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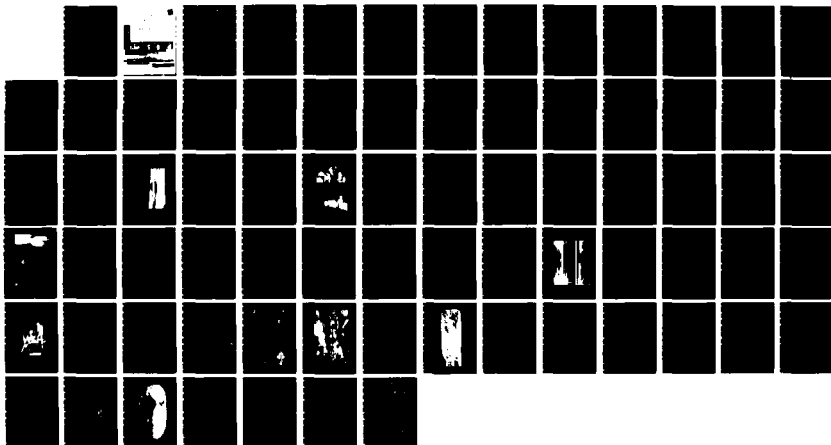
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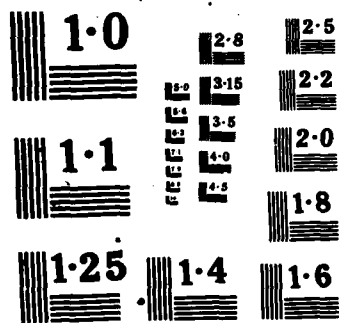
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UNDERWATER ARCHAEOLOGICAL INVESTIGATIONS
MOBILE BAY SHIP CHANNEL
MOBILE HARBOR, ALABAMA


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May 1986

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ABSTRACT

An archaeological Phase II assessment of 22 magnetic anomalies has been completed as part of a planned harbor expansion and modification by the U.S. Army Corps of Engineers, Mobile District. All investigated anomalies proved to be modern harbor debris for which no further work is required.

A second goal of the project involved a diving and remote-sensing survey of the Confederate obstructions, 1Mb28. These obstructions consist, in part, of vessels which were loaded with brick and sunk across the old channel during the American Civil War. The purpose of the survey was to accurately delineate and precisely position the vessel obstructions in relation to proposed harbor improvements.

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Ms. Dorothy Gibbens, marine archaeologist for the U.S. Army Corps of Engineers, ably filled the dual roles of project monitor and diving supervisor on behalf of the federal government.

Clell L. Bond, principal investigator for the project, provided guidance and advice throughout all phases of the study.

The author particularly acknowledges the hard work of the field crew in Mobile. The diving team was composed of Jack Irion, Stephen James, Robert Gearhart, Todd Hannahs, David Beard, Paul Teas and Dennis Zabaldo.

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CHAPTER 1 INTRODUCTION

This report describes the cultural resource investigation of 22 magnetic anomalies and the delineation of the physical extent of the Confederate obstructions at Dog River Bar (state historic site 1Mb28) in Mobile Bay, Alabama. The study was conducted for the U.S. Army Corps of Engineers, Mobile District (Corps) by archaeologists employed by Espey, Huston & Associates, Inc. (EH&A).

PROJECT LOCATION

The Mobile Bay study area (Figure 1) is located in the extreme southwestern portion of Alabama in the East Gulf Section of the Coastal Plain Province. The roughly L-shaped bay, which is bounded on the east by Baldwin County and on the west by Mobile County, is approximately 30 miles (mi) (48.3 kilometers [km]) long and averages approximately 10 mi (16.1 km) in width. The primary rivers associated with the estuary are the Tensaw and Mobile rivers, which enter the bay at its northern terminus. Dauphin Island and Mobile Point separate the bay from the Gulf of Mexico. The metropolitan city of Mobile is located in the northwestern quadrant of the bay, while the smaller communities of Spanish Fort and Fairhope are located on its eastern shore.

INVESTIGATION PURPOSE

This investigation was conducted for and funded by the U.S. Army Corps of Engineers, Mobile District, under Contract No. DACW01-85-C-0103. The required work involved the relocation of 21 previously-reported (Mistovich and Knight 1983a) magnetic anomalies in Mobile Bay and underwater testing to determine their physical and historical nature, and to assess their potential eligibility to the National Register of Historic Places (NRHP), as defined under 36 CFR 60. A subsequent amendment to the basic contract added the testing of another anomaly (Tb-1-6) and provided for additional diving and remote-sensing surveys to be performed at the site of the Confederate obstructions (1Mb28) which was first discovered by EH&A in 1983 to be partially situated within the area of a proposed Turning Basin (Irion and Bond 1984; Irion 1985). This work was conducted as part of the proposed Mobile Harbor Deepening Project and was authorized in partial fulfillment of the Mobile District's responsibilities for cultural resources under the National Historic Preservation Act of 1966 (PL 89-665) as amended, the National Environmental Policy Act of 1969 (PL 91-190), Executive Order 11593, and the Archaeological and Historic Preservation Act of 1974 (PL 93-291).

This reported investigation follows and is, in part, based on the findings of a previously authorized baseline literature review and remote-sensing survey which was conducted by OSM Archaeological Consultants, Inc. (Mistovich and Knight 1983a).

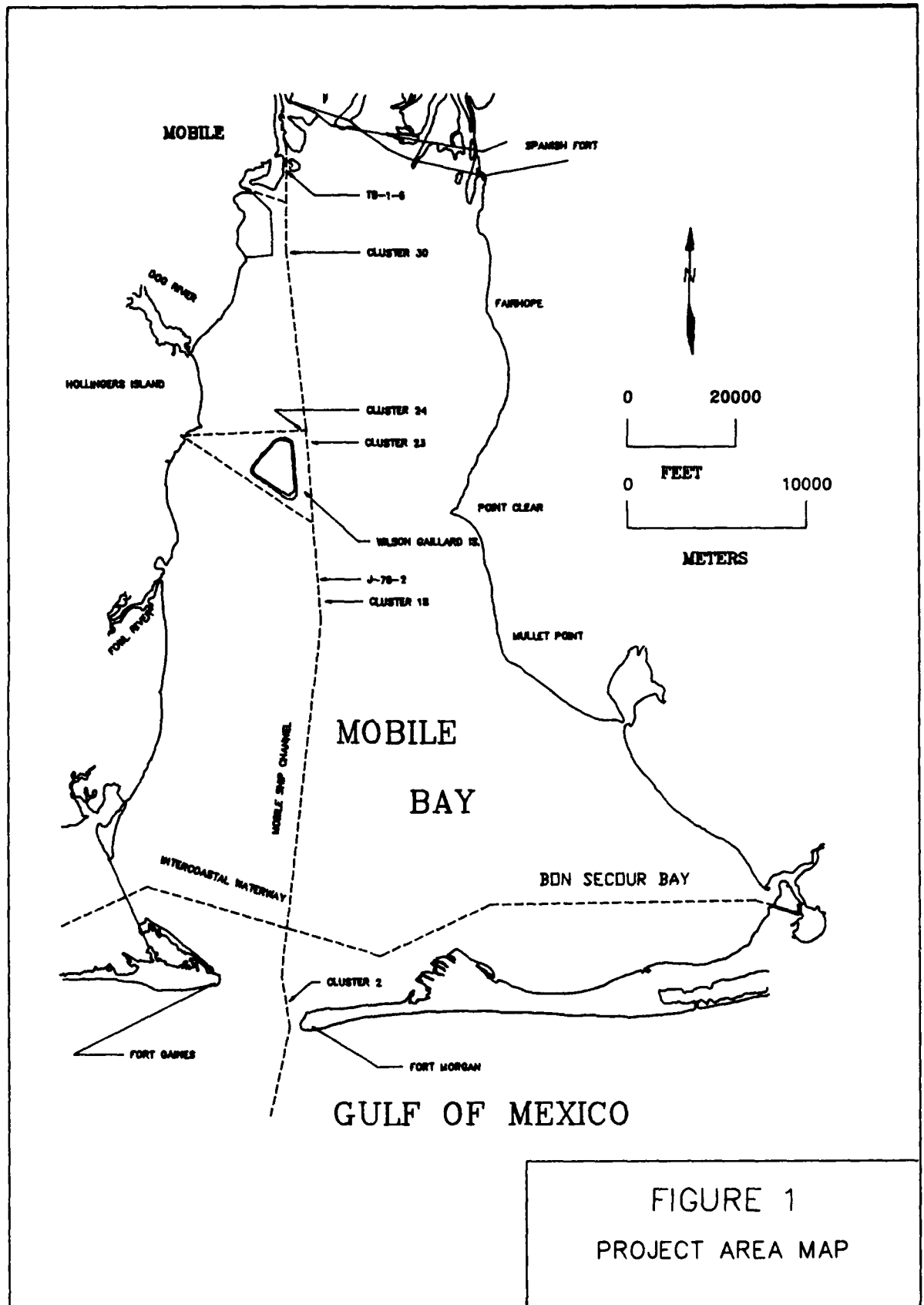


FIGURE 1
PROJECT AREA MAP

AREAS OF INVESTIGATION

The various sites selected for investigation under the present contract are separated by as much as 26 mi (42 km) and scattered along the ship channel from one end of Mobile Bay to the other. Each area entails a separate body of environmental characteristics which, in one way or another, affected the progress of work. For this reason, each work area is described separately with special attention paid to particular problems which influenced the conduct of the work.

Cluster 2

Cluster 2 is located in the south end of Mobile Bay, approximately 3,500 feet (ft) (1.06 km) west-northwest of historic Fort Morgan, in 47 ft (14.3 meters [m]) of water. Three anomalies were reported for this cluster in 1983, all of which were located within the boundaries of the ship channel.

Two major factors inhibited work in this area: current and ship traffic. The single most limiting factor was the prodigious current which flows through the relatively narrow mouth of the bay. At full flow during ebb tide, the current was measured at over 2 knots. The force of the current required that dives in this area be planned around the tidal chart. It was found that the current was slack, or at least relatively weak, for a two- or three-hour period centering around the time of the change between low and high tide. Diving was practical only during the "window" of slack tide, so the investigation of Cluster 2 had to be scheduled to coincide with the days that high tide occurred during mid-morning to early afternoon.

Another constant problem was ship traffic in the channel. Two of the anomalies in the cluster lay in a direct line with the range marker for ships entering the bay. Although the EH&A vessels were never forced to move after anchoring over the site, diving operations always ceased when ships passed the anchorage. Radio contact was always made with the approaching vessel to insure that they could safely pass by the diving platform.

Surface-supplied air diving equipment was used in this area to insure the safety of the divers. Not only were the divers tethered to the surface with their umbilical lines, but they were also in constant voice communication with both a surface tender and each other.

Cluster 18

Cluster 18 is located a short distance from the Middle Bay Light on the west side of the channel in the area of a proposed new passing lane. The cluster is approximately 12.6 mi (20.2 km) south of the MacDuffie Coal Terminal at a bend in the ship channel. There are three anomalies listed in the cluster, two of which (I-62-1 and I-62-2) were shown to be on the edge of the channel in 15 ft (4.6 m) of water, while the third (I-58-3) was in the excavated channel with

a water depth of 38 ft (11.6 m). It was later discovered through magnetic prospection that the latter anomaly no longer existed. As a result, all diving on this cluster took place in shallow water on the channel edge. Because of the proximity of the tested areas to the channel and because of the multitude of shrimp boats whose skippers tended to ignore the "diver down" flags, the surface-supplied air with three-way communication was employed while diving on this cluster.

Cluster 23

Cluster 23 consists of six reported anomalies on the east, center and west sides of the channel below the intersection of Hollinger Island Channel. Two of the target areas in this cluster, K-79-2 and K-84-1, both of which were reported to be in the channel, no longer produce a perturbation of the magnetic field.

Cluster 24

Cluster 24 is located from the center to west of the channel and slightly north of the intersection of Hollinger Island Channel. The cluster was originally reported to consist of four anomalies. Of the four target areas, K-80-3, reported at 16 gammas, was not relocated with the magnetometer and was determined to no longer exist in the area. Water depth for this cluster ranged between 15 ft (4.6 m) and 50 ft (15.2 m).

Cluster 30

Cluster 30 was recorded to consist of four magnetic anomalies. A subsequent examination by EH&A personnel of OSM's side-scan data indicated that two of these anomalies, L-92-7 and L-88-3, were probably generated by the same source which appeared as four linear objects approximately 100 ft (30.5 m) long.

Cluster 30 is the northernmost of the areas of investigation and is located approximately 2.5 mi (4 km) south of the MacDuffie Coal Terminal adjacent to the Brookley Complex. Water depth for this cluster ranged between 12 ft (3.6 m) and 40 ft (12 m) depending upon the individual anomaly's location on the bank, slope or bottom of the channel.

Anomaly J-76-2

J-76-2 was the only non-clustered anomaly investigated under the basic contract. The anomaly was located on the south end of Wilson Gaillard Island on the west edge of the channel in 15 ft (4.5 m) of water.

Anomaly Tb-1-6

Tb-1-6 was investigated under an amendment to the original contract. This anomaly was tested for two reasons. First, it registers over

800 gammas on the magnetometer, but was not originally recommended for testing by OSM Archaeological Consultants. Second, it lies very close to the hypothetical northwest extension of the western arm of the obstructions. It was, therefore, necessary to assess the anomaly's potential relationship to the Confederate obstructions.

The published coordinates for anomaly Tb-1-6 actually place it in an area of convergence of two strong magnetic fields generated by objects of considerable mass. One of these fields is generated by a large dredge pipe located at anomaly Tb-2-2 which was investigated by EH&A in 1983 (Irion and Bond 1984). The second field is generated by the object which was investigated under the current contract. Actual coordinates for this object are as follows:

<u>Alabama West</u>	<u>Lat./Long.</u>	<u>UTM 16</u>
N 239229.064	Lat. 30° 39' 24.273"	N 3391830.400
E 333596.903	Long. 88° 1' 45.149"	E 401390.800

The target is located on the east side of the ship channel in 20 ft (6.1 m) of water adjacent to Little Sand Island. It is near the hypothetical northwest extension of the western line of the Confederate obstructions, which necessitated its testing.

The Confederate Obstructions

The Confederate obstructions, also known as the Dog River bar obstructions, were first discovered by EH&A in 1983 (Irion and Bond 1984). They were installed by the Confederate Corps of Engineers between 1862 and 1864, specifically to prevent the entrance of the Union navy into Mobile through Choctaw Pass and up the Mobile River. The defenses consisted of three main batteries and three floating batteries covering obstructions of pilings and sunken hulks. The main batteries formed the inner line of defense from Choctaw Point spit to Spanish River. Choctaw Point Spit Battery mounted four guns; Gladden Battery, 0.75 mi (1.2 km) to the east on Pinto Island spit, mounted between four and seven guns (10-inch columbiads). The strongest battery in the line was McIntosh, also known as Spanish River Battery, which mounted six guns in a casemate plated with railroad iron and two guns in barbette. Battery McIntosh was 0.75 mi (1.2 km) farther east from Battery Gladden and formed the north-east corner of the obstructions. Eight rows of piles, 5 to 10 ft (1.5 to 3 m) apart, were driven between Choctaw Point spit and Spanish River shoal 0.23 mi (0.4 km) south of the batteries. From Battery McIntosh, the obstructions run south-southwest 1.35 mi (2.17 km), then turn to the west at Dog River bar across the old ship channel for about 0.6 mi (1 km), then turn again to run north-northwest to Choctaw Point spit, a distance of about 0.8 mi (1.3 km). The outline of the obstructions is keystone-shaped in plan, with the northern and eastern lines formed by rows of pilings and the southern and western lines composed of sunken vessels aligned end-to-end. The Turning Basin, proposed as part of the Mobile Harbor Deepening Project, will effect a portion of the western line of the obstructions.

INVESTIGATED ANOMALIES

Twenty-one anomalies were selected by the Corps for investigation under the present contract. Twenty of these anomalies belong to five separate clusters consisting of between three and seven individual anomalies. The clusters were selected for investigation on the presumption that an historic site, such as a shipwreck, would produce a signature consisting of numerous individual anomalies rather than a single broad curve. In recommending these anomalies for further investigation, Mistovich and Knight (1983a:154) define a cluster as "three or more anomalies within an area of 50,000 square meters". This clustering of magnetic readings has been presumed to be potentially indicative of the kind of signature produced by a shipwreck which has broken apart and scattered its cargo over a wide area. The investigated anomalies are listed in Table 1, along with their cluster designations and approximate locations.

SCHEDULING AND PERSONNEL

EH&A scheduled field operations to be conducted on the basis of a flexible six-day work week with the day off reserved to compensate for down-days due to adverse weather conditions or equipment malfunction. Operations commenced on June 1, 1985 and concluded August 28, 1985. Seventy-three calendar days were spent in the field on the basic contract; an additional 16 days were spent delineating the obstructions and testing Tb-1-6.

EH&A's Technical Proposal called for 70 work days to be spent in the performance of the tasks outlined under the basic contract. Single anomalies were estimated to require five days for investigation, which includes two days for relocation with the positioning equipment and three days for bottom search and sub-surface testing. Work schedules for clustered anomalies were estimated somewhat differently because of their areal concentration. These were estimated by adding one day for positioning, one day for magnetic isolation and two days for subsurface testing of each magnetic anomaly in the cluster. Cluster 2 was figured on the basis of three separate anomalies because of the increased diving hazards and current which severely limited daily bottom time.

The formula used to estimate the required investigation time was found to be generally reliable. Some anomalies naturally required less than the estimated time to be fully evaluated while others took considerably longer. Cable, for instance, could usually be located and removed in half a day, while deeply buried objects would require several days to expose and record. The estimated time was also shortened by the fact that four of the anomalies recorded in 1982 were no longer present in 1985 and that two of the anomalies were generated by a single massive target. The actual bottom time spent per project area is illustrated in Table 2.

Fairhope, Alabama, on the eastern shore of Mobile Bay, served as field headquarters for the project. The dive vessels were moored in nearby Fly Creek at which point the project areas were between 7 and 26 mi (11.2 and

TABLE 1
MOBILE HARBOR DEEPENING PROJECT
ANOMALIES EVALUATED

Cluster No.	Water Depth	Location	Anomalies
2	40-45 ft	center to east side of channel	B-8-3 B-10-1 B-19-1
18	12-15 ft	west side of channel within new passing lane	I-58-3 I-62-1 I-62-2
23	10-42 ft	east, center, and west side of channel; below intersection of Hollinger Island Channel	K-79-1 K-79-2 K-80-4 K-83-1 K-83-2 K-84-1
24	10-42 ft	center to west of channel north of Hollinger Island Channel	K-79-3 K-80-3 K-83-3 K-83-4
30	8-42 ft	center to east of channel	L-87-1 L-88-3 L-90-3 L-92-7
Individual Anomaly	15 ft	west side of channel	J-76-2
Individual Anomaly	20 ft	east side of channel at Little Sand Island	Tb-1-6

TABLE 2
BOTTOM TIME BY PROJECT AREA

Project Area	Bottom Time (in minutes)
Cluster 2	701
Cluster 18	1,180
Cluster 23	490
Cluster 24	1,161
Cluster 30	2,930
Tb-1-6	2,742
J-76-2	332
1Mb28	<u>2,308</u>
Total	11,844

41.6 km) distant. With an average vessel speed of about 16 knots per hour, the project areas could be reached within 20 to 90 minutes depending on its location in the bay. Average trip time was about 30 minutes.

A crew of seven was found to work efficiently under the conditions present in Mobile Bay. In part, this number was dictated by the need to employ surface-supplied air diving equipment. In order to keep two surface-supplied divers in the water, an additional two persons were engaged in hose-tending while one person was required for each of the tasks of radio operator, safety diver and equipment operator. The seven EH&A crew members in Mobile were: Jack B. Irion (Project Archaeologist), Stephen R. James (Assistant Archaeologist), Paul C. Teas III (Dive Master), David Beard, Robert Gearhart, Todd Hannahs and Dennis Zabaldo. EH&A was assisted during the positioning and remote-sensing phases by Aquanav, Inc. of Houston, Texas. Aquanav crew chiefs in Mobile were Keith Codd and Aubrey Skeen. A Corps diving supervisor was on board at all times during diving operations.

RESEARCH STRATEGY AND DESIGN

The primary emphasis of the investigation was directed toward the assessment of previously-located magnetic anomalies in terms of potential NRHP eligibility. Because the entities to be investigated were originally discovered only through magnetic and side-scan sonar detection, it was assumed at the beginning of the study that the primary significance of any discovered resources might be in the realm of historical importance. Although the potential presence of prehistoric resources was not intentionally ignored, it was realized that the techniques of the original survey inherently precluded the discovery of such resources except by fortuitous chance.

Although a number of generalized research questions of an anthropological/historical nature had been proposed at the end of the baseline study (Mistovich and Knight 1983a:205-206), the specific formulation of the highly-touted culturally-oriented research designs and research questions seemed both inappropriate and unnecessary at the initiation of this investigation. There was, in fact, no prior evidence to suggest that any of the anomalies might represent anything other than modern harbor debris. It was the explicit research strategy of this study to further the cumulative data base on which subsequent research problems might be based by considering each anomaly as a cultural resource and, within existing technologies, to obtain information on:

1. areal and vertical extent of the anomaly and of the site it represents;
2. cultural/historical associations of the site and the components of the site;
3. site function;
4. spatial and temporal variability, if any, within the site; and
5. degree of preservation, with respect to both the general condition of the site and the preservation of artifacts, and interdisciplinary data within the site.

CHAPTER 2 ENVIRONMENTAL SETTING

A number of comprehensive environmental studies have been conducted in and for Mobile Bay in the last few years, many in connection with Federal permit requirements for the oil and gas industry. A recent summary, published in April 1984, is contained within an environmental impact statement entitled Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi (U.S. Army Corps of Engineers, Mobile District 1984). Another major study was undertaken by the Mobile District as a feasibility report of proposed channel enlargements in Mobile Bay (U.S. Army Corps of Engineers 1979). The purpose of this section is not to provide a restatement of data thoroughly discussed elsewhere, but rather to emphasize those conditions which affect the archaeological working environment, the potential for preservation of archaeological material, and the feasibility of recovering this material.

CLIMATE

The climate of the Mobile area is temperate bordering on subtropical, with summer temperatures moderated by sea breezes. Rainfall occurs throughout the year, generally in the form of hard showers of short duration (U.S. Army Corps of Engineers, Mobile District 1984:3-2).

Average annual precipitation is 57 inches (144 centimeters [cm]) on the western shore of the bay and 64 inches (162 cm) on the eastern shore. The greatest amount of rainfall occurs between June and September (U.S. Army Corps of Engineers, Mobile District 1984:3-2).

Prevailing winds in the area are seasonably variable. Winds from the south or southwest prevail from March through August and from the north or northwest for the remainder of the year. Due to the large surface area and shallow depth of Mobile Bay, it is extremely susceptible to the effects of wind direction and strength. Southerly winds generally resulted in favorable working conditions for archaeological diving, while northers tended to strengthen ebb currents and extend the discharge of riverine particulate matter. This resulted in strong currents of several knots and very poor underwater visibility in both the upper and lower bay.

GEOLOGY AND SEDIMENTATION

Mobile Bay lies in the East Gulf Coastal Plain. The coastal counties of Mobile and Baldwin include tidal marshes and areas described as Coastal Lowlands or Coastal Flatwoods. The interior is separated from the coastal area by an erosional escarpment with relief of up to 100 ft (30.4 m).

The estuarine system is a drowned river valley mouth, possibly a graben, that is filling with sediments introduced by the Mobile River system.

This deposition has progressively narrowed the mouth of the bay and created the Mobile Bay-Mississippi Sound system.

An annual average of 4.7 million tons of suspended sediment is transported into the estuary (U.S. Army Corps of Engineers, Mobile District 1984:3-66). The bay bottom is composed mostly of silty clays and clays. Coarse inorganic sands encircle the bay along the shores. A bay-wide sedimentation rate of 22 inches (in) (56 cm) during the past century has been calculated. The southern shoreline and tidal inlet have been modified by the deposition and removal of sand from east to west by longshore currents.

Deposition is an extremely important factor in judging the potential quality of submerged archaeological remains. The rapid covering of a ship's hull by deposition of sediment frequently creates a reduced-oxygen environment suitable for the preservation of its organic materials. Muckelroy (1978:27) has noted, in reference to submerged archaeological sites, that "...the quality of the surviving remains will be determined principally by the nature and extent of the sedimentary deposits".

Archaeological excavations at the Confederate obstructions recorded a minimum of 1.5 ft (0.4 m) of sediment covering the submerged wrecks in the Western line (Irion 1985:18). The sediment sealed the wooden hulls in an anaerobic environment which contributed to the excellent preservation of the lower timbers (Irion 1985:28).

HYDROLOGY

The average depth of Mobile Bay is 9.7 ft (2.9 m), with the maximum depth being about 60 ft (18.3 m) off Fort Morgan. Water depths in the project areas ranged from between 12 and 50 ft (3.6 and 15.2 m) with the greater depths occurring in the excavated ship channel.

Two dredged navigation systems cross the bay, the Mobile Ship Channel from north to south, and the Gulf Intracoastal Waterway from east to west. An underwater levee parallels the sides of the upper third of the 40-ft (12 m) deep ship channel (U.S. Army Corps of Engineers, Mobile District 1979:B-46).

The hydraulic characteristics of the estuary are influenced by a variable volume of stream discharge, wind, and tidal conditions. The L-shaped morphology of Mobile Bay is also significant in regard to the movement of water. The narrow outlet into the Gulf acts to confine fresh water and restrict the flow of saline Gulf water into the bay (U.S. Army Corps of Engineers, Mobile District 1982:B-48).

The dredging of the Mobile Ship Channel has significantly altered the saline characteristics of Mobile Bay. By facilitating the landward movement of Gulf water into the bay, a salt wedge moves into the channel during flood tide.

During periods of large river flow, the stratification of the waters over the channels is marked. The lens of fresh water riding over denser saline water below will accelerate ebb flows. The Coriolis effect, combined with the dredge spoil levee along the channel, forces the majority of the saline water to the east side of the bay. During low streamflow, salt water intrudes as far as 21 mi (33.7 km) up the Mobile River, while during high river discharge, salinity values can drop in the Lower Bay from 20 parts per thousand (ppt) to nearly zero (U.S. Army Corps of Engineers, Mobile District 1982:B-48).

CHAPTER 3

PREVIOUS INVESTIGATIONS

Marine archaeology in Mobile Bay has, up until the present Channel Deepening Project studies which began in 1983, been generally limited to remote-sensing surveys connected with the permitting of navigational improvements, shell dredging and oil and gas lease tracts. The one major exception to this is the study conducted by the Smithsonian Institution on the Civil War monitor Tecumseh (U.S.S. Tecumseh 1984). The ironclad was sunk in 1864 at the mouth of Mobile Bay while attempting to force an entrance into the bay at the head of Admiral David Farragut's fleet of Union warships. In 1966, the Smithsonian received title to the wreck and began formulating plans to raise the ship. These plans were eventually dropped in 1974 after Congress refused to grant funding for the project. There is still considerable local interest in raising the Tecumseh, but the project would be both technologically difficult and incredibly expensive.

Lately, local interest has centered around the exploration of two Confederate ironclads, the Huntsville and the Tuscaloosa, sunk in the Spanish River only a few miles north of Mobile. Small sections of the stern and deck of one of the vessels, thought to be the Huntsville, have been uncovered by local divers under archaeological supervision (Schell, personal communication 1985). The project is largely the brainchild of a Mobile lawyer, Sidney H. Schell, who hopes to generate enough interest in the warships to fund their raising, preservation and display. Mr. Schell has done a considerable amount of research on Mobile's Civil War history and has generously shared his findings with the author.

A number of cultural resource surveys have been performed in Mobile Bay using remote-sensing techniques. Remote-sensing surveys have been performed in the upper bay by Hudson (1974) and Saltus (1978) in conjunction with the Theodore Ship Channel and disposal area and the Pinto Pass disposal site. Additional surveys were conducted in support of shell dredging permits by Floyd (1981a). Mistovich (1981) performed an on-site evaluation of the effects of exploratory shell dredging.

The increased activity of the petroleum industry in the bay and Alabama coastal waters has generated several remote-sensing surveys. Shallow gas hazard and cultural resources surveys have been performed for Mobil Oil (Marine Environmental Sciences Consortium 1979; Dames and Moore 1981; Coastal Environments 1982), Shell Oil (Floyd 1981b), Phillips Petroleum (Hudson 1981), and Exxon (Racal-Decca 1981, 1982).

Prior to 1983, all marine cultural resource surveys had been restricted to the reconnaissance or Phase I level whose major purpose was to identify and avoid potential resource areas. The baseline survey performed for

the present study was the first to be followed by a large-scale effort directed at ground truthing magnetic anomalies. This study, conducted by OSM Archeological Consultants, consisted of a literature/archival search and remote-sensing survey of over 2,000 linear miles of bay and gulf waters (Mistovich and Knight 1983:vii). The survey resulted in the recording of 608 magnetic anomalies. Most of these were able to be eliminated from further study through comparison with the side-scan imagery which clearly demonstrated them to have been generated by modern harbor debris such as steel cable. Nevertheless, 20 magnetic clusters and 16 individual anomalies were recommended for Phase II testing. Prioritized on the basis of constructional needs, nine individual anomalies and one cluster located in two separate areas, a proposed Turning Basin in the upper bay and a proposed Transshipment Facility in the lower bay, were selected by the Corps for testing and evaluation.

In 1983, the Corps contracted EH&A to perform the first major underwater evaluation of magnetic anomalies in Mobile Bay. This study resulted in the discovery of the Confederate obstructions (1Mb28) which consist of over a dozen historic ships used by the Confederate Army during the Civil War to block the approach to the Mobile River (Irion and Bond 1984). The Confederate obstructions have since been declared eligible for inclusion in the NRHP. Historical evidence uncovered during the course of the study indicated that at least one, and possibly two, steamboats and a flatboat would be affected by the construction of the proposed Turning Basin (Irion and Bond 1984:87).

The following year, EH&A conducted test excavations on one of the steamboats, identified as the Cremona, to determine its spatial limits, state of preservation, and construction details (Irion 1985). The 1985 study concluded that the preservation potential for substantial amounts of the hulls of all the submerged wrecks in the obstructions was high and that mitigation would be recommended for any of the other vessels directly affected by the proposed channel improvements. A part of the present study resulted from the urgent need to determine the precise number of obstruction vessels which would be affected by the proposed channel enlargement.

CHAPTER 4 INVESTIGATIVE PROCEDURES AND TECHNIQUES

ANOMALY INVESTIGATIONS

The EH&A archaeologists employed a variety of methods to locate and ultimately identify magnetic anomalies in the work areas. Techniques changed to meet the challenges of radically different depths and conditions of visibility and current.

The project areas in the middle and upper bay are characterized by murky water and silty clay bottom. Depths ranged between 12 and 50 ft (3.6 to 15.2 m) depending upon whether the anomaly was situated in the channel or on the "flats." Visibility ranged from 1 ft (0.3 m) to a total absence of light. Visibility improved at the southernmost project area (Cluster 2) to about 15 ft (4.5 m), but divers had to contend with a strong current in excess of 2 knots. EH&A adapted its testing program to techniques most suitable to the prevailing conditions of each area.

Methods employed under the contract amendment to delineate the Confederate obstructions will be discussed separately in Chapter 5.

Positioning

Initial positioning was performed with a Motorola Mini-Ranger III radar positioning unit onto Universal Transverse Mercator (UTM) coordinates provided by the USCE. The Mini-Ranger III system consists of land station transponders which transmit to a mobile receiver mounted on board the survey vessel. U.S. Coastal and Geodetic (U.S.C.&G) survey monuments were utilized to provide shore beacon positions for the survey net. Mini-Ranger beacon coordinates are provided in Table 3. The system provides a continuous readout of the distance from two of the transponders, and may be switched to a third as a check. The Mini-Ranger III provides a distance measurement accurate to within +1 m.

The loss of the positioning buoys deployed at the anomaly targets was a major problem faced by the field personnel. Although this had not been much of a problem in past experience in Mobile Bay, the target areas in 1985 were in high-use areas for commercial shrimpers, whose nets were likely to snag the buoys. In addition, many of the anomalies were located directly in the ship channel and so were subject to loss from being run over by freighters, tugboats or any other large vessel plying the channel. As a result, a method for relocating the positions on a day-to-day basis had to be formulated since it was not cost effective to keep the Mini-Ranger on board for the duration of the project.

It was originally planned to take optical sitings using an electronic distance meter to each of the buoy locations. These instruments, however, depend upon bouncing a beam of light off a small stationary mirror. To use the

TABLE 3
MINI-RANGER BEACON COORDINATES

Station	Easting	Northing
Fort Gaines	395489.85	3346558.37
Mon Louis	392981.72	3359185.17
Fowl	394688.21	3371363.62
Hagen	398335.19	3385521.75
Mullet	412727.93	3364983.93

UTM: Zone 16
Spheriod: Clark 1866

device for our purposes, the mirror would have to be mounted in a boat, whose pitching and rolling would render repositioning on a precise point impossible.

As a compromise, it was determined that a Loran C navigation device would be the quickest and most efficient means of relocating the points with reasonable accuracy. Fortunately, Mobile is in an ideal location for the Loran C network and a point can be relocated with an accuracy of ± 30 ft (9 m).

Loran C is a hyperbolic navigation system which employs three or more fixed transmitter sites, whose transmissions are time related in a known, precise way. The Loran series of navigation systems transmits identifiable pulse groups from a group of transmitters known as the Loran chain. The distance from the transmitters to the receivers is measured in microseconds and displayed as the Time Difference (TD) between the master and all secondary stations. The Loran system employed by EH&A is a Raytheon Raynav 550.

The procedure for obtaining accurate Loran coordinates for the anomaly targets was as follows:

1. The Loran coordinate for the permanent boat slip was recorded so that the accuracy of the system could be checked on a daily basis.
2. The survey vessel was positioned over the recorded coordinate using the Mini-Ranger III. At the moment the coordinate was reached, a fix was simultaneously taken with the Loran and a buoy dropped at the point.
3. A check of the coordinate buoy was made using the third range of the Mini-Ranger III, at the same time the Loran coordinates were checked.
4. Immediately following the second check of the position using the surveying equipment, a second vessel performed an ad hoc magnetometer survey over the general area. This provided instant verification that a magnetic anomaly existed in the buoyed location.

A magnetometer survey of the area of the buoy positioned by the Mini-Ranger III was thought to be of particular importance in the few instances when a magnetic anomaly was not detected at a given coordinate. In this way, the failure to relocate an anomaly at the published coordinates could be presumed to be because the anomaly was simply no longer there rather than being due to any error in the Loran system. An area having at least a 300-ft (91-m) radius was surveyed around the published coordinate to insure that the anomaly would be detected.

Remote Sensing

All remote sensing was performed with a Geometrics 866 proton precession magnetometer. This unit is remarkably well suited to marine survey archaeology. The console is built into its own water-tight carrying case which is light-weight (13 lbs), small, and exceptionally portable. The "866" offers high-precision measurement within 0.1 gamma resolution. The unit has a built-in dual trace recorder which produces a permanent record annotated with exact readings, time, scale, and date factors. A continuous LED readout was found useful when refining buoy positions, and a strip chart was not required. A little experimentation showed that the machine performed best for archaeological interpretation when set on the 20/200 or 50/500 gamma sensitivity scale with a sample interval of 1.5 seconds.

All remote-sensing activities were carried out from the MV Lanny, one of two 32 ft (9.7 m) aluminum crewboats leased by EH&A for the duration of the project (Figure 2). Because of the non-ferrous construction of the vessel, it was possible to use the magnetometer in a variety of ways. For the initial survey of an area or in instances where the site lay in excess of 15 ft (4.6 m) of water, a marine tow system with a 50 ft (15.2 m) setback was employed. In shallow areas, a land sensor, mounted on the end of an aluminum mast, was boomed off the bow. This allowed for more precise placement of the marker buoys over the areas of highest magnetic deviation.

Because of the extremely poor visibility in Mobile Bay, precise location of the anomaly targets with the magnetometer has proven essential to the relocation of the objects underwater. By marking the point of highest magnetic deviation, the search area is considerably reduced for the divers who often must rely solely on their sense of touch to find the object. It is extremely important to reduce the necessary search area as much as possible because of the disorienting effects of working in zero visibility. After marking a central point, the divers may then work off this point using a search line which orients them back to the focus. In this way the divers could be certain that they had thoroughly covered the area during their search.

A number of techniques were tried to efficiently and accurately locate the point of maximum magnetic deviation for any given anomaly. The two most successful techniques employed the marine sensor deployed from the dive vessel which was anchored some 50 to 100 ft (15 to 30 m) away from the general vicinity of the anomaly. The first of these methods utilized a diver to tow the sensor, while the second could be implemented by a snorkler on the surface.

The diver-towed method required the use of a two-way communication system between the divers and the magnetometer operator on the surface. EH&A utilized a Widolf demand mask equipped with a second-stage Scubapro regulator, a microphone inside the mask and a "bone phone" worn under the hood or mask band (Figure 3). The procedure for conducting a bottom search with the magnetometer was simple, but effective. With one diver positioned at a buoy

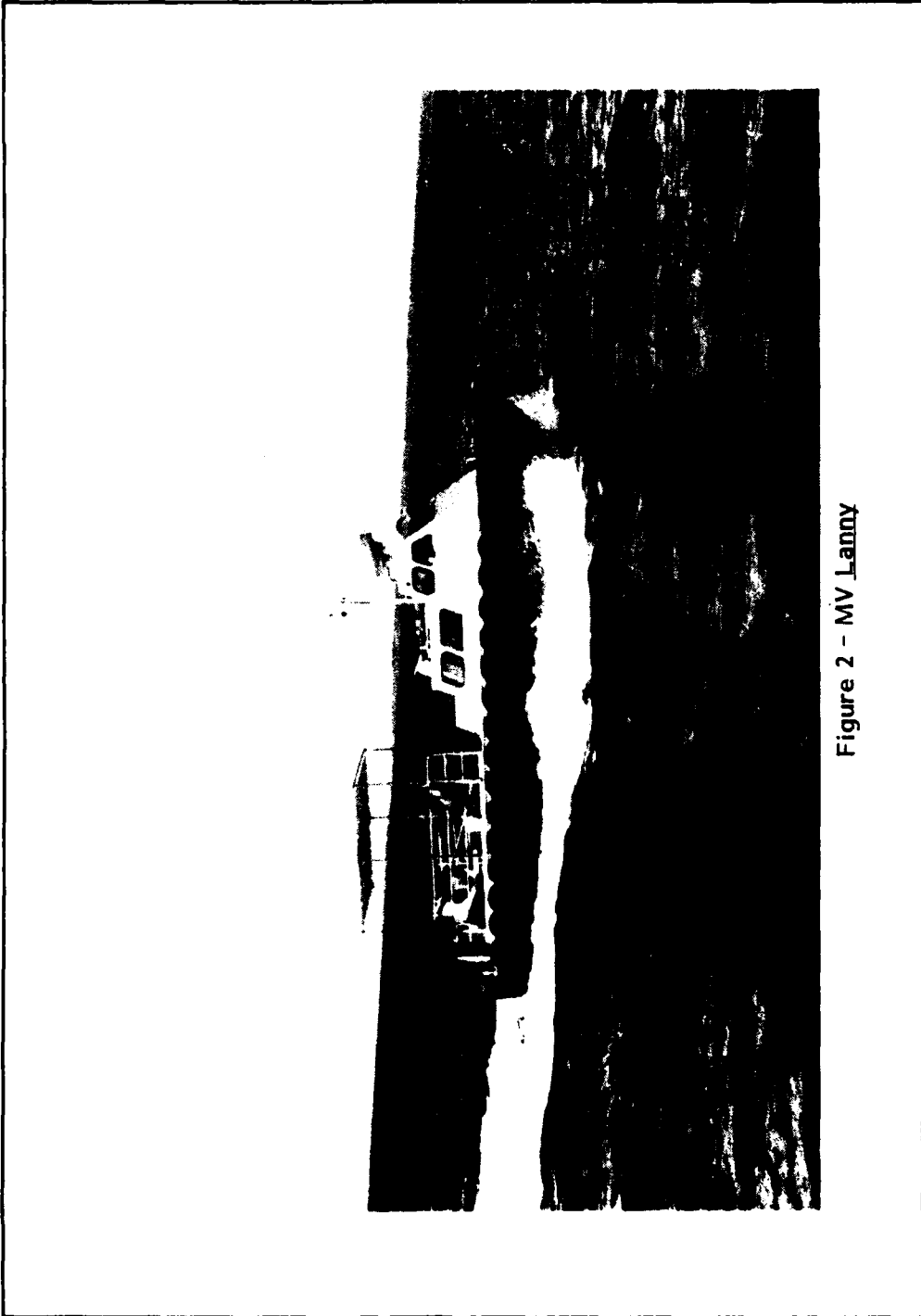


Figure 2 - MV Lanny

marking the general location of the anomaly and keeping hold of the magnetometer cable, the second would swim the "fish" on the surface in the opposite direction from the boat. When the diver was 50 to 75 ft (15 to 23 m) from the positioning buoy, he dropped the fish to the bottom and rejoined the other diver at the non-ferrous buoy anchor. The divers, on command from the surface, would then begin to slowly pull the fish toward them on the bottom. If a significant peak registered on the magnetometer, the operator dispatched one of the divers to examine the area around the mag fish with an 8-ft (2.4-m) aluminum probe. If nothing was encountered, the point was marked with a buoy and the divers would continue to pull the fish until the readings began to level off to a normal background. Beginning from the new buoy location, the procedure was then repeated at a 90-degree angle to the first pull. In this way, the zone of magnetic perturbations would be gradually refined until the marker was within inches of the targeted object. With the fish so close to the ferrous target, the magnetometer produced anomalous readings which were often in excess of 40,000 gammas, even for a relatively small object.

A second method for precisely locating a metallic object with the magnetometer did not require the use of underwater communications equipment. In this case, the magnetometer fish was suspended from a life ring to a depth of 1 to 2 ft (0.3 to 0.6 m) above the bottom. A snorkler could then swim the ring on the surface in any direction, while a slight tension was kept on the cable from the boat. A temporary buoy attached to a small weight was deployed by the snorkler at the peak magnetic reading. Both of the methods, as they have been outlined, proved to be effective in the field in relocating even very small objects such as a steel can and a pair of pliers. The second method has the added advantage that it keeps the fish off of the bottom, thereby saving some wear and tear and potential damage.

In general, the magnetometer was found to be an essential tool which was used on a day-to-day basis. Although the search methods would seem to be time consuming, as indeed they are, the time is well spent when compared to that which would be required to effectively examine a three-dimensional area in total darkness. It is doubtful, in fact, that many of the objects which were located with the aid of the magnetometer could have been located in any other way.

Diving And Excavation

Because of the highly-variable conditions of depth, visibility and current throughout the project area, EH&A approached the problem of undersea exploration and excavation in a flexible manner which utilized techniques specifically effective in the conditions of the work area. Three primary techniques were employed in the physical relocation of the anomaly targets. These consisted of a visual and tactile search of the bottom surface, subsurface probing to a maximum of 20 ft (6.1 m), and bottom sediment removal to a maximum of 7 ft (2.1 m). As previously discussed, the magnetometer was used to delineate the precise location of each anomaly prior to subsurface testing.

Diving operations were conducted from two identical 32-ft (9.7-m) aluminum-hulled crewboats, the MV Lanny and the MV Mark. The boats were each equipped with a single 6-71 Detroit diesel engine, VHF marine-band radios and radar. The Mark was also equipped with a Raynav 550 Loran C navigational computer. The vessels were generally lashed together side by side during diving operations to provide a larger work space.

SCUBA and surface-supplied air (SSA) diving equipment was employed during the project, its use depending upon environmental conditions and task. The SSA equipment consisted of a Widolf full-face mask with a built-in Scubapro demand regulator. The mask was equipped with a microphone and bone conductor phone for hard wire communication. The masks and surface tender's communication box were wired in such a way as to provide three-way open-circuit communication between two divers and the surface. Air was supplied to the SSA divers either by means of a Keene compressor or from four 235 ft³ "H" bottles which were refilled by means of an on-board Bauer high pressure air compressor which was also used to refill the SCUBA tanks.

An underwater circle search was conducted immediately after a buoy was positioned in the area of greatest magnetic deviation. A line, 45 ft (13.7 m) in length and knotted at 5-ft (1.5-m) intervals, was attached to a concrete or lead anchor. Two divers then visually and tactilely inspected the area of the circle, using the line to control their distance from the center. The beginning of each revolution was marked by a stake so that the divers would know when the revolution had been completed. At the completion of each circle, the divers moved down the line 10 ft (3 m) and began the next revolution. The almost total lack of visibility made the use of the line mandatory for the divers to hold their relative positions.

When it was necessary, for safety reasons, to use only the SSA equipment, the bottom searches were conducted somewhat differently in order not to foul the divers' umbilicals either with each other or with the buoy line. In this instance, one diver held the second diver's umbilical at the position marker while he conducted the search in a 180-degree arc. At the completion of each arc, he was informed by the anchorman who would then let out an additional 5 ft (1.5 m) of slack for the next concentric arc.

During the course of the circle search, the area was extensively probed (Figure 4). The probes were of two types and consisted of 8 ft (2.4 m) long aluminum rods and 20-ft (6-m) long, 1-in (2.5-cm) diameter PVC pipe. The PVC pipe was employed in the event that nothing could be located either visually or with the shorter probe. The PVC pipe was connected to a Honda 3-in (7.6-cm) water pump in order to facilitate driving it into the bottom sediments.

The next step involved excavation of bottom sediments to uncover the source of the magnetic disturbance. A hydraulic dredge has proven to be the most efficient and effective excavation tool for the relatively shallow waters of Mobile Bay. In the investigated areas in the 50-ft (15-m) depths of the ship



Figure 3 - Diver Preparing to Descend to Work Site



Figure 4 - Diver Using Aluminum Probe

channel, the dredge had the added advantage of being able to be quickly deployed and retrieved in the event that the passage of a large ship would have required a rapid departure. The dredge operates by forcing water under pressure through a port feeding into a 2-in (5-cm) steel pipe. The pipe is bent at a 30-degree angle and it is crucial that the water feed into the bend in such a way that the flow is directed towards the exhaust end. A powerful suction is created at the opposite or intake end of the pipe.

The data retrieval methods outlined in this chapter have been proven effective and gradually refined during the course of three seasons in Mobile Bay. Employing these methods, EH&A has maintained a 100% success rate in relocating and assessing anomalies on the bay floor. The key to this successful retrieval rate is believed to be the innovative use of the proton magnetometer to reduce the search area to the absolute minimum for the divers, who must usually work under conditions of total darkness.

CHAPTER 5

DESCRIPTION AND EVALUATION OF INVESTIGATED ANOMALIES

Twenty-one anomalies were investigated for NRHP eligibility under the basic contract between the Corps and EH&A. Twenty of these magnetic disturbances were grouped into five clusters containing between three and six anomalies each. In addition to the clusters, a single isolated target, J-76-2, was also scheduled for testing under this contract. A later contract modification called for testing and evaluation of an additional isolated anomaly, Tb-1-6. The following chapter, organized by cluster and anomaly numbers, briefly describes the ferrous source of each magnetic anomaly. The discussion of Tb-1-6, which presented special problems to the excavators, follows that of the anomalies tested under the basic contract.

CLUSTER 2

Anomalies B-8-3 and B-19-1

These two anomalies were found to have been generated by a single source, consisting of modern debris which had collected in a dredge scar in the channel. The debris was composed of cans and small sheet metal and cable fragments.

Anomaly B10-1

Anomaly B-10-1 was found to have been generated by a partially buried steel cable 73 ft (22.2 m) long. The cable was 1 in (2.54 cm) in diameter and was composed of 6 strands of 25 wires per strand and a natural fiber core.

CLUSTER 18

Anomaly I-62-1

Anomaly I-62-1 consisted of a length of pipe 37 ft (11.2 m) long and 18 in (45.7 cm) in diameter. The function of the pipe is unknown.

Anomaly I-62-2

A broken fragment of steel cable, 24.7 ft (7.2 m) long generated the anomalous reading in this location. The cable was formed of seven strands comprised of 19 wires to the strand. The cable had a diameter of 1.5 in (3.8 cm).

Anomaly I-58-3

Anomaly I-58-3 no longer exists in its recorded position.

CLUSTER 23

Anomaly K-79-1

Anomaly K-79-1, a very small target generating only a 9 gamma deviation, was found to consist of miscellaneous, unidentifiable metal fragments and a modern pair of pliers.

Anomaly K-79-2

Anomaly K-79-2 no longer exists in or near its recorded position.

Anomaly K-80-4

A length of steel cable, 6.6 ft (2.02 m) long and 3 in (7.6 cm) in diameter, accounted for the magnetic disturbance in this area.

Anomaly K-83-1

Anomaly K-83-1 no longer exists in or near its recorded position.

Anomaly K-83-2

A short length of steel cable, 4.2 ft (1.2 m) long and 1.5 in (3.8 cm) in diameter, was located at this position.

Anomaly K-84-1

Anomaly K-84-1 no longer exists at or near its recorded position.

CLUSTER 24

Anomaly K-79-3

Anomaly K-79-3 consisted of 15.8 ft (4.8 m) of steel cable with a diameter of 1 in (2.54 cm). The cable was composed of seven large strands with each strand consisting of seven smaller strands formed of seven wires.

Anomaly K-80-3

Anomaly K-80-3 no longer exists at or near its recorded position.

Anomaly K-83-3

Anomaly K-83-3 consisted of a piece of cable 60 ft (18.2 m) long with a loop formed in one end and held in place by a mandrel. The cable was formed by six wire strands and one synthetic fiber strand and had a diameter of 1.5 in (3.8 cm). The wire strands were composed of 25 individual wires. This type of cable is generally employed as a mooring or towing line.

Anomaly K-83-4

A sunken channel buoy created the perturbation of the magnetic field in this area. The buoy is in the shape of an inverted, truncated cone 3 ft (0.9 m) in diameter at the top and 6.7 ft (2 m) long. Two lifting rings are welded to the top and a third to the side. A stabilizing fin is attached opposite the lifting ring on the side. The buoy is attached by means of a chain to a concrete anchor. Correspondence with the U.S. Coast Guard revealed that analogous anchors weigh in the vicinity of 2 tons (1,800 kg).

CLUSTER 30

Anomalies L-88-3 and L-92-7

Both anomalies L-88-3 and L-92-7 are generated by the same large mass. This mass consists of four concrete pipes which are reinforced with wire mesh. Each pipe measures slightly over 95 ft (29 m) in length and 4 ft (1.2 m) in diameter. A local informant suggested that the objects may have been part of the cargo of a barge while carrying pilings for the construction of the I-10 bridge.

Anomaly L-87-1

The anomalous reading at L-87-1 was generated by two small steel plates of unknown purpose. One plate is rectangular and measures 4 ft by 2.2 ft (1.2 x 0.7 m). The second object is L-shaped in profile with a U-shaped rod fitted loosely through two holes in one face. The piece is 0.5 ft (0.15 m) wide while the two arms of the "L" measure 0.52 ft (0.16 m) high. Both objects were removed from the area.

Anomaly L-90-4

Anomaly L-90-4 is buried by over 7 ft (2.1 m) of mud in the bottom of the ship channel. Because of the soft unconsolidated nature of the bottom sediments in this location, only limited information could be acquired on this anomaly. A combination of hydraulic jet and induction dredge was used to remove a portion of the overburden and expose a small portion of the target. This was found to be a cylindrical pipe between 1 and 1.5 ft (0.3 to 0.5 m) in diameter. The length for the object was determined by probing along its surface until each end was reached. In this way the target was determined to measure approximately 12 ft (3.6 m) long. Extensive probing in the vicinity of the pipe showed it to be an isolated occurrence.

SINGLE ANOMALY

Anomaly J-76-2

Anomaly J-76-2 was generated by a length of steel cable 20 ft (6 m) long. The cable was formed of six strands with 19 wires to the strand. The diameter of the cable was 1.5 in (3.8 cm).

EVALUATION OF ANOMALIES

All of the anomalies investigated within Mobile Harbor by EH&A under the basic contract are composed of modern debris. Fully one third of the anomalies investigated were found to be steel cable, a material in constant use in the bay as mooring, towing and lifting lines. When the worn cable breaks, it is often simply discarded over the side.

Twenty-four percent of the anomaly positions no longer register as a disturbance of the magnetic field. EH&A's magnetic survey was generally carried out to a radius of 300 ft (90 m) from the recorded position of the anomaly. The absence of the anomalies from their recorded positions may be accounted for in one of two ways. First, their absence may be a result of a positioning error in the original survey. It is more likely, however, that the anomalies have been removed in the time between the original survey in 1982 and the diving investigation in 1985. Small objects dropped in the bay have a fairly high rate of mobility as a result of the large number of shrimp boats which ply its waters. A local informant involved in commercial shrimping informed the EH&A crew that shrimp nets are dragged up to an inch (2.54 cm) below the surface of the mud, thereby snagging anything which is lying directly on the bottom. He further indicated that some shrimpers prefer the deeper waters of the channel while another group of shrimpers stay only on the mud flats on the sides and that the channel shrimpers dump anything snagged in their nets on the flats and vice versa. In this way, there is a constant movement of material in the vicinity of the channel.

None of the anomalies investigated were of historic significance and no further work is recommended for them. All construction proposed for the investigated areas is therefore regarded as cleared, from an archaeological standpoint.

RECOMMENDATIONS

As a result of EH&A's extensive experience in the hands-on ground truthing of magnetic anomalies, recommendations are made to the U.S. Army Corps of Engineers, Mobile District, as to the types of anomaly signatures which should be investigated in the future. Most of the anomalies which were selected for investigation under the basic contract were chosen, not because of the strength of their magnetic field, but because of their proximity to one another. This clustering of magnetic readings has been presumed to be potentially indicative of the kind of signature produced by a shipwreck which had broken apart and scattered its cargo over a wide area. In recommending these anomalies for further investigation, Mistovich (1983:154) defines a cluster as "three or more anomalies within an area of 50,000 square meters". Mistovich admits that the definition is probably too liberal for the more concentrated wreckage which could be expected in a protected bay environment as opposed to an active coast line. This proved to be the case.

In all the clusters, with the exception of Cluster 30, the anomalies were clearly isolated occurrences against a magnetically clean background. It is judged by EH&A that a shipwreck in a relatively low-energy environment like Mobile Bay would produce a signature consisting of a broad field with stronger peaks representing concentrations of mass. With the high sedimentation rate and generally calm water, it is unlikely that artifacts could migrate very far from the main concentration, except, perhaps, in the case of vessels lost to hurricanes.

An example of an actual historic shipwreck was examined by EH&A in 1985. The wreck has been tentatively identified as the Thomas Sparks, an early iron-hulled, screw-propulsion vessel built in 1854 which was "almost instantly dashed to pieces" (Mobile Register 1866) when it hit the pilings and wrecks which compose the obstructions. Despite its violent end, its wreckage is confined to the area of the intact portion of the hull. Based on the example of this wreck, admittedly of an iron rather than wooden hull, it is considered highly unlikely that three or four anomalies, unassociated with a general increase and disruption of the background field and separated by as much as 700 ft (213 m) as would be the case in Mistovich's model, could ever be indicative of a shipwreck within the environment of Mobile Bay.

Many of the anomaly targets investigated under the basic contract were located directly in a major ship channel which has been continually dredged since 1910. Because Mobile Bay has historically been shallow (averaging 10 ft [3 m]), it is virtually impossible that any intact remains of an historic site would exist beneath what would have been over 40 ft (12 m) of clay. Any anomalies which are encountered within the channel itself are probably of recent deposition. It may, however, be advisable to investigate the cause of extremely large anomalies of, for example, over 500 gammas, simply to determine if they will have an adverse effect on the dredging operation.

It should, of course, be noted that these remarks only address the particular environment of Mobile Harbor and may not hold true in other settings with different forces at work. The cluster model was developed, for example, for the Texas coast, a high-energy environment capable of dispersing material over a very large area. Potential shipwrecks have also been reported, again off Texas, to be buried by as much as 40 ft (12 m) of sand. Neither of these phenomena seem to hold true for Mobile Bay, however, except at the mouth where forces similar to those off Texas are at work.

INVESTIGATION OF ANOMALY TB-1-6

Methodology

Anomaly Tb-1-6 was tested in a method identical to that described for the anomalies under the basic contract. After carefully isolating the target with the magnetometer, a 10-ft by 8-ft (3-m x 2.4-m) trench was excavated to a depth of 8 ft (2.4 m). No trace of the target was found in the trench.

Further experimentation was performed with the magnetometer to verify that the source of the anomaly was within the boundaries of the trench. As described earlier, the magnetometer sensor was suspended above the bottom from a life ring. A snorkler on the surface swam the ring over the area and buoyed the point of strongest magnetic disturbance. The bottom of the trench was then thoroughly probed with 8-ft (2.4-m) aluminum rods, concentrating around the buoyed point. This, too, failed to locate the source of the anomaly.

Finally, a 20-ft (6-m) long piece of 1.5 in (38 mm) diameter PVC pipe was rigged to a water pump to make an hydraulic probe. Using this, the anomaly was detected at a depth of 15 ft (4.6 m) from the base of the trench, making a total depth of 23 ft (7 m) beneath the sediment or -43 ft (-13 m) MSL.

Description of the Anomaly

Because of the depth of the sediment covering the anomaly, it was judged impractical to attempt to excavate down to it. As a result, information about the target was retrieved using the probe and remote sensing. The object appears to be relatively small compared to its mass, measuring no more than 4 to 5 ft (1.2 to 1.5 m). Nevertheless, the target produces a magnetic reading of 460 gammas at a distance of 45 ft (13.7 m), suggesting a mass of over a ton (Breiner 1973:43). The object lies on a harder-packed bottom than the sediment which covers it. It was found, in fact, that the hydraulic probe could not penetrate through this strata. The area was carefully bracketed with both the probe and the magnetic sensor. In this way, it was determined that the target is an isolated occurrence unassociated with any other indicators of a potential shipwreck.

Conclusions

It is hypothesized that the object was deposited during or subsequent to the dredge and fill operation in the vicinity of Little Sand Island, which was created from dredge disposal material. This would suggest that the target is dated post-1914, when the channel was straightened to its present position. Prior to this date, the coordinates for the anomaly would have fallen in shoal waters of 3 to 4 feet (0.9 to 1.2 m) over Choctaw Point spit. This area was, therefore, not navigable until the second decade of the twentieth century. Additionally, the target has been determined to represent an isolated occurrence with a magnetic signature similar to that produced by steel pipes found by EH&A in other parts of the bay.

CHAPTER 6 DELINEATION OF THE CONFEDERATE OBSTRUCTIONS

HISTORICAL BACKGROUND

Few places in the Confederacy were as strongly defended during the Civil War as Mobile, Alabama. As a result, the city survived as a Confederate port from 1861 to August, 1864, when Farragut's warships entered the bay and Union troops invested the two forts, Morgan and Gaines, at the entrance to the Gulf. Despite the loss of the bay to the enemy, the City of Mobile did not fall until nine months later, three days after Lee's surrender at Appomattox.

From 1861 to 1864, Mobile's survival had been paramount to the survival of the Confederacy. After the fall of Pensacola and New Orleans in 1862, the city was the last major port open to the Confederates in the eastern Gulf of Mexico. As such, Mobile was a major point for communication and resupply. Essential military supplies and medicines, purchased in Europe and shipped through Cuba, were smuggled past the Union fleet in swift blockade runners. When the same ships slipped out of the bay on a dark night, they were laden with cotton, the South's primary medium of exchange in European markets.

Not only war supplies, but also luxury goods were carried by the blockade runners into Mobile, where they fetched incredible prices. One Southern historian later complained that "cotton, instead of being exchanged for British gold, was exchanged for trinkets, silks, satins, laces, broadcloths, brandy, rum, whiskey, fancy slippers and ladies goods" (Fleming 1911:188). Supplied by the blockade runners and feeling secure behind the defenses, Mobilian society indulged in a seemingly endless round of parties (Delaney 1981:115).

Mobile remained in Confederate hands because of an elaborate system of land and sea defenses which made it nearly impregnable from outside attack. Lacking a navy capable of defending their home ports, "Southern engineers were compelled to recognize the inefficiency of existing modes of defense and to draw on their scientific knowledge and ingenuity for new ones" (Sheliha 1868:104-105).

The Confederate obstructions at 1Mb28 were part of the works designed specifically to prevent entrance into the city of Mobile through Choctaw Pass and up the Mobile River. The defenses consisted of three main batteries covering obstructions of pilings and sunken wrecks (Figure 5). The batteries formed the inner, or northernmost, line of defense from Choctaw Point spit to Spanish River. The Choctaw Point spit battery mounted four guns; Gladden Battery, 0.75 mi (1.2 km) to the east on Pinto Island spit, mounted between four and seven 10-inch columbiads. The strongest battery in the line was McIntosh, also known as Spanish River Battery, which mounted six guns in a casemate plated with railroad iron and two guns in barbette. Battery McIntosh was 0.75 mi (1.2 km) farther east of Battery Gladden and formed the northeast



Figure 5 - Merrill's Map A (1866)

corner of the obstructions. Eight rows of pilings, 5 to 10 ft (1.5 to 3 m) apart, were driven between Choctaw Point spit and Spanish River shoal 0.23 mi (0.4 km) outside the batteries. From Battery McIntosh, the obstructions run south-southwest 1.35 mi (2.17 km), turn to the west at Dog River bar across the old ship channel for about 0.6 mi (1 km), then turn again to run north-northwest to Choctaw Point spit, a distance of about 0.8 mi (1.2 km). In plan view, the obstructions resemble a keystone in shape. The defenses also included a number of floating iron-clad batteries which were anchored inside the obstructions to provide additional fire-power. A description of one of these batteries is provided in Appendix C.

The "lower obstructions" at Dog River bar consisted of pilings and sunken ships filled with brick. There is no lack of contemporary sources for the composition of this line. J. W. Porter, a refugee from Alabama who surrendered to Federal forces on September 13, 1862, reported:

"From this battery (McIntosh), with a wide sweep to the south and west, was a line of obstructions across the channel to the west shore. This line was formed of spiles (sic) and sunken vessels filled with brick. Millions of new brick were sunk there" (U.S. Navy 1921a).

Farragut himself found the obstructions to be a formidable obstacle. In a report made to Gideon Wells, Secretary of the Navy, he wrote:

"The rebels have so obstructed the channel by piles and by sinking vessels loaded with brick that in that shoal water it will be difficult to do anything with them" (U.S. Navy 1921b).

The vessel obstructions were put into place in the spring of 1862 in a matter of a few days, an astonishingly short time considering the number of vessels and tons of brick and debris involved. The catalyst for this hasty action was the fall of New Orleans to Admiral Farragut on April 16 of that year. Believing an attack on Mobile to be imminent, the Confederate engineers, under the direction of Charles T. Liernur, rapidly commandeered available vessels to be scuttled at the Dog River bar. By April 28, General John Forney telegraphed to General G. T. Beauregard in Mississippi that "in a day or two I shall have all the passes of approach to the City over Dog River bar effectively stopped up, leaving passage for our gunboats only which can be closed at any moment" (Forney 1862).

A number of corroborative statements confirm that the vessels were in place by the end of April or early May. On May 15, 1862, Charles Iverson Graves, stationed aboard the C.S.S. Morgan in Mobile Bay, wrote the following account back to his sweetheart, Maggie Lea, in North Carolina:

"We met with a terrible accident a few evenings ago, which accounts for our being off the City instead of at

Choctaw Pass. We had been down on a reconnoitering expedition and were returning about sunset to take our position for the night. In attempting to force our way over the obstructions one wheel struck the deck of one of the sunken steamboats and completely disabled one engine, snapping the rods like pipestems and stripping the planking from the top of the wheel house" (Graves 1862).

Purchase vouchers which also agree with this date still exist for some of the ships. Obstruction vessels for which these documents are still extant are provided in Table 4. It will be noted that two of the vessels, the Vernon and the California, did not have claims filed on them until March, 1863. It is not known why the claims for these vessels were filed later than the others unless they were used as gates and not actually sunk until this date. It is equally possible that these were delinquent claims which simply were not acted upon until 11 months after the fact.

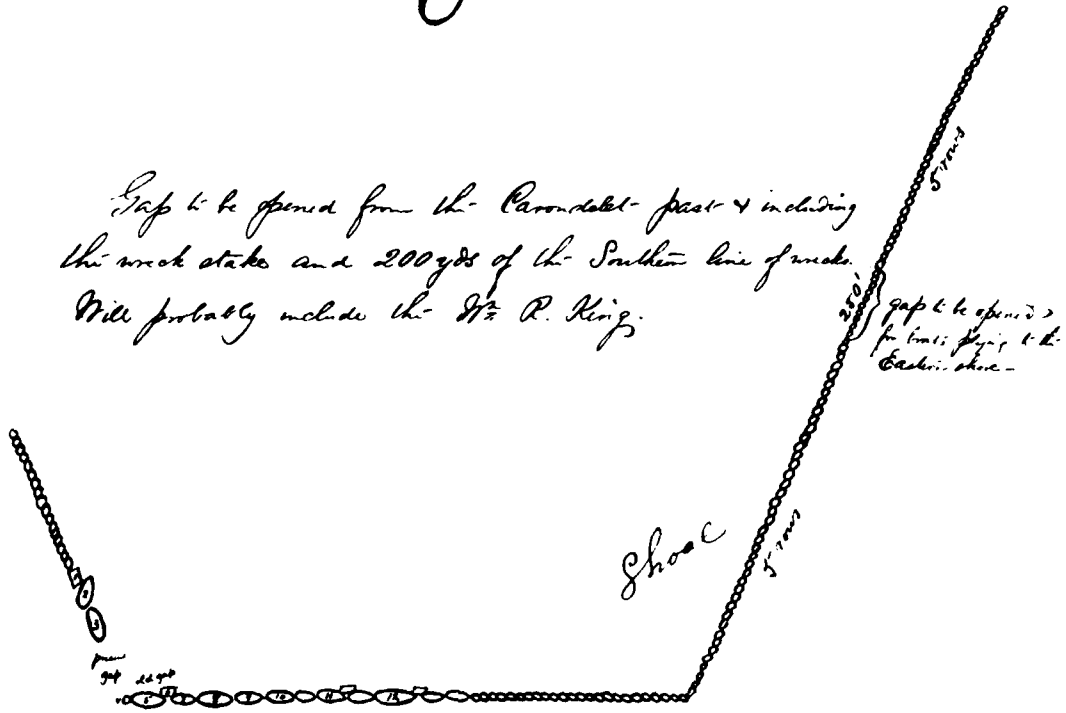
One of the major research questions which this and past studies of the obstructions (Irion and Bond 1984; Irion 1985) has tried to answer relates to identity of the vessels which were sunk at the obstructions. Part of the difficulty involved in answering this question lies in the haste with which they were sunk. This problem is reflected in the response of Jeremy Gilmer, Chief of the Confederate Engineer Bureau to James Seddon, Secretary of War, in response to his directive of February 17, 1863, to report the number and amount of claims for vessels siezed by the Engineer Bureau:

"Other officers experience like difficulties, making it next to impossible for them to render property returns, based on personal knowledge, as to the application or deposition of property for which they have made payments. For instance, vessels are taken by direction of Commanding General, and sunk in navigable channels or obstructions, and payments made afterwards, by Engineer officers, who have never had the property in charge, nor had they any control of the vessel before it was sunk beneath the water" (Gilmer 1863).

The identification of obstruction vessels made in this and previous EH&A reports is based on five primary sources: W. R. Merrill's 1866 map of the obstructions which names 12 of the vessels (Figure 6); the microfilmed records compiled by the Federal government of vessels associated with the Confederacy (National Archives Microfilm M909, "Vessel Papers"); the microfilmed records of "Confederate Papers Relating to Citizens or Business Firms" (National Archives Microfilm M346); the compiled service record of Lieut. Charles T. Liernur (National Archives Microfilm M258); and loose, printed records in the rare book collection of the Library of Congress. In most instances, information which was gleaned from one source could be augmented by another (see Appendix A).

C

Gap to be opened from the Carrollton part & including
the wreck stake and 200 yds of the Southern line of wreck.
Will probably include the W^h R. King.



- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Flat filled with brick 2. River steamer - <i>Cornelia</i> - 190' long 3. " " <i>Carrollton</i> - 180' long
(machinery removed) 4. Wreck stake 5. Gulf steamer - <i>Col. Clay</i> - 150'
long, 7' hold - No machinery - Hull
filled with brick & building debris.
(used to close old gap) 6. Flat filled with broken brick
50' long 7. Kentucky brig - filled with brick
65' long | <ol style="list-style-type: none"> 8. Steamer - <i>W^h Jones</i> - 180' long 9. " <i>Elipso</i> with a number
flat on top. 10. Steamer - <i>W^h R. King</i>. 11. Barge <i>Vernon</i> 12. War Steamer <i>Phoenix</i> - 250' long -
made to the Nashville. <p>Other wrecks interspersed - All
held in place by piles</p> |
|---|---|

Figure 6 - Merrill's Map C (1866)

TABLE 4
PURCHASE VOUCHERS FOR VESSELS SUNK AT THE OBSTRUCTIONS

Vessel	Voucher Date	Amount	Claimant/Owner
<u>Cremona</u>	May 5, 1862	\$1,000.00	A. T. Jones ⁺
<u>Carondelet</u> *	May 8, 1862	\$8,000.00	Cox, Brainard & Co.
<u>Eclipse</u>	May 15, 1862	\$1,250.00	Cox, Brainard & Co.
<u>Isabel</u>	May 5, 1862	\$4,500.00	Unknown
Barge (unnamed)	June 30, 1862	\$3,000.00	Cox, Brainard & Co.
Barge (unnamed)	Sept. 8, 1862	\$4,457.22	Cox, Brainard & Co.
Schooner (unnamed)	May 12, 1862	\$ 350.00	P. O. Foster
Flat boat (unnamed)	May 7, 1862	\$ 500.00	Williams Otis ⁺⁺
<u>Vernon</u>	March 3, 1863	\$5,000.00	P. O. Foster
<u>California</u>	March 3, 1863	\$1,500.00	P. O. Foster

* The boilers off this vessel were sold for \$1,000 on Sept. 30, 1862.

+ One of the partners in Cox, Brainard & Co.

++ Also supplied materials and tools for building the obstructions.

Vessel registration papers have also been examined for some of the ships, which provided additional details as to size and rigging. Not all vessels, however, were federally documented. This proved to be the case with the Carondelet, one of the two ships to be effected by the Turning Basin construction. Although specific dates have been obtained for her arrival in Mobile from New Orleans (Irion 1985:44), she was neither registered in the Mobile harbor master's log (National Archives) nor listed in the Federal Enrollments Register (National Archives Record Group 44). Further research revealed that federal law exempted coastal vessels carrying U.S. products within the same tax district from making report of her arrival or from carrying documentation papers. The text of this law is provided in Appendix B.

A list of the vessels which are currently known to have been sunk at the Dog River bar obstructions is provided in Appendix A, along with a brief description of the evidence and sources. W. A. Merrill's 1866 map, drawn to accompany a report to the Chief Engineer of the U.S. Army Corps of Engineers (previously cited as Figure 6) is the only source for the relative positions of these vessels within the obstructions. This map shows three vessels in the western line: a flat, the Cremona, and the Carondelet. Fourteen vessels, eight of which are named by Merrill, are shown in the southern line.

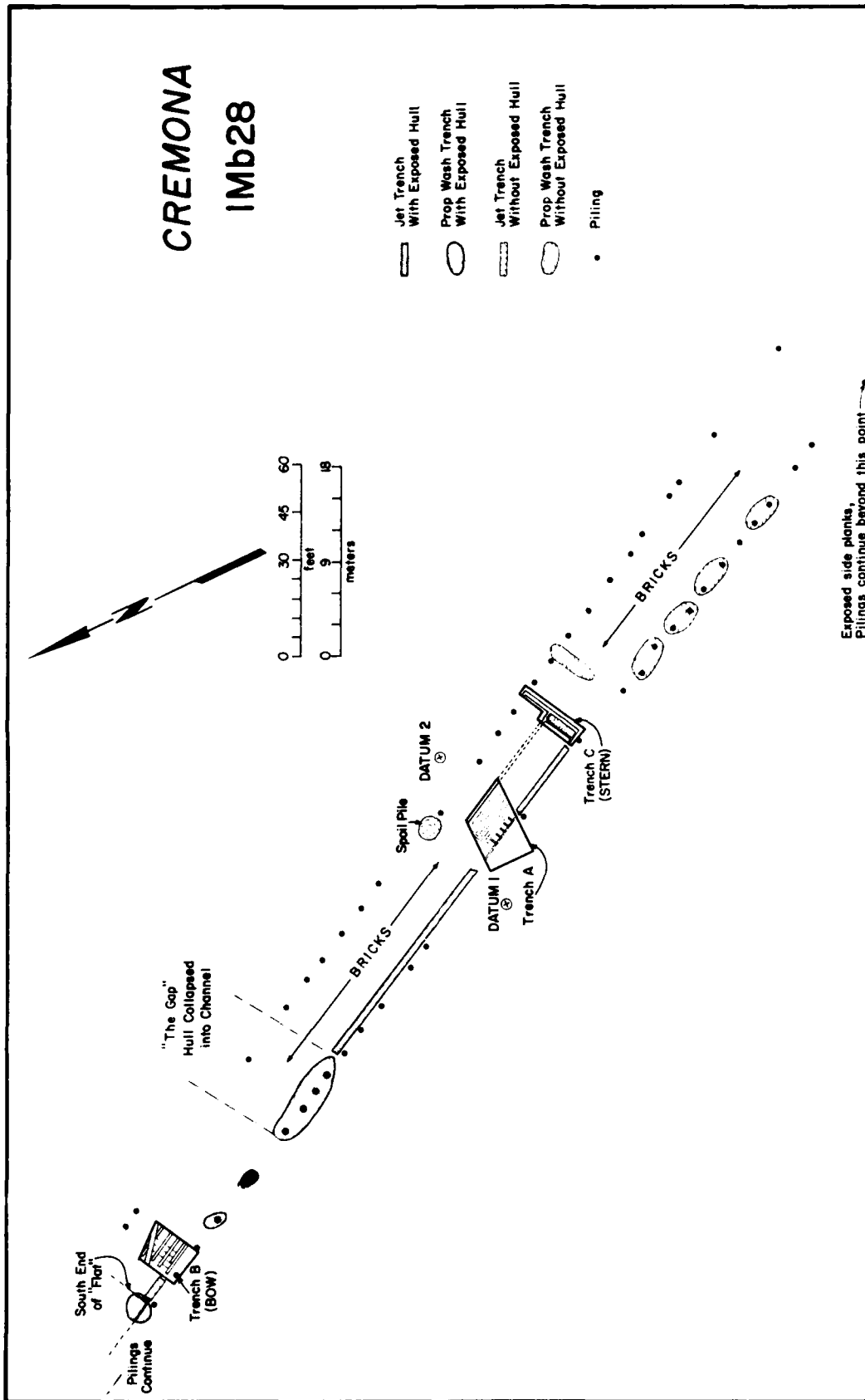
The archaeological picture is complicated by two historical activities: the opening and closing of gates or passes through the obstructions during the Civil War and the enlargement of the channel through the obstructions in the 1870s. Neither of these events are historically well documented.

The gates were designed by the Confederate engineers to permit a quick and effective method of closing the gaps in the obstructions left open for the passage of friendly vessels. The gate simply consisted of a vessel loaded with brick which was tied up next to the gap and ready to be scuttled at a moment's notice. Several of these gates were sunk and raised as a result of moments of panic followed by failure of the threat to materialize. The apparent frequency of this activity, coupled with the lack of detailed records, makes it impossible at this stage to accurately define the sequence or placement of all of these gates.

A further complication results from the activities of the Mobile Harbor Board, which undertook the reopening of the channel to ship traffic in 1871-72 (Weber 1968). Part of this project involved the widening of the gap through the lower obstructions from 200 to 600 ft (61 to 183 m). The process for the removal of the wrecks is described in a contemporary newspaper account.

"This is effected by the agency of a diver, clad in submarine armor, who goes to the bottom and deposits a torpedo, or tin cannister, containing a charge of 20 to 25 pounds of powder, as deeply as possible, amidst the heavy material to be removed. The powder is then exploded by means of an electric battery, and the

CREMONA IMb28



Exposed side planis, Piling continue beyond this point

Figure 7 - Site Plan of the Cremona

loosened fragments grappled and removed by a powerful dredge machine." (A Trip Down the Harbor 1871:2).

The historic activities outlined above, combined with the possible inaccuracies of nineteenth century surveying, have made it necessary for the Corps to precisely determine the present extent of the wreck obstructions as they relate to the proposed channel improvements. As a result, a modification to EH&A's basic contract was made at the end of the 1985 field season to provide additional information on the area of National Register Historic Site 1Mb28. This work was a logical extension of EH&A's previous work on the obstructions in 1983 and 1984.

In 1984, EH&A undertook the archaeological testing of one of the ships in the line which was to be effected by the dredging of the Turning Basin (Figure 7). This vessel was identified as the Cremona, a stern-wheel river packet (Irion 1985). To the northwest of this vessel lies a "flat", a simple vessel of minimal architectural interest. A third vessel, identified as the Carondelet, was located to the southeast but its limits were not defined other than to determine that at least part of it lies within the impact zone. These three vessels were designated as Components A, B, and C of site 1Mb28.

EH&A's 1985 contract modification called for an accurate assessment of the potential impact of the dredging operation on the western arm of the obstructions and a determination of the effect, if any, on the southern arm. This task was achieved through a combination of diving and remote sensing.

Particular attention was paid to the intersection of the western and southern lines where, according to historical references, a 600-ft (183-m) wide channel was opened through the obstructions six years after the end of the war. The primary goal of the study was to establish the precise location of this "gap" and to determine if any other ships, besides those already identified as Components A, B, and C (based on Merrill's 1866 map), would be affected by the proposed dredging.

METHODOLOGY

A variety of methods were employed to accurately delineate the boundaries of the Dog River bar obstructions. By physically tracing and buoying the line of obstructions using visual search and probe techniques, the area required for intensive remote-sensing survey could be reduced. The electronic equipment, on the other hand, "saw" bottom features which could be missed by divers because of the extremely limited visibility which is typical of the area. Figure 8 reproduces typical sidescan, magnetometer and fathometer charts obtained during the survey which clearly show the piling and wreck obstructions. It should be noted that the distortion in the lines such as may be seen in the hull of the Phoenix are the result of a slight change in the vessel track.

Beginning from the surviving datum points employed in 1984 at the Cremona, the divers followed the line of pilings to the southeast. These pilings are spaced approximately 25 ft (7.6 m) apart. The divers, after locating one piling, tied one end of a search line to it and worked their way south in order to locate the next piling in a row. Pilings were periodically buoyed in order to establish the line for later survey. The buoyed pilings are illustrated on the accompanying map as "measured piling position" (Figure 9).

A similar procedure was followed to establish the southern line. Working from the general area in which the southernmost piling in the western arm was located, the magnetometer was employed to detect the beginning of the western end of the southern arm. The area of magnetic deviation was investigated by the diving team in order to verify the presence of pilings and bricks which signals the association with the obstructions.

Once selected, points were buoyed on both the western and southern arms, and a remote-sensing survey was conducted with survey lines on both the inside and outside of the obstructions. The four survey tracks used to obtain this data are illustrated on the map in Figure 10. The remote-sensing equipment array (Figure 11) consisted of the following:

- o Motorola Mini-Ranger III radar positioning device
- o MiniTrac Navigational Computer
- o Klein 571 100-KHz sidescan sonar
- o Raytheon DE719B recording fathometer
- o Geometrics 866 proton precession magnetometer

RESULTS OF THE DIVING AND REMOTE-SENSING SURVEY

As a result of the combined diving and remote-sensing survey of the Confederate obstructions at Dog River bar, the area has been successfully delineated and specific recommendations of mitigation or avoidance are provided to the Corps. The survey verified that the only vessels affected by the proposed

FATHOMETER

MAGNETOMETER

SIDESCAN SONAR

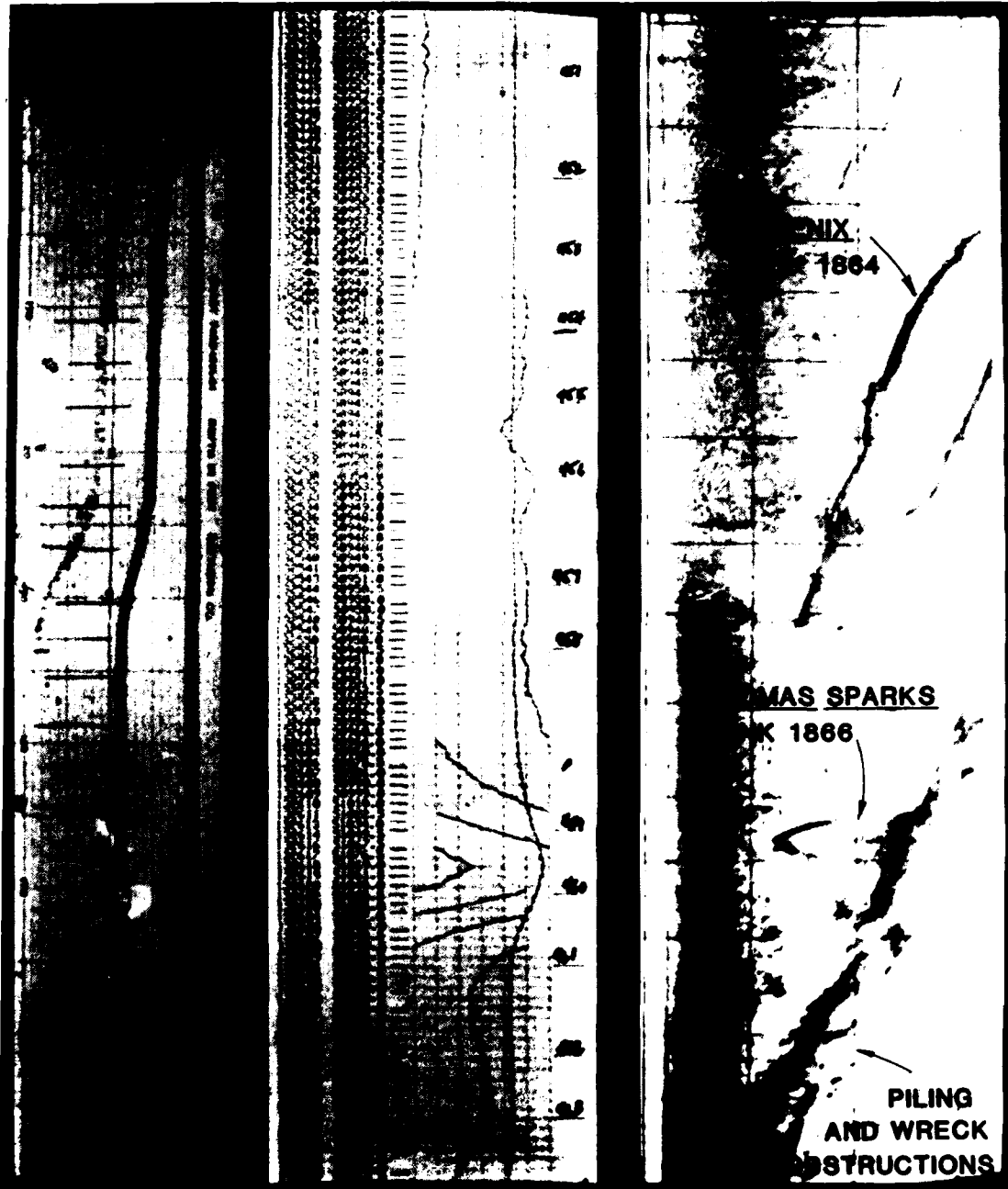


Figure 8 - Remote Sensing Charts of the Obstructions

CTIONS 1Mb28

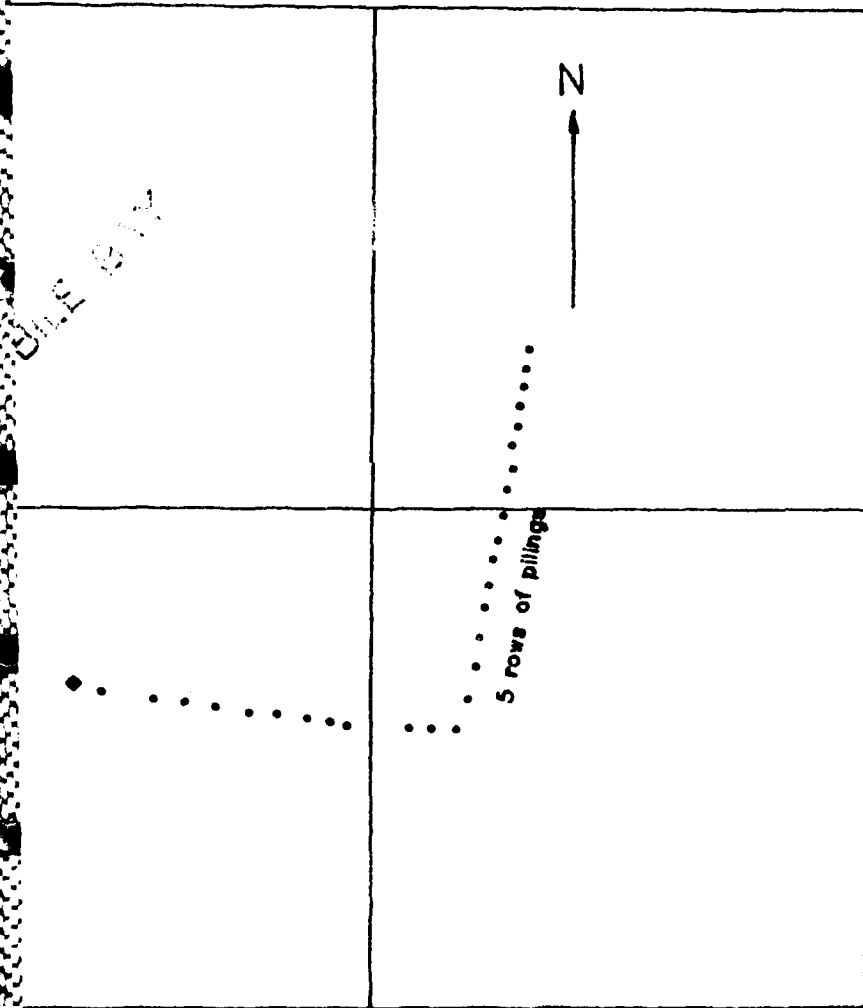
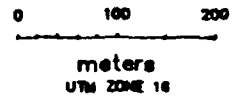


FIGURE 9
MAP OF THE PILING
POSITIONS

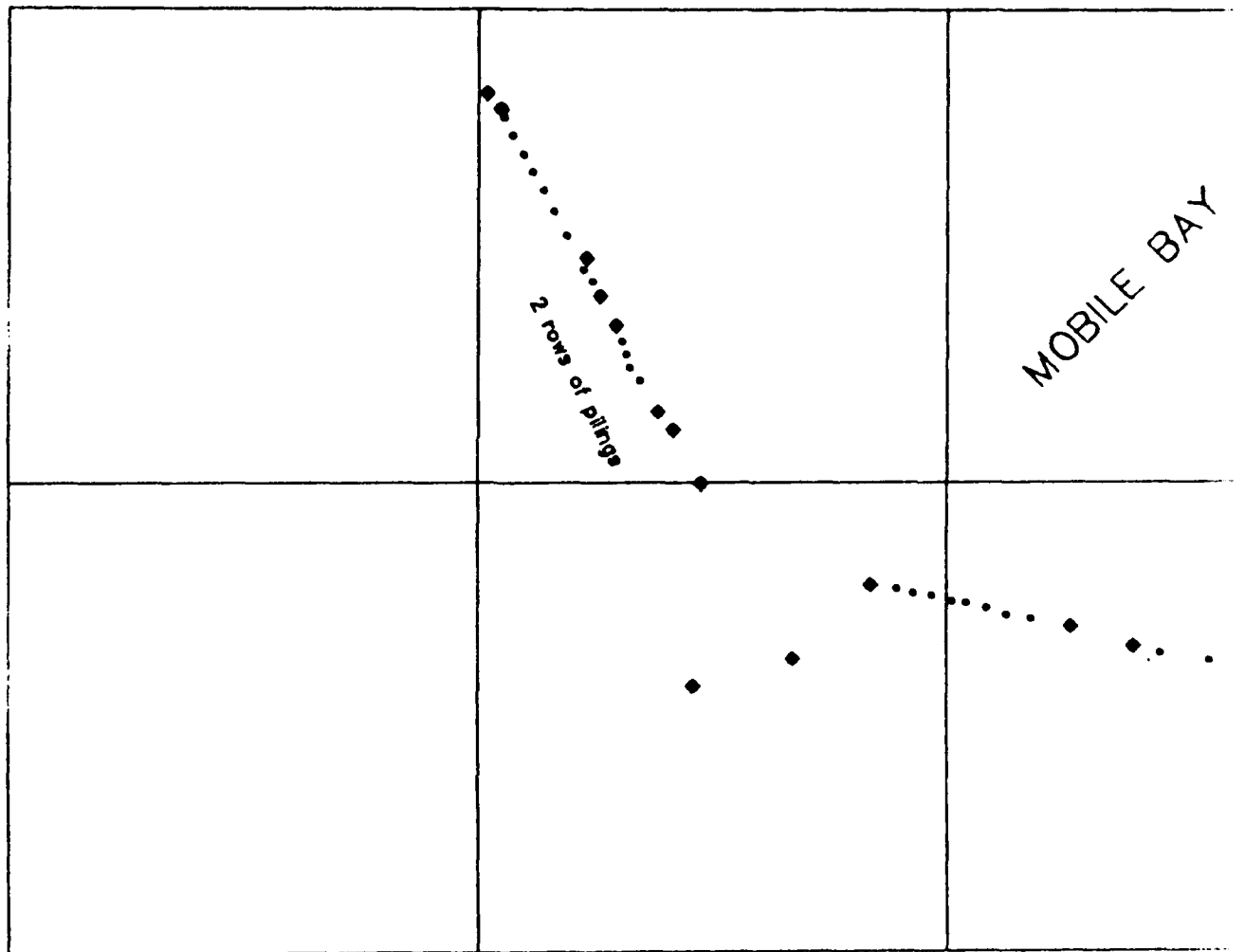
LEGEND

- ◆ MEASURED PILING POSITION
- APPROXIMATE PILING POSITION



DRAWN DEC, 1988

CONFEDERATE OBSTRUCTIONS



IONS 1Mb28

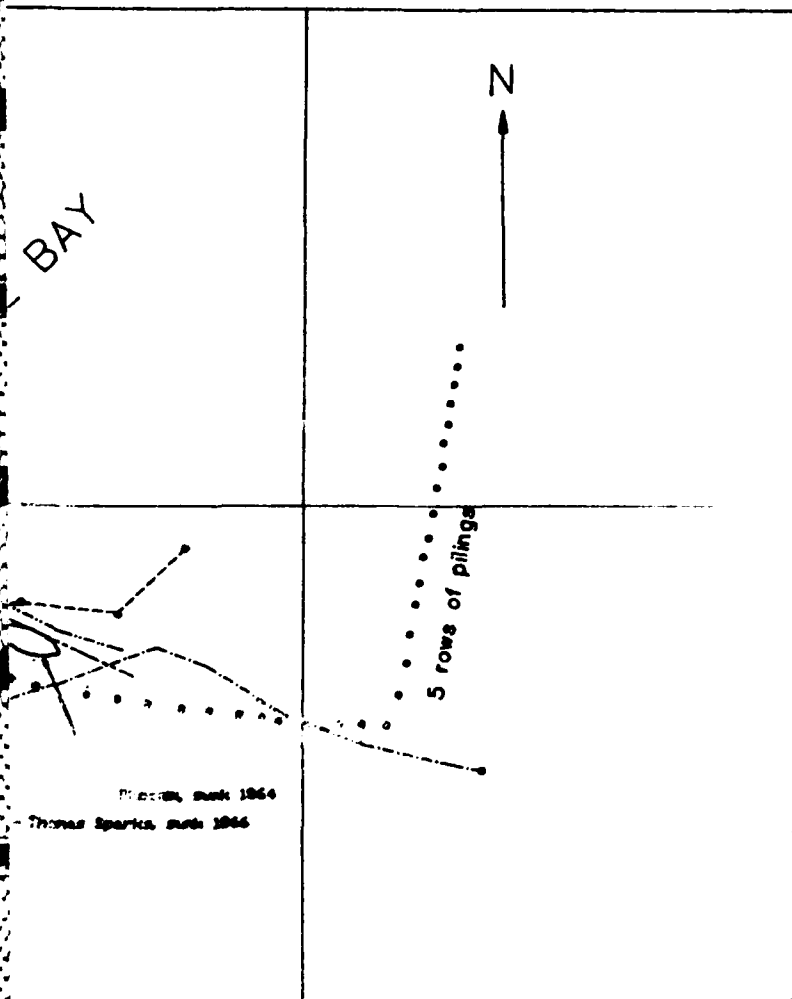


FIGURE 10
SURVEY TRACKS AND
WRECK POSITIONS

LEGEND

- FIRST TRACK
- SECOND TRACK
- THIRD TRACK
- FOURTH TRACK

- ◆ MEASURED PILING POSITION
- APPROXIMATE PILING POSITION

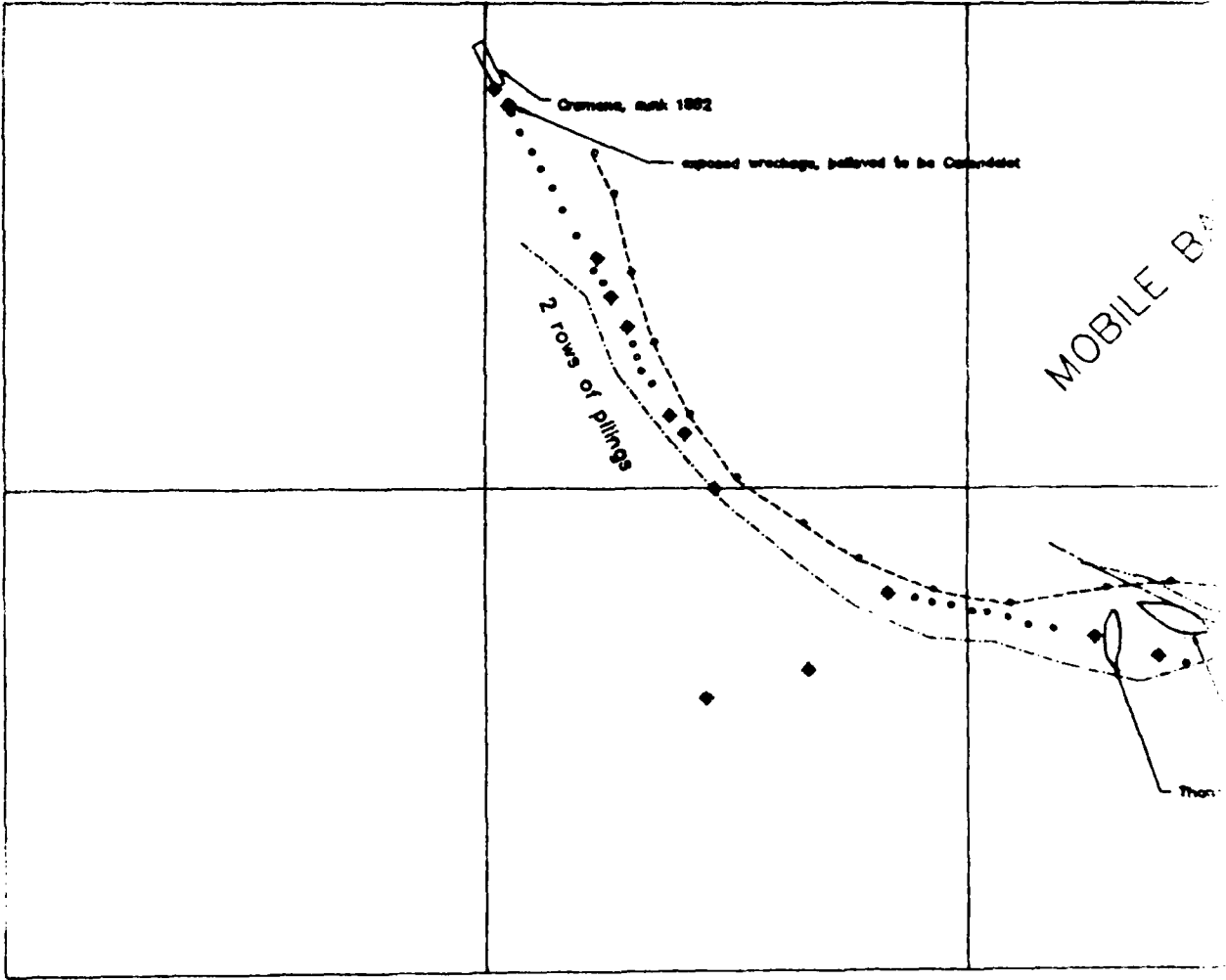
0 100 200

meters
UTM ZONE 18

DRAWN DEC. 1985

1 Mb 28

CONFEDERATE OBSTRUCTION



2 18 62



Figure 11 - Sidescan Sonar Equipment Aboard the Mark

Mobile Harbor Deepening Project are the three previously identified as the flatboat, the Cremona and the Carondelet. It was further discovered that the Carondelet is not the last vessel in the western arm, as was previously indicated from historical references (Merrill 1866). The pilings continue some 330 ft (100 m) where they end at the gap created in 1871. Figure 12 illustrates the confirmation of this data by the magnetometer. The bricks actually continue at a deeper level for a short distance beyond the last piling at the gap. It is suspected that this is the result of relatively inefficient nineteenth century dredging equipment which was unable to remove all traces of the obstructions from the channel.

The presence of additional brick-laden vessels south of the Carondelet came as something of surprise, considering the detailed and seemingly reliable information provided by W. A. Merrill in his 1866 report to the U.S. Army Chief of Engineers. Further research into existing Confederate archives has, however, shed some light on an otherwise perplexing situation.

Two Confederate maps in the archives of the Southern Historical Collection (SHC) at the University of North Carolina at Chapel Hill have proven to be the most reliable map sources to date. Both of these maps predate the only Confederate-made map in the National Archives collection, a captured document drawn at the direction of Lt. Col. Viktor Sheliha in 1864. The earliest of the two maps dates to 1862, probably soon after the installation of the obstructions, and is executed in pencil (Figure 13). It shows five vessels in the western line, not three, and 11 in the southern line. The Merrill map also shows 11 major vessels here, one of which is the Phoenix, which was not sunk until 1864. The Phoenix has been sunk in a gap which was probably opened earlier in 1864 and which had been closed in 1862 and 1863. No gap at all is shown on the 1862 map.

The second SHC map is a watercolor drawn to accompany Danville Leadbetter's progress report to the Confederate Chief of Engineers dated March 15, 1863. This map shows a gate about midway up the vessel obstructions on the western arm in the center of the natural channel (Figure 14). It is suspected that the central ship in the row of five was later raised to create an entrance into the channel. It will be recalled from Charles Iverson Graves' letter that friendly ships had a difficult time getting through the obstructions when they were first built: "In attempting to force our way over the obstructions one (paddle) wheel struck the deck of one of the sunken steamboats and completely damaged one engine" (Graves 1862). The sources indicate that after a lessening of the Union threat, a gate was opened to facilitate access to the city. The location of this gate probably corresponds to the gap in the bricks south of the Carondelet. At some point, and it is unclear when, this gate was closed with the piling obstructions which are still in place.

It is not clear why Merrill, surveying the wreckage at the end of the war, was aware of only three vessels in the western arm. The 1985 field season clearly demonstrated that more brick-filled vessels exist in this line, exactly as is shown in Leadbetter's 1863 map. The most likely explanation for Merrill's

ATIONS 1Mb28

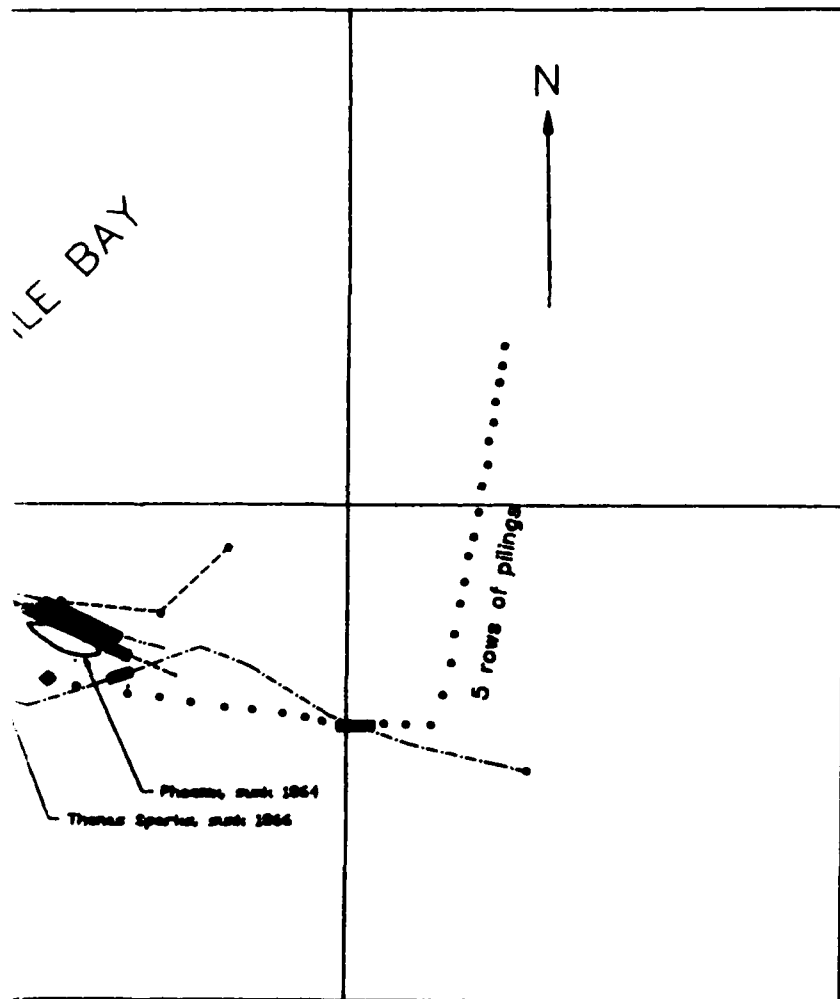


FIGURE 12
MAGNETIC ANOMALY
POSITIONS

LEGEND

- MAGNETIC ANOMALY
- - - - -** FIRST TRACK
- - - - -** SECOND TRACK
- - - - -** THIRD TRACK
- - - - -** FOURTH TRACK

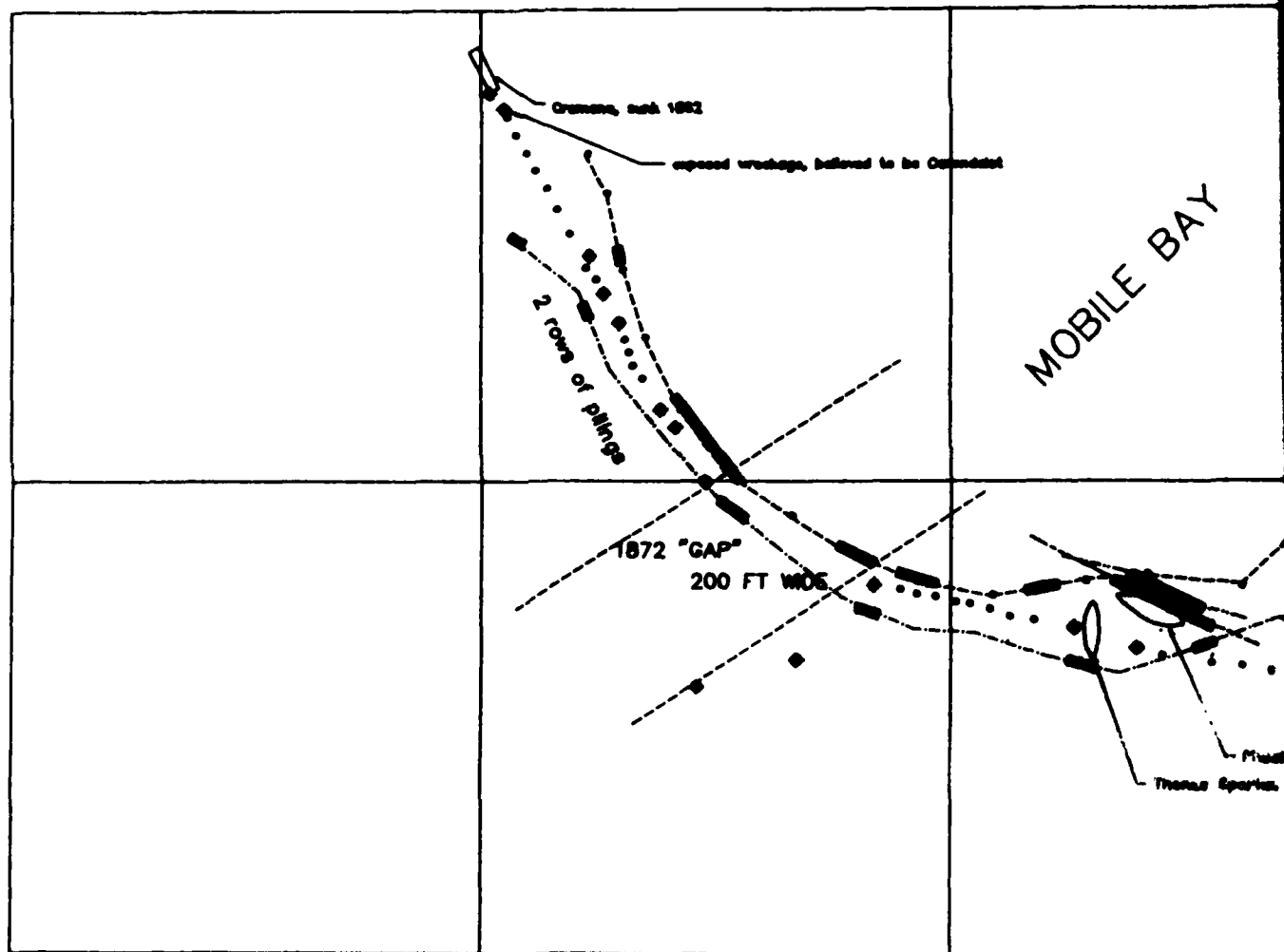
- ◆ MEASURED PILING POSITION
- APPROXIMATE PILING POSITION

0 100 200
 meters
 UTM ZONE 18

DRAWN DEC, 1968

1012

CONFEDERATE OBSTRUCTIONS



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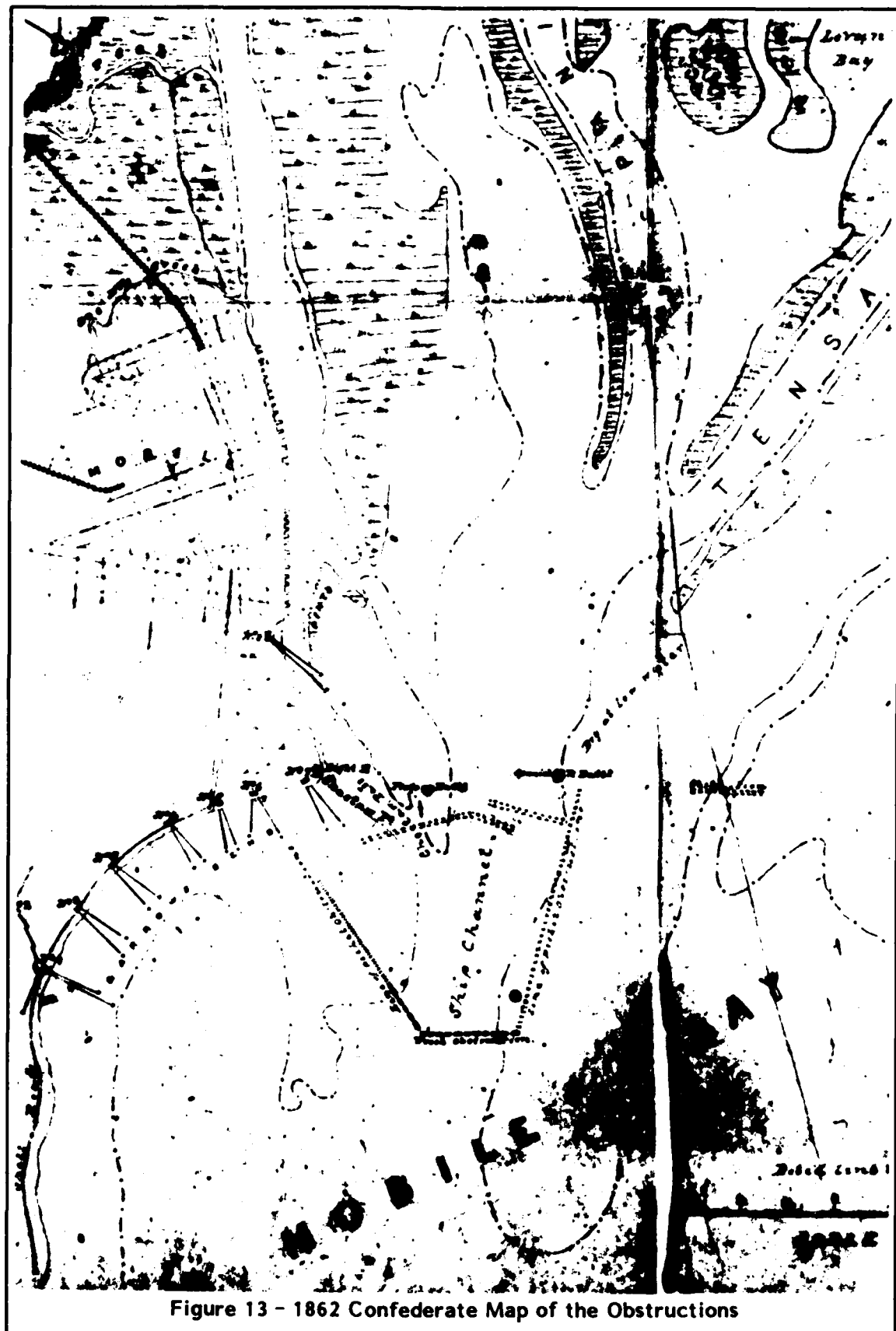


Figure 13 - 1862 Confederate Map of the Obstructions



Figure 14 - Leadbetter's 1863 Map of the Obstructions

omission is rooted in the urgent manner in which they were sunk and the lack of adequate records taken at the time. Merrill admitted in his report to the Chief of Engineers that he was unable to obtain an accurate map of the obstructions and that his information was based on the recollections of Col. Sheliha and "the man who actually drove the piles" (Merrill 1866). Because of the frequency with which the gates were opened and closed at the intersection of the two lines, recollections of this area were probably particularly hazy.

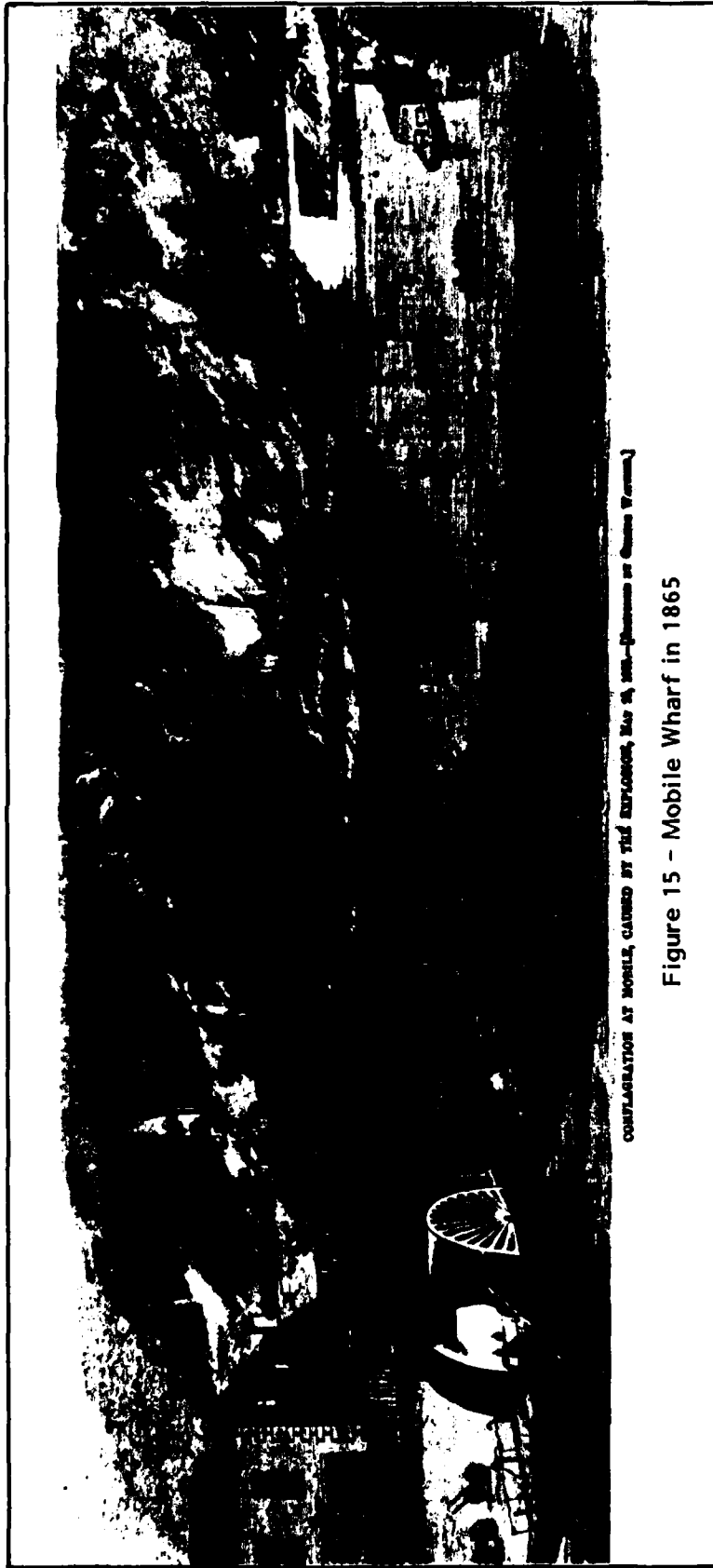
The diving survey in this area found the brick lense to be compact and buried by about 4 ft (1.2 m) of silt. Three exceptionally thick pilings 2-ft (0.6 m) diameter as opposed to 1 ft (0.3 m) were discovered which inclined about 30 degrees off vertical to the northwest; all other pilings have been found to be perfectly vertical. The smaller diameter pilings were barely visible above the mud or not at all. This data suggests that the obstructions may have been partially removed or cut down in this area to create an opening through the obstructions. Further excavation could resolve this issue, although it is not recommended for the present project since it lies well out of the impact area.

Possibly as many as eight vessels survive in the southern line east of the 1871 gap which will not be affected by the proposed project. These include the unfinished ironclad warship Phoenix whose existence was verified by EH&A archaeologists with the discovery of a vessel measuring 250 ft (76 m) long and equipped with what is believed to be an iron ram (see Appendix A). Up to 8 ft (2.4 m) of the 3-ft (0.9 m) thick hull side is exposed above the mud. Also discovered in this area is the wreck of a vessel identified as the Thomas Sparks. The Thomas Sparks was an early iron-hulled ship built in Wilmington, Delaware in 1854. She carried four masts and had steam-driven screw propulsion. The ship was wrecked on the obstructions during a storm on January 12, 1866 (Mistovich and Knight 1983a:111). All of the southern line of obstructions are a minimum of 2,000 ft (610 m) outside the Turning basin area.

RECOMMENDATIONS

Alabama's historic site 1Mb28 represents a unique resource for the study of Confederate coastal defense and nineteenth century American navigation. The hulls of possibly a dozen flat boats, river steamboats, Gulf sidewheelers and sailing schooners lie buried under tons of brick and debris at the bottom of Mobile Bay. A contemporary drawing of the Mobile City wharfs illustrates the variety of craft which are to be found in the obstructions (Figure 15).

Because the vessels in the obstructions were intentionally sunk, they were stripped of their engines and upper works. As a result, the major artifacts on the site are the hulls themselves. Because the 1984 testing project satisfactorily explained the methods of hull constructions employed in the Cremona and the flat, no further work was recommended on these vessels (Irion 1985:54). Additional work was recommended, however, for the third vessel to be affected by the Turning Basin construction (Irion 1985:55). This vessel has been



CONFLAGRATION AT MOBILE, CAUSED BY THE EXPLOSION, MAY 15, 1865. (REPRODUCED BY COURTESY OF THE U.S. ARMY ARCHIVES)

Figure 15 - Mobile Wharf in 1865

identified as the Carondelet, a sidewheel steamer which, before the War, had plied the waters between New Orleans and Mobile.

Work conducted on the obstructions during the 1985 season has successfully concluded that no additional vessels will be affected by the proposed Turning Basin construction and that a sufficient buffer zone exists between the Turning Basin and ships in the southern line. It is, however, recommended that a limited diving survey be carried out to the northwest of the flat boat in order to determine the extent and estimated number of pilings in this direction.

BIBLIOGRAPHY

- A Trip Down the Harbor
1871 Mobile Daily Register. July 12:2.
- Arnold III, J. Barto
1982 A Matagorda Bay Magnetometer Survey and Site Test Excavation Project. TAC Publication NO. 9. Texas Antiquities Committee, Austin, Texas.
- Breiner, S.
1973 Applications Manual for Portable Magnetometers. Geometrics, Sunnyvale, California.
- Coastal Environments
1982 Cultural Resources Survey, Block 71 and 72, Mississippi Sound Area, Offshore, Alabama. Report to Mobil Oil Co., Houston, Texas.
- Dames and Moore
1981 Geologic Hazards and Cultural Resources Surveys of Proposed Mobil Oil Exploration and Producing Southeast. Houston, Texas.
- Delaney, Caldwell
1981 The Story of Mobile. The Haunted Book Shop, Mobile.
- Federal Enrollment List
1854 "Vernon", enrollment No. 52. Ms. on file, National Archives, Washington, D.C.
1859 "Col. Clay" Enrollment No. 19, 1 May 1859. Ms. on file, National Archives, Washington, D.C.
- Fleming, Walter L.
1911 Civil War and Reconstruction in Alabama. Arthur H. Clark, Cleveland.
- Floyd, Robert
1981a Proton Magnetometer Survey of the Proposed Dredge Areas Permit Modification to Dredge within 1500' of the Mobile Ship Channel, Alabama. Report submitted to Radcliff Materials, Mobile.
1981b Archaeological Assessment of Geophysical Survey Data, Portions of Blocks 113 and 132, Northwest Gulf Area, Offshore Alabama. Report to Shell Oil, Houston, Texas.
- Forney, Gen. John. H.
1862 Telegram to Gen. G. T. Beauregard, April 28, 1862. Ms. on file, Western Reserve Historical Society, Cleveland.

- Foster, James Fleetwood
1960 Antebellum Floating Palaces of the Alabama River and the "Good Old Times in Dixie." Edited by Bert Neville. Coffee, Selma. Originally published 1904, Wilcox Banner.
- Gilmer, Jeremy
1863 Letter to James A. Seddon, March 18, 1863. Records of the Engineer Department, Letters and Telegrams Sent, Record Group 109, Chap. III, Vol. I, Ms. on file, National Archives, Washington, D. C.
- Graves, Charles Iverson
1862 Letter to Maggie Lea, May 15. Ms. on file, Southern Historical Collection, University of North Carolina, Chapel Hill.
- Hudson, Jack C.
1981 Magnetometer Survey, Areas of Blocks 71, 72, 73, 89, 90, 91, Northwest Gulf Area, Alabama. Report to Phillips Petroleum. Cultural Resources Services, Seabrook, Texas.
1974 A Magnetometer Survey of the Theodore Ship Channel and Barge Channel Extension, Mobile Bay, Alabama. Report to U.S. Army Corps of Engineers, Mobile District. Gulf South Research Institute, Baton Rouge, Louisiana.
- Irion, Jack B. and Clell L. Bond
1984 Identification and Evaluation of Submerged Anomalies, Mobile Harbor, Alabama. Prepared for U.S. Army Corps of Engineers, Mobile. NTIS Report Number COESAM/PD-EC-84-004. Espey, Huston & Associates, Inc., Austin, Texas.
- Irion, Jack B.
1985 Archaeological Testing of the Confederate Obstructions, 1 Mb 28,
Mobile District. NTIS Report Number COESAM/PD-EC-85-001. Espey, Huston & Associates, Inc., Austin, Texas.
- Lloyd, James T.
1856 Lloyd's Steamboat Directory and Disasters on the Western Waters. James T. Lloyd, Cincinnati.
- Lytle, William M. and Forest R. Holdcamper
1975 Merchant Steam Vessels of the U.S. 1790-1868, the "Lytle-Holdcamper List." Steamship Historical Society of America, Staten Island, New York.
- Marine Environmental Sciences Consortium
1979 Remote Sensing Archaeological Survey of Proposed Well Sites in Mobile Bay, Alabama. Report submitted to Mobil Oil Corporation, Houston, Texas.

Mistovich, Tim S.

- 1981 Cultural Resources Evaluation of Reef Shell Techniques, Mobile Bay, Alabama. Report to Radcliff Materials, Mobile. OSM, Moundsville, Alabama.

Mistovich, Tim S. and Vernon J. Knight, Jr.

- 1983a Cultural Resources Survey of Mobile Harbor, Alabama. Submitted to U.S. Army Corps of Engineers, Mobile. OSM Archaeological Consultants, Moundsville, Alabama.

- 1983b Cultural Resources Survey of Mobile Harbor, Alabama. Index Volume. OSM Archaeological Consultants, Moundsville, Alabama.

Muckelroy, Keith

- 1978 Maritime Archaeology. Cambridge University, Cambridge.

Otis, William

- 1862 Articles of Agreement between William Otis and Charles M. Bancroft, Sept. 8, and Charles T. Liernur for construction of iron clad floating battery. Ms. on file, William Otis Papers, Confederate Papers Relating to Citizens or Business Firms, National Archives Microfilm M346, Roll 202.

Racal-Decca Survey

- 1981 A Multi-Sensor Engineering Survey of Offshore Alabama, Mobile Bay Area, Northwest Gulf Blocks 111 and 112 for Exxon Company, USA. Rascal-Decca, Houston, Texas.

- 1982 A Multi-Sensor Engineering Survey of Offshore Alabama, Lower Mobile Bay Area, Block 62. Report for Exxon Company, USA. Racal-Decca Survey, Houston, Texas.

Rodabough, John E.

- 1985 Steamboats on the Upper Tombighee. Tombighee Press, Hamilton, Mississippi.

Saltus, Allan R.

- 1978 Performance of a Cultural Resources Survey, Pinto Pass Disposal Area, Mobile Bay, Alabama. Report submittal to U.S. Army Corps of Engineers, Mobile.

Schell, Sidney H.

- 1985 Personal communication.

Sheliha, Viktor E.K.R. von

- 1864 Affidavit regarding disposition of Phoenix, Sept. 7, 1864. Ms. in Letters Sent, Engineer office, Mobile, Record Group 109, National Archives.

- 1868 A Treatise on Coast Defense. E. F. Spon, London.

Treasury Department

1857 Regulations Under the Revenue Laws. A.D.P. Nicholson, Washington, D. C.

U.S. Army Corps of Engineers, Mobile District

1979 Technical Report on Mobile Harbor, Alabama. Corps of Engineers, Mobile.

1984 Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi. Draft Generic Environmental Impact Statement.

U.S. Navy Department

1921a Abstract of a Statement of J. W. Porter, a refugee from Alabama, who surrendered September 13, 1862, received from Rear Admiral Farragut, September 29. Official Records of the Union and Confederate Navies in the War of the Rebellion, I, 19:198.

1921h Report of Rear-Admiral Farragut, U.S. Navy, Referring to the disposition of the C.S.S. Ram Tennessee and investment of Fort Morgan. In Official Records of the Union and Confederate Navies in the War of the Rebellion I, 21:527.

1971 Civil Water Naval Chronology: 1861-1865. GPO, Washington, D.C.

U.S.S. Tecumseh: Still Resting Comfortably After 120 Years.

1984 Port of Mobile, Vol. 57, No. 8:22-26.

Way, Fredrick

1983 Way's Packet Directory: 1848-1983. Ohio University, Athens, Ohio.

Weber, Alma B.

1968 Mobile Harbor: Problems of Internal Improvement: 1865-1900. Reprinted from Journal of Alabama Academy of Science, 39.

Wreck of the Thomas Sparks

1866 Mobile Daily Register. January 14:1.

APPENDIX A
VESSELS SUNK IN THE DOG RIVER BAR OBSTRUCTIONS - 1Mb28

1. Cremona Stern-wheel river steamboat, registered dimensions: 268 tons (243 t), 182' (55.4 m) long, 30' (9.1 m) beam, 6.5' (1.9 m) hold. Built in 1852 by John Evans, New Albany, Indiana. Engaged in Tombigbee River trade before the war. First steamboat in Alabama equipped with a caliope. Archaeologically tested in 1984 by EH&A (Irion 1985). Will be affected by proposed Turning Basin construction.

Sources: Lytle and Holdcamper 1975; Foster 1960; New Albany Daily Ledger, October 21, 1852; Vessel Papers, National Archives; Merrill 1866.

2. Carondelet Side-wheel gulf steamboat, 160' (48.7 m) long. Owned by Cox, Brainard and Co. and engaged in New Orleans - Mobile trade before the war. Apparently undocumented vessel, so no federal registration papers exist (see Appendix B). Will be affected by proposed Turning Basin construction.

Sources: Foster 1960; Mobile Daily Register, November 28, 1859.

3. Col. Clay Gulf side-wheel steamship, 144.5' (44 m) long; 496 tons; 7' (2.1 m) hold; 35'8" (10.8 m) beam; one deck, two masts; built 1851, New Orleans, Louisiana. Removed in 1871.

Source: Lytle and Holdcamper 1975, Merrill 1866, Federal Enrollments 1859, Lloyd 1856.

4. Kentucky Brig 65' (19.8 m) long. Probably removed 1871.

Source: Merrill 1866.

5. William Jones 180' (54.8 m) long. Only vessel of this name listed burned in 1855 in the Alabama River. No further information. Probably removed in 1871.

Source: Merrill 1866, Lytle and Holdcamper 1975.

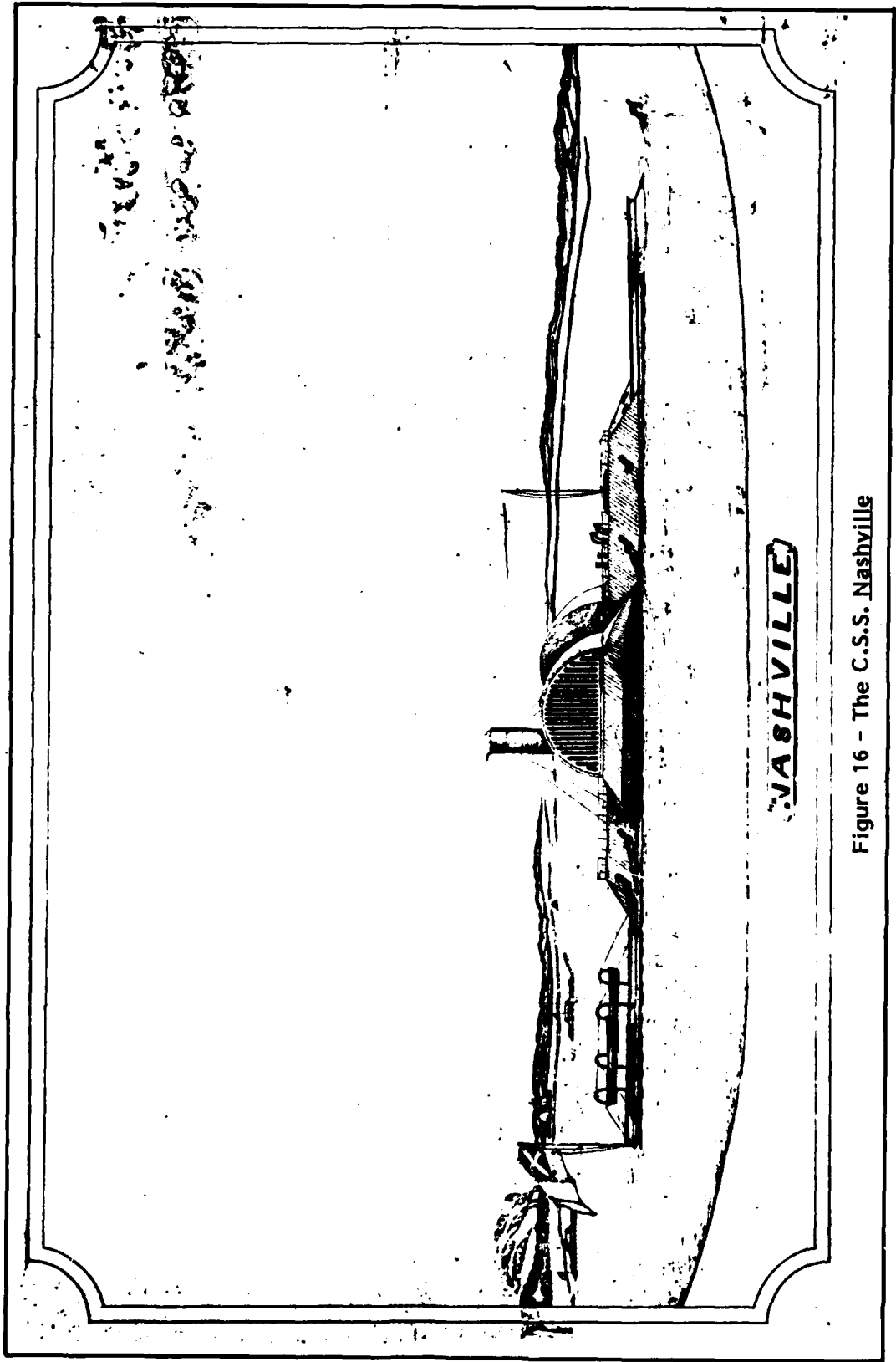


Figure 16 - The C.S.S. Nashville



Figure 17 - Explosion of the Phoenix

10. California Schooner, 1 deck, 1 mast, 84' x 29' x 4'10"
(25.6 m x 8.8 m x 1.4 m), 77 tons. Built at
Mobile, 1858.
- Source: Enrollment No. 31 (12 July 1859);
Vessel Papers, National Archives.
11. Isabel Schooner, 1 deck, 2 masts, 48'8" x 15'2" x 4'11"
(14.8 m x 4.6 m x 1.4 m). Plank stern and
straight head. Built Charleston, S.C., 1861.
- Source: Vessel Papers, National Archives.
12. Unnamed Barge Owned by Cox, Brainard & Co., Mobile.
117' x 26' (35.6 m x 7.9 m). Carrying capacity
of 900 bales of cotton.
- Source: "Cox, Brainard & Co.", Confederate
Papers Relating to Citizens or Business Firms,
National Archives Microfilm M346.
13. Unnamed Schooner Valued at \$350.00, no other details known.
- Source: "P.O. Foster", Confederate Papers
Relating to Citizens or Business Firms,
National Archives Microfilm M346.
14. Thomas Sparks Wrecked on the obstructions January 12, 1866.
Iron hull, 373 tons, built Wilmington, Delaware
1854. Steam screw propulsion with 4 masts.
Dimensions: 197.5' x 22.7' x 8.5' (60.1 m x
6.9 m x 2.5 m).
- Source: Mistovich and Knight 1983; Federal
Enrollment Records, National Archives.

APPENDIX B
1857 REGULATIONS UNDER THE REVENUE LAWS
EFFECTING INTERCOASTAL COMMERCE

ARTICLE 133 - The master of a vessel of 20 tons burden or upward, licensed for the coasting trade, bound from one collection district included in one great collection district to another within the same district... having on board goods, wares, merchandise, of the growth or product of the United States only (except distilled spirits) or distilled spirits not exceeding 500 gallons, or wine in casks not exceeding 250 gallons, or wine in bottles not exceeding 100 dozens, or sugar in casks or boxes not exceeding 3,000 pounds or tea in chests or boxes not exceeding 500 pounds or coffee in casks or bags not exceeding 1,000 pounds or foreign merchandise in packages as imported not exceeding in value \$400, or foreign merchandise of any kind including any or all of the articles mentioned, the aggregate value of which does not exceed \$800, the duties upon which have been paid or secured, may proceed from one place to another, within the limits aforesaid, without delivering a manifest thereof, or obtaining a permit to depart from any officials of the customs (Treasury Department 1857:99).

APPENDIX C
ARTICLES OF AGREEMENT BETWEEN
WILLIAM OTIS AND CHARLES BANCROFT, SEPT. 8, 1862, AND CHARLES T. LIERNUR
FOR CONSTRUCTION OF AN IRON CLAD FLOATING BATTERY

"Length (80) eighty feet, width (60) sixty feet, depth of hold from underside of deck, timber to bottom of planking six feet four inches.

"Framework to be of thus form, crossing at right angles well secured by tie rods and bolts. The bottom of the hull enclosed by the space formed by the cross trusses to be of solid twelve inch square timber on which the turret rests. The upright timbers of the trusses to be secured inside the turret by a sufficient number of knee braces to give, in the opinion of the engineer in charge, a sufficient stiffness to the hull.

"The turret to be nearly elliptical in plan, measuring 36 by 21 feet, in the clear, formed by two circles of 18 feet diameter touching each other in center of turret, and united by an arc of a circle of 35-1/2 foot radius. Both circles to be turntables on which the guns are to be mounted.

"The walls of the turret to be 24 inches of solid timber the inner and outer courses crossing joints, the whole covered with double thickness of railroad iron fastened perpendicularly. Height of turret 21 feet. The entire work to be performed and the material furnished in accordance with the specifications and plans accompanying this contract. To be paid \$25,000." (Otis 1862).

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