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CNC CHARLESTON
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COMPLETION REPORT INTERIM MEASURE FOR AREA OF CONCERN 501 (AOC501) WITH TRANSMITTAL CNC CHARLESTON SC

10/20/1998

CNC CHARLESTON

COMPLETION REPORT

INTERIM MEASURE FOR
AOC 501

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

October 15, 1998

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 29405-2106

IN REPLY REFER TO:

Ser: 887

OCT 20 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:

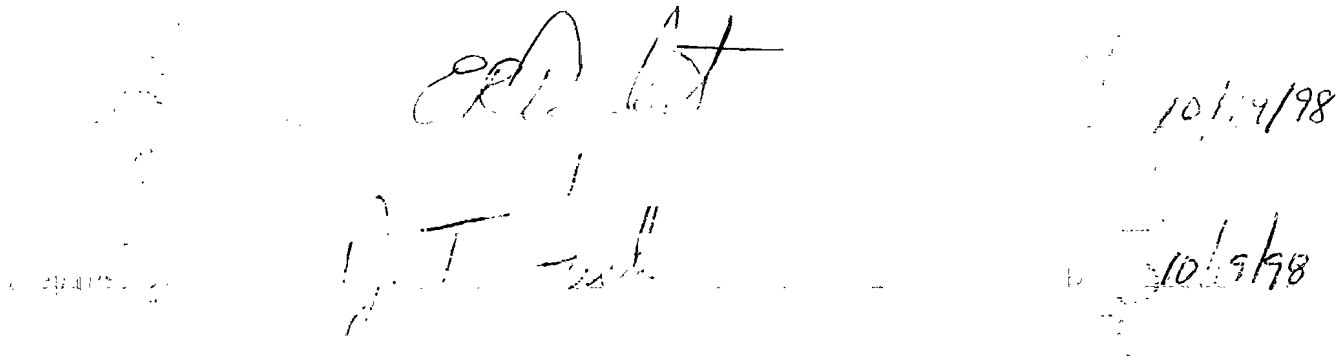
The enclosed interim measure completion report for Area of Concern (AOC) 501 is submitted to fulfill the requirement of Permit Condition IV.D.6 for Permit Number SCO 170 022 560. If the Department of Health and Environmental Control should have any questions, please contact Reece Batten of Southern Division Naval Facilities Engineering Command (NAVFAC) at (803) 820-5578.

Sincerely,

E.R. Dearhart
Director

Encl:
(1) AOC 501 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)



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1899 NORTH HOBSON AVENUE
NORTH CHARLESTON, SC 29405

COMPLETION REPORT

INTERIM MEASURE FOR
AOC 501

NAVAL BASE CHARLESTON
CHARLESTON, SC

Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
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October 15, 1998

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ACRONYM LIST

AOC	Area of Concern
CEERD	Charleston Environmental Engineering and Remediation Detachment
CFR	Code of Federal Regulations
CHASP	Comprehensive Health and Safety Plan
CMSs	Corrective Measures Studies
CSAP	Comprehensive Sampling and Analysis Plan
DDESB	Department of Defense Explosive Safety Board
DERP	Defense Environmental Restoration Program
DET	Environmental Detachment Charleston
DON	Department of the Navy
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ERT	Emergency Response Team
EZ	Exclusion Zone
FM	Frequency Modulated
HAZWOPER	Hazardous Waste Operations and Emergency Response
HW/HM	Hazardous Waste/Hazardous Material
IM	Interim Measure
IRP	Installation Restoration Program
LEL	Lower Explosive Limit
MSDS	Material Safety Data Sheet
NIOSH	National Institute of Occupational Safety and Health
NPDES	National Pollution Discharge Elimination System
OBA	Oxygen Breathing Apparatus
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
PPM	Parts Per Million
PVC	Poly Vinyl Chloride
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFA	Facility Assessment
RFI	Facility Investigation
SARA	Superfund Amendments and Reauthorization Act
SHSO	Site Health and Safety Officer
SOUTHDIV	Southern Division Naval Facilities Engineering Command
SSHSP	Site-Specific Health and Safety Plan
SWMU	Solid Waste Management Unit
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 501. AOC 501 is identified as an area expected to contain unexploded ordnance (UXO). This site is identified on Charleston Naval Base Map H606-285 at coordinates L-6, as depicted in Figure 1, at a depth varying from 20 to 35 feet. The affected area at AOC 501 consists of a 480,000-ft^2 area in the Cooper River between Piers X and Y, west of the inner channel

line in Zone J. The ordnance suspected at AOC 501 consists of two Mark 47 Torpex loaded depth bombs, which were dropped on 20 November 1943.

1.4 AREA OF CONCERN 501 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 501 consisted of searching a 480,000-ft^2 area, which is approximately 1200 feet from the shore at a depth varying from 20 to 35 feet. The Groin Break Wall, the Naval Degaussing Station (Pier Y), the main channel, and the shoreline border the area. Reactives Management Corporation was contracted to perform the search and diving operations. The instrumentation used to perform the search was a Datasonics CHIRP II acoustic sub-bottom profiler, DMG-50 Gradiometer, and the Surfmaster P.I. (Pulse Induction) underwater metal detector. The CHIRP II and the Gradiometer were pulled with a boat in a 25-foot lane pattern parallel to the longest side. The CHIRP II and Global Positioning System (GPS) beacon were mounted vertically on the stern of the boat. The CHIRP II bounces frequency modulated (FM) acoustic signals from two channels, 2 to 8 kHz and 8 to 23 kHz, off the bottom of the search area and analyzes the returned waves by computer. By simultaneously using multiple frequencies, the CHIRP II profiles such bottom and sub-bottom conditions as sediment layers, objects, clay lenses, mooring blocks, depth bombs, and other physical and thermal based density gradients. Sub-bottom penetration depends on the density of the bottom sediment(s) but extends from approximately 10 feet to 40 feet. The plot of the returned energy is actually a curve or parabola with its center or focus being the location of the target as the CHIRP II approaches and leaves the target. The GPS system records this location for future reference. The DMG-50 Gradiometer uses a pair of solid state magnetometers to detect changes in magnetic gradients and analyzes those changes with microprocessors. The magnetic gradiometer and weights were inserted inside poly vinyl chloride (PVC) tubing and pulled by a boat using a rope to insure that the gradiometer was on or near the bottom. The gradiometer was used to help characterize density variations detected by the CHIRP II and as a quality assurance check on the acoustic sub-bottom profiler, CHIRP II. A geophysical analyst interpreted all electronic CHIRP II and DMG-50 search data. Seven anomalies were selected as targets based on the geophysical analyst's interpretation of the data. Three additional targets were chosen as quality assurance checks and will be discussed in section 2.2. The seven targets were reacquired by GPS and were marked with an anchor and buoy line. Explosive Ordnance Disposal (EOD) divers using a hand held Surfmaster P.I., which uses the

detection principle of pulse induction and is capable of detecting metal objects to a depth of four feet below the river bottom, made dives at each buoy. The dives consisted of a six-foot diameter circle and a twelve-foot diameter circle. Items were recovered at five of the seven target locations (see Appendix B). The Surfmaster did not detect any ferrous or non-ferrous metallic objects at Targets 4 (T-4) or Target 6 (T-6). Items found included: Oxygen Breathing Apparatus (OBA) canister, wood with embedded nails, pliers, angle iron, spike, large section of pipe, metal clad line, channel beam, and several bolt clumps. No ordnance was discovered during the search of the 480,000-ft^2 area.

2.2 PERFORMANCE OF QUALITY ASSURANCE/ QUALITY CONTROL. Three random dive locations were chosen to insure quality assurance. No metal objects were found at two of the three locations (R2, R3); but at R1, a 2″ x 8″ x 12″ piece of channel beam was found. The diver also reported that another piece of beam was still on the river bottom in the same vicinity. The Detachment felt that this discovery would have discredited the survey if Reactive Management Corporation had not performed additional dive time to explain the channel beam. After additional diving at R1, the piece of channel beam that was reported after the first dive turned out to be several bolts in a row with hard clay adhered to them (see Appendix D section 3d). The DMG-50 gradiometer also was used to verify dense variations in the river bottom. The Detachment felt that the additional explanation of R1 in Addendum 2 in Appendix D fully explains the reason why a small piece of channel beam could be missed and that the quality of the survey is fully satisfactory.

2.3 OBSERVATIONS NOTED The divers reported that the sediment on the bottom varied from hard packed sand to very silty mud. The divers also reported that visibility was from several inches to zero depending on what type of sediment they were in. The swift tide and winds made it difficult to maneuver the boat in a straight line and it also made it difficult to swim on the bottom.

2.4 PROBLEMS ENCOUNTERED. The anchors and buoy line dropped at each target were based on the GPS recorded during the survey. Reacquiring the same location sometimes took several attempts when placing these buoys.

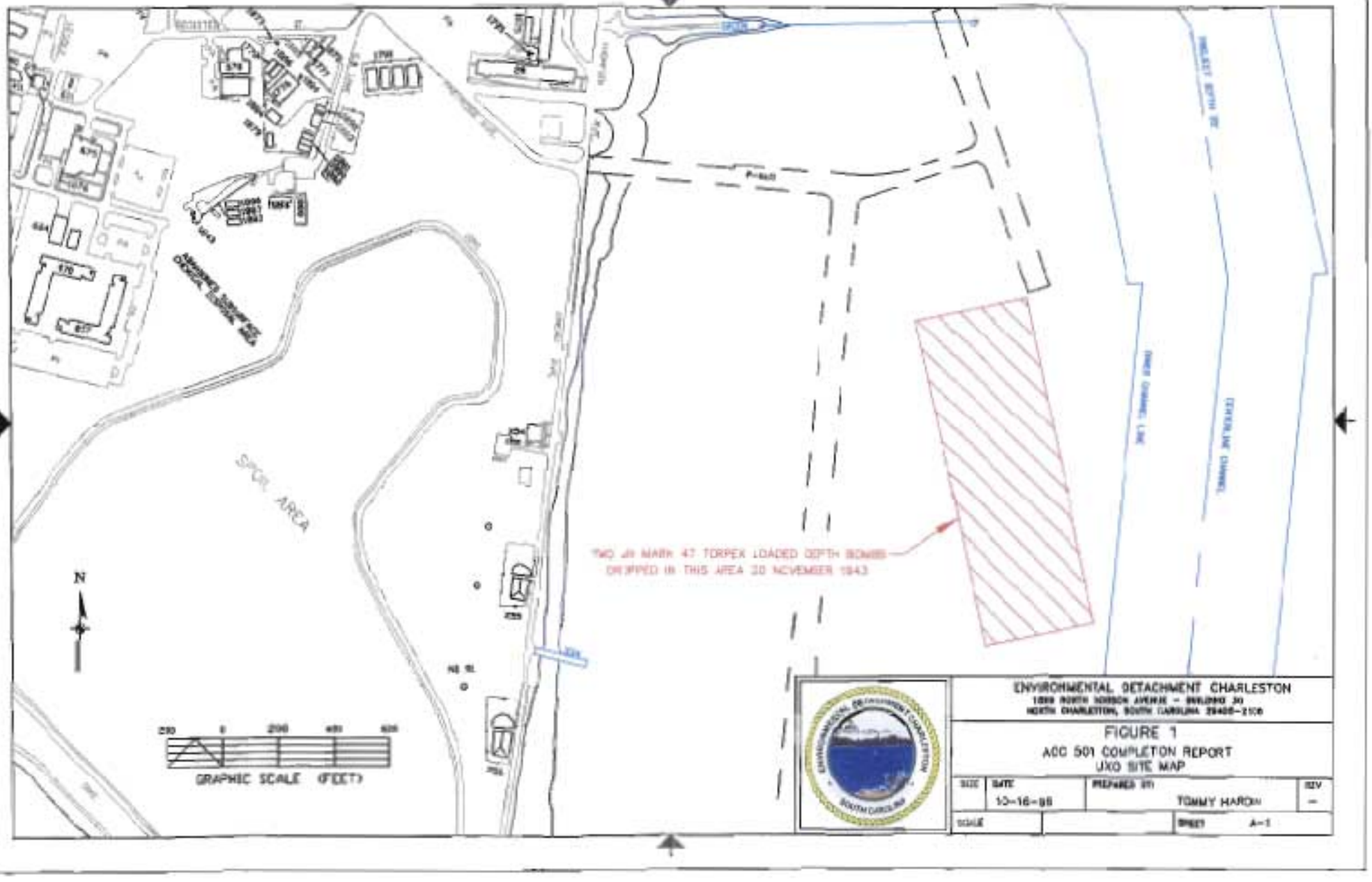
3. INTERIM MEASURE OUTCOME.

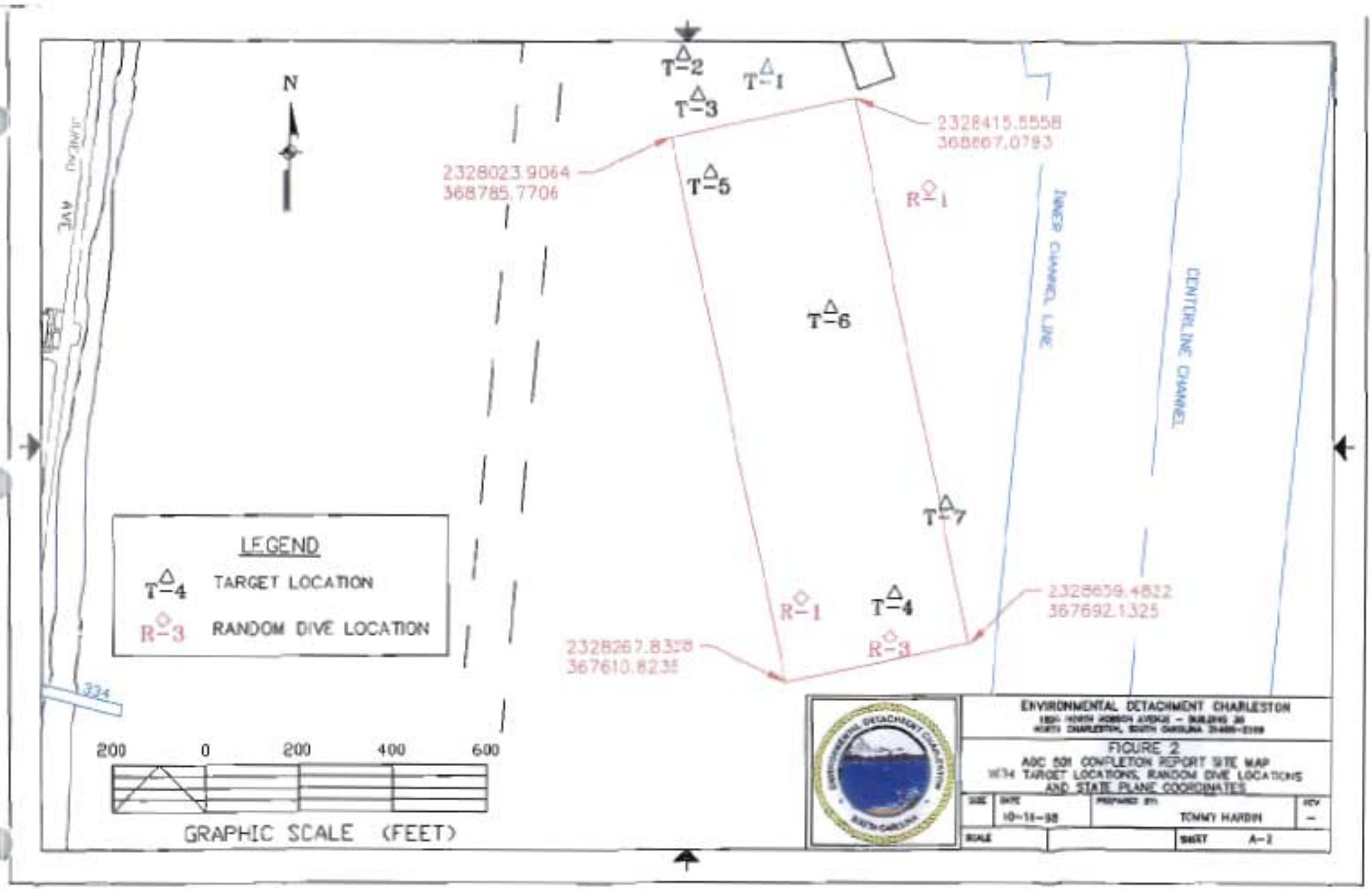
3.1 SITE CONDITIONS FOLLOWING COMPLETION OF WORK. Following the completion of all site work and data review on September 16, 1998, the Detachment had investigated all potential UXO targets and proved through geophysical surveys that no other potential UXOs exist within four feet from the river bottom at AOC 501. 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 501.

APPENDIX A
Site Maps


SPOIL AREA
TWO JU MARK 47 TORPEX LOADED DEPTH BOMBS
DROPPED IN THIS AREA 20 NOVEMBER 1943
N
GRAPHIC SCALE (FEET)
ENVIRONMENTAL DETACHMENT CHARLESTON
FIGURE 1
ACC 501 COMPLETON REPORT
UXO SITE MAP
10-16-98
TOMMY HARDIN
A-1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T-1
T-3
T-5
T-6
T-7
T-4
R-1
R-3
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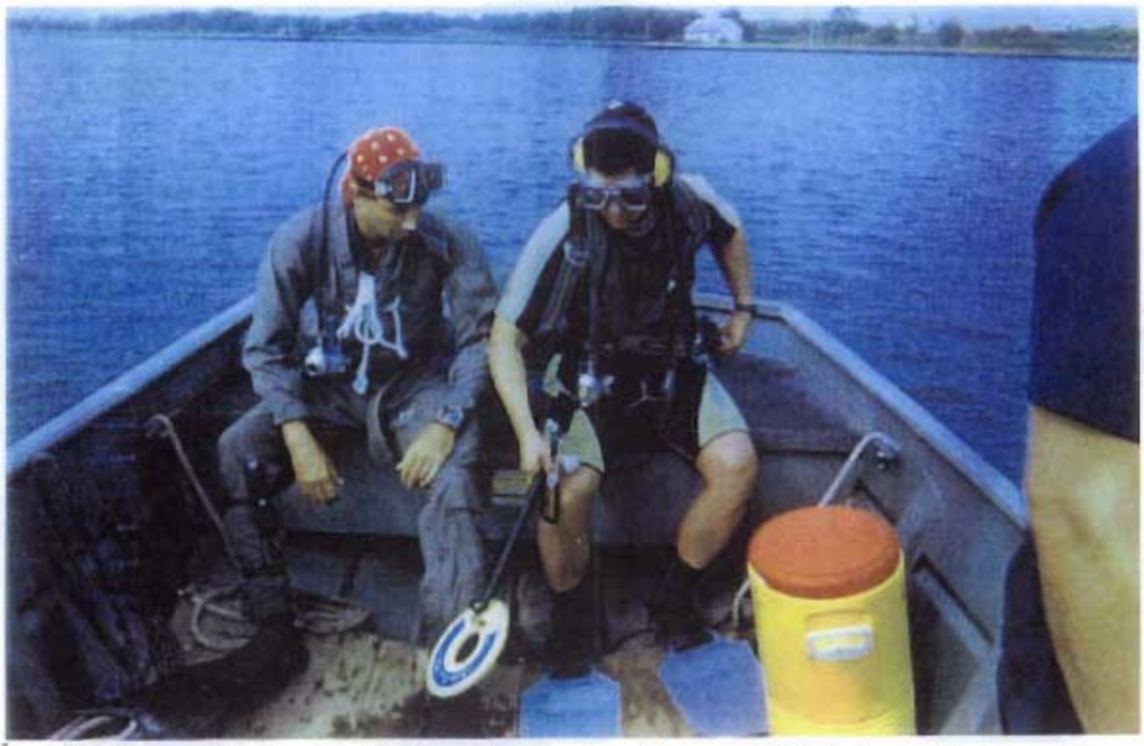
INNER CHANNEL LINE
CENTERLINE CHANNEL
JAMES AVE
334
LEGEND
T-4 TARGET LOCATION
R-3 RANDOM DIVE LOCATION
200 0 200 400 600
GRAPHIC SCALE (FEET)
ENVIRONMENTAL DETACHMENT CHARLESTON
FIGURE 2
AOC 501 COMPLETION REPORT SITE MAP
WITH TARGET LOCATIONS, RANDOM DIVE LOCATIONS
AND STATE PLANE COORDINATES
10-15-98
TOMMY HARDIN
A-2

APPENDIX B
Photographs

The Geophysicist watches the computer monitor to help guide the boat driver during the survey.

The CHIRP II mounted to the stern of the boat prior to launching the boat.

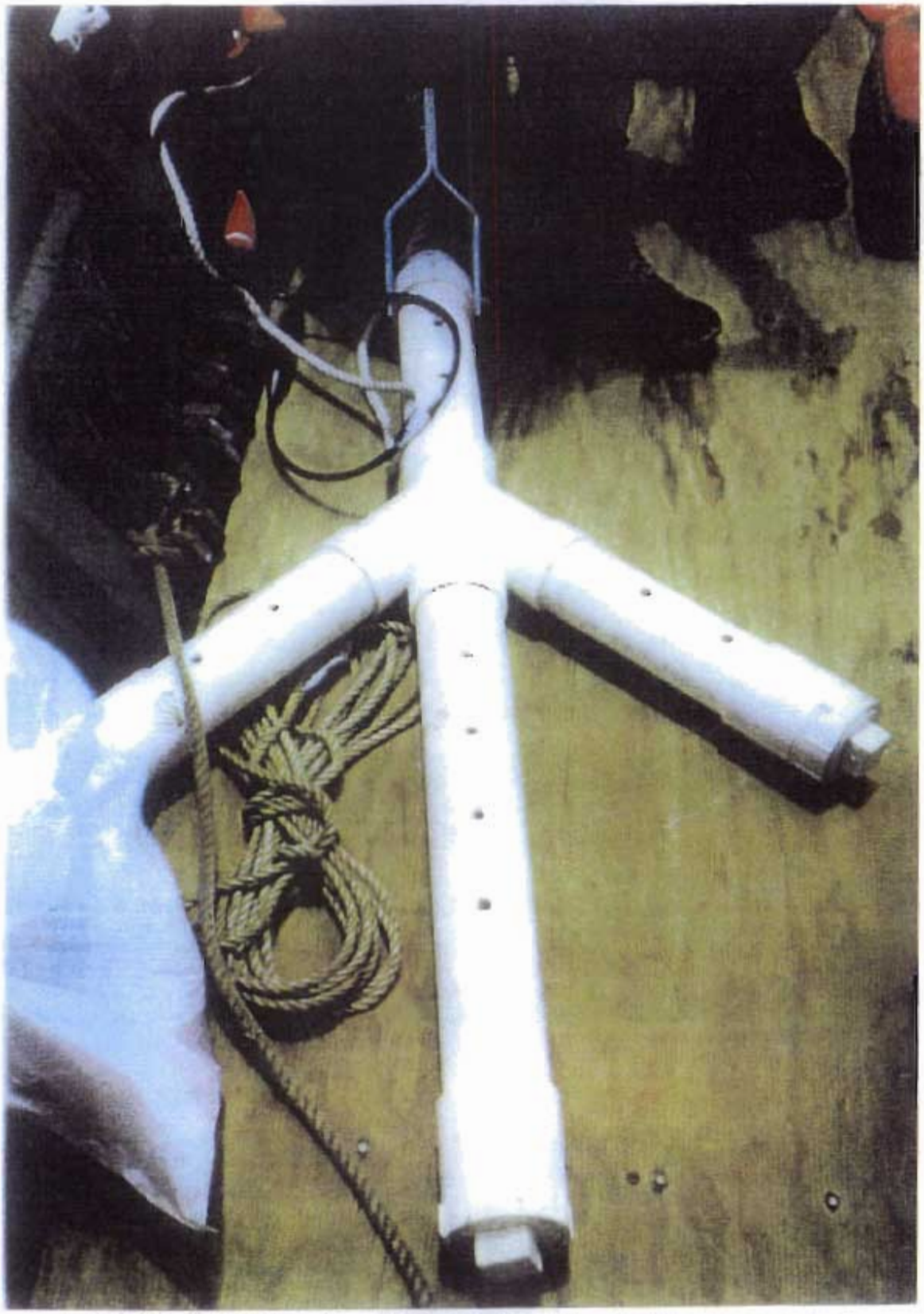


EOD divers testing the Surfmaster under water metal detector prior to a dive.

Divers are exiting the Cooper River at AOC 501.

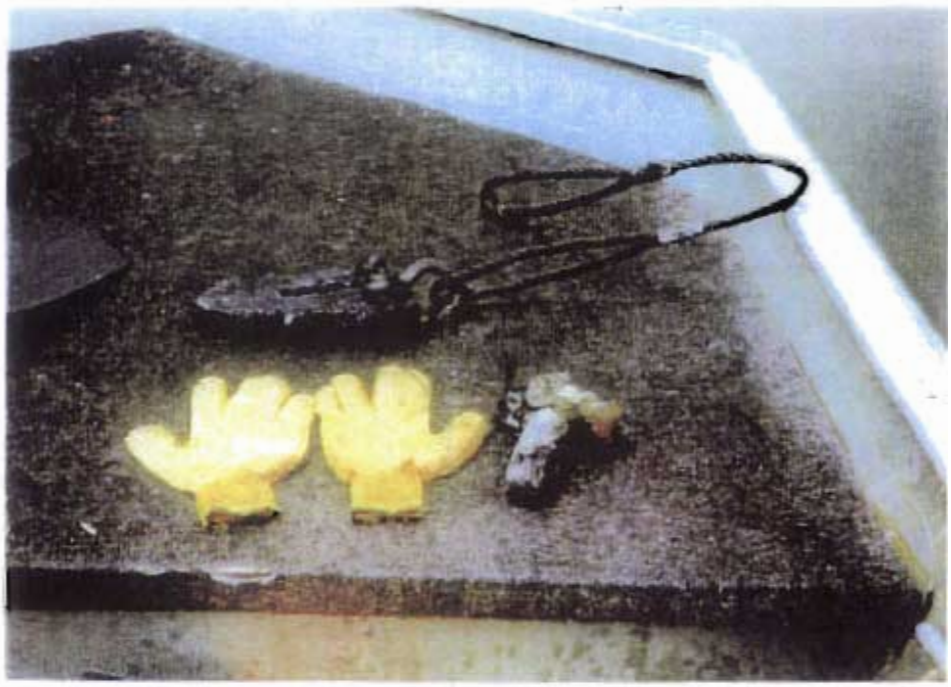
Looking south at AOC 501 with the Cooper River Bridge in the background.

EOD diver entering the water with the Surfmater under water metal detector.



The DMG-50 Gradiometer, which is inside of the PVC towing container.

A badly corroded oxygen breathing apparatus was found at Target 1 (T-1).



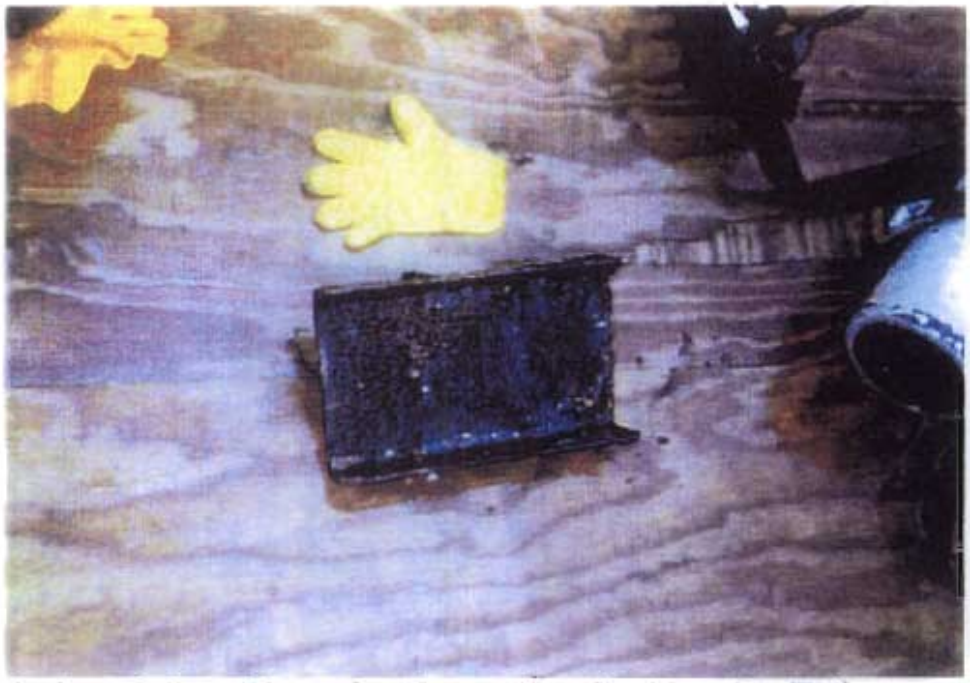
A shackle recovered at Target 1(T-1) location.

A piece of wood with embedded nails, beer can, and pliers are shown above was found at Target 2 (T-2) location. Also found but not recovered was a piece of angle iron.

One of many corroded three-dimensional bolts found at random dive 1 (R-1).

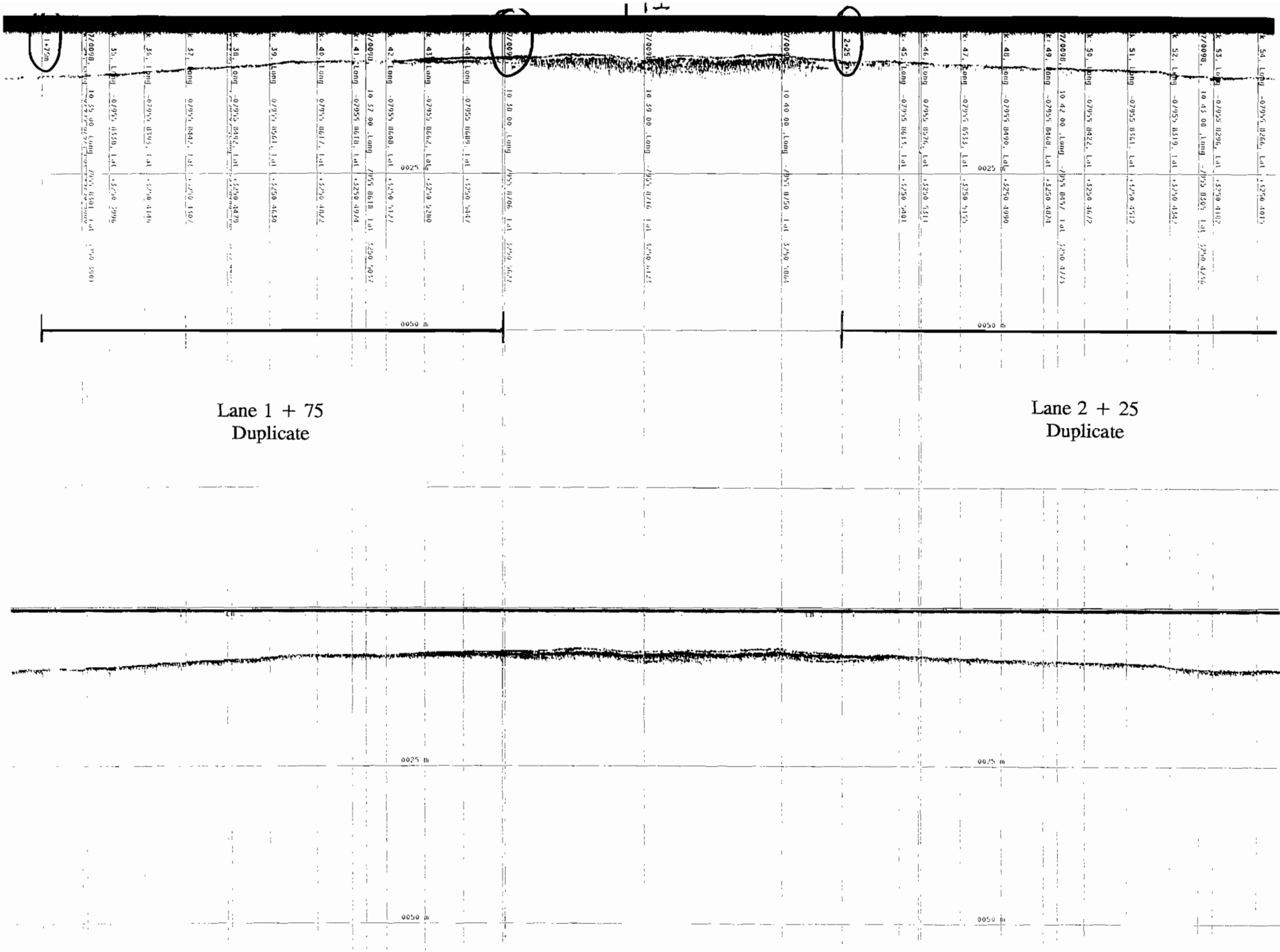
A rusty pipe approximately 1" dia. x 30" long was recovered at Target 5 location.

Four pieces of pipe approximately 1" dia. x 30" long was found at Target 7 (T-7) location.



A piece of channel beam found at random dive1 location (R-1).

APPENDIX C
AOC 501 Geophysical Survey Graph Plots



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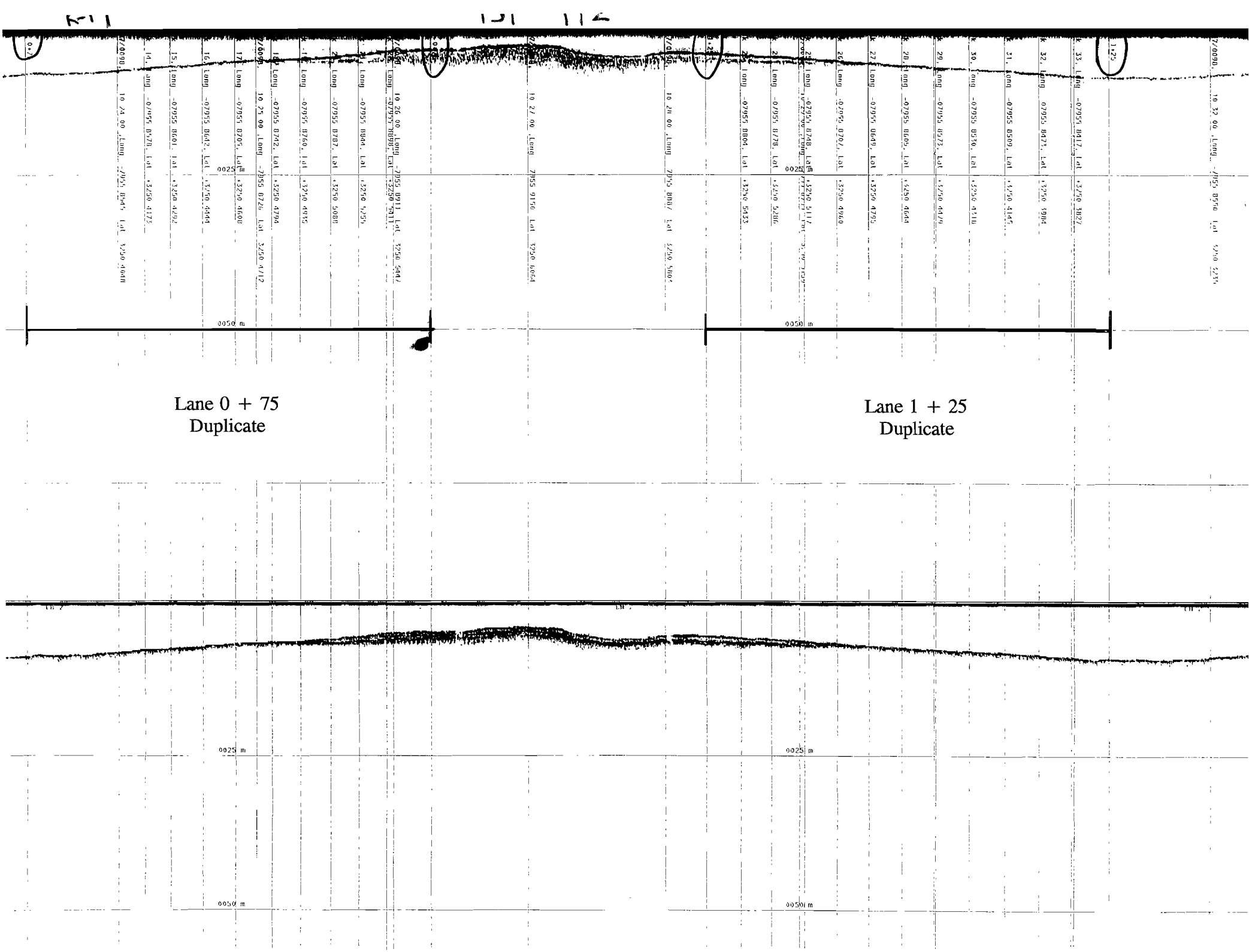

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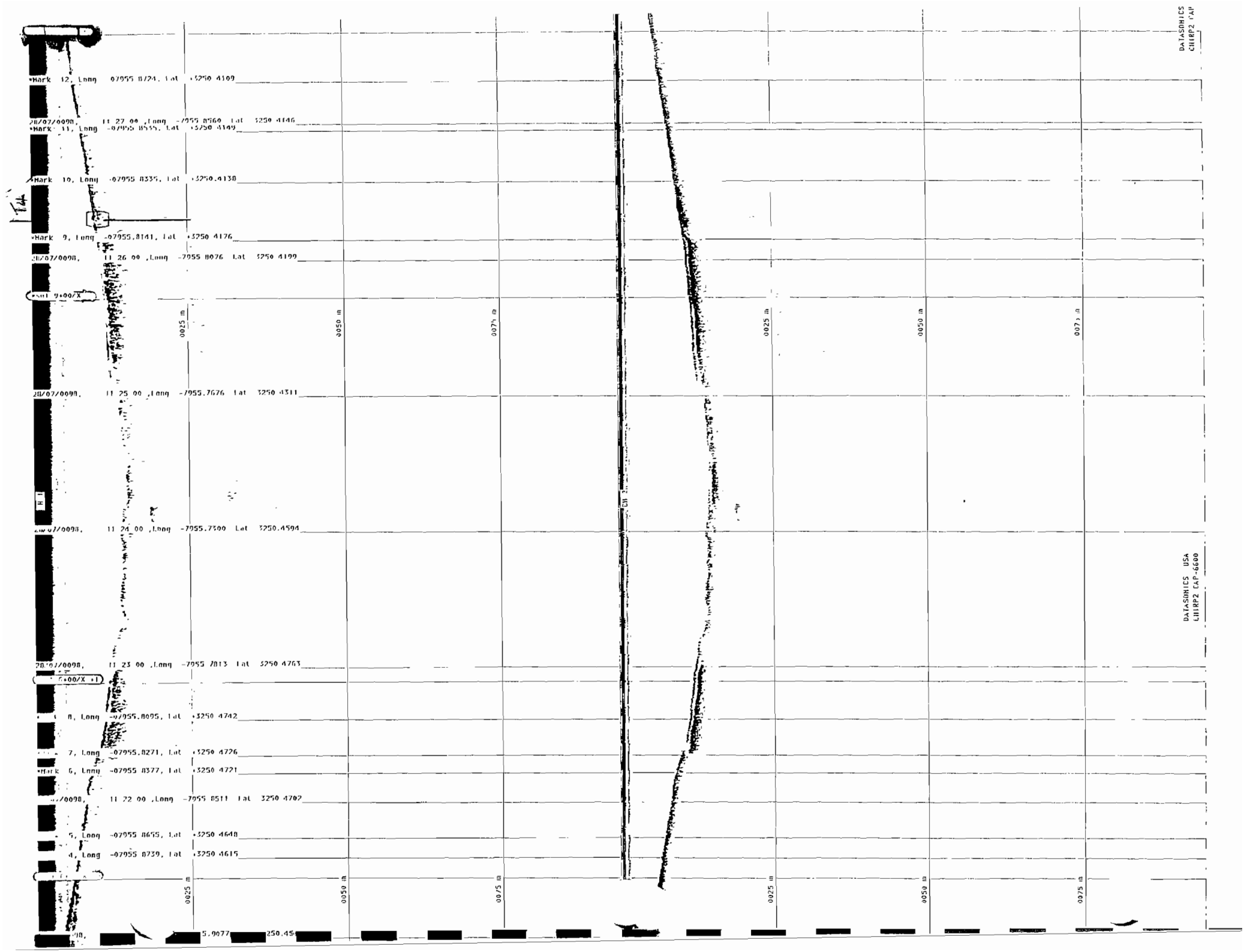
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28/07/0098, 11 24 00 ,Long -7955.7300 Lat 3250.4504
28/07/0098, 11 23 00 ,Long -7955.7813 Lat 3250.4763
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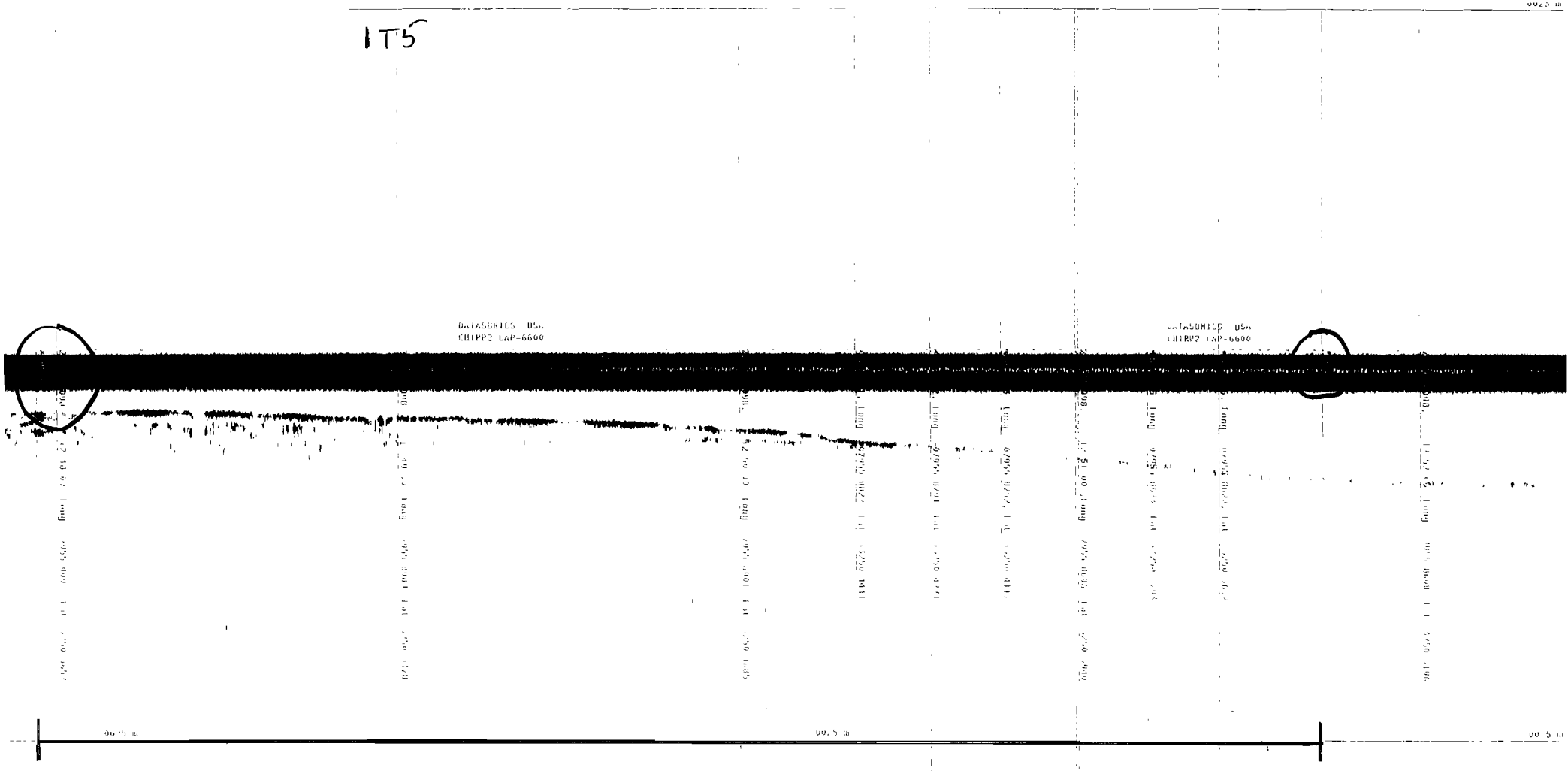
0025 m
0050 m
0075 m
DATASONICS
CHIRP2 CAP--6600

IT5



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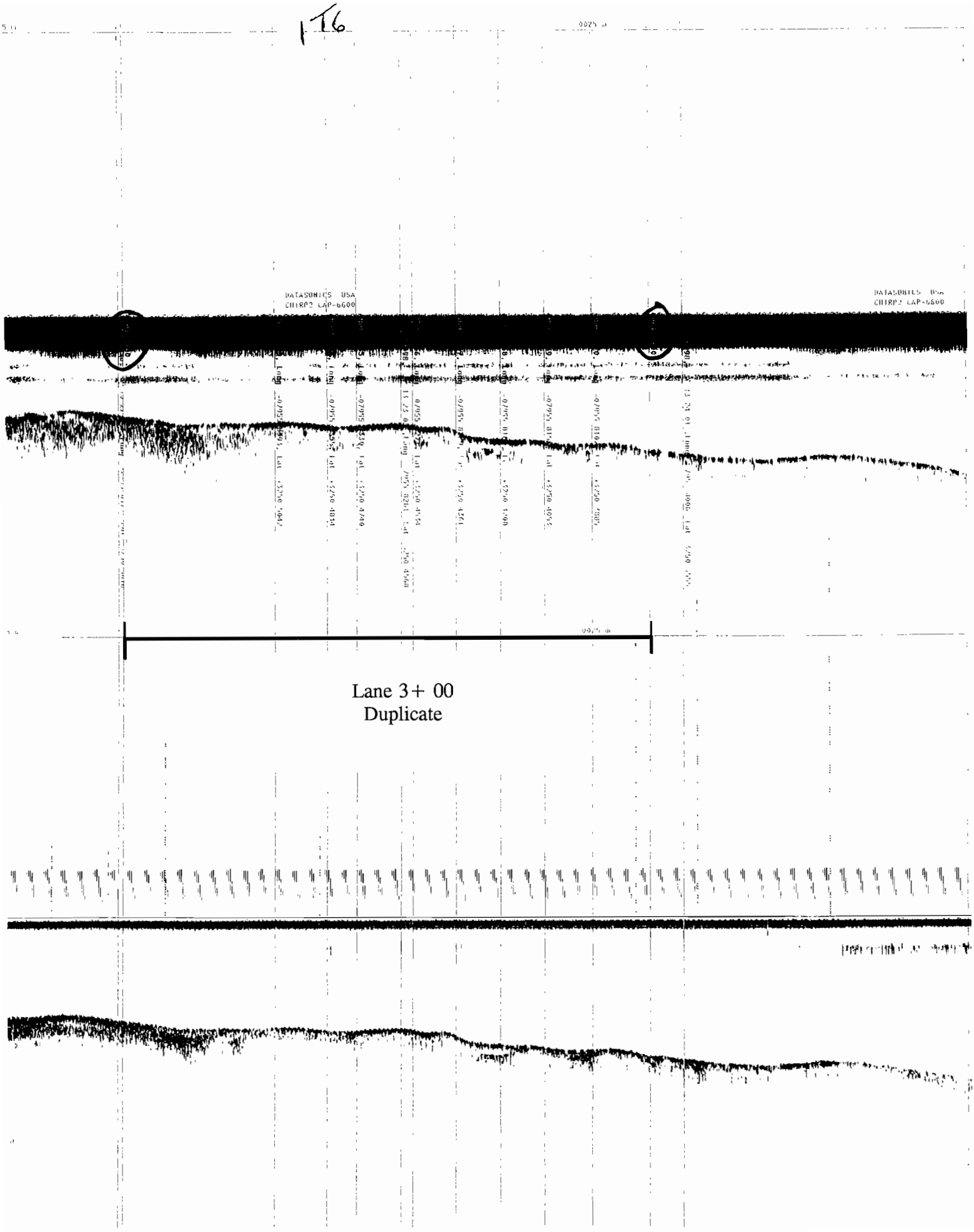

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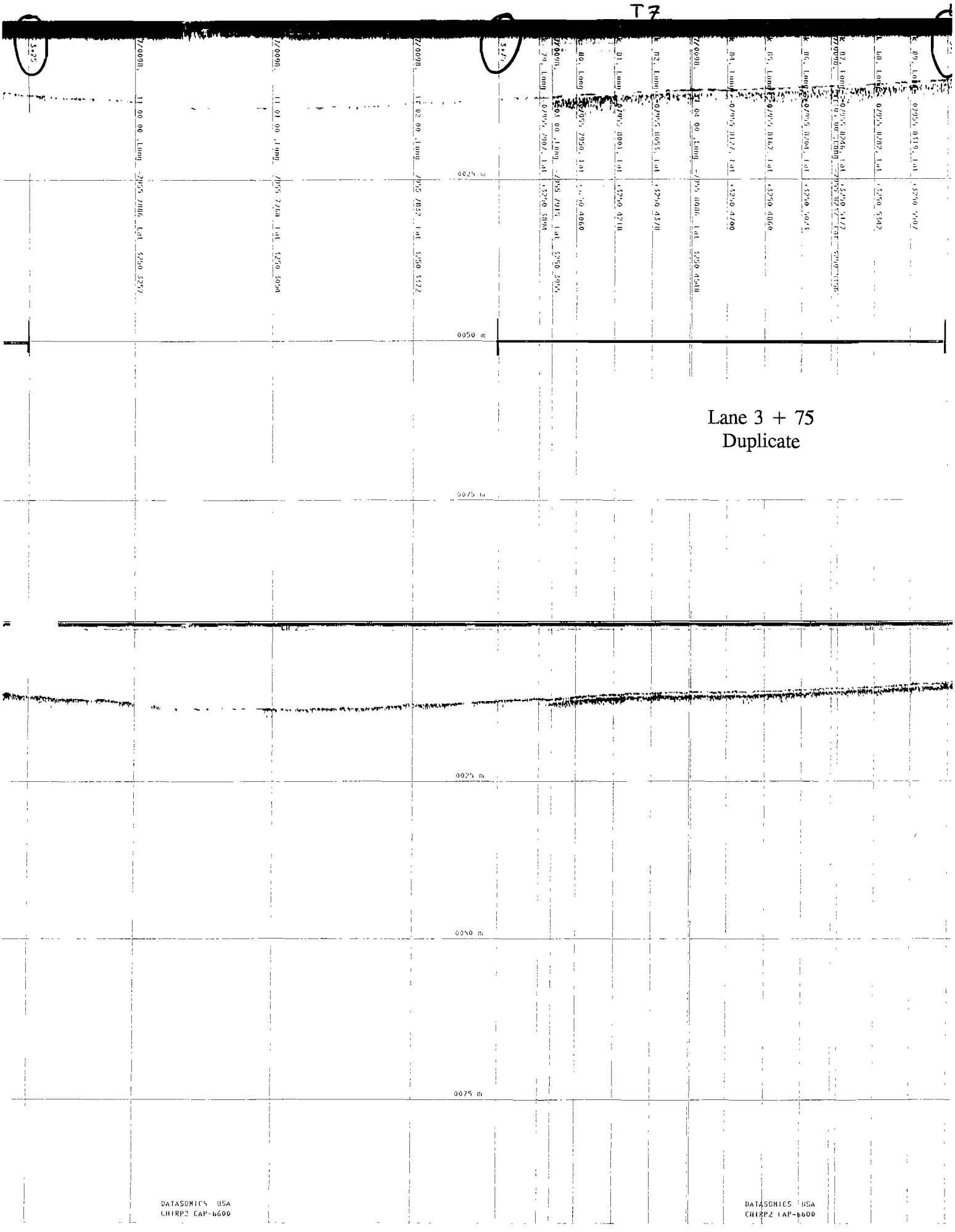

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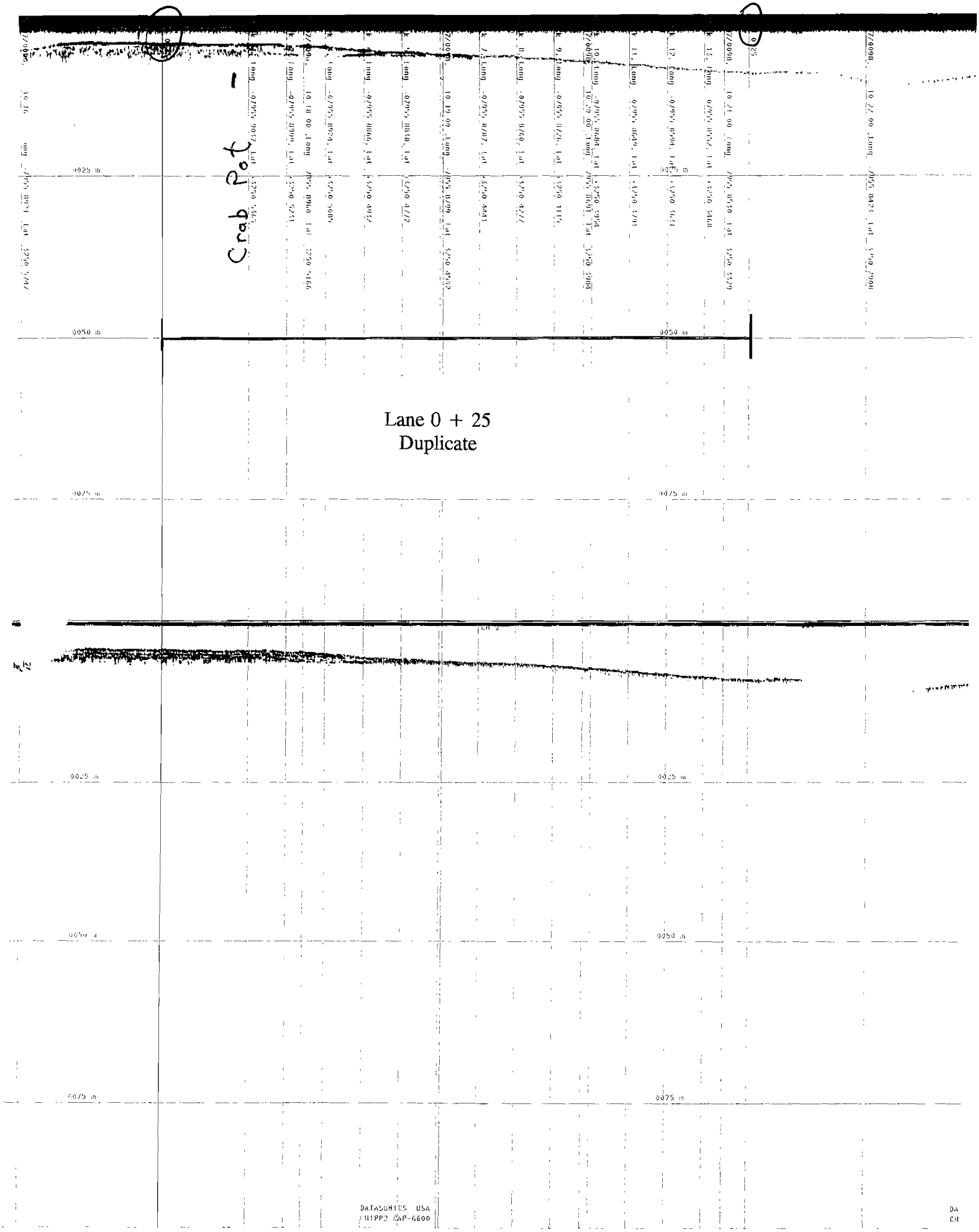
Crab Pot
Lane 0 + 25
Duplicate
DATASONICS USA
UHPP2 CAP-6600

APPENDIX D
Reactives Management Corporation
Final Report

Supervisor of Shipbuilding,

C & R, USN

Contract No. N62678-98-C-0001

Final Report

Prepared by:

Reactives Management Corporation
1025 Executive Blvd., Suite 101
Chesapeake, VA 23320

(757) 436-1033

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LIST OF FIGURES & ATTACHMENTS

1. Purpose

The purposes of this report are to:

a. Comply with the reporting provisions ¶ C.19.1 of Contract N62678-98-C-0001.

b. Report the data generated during electronic and diving searches done under this contract from July 27 through August 13, 1998.

c. Discuss the data and what it means in terms of locating and identifying in-sediment objects, especially unexploded ordnance (UXO).

d. State conclusions about the possible locations of UXO in Area of Concern (AOC) 501 of the former Charleston Naval Base.

2. Background Information

a. CHARLESTON NAVY BASE. The Charleston Navy Base began as a small ship repair facility during the Civil War. It was expanded in 1901 when nearly 20,000 acres of land was acquired. The shipyard facilities and capabilities were greatly increased as result of the two world wars. Eighteen ships were built here during WWI and 229 ships were built during WWII. In the post WWII years, Charleston Naval Shipyard remained one of the largest facilities for major overhauls and conversions of ships, including nuclear powered submarines. In the early 1990's, Charleston Naval Base was the third largest home port in the United States.

Also in the 1990's, Charleston Naval Base was put on the Base Realignment and Closure list. Mission closure of the base was October 1, 1995, marking the end of a long, productive era of service to the U.S. Navy operating and war-fighting forces. At that time, full closure and disestablishment activities of the Naval Base and Naval Station began in preparation for eventual base reuse.

In preparation for full closure, a Resource Conservation and Recovery Act (RCRA) Facility Investigation in was performed in 1995. During the investigation, a waterborne site, labeled Area of Concern (AOC) 501, was identified for further investigation. AOC 501 is an area approximately 400' x 1200' in the Cooper River known to have swift currents and poor visibility. The area is bordered by the Groin Break Wall and the Naval Degaussing Station and the main channel of the Cooper River and the shoreline. It was believed that two Mark 47 Torpex loaded depth bombs may have been dropped in AOC 501 in November, 1943. For general, planning purposes during this project, it was assumed that the sediment(s) on the bottom of AOC 501 had a density ranging from approximately 60 pounds per cubic foot (lb/ft^3) to approximately 110 lbs/ft^3.

b. CONTRACT/ PROJECT. Work done under this contract is based on Reactives

Management Corporation's response to Solicitation No. N62678-98-R-0069. Contract N62678-98-C-0001 was awarded on April 22, 1998. The first stage, submission of a dive plan, was completed on May 5, 1998. The second stage was completed from July 27 to August 13, 1998. Electronic searches were conducted on July 27 and July 28. Detailed dive planning was completed on July 29, 1998. Initial diving operations were conducted on July 30, July 31, and August 1. Additional dives were completed on August 11 - 13, 1998.

c. MK 47 DEPTH BOMB. The items of concern for this project were two Torpex loaded Mark 47 depth bombs. The Mk-47 is a cylindrical bomb with a flat nose and conical tail. The body consists of three pieces of metal tubing, welded together. There are both a nose fuze well and a transverse fuze well, welded in place 15 inches from the nose. The bomb is equipped with a drum tail. Looking from the tail toward the nose, the tail 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 aft end of the bomb and to the drum shroud. The fin assembly is bolted to the base of the bomb. As with many World War II era bombs, there are two suspension systems. A two lug suspension is diametrically opposite a one lug or banded suspension point. Torpex, the explosive filler, exists in several different forms. All forms are a mixture of RDX (approximately 41%), TNT (approximately 40 %), and aluminum powder (approximately 18%).

The bomb is shown in Figure 1. The general dimensions of a Mk-47 are:

Length:
- Overall: 49.9 in.
- Body: 27.8 in.
- Tail: 24.6 in.

Diameter:
- Body: 15.0 in.
- Tail: 15.4 in.

Weight:
- Total: 355 lbs
- Steel: 103 lbs
- Torpex: 252 lbs

Density of Torpex: 1.81 — 1.82 g/cc ($\pm$113 — 113.5 lb/ft^3)

Bomb Body Thickness: 0.060 in.

The bomb when new was olive drab in color with a 1 in. yellow band around the nose, a 1 in. band on each side crosswise around the fuze well, and a ¼ in. band around the center of gravity. Torpex loaded bombs had the weight and Mark number stencilled in blue. It was anticipated that these original colors would have degraded.

d. CHIRP II. The CHIRP system used on this project was the Datasonics CHIRP II acoustic sub-bottom profiler. The systems are called "chirp" because workers can hear the change in frequencies as the unit works — it literally chirps. The CHIRP II bounces frequency modulated (FM) acoustic signals from two channels, 2 to 8 kHz and 8 to 23 kHz, off the bottom of the search area and analyzes the returned waves by computer. The higher frequencies produce good resolution while the lower frequencies produce better bottom penetration. Differences in density(s) between objects or targets and sediments on and in the bottom are detected. These differences or anomalies are then plotted on a graph. By simultaneously using multiple frequencies, the CHIRP II profiles such bottom and sub-bottom conditions as sediment layers, objects (clay lenses, mooring blocks, depth bombs), and other physical- and thermal- based density gradients. Sub-bottom penetration depends on the density of the bottom sediment(s) but extends from approximately 10 feet to 40 feet. There are practical detection limits based on the width of the target and the difference in densities between the target and background. Smaller targets generally are harder to detect. Targets against a heterogeneous background of varying densities are harder to detect. Targets with densities similar to the background are harder to detect. (Side scan sonar equipment was considered and eliminated due to the lack of ability to penetrate the riverbed.)

The CHIRP radiating element, or fish, and Global Positioning System (GPS) beacon, are mounted vertically on the stern of the boat. As the boat approaches a target, the return wave from leading edge of the emitted acoustic radiation is recorded. As the boat (actually the CHIRP emitting element) passes over the target, the returned energy shows an apparent change in location because the object is nearer the CHIRP. As the boat goes away from the target, the returned energy plot again shows the apparent change in location because the object is farther away from the CHIRP. The plot of the returned energy — approaching, near, receding — forms a curve or parabola with its center or focus being the location of the target. The GPS system records this location for future reference.

e. GRADIOMETER. The gradiometer used on this project was the Hydrographic Survey Products Digital Marine Gradiometer model DMG-50. The DMG-50 uses a pair of solid state magnetometers to detect changes in magnetic gradients and analyzes those changes with microprocessors. Using a magnetic gradiometer on this project provided two benefits. First, the gradiometer was used to help characterize density variations detected by the CHIRP II. Second, the magnetic gradiometer technique was used as a quality assurance check on the acoustic sub-bottom profiler, CHIRP II.

f. WHITE'S ELECTRONICS, INC. SURFMASTER P.I. (PLUS). The Surfmaster P.I. (Pulse Induction) was selected for use on this project because the White's Pulse 2000 Underwater Metal Detector cited in §4.2 of the Solicitation is no longer in production. The Surfmaster P.I. (Plus) was recommended by the manufacturer as the replacement. The unit consists of a handle assembly, a detecting loop, a control box, and headphones. A pulse induction instrument is inherently biased toward ferrous over non-ferrous metals. As the Mk-47 bomb case and tail assembly weigh more than 100 pounds, this bias was considered a positive factor. The Surfmaster P.I. (Plus) is intended for underwater use and can detect

objects at depths up to 4 feet. It is very sensitive to small bits of iron. A reasonable field check is a gold or silver ring or wrist watch. These smaller, nearby objects are harder to detect and reasonably simulate such a larger, farther, ferrous object as a Mk-47 bomb case and tail assembly.

To make operations more efficient, the handle was removed from the search head. The control module was worn on either the diver's weight belt or a separate nylon belt. The search head was held by the mounting rod that is normally inserted into the handle. This configuration allowed the diver to swim more efficiently, control the position and attitude of the search head, an cover an area approximately four (4) to eight (8) feet wide. The diver would enter the water and search with the control module on his waist, the headset on his ears, and the search head and mounting rod in his hand.

3. Search Procedures

a. POSITION LOCATION. Locations during this project were determined by GPS equipment. The four corners of the search area were defined (see Figure 2). Initial search lanes within the area were established at 50 foot intervals. To insure better coverage and improve the quality of the data, secondary search lanes were established at 25 foot intervals. Because of real world limitations on the equipment, it was assumed that the CHIRP acoustic cone was only 80°, not the advertised 110°. The width of the cone on the bottom — the actual area searched — is listed in Table 1. The average water depth varied between location and tide state but was in the 20 to 35 feet range. The cone width or search width at these depths was approximately 48 to 85 feet. The 25 foot lane pattern therefore insured coverage of the bottom in the search area. Actual coverage of the search area is shown in Figure 3 through Figure 6.

Table 1: Acoustic Cone or Search Width as a Function of Water Depth

Water Depth (Feet)	Cone (Search) Width (Feet) (approximate)
15	35
20	48
25	60
30	70
35	85

To confirm positions, a buoy would be set. The boat would then move away from the buoy and re-approach from a different direction. At one random dive location (R1)

discussed below, it was known that the buoy was set five (5) feet from the designated location. As the search area around the buoy was a circle with a radius of twelve (12) feet, this was considered an acceptable error. A diver, to clear an underwater search line, picked up the buoy, moved the search line under it, and reset the buoy. When it was picked up, the buoy was shown to be six (6) feet from the designated location. Based on this observation and the inherent accuracy of GPS receiver with an integrating beacon antenna, it was assumed that all positions were described to within less than six (6) feet. This was considered an acceptable and manageable error.

b. CHIRP II. The CHIRP and GPS systems were mounted in a 24 foot boat as discussed in the Background Information, above. Figures 8 and 9 show the CHIRP in operation. The cardboard shipping case and tarp were set up to reduce glare on the computer display screens. Data was stored electronically during the day and printed and analyzed at night. Parabolas or other areas of concern were identified, their latitude and longitude locations determined, and marked as target dive locations for the next day's work.

As a quality assurance check, three runs with the CHIRP and DMG-50 (see below) across the search area perpendicular to the main search lanes were conducted. As the search area was approximately 1200 feet long, the transverse or QA checks were at 300, 600, and 900 feet from the base line or northern end of the search area. There were no results on these QA runs different than the results on the main search lanes or runs. That is, no objects approximately the size, shape, and acoustic and magnetic density of a Mk-47 depth bomb were located.

c. GRADIOMETER. The DMG-50 (see Figure 10) was used primarily to assist in identification of CHIRP targets and as a magnetic quality control check on the acoustic sub-bottom profiler. As with the CHIRP, the search area was searched in lanes at 25 foot intervals, with three shorter, perpendicular runs as a quality control check on the longer search runs. No objects larger, both in physical size and magnetic signature, than a crab pot were detected either during search or during the QA runs.

d. DIVE OPERATIONS. A weight (the clump) with a buoy line was set as near as possible to the target location, using a Garmin GPS III with integrating beacon to determine positions. The clump set was within three to five feet of the GPS mark determined by the CHIRP system. Exact positions were almost impossible to achieve due to the effect of the current on the buoy line and boat drift due to current and wind. Two divers would descend the buoy line. One diver, with a line attached to his equipment, would sit on the clump. The second diver would swim to the end of the line and cover the bottom from the clump to as far as he could reach with a hand-held White's Electronics, Inc. Surfmaster PI (Plus) metal detector. This inner circle was considered to be a six (6) foot search circle with its center the clump. When the search diver had completed one circle around the clump, the line would be extended an additional six feet. The search diver would then swim in another circle. That circle was considered to be a twelve (12) foot circle, with its center at the

center of the inner circle or clump. The 12 foot diameter for the outer circle was selected because it accounted for inaccuracies and vagaries in positioning the buoy and could be readily and reliably searched by one diver with a hand held instrument. If the diver did not detect anything within five or six fin kicks, he would check his ring or watch with the hand-held metal detector to insure it was functioning. The White's Surfmaster PI will detect both gold and silver rings and watches. If either the clump sitter or the search diver felt that visibility or current rendered the search unreliable, the operation was stopped and the area re-searched the next day. Figure 11 represents the search patterns at each target and random dive location. Figures 12 through 19 show divers preparing and recovering from dives.

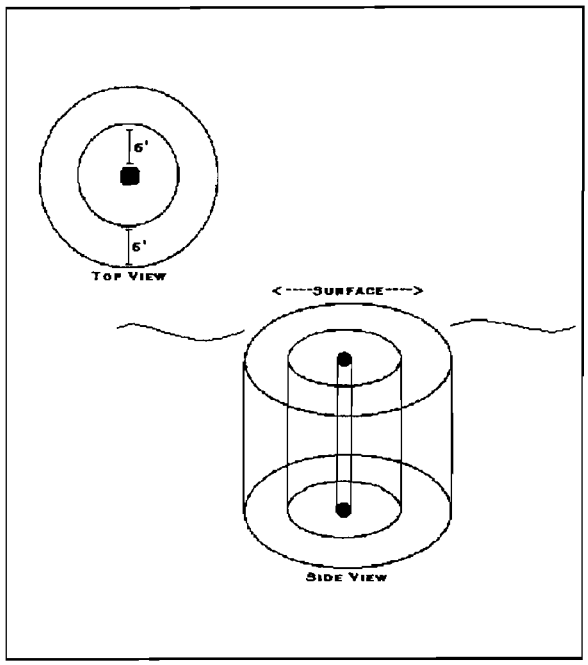


Figure 11 — Search Pattern

All electronic (CHIRP and DMG-50) search data were interpreted by a geophysical analyst. Seven (7) anomalies were selected as targets based on the geophysical analyst's interpretation of the data, sampling theory, and statistics. In addition, three (3) random dives were selected. These locations were not truly random but were not based on any specific electronic data. One of these random dive sites (R2) was selected in the north-east corner of the AOC. The location was selected because CHIRP coverage, while adequate, was not as dense as at other parts of the AOC. Another random site (R3) was selected near the center of the AOC, where CHIRP coverage was dense, and was used to confirm the negative CHIRP and DMG-50 findings.

The first random dive location (R1) was selected relatively near the southwest corner of the AOC because the targets identified by the geophysicist were all to the north. This is probably the most important dive location of the project and will be discussed in detail here, not in the data section below. As described above, a buoy was set and a two man dive team descended. Original visibility on the bottom was approximately eight (8) inches. As the search diver moved around the search circles, visibility, due to loose sand from bottom sediments, decreased to zero. The search diver located a channel beam section (see data, §4.b below) approximately two (2) inches deep, eight (8) inches wide, and twelve (12) inches long. This section was placed in the hands of the clump diver, later taken to the surface, measured and photographed, and discarded.

The search was continued. The diver then detected other anomalies with the Surfmaster. The bottom at R1 is hard packed sand. The diver could sense dense (ferrous and/or non-ferrous) anomalies with the Surfmaster that seemed to be approximately two (2)

inches high. The anomalies were essentially continuous and seemed to begin in the outer, twelve foot, circle, cross the inner circle, and end near the other side of the outer circle for an estimated total length of twelve (12) to fifteen (15) feet long. It was assumed that these touch- and Surfmaster- anomalies were another steel channel beam. Because bottom visibility was at or near zero and no long or large objects were expected based on the CHIRP and DMG-50 results, neither diver was wearing a compass.

When the GPS data were examined, they revealed that the CHIRP search in this area was light and that at the location where the beam was recorded, anomalies would have been detected by the edge of the cone, not the center for an optimum search. In addition, the orientation of the channel or beam would determine how the data appeared on the CHIRP print-out. A north-south orientation, roughly along the CHIRP search path, would have appeared as a layer on the bottom, not a specific object in the bottom. An east-west orientation, roughly perpendicular to the CHIRP search path, on the other hand, should have produced the parabolic response described above. If the CHIRP had not recorded *any* data, the reliability of the electronic search would be in question. A false negative report would be unsatisfactory; a bomb might have been missed.

Upon examination of the CHIRP data, the geophysical analyst detected a small, faint parabolic response, some faint layering, and numerous, small points. This data is not consistent with one long, narrow piece of channel or beam. Because of this significant discrepancy — a diver-reported object apparently not clearly identified by the CHIRP — a second diving operation was conducted for the purposes of quality assurance. The first day's diving at R1 in the traditional circular pattern, could not detect the beam. Diving operations were modified for the second day. Two points, one north and one south, of the reported beam location were marked with buoys and connected with an underwater line. Physical measurement of the line was approximately 100 feet. GPS locations of the buoys were 96 feet apart. These observations were used to confirm positioning data, allowing for knots and loops at each end of the search line. This north-south line was approximately 35 feet west of the reported beam location. A diver would swim along the north-south rope, searching the bottom with a Surfmaster and by feel. When he reached the buoy at the end of the line, he would move it approximately five (5) feet east and swim to the other buoy. When he reached that buoy, he would move it approximately five (5) feet east and swim to the other end of the search line. This back-and-forth pattern, called a running jack-stay search, covers the bottom of the search area in long, narrow triangles with considerable overlap.

The north-south search began approximately 35 feet west of the reported beam location and extended approximately 24 feet east of the location. Numerous anomalies in the reported beam location were detected with the Surfmaster. These anomalies would extend approximately two to three feet, stop for a short distance, then continue again for a total length of five to six feet. Most of these anomalies tended to be perpendicular to the search line, or generally east-to-west. These anomalies consisted of three-dimensional ferrous clumps, apparently with bolts or spikes welded together embedded in timber. One of these items was taken to the surface, photographed, and released to a SUPSHIP representative.

The second diver reported that these items, embedded in the hard bottom, felt rather like a channel beam.

Based on the results of the second diving operation, a telephone interview was conducted with the diver who reported the beam. (The diver is currently on a UXO project at Tobyhanna Army Depot in northeastern Pennsylvania.) He reported that he detected a Surfmaster anomaly in the outer or twelve (12) foot circle which he followed on a tangent toward the inner, six (6) foot circle. He detected another Surfmaster anomaly on the other side of the outer circle and assumed that the two anomalies were connected. Based on the signals from the Surfmaster, he assumed that he had found another piece of channel, similar to the recovered item given to the clump diver. He never saw the "channel," but since the signals described something clearly different than a Mk-47, believed the object was just debris on the bottom and not worthy of specific measurements.

Taking all available data, the second dive proved the quality and accuracy of the CHIRP search. The dive found numerous small objects of various orientations on a hard sand bottom. As stated above, the CHIRP data indicated a small, faint parabolic response; some faint layering; and numerous, small points which is precisely how numerous small, thin objects with various orientations would likely appear. Objects laying in a line parallel to the search lane at the edge of the acoustic cone would appear as faint layering against a relatively hard background; small, dense objects would appear as points; and a small object (or group of small objects) would appear as a faint parabola. No large object had been missed. The false report was true — no bomb was in the area.

4. Data

a. LOCATIONS: (All locations based on WGS 84)

i. Search area: A rectangle (AOC 501) with corners at the following locations:

Point 5: 32 50.5677 N / 79 55.8287 W
Point 6: 32 50.5549 N / 79 55.9054 W
Point 7: 32 50.3735 N / 79 55.7834 W
Point 8: 32 50.3608 N / 79 55.8601 W

ii. Target dive locations:

T01: 32 50.6123 N / 79 55.8717 W
T02: 32 50.6063 N / 79 55.9151 W
T03: 32 50.5943 N / 79 55.8959 W
T04: 32 50.4162 N / 79 55.8218 W
T05: 32 50.5405 N / 79 55.8995 W
T06: 32 50.4909 N / 79 55.8358 W
T07: 32 50.4246 N / 79 55.7980 W

Note: Not all targets are located in the search area. Extra target dives were conducted a part of the QA/QC plan to ensure conformance with the technical

requirements of the contract.

iii. Random dive locations:
R1: 32 50.401 N / 79 55.855 W
R2: 32 50.559 N / 79 55.814 W
R3: 32 50.393 N / 79 55.830 W

These data are summarized in Figure 20.

b. ITEMS LOCATED BY DIVING AT TARGET AND RANDOM LOCATIONS.

Site	Located Items	
T01	Recovered:	• Badly corroded Oxygen Breathing Apparatus (OBA) canister, ±2" x ±8" x ± 8" • Two small shackles or chain links, badly corroded
T02	Recovered: Not Recovered:	• Beer can, wood with embedded nails, and pliers • Clump of angle iron welded or corroded together
T03	Not Recovered:	• ±20' of cable in one piece (same cable as at T07)
T04	Nothing Detected	
T05	Recovered: Not Recovered:	• Rusty spike or pipe, ±1" diameter x ±30" long, weight ±5 lbs • Large pipe, ±3" diameter x more than 12' long
T06	Nothing Detected	
T07	Recovered: Not Recovered:	• Four (4) pieces of pipe or metal clad line, ±1" diameter x ±30" long, total weight ±8 lbs • Numerous small magnetic pieces, both inside and outside dive circle
R1	Recovered:	• Section of channel beam, ±2" x ±8" wide x 12" long, metal ±½" thick • One (of many) corroded three dimensional spike or bolt clumps ± 5" x ± 5" x ±5"
R2	Not Recovered:	• Tree limbs and branches
R3	Not Recovered:	• Tree limbs and branches

Figures 21 through 30 depict some of the items located and recovered by the divers.

5. Discussion

The CHIRP did not identify any object approximately 15 inches in diameter and 50 inches long in or near the search area. Several CHIRP-identified targets were of interest and were selected for further investigation by diving. At no target location were any ordnance, specifically a Mk-47 depth bomb, or ordnance-related items identified. The targets outside the designated area of the search were detected by the CHIRP during turns to align the boat with a search lane. The CHIRP and GPS were allowed to run to collect the maximum amount of data. Targets, or the parabolas discussed above, identified during these turns and alignment movements were investigated as if they were located in the search area.

The discussion about the reported beam at R1 was included in the diving operations section above. As stated there, R1 was probably the most important dive site due to the apparent discrepancy between man and machine. Good, accurate, proper electronic search equipment capable of detecting a steel cylinder 15 inches in diameter and 50 inches long, a Mk-47, apparently did not detect a steel beam 15 feet long. Upon further investigation in waters well known for their poor visibility and strong currents, it was determined by manual search procedures that the beam did not exist. The original report was not accurate.

The same thought processes and operations at R1 were used across AOC 501. Reliable electronic equipment was used to limit manpower requirements. But all electronic observations were confirmed with manual diving operations. Thus the search, find, and identify systems used in AOC 501 did not rely on a single procedure or technique but rather on a network of procedures and instruments, all different to eliminate errors and biases, all reinforcing each other.

6. Conclusions

1. The area was thoroughly searched by remote techniques with overlapping coverage as per §4.2 of the Solicitation. Additional areas were voluntarily added to the AOC because of anomalies detected by the CHIRP. These remote search techniques were confirmed by divers with ferrous and non-ferrous hand-held metal detectors at target areas and at a random areas.

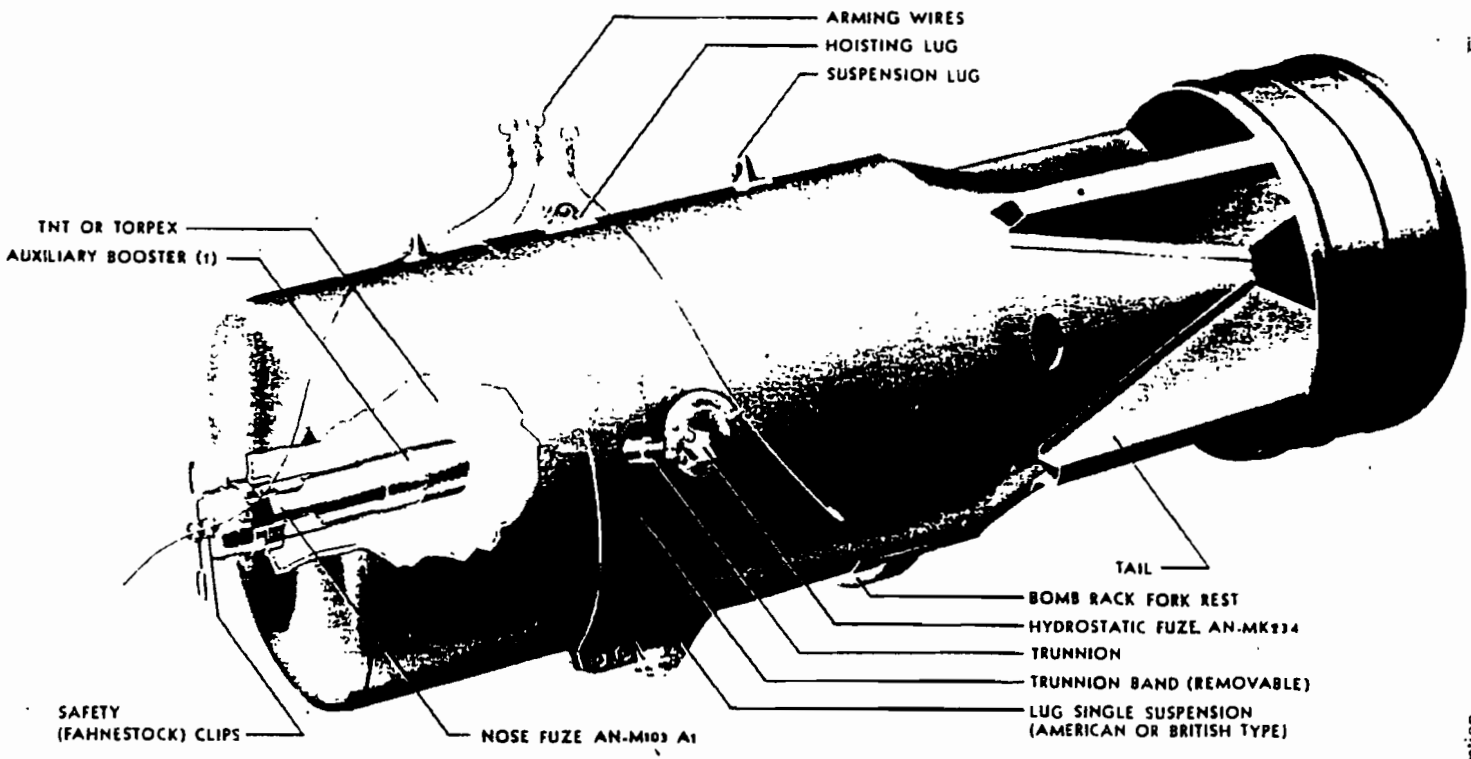
2. Targets within or near the search area did not contain any ordnance or ordnance related items. Dives at the target and random areas confirmed the absence of ordnance up to four feet deep in the river bottom.

3. The targets at T04 and T06, while having a density that was indicated by the CHIRP, were neither ferrous nor non-ferrous and therefore could not have been either an intact or degraded Mk-47 depth bomb. Likely materials include wood, concrete blocks, or clay lenses imbedded in the silty bottom.

4. The Search Objectives in §4.3 were met, as applicable:

Requirement	Action
Accurately locate, record, and physically mark the location of target anomalies (potential UXOs).	Done by CHIRP with DMG-50 as a QA check.
Excavate [anomalies to determine source].	Done by diving with pulse indicator hand-held metal detectors.
Coordinate disposal of the UXOs.	Not applicable.
A satisfactory subsurface geophysical search constitutes a thorough search of the defined area with the above prescribed instrumentation which: a) detects no anomalies, or b) all anomalies prove not to be ordnance, or c) anomalies which prove to be ordnance are marked and excavated for disposal by [Naval Weapons Station Explosive Ordnance Disposal Mobile Unit Six. . .].	 a) seven anomalies detected b) no anomalies were ordnance or ordnance-related c) not applicable

5. Mk-47 Depth Bombs do not exist within four feet of the surface of the river bottom in AOC 501.



325–pound Depth Bombs AN–Mk 41 and AN–Mk 47

Figure 1: Mk-47 Depth Bomb

Figure 2: Boundary Survey Data

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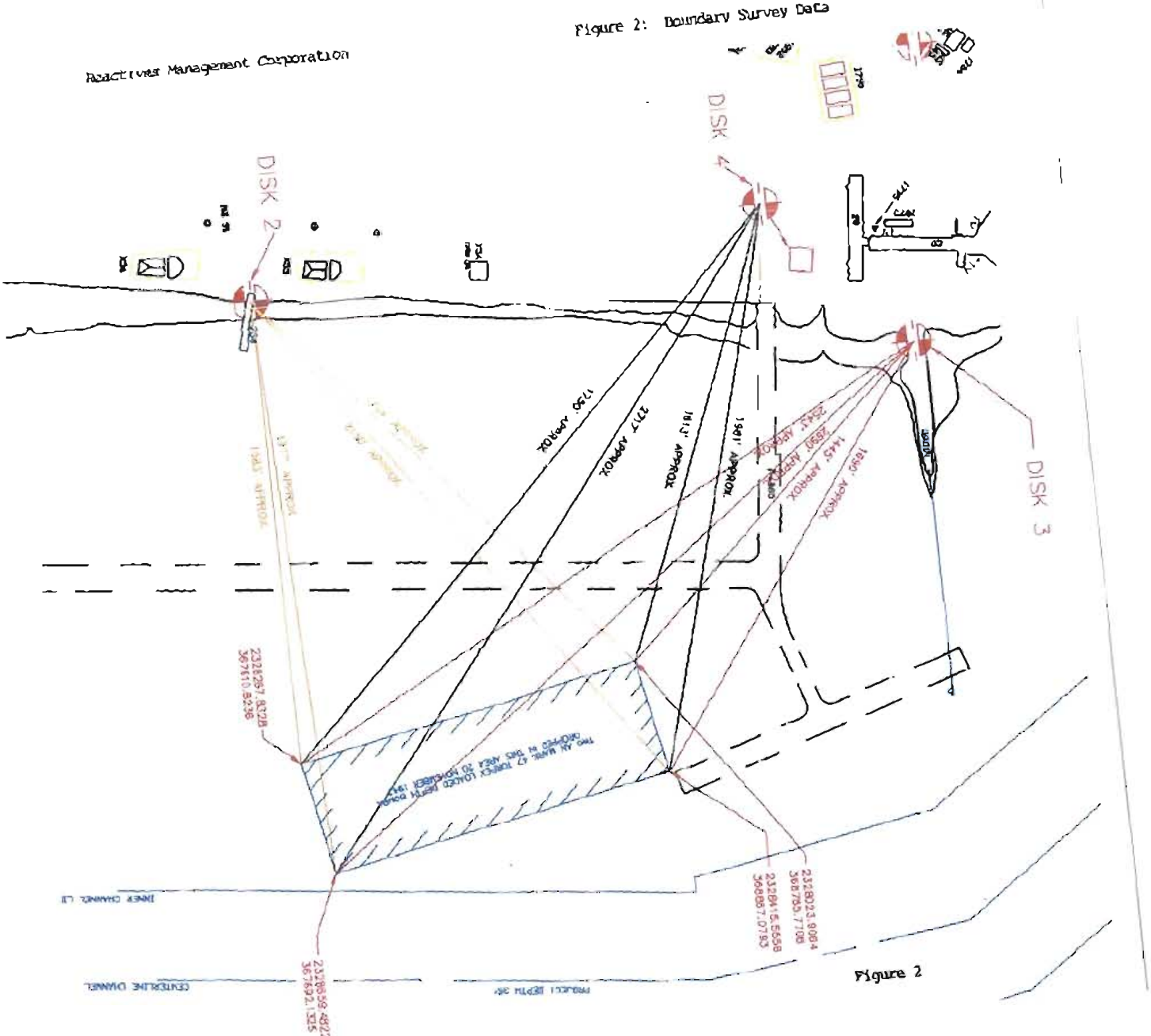
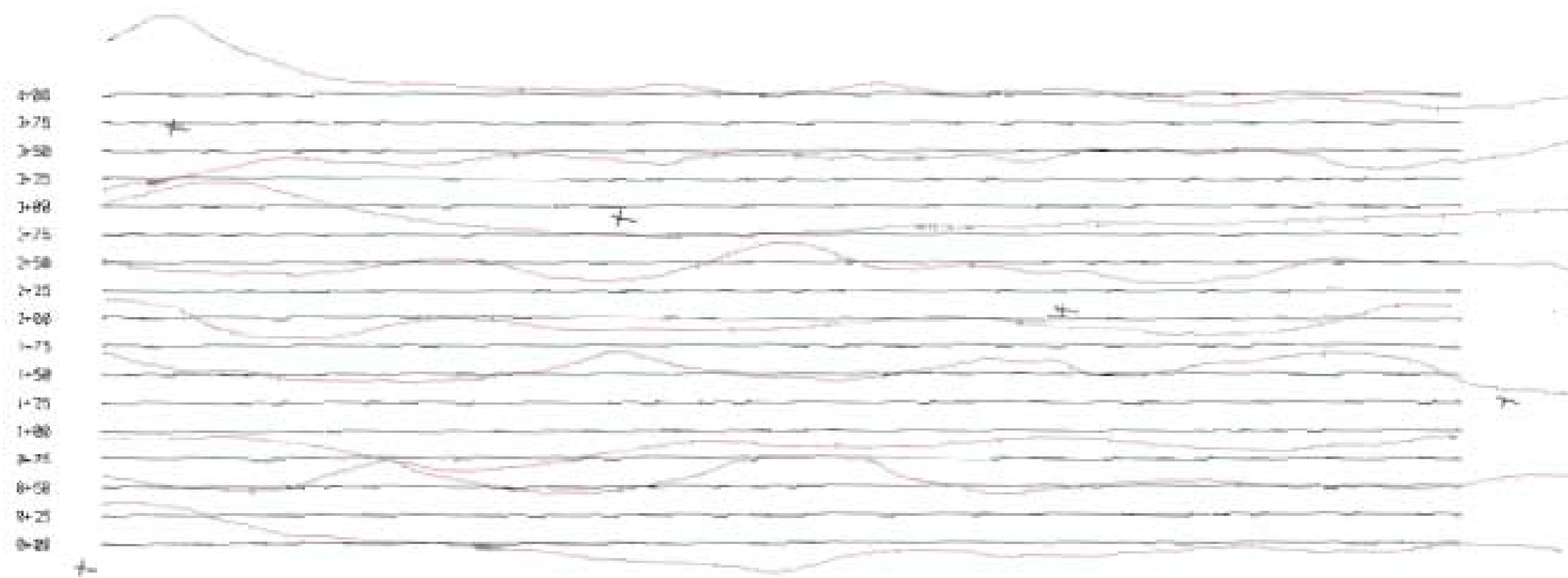


Figure 2

Chirp Acquisition Track

Boat track during CHIRP sub-bottom data gathering operations, 27 July, 1998.

Chart Origin (Lower left corner)
Scale 1:1200
Grid Tick Interval 400 Ft.



Chirp Acquisition Track

Boat track during CHIRP sub-bottom data gathering operations, 28 July, 1998.

Chart Origin (Lower left corner)
2 327 800 E
368 900 N
Scale 1:1200
Grid Tick Interval 400 Ft.

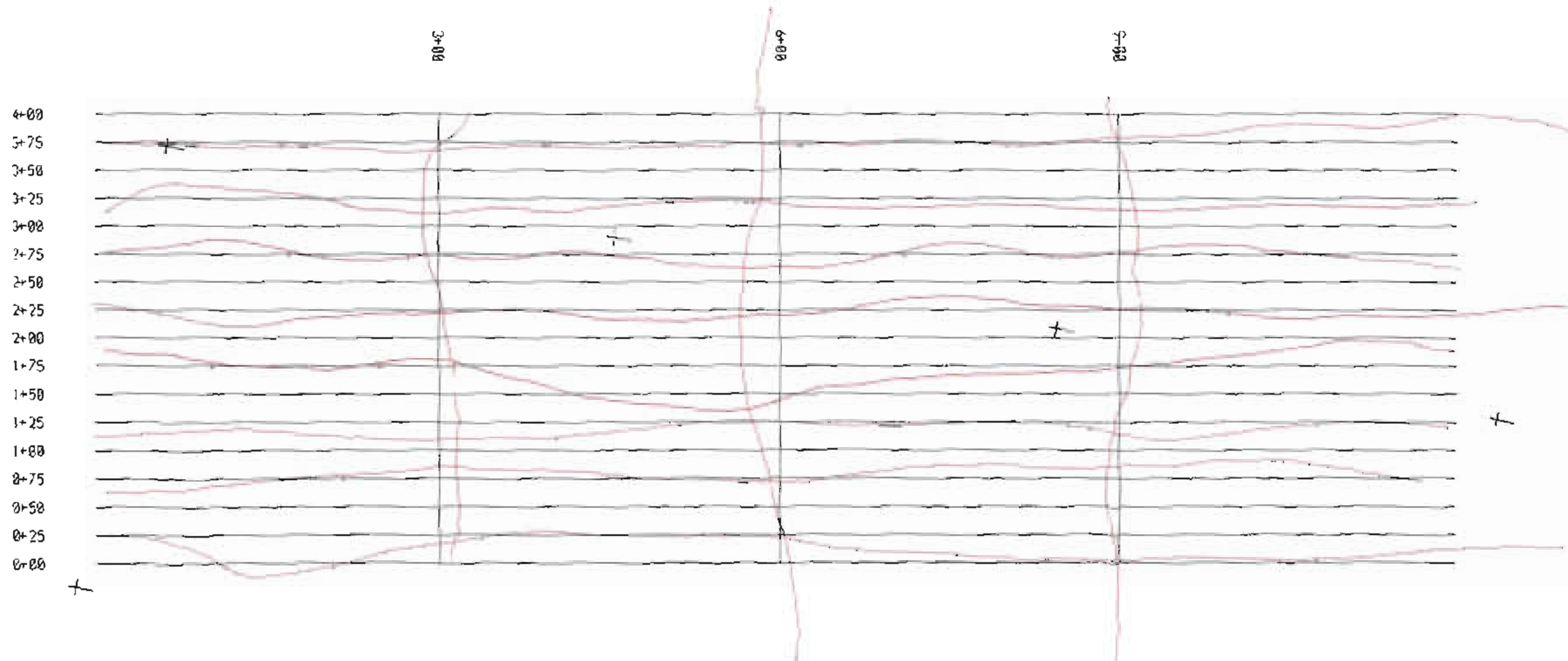


Figure 4: Search Area Coverage - CHIRP Boat Track 7/28/98

Reactives Management Corporation

Gradiometer Acquisition Track

Boat track during GRADIOMETER pass over search area, 28 July, 1998.

Chart origin (lower left corner)

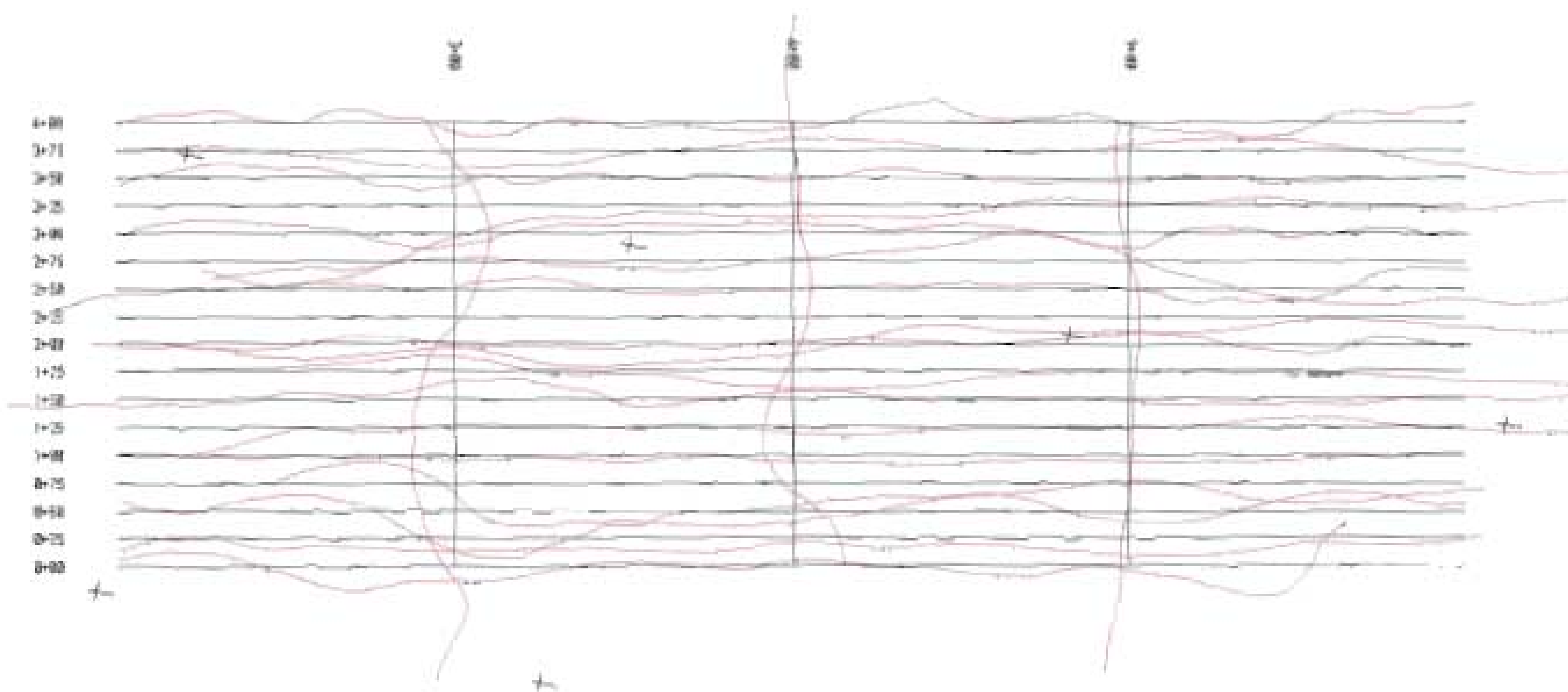


Figure 5: Search Area Coverage - Gradiometer Boat Track

Management Corporation

Chirp Acquisition Track

Combined boat track during CHIRP sub-bottom data gathering operations, 27 - 28 July, 1998.

Chart Origin (lower left corner)
E 327 600 E
368 900 N
Scale 1:3000
Grid Line Interval 400 ft.

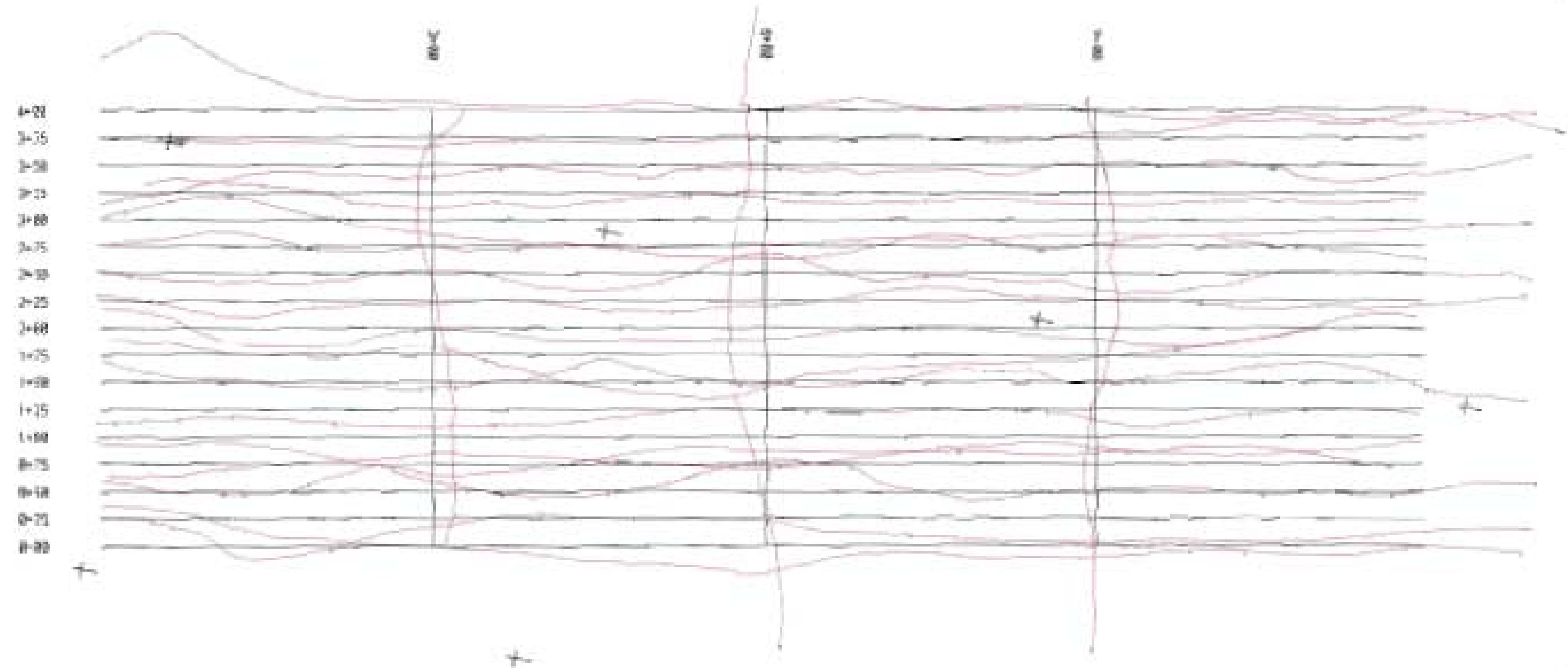


Figure 6: Search Area Coverage - Combined Boat Track

Reactive Management Corporation

Figure 7

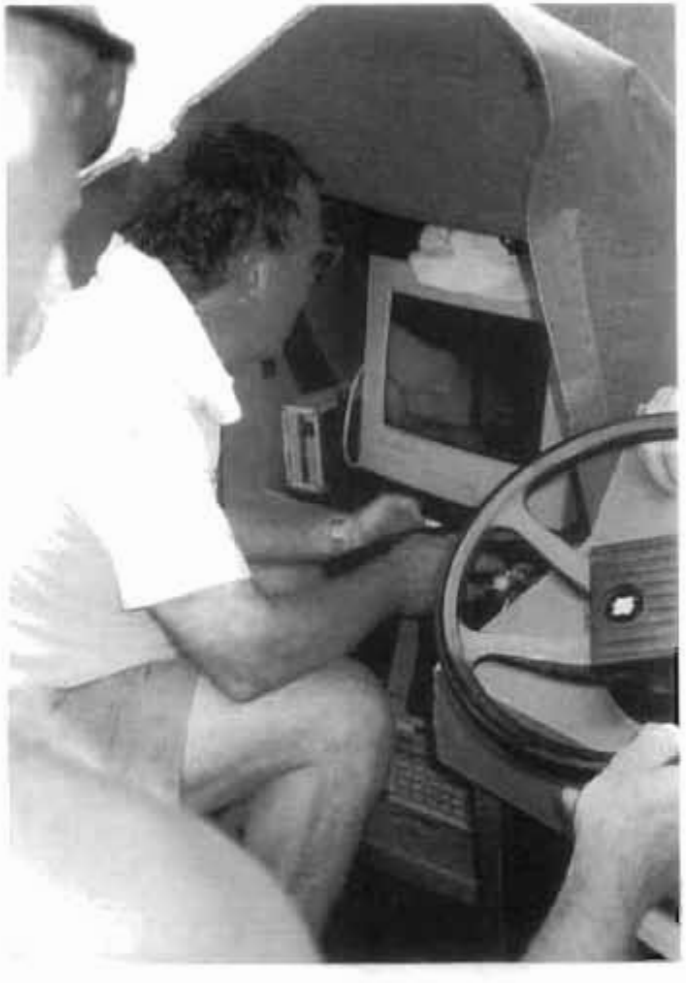


Figure 8

Figure 9

Figure 10

Figure 12

Figure 13

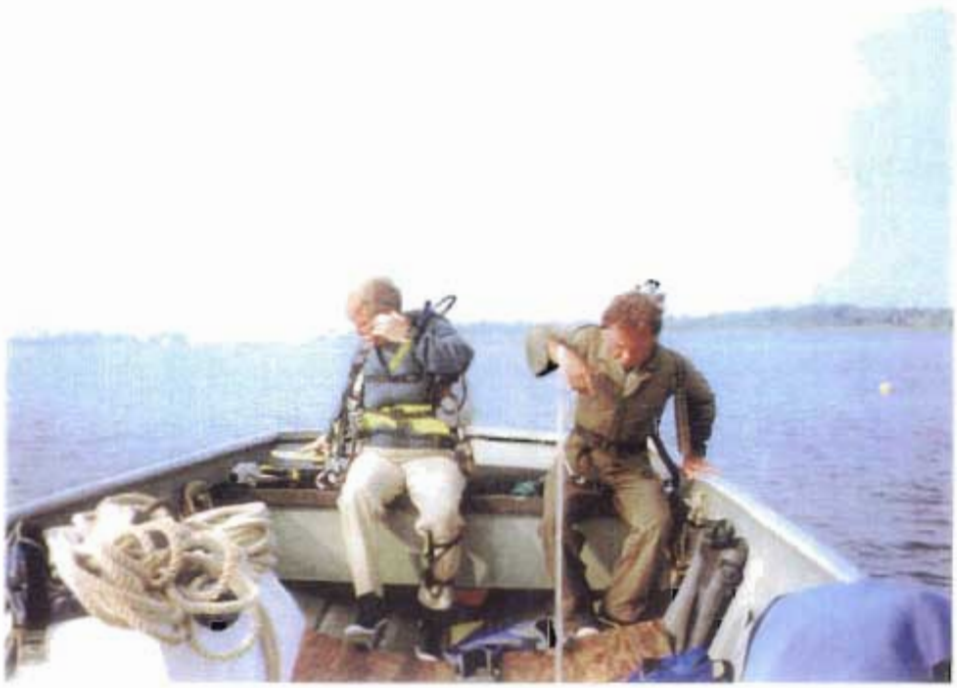


Figure 14

Figure 15

Figure 16

Figure 17

Figure 18

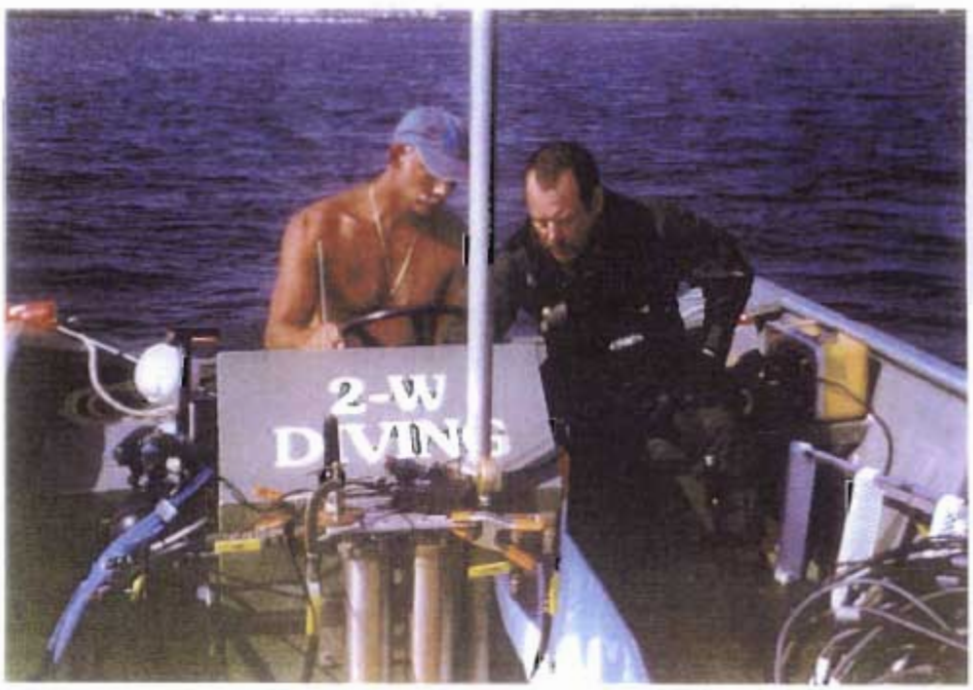


Figure 19

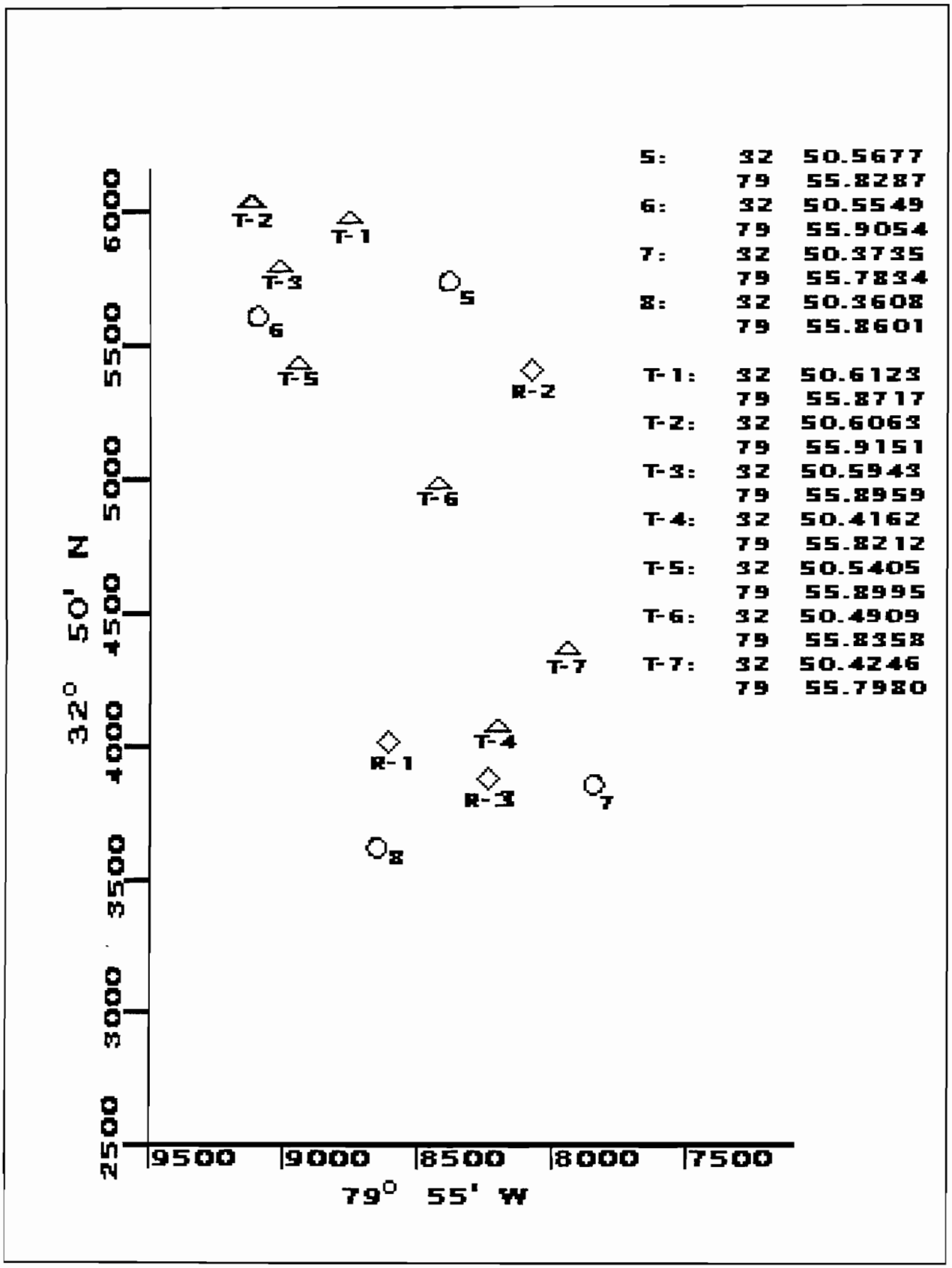


Figure 20: Dive Locations (approximate)

Figure 21

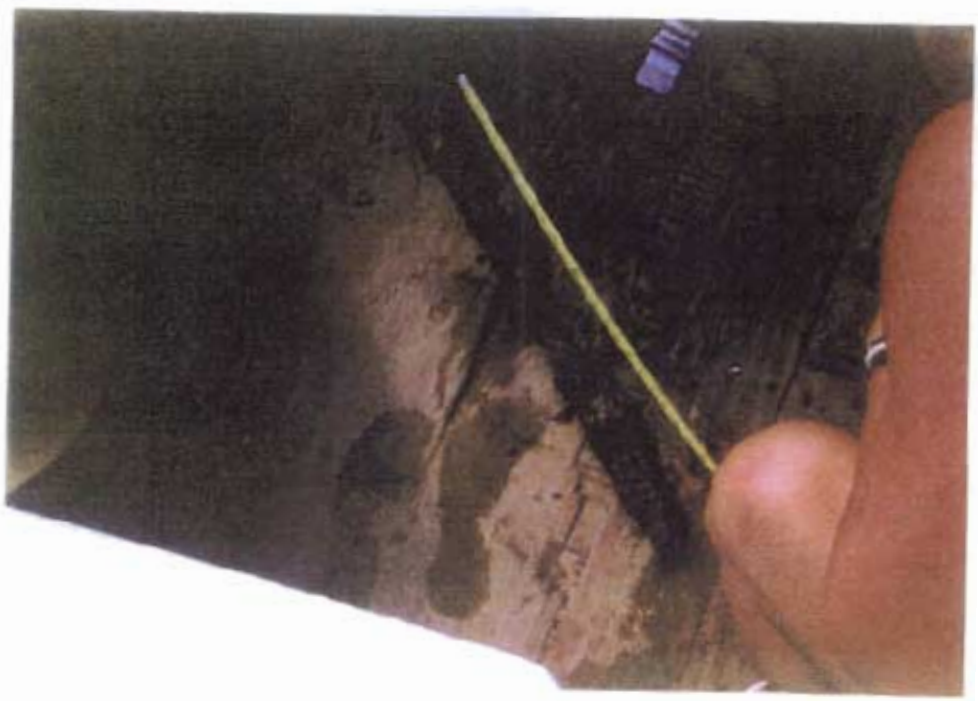


Figure 22

Figure 23

Figure 24

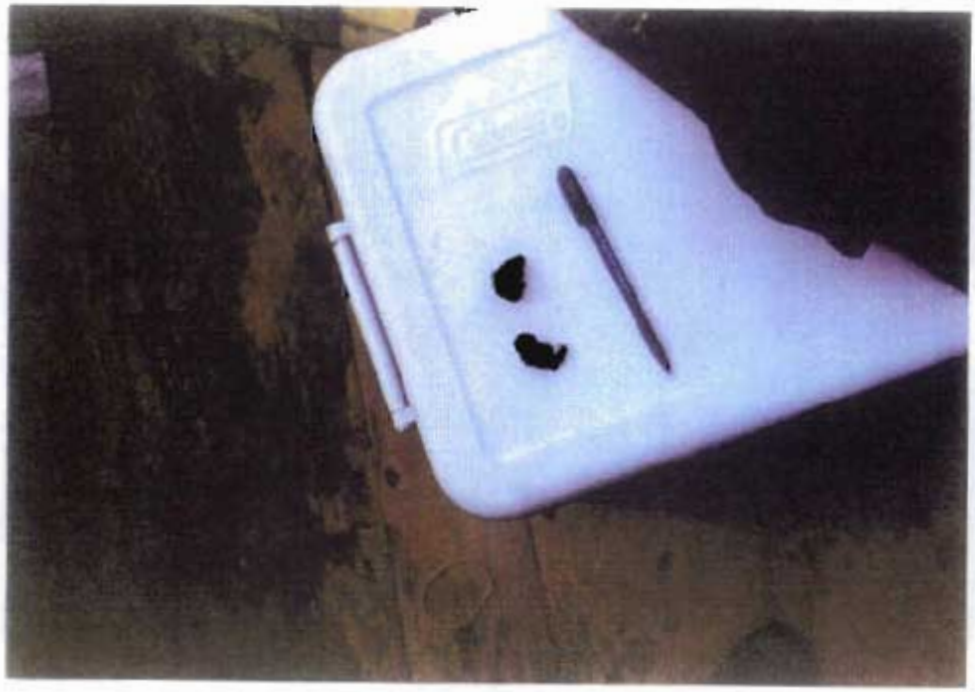


Figure 25

Figure 26

Figure 27

Figure 28

Figure 29

Figure 30

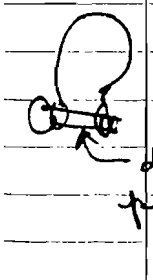
Commander Jennings 720-7701
Monitor ch. 16 VHF ~~AM~~FM (1)

7/27/98 0800 ARRIVE on site; transfer equip - go to set up area by Marina

1030 - continue set-up; Read + Sign HASP

CREW: Chris (2-W); Ed (ORE); GW+CW

1525 - line 0 (magnetometer gradiometer) No significant reading test w/ 1 3/4 shackle = half scale deflection when pumping marker buoy line.



1545 0+50 : No significant reading about ½ scale deflection during turns between N end of grid & grain (fleet piling wall)

1550 0+100 N.S.R.

1600 ~ to dock

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Attachment 1: Daily Log Book Records (10 pages)

7/28/98 0600 Arrive on site; set up
0930 Boat in water

CREW: Chris, Ed, GW + CW +
Tommy Hardin (Govt rep - env.)

0955 Beginning line 1 @ 0+25
(CW) 1005 (had to go back for equip repair)
1115 Begen; picked up crab pot on GHRP.
1120 EOL 1
1124 0+75 (Line 2)
1126 EOL 2
1128 0+125 (Line 3)
1131 EOL 3
1135 0+175 (Line 4)
1138 EOL 4
1140 0+225 (Line 5)
1145 EOL 5
1147 0+275 (Line 6)
1150 EOL 6
1155 0+325 (Line 7)
1200 EOL 7
2020 0+375 (Line 8)
1206 EOL 8

[lines begin & end about 50-100' beyond markers]

1210 Going to run @ 300', 600' + 900' perpendicular for additional QC
1221 0+300 (Line A) B
1223 ~~B~~ EOL A B
1225 0+600 (Line ~~B~~ C)
1227 EOL ~~B~~ C
0+900 (Line ~~C~~)
EOL C
— Missed line "A"
1235 - Going to boat ramp to remove fish + do mag sweep

Rope for fish is ~~46'~~ 51' 6"

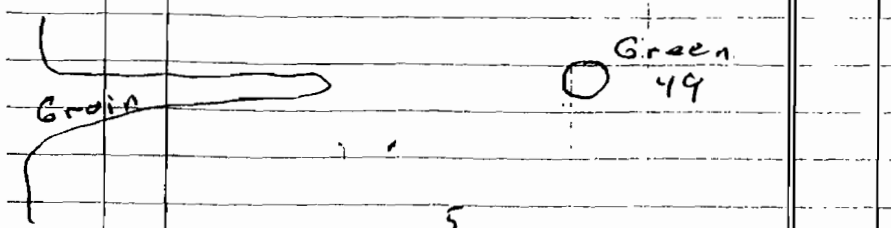
1310 Deploy mag
1530 completed 17 lines @ 0+25+
1550 ~~Done~~ - Completed 3 perpendicular lines; done

7-29

0800 - crew on site; checking boat
- Capt & Surgi mtg w/ Tommy; select 10 pts
1030 - to marina; survey on site
- crew maintaining position
1300 - surveyor cannot set pts
1330 - S C W to U S Boat for GPS system
1500 S C W returns; Tommy to Dr.
- crew mod's PI's to fit suits
- crew sets up GPS ~~buoy~~ beacon.
1630 - dpt site
8 hrs - ½ hr lunch

7-30

0730 - crew on site.
0745 - boat arr
comms check
briefing
0800 - dpt dock
0915 - on set T-1
- divers dressing
- see map pg 6
0930 - left surface (Art & Joe) (35' dept)
0950 - rtn to surface
- 2 circles (± 6', ± 12')
- hand penetration to ± 18"
- 3 obj: OBA cannister
S C W 2x shackles
1010 at T-5
break surface (Art & Joe)
1040 rtn to surface 3" dia (35' dept)
- large pipe ~~6" x 8' W x long~~ ①
- 1 obj - rusty spike (wt 5-lbs)
- hand probe 6" → 8" in mud
① long almost like cable
- same 6' & 12' circle
1130 - on shore for lunch
1245 - Getting ready to get on boat
- " - off dock



	T-1	32 50.6123 79 55.8717	T-6	32 50.7904 79 55.8358
	T-2	32 50.6063 79 55.9151	T-7	32 50.7246 79 55.7980
	T-3	32 50.5943 79 55.8954	R-1	32° 50.401 79 55.855
	T-4	32 50.4162 79 55.8418		
	T-5	32 50.5405 79 55.8995		
5	32 50.5677 79 55.8287			
6	32 50.5549 79 55.8054			
7	32 50.3735 79 55.7834			
8	32 50.3608 79 55.8601			

1300 at T-4
dive crew Bill & Dan / Art dive master
1305 in water
1315 on surface (35' depth)
nothing detected
used thrust water for QA check
1325 at T-7; in water
1335 divers on surface (40' depth)
nothing detected
1345 stopped operation due to current

re-do T-7 outside circle

plan for Friday: T-7 (out)
T-6
R-1
R-2

briefing in marina office

1450 - last site

7-31-98

0730 crew on site
0735 Barge on site; get gear ready.
0755 boat on site
- comms check
- gear loaded
- dive / plan / safety briefing
0855 - on water @ CIW
0925 - set T-7 mark
dive team: Dan & Curt (Joe Steby)
0930 ~~0928~~ - team in water
0945 Team out of water ①
4 obj: ± 1" x ± 30" (38' dept)
wt: ± 8 lb total
moving to T-6 T-2 @ CIW.
① soft silt as yesterday
lot of small frag. (metallic
ofp); outside circle
0955 setting up on T-2.
1000 team (Dan & Curt) in water (± 20' deep)
1025 team out of water
not recovered: lumps of
angle irons welded / corroded
together.
- beer can, wood w/ nail, pliers
moving to T-3
1045 set T-3

1050 team in water (Dan & Curt)
1105 team on surface (20' deep)
± 20' cable in one piece on
at T-7 5 @ CIW. NOTE: ORIGINAL CORRECTED SHOULD BE T-7
1110 Tommy on water - turned over
pix. Dive last target & one
random
1120 Lunch on shore
1230 stopped ops for day -
current & wind too
strong.
1245 Times debriefing
← 7-29-98 0800 arr site
1630 dpt site (-½ hr lunch)
← 7-30-98 0730 arr site
0900 - dpt dock
0930-0950: T-1 } Curt to dive
1010-1040: T-5 }
1130 - on shore for lunch
1250 - dpt dock
1305-1315: T-4 } Bill & Dan
1325-1335: T-7 }
1345 stn to dock
1450 - dpt dock
CALL TODAY 8 HOURS

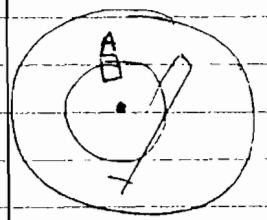
(times of briefing: cont'd)

7-31-98
0730 - on site
0855 - dpt dock
0930 - 0945: T-7 (ttn) Don't ent
1000 - 1025: T-2 " "
1050 - 1105: T-3 " "
1120 - shove for lunch
1245 - times briefing as above & dpt. site
call today till 1300 (½ hr lunch)

T-4 how big
how deep? > verbal to Tommy

8-1-98
0730 - on site
- briefing
0830 - in boat
- moving to T-6
at T-6
0850 - left surface (Joe & George)
0908 - on surface

random search
0930 - left surface (Joe & George)
1010 - reached surface
coordinates 32° 50.401'
79° 55.855'



A: channel bran
± 8" wide × ±12" l
B: channel bean
± 8" wide × ±15-20'
A was moved to surface
B was left in place.

NEED TO KNOW: • depth of SHIP II
• exact location of R-1 relative to search box

11 drop
dive selection site

1.) N.E. corner

corner 7 ~~55.860'~~ 50.3608

corner 5 55 50.5627

T-7 50.5246

50° = 60.80 ft

50.1° = 60.8 ft

50.11 = 60.8 ft

50.111 = 6. ft

50.5577

.001

50.5586

32° ~~50.548~~

32 50.559

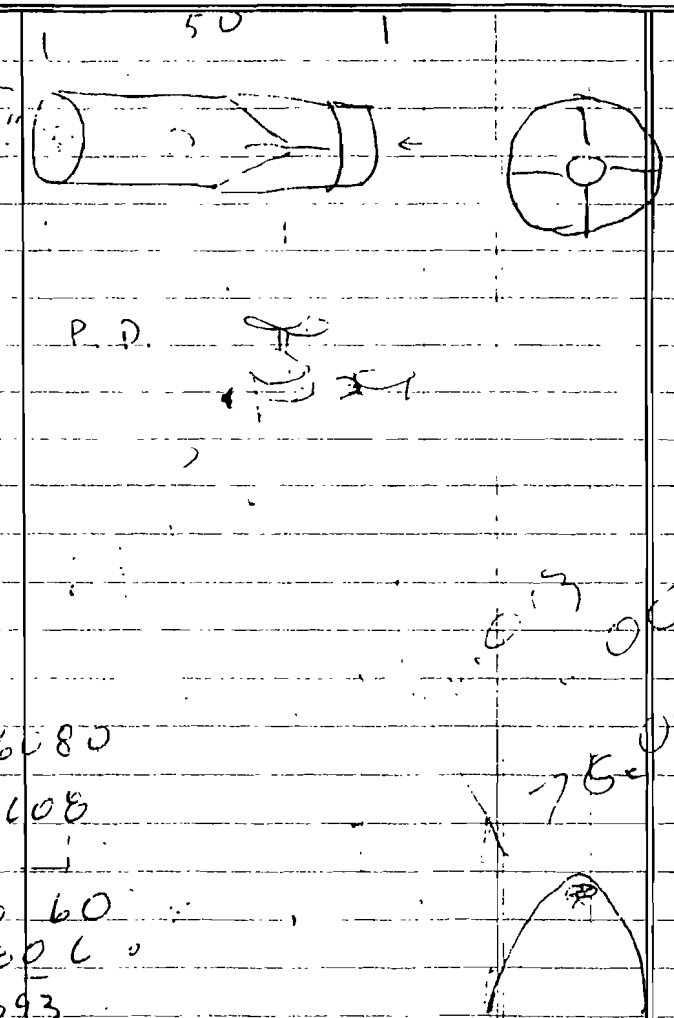
R2 { NE 32° 50.~~548~~ 559 7455.814
corner. 79° 55.~~830~~' 814

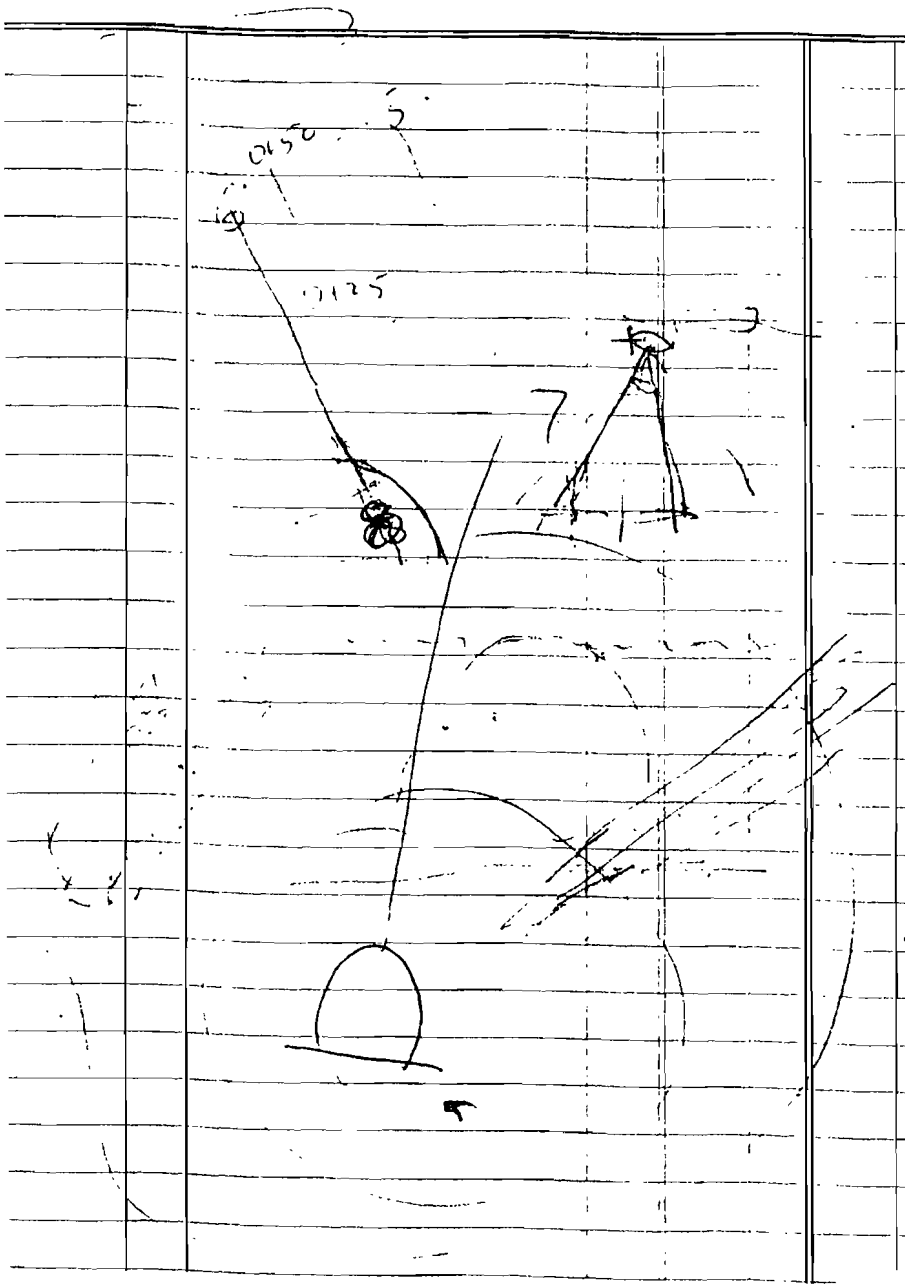
R3 { N.1 32° 50.~~380~~' .393
79° 55.830'

~~29~~

R-1 32 50.401
79 55.855 WE30

32° 50





12 Aug

0800 boat ran at ramp

0830 dive crew (Chris, Doc) & Tom

0930 setting WE 10 (32° 50.548' / 79° 55.810'

(different watch)

0925 - Doc & George @ WE 10

0955 on surface

tree branches, silt, some current (vis 0)

1115 - Doc & George @ WE 20

1142 - on surface

stronger current, more silt (vis 0), wooden pole or branch 3" x 4-5 feet (non-mag, non-ferrous)

1305 - Doc & George @ WE 30

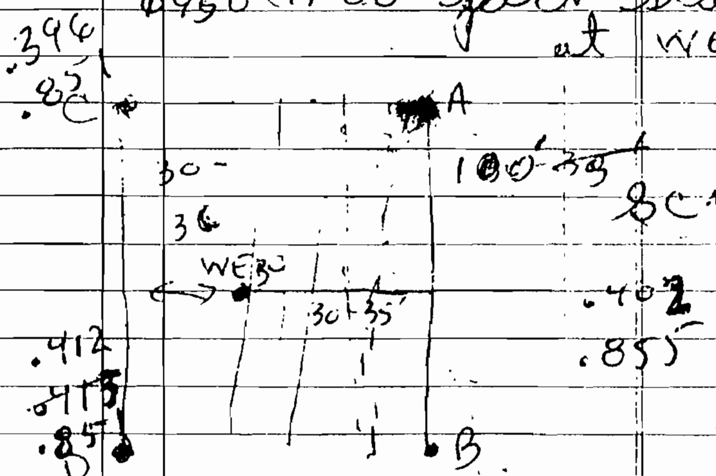
1400 - on surface

slack water, could recovered one first stage lump & one smaller piece

1430 - boat dpts

1450 - Tommy Harden 743-6777 exp 2-2

13 Aug
0800 start
0915 - 0935: Chris - 30'
2500 psi in 2100 psi out
lots of small hits at
WE-15
0950-1100 jack stay search
at WE30



1125 - resume jack stay search
1240 - out of water

1310 took position
WE30 32° 50.402'
55 79° 55.855'
C 32° 50.396
79° 55.851
32° 50.412'
~~55°~~ 79.851'

delete
2-3 feet
5-6 feet
long
line traces

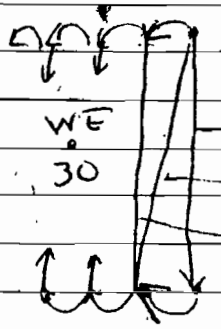
nothing solid more than
2-3 feet; would break,
then pick up again for 5-6
feet total length.

.412 .396 .016
.016 6000 96000
.004 .855 .851 .004 6000 24000
96 feet length
of line from C → D.

Recap - notes not taken earlier
due to rain
0800 - loading boat
0900 - at WE30
0915 - 0935 Chris in water at
WE30; lots of small

nothing to explain beam.

0940 – set up two points 135 ft west of WE 30. Line between pts is ±100 ft long (there are A & B below) Plan to search bottom with M lites in jack stay pattern (see below)



at end: C • 32 50.396 / 79 55.851

• WE 30

D • 32 50.412 / 79 55.851

0950 – jack stay search of area
1100 from A-B to WE 30
1125 – jack stay search from
1240 WE-30 to C-D.
distance from C to D: 96'

- distance WE-30 to CD: 24 ft.
- est. distance from A-B to WE-30: 30ft
- area searched: 50 × 100 = 5000 ft²
- area around WE-30 where beam reported:

$$A = \pi r^2 = (3.14)(6)^2 = \pm 113 \text{ ft}^2$$

- area where beam reported searched (5000 ft² vs 113 ft²)
- Chris reports lots of tracks about 2-3' long around WE-30. Tracks would have signature about every 1-2' for length of 2-3', then break. New track would run for another 2-3 feet for a total of 5-6 feet. One lump recovered.

1310 re-track positions

WE-30: 32° 50.402' / 79° 55.85
(22) C : 32° 50.396' / 79° 55.851'
(23) D : 32° 50.412' / 79° 55.851'

1330 back to dock; unload gear & fresh water rinse
1710 last dpts, GCW copies notes
1725 BCM dpt.

Addendum Number 2

Supervisor of Shipbuilding,

C & R, USN

Contract No. N62678-98-C-0001

1. Purpose:

The purposes of this addendum are to:

a. clarify the capability of the CHIRP II to penetrate river bottom sediments

b. discuss the section of channel beam found at the random dive site R-1

c. submit additional electronic search data in the form of CHIRP recordings

2. Background Information

The previously submitted Final Report consisted of six sections. This addendum follows the same format for consistency.

A request was telephonically made on September 22, 1998, to provide the information listed in the purposes section. This information is needed to better understand the Final Report submitted earlier and to insure compliance with the provisions of the contract.

3. Search Procedures

Search procedures are documented in the Final Report. To briefly review, the Area of Concern (AOC) was approximately 400 feet wide and 1200 feet long. The long axis tended to be in a north-south direction. The AOC was searched electronically along the long axis. One search pattern was established on 50 foot lane centers. These search lanes were designated in feet as 0 + 00 (the base search lane), 0 + 50 (the second search lane, 50 feet from the base lane), 1 + 00 (the third search lane, 100 feet from the base lane) and so forth to 3 + 50 (350 feet from the base lane). The second search pattern was on 25 foot centers and designated at 0 + 25 (25 feet from the base lane), 0 + 75 (75 feet from the base lane), 1 + 25 (125 feet from the base lane).

Once these long lanes were completed, three short lanes, tending east and west, were searched. These shorter lanes were designated 3 + 00/X (300 feet south from the top or north side of the AOC, crossing the AOC), 6 + 00/X, and 9 + 00/X. Target 4 (T4 or T04) is on lane 9 + 00/X and is in the first addendum, the last page of the Final Report. The recordings show the start of each search lane as SOL or start of lane. The end of each lane is marked as EOL. The date, time, and position (longitude and latitude) are also marked on the recordings.

The penetration of the river bottom by Datasonics CHIRP II acoustic sub-bottom profiler used for this work depends in part on the nature of the bottom. In soft, unconsolidated silt

penetration may be as deep as 100 feet. Vigorously growing oyster beds limit penetration to only a few inches. Given the varying nature of the river bottom in AOC 501, penetration extended from approximately 10 to 12 feet in firmer sand to approximately 40 feet in softer, siltier areas.

4. Data

There are currently four printed copies of the CHIRP data. These recordings have been designated Original, Duplicate, Duplicate 2, and Duplicate 3. The recordings designated Original and Duplicate are submitted with this addendum. Reactives Management has kept Duplicate 2 and Duplicate 3 in its files.

The CHIRP recordings submitted with this addendum show the search lanes designated as described above. The CHIRP recordings consist of long strips of thermal paper. The recordings were left in the rolled format because some targets are outside the search lanes and cutting the recordings will destroy some data.

The targets are designated in ball point pen at the top of the recording. The designations are in the format T1 or T01, T2 or T02, etc. There are eight sites on the recordings that are of concern:

Site	Location of Data
T01	Between Lanes 1 + 75 and 1 + 25
T02	Adjacent to one another, between Lanes 0 + 75 and 1 + 25
T03	
T04	Addendum to the Final Report, Lane 9 + 00/X
T05	Lane 0 + 00
T06	Lane 3 + 00
T07	Lane 3 + 75
R1	Lane 0 + 75

5. Discussion

A short piece of channel beam was found at the random dive site R1. R1 is discussed on pages 6 through 8 in the Final Report. There is no strong or point-source target on the CHIRP recording. There are three reasons for this. First, the bottom at R1 was hard packed sand and was covered with three-dimensional ferrous objects, apparently bolts or spikes welded together and embedded in timbers. This background decreases the sensitivity of the CHIRP and produces a layering image on the recording. Second, the area in which

the small piece of channel beam was found was searched by the edge of the acoustic cone from the CHIRP. Again, this tends to decrease sensitivity and produces a faint parabola on the recording. Third, the size of the beam, given the background (hard sand, numerous ferrous objects) and the location near the edge of the cone, was small enough that it was at or near the limit of detection. This produced the faint parabola, layering, and numerous small points, not one strong parabola, on the recording. There are locations within the AOC where the bottom is literally covered with tree limbs and branches. R2 and R3 are two examples of this. When the CHIRP located larger pieces of these, or similar objects such as clay lenses or blocks of concrete, they were recorded like the objects at T04 and T06. T04 and T06 produced strong, well-defined targets on the CHIRP recording but contained no ferrous objects (and therefore no Mk-47 depth bomb). The CHIRP was used to define sites within the AOC that required specific, detailed, man-based magnetic searches. It was the best technique for this purpose and was used by a qualified geophysicist as intended.

6. Conclusions

As stated in the Final Report, the Statement of Work in Contract N62678-98-C-0001 was completed and no Mk-47 depth bombs were found within AOC 501.