers left Surface

1115 Divers back on Surface

1304 4th Set of Divers left Surface

1339 Divers back on Surface

1501 5th Set of Divers left Surface

1537 Divers on the Surface

1550 Secure from diving operations, Pick up diving flags

1600 Break down Dive Site and Recover Boat

1630 Wash Boat and equipment, fill Tanks at Dive Shop.

1700 SECURE FOR DAY.

Today's dives covered from 210 thru 110. Nothing found.

4-28-98 Tue Cool & Windy 67° Air Water 68°

0700 Launched Boat and Set up Dive Station

0730 Safety Brief

0745 Div. Sup Brief - Chamber is being used will  
NOT be available till 10:30

1040 Chamber is free and on line START Dive ops.

1104 1st Set of Divers left Surface

1138 Divers on Surface

1328 2nd Set left Surface

1417 2nd Set of Divers Surfaces

1523 3rd Set of Divers left Surface

1606 Divers on The Surface

1610 Sent two men to sweep under pier end, lots of  
Junk but no bombs Tide was out

1630. Break down Dive Station and Dive ops for the Day  
Recovered 5EL Boat. Filled Tanks and washed down

Boat. Today's diving covered hours from 110 to 30

1700 Secured for the day.

4-29-98 6020 Cool & mild. 15 Kts of wind

0700 Launched Boat and set up DIVE STATION

0730 Safety Brief

0745 Dive sup Brief - Chambers in use, will not  
be available till 1030. Used time to RECORD  
Spills MSA ACROSS THE RIVER, found pull up  
40 m. round that had been dredge up from  
pier area.

1058 Start diving ops 1st set of DIVER LEFT  
Surface.

1140 DIVER RETURNED TO SURFACE THIS DIVER  
COMPLETED JACK STAY LINES IN AOC 500.

1342 DIVERS LEFT SURFACE DOING A CIRCLE  
SEARCH OF TARGET AREA, LINES 50 FT 50 FT  
OUT FROM PIER J. THIS IS A QC OF AOC  
500.

1404 Divers ON 400 SURFACE

1407 Moved TO PIER G FOR QC AND TO  
RECOVER SMALL BUILDING FOR YARD.

1449 Divers LEFT SURFACE TO DO QC CHECK  
OF AOC 500.

1510 Divers ON THE SURFACE. QC COMPLETED