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SESSION 2A

SEA FLOOR MONITORING

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Date: December 8, 1998

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INTRODUCTION

Dr. Jack B. Irion
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The MMS Seafloor Monitoring Program initially began in 1996 as a means to determine if the oil and gas industry was doing all they should to avoid impact to a protected group of biological features off the coast of Mississippi and Alabama. These features consist of carbonate pinnacles clustered along the shelf break that formed as coral reefs during the last Ice Age. Today, these pinnacles are under 300 feet of water and are an important habitat for red snapper and other game fish. This area of 70 lease blocks is collectively known as the Pinnacle Trend and is protected by MMS stipulation. Industry is required to locate these features using remote sensing surveys and to avoid then during pipeline construction, drilling operations, and platform installation. However, since the pinnacles lay out of sight beneath the sea, we, as an agency, had no real way of knowing if industry was carrying out their responsibility to avoid harming them.. It became necessary, then, to develop a means to monitor industry performance and the effectiveness of MMS mitigations applied to permit applications.

Regulations for implementing the procedural provisions of the National Environmental Policy Act (40 CFR 1505.2) state that "a monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation." The MMS, in order to ensure safety and environmental protection, also has the authority under 30 CFR 250.33 (o) for Exploration Plans and 30 CFR 250.34 (s) for Development Plans to require operators to conduct various monitoring programs. More specific guidance to operators has been and can be provided through Notice to Lessees (NTLs), Letters to Lessees (LTLs), and Lease Sale Environmental Impact Statements (EISs). Presently, monitoring programs can be initiated through NTL 98-11 for chemosynthetic communities, NTL 98-26 for site clearance, the Live-Bottoms (Low Relief) stipulation, and the Live-Bottom (Pinnacle Trend) stipulation.

Several schemes were initially suggested to accomplish the initial goal of monitoring the seafloor in the pinnacle trend. These included using ROV cameras and hiring contractors to survey a single block. Our Regional Supervisor for Leasing and Environment, however, supported an alternative, hands-on approach, that involved purchasing a side-scan sonar and positioning equipment and sending MMS scientists into the field. We believed that an in-house MMS monitoring team would give us more flexibility and control, allow us to respond rapidly to emergency issues, and keep costs down. Using the same budget originally allocated for a single survey in the Pinnacle Trend, the monitoring team completed five separate projects in its first season in 1997 and looked at a variety of environmental and operations issues. When combined with the scientific dive team already in existence, MMS was given eyes to see what kind of job we were doing to protect the submarine environment.

As this project was being realized, added weight was given to the need for developing a monitoring program by the Government Performance and Results Act of 1993, as amended in 1997. This act requires federal agencies to report on their performance in terms of measuring "outcomes" that result from their activities, rather than outputs. More specifically, MMS is required to ask of itself how effective the agency is in ensuring environmentally sound OCS operations. The seafloor monitoring program became an important tool for managing for results and has been expanded beyond its original mandate to assess the Pinnacle Trend to include a sample of virtually all types of mitigations affecting the seafloor.

The second field season of the seafloor monitoring program concluded in November of this year and was notable for achieving a number of successes despite an unusually active hurricane season. In fact, only one proposed project was totally canceled, and this after suffering not one, but three cancellations for weather. The background on this project, which continues monitoring efforts at biologically diverse Sonnier Bank, and is now scheduled for next June.

By combining the technologies of side-scan sonar survey and SCUBA diving, MMS scientists are able to directly study significant seafloor features that come to light as a result of oil and gas industry surveys. In this way, we are able to better apply appropriate mitigative requirements for their protection without being overly restrictive to industry. A good example of this is our assessment of a newly discovered coral habitat off Louisiana. Dr. Rik Anuskiewicz summarizes this project as well of the results of an experiment conducted to compare the effectiveness of high resolution side-scan over photo-documentation surveys in the eastern Gulf.

The seafloor monitoring program has proven to be useful in assessing archaeological features as well as biological ones. By surveying sunken vessels discovered during lease block or pipeline surveys with our high resolution equipment, we are frequently able to distinguish modern wrecks from possibly historic ones. Six wrecks have been assessed in this way; five proved be modern and of no particular significance. One wreck, discovered in 1998, may be historic and will be investigated by the dive team next year. In addition, the monitoring program has assessed several historic wrecks as part of our responsibility for the management of historic wrecks on the outer continental shelf. By locating and identifying historic wrecks, we can reduce the number of blocks where industry is required to search for them using remote sensing survey at 50-meter survey intervals. In this way, we have already eliminated more than 20 blocks from this requirement at an estimated savings to industry of more than a million dollars.

Having this equipment and expertise in-house, we are sometimes able to respond to requests for assistance from other organizations with shared interests. This past summer we were afforded the opportunity to provide assistance to the University of West Florida's exploration for historic shipwrecks in Pensacola Bay. Using our high resolution side-scan we were able to provide UWF with acoustic images of an 18th century Spanish wreck off Santa Rosa Island, and the late 19th century sailing ship *Catharine*. Using our equipment, we were able to relocate and buoy the 439-year-old Emanuel Point wreck in time for a wreath-laying ceremony with the president of Spain to commemorate the establishment of Pensacola by Tristan de Luna. This wreck is one of the original vessels that first brought colonists to Pensacola.

Discovering shipwrecks and exploring coral reefs may seem like a glamorous job, but the seafloor monitoring program also tackles critical operations issues as well. This year alone we have inspected anchor damage from a break away derrick barge, found evidence of an abandoned drill site not properly restored, and examined the site of an oil leak in the vicinity of an artificial reef.

Dr. Jack B. Irion joined the Minerals Management Service in August 1995 with the title of marine archaeologist. Prior to MMS, Dr. Irion served as vice president for Nautical Archaeological Services with the consulting firm of R. Christopher Goodwin & Associates, Inc., in New Orleans, Louisiana. For over 15 years, Dr. Irion provided archaeological consulting services to the Baltimore, Charleston, Mobile, New Orleans, Pittsburgh, Philadelphia, Savannah, Vicksburg, and Wilmington Districts of the Corps of Engineers, as well as to the Maryland Port Administration, and the State of Tennessee. Dr. Irion received his B.A. (1974) and M.A. (1977) in Archaeological Studies from The University of Texas at Austin. He was awarded his Ph.D. from the Institute of Latin American Studies of the University of Texas in 1991. During his career, Dr. Irion has specialized in conducting remote sensing surveys for shipwrecks, which succeeded in locating such historically significant vessels as the C.S.S. *Louisiana*, the sailing barque *Maxwell*, and the steamboats *Princess*, and *Kentucky*. In addition, he has directed numerous diving investigations on historic shipwrecks, including the steamship *Columbus* and the Civil War gunboats *Tawah* and *Key West.* Most recently, he has participated in MMS investigations of the Civil War vessel U.S.S. *Hatteras* and the steam packet *New York.*

INVESTIGATIONS OF LIVE/HARD-BOTTOM AREAS OFFSHORE FLORIDA AND LOUISIANA

Dr. Richard J. Anuskiewicz
Minerals Management Service
Gulf of Mexico OCS Region

INTRODUCTION

The following three field investigations are a part of the Gulf of Mexico Region (GOMR) Sea Floor Monitoring Program. These investigations used high resolution side-scan sonar imagery and diver hands-on verification of data to make recommendations about future projects with similar informational needs. These three field projects represent and support new imagery methods to access the presence, absence, and potential impact to hard/live-bottom biological communities living on the sea floor of oil and gas development. Hard/live-bottom communities can be defined as "sea grass communities or those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or

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Rik Anuskiewicz was awarded his B.A. in 1972 and his M.A. in 1974 in anthropology, with specialization is archaeology from California State University at Hayward. Rik was employed with the U.S. Army Corps of Engineer Districts of San Francisco, Savannah, and New England Division from 1974 to 1984, as a terrestrial and underwater archaeologist. In 1980 he began work on his doctorate. In 1984 he accepted his present position with Department of the Interior, Minerals Management Service, Gulf of Mexico Region as a marine archaeologist. Rik received his Ph.D. in 1989 in anthropology, with specialization in marine remote-sensing and archaeology from the University of Tennessee at Knoxville. Rik's current research interest is focused on using remote-sensing instrumentation as a tool for middle-range theory building through the correlation of instrumental signatures to specific observable archaeological indices.

MONITORING ARCHAEOLOGICAL SITES

Dr. Jack B. Irion
Minerals Management Service
Gulf of Mexico OCS Region

Archaeological sites are among the resources on the Outer Continental Shelf (OCS) that are managed by MMS. These seafloor features generally are reported to MMS as "potential" sites by the oil and gas industry after they conduct remote-sensing surveys within their lease blocks. Potential sites may relate to either possible historic shipwrecks or prehistoric sites dating to the last Ice Age when sea level was lower than it is today. Possible shipwreck sites include areas either where anomalous

readings of ferrous metals were detected or where the side-scan sonar image shows some unusual bottom feature that resembles a vessel hull or shipwreck debris. Possible prehistoric sites are identified in the subbottom record as relict landforms where early man was likely to have camped, such as channel margins, river terraces, levees, and point bars. It is generally impossible to establish from the remote-sensing records alone if any of these "potential" sites are, in fact, historic or prehistoric sites.

Lacking this vital information, MMS establishes zones of protection around the potential sites identified in the remote-sensing record and directs industry to avoid these features during its operations. By performing monitoring surveys to verify that industry complied with these permit requirements, MMS also has been able to determine whether many of these "potential" shipwreck sites are actual historic sites worthy of federal protection. In most instances, these sites have been found to be modern and can be dismissed as mere hazards. However, a number of significant historic sites have been located and documented on the federal OCS in the Gulf of Mexico as a result of cooperation between industry, the MMS, and private citizens. This paper discusses some of the significant sites that have been discovered on the OCS and their importance to the history of the Gulf of Mexico. These sites include a steamship that was one of the first links of trade with a fledgling Republic of Texas, the Civil War wreck of the USS *Hatteras*, a vessel we believe may have been built as a Civil War blockade Runner, and numerous casualties of the German submarine Wolf Packs during World War II.

THE STEAMSHIP *NEW YORK*

History of the Vessel

The *New York* was constructed in New York City in 1837 for the Southern Steam Packet Company, a partnership formed between J. P. Allaire, Charles Morgan, and John Haggerty. Vessel Registration No. 340 (National Archives), dated 13 October 1843, identifies the vessel as a steamboat 165 feet long, with a beam of 22 feet, and a depth of 10 feet. It was described as having one deck and two masts. A drawing of the ship on file in the Mariner's Museum in Newport News, Virginia, shows a cross-head type steam engine (Figure 2A.1).

During 1837 and 1838, the *New York* made regular trips between New York and Charleston, South Carolina (Heyl 1969, 225). After the Southern Steam Packet Company was dissolved, the vessel was taken over by Morgan and transferred to New Orleans, where it was engaged in trade between that city and Galveston, in the newly independent Republic of Texas. Her first voyage under Morgan was undertaken November 1838, under consignment to McKinney & Williams, agents (Hayes 1971, 323). Fierce competition soon broke up Morgan's monopoly on the Galveston-New Orleans trade, and he responded by extending the *New York*'s route to include New York City. In May 1839, the *New York* undertook the first regular steamship service between Galveston and the Port of New York, with stops at Key West and Charleston. The ship was advertised to make the voyage in eight days and had accommodations for 200 passengers. The cabin rate between Galveston and New York was $110.00 (Hayes 1971, 326).

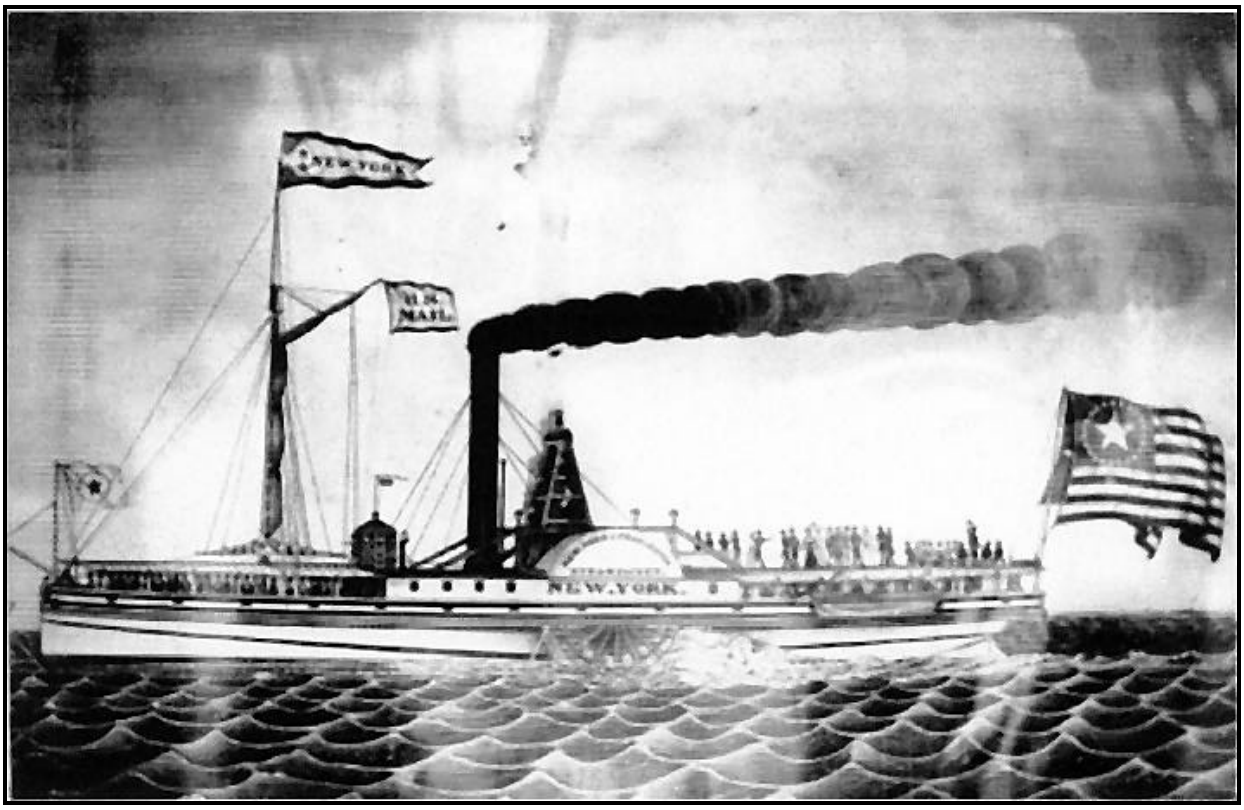

Figure2A.I. DrawingofthesteamshipNewYork.CourtesyMariners'Museum,NewportNews, Virginia.

The *New York* departed Galveston for what was to become her final voyage on 5 September 1846. By 10 p.m. that evening, she came to anchor in heavy seas some 50 miles eastward of Galveston, having unknowingly sailed into the path of a hurricane. After a fearsome pounding by seas and wind, which lifted the promenade deck, stove in the starboard guard and wheel house, carried away the smoke stack, and sprang the hull, the *New York* foundered in 10 fathoms of water at 6 a.m. on the morning of September 7 *(Daily Picayune*, 10 September 1846). Seventeen passengers and crewmen, including five children, were lost when the ship went down. The remaining survivors clung to rafts fashioned from a portion of the promenade deck and other wreckage for more than 12 hours until they were rescued by another steamer, the *Galveston (New Orleans Gazette*, 10 September 1846).

Discovery of the Wreck

A group of amateur divers from New Iberia, Louisiana, began searching for the wreck of the *New York* in 1985. Working only from the sparse clues contained within the survivors' accounts published in the New Orleans newspapers in 1846, the divers deduced the general location of the wreck site. They subsequently interviewed shrimpers who worked in the area to obtain information on the

location of net hangs.[1] Over the course of the next five years, the team systematically tested each hang site in a ten-mile square area using a fish finder to locate targets above the seafloor. After a supreme amount of effort and patience, utilizing equipment that is primitive by hydrographic surveying standards, the divers discovered in 1990 a wreck they believed to be that of the *New York*. Materials recovered from the site, including coins and a mortising machine patented in 1836, were consistent with the 1846 sinking of the steamer. Subsequent examination of the site by MMS confirmed the presence of a low pressure steam engine at the site, which also is consistent with the cross-head engine mounted in the *New York* (Figure 2A.2).

MMS Involvement with the *New York*

The High Island Area lease block in which the *New York* lies was surveyed by an oil and gas company for shallow hazards in 1988 at a line spacing of 150 meters, the survey interval required by MMS at the time for all blocks in the archaeological high probability area. The survey recorded a magnetic anomaly with a perturbation of 100 gammas over the wreck site, but the consulting archaeologist at the time did not associate it with the location of a significant historic shipwreck. Subsequently, a study conducted for the MMS with the purpose of determining high probability areas for the location of historic wrecks in order to reduce the survey interval for those blocks from 150 meters to 50 meters placed the wreck of the *New York* in Vermilion area, more than 160 kilometers away from its actual location. As a result, survey requirements for the block containing the wreck site were reduced to 300 meters, further reducing the chances that MMS would have ever identified the site. Fortunately, the leader of the team that discovered the wreck shared the location of the site with MMS in the interest of preserving it from inadvertent destruction by oil and gas development in the block.

MMS first visited the site of the wreck in July 1997, for the purpose of identifying the wreckage and conducting an intensive remote sensing survey in order to assess the site's size and extent. There was a particular concern to investigate the possible relationship between other magnetic anomalies discovered during the 1988 survey and the shipwreck.

Survey was conducted along north/south tracklines spaced 30 meters apart over an area 1,500 feet wide (east-west) by 4,000 feet long (north-south). Survey instrumentation included a Geometrics G-866 proton precession magnetometer and a Marine Sonics Seascan 600 kHz side-scan sonar. Positioning control was maintained with a Trimble NT200D differential GPS receiving the U.S. Coast Guard differential beacons with an accuracy of ±10 meters. The side-scan sonar receives positioning input from the DGPS and links the image files with the positioning files. The magnetometer was time synchronized to the DGPS and magnetic data were output to a computer for storage. The time-synchronized magnetic and positioning files were later merged in post-processing to produce a single X, Y, Z coordinate file. The resulting file was contoured using *Surfer* software. Magnetic contouring revealed that wreck debris was scattered over the seafloor for a distance of

[1] Many shrimpers maintain personal logs of obstructions within the areas in which they operate. These hangs often go unreported since this knowledge provides them a distinct economic advantage over competitors.

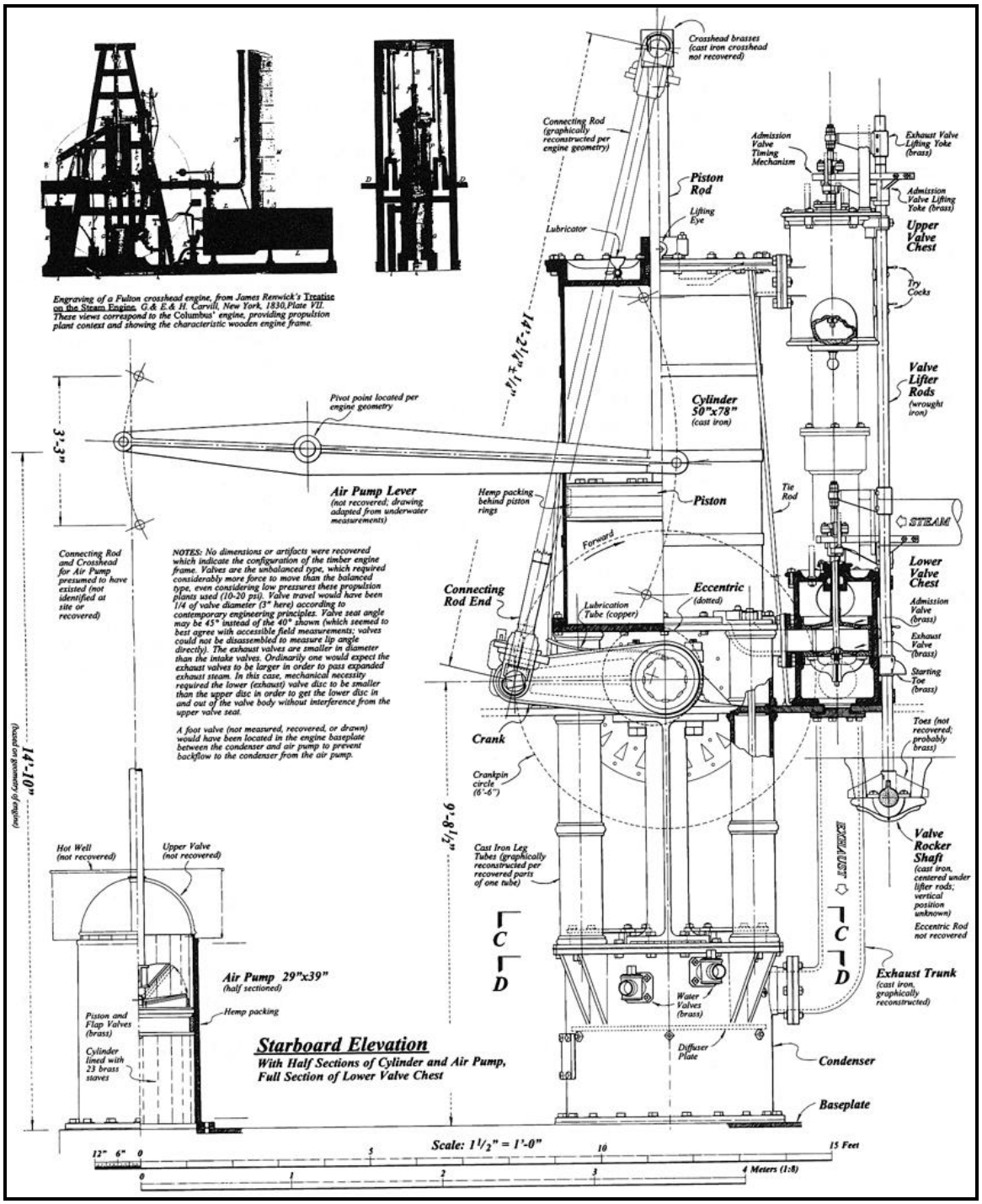

Figure 2A.2. Example of a crosshead steam engine, ca. 1828.

about 450 meters. The principal areas of magnetic perturbation centered over the hull (containing the steam engine) and a paddle wheel to the east (Figure 2A.3). Several small, concentrated anomalies were observed curving to the south east from the main wreck site. At present, none of these anomalies have been tested archaeologically.

Conclusions

The wreck of the *New York* serves as an important lesson for the MMS/GOMR archaeological program. The fact that the wreck site lies outside the currently designated high probability area for historic shipwrecks suggests that the model on which this designation is based needs to be reevaluated. Secondly, it highlights the importance of developing better public outreach to the sport diving community and other maritime interests to enlist their trust and cooperation in helping to locate historic wrecks in the Gulf of Mexico. It is unlikely that MMS would have discovered this nationally significant site without their assistance and cooperation. Finally, the analysis of the wreck by MMS demonstrates that the potential site size for a shipwreck on the OCS can exceed 24 ha (61 acres) of bottom land and be characterized by multiple, individual magnetic anomalies scattered over a wide distance. Since the majority of vessels that wrecked on the OCS did so as a result of foundering and being literally torn apart during a violent storm, this pattern may be expected to be repeated at other sites and should be considered as a general rule to guide decisions relating to activity avoidance zones.

THE WRECK OF THE *HATTERAS*

A number of important Civil War vessels have been located in state waters, such as the Confederate ironclads CSS *Louisiana* in Plaquemines Parish, Louisiana, and the *Huntsville* and *Tuscaloosa* in the Mobile River. The remains of the Union ironclad *Tecumseh*, whose sinking by a Confederate mine prompted Farragut's famous order "Damn the torpedoes, full speed ahead!" are well known off Fort Morgan, Alabama. Only one U.S. warship, however, was sunk at sea in the Gulf. This important shipwreck, the USS *Hatteras*, has been the subject of repeated investigations by the MMS, the Texas Historical Commission, and Texas A&M University at Galveston.

The USS *Hatteras* was a side-wheel steamer acquired by the Navy in 1861 and armed with four 32-pounder cannon (a 20-pounder rifled cannon was added later). After distinguished service in the South Atlantic Blockading Squadron, the vessel was transferred to the Gulf Blockading Squadron on 26 January 1862. In less than a year, the *Hatteras* captured seven Confederate blockade runners off Vermilion Bay, Louisiana. Early in 1863, she was ordered to join the squadron under Rear Admiral David Farragut, who was attempting to retake the key Texas port of Galveston, Texas. The Civil War in the Gulf is defined by the Northern strategy of the blockade of Southern ports and the daring attempts by Confederate vessels to run this blockade.

As the blockading squadron lay off the coast on the afternoon of 11 January 1863, a set of sails was sighted just over the horizon and the *Hatteras* was ordered to give pursuit. She chased the intruder for four hours, closer and closer into shore, and farther and farther from her supporting fleet. Finally, as dusk was falling, the *Hatteras* came withing hailing distance of the square-rigged, black-hulled

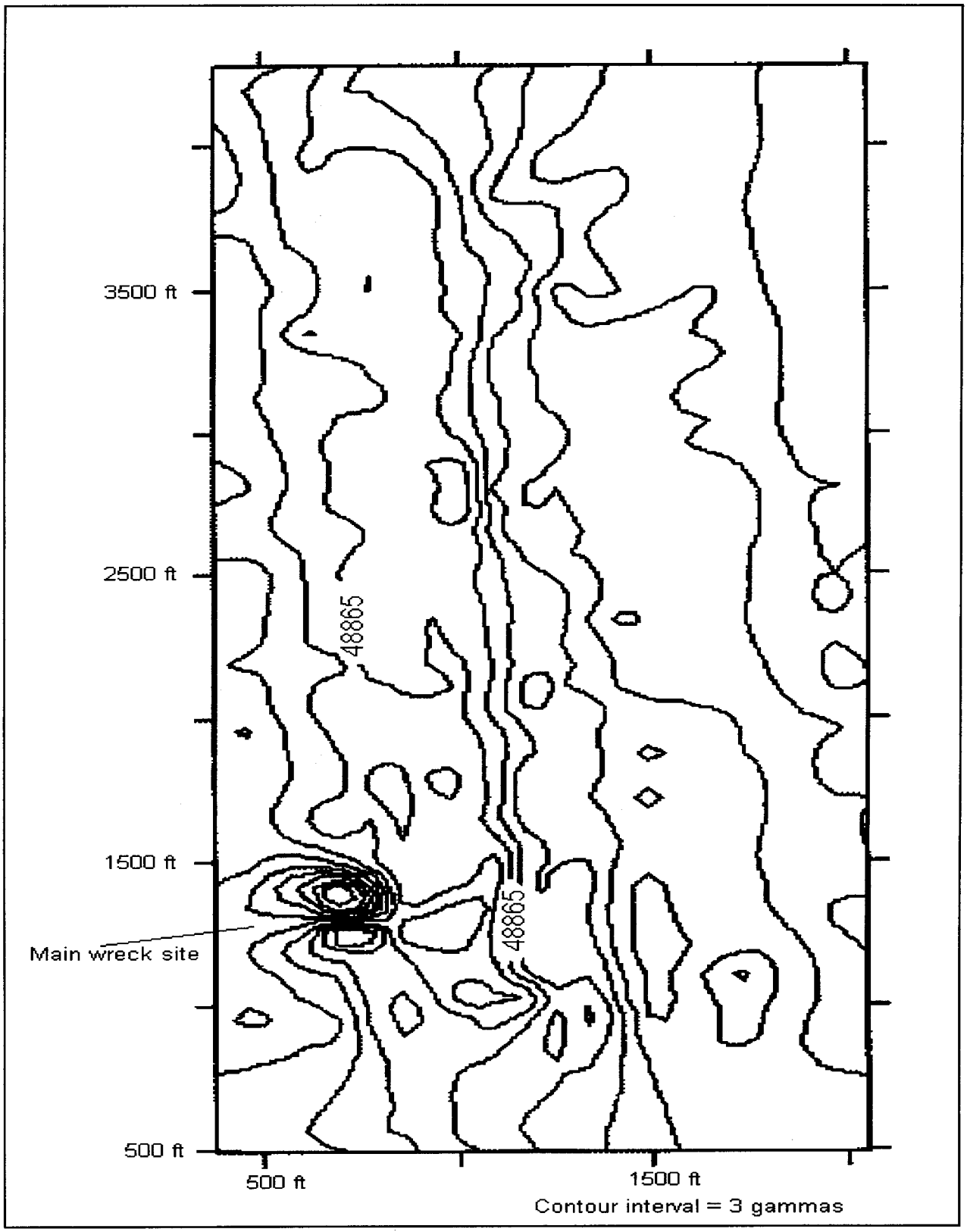

Figure 2A.3. Magnetic contour map of the wreck site of the New York.

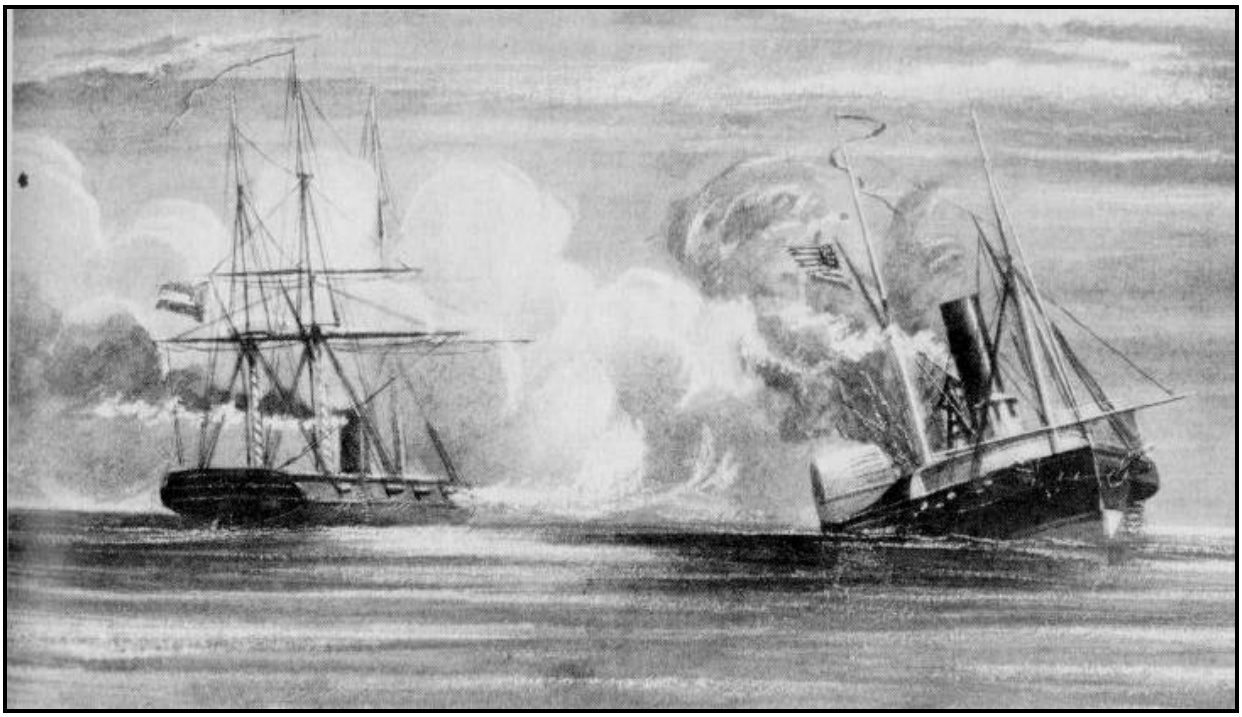

Figure 2A.4. The sinking of the USS Hatteras by the CSS Alabama. Courtesy U.S. Navy Photographic Center.

vessel. Commander Homer C. Blake demanded to know the identity of the ship. "Her Britannic Majesty's Ship *Vixen,*" came the reply. Blake ordered one of *Hatteras'* boats launched to inspect the "Britisher." Almost as soon as the boat was piped away, a new reply came from the mystery ship, "We are the CSS *Alabama!"* A broadside from the Alabama's guns punctuated the reply. Within 13 minutes, the *Hatteras,* sinking rapidly, surrendered (Figure 2A.4).

The Hatteras today rests in 58 feet of water about 20 miles off Galveston. Her 210-foot long iron hull is completely buried under about three feet of sand. Only the remains of her 500-horsepower walking beam steam engine and her two iron paddle wheels remain exposed above the sea floor. Since the site's discovery in the 1970s, MMS has engaged in periodic monitoring of the wreck to ensure that it is not damaged by surrounding oil and gas lease development. Although the wreck remains the property of the U.S. Navy, MMS has joined forces with the THC and Texas A&M at Galveston to preserve this important archaeological treasure for posterity.

The wreck of the US *Hatteras* is an integral part of the story of the Civil War on the Texas coast, the defense of which is regarded as one of the greatest military feats of the Confederacy. The ship's dramatic history, along with the fact that the remains of the vessel are virtually intact, make it one of the most important underwater archaeological sites in the United States.

HORN ISLAND SHIPWRECK

Another wreck possibly associated with the Civil War in the Gulf was recently documented by MMS. Loran C coordinates of an historic side-wheel steamship off Hom Island, Mississippi, were

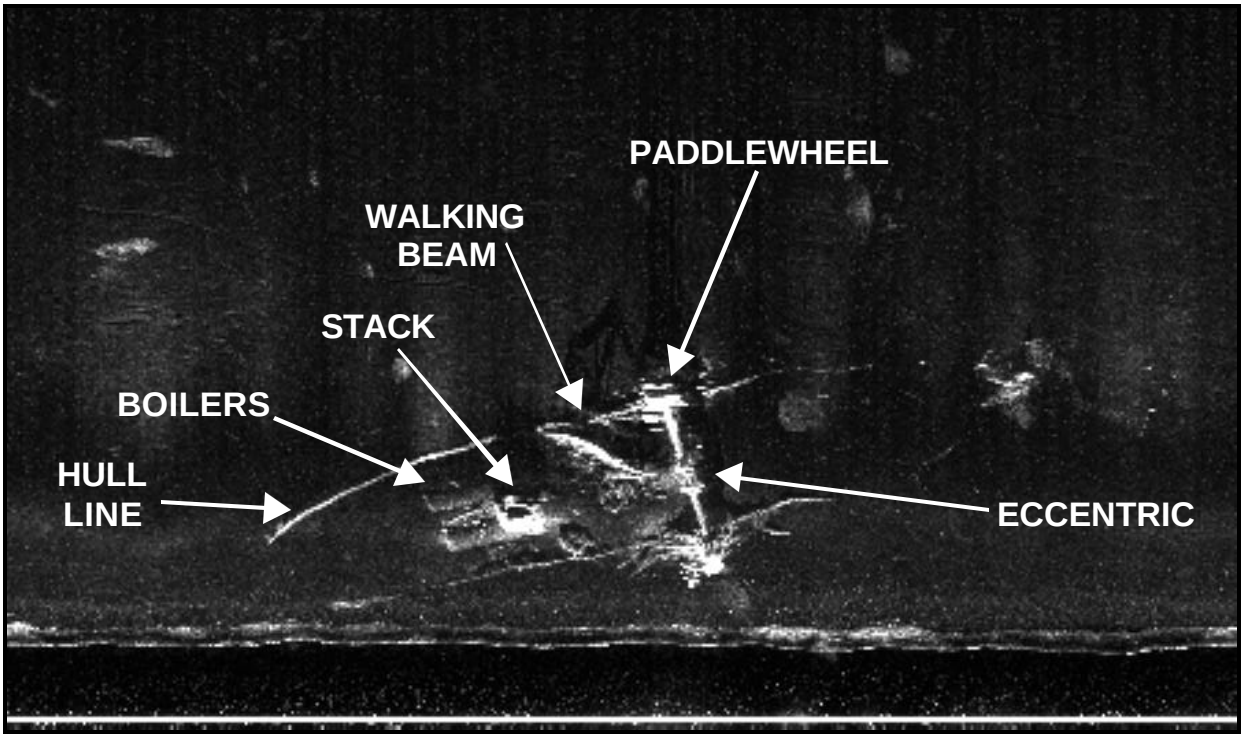

Figure 2A.5. Side-scan sonar image of the Horn Island shipwreck (22HR843).

provided to MMS by an informant. Because of the inherent inaccuracy of Loran C, there was a possibility that this site could lie in federal waters. Side-scan survey and DGPS positioning confirmed that the vessel lies in Mississippi waters. Information about the site was relayed to the Mississippi State Historic Preservation office, who had no information about the vessel in their archaeological site records. The site has been assigned a trinomial designation of 22HR843.

The Horn Island shipwreck is a side-wheel steamship with an apparently intact walking beam engine and two large boilers visible above the seafloor. From the side-scan image, the vessel measures 53.6 meters long by 10 meters wide (Figure 2A.5). Local informants report that it has an iron hull, although this has not been confirmed. Research presently is being conducted to identify the wreck, which most likely dates to the last half of the nineteenth century. Preliminary research suggests that

the vessel may be the *Heroine*, which was built in Glascow in 1862 as a blockade runner (Way 1983, 213). After the Civil War, the vessel was used as a towboat in New Orleans and after 1880 was converted into a passenger boat on the New Orleans-Bay St. Louis-Biloxi run. The *Heroine* disappears from the historical record after 1906, which coincides with a major hurricane that made landfall on the Mississippi coast. Could the *Heroine* have been lost in this storm? Is the Horn Island Wreck the last remains of this vessel? Field work to be conducted as part of the seafloor monitoring program next summer may answer these questions. Because of its apparently intact condition, the vessel should be considered to be potentially eligible to the National Register of Historic Places.

WORLD WAR II SHIPWRECKS

Federal law defines an historic site as at least fifty years old. As a result, wrecks associated with World War II now meet that criterion. Nearly all the shipwrecks in the Gulf from that period relate to one cause—attack by the German submarines known as "U-boats." U-boat comes from the German word "Unterseeboot."

During the years 1942 and 1943, a fleet of more than 20 German U-boats cruised the Gulf seeking to disrupt the vital flow of oil carried by tankers from ports in Texas and Louisiana. They succeeded in sending 56 vessels to the bottom; 39 of these are now believed to be in state or federal waters off Texas, Louisiana, and Florida. After their initial, devastating success, U-boat attacks in the Gulf became rare by the end of 1943 after merchant vessels began cruising in armed convoys. The opening of the "Big Inch" pipeline from Texas to New Jersey also contributed to freeing the war effort from relying on ships to transport crude oil.

At least 13 of the U-boat casualties have been discovered, largely through the efforts of the oil and gas surveys. These include the *Cities Service Toledo*, the *Sheherezade*, the *R.W. Gallagher*, the *R.M. Parker*, the *David McKelvey*, the *Hamlet*, the *Heredia*, the *Halo*, the *Bayard*, the *Benjamin Brewster*, the *Gulf Penn*, the *Alcoa Puritan*, and the *Robert E. Lee*. All of these wrecks have substantial physical remains on the seafloor and principally were located using side-scan sonar. The depths of the wrecks range from as little as 36 feet (*Benjamin Brewster*) to more than 4,000 feet of water (*Robert E. Lee* and *Alcoa Puritan*).

The *Cities Service Toledo*, lost in the South Marsh Island Area, is fairly typical of the losses to American shipping during the U-boat war in the Gulf (Figure 2A.6). The *Toledo* was an 8,192-ton steamship built in 1918 (Browning 1996, 140). On 10 June 1942, it left Corpus Christi, Texas, carrying 84,000 barrels of crude oil bound for Portland, Maine. The vessel sailed alone and plied a nonevasive course, making it a sitting duck for the *U-158* under the command of *Kapitänleutant* Erich Rostin. Just two days before, Rostin had sunk the freighter *Hermis* and the tanker *Scheherezade*.

Twenty miles east of the Trinity Shoals Gas Buoy, the *U-158* fired two torpedoes that struck two seconds apart on the starboard side amidships in the #6 and #7 tanks at 1:50 a.m. on 12 June (*Times-Picayune*, 17 June 1942). The vessel immediately listed to starboard and soon was struck by two more torpedoes in the #4 and #5 tanks. The last torpedo was an incendiary that caused the ship to

Figure 2A.6. The SS Cities Service Toledo.

burst into flames. The Navy gun crew manned their single 5" bow gun as long as possible and fired 3 rounds at a light they believed to be the submarine. Ceasing after the gun's recoil began to tear the plates from the deck of the badly listing ship, the nine men of the gun crew abandoned the vessel with the rest of the crew of eight officers and 28 men. The explosion and fire had destroyed the life rafts and two of the ship's boats. A third boat was launched but the crew could not clear it from the flaming water surrounding the stricken ship and were forced to abandon it. Seventeen men abandoned the ship in the remaining lifeboat and were rescued by the Norwegian tanker, SS *Belinda*, several hours later. Eight hours after the attack, the tankers SS *Gulf King* and SS *San Antonio* rescued the surviving 13 men in the water. Fifteen men were lost in the attack, including one officer, ten crewmen, and four armed guards. One of the survivors, who had abandoned a law career for life as a naval gunner, commented from his bed in a Marine hospital: "Law is easier any day" *(Times Picayune*, 17 June 1942).

One of the worse casualties in human terms of the U-boat war in the Gulf was the *Heredia*, a 4,700 ton freighter owned by the United Fruit Company (Figure 2A.7). The *Heredia* was bound for New Orleans from Puerto Barrios, Guatemala, with a cargo of 40,000 stems of bananas and 5,000 bags of coffee when she was attacked by the *U-506* on 19 May 1942 (Navy Dept. 1942a; Browning 1996, 111). Three torpedoes struck the vessel, causing her to plunge beneath the sea stem first within three minutes. Thirty-six men lost their lives in the attack. Among the 23 survivors were two children, a

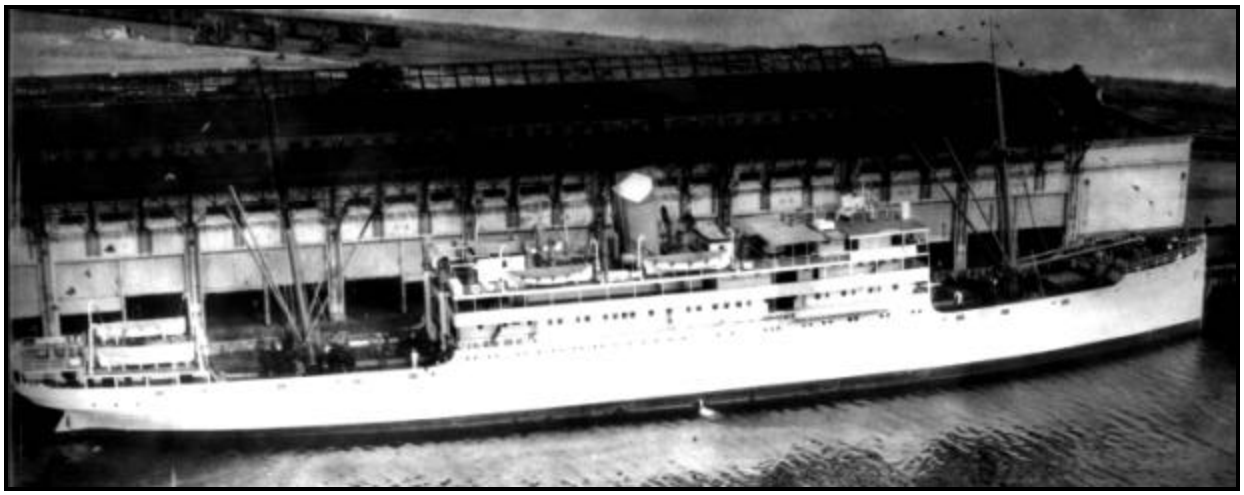

Figure 2A.7. The SS Heredia.

9-year-old boy and an 11-year-old girl, who later recounted that sharks approached her close enough to tickle her feet as she clung to a hatch cover for 15 hours awaiting rescue *(Times-Picayune,* 25 May 1942). In only ten days between 10 May and 20 May 1942, the same U-boat also sank the tankers *Aurora, Gulfpenn, David McKelvey, William C. McTarnahan, Sun, Gulfoil, and Halo* (Wiggins 1995, 234f). The captain of *U-506,* Erich Würdemann, was subsequently awarded the Iron Cross (First Class) and, later, the coveted Knights Cross. Würdemann was responsible for sinking 16 vessels during his career, costing the Allies nearly 87,000 tons of shipping, before the U-506 was itself sunk by an US B-24 Liberator aircraft off Vigo, Spain on 12 July 1943.

Between May 1942 and December 1943, German U-boats harassed American shipping in the Gulf with near impunity. Only one Nazi submarine, the *U-166,* is believed sunk in the Gulf; it has yet to be discovered (Figure 2A.8). The *U-166* was commissioned on 23 March 1942. It departed Kristianstad, Norway, on its first patrol to the North Atlantic under the command of *Oberleutnant* Hans-Günther Kuhlmann on 1 June. Returning to base at Lorient, France, on 10 June without scoring any successes, the *U-166* departed for the Gulf seven days later. Kuhlmann's first victim in the Gulf was the *Carmen,* a small freighter registered in the Dominican Republic. Two days later on 13 July the *U-166* claimed as its second kill the *Oneida,* an unarmed 2300-ton freighter owned by the Ford Motor Company that was steaming in ballast for Punta Gorda, Cuba. The American trawler *Gertrude* was Kuhlmann's third victim. Probably stung by the failure of his first cruise, and the frustrating lack of important targets as his second cruise neared its end, Kuhlmann was no doubt elated when the 5,184-ton passenger steamer *Robert E. Lee* unwittingly sailed into his path. The *Robert E. Lee* was sailing from Port-of-Spain, Trinidad, to New Orleans under escort of the *PC-566.* Aboard the vessel were 268 passengers who, ironically, were mostly survivors of other sinkings. Lookouts on the *Robert E. Lee* spotted a torpedo 200 yards before it struck just aft of the engine room (Browning 1996, 194). The explosion destroyed the #3 hold and vented through the B and C decks, wrecking the engines, the radio equipment, and the steering gear. The ship sank stem first within 15 minutes as the *PC-566* began dropping depth charges (Figure 2A.9). One of the *Robert E. Lee's* officers, nine of her merchant crew, and 15 passengers died in the attack. Survivors were picked up by the *PC-566,* the *SC-519,* and the tug *Underwriter* and transported to Venice, Louisiana.

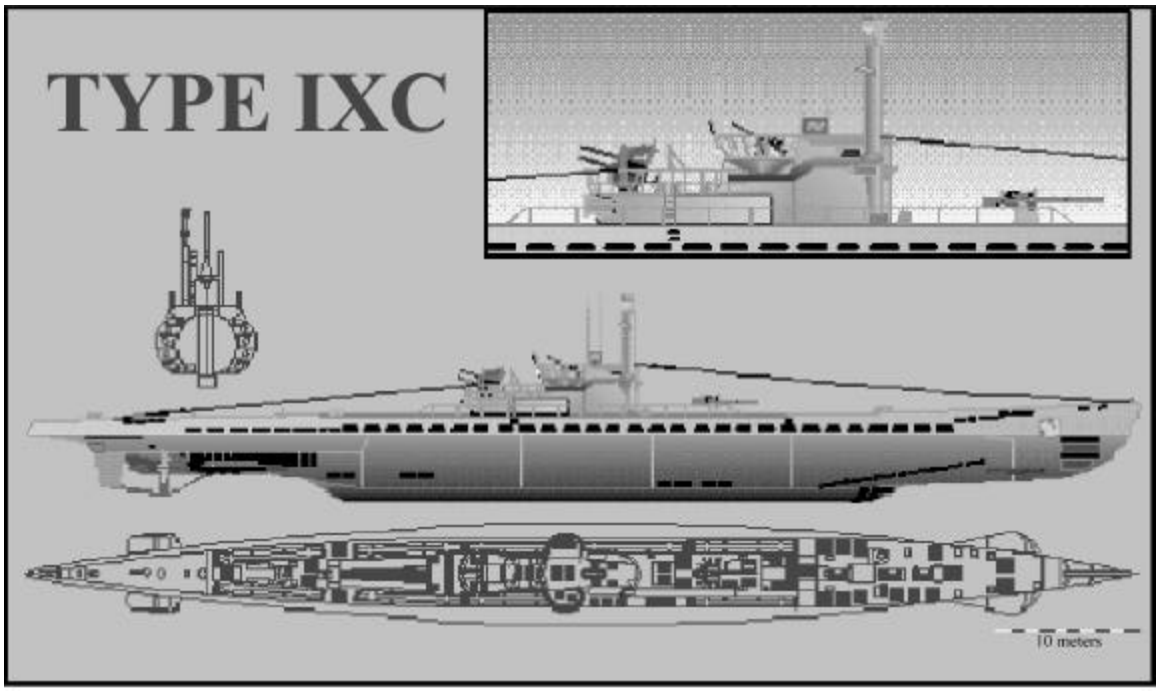

Figure 2A.8. A Class IXC German U-boat, the same type as the U-166.

What became of the *U-166* after the attack on the *Robert E. Lee* remains a mystery. This much is known for certain: the submarine never returned and was presumed lost. The crew of the *PC-566* reported that a small oil slick followed their depth charges (Navy Dept. 1942b), but this was a common tactic employed by submariners to trick their attackers into believing that the boat was damaged. Two days after the attack on the *Robert E. Lee,* the crew of a J4F-1 Grumman torpedo plane spotted an U-boat on the surface in shallow water 20 miles south of Isles Dernieres, Louisiana, in what is now South Timbalier Area. As the plane turned to attack the submarine, it was spotted by the Germans and the sub crash-dived. After launching their 325-pound depth charge from an altitude of 250 feet, the aviators saw a sheen of oil come to the surface and believed that they had damaged the sub. However, it is hard to imagine that the sub would have remained undiscovered in only about 60 feet of water after 56 years. In fact, it is not even certain that the sub spotted by the flyers was the *U-166*. Declassified German documents reveal that there were five U-boats patrolling the Gulf in August 1942. It seems more likely that the *U-166* was damaged by the depth charges from the *PC-566* and sank somewhere in the deep abyss of Mississippi Canyon. Our best hope for finding the lost sub now is the deep water exploration currently being undertaken by the oil and gas industry.

The discovery of and continued research on World War 11 shipwrecks in the Gulf gives us a new appreciation for the strategic importance of this region to the war effort. At great personal risk, the U.S. Merchant Marine kept up the flow of oil to fuel the Allied war machine. The evidence of their sacrifice lies beneath the waves on the Outer Continental Shelf. These wrecks deserve our protection not only as war graves, but as silent monuments to the courage of the Merchant Marine and the role of the Texas and Louisiana oil industry in the defeat of the Axis powers.

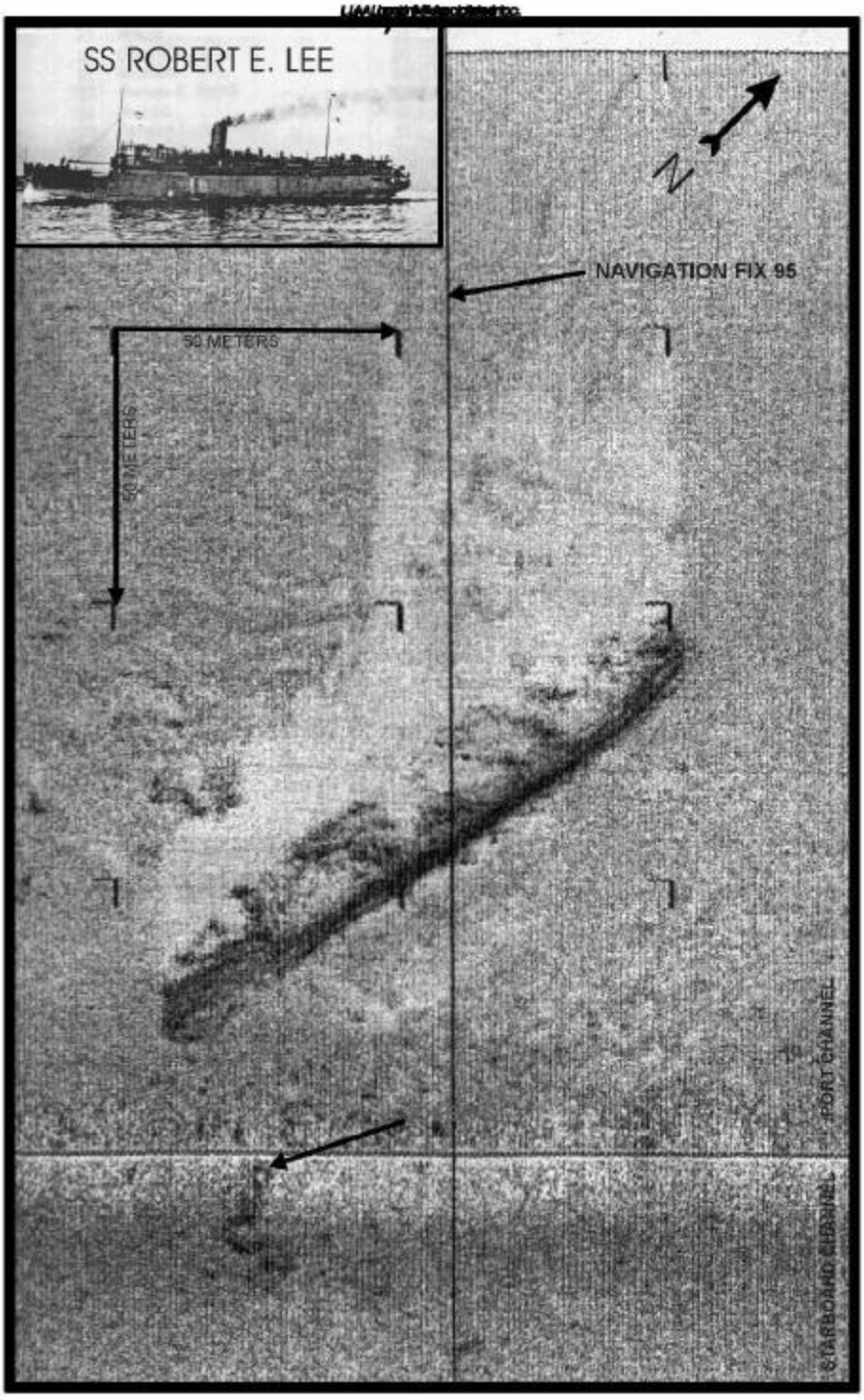

Figure 2A.9. The SS Robert E. Lee, superimposed over the side-scan sonar record of the shipwreck. Courtesy John E. Chance & Associates, Inc.

CONCLUSIONS

The Seafloor Monitoring Program is having a significant effect on our ability to interpret and understand underwater archaeological remains in the Gulf of Mexico. Not only can we proactively insure that MMS avoidance mitigations actually are applied, but we can, for the first time, take the opportunity to examine remote sensing targets in the field to determine if they are, in fact, historic shipwrecks or merely modern debris. By developing a better understanding of what shipwrecks in the Gulf actually look like, we are able to make better, and we hope, less restrictive management decisions to insure their preservation for future generations of Americans.

AUTHOR'S NOTE

The Horn Island shipwreck (22HR843) discussed here was posited at the time of the ITM to be the wreck of the *Heroine.* Since that time (1998) the MMS has sponsored additional fieldwork and historical research at the site to identify the vessel. Subsequently, the shipwreck has been identified positively as the *Josephine.* The *Josephine* was constructed by Harland & Hollingsworth in Wilmington, Delaware, in 1867 and sank during a winter storm on 8 February 1881. The vessel was operated by the Charles Morgan Line, the principal steamship line serving the Gulf Coast throughout most of the nineteenth century.

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Dr. Jack B. Irion joined the Minerals Management Service in August 1995 with the title of marine archaeologist. Prior to MMS, Dr. Irion served as vice president for Nautical Archaeological Services with the consulting firm of R. Christopher Goodwin & Associates, Inc., in New Orleans, Louisiana. For over 15 years, Dr. Irion provided archaeological consulting services to the Baltimore, Charleston, Mobile, New Orleans, Pittsburgh, Philadelphia, Savannah, Vicksburg, and Wilmington Districts of the Corps of Engineers, as well as to the Maryland Port Administration, and the State of Tennessee. Dr. Irion received his B.A. (1974) and M.A. (1977) in Archaeological Studies from The University of Texas at Austin. He was awarded his Ph.D. from the Institute of Latin American Studies of the University of Texas in 1991. During his career, Dr. Irion has specialized in conducting remote sensing surveys for shipwrecks, which succeeded in locating such historically significant vessels as the C.S.S. *Louisiana*, the sailing barque *Maxwell*, and the steamboats *Princess*, and *Kentucky*. In addition, he has directed numerous diving investigations on historic shipwrecks, including the steamship *Columbus* and the Civil War gunboats *Tawah* and *Key West.* Most recently, he has participated in MMS investigations of the Civil War vessel U.S.S. *Hatteras* and the steam packet *New York.*

BIOLOGICAL CHARACTERIZATION AND MONITORING OF SONNIER BANK

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ABSTRACT

Sonnier Bank is a siltstone mid-shelf bank resulting from salt diapirism similar to most other topographic features along the northern Gulf of Mexico continental shelf. Though not a true coral reef, a remarkable biota of more than 100 species of fish and a nearly 100% cover of attached invertebrates including eight species of coral are represented. Sonnier Bank is very similar to, and in many respects better developed than Stetson Bank, which is now part of the Flower Garden Banks National Marine Sanctuary.

The Minerals Management Service (MMS) has initiated a program to further characterize the biota and community stability at Sonnier Bank. This program is part of a multiyear monitoring effort. Repetitive photographic stations installed by a previous project of the nonprofit organization Gulf