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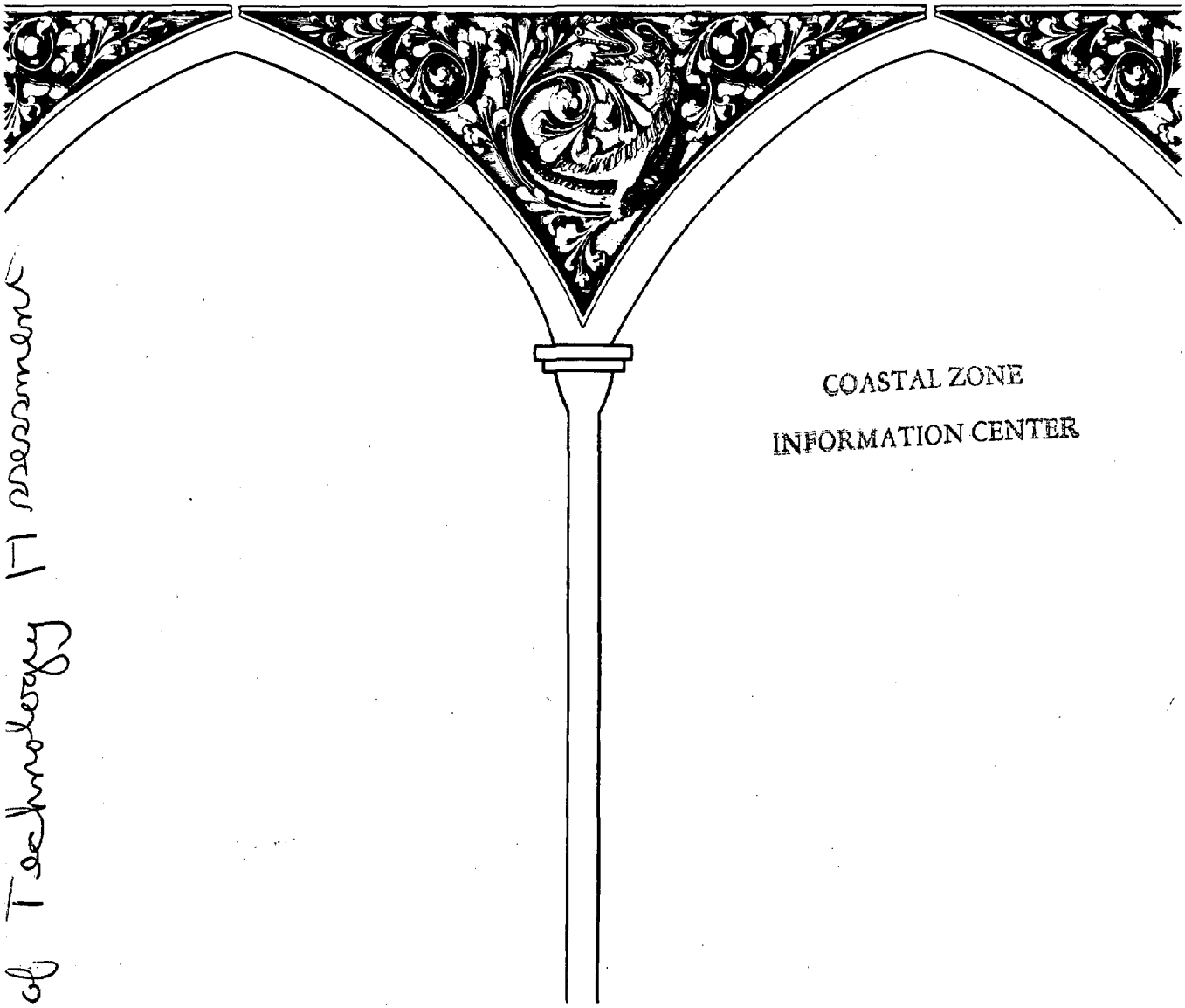

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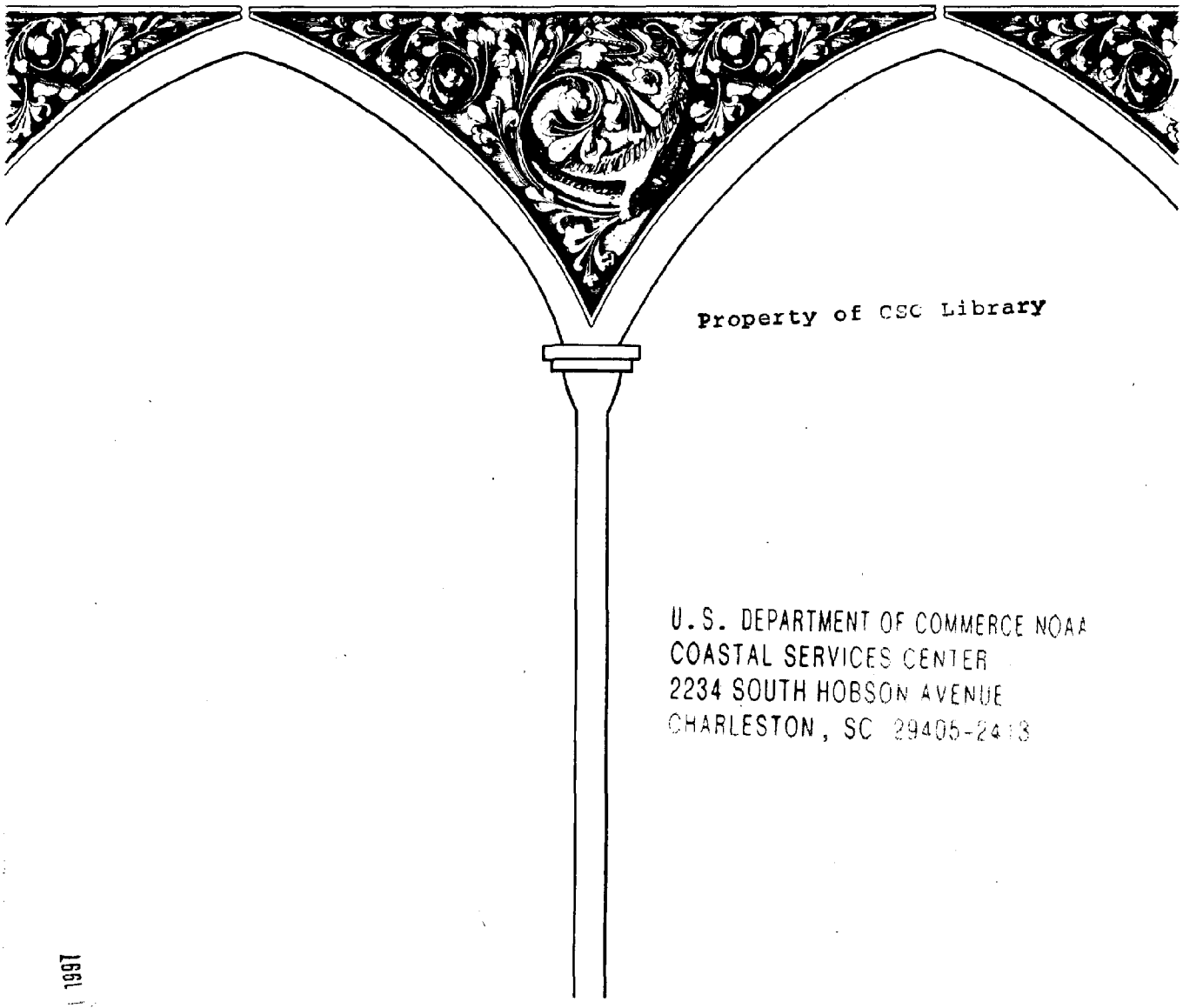

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Foreword

Exploration, trading, and other maritime activity along this Nation's coast and through its inland waters have played crucial roles in the discovery, settlement, and development of the United States. The remnants of these activities include such varied cultural historic resources as Spanish, English, and American shipwrecks off the Atlantic and Pacific coasts; abandoned lighthouses; historic vessels like Maine-built coastal schooners, or Chesapeake Bay Skipjacks; and submerged prehistoric villages in the Gulf Coast. Together, this country's maritime activities make up a substantial component of U.S. history.

This background paper describes and assesses the role of technology in underwater archaeology and historic maritime preservation. As several underwater projects have recently demonstrated, advanced technology, often developed for other uses, plays an increasingly important role in the discovery and recovery of historic shipwrecks and their contents. For example, the U.S. Government this summer employed a powerful remotely operated vehicle to map and explore the *U.S.S. Monitor,* which lies on the bottom off Cape Hatteras. This is the same vehicle used to recover parts of the space shuttle Challenger from the ocean bottom in 1986. The Commonwealth of Virginia is using a variety of advanced techniques to document and excavate one of General Cornwallis's ships, intentionally sunk off Yorktown during the Revolutionary War to prevent General Washington from capturing it. In international waters, the location and documentation of the British luxury liner *Titanic* was possible only by using a variety of sophisticated positional devices and deep water submersibles. These efforts have captured the interest and imagination of the American public.

This background paper also examines the legal framework that affects the salvage of historic shipwrecks and recovery of artifacts. Historic shipwrecks in U.S. coastal waters contain a wealth of important information about the economic and social history of this country. Yet they are suffering rapid attrition, in part because the United States lacks a coherent national policy to guide the identification and preservation of underwater and maritime cultural resources. For example, State laws governing historic shipwrecks found in State coastal waters often conflict with Federal Admiralty law, which gives private salvors the right to salvage shipwrecks, regardless of their age or historic value. Attempts to place historic shipwrecks under the same protection as other historic cultural resources have led to the Historic Shipwreck Act of 1987, which is discussed and analyzed in this background paper.

In undertaking this work, OTA sought the contributions of a wide spectrum of knowledgeable and interested experts within Federal and State Governments and the private sector. Some provided information and guidance, others reviewed drafts of this background paper. OTA gratefully acknowledges their contributions of time and intellectual effort.

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INTRODUCTION

In 1986, at the request of the House Interior Committee and its Subcommittee on Public Lands the Office of Technology Assessment (OTA)[1] completed a report on *Technologies for Prehistoric and Historic Preservation*.[2] The report assesses the use of technologies[3] for locating, analyzing, and protecting elements of the Nation's prehistoric and historic heritage, and reviews the legislative basis for historic preservation in the United States.

Because submerged and maritime resources are among the most neglected of U.S. cultural resources, and the United States lacks an effective national policy for protecting them, the House Interior Committee and Public Lands Subcommittee asked that OTA develop this background paper, extending the report's analysis of technologies for underwater archaeology and maritime preservation.[4] Information contained in this background paper derives primarily from a workshop convened by OTA, February 20, 1986, in which participants met to discuss issues concerning the preservation of underwater archaeological and maritime historical resources. OTA also obtained additional material from staff research, personal interviews with underwater archaeologists and preservation professionals, and from an informal meeting on underwater archaeology and maritime preservation held at OTA, November 3, 1986.

The National Historic Preservation Act (16 U.S.C. 470 et seq.) acknowledges the diversity of America's cultural heritage. The Congress of the United States has declared, through this legislation that:

> . . . the preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Americans.[5]

Underwater archaeological and maritime resources constitute a significant part of that cultural diversity, comprising structures, objects, and sites.

Underwater archaeology refers to the study of the remains of prehistoric and historic human activities found underwater. These remains generally include the following:

- **Shipwrecks**, both scattered and intact, in deep or shallow water, within coralline formations, and on or near shore, when, for example, they are found within landfills or isolated as hulks by uplift, lowered water levels, or changes in river channels. Shipwrecks and their cargoes reveal life at the moment of each sinking, and can provide otherwise unavailable information on marine technology, shipbuilding, navigation, and warfare. Many ships served as homes at sea. Study of historic shipwrecks can therefore provide valuable insights into trade, shipboard life, and the interaction between the Old and New Worlds in the exploration and settlement of this country.
- **Lost objects**, such as the contents of early traders' canoes lost in rivers and lakes. They often provide useful information on trade routes, life in the period of exploration, and early settlement patterns.
- **Submerged prehistoric sites**, including those of relatively recent periods that have subsided near shore or been flooded by reservoirs, and those on the Outer Continental Shelf that have been inundated by rising sea levels. The latter, whose existence is only now being demonstrated, are especially important because they illustrate human adaptations to coastal environments during the earliest phases of North American prehistory.

[1]OTA conducted its assessment in part by convening a series of workshops that addressed issues surrounding the uses of technologies for dry-land archaeology, underwater archaeology, prehistoric and historic structures, and prehistoric and historic landscapes. A fifth workshop focused on problems relating to the physical protection of all classes of cultural resources.

[2]U.S. Congress, Office of Technology Assessment, *Technologies for Prehistoric and Historic Preservation*, OTA-E-319 (Washington, DC: U.S. Government Printing Office, Sept. 1986).

[3]The term, preservation technologies, refers broadly to any equipment, methods, and techniques that can be applied to the discovery; analysis; interpretation; restoration; conservation; protection; and management of prehistoric and historic sites, structures, and landscapes.

[4]Letter of Oct. 8, 1986, signed by Representatives Morris K. Udall and John F. Seiberling.

[5]National Historic Preservation Act, Sec. 1(b) (Purpose of the Act), para. 4.

Submerged remains encompass sites that functioned as work areas, dwellings, or debris deposits. They vary widely and may consist of such remains as farms, warehouses, piers, middens, wells, villages, towns, even cities.

Maritime preservation encompasses underwater archaeology but extends to a wide variety of maritime-related historic cultural resources such as ships and other vessels still afloat or dry-berthed; shore installations such as lighthouses, shipyards, drydocks, and coastal defense systems; settlements dependent on shipping, canals, locks and levees; documents, works of art, and archives pertinent to maritime activities; and, finally, to intangible cultural resources such as skills in boatbuilding and navigation.

Publicity surrounding the recovery of artifacts from several well-known historic shipwrecks, as well as the development of technologies for locating and preserving historic shipwrecks, have focused greater attention on underwater cultural resources. This background paper attempts to articulate the most important policy issues related to the preservation of underwater archaeology and maritime cultural resources. Some of the information in this background paper appeared in *Technologies for Prehistoric and Historic Preservation* in different form and organization. We refer the reader to it for an overview of the issues common to all disciplines within the preservation field.

PRINCIPAL FINDINGS

If significant underwater and maritime historic cultural resources are to receive more effective protection, the United States will have to develop a coherent national policy for managing them.

The current lack of a coherent national policy for underwater archaeology and maritime preservation has impeded the location and protection of many historically significant cultural resources. In spite of the many cultural conservation laws enacted since 1906, particularly the National Historic Preservation Act, and their supporting regulations, standards, and guidelines, underwater archaeology and maritime preservation have received relatively little attention within the Federal Government. No single Federal department or agency has been specifically charged with funding, coordinating, and directing a strong, visible national program for underwater archaeology and maritime preservation. Nor has the Federal Government asserted sovereign prerogative over historic shipwrecks in its waters.

The Federal Government and States have begun to allocate more resources for protecting underwater and maritime cultural resources. For example, in 1987 the National Park Service published the first criteria for evaluating and nominating historic ships and shipwrecks to the National Register of Historic Places, and in fiscal year 1986 Congress appropriated $255,000 for Phase I of the National Maritime Initiative, which is funding:

- an exhaustive literature search of the Nation's maritime resources;
- the drafting of standards for documentation of vessels; and
- the drafting of guidelines for nominating maritime resources to the National Register of Historic Places.

Several other industrialized nations have focused significant resources on underwater archaeology and maritime preservation. Their commitment to the protection of underwater and maritime cultural resources appears more determined than U.S. efforts. For example, preservation professionals in the United States view the recovery and restoration of the 17th century Swedish warship *Wasa* and the English Tudor flagship *Mary Rose* as successful models for U.S. efforts. The successes of these restorations have depended on long-term commitment by the governments of Sweden and the United Kingdom, whose goals are to engender public interest, and to obtain reliable funding for proper research and interpretive facilities, and access to technical expertise.

Underwater and maritime cultural resources are vulnerable to a wide variety of natural and manmade threats.

Looters and commercial treasure salvors constitute the most serious manmade threats to shipwrecks. In the process of searching out and extracting commercially promising contents they may destroy significant archaeological information. However, natural threats, such as shoreline erosion and wave action, may also significantly deplete irreplaceable underwater and maritime cultural resources. Weathering, neglect, and lack of maintenance rapidly deteriorate floating vessels. Rainwater left standing in ships' holds rapidly destroys interior planking and steel and iron fittings.

The preservation of submerged and maritime historical cultural resources depends heavily on advanced and often costly specialized technologies.

Working underwater is hazardous and difficult. Such locational technologies as side-scan sonar, sub-bottom profilers, magnetometers, and remotely operated vehicles were originally developed to explore the sea bottom for national security purposes, laying undersea cables, and for oil and mineral exploration. Because some of these specialized technologies are so expensive, only the best financed users can acquire and apply them.

Technologies for scientificially analyzing and stabilizing the ever increasing numbers of objects recovered from underwater require highly skilled conservators knowledgeable about a variety of different materials, such as brass, different species of wood, and iron. These specialists are in seriously short supply. Likewise, there are not enough properly trained restorers of the many

historically significant floating and dry-berthed ships and other vessels in severe need of protective treatment. Future research on conservation of cultural resources should focus on training; developing more sensitive, low-cost methods and instrumentation; and on the exploitation of new sources of archaeological and technological information.

Historic shipwrecks in U.S. coastal waters contain a wealth of important information about the economic and social history of this country, yet historic shipwreck sites are suffering rapid attrition. Passage and implementation of the *Abandoned Shipwreck Act* (H.R. 74 and S. 858) would assist in preserving significant historic shipwrecks for future generations by removing historic shipwrecks from the purview of Federal admiralty courts and placing them expressly under Federal historic preservation law.

The lack of Federal leadership in resolving the question of jurisdiction over and ownership of significant historic shipwrecks has severely hampered most efforts to protect them for the public and has resulted in lengthy court conflicts between commercial treasure salvors and preservationists. Although submerged archaeological sites under Federal administration are subject to the same laws, regulations, and management policies that govern sites on dry land, the status of some submerged cultural sites, especially shipwrecks, situated outside national parks and marine sanctuaries, is adversely affected by a highly complicated body of law dealing with maritime activities. Yet, other countries such as Australia, Canada, Cyprus, Norway, Sweden, and the United Kingdom have enacted national laws regulating the management of all cultural resources within the waters of their outer continental shelves.

In the absence of Federal legislation to safeguard historic shipwrecks, 27 States have passed antiquities statutes to broaden their jurisdiction and exert regulatory control over significant wrecks within their territorial waters. Yet legal actions taken in Federal court by commercial treasure salvors have called into question the validity of State laws in controlling the recovery of materials at historically significant sites, and have denied the States authority to enforce their statutes.

H.R. 74 and S. 858, which are nearly identical, would treat shipwrecks more like historic properties on land. Among other things, these bills:

- assert U.S. ownership of abandoned shipwrecks and transfers to the States title to those shipwrecks that are embedded in the submerged lands of a State, in coralline formations, or included in or determined eligible for inclusion in the National Register of Historic Places;
- declare that the laws of salvage and of finds do not apply to these abandoned shipwrecks;
- confirm Federal ownership of abandoned shipwrecks on Federal lands;
- retain any existing Federal admiralty and salvage law for all shipwrecks not covered by these bills; and
- direct the Advisory Council on Historic Preservation to develop guidelines to assist the States and the Federal Government in carrying out their responsibilities and to allow for non-injurious recreational exploration and private sector salvage of shipwreck sites.

Passage of either bill would not restrict the right of sport divers to visit and explore such wrecks, nor would it affect admiralty claims for the ownership of wrecks beyond the three-mile off-shore State-controlled limit.

A federally funded facility that focuses on the research and development of preservation technology could make a major contribution to the study and preservation of underwater and maritime cultural resources.

Although the private sector has a significant role in developing and using preservation technologies, the Federal Government has the lead responsibility for guiding preservation efforts throughout the United States. Participants in the OTA assessment, *Technologies for Prehistoric and Historic Preservation*, cited the critical need for a federally supported facility for preservation technologies. A center would foster the research and development of advanced, cost-effective technologies, train professionals in their use, develop technical standards, disseminate accurate technical information, and promote public edu-

cation about historic preservation. A center could also develop automated database systems for archiving and manipulating preservation information.

A federally supported center for preservation technology would encourage closer interactions among underwater archaeologists, maritime preservationists, dry-land archaeologists, historians, scientists, and engineers. It would be the primary source to which individuals could look for state-of-the-art technical information for *all* relevant disciplines in the field.

In order to assist the Federal agencies in carrying out their legislatively mandated responsibilities, Congress may wish to establish such a federally chartered center. It could mandate the establishment of a Federal Center for Preservation Technology within the Department of the Interior or some other Federal agency. Alternatively, Congress could create a National Center for Preservation Technology, managed by a consortium of universities and preservation organizations. Such an institution would be able to draw on a multitude of different skills in several universities, and in many university departments. If a Center for Preservation Technology were established, technologies for underwater archaeology and maritime preservation could constitute a significant portion of its workload.

A Coalition for Applied Preservation Technology (CAPT) has recently been formed whose membership represent a wide variety of private preservation organizations. CAPT is devoted to establishing a multidisciplinary National Center for Applied Preservation Technology.

The lack of National and State inventories of underwater archaeological sites and maritime historical resources has seriously impeded efforts to protect these resources. If the Federal Government and the States wish to protect underwater archaeological sites and maritime cultural resources, they should apply greater efforts to making such inventories.

Although thousands of historic ships and smaller vessels, and prehistoric sites are suspected to exist in State and Federal waters, both levels of government have neglected underwater archaeological and maritime resources in their inventories. For example, the first serious Federal effort to undertake a computer-based resource survey did not begin until 1986, with the National Maritime Initiative, which is directed at surveying historic maritime resources and recommending standards and priorities for their preservation. The first phase of the Initiative has thus far surveyed only one maritime resource category out of eight identified—preserved historic vessels over 40 feet long and over 50 years old.

The National Register of Historic Places serves as an important planning and protective tool for historic cultural resources. *National Register Bulletin* #20, "Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places," which is designed to increase National Register listings of these resources, will assist in efforts to protect them as well.

Several States have inventoried their underwater and maritime cultural resources. Maryland, for example, has begun a survey of its maritime resources. Its Patuxent River Project, which was begun in 1978, includes a systematic survey of the river, including shipwrecks, wharfs, ferry landings, and inundated shore areas. In addition, the State's Chesapeake Bay Waterways Survey, completed in 1982, resulted in the listing of the Skipjack Fleet in the National Register of Historic Places, as a district.[6]

Future inventories of underwater archaeological and maritime resources should be placed on standardized computer databases. The Shipwreck Reference File of the Texas State Antiquities Commission, which is now being computerized, could serve as a possible model. The file is based on information culled from both historic and contemporary sources such as maps and field reports. Since 1972, the Commission has listed over 1,000 shipwrecks of which approximately one-half have proved historic.

Increased identification, interpretation, and protection of significant underwater and maritime cultural resources will depend on greater public

[6]Skipjacks are Chesapeake Bay-built shallow draft sloops, designed to dredge oysters. The Skipjack fleet is the last remaining working sailing fleet in the United States.

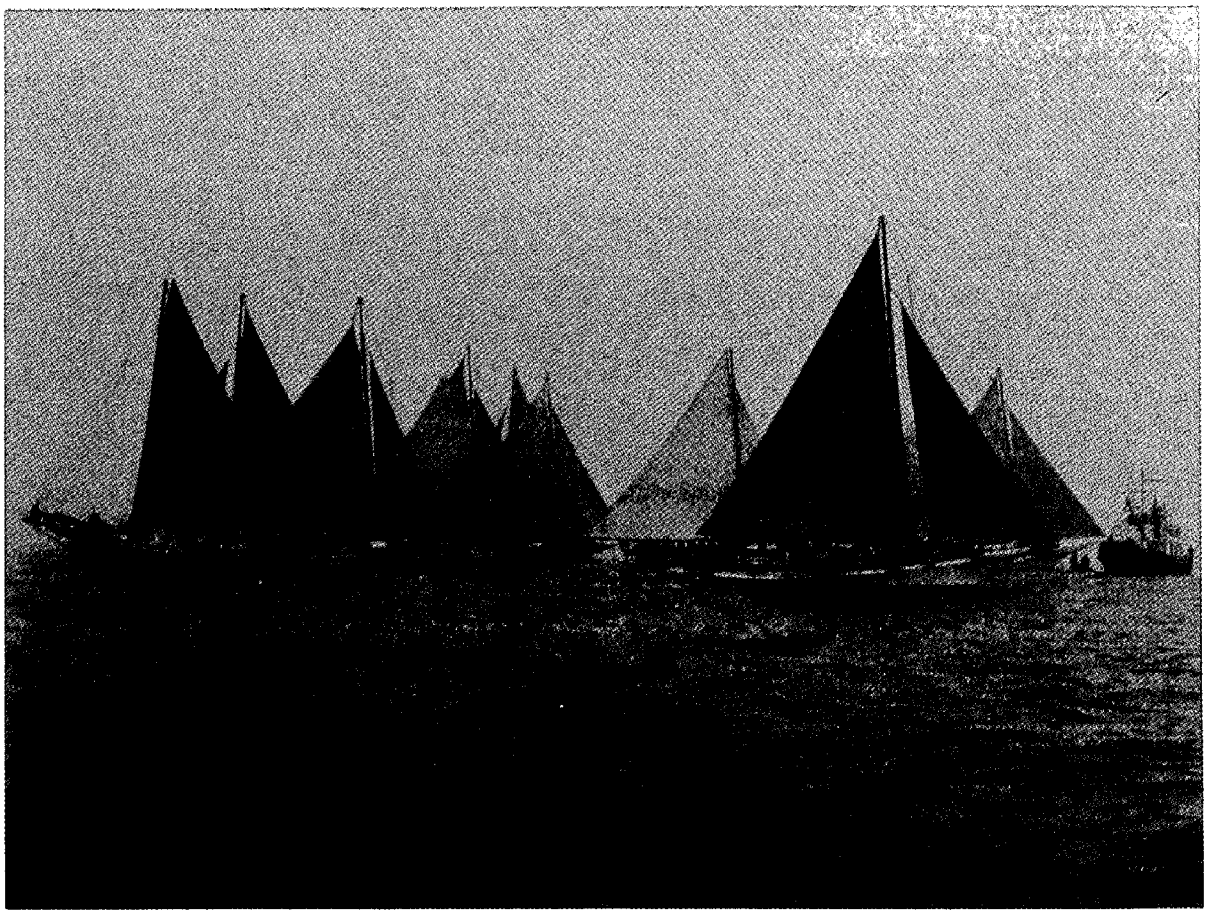


Photo credit: Ray A. Williamson

Skipjack fleet off Sandy Point Light, Chesapeake Bay, MD

appreciation of their historical value and the scarcity of their numbers. Federal, State, and local education programs should be expanded to reach a wider audience.

The public is often unaware of the crucial differences between treasure hunting, which focuses on historic objects of high intrinsic cultural or economic value, and archaeology, which focuses on the scientific understanding of the entire archaeological site within the context of its surroundings. In their attempts to recover artifacts quickly, treasure hunters both deliberately and inadvertantly destroy much of the contextual information essential for advancing scientific knowledge of prehistoric and historic sites. Improved education of the general public, and those whose activities might adversely affect significant sites, could result in a higher degree of protection. Specifically, it will be important to educate sport divers, fisherman, salvors, the oil and gas industry, and other users of underwater resources, as well as Federal and State agencies and local communities about the historic value of such sites.

In order to improve the preservation of underwater archaeological and maritime cultural resources, the National Park Service and other Federal agencies could focus more consistent attention on them.

The National Park Service could take the lead in developing and articulating a clear national policy to guide the preservation of maritime and underwater cultural resources and coordinate Federal programs for preserving these elements

of the country's history. It could also include more in its publications series on the technologies for underwater archaeology and maritime preservation.

The National Maritime Initiative involves Federal and private groups,[7] and is helping to focus attention on the Nation's historic maritime resources. Congress might consider an additional initiative to inventory and protect other submerged non-maritime sites. The greatest need is for sustained and predictable funding for such initiatives. In addition, it will be particularly important for the Federal agencies to achieve more effective coordination in their efforts to develop technologies for underwater archaeology and maritime preservation. An information clearinghouse would be of substantial assistance in this area. Congressional oversight may be necessary to assure that information sharing and coordination are truly effective.

Since 1976, tax incentives have promoted the protection of historic income-producing structures in virtually every congressional district. It may be appropriate for Congress to extend such tax incentives and make them available for privately owned, income-producing floating and dry-berthed historic vessels. Congress might also consider providing incentives for encouraging salvors to follow established archaeological procedures for excavating shipwrecks.

As manager of the National Marine Sanctuaries, the National Oceanic Atmospheric Administration (NOAA) has taken the lead in the efforts to map and preserve the *U.S.S. Monitor*, the historic Union ironclad, which lies off Cape Hatteras. However, it has little in-house underwater archaeological expertise. If NOAA expects to expand its involvement in underwater archaeology, as it acquires new ocean areas for sanctuary designation, it could develop its own in-house cultural resource expertise.

The Federal Government could assist State and local efforts by providing additional funding for projects in underwater archaeology and maritime preservation. If properly funded, universities and other private groups could provide considerable technological assistance to Federal, State, and local projects.

[7]For example, the National Trust for Historic Preservation, which has attempted to promote the concept of a national maritime policy since 1976.

MAJOR ISSUES

Federal admiralty law and contradictory decisions from Federal courts concerning the disposition of historic shipwrecks and their contents have created uncertainty within State governments over the extent to which they can regulate salvage within their waters for public benefit. This confusion has denied historic shipwrecks and their contents the long-standing legal protection enjoyed by all other culturally significant resources and has left them vulnerable to the often destructive actions of those interested in the recovery of commercially profitable objects, rather than the scientific study of archaeological sites.

Aggravating the risk to historic shipwrecks and their contents is the increasing availability of new and powerful technologies that will hasten their location and possible damage and loss. For example, state-of-the-art remote sensing instruments are now powerful enough to locate most of the shipwrecks in U.S. waters. Deep diving remotely operated vehicles (ROVs) and robots can visit sites previously unreachable.

Of all cultural resources, submerged archaeological and many maritime historical resources are among the most heavily dependent for their preservation on complex and often costly technologies (table 1). Some technologies enable underwater archaeologists to confront often hazardous working conditions as well as a host of practical problems that affect breathing, visibility, movement, communication, and length of research time at sites. These include tides, currents, cold, depth, turbidity, hostile marine animals, plants, and severe concretion or deep burial of objects by sediments. Other technologies enable the constant, highly specialized maintenance essential to all items recovered underwater, and to many maritime resources, such as floating and dry-berthed vessels.

Currently, there exists only a small core of professionals experienced in the wide array of methods used to survey, record, excavate, recover, analyze, inventory, conserve, and interpret cultural materials. Participants in the OTA study identified a range of concerns related to the use of existing or potential technical applications in the underwater archeological and maritime preservation processes. The following issues apply generally to most or all technologies for underwater archaeological and maritime historical sites. They are not necessarily in priority order:

Table 1.—Some Research Technologies Discussed in This Background Paper

- *side-scan sonar:* locates shipwrecks and sites on the bottom surface by detecting the echoes of high-frequency acoustic pulses transmitted from an instrument towed behind ship;
- *sub-bottom profiler:* locates shipwrecks and sites below the bottom by detecting the return signals of lower frequency acoustic pulses from instrument towed behind ship;
- *magnetometer:* registers changes in the local magnetic field as detector passes over iron-bearing cultural material. It can be used from a ship or an airplane;
- *remotely operated vehicles (ROVs):* a variety of submersible vehicles that can carry photographic or video cameras to image submerged objects. ROVs can also retrieve samples from the bottom.
- *photography:* black and white, color, and infrared at a wide variety of scales; and
- *video:* color and black and white.

SOURCE: Office of Technology Assessment, 1987.

Issue A: The lack of a coherent national policy for underwater archaeology and maritime preservation has impeded the location and protection of important cultural resources.

This lack is felt at both the Federal and State levels, and is ultimately reflected in local communities. Compared with efforts by Federal and State agencies to preserve other elements of the Nation's cultural heritage, the preservation of both maritime and submerged archaeological resources has been extremely limited. No single Federal department or agency has been specifically charged with funding, coordinating, and directing a strong, visible national program for underwater archaeological and maritime preservation. In addition, the Federal Government has never even asserted sovereign prerogative over historic shipwrecks in its waters. In spite of the body of cultural conservation laws enacted since the Antiquities Act of 1906 (table 2), particularly the watershed *National Historic Preservation Act*, and its Section 106 (box A),[8] submerged cultural

[8]As well as the many supporting regulations, standards, and guidelines, and management and protection mechanisms, including the National Register of Historic Places.

Table 2.—Prehistoric and Historic Preservation Laws and Executive Orders

Laws:

- The Antiquities Act of 1906, Public Law 59-209 (6 U.S.C. 431-433)
- The National Park Service Organic Act (An Act of Aug. 25, 1916), (39 Stat. 535, 16 U.S.C. 1)
- The Historic Sites Act of 1935, Public Law 74-292 (16 U.S.C. 461-467)
- The National Historic Preservation Trust Act of 1949, Public Law 81-408 (63 Stat. 927, 16 U.S.C. 468 et seq.)
- The Submerged Lands Act of 1953, Public Law 83-31 (67 Stat 29, 43 U.S.C. 1301 et seq.)
- Outer Continental Shelf Lands Act, Public Law 83-212 (67 Stat. 462, 43 U.S.C. 1331 et seq.)
- The Management of Museum Properties Act of 1955, Public Law 84-69 (16 U.S.C. 18f)
- The Reservoir Salvage Act of 1960, Public Law 86-523 (16 U.S.C. 469-469c)
- The Department of Transportation Act of 1966, Public Law 89-670 (80 Stat. 931)
- The National Historic Preservation Act of 1966, Public Law 89-665 (16 U.S.C. 470)
- The National Environmental Policy Act of 1969, Public Law 90-190 (16 U.S.C. 470)
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment," May 13, 1971. (36 F.R. 8921)
- Alaska Native Claims Settlement Act, Public Law 92-203 (85 Stat. 688, 43 U.S.C. 1601-1624)
- The Archaeological and Historical Preservation Act of 1974, Public Law 93-291 (88 Stat. 174, 16 U.S.C. 469 et seq.)
- American Folklife Preservation Act of 1976, Public Law 94-201 (20 U.S.C. 2101-2107)
- The American Indian Religious Freedom Act of 1978, Public Law 95-341 (92 Stat. 46a, 42 U.S.C. 1996)
- Central Idaho Wilderness Act of 1980, Public Law 96-312 (94 Stat. 948, 16 U.S.C. 1274)
- National Historic Preservation Act Amendments of 1980, Public Law 96-515 (94 Stat. 2987, 16 U.S.C. 470 et seq.)
- The Archaeological Resources Protection Act of 1979, Public Law 96-95 (16 U.S.C. 470aa et seq.)
- Convention on Cultural Property Implementation Act, Public Law 97-446 (96 Stat. 2350-2363, 19 U.S.C. 2601-2613)

Legislation under consideration in the 99th Congress:

- R.M.S. TITANIC Memorial Act of 1985 (H.R. 3272)
- The Abandoned Shipwreck Act of 1985 (H.R. 3558 and S. 2569)
- The Olmsted Heritage Landscapes Act of 1985 (H.R. 37)

Regulations:[a]

- 43 CFR 3 (Antiquities Act)
- 43 CFR 7 (Archeological Resources Protection Act of 1979)
- 36 CFR 60 (National Historic Preservation Act of 1966 (NHPA) and EO 11593)
- 36 CFR 61 (NHPA and EO 11593)
- 36 CFR 63 (NHPA and EO 11593)
- 36 CFR 65 (Historic Sites Act of 1935)
- 36 CFR 66 (Archaeolgical and Historic Preservation Act of 1974)
- 36 CFR 68 (NHPA)
- 36 CFR 800 (NHPA and EO 11593)
- 40 CFR 1500 (NEPA) "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act."

Standards and Guidelines for Historic Preservation:

"The Secretary of the Interior's **Standards for Rehabilitation** and Guidelines for Rehabilitating Historic Buildings," National Park Service (revised 1983), booklet.

"The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation," *Federal Register* 48, No. 190, Thursday, Sept. 29, 1983.

"Final Uniform Regulations, Archaeological Resources Protection Act of 1979," *Federal Register* 49, No. 4, Friday, Jan. 6, 1984.

"Draft Guidelines for Historic and Archeological Resource Management: Federal Agency Responsibilities Under Section 110 of the National Historic Preservation Act," National Park Service, Feb. 5, 1986.

Advisory Council on Historic Preservation, Executive Director's "Procedures for Review of Proposals for Treatment of Archaeological Properties: Supplementary Guidance," 45 *Federal Register* 78808.

Advisory Council on Historic Preservation "Protection of Historic Properties," 36 CFR Part 800, *Federal Register* 51, No. 169, Sept. 2, 1986.

[a]Regulations are promulgated, adopted, and then compiled in the Code of Federal Regulations (CFR), in order to implement provisions of general laws. The name of the act it implements follows each citation.

SOURCE: U.S. Department of the Interior and OTA.

resources and many historic maritime resources have, at best, received uneven attention by Federal agencies.

Two recent developments, however, promise to encourage more aggressive protective Federal action:

1. publication of the first criteria for evaluating and nominating historic ships and shipwrecks to the National Register of Historic Places,[9] [10] and
2. the National Maritime Initiative (see the section, **Federal Policy Toward Underwater Archaeology and Maritime Preservation**), monies for which were allocated by Congress

[9]"The National Register has been underutilized for maritime resources, particularly historic vessels. By 1976, the tenth year of the National Register Program, only 44 vessels were listed." James P. Delgado, "The National Register of Historic Places and Maritime Preservation," *The APT Bulletin* 9, No. 1, 1987, p. 35.

[10]James P. Delgado and a National Park Service Maritime Task Force, *National Register Bulletin #20*, "Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places" (Washington, DC: U.S. Department of the Interior, National Park Service, Interagency Resources Division, 1987) This publication aids preservation professionals and other interested citizens in identifying, evaluating, and nominating historic vessels and shipwrecks to the National Register of Historic Places.

Box A.—Title I, Section 106, Historic Preservation Act

The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking.

in fiscal year 1986 to the Department of the Interior for Phase One.

Federal Programs

Every Federal agency is required by law to preserve prehistoric and historic properties on lands (including submerged lands) within its jurisdiction and to consider their treatment in general program planning. Each agency plays a different part in the process of cultural resource management and the development of relevant technologies (table 3). The National Park Service (NPS), for example (box B), is specifically charged with protecting cultural resources within the National Park System and with providing general technical preservation assistance. The U.S. Army Corps of Engineers, by contrast, has jurisdiction over the Nation's coasts and navigable waterways, regulating both public and private projects such as dam building or dredging, and is obliged to balance preservation needs against other program requirements.

In the absence of a coherent national policy for safeguarding submerged archaeological sites and maritime resources, the agencies, which possess varying degrees of expertise, and generally inadequate funding, have continued to locate, analyze, and manage them. Although carried out in a fragmented fashion, some of the government's activity has produced work of excellent quality and has involved diverse groups from the public and private sectors. Federally supported efforts include the following:

Table 3.—Federal Agencies With Major Roles in Underwater Archaeology and Maritime Preservation

Advisory Council on Historic Preservation
Bureau of Reclamation (Department of Interior)
Environmental Protection Agency
Fish and Wildlife Service (Department of Interior)
General Services Administration
Minerals Management Service (Department of Interior)
National Endowment for the Humanities
National Oceanic and Atmospheric Administration (Department of Commerce)
National Park Service (Department of Interior)
National Science Foundation
Smithsonian Institution
U.S. Army Corps of Engineers (Department of Defense)
U.S. Coast Guard (Department of Defense)
U.S. Forest Service (Department of Agriculture)
U.S. Navy (Department of Defense)
U.S. Soil Conservation Service (Department of Agriculture)

SOURCE: Office of Technology Assessment, 1987.

The National Park Service

NPS has long assumed the primary role in providing technical assistance on all aspects of historic preservation throughout the national park system, to other Federal agencies, to State agencies, local preservation organizations, and the general public. Through its Submerged Cultural Resources Unit (SCRU)[11] in Santa Fe, New Mexico, the Service is actively involved in underwater archaeological field work in many areas under NPS jurisdiction. SCRU began in 1976 as a special team charged with designing site management strategies based on the impacts of waters on archaeological materials in selected reservoirs throughout the country.[12] SCRU has now become a fixture within NPS and the national leader in underwater park interpretation, park manage-

[11]SCRU is a component of the Southwest Cultural Resources Center, Southwest Regional Office.

[12]D.J. Lenihan, T.L. Carrell, S. Fosberg, et al., *The Final Report of the National Reservoir Inundation Study*, U.S. Department of the Interior, National Park Service, Southwest Cultural Resources Center, 1981. This report is the product of a 5-year cooperative effort involving NPS as lead agency, the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and the U.S. Soil Conservation Service.

Box B.—The National Park Service

The National Park Service is an agency of the U.S. Department of the Interior and the only Federal land-managing agency with a major responsibility for preservation of prehistoric and historic cultural resources. The National Park System comprises over 333 areas and takes in nearly 79 million acres in 49 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, Saipan, and the Virgin Islands. These areas are deemed so important to the Nation that they enjoy special protection in accordance with various Acts of Congress.

By an Act of March 1, 1872, Congress established Yellowstone National Park in the Montana and Wyoming territories and began a worldwide national park movement. By an Act of August 25, 1916, Congress created the National Park Service to administer the many units within the National Park System. In addition to managing the national parks, NPS fulfills many responsibilities in connection with protecting cultural resources for the entire Federal Government. Until 1975 NPS archaeologists performed work for all Federal agencies. Today, NPS maintains the National Register of Historic Places, the Historic American Buildings Survey (HABS), the Historic American Engineering Record (HAER), and technical assistance on the preservation of prehistoric and historic sites. NPS has identified submerged cultural resources within 23 of 45 submerged areas within the National Park System. These resources are subject to the same protective laws as are those within terrestrial sites.

SOURCE: National Park Service.

ment, and diver training. It provides the only professional team within the Federal Government devoted to underwater archaeological activities.

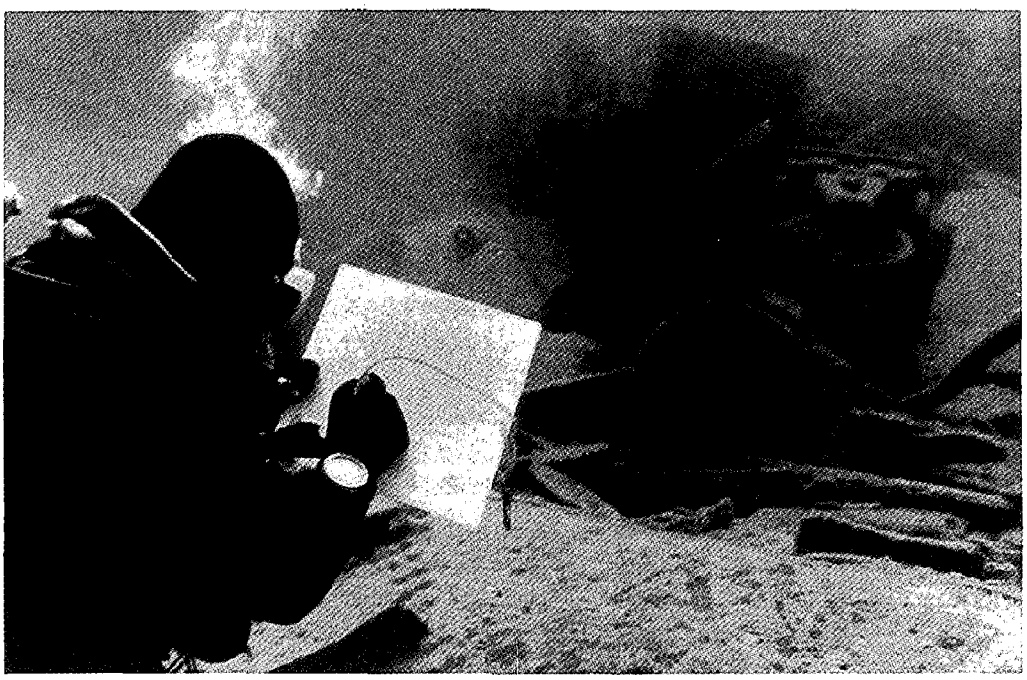
SCRU has studied shipwreck and other underwater archaeological sites within 23 of the 45 submerged resource areas (table 4) managed by NPS throughout the United States and its territories. SCRU has located shipwrecks, and recorded, measured, and documented them in such dissimilar underwater environments as: Lake Superior, Michigan, where the Isle Royale National Park contains numerous wrecks; Pearl Harbor, Hawaii, where the remains of the *U.S.S. Arizona* and *U.S.S. Utah* lie as a result of the 1941 Japanese aircraft attack that drew the United States into World War II; Alaska; and off Kosrae in the U.S. Trust Territory of the Pacific. SCRU has also successfully secured the participation of volunteer sport divers and local historians at Isle Royale; Channel Islands National Marine Sanctuary off the coast of California; Apostle Islands in Lake Superior, Wisconsin; and Point Reyes-Farallon Islands National Marine Sanctuary, California. The Unit has also worked with local news media, the National Geographic Society, and the British Broadcasting Corp. to interpret shipwreck archaeology and "the conservation-oriented, nondestructive technique that is their distinctive trademark."[13] SCRU is often consulted by other Federal agencies, State offices, and private archaeologists for guidance and is currently advis-

Table 4.—Submerged Resource Areas Surveyed by the National Park Service

Wrangell-St. Elias National Park, Alaska
Glen Canyon National Receration Area, Arizona
Montezuma Well, Arizona
Buffalo National River, Arkansas
Arkansas Post National Memorial, Arkansas
Channel Islands National Park, California
Golden Gate National Recreation Area, California
Point Reyes National Seashore, California
Biscayne National Monument, Florida
Everglades National Park (Ft. Jefferson National Monument), Florida
Gulf Islands National Seashore, Florida
Pu'uhonua o honaunau National Historical Park, Hawaii
U.S.S. Arizona Memorial, Hawaii
Indiana Dunes National Lakeshore, Indiana
Assateague Island National Seashore, Maryland
Cape Cod National Seashore, Massachusetts
Isle Royale National Park, Michigan
Ozark National Scenic Riverway, Mississippi
Lake Mead National Recreation Area, Nevada
Chickasaw National Recreation Area, Oklahoma
Amistad National Recreation Area, Texas
Lake Meredith National Recreation Area, Texas
Padre Island National Seashore, Texas
Apostle Islands National Lakeshore, Wisconsin
Grand Teton National Park, Wyoming
Virgin Islands National Park, Virgin Islands
Buck Island Reef National Monument, Virgin Islands
War In The Pacific National Historical Park, Guam

SOURCE: National Park Service, Submerged Cultural Resources Unit.

[13]James P. Delgado, National Park Service, personal communication, February 1987. See also Peter G. Howorth, "California Shipwrecks: Finders, Weepers," *Waterfront*, February 1986.



Diver drawing engine of Glenlyon, sunk at Isle Royale, MI, in 1924.

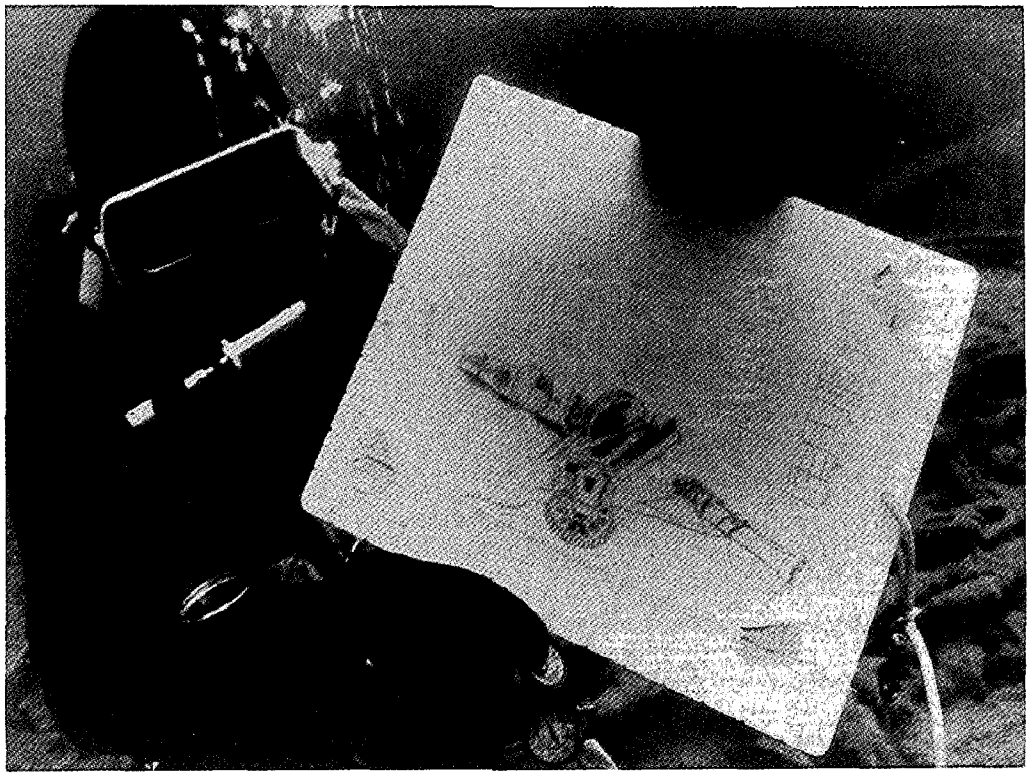


Photo credit: National Park Service, Submerged Cultural Resources Unit

Illustration of engine done underwater by Submerged Cultural Resources Unit illustrator.

ing the National Oceanic and Atmospheric Administration on its *U.S.S. Monitor* preservation project.

The NPS has recently created a position of Maritime Historian and institutionalized its efforts for the National Maritime Initiative in its Maritime Initiative Office. NPS also maintains a National Maritime Museum in the Golden Gate National Recreational Area in San Francisco.

Together with the University of New Mexico, NPS supports a Spanish Colonial Research Center, which is devoted to studying the historical records and material culture of the Spanish Colonial period. One objective of the center is to develop a computerized database from Spanish Colonial and other archival sources. Among other things, the Center is active in studying and interpreting the maritime records of Spain.

NOAA's U.S. National Marine Sanctuary Program

This program, within the Office of Ocean and Coastal Resource Management, oversees the management of seven sites (table 5) within U.S. waters. These are fragile ecosystems designated nationally significant pursuant to Title III of the Marine Protection, Research, and Sanctuaries Act of 1972, 16 U.S.C. 1431 *et seq.* (amended in 1984).[14]

NOAA's cultural conservation efforts so far affect only one site among the seven—the *U.S.S. Monitor* National Marine Sanctuary (box C). Designated for its historic significance in 1975, the sanctuary encloses a circular area 1 nautical mile in diameter surrounding the wreck of the historic Civil War ironclad. The vessel, resting upside down in the "Graveyard of the Atlantic" off Cape Hatteras, North Carolina, represented a revolutionary technical advance over the typical broadside warships of that era and changed the character of naval warfare. Sunk during a storm in 1862, she had, during the same year, battled the Confederate ironclad *C.S.S. Virginia* (formerly the Merrimac) in the famous duel of the ironclads off Hampton Roads, Virginia.

Table 5.—National Marine Sanctuaries

- *U.S.S Monitor* National Marine Sanctuary, designated 1975—a one-square-nautical-mile area surrounding the wreck of the historic Civil War ironclad of the Union, sunk off Cape Hatteras in 1862
- Key Largo National Marine Sanctuary, designated 1975—a 100-square-nautical- mile area off the Florida keys which includes part of the largest of North America's coral reef systems
- Channel Islands National Marine Sanctuary, designated 1980—a 1,252-square-nautical-mile area off the coast of Southern California, which contains shipwrecks and supports one of the world's largest and most diverse marine mammal populations as well as one of the most extensive of the State's few remaining kelp beds
- Looe Key National Marine Sanctuary, designated 1981—a 5.3-square-nautical-mile reef area located off the lower Florida Keys
- Gray's Reef National Marine Sanctuary, designated 1981—a 17-square-nautical-mile area 17.5 nautical miles off Florida where the warm Gulf stream meets the cooler waters of the coast over a limestone outcropping which supports sponges, corals, tropical reef fish, and invertebrates
- Point Reyes-Farallon islands national Marine Sanctuary, designated 1981—a 948 square-nautical-mile site nothwest of San Francisco, California, representative of near and offshore northeastersn Pacific habitats and notable for its unique concentration of seabirds
- Fagatele Bay national Marine Sanctuary, designated 1986—a 163-acre bay off Tutuila Island, American Samoa, comprising deep-water coral terraces characteristic of high volcanic islands in the tropical Pacific

SOURCE: National Oceanic and Atmospheric Administration.

The *U.S.S. Monitor's* designation directs NOAA to extend protection to a cultural resource located beyond the limits of the country's territorial sea to the Outer Contintental Shelf and to examine interactions between natural and cultural elements.[15] The agency is managing the site through its *U.S.S. Monitor* Project. The project is a multiyear effort by NOAA to develop and begin implementing a master plan, the first phase of which calls for an assessment of preservation options ranging from research, survey, recording, documentation, and removal of contents from the site, to total recovery. These options reflect the full spectrum of cultural resource management issues[16] and include not only in situ archaeolog-

[14]This legislation and its attendant regulations: 1) enhance resource protection through comprehensive and coordinated management; 2) support scientific research on discrete marine resources for improved long-term planning; and 3) promote public awareness, appreciation, and judicious uses of these resources through educational and recreational initiatives.

[15]Nancy Foster, "National Marine Sanctuaries—Saving Offshore Ecosystems," *Sea Technology*, November 1986, pp. 22-28.

[16]See Draft "U.S.S. Monitor National National Marine Sanctuary Research Management Plan," National Oceanic and Atmospheric Administration, 1987.

Box C.—The U.S.S. Monitor Project

Teams from NOAA, the U.S. Navy, as well as archaeologists from NPS and scholars from the Smithsonian Institution recently took part in an expedition to the *U.S.S. Monitor* to determine, over a 10-day period, the rates at which elements of the ship are corroding and breaking apart. The Navy contributed their ocean-going tug *Apache*, which lowered the Navy 1-ton ROV *Deep Drone* to the site. The *Deep Drone* provided images of the *Monitor* to video screens aboard the *Apache*, and probed the armor plating of the vessel with a device that measures the weak currents of electricity passing between the metal and water immediately surrounding it. These currents indicate the rate at which metal is rusting. The *Deep Drone* is outfitted with several attachments, among them instruments designed for various kinds of measurements as well as manipulation and recovery of objects. Scientists can, by learning which parts of the *Monitor* are deteriorated to the point of collapse, establish certain preservation priorities. Assisted by *Deep Drone*, a bank of computers installed on the *Apache*, and acoustical devices situated on the oceanfloor near the wreck, researchers also produced a detailed map of the site, including debris that spilled out around the area during sinking. Two visits to the *Monitor* involved free-swimming divers in 1979 and the recovery of a 1,270 pound anchor in 1983.

SOURCE: National Oceanic and Atmospheric Administration.

ical study, but also conservation, interpretation, and display requirements in the event of excavation.[17] The project is making the *U.S.S. Monitor* the centerpiece of a permanent public interpretation and education drive and has selected a principal museum to curate and display artifacts and information about the *Monitor*.

NOAA has examined foreign efforts in underwater archaeology and maritime preservation for

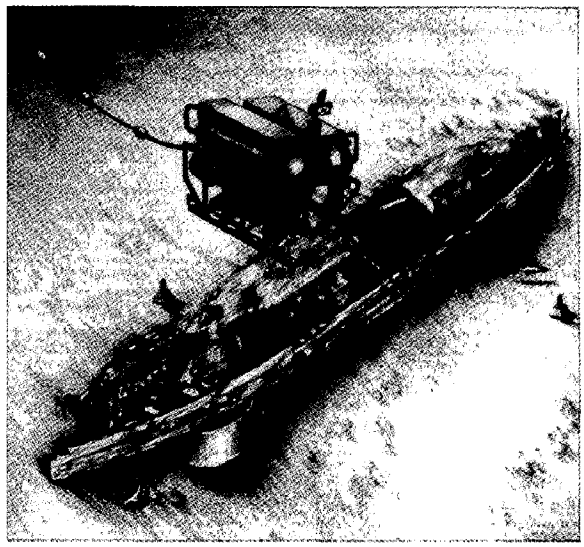


Photo credit: Eastport International, Inc.

Artist's rendering of the remotely operated vehicle, *Deep Drone*, above the wreck of the Civil War Union ship, *U.S.S. Monitor*, lying 230 feet deep off the coast of Cape Hatteras, NC.

guidance on its *U.S.S. Monitor* Project. NOAA seeks to avoid mistakes made during the salvage of the *U.S.S. Cairo*, a Civil War Union ironclad, which sank to the bottom of the Yazoo River in Mississippi after striking a Confederate mine in 1862. The vessel and all contents lay essentially intact beneath the river's mud and silts. What started in 1955 as a well-meant grass-roots venture among local enthusiasts, historians, Civil War buffs, and businessmen to raise and display the craft caused its near-destruction and the loss of a significant portion of its wood and metal components as well as its cargo. The operation, flawed by inexpert underwater survey, lack of sufficient research, and inadequate analysis of technical needs, resulted in the breaking apart of the ship during lifting and virtual abandonment of salvaged parts in open air storage. Only with the intercession in 1977 of the National Park Service was proper rescue, conservation, and display achieved.[18]

NOAA, unlike land-managing agencies, has not established its own team of archaeologists or cultural resource specialists but has relied during the

[17]In the event raising appears infeasible, NOAA is considering two alternatives for display purposes: 1) a reconstruction of the ship within which materials and conserved artifacts would be incorporated; and 2) replicas, one of which would be presented in an aquarium-like setting, the other as a full-scale replica. These alternatives were developed by the Harper's Ferry Center of the National Park Service and described in its report to NOAA, "An Assessment of the Interpretive Potential of the *U.S.S. Monitor*."

[18]H. Thomas McGrath, Jr., "The Preservation of the *U.S.S. Cairo*," *Underwater Archaeology: The Proceedings of the Eleventh Conference on Underwater Archaeology*, Calvin R. Cummings (ed.), Special Publication #4 San Marino, CA: Fathom Eight, 1982.

past decade on other Federal and State agencies, universities, private corporations, organizations, and individuals for interdisciplinary technical expertise. For example, through interagency agreement, NPS staffs and manages the Channel Islands and Point Reyes-Farallon Islands National Marine Sanctuaries. NPS's Senior Archaeologist, a SCRU archaeologist, the Acting Maritime Historian, and staff from the NPS Harper's Ferry Center are assisting NOAA in developing general management policies for submerged cultural resources (including the *U.S.S. Monitor*) and managing any archaeological materials extracted from the *Monitor*. Likewise, the U.S. Navy Supervisor of Salvage and Diving is providing NOAA with planning and operational assistance as well as some of the latest undersea technologies. Also, the former Director of Restoration for the Statue of Liberty/Ellis Island Foundation has established the National Foundation for Maritime Conservation to aid the *U.S.S. Monitor* Project.

The U.S. Army Corps of Engineers

The Army Corps of Engineers, which was organized by George Washington in 1776, has become a major command. In addition to providing support to the fighting Army, it is responsible for the planning, design, construction, and maintenance of such facilities as military hospitals, barracks, commissaries, and family housing. Through its Civil Works Program, the Corps is also responsible for regulating construction, expansion, and alteration along the nation's coastlines and navigable inland waterways. It employs a number of archaeologists who review the many projects carried out or regulated by the Corps to assure compliance with historic preservation laws and regulations.

The Corps mounts some of the Federal Government's most expensive and technically complex projects to aid flood control and navigation. Many of these projects are potentially destructive to shipwrecks and other submerged archaeological sites. They include harbor facility development, reservoir, dam, bridge, levee, dike, seawall, tunnel, island, canal, lock, and hydroelectric plant construction, filling, ocean dumping, channel improvement, and shoreline stabilization.

In support of these activities, the Corps removes nearly 300 million cubic yards of material per year from beneath the sands and sediments of submerged lands, which makes dredging one of the Corps' greatest threats to archaeological remains. One of the most frequently dredged areas is the lower Mississippi River between Baton Rouge, Louisiana and the Gulf of Mexico. Every year, the Corps dredges over 18 million cubic yards of material from this waterway because of virtually constant deposition of sediments.[19] The Corps also confronts the problem of disposal of dredging products, studying their environmental effects, and seeking ways to put them to beneficial use.

Many activities regulated by the Corps require authorization through three kinds of permits—individual, nationwide, and general.[20] The Corps has left the issuance of permits for activities affecting historic shipwrecks to the discretion of individual District Engineers (thirty-six within eleven Divisions).

Two cases demonstrate that this policy has led to inconsistent levels of review and differences from District to District as to the suitability of permits to projects. In the instance of the *Whydah*, a pirate ship whose remains are being excavated off the coast of Cape Cod in Massachusetts, the New England District Engineer issued an individual permit to private salvors and entered into a Memorandum of Agreement with the Massachusetts State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) in fulfillment of requirements under Section 106 of the National Historic Preservation

[19] *Navigation: The Role of the Corps*, U.S. Army Corps of Engineers, October, 1983. See also *U.S. Army Corps of Engineers Permit Program: A Guide for Applicants*, November, 1977, *Fifteen Steps to a Civil Works Project*, January, 1986, *Channel Improvement and Stabilization on the Mississippi River*, U.S. Army Corps of Engineers, October 1979, and *U.S. Army Corps of Engineers and the Environment*, Department of the Army, Office of the Chief of Engineers, Washington, D.C.

[20] The U.S. Army Corps of Engineers issues permits under the authority of Sec. 10 of the River and Harbors Act of 1899, Sec. 404 of the Clean Water Act (Public Law 92-500), and Section 103 of the Marine Protection, Research, and Sanctuaries Act (Public Law 92-532). These laws, as stated in "Application for a Department of the Army Permit," require permits authorizing structures and work in or affecting navigable waters of the United States, the discharge of dredged fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters."

Act.[21] The Memorandum of Agreement, negotiated as a stipulation of the individual permit, is designed to ensure that excavation proceeds according to accepted archaeological standards.

By contrast, the Philadelphia District Engineer authorized recovery at the site of the 18th century Dutch-built vessel *DeBraak*, located off the coast of Lewes, Delaware under a nationwide permit for marine salvage. The Corps did not enter into a Memorandum of Agreement in observance of Section 106, nor did it seek comment by the ACHP. It deferred oversight of the salvage to the State which apparently had inadequate means to assure that properly controlled excavation at the site prevailed. As the hull was raised, it suffered severe damage and a loss of contents and interior features as a result of being inadequately supported.[22] According to an analysis by the National Trust for Historic Preservation (NTHP), the Corps' Nationwide Permitting Program fails to allow for Army compliance with Section 106 and is ineffectual for the purposes of historic preservation. It now offers the District Engineer the option of either requesting ACHP comment or modifying, suspending, or revoking the permit altogether. Some effort to correct deficiencies in Corps permitting of actions affecting historic shipwrecks has begun and involves discussions between NTHP and ACHP with the Corps at the headquarters level. Locally, the New Orleans District is considering a Programmatic Agreement for submerged resources as part of a larger proposed "Nautical Cultural Resource Management Plan."[23]

[21] "The head of any Federal agency having direct of indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking."

[22] John M. Fowler, Advisory Council on Historic Preservation, personal communication, July, 1987.

[23] Advisory Council on Historic Preservation, Memorandum of June 12, 1987.

Minerals Management Service (MMS)

MMS is an agency of the U.S. Department of the Interior formed in 1982 and given responsibility for regulating oil, gas, and mineral exploitation on the Outer Continental Shelf. Prior to 1982 such regulatory authority was vested in the U.S. Geological Survey and the Bureau of Land Management. These two agencies had, since 1974, administered a program for cultural resources on the Outer Continental Shelf (OCS) (43 U.S.C. 1331, ff).

The Outer Continental Shelf Lands Act Amendments of 1978 prohibit "the disturbance of any site, structure, or object of historical or archaeological significance by oil and gas exploration."[24] However, this Section applies only to areas containing mineral-related activities, not to the entire OCS. The Federal Government is obliged to locate and evaluate the significance of cultural resources before issuing permits for any actions including oil or gas leasing and development on the OCS. According to a November 24, 1980 ruling of the Interior Department Solicitor, however, the Federal Government can legally transfer these responsibilities to oil and gas lessees should the discovery of sites within a given tract appear likely.[25]

The OCS program requires lessees to undertake archaeological surveys (generally 9 square miles in area) of all blocks leased, to apply remote sensing technology (sub-bottom profilers, side-scan sonar, and proton magnetometers), and to avoid any areas that resulting data indicate may contain wrecks or other sites. During the first 5 years of the OCS cultural resources program, before it established positions for professional archaeologists,[26] many surveys were inadequate and hastily executed, but routinely accepted. In the late 1970s and early 1980s lessees objected to these requirements as excessive and burdensome, asserting that none of their surveys had revealed a site of great archaeological significance. The agency has attempted to address the companies' concerns by developing, testing, and

[24] Sec. 206 (g)(3).

[25] Melanie J. Stright, *Federal Cultural Resources Management on the OCS; Problems and Potential*, U.S. Department of the Interior, Bureau of Land Management, November 1981.

[26] Ibid., p.2.

refining a predictive model based on a pilot study of the northern Gulf of Mexico Continental Shelf, funded by NPS.[27] MMS established predictive models of all areas where significant leasing is underway or expected. These models cover both shipwrecks and other submerged prehistoric sites.

The number of prehistoric archaeological sites on the OCS is difficult to estimate as there is little information on human activity during the late Wisconsin glacial period,[28] when such sites would have been above water (about 12,000 to 6,000 years before present). Lately, archaeologists have turned their attentions to inundated prehistoric sites on the continental shelves, believing in their potential to reveal important information on prehistoric peoples unavailable from terrestrial sites—evidence concerning their migrations, their food gathering habits, and how they established cultural contacts in North America during periods of lowered sea levels.[29]

MMS has sought to reduce the number of surveys required within the more than 400 million-acre OCS while maintaining an acceptable level of cultural resource protection through Regional Baseline Studies (box D). The baseline studies, 10 in all, identify areas of the OCS that most likely contain significant archaeological materials. With the exception of the Alaska studies, which focus on prehistoric sites, all of them discuss both prehistoric and historic sites.

The agency has also begun an effort to characterize all unidentified magnetic anomalies generated by proton magnetometers and recorded on strip charts during lease block surveys made over more than a decade. Archaeologists have been attempting for some time to discern patterns that would allow them to recognize, from among the countless ferrous objects buried beneath the world's waterways, those which constitute shipwrecks or their contents. By isolating such sites, archaeologists could devise strategies to protect certain submerged cultural sites from destructive activities, particularly where avoidance and "ground truthing," or testing may not be possible.[30]

State Programs

The State Historic Preservation Offices, as recipients of Federal monies through the Historic Preservation Fund, act to some extent as agents or extensions of the Federal Government. Yet, as noted earlier, no uniform or comprehensive Federal legislative framework for protecting historically significant shipwrecks on submerged lands exists to guide the States as they deal with often intense competition over the uses of their submerged lands. Twenty-seven States have enacted laws asserting control over and/or ownership of cultural sites in their waters. These laws offer differing degrees of protection. A few stipulate stringent and detailed operational requirements through permits or contracts to control the actions of salvors, sport divers, and archaeologists.

According to a recent study,[31] the States spend approximately 1 percent of their total historic preservation budgets on survey, evaluation, and conservation of historic shipwrecks. In 1983 (the latest year for which figures have been compiled), 16 States spent around $3,379,253. Between 1967 and 1983, 21 States reported some attempts at survey, totaling 296,201 acres. They discovered 671 historic shipwrecks, using State or Federal criteria. Out of 2,883 shipwrecks, 437 have been located by States, 2,299 by sport divers, and 147 by salvors. Salvors in seven States have claimed 34 wrecks. A number of coastal States have begun to investigate historical records to determine if their waters contain more wrecks than

[27]See Sherwood M. Gagliano, Charles E. Pearson, Richard A. Weinstein, et al. (Coastal Environments, Inc.), *Sedimentary Studies of Prehistoric Archaeological Sites: Criteria for the Identification of Submerged Archaeological Sites of the Northern Gulf of Mexico Continental Shelf*, U.S. Department of the Interior, National Park Service, Washington, DC, 1980. See also Coastal Environments, Inc., Sherwood M. Gagliano, Project Director, *Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf*, U.S. Department of the Interior, National Park Service, Washington, DC, 1977.

[28]The geological period known as the Wisconsin glacial period extended from about 25,000 to 6,000 before the present.

[29]Melanie J. Stright, "Evaluation of Archaeological Site Potential on the Gulf of Mexico Continental Shelf Using High-Resolution Seismic Data," *Geophysics*, vol. 51, No. 3, March 1986, p. 605.

[30]Richard Anuskiewicz, Minerals Management Service, personal communication, June, 1987.

[31]Anne G. Giesecke, "The Best in State Historic Shipwreck Programs," *Proceedings of the Sixteenth Conference on Underwater Archaeology*, Special Publication Series #4, published by The Society for Historical Archaeology, Ronald L. Michael (ed.), 1985.

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Box D.—Regional Baseline Studies Completed for the Minerals Management Service

Bering Land Bridge Cultural Resource Study, Final Report, The University Museum, University of Alaska, 1976.

Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf, Coastal Environments, Inc., 1977.

An Archaeological Literature Survey and Sensitivity Zone Mapping of the Southern California Bight, Science Applications, Inc., 1977.

Western Gulf of Alaska Cultural Resource Study, Final Report, E.J. Dixon, Jr. (ed.), 1977.

Beaufort Sea Cultural Resource Study, Final Report, E.J. Dixon, Jr. (ed.), 1978.

Lower Cook Inlet Cultural Resource Study, Final Report, E.J. Dixon, Jr. (ed.), 1979.

Summary and Analysis of Cultural Resource Information on the Continental Shelf From Cape Hatteras to Key West, Science Applications, Inc., 1981.

Alaskan Outer Continental Shelf Cultural Resource Compendium, Final Report, E.J. Dixon, Jr., S. Stoker, and G. Sharma, 1986.

Regional baseline studies are based on the assumption that underwater archaeological sites do not occur randomly on the seafloor.[1] Submerged prehistoric sites, therefore, would be located relative to the paleogeography of the OCS. Shipwrecks would probably lie in close proximity to past and present ports, sea routes, weather patterns, and hazards to navigation.

However, the efficacy of predictive modelling is the subject of considerable debate within the archaeological community. Some experts have noted that shipwrecks do occur randomly on the seafloor. For example, acts of war cause shipwrecks wherever opposing forces encounter each other. Likewise, storms have sunk many vessels in the open sea, after blowing them miles from regularly traveled lanes. These experts further assert that predictive models cannot adequately serve as replacements for hard data derived from actual onsite survey. Regional baseline studies function as predictive models to identify areas of the Shelf which could be expected to yield significant archaeological resources. As such, they can be used as a controlled approach to locating potential sites. However, such models may miss some highly significant sites that fall outside of the categories covered in the models.[2]

Predictive modeling for the OCS is demonstrated through the following publications:

Cultural Resource Evaluation of the Northern Gulf of Mexico Continental Shelf, Coastal Environments, Inc., Academic Press, New York, 1983.

Sedimentary Studies of Prehistoric Archaeological Sites, Coastal Environments, prepared for the U.S. Department of the Interior, National Park Service, Division of State Plans and Grants, 1980.

Archaeological Investigations on the Outer Continental Shelf: A Study Within the Sabine River Valley, Coastal Environments, Inc., prepared for the U.S. Department of the Interior, Minerals Management Service, 1986.

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[1]See, for example, *Sedimentary Studies of Prehistoric Archaeological Sites*, Coastal Environments, Inc., 1980, which refines the predictive model developed by Coastal Environments, Inc. for the Minerals Management Service. The rationale for this model involves a series of geochemical and sedimentological analyses to which core samples from selected onshore prehistoric archaeological sites were subjected. These analyses revealed material traces characteristic of cultural deposits.

[2]1U.S. Congress, Office of Technology Assessment, *Technologies for Prehistoric and Historic Preservation*, OTA-E-319 (Washington, DC: U.S. Government Printing Office, September 1986), pp. 54-56.

SOURCE: Minerals Management Service.

are currently known. Virginia, Texas, and California have each recorded information on more than 2,000 shipwrecks off their respective coasts. They must now determine what material evidence of those wrecks remains.

Each State has taken its own approach to managing its historic shipwrecks. North Carolina employs a core staff to study the State's shipwrecks. South Carolina enlists the aid of hundreds of sport divers and has obtained supplementary grant funding for its underwater archaeological activities. Vermont works with the Lake Champlain Society, a private organization. Virginia funds no underwater archaeology itself, but relies on Federal and private funds for its efforts. It is currently focusing on the Yorktown shipwrecks, remnants of Cornwallis' fleet scuttled in the York River during the Revolutionary War. The State has made effective use of volunteers, allowing public access to the site for educational purposes. Michigan has established underwater preserves for areas of special natural and cultural interest. It was the "first Great Lakes state to enact specific legislation regulating the salvage of shipwreck materials."[32]

Private Programs

The National Trust for Historic Preservation (NTHP)

The NTHP (box E) has, since 1976, maintained a Maritime program to publicize underwater archaeology and maritime preservation issues, to build and educate new constituencies, to award grants, communicate more effectively with established constituencies, and to provide technical publications.[33] It has also completed a maritime preservation public service video program. With the assistance of a private broker and financial service firm, The Trust also sponsors a maritime heritage insurance program to assist organizations involved in maritime heritage to obtain insurance for historic vessels. The Trust, as a participant in the U.S. National Marine Sanctuary Program, has provided NOAA with advice on public information and outreach to generate and maintain funding dedicated to protecting the *U.S.S. Monitor*. In addition, the Trust has established a Maritime Advisors Network to deal with critical questions in the field and has commented on such issues as the National Register guidelines for nominating historic ships and shipwrecks and current maritime controversies as the salvage of the 18th century vessel *H.M.S. DeBraak* off the coast of Delaware.[34] The Trust was also a key advocate

[32]Historic shipwrecks in Michigan waters are nevertheless under considerable stress from salvors and divers. See John R. Halsey and James L. Martindale, "The Sack of the Inland Seas: Shipwreck Plundering in the Great Lakes," paper presented at the 52nd Annual Meeting of the Society for American Archaeology, Toronto, May 7, 1987.

[33]For example, it has published a *Directory of Maritime Heritage Resources* (Washington, DC: National Trust for Historic Preservation, 1984).

[34]See "Treasures Lost in the Finding" *The New York Times*, Aug. 28, 1986. Dispute surrounds the most recent stage of excavation at the site late in 1986. As noted, a salvage crane hauled up what remained of the ship's hull, losing artifacts it had contained in the process. The hull may need to be returned to the water if the State cannot acquire funds to treat and conserve it properly.

Box E.—The National Trust for Historic Preservation

The National Trust for Historic Preservation whose membership numbers around 190,000 is a national, private, non-profit organization chartered by Congress in 1949 to encourage public participation in the preservation of buildings, objects, and sites significant in American prehistory and history. Support for the National Trust comes from membership dues, endowment funds, contributions and grants from private foundations, and the Federal Government. Under provisions of the National Historic Preservation Act of 1966, the U.S. Department of the Interior, through the National Park Service, disburses approximately 20 percent of the Trust's annual operating budget. Although it has never done so, the Trust is empowered to litigate when shipwreck sites are inappropriately handled and to advocate the preservation of shipwrecks to governmental and private decisionmakers.

The Maritime Department of the National Trust has formed a series of working committees to advise them on technical and policy issues in the field of maritime preservation. Among other things, the Maritime Department is developing educational material about historic shipwrecks for State and Federal decisionmakers, as a stimulus to the protection of underwater cultural resources.

SOURCE: National Trust for Historic Preservation.

of the Sailing School Vessels Act.[35] The Trust is expanding its Yankee Intern Program[36] for maritime activities and plans to develop a prototype Antiquities Act for consideration by those States still lacking specific legislation to protect historic shipwrecks in their waters. It is preparing a manual for documentation of historic maritime resources and is also studying the possibility of Investment Tax Credits for vessels as well as incentives to encourage archaeologically controlled investigation of submerged sites.[37]

International Efforts

Several countries have focused significant resources on underwater archaeology and maritime preservation. Preservation professionals in the United States view the recovery and restoration of the 17th century Swedish warship *Wasa* and the Tudor flagship *Mary Rose* as successful models for U.S. efforts. Although they are not without problems, these operations have demonstrated especially meticulous planning, execution, and significant governmental funding commitment.

- The *Wasa*, a warship which sank in Stockholm Harbor in 1628, was raised by the Swedish Government in 1961. It was spectacularly well-preserved and intact after its immersion in the Baltic Sea, whose salinity is too low to sustain the survival of the wood-borer *Teredo navalis* and other shipworms.[38] These marine creatures quickly infest and feed on submerged wood, inflicting heavy damage to the piles of piers and wharfs and wooden components of sunken vessels not covered by sediments. The conservation of the *Wasa* over the past 25 years represents a pioneering effort both in type and scale. It established most of the techniques now governing the treatment of cultural materials excavated from the deep.[39] A provisional curation, education, and display facility permits public visitation.

  Although conservation and restoration of the *Wasa* represents the highest quality approach and scientific know-how, recent problems place the health of the vessel in jeopardy.[40] Rain leaking through the aluminum shed which houses the ship has caused temperature fluctuations and condensation. This condensation has contributed to rapid shrinkage of those areas of her wooden hull which have apparently not received sufficient treatment with the preservative polyethylene glycol. Conservators ceased applying the preservative in 1980 when it seemed that the ship could no longer absorb the substance. Respraying resumed after 3-inch broad cracks appeared in some places. Curators lament the fact that because of inadequate funding a permanent museum which could provide the essentials of constant temperature and humidity cannot be completed until 1990. This development illustrates the level of commitment needed for major preservation projects and the continuing research required to anticipate the effects of certain treatments under changing conditions.
- The *Mary Rose*, raised in 1982 by the British government, was the flagship of Henry VIII's fleet.[41] She foundered at the entrance to Portsmouth Harbor in 1545 while on her way to engage the French fleet. The wreck was located in 1970 after a search using a

[35]Lynn Hickerson, National Trust for Historic Preservation, personal communication, August 1987.

[36]The Yankee Intern Program is sponsored jointly by NTHP and Yankee Publishing, Inc. It allows college and university students and faculty to participate in maritime-focused activities. Such activities include working with owners and managers of historic ships and docks to complete measured drawings and restoration, instructing high school students in maritime historical research techniques, and raising funds to relocate historic lighthouses threatened by shore erosion, and producing slide and video presentations to educated and garner the financial support of the public, foundations, and other institutions.

[37]Marcia Myers, Maritime Department, National Trust for Historic Preservation, personal communication, 1986.

[38]Carl Olof Cederlund, *The Old Wrecks of the Baltic Sea: Archaeological Recordings of the Wrecks of Carvel-Built Ships*, pp. 19-20, BAR International Series, Oxford, England, 1983. See also Anders Franzen, *Vasa: The Strange Story of a Swedish Warship From 1628* (Stockholm: Bonniers Norstedts, 1963).

[39]For example, the use of polyethylene glycol as a preservative for waterlogged wood.

[40]See "New Woes Assault Sweden's Ill-Fated Naval Monument," *Albuquerque Journal*, Jan. 1, 1987, p. D15.

[41]"The Cheesebox," *The Monitor National Marine Sanctuary Activities Report*, vol. 4, No. 1, May 1985 published by East Carolina University, Department of History, Program in Maritime History and Underwater Archaeology.

side-scan sonar and sub-bottom acoustic profiler located an anomalous signal in the area in which the wreck was thought to lie.

In raising the *Mary Rose*, British archaeologists and engineers developed a specially engineered recovery apparatus, the cradle of which was designed to continue supporting the hull in dry dock through the initial conservation phases. It was the product of extensive multi-professional collaboration. The Mary Rose project will serve as a test bed for conservation chemistry and allow chemists to determine the best methods for conserving waterlogged wood.[42]

The *Mary Rose* also represents an important collaboration between sport divers and professional preservationists. The wreck was discovered by members of the British Sub-Aqua Club, who worked closely with supervising archaeologists. Without these essential volunteers, successful excavation, raising, and subsequent conservation would have been impossible.

The relatively successful restorations of both the *Wasa* and the *Mary Rose* depended on long-term commitments by governments, preservationists, and scientists to engender public interest, and to obtain reliable funding, proper research and interpretive facilities, and access to technical expertise.

ISSUE B: The lack of Federal legislation to determine jurisdiction over and ownership of historic shipwrecks has severely hampered most efforts to protect them for the public.

Recent legislation,[43] and more effective enforcement of older preservation laws, have led to improved protection of archaeological sites on lands controlled by the Federal Government. Submerged archaeological sites under Federal administration are subject to the same laws, regulations, and management policies governing sites on dry land. These laws, regulations, and policies are intended to shield submerged sites from such destructive activities as mineral exploration and dredging, and also limit private access to them if they lie within national parks and marine sanctuaries. However, the status of historic shipwrecks situated outside national parks and marine sanctuaries, is adversely affected by an additional, highly complex body of law governing maritime activities, as well as ancient legal principles, such as property ownership, admiralty law, and the law of finds.[44] Further complicating matters are the several different marine jurisdictions (box F). Other countries such as Australia, Canada, Cyprus, England, Norway, and Sweden have enacted national laws regulating the management of all cultural resources within the waters of their outer continental shelves.[45]

Maritime salvaging tradition lies at the heart of continuing conflict over the treatment of U.S. historic shipwrecks, which has pitted private salvors and State preservation officers against each other. This tradition, established to motivate privately conducted rescue of vessels in peril, rewards salvors for their attempts, or grants them possession of abandoned vessels and their contents. However, maritime law treats both historic and modern vessels identically, considering the time of abandonment, whether 2 or 200 years ago, irrelevant.

[42]Margaret Rule, "The Raising of the *Mary Rose*," *The Illustrated London News*, October 1982.

[43]The Archeological and Historical Preservation Act of 1974 (Public Law 93-291; 88 Stat. 174) which amended the Reservoir Salvage Act of 1960 (Public Law 86-253; 74 Stat. 220; 16 U.S.C. 469-469c) and The Archeological Resources Protection Act of 1979 (Public Law 96-95; 93 Stat. 712, 16 U.S.C. 470) and the 1980 amendments to National Historic Preservation Act of 1966 (Public Law 96-515; Stat. 2997) among others.

[44]Admiralty law of salvage rewards the person or persons who assist in saving a ship in peril and requires payment by its owner of a salvage fee. If no owner is found, the ship and its contents may be sold to raise the award. The law of finds awards lost or abandoned property to the person or persons finding it. "The law of finds and the law of salvage are not always clearly distinguished by admiralty courts." Thompson M. Mayes, "Current Legal Issues in the Law of Historic Shipwrecks," *A Memorandum for the Office of General Counsel*, National Trust for Historic Preservation, October 1986.

[45]See P.J. O'Keefe, *Current Developments Regarding Regulation of Marine Archaeology Outside Territorial Waters*, University of Sydney; cited by Douglas Shallcross and Anne Giesecke, "The Status of Federal and State Regulation of Underwater Cultural Resources: Lessons of the Treasure Salvors and Cobb Coin Cases," *Underwater Archaeology: The Proceedings of the 14th Conference on Underwater Archaeology, 1986*. See also George R. Fisher, *Legal Considerations in Underwater Archaeology*, National Park Service, Southeast Archeological Center, Tallahassee, Fl (paper presented at the annual meeting of the Society on Underwater Archaeology, Philadelphia, PA, January 1976).

Box F.—The Seven Marine Jurisdictions

U.S. Marine Jurisdictions Comprise:

1. internal waters (those inside the coastline);
2. the Territorial Sea (three nautical miles from the mean low tide) in which jurisdiction is the same as if the area were dry land, under the State governments;
3. the Contiguous Zone (12 nautical miles from State waters) within which the Federal Government controls customs, rights of passage, health regulations, military activitiies, and navigation;
4. the Outer Continental Shelf (the seabed beyond the Territorial Sea to slightly beyond 200 miles) on which the Federal govenment exercises controls relating to natural resource exploitation;
5. the High Seas, the area beyond the Outer Continental Shelf to which international law applies;
6. the Exclusive Economic Zone (see below); and
7. the fishery Conservation Zone (16 U.S.C. 1811), extending to a distance of 200 nautical miles from the baseline from which the breadth of the territorial sea is measured.

These definitions are, for the most part, recognized by other nations. Further definitions cover:

- Navigable inland waters are those which were navigable by any kind of vessel on the date a State entered the Union. The present accepted legal definition, however, covers those waters which are usable for interstate or foreign commerce. The United States controls operations on and under navigable inland waters, but the adjoining State owns the water and submerged beds.
- Non-navigable inland waters—the owner of the shoreline (riparian owner) is the owner of the water and the subsurface land under it to the center of the body of water.

The Exclusive Economic Zone (EEZ) is a zone contiguous to the Territorial Sea, including zones contiguous to the territorial seas of the United States, Puerto Rico, the Commonwealth of the Northern Mariana Islands (to the extent consistent with the Covenant and the United States Trusteeship Agreement), and U.S. overseas territories and possessions. The EEZ extends to a distance 200 nautical miles from the baseline from which the breadth of the Territorial Sea is measured. Within the EEZ the United States has, to the extent permitted by International Law:

- sovereign rights for the purpose of exploring, exploiting, conserving, and managing natural resources, both living and non-living, of the seabed and subsoil and the superajacent waters and with regard to other activities for the economic exploitation and exploration of the zone; such as the production of energy from the water, currents, and winds; and
- jurisdiction with regard to the establishment and use of artificial islands, and the installations and structures having economic purposes, and the protection and preservation of the marine environment. Proclamation No. 5030, *Exclusive Economic Zone of the United States*, Mar. 10, 1983, 48 F.R. 10605.

SOURCE: Office of Technology Assessment, 1987.

Maritime law is in sharp contrast with preservation law, in which prehistoric and historic sites and objects found on public land are considered to be held in trust by the U.S. Government for all its citizens. As such, according to a substantial set of preservation laws (Table 2), cultural resources on public lands must be managed for the public good.

In the oceans surrounding the U.S. coast, private salvors, particularly treasure hunters, search out gold and silver items, coins, jewels, and highly valued antiquities at wreck sites, employing such devices as dredges, blowers, and explosives. They may ruin such contextual remnants as hulls, furniture, armament, and cargo, leaving sites unfit for proper scientific investigation, and for public display and education. Because only an extremely small number of wrecks contain such desirable artifacts, their searches "have destroyed the archaeological potential of hundreds of historic, but not commercially promising sites."[46]

[46]See Carol Weare, "Saving Shipwrecks: An Underwater Imbroglio," *Place*, December 1983.

Photo credit: National Park Service, Submerged Cultural Resources Unit

Submerged Cultural Resources Unit diver examines the bow of *America*, sunk at Isle Royale, MI, in 1928.

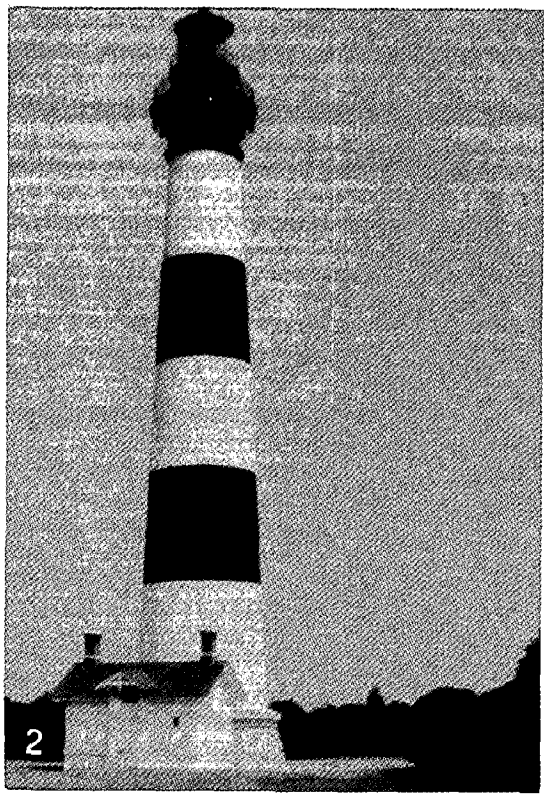
Interest Groups

Historic shipwrecks are the focus of three competing groups:

1. *Treasure Hunters.*—As potential profiteers from the sale of gold, silver, gems, and other valuables, and as successful claimants of historic wrecks in Florida and Texas, they are the most aggressive seekers of these fragile resources, even when, as is often the case, their quests result in financial losses.[47] Although only about a dozen treasure hunters operate full time, their sometimes flamboyant, high-risk activities have captured the public interest. They have, through assiduous lobbying in Congress, been instrumental in the repeated defeats (since 1979) of earlier versions of the Abandoned Shipwreck Act. One of the most popular means of financing treasure hunting explorations involves investors who form partnerships, syndicates, or other business relationships. Salvaging ventures have been stimulated by liberal tax shelters for investors in limited partnerships. However, the tax reforms enacted by the 99th Congress are likely to render some salvage efforts less attractive because they place greater restrictions on the losses investors may claim from high risk, limited partnerships.
2. *Underwater Archaeologists and Maritime Historians.*—They are joined by Federal and State Historic Preservation Officers, general and nautical museum curators, and conservators responsible to governmental agencies and universities for the care of recovered objects. This group is interested primarily in preserving and conducting research on maritime and underwater archaeological sites, and interpreting them to the public. Historic shipwrecks provide information on such subjects of historical and public interest as commerce, naval warfare, exploration, and vessels—their construction, cargo, passengers, and the details of their loss at sea.
3. *Sport Divers.*—This interest group is by far

[47]Anne G. Giesecke, Statement on H.R. 3558 before the House Subcommittee on Oceanography, Oct. 29, 1985.

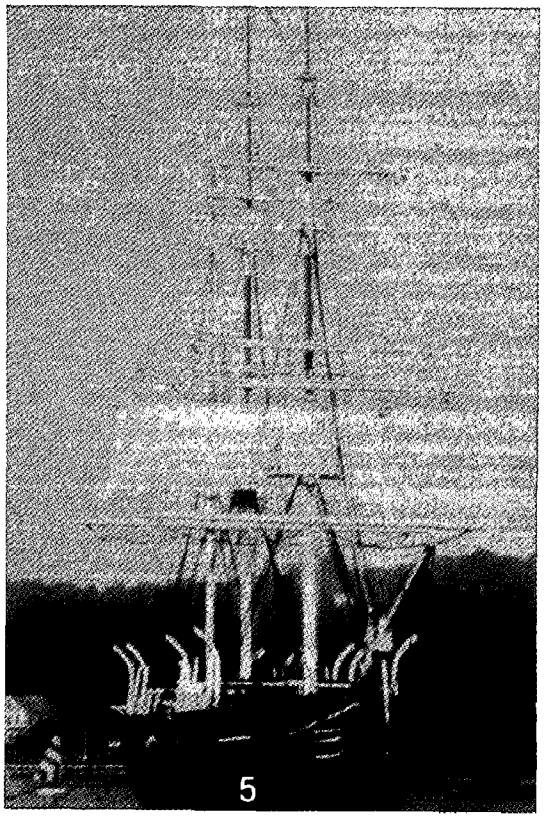
Credit: National Trust for Historic Preservation



Credit: National Trust for Historic Preservation

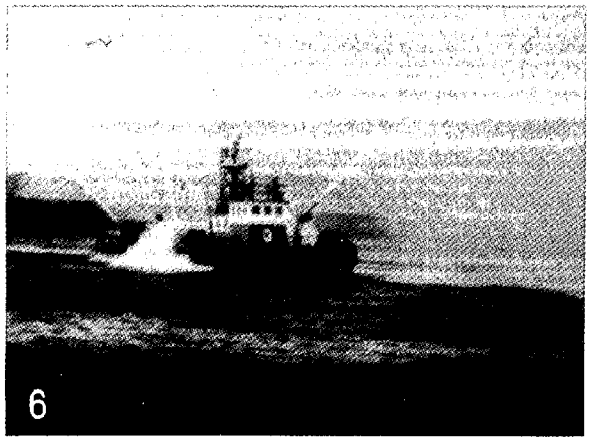
Credit: Lynn R. Hickerson, National Trust for Historic Preservation

Credit: Norman Brewer, National Trust for Historic Preservation



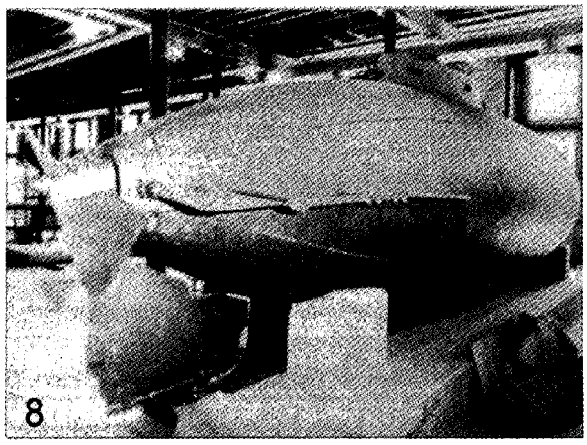
Credit: National Trust for Historic Preservation

Photo 1: Apprentices at the Maine Maritime Museum, Bath, ME work on the planking of a traditional Maine peapod—one of many activities and exhibits available for visitors at the museum's four city-wide and waterfront sites. **Photo 2:** Bodie Island Light Station. Now part of Cape Hatteras National Seashore, North Carolina. Erected 1872. **Photo 3:** The *E'ala*. Double hulled voyaging canoe, Waianae, HI. 1979 Maritie Grant recipiant, National Trust For Historic Preservation. **Photo 4:** Ronson ship excavation site, New York City. Archaeologists working amidships, removing ceiling planking to expose frames. **Photo 5:** The *Charles W. Morgan*, Mystic Seaport, CT.

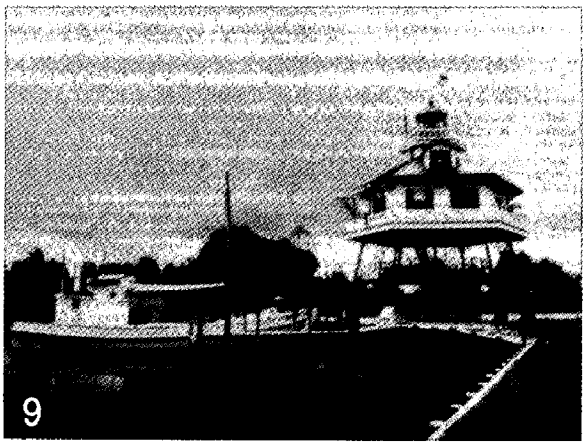


Credit: National Trust for Historic Preservation

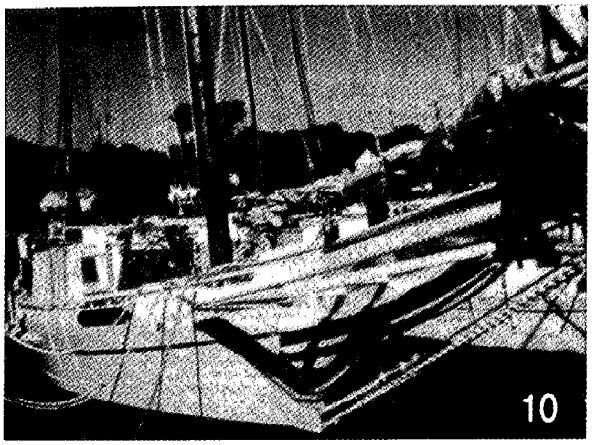
Credit: T. M. Slade, National Trust for Historic Preservation



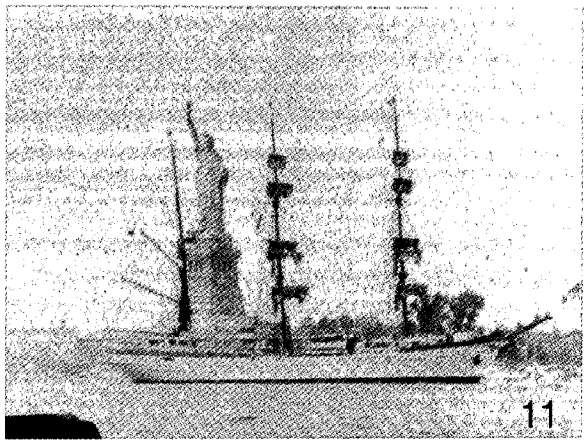
Credit: National Trust for Historic Preservation



Credit: National Trust for Historic Preservation



Credit: Ray A. Williamson



Credit: U.S. Navy

Photo 6: The Tacoma Fireboat #1. Tacoma, Washington. Entered service, October 1929. Listed on the National Register of Historic Places. **Photo 7:** Blackstone Canal, Providence RI. **Photo 8:** Historic *Holland II* submarine, Paterson Museum, Paterson, NJ. **Photo 9:** Drum Point Lighthouse and the William B. Tennison, Calvert Maritime Museum, Solomons Island, MD. **Photo 10:** The skipjack, *Kathryn*, Tilghman Island, MD, ready for the oyster season. **Photo 11:** The Romanian Bark, *Mircea*, taking part in the bicentennial celebration off the Statue of Liberty by the tall ships, called Operation Sail.

the largest. The Conference on Underwater Archaeology and the Society for Historical Archaeology estimate that there are more than 2 million sport divers in the United States, many of whom find diving on wrecks an enjoyable, exciting, and educational pastime. Along with fishermen, sport divers locate the bulk of all shipwrecks within U.S. coastal and inland waters. They collect artifacts, and also photograph and study the histories of undersea wrecks avocationally. Many volunteer their services to qualified archaeologists. Some, however, also loot and disturb sites. Sport divers strongly advocate their right under protective shipwreck legislation to legal access to submerged wrecks. Their principal membership and trade organizations, such as the Diving Equipment Manufacturer's Association, have supported the latest version of the Abandoned Shipwreck Bill (H.R. 74 and S. 858).

Litigation Over Ownership of Historic Shipwrecks

As noted earlier, in the absence of Federal legislation to safeguard historic shipwrecks, 27 States have passed antiquities statutes to broaden their jurisdiction and exert regulatory control over significant wrecks within their territorial waters (box G). Yet several Federal court cases, disputed over more than a decade, have denied the States authority to enforce their statutes. These cases, dealing with competing claims to historic shipwrecks between commercial salvors and State preservationists, have also called into question the validity not only of State governments, but the Federal Government, in controlling the recovery of archaeological materials at significant sites.

Two major litigations in particular have proved lengthy, complex,[48] costly, and ultimately inconclusive for preservation purposes because of the highly inconsistent and even contradictory rulings emanating from State, admiralty, and appellate courts. *Treasure Salvors, Inc.* v. *Unidentified Wreck and Abandoned Sailing Vessel* (cases I,II, and III) concerned efforts by the State of Florida and the Federal Government to exercise regulatory control over commercial salvaging at historic shipwreck sites on the Outer Continental Shelf (OCS). *Cobb Coin, Inc.* v. *Unidentified Wreck and Abandoned Sailing vessel* was part of efforts by the State of Florida to oversee recovery at historic shipwrecks within its three-mile territorial limit. The *Treasure Salvors* cases even involved claims by a rival salvor and Supreme Court interpretation of the merits of their claims.

Treasure Salvors, Inc., after searching for the wrecks of the *Atocha* and the *Santa Margarita*,

Photo credit: Mitch Kezar, National Park Service

Sport divers begin a dive at Isle Royale National Park on a shipwreck bouyed by the National Park Service for visiting sport divers.

[48]See also J. Barto Arnold III, "The Platoro Lawsuit Revisited," *Underwater Archaeology: The Proceedings of the Fourteenth Conference on Underwater Archaeology*, Calvin R. Cummings (ed.), Special Publication #7 (San Marino, CA: Fathom Eight, 1986) for a description of the complex, expensive, and lengthy litigation process in which the State of Texas has been engaged to claim, for public benefit, the *Espiritu Santo* wreck off Padre Island. Its efforts proved only partially successful. The case deals primarily with State's rights, specifically, permitting authority and the courts requirement that it pay for or buy back one-third of all artifacts recovered.

Box G.—State Historic Shipwreck Legislation

The following States and Trust Territories have, since 1963, adopted legislation to enable management of historic shipwrecks in their waters for public benefit. Most of these laws permit, under certain conditions, some recovery of archaeological materials by private parties. No State has forbidden sport diving on historic shipwrecks :

Alaska	Alaska Stat. 41.35 (1977)
Arizona	Ariz. Rev. Stat. 41.841 (1982)
Colorado	Colo. Rev. Stat. 24.80.401-410 (1973)
Florida	Fla. Stat. Ann. 267 (Supp. 1982)
Georgia	Ga. Code Ann. 12.3 (1981)
Guam	Chpt. XIII. 13985.-5
Hawaii	Hawaii Rev. Stat. 6E (1976)
Indiana	Ind. Stat. Ann. 14.3.3.3-4 (Supp. 1983)
Louisiana	La. Stat. Ann. RS 41.1601 (Supp. 1982)
Maine	Me. Rev. Stat. Ann. 27. 373-378 (1982)
Massachusetts	Mass. Gen. Laws Ann. 6. 179-180 (1974)
Michigan	Mich. Comp. Laws. Ann. 299.51-54 (Supp. 1982)
Minnesota	Minn. Stat. Ann. 138 (1979)
Mississippi	Code Ann. 39.7 (1972)
Montana	Code Ann. 22.3.421-442 (1981)
New Hampshire	Rev. Stat. Ann. 227.C. (Supp. 1981)
New York	Consol. Laws Ann. 14 (McKinney 1982)
North Carolina	Gen. Stat. 121.22-28 (1981)
North Dakota	Century Code 55.021.03.10 (Supp. 1981)
Oregon	Rev. Stat. 358.905 (1983)
Rhode Island	Gen. Laws 42.45.1. (1977)
South Carolina	Code of Laws Ann. 54.7.40. (Supp. 1982)
Texas	Code Ann. 191.01 (1978)
Vermont	Stat. Ann. 22.701. (1978)
Virginia	Code 10.145. (Supp. 1983)
Wisconsin	Stat. Ann. 27.012 (1973)
Northern Mariana Islands	P.L. No. 3-39 11

SOURCE: Anne G. Giesecke, *Journal of Field Archaeology*, "Management of Historic Shipwrecks in the 1980s," 12:108-112, 1985.

discovered in 1971 the first of quantities of gold artifacts from the *Atocha* wreck, submerged 9 miles off the coast of Florida in what both the company and the State believed were territorial waters. Treasure Salvors, Inc., under the stipulations of the Florida Archives and History Act, entered into a contractual arrangement with the State for the sole right to continue search and salvage of the *Atocha*. In 1975, after having recovered nearly $6 million in artifacts and treasure from the wreck site and having learned of an unrelated Supreme Court decision finding that Florida had no interest in or authority over the waters surrounding the *Atocha* site, Treasure Salvors, Inc., severed its contract with the State. It then initiated an action in admiralty court to obtain title to and possession of the wreck. Treasure Salvors asserted that in the case of an abandoned vessel, the finder assumes possession according to long-standing principles of maritime law. The State fought the action and with the intervention of the Federal Government claimed ownership of the wreck. They cited the Outer Continental Shelf Lands Act (OCSLA) which applies to the area in which the *Atocha* lay and the both the Antiquities Act and the Abandoned Property Act, which reflect the concept of English common law on "sovereign prerogative."[49] Jurisdiction of the OCS is controlled by two pieces of legislation, the Submerged Lands Act (143 U.S.C 1301; Public Law 83-31) and the Outer Continental Shelf Lands Act (43 U.S.C. 1331, ff).

The Submerged Lands Act relinquishes to the States full control over all submerged lands extending to 3 nautical miles offshore, except for the gulf coast of Florida and Texas, whose jurisdictions extend 10 nautical miles.[50] Separate acts apply to the submerged lands of the Territories.[51] The OCSLA reserves the submerged lands on the OCS to the Federal Government and subjects them to administrative control by the Secretary of the Interior.

The Submerged Lands Act:

> . . . confirms and establishes the titles of the States to lands beneath navigable waters within State boundaries and to the natural resources within such lands and waters, provides for the use and

[49]"The Administrator of the General Services Administration is authorized to make such contracts and provisions as he may deem for the interest of the Government, for the preservation, sale, or collection of any property or the proceeds thereof, which may have been wrecked, abandoned, or become derelict, being within the jurisdiction of the United States and which ought to come to the United States . . ."

[50]43 U.S.C. 1301 (a)(1),(2) Submerged Lands Act.

[51]Puerto Rico: sec. 8 of the Act of Mar. 2, 1917 (48 U.S.C. 749). Guam, Virgin Islands, and American Samoa: Sec. 1 of the Act of Oct. 5, 1974 (48 U.S.C. 1705). Northern Mariana Islands: Sec. 3 of the Proclamation No. 4726, Feb. 21, 1980 (48 U.S.C. 1681).

control of said lands and resources, and confirms the jurisdiction and control of the United States over the natural resources of the seabed of the Continental Shelf seaward of State boundaries.

The Act deals largely with purview and mineral exploitation but not with the disposition of man-made or cultural objects—historic shipwrecks and other submerged archaeological sites.

Federal courts upheld the claims of Treasure Salvors, Inc., stating that the United States through the OCSLA asserted ownership of and jurisdiction over mineral and other natural resources, but not cultural resources. The Abandoned Property Act applied only to property let go or lost during the Civil War, clearly not the correct historic period of the cultural materials under litigation. The courts also concluded that the English rule of "sovereign prerogative" never "took root" in America, that the "American Rule" has prevailed, which places ownership with the finder. When Treasure Salvors, Inc., in a further action tried to compel Florida to release 25 percent of the treasure still retained under the void salvage contract, the State countered by attempting to bar the company's claim under the 11th amendment to the Constitution. The 11th amendment prohibits citizens from suing States in Federal courts, but the Fifth Circuit Court rejected Florida's action, arguing that Treasure Salvors, Inc., was not prohibited under the 11th amendment because its suit was against individuals employed by the State, not the State itself.

The 11th amendment, however, has been successfully used in Massachusetts to thwart salvors' maritime claims.[52] The court held that the State had a "colorable claim of title" to the pirate ship *Whydah*, which sank off its coast in April 1717.[53] However, in a recent case testing the State's laws regarding excavations within its coastal waters, a State court ruled against the State's claim. The ruling is expected to be appealed to the State Supreme Judicial Court.[54]

By contrast, in another recent case, *Klein* v. *Unidentified Wreck and Abandoned Sailing Vessel*, the United States Court for the Southern District of Florida found for the Federal Government on the issue of ownership of excavated shipwreck items because they had been embedded in land owned by the United States and administered by the National Park Service.

In *Cobb Coin, Inc.*, conflict again focused on the State of Florida, whose submerged lands contain the remains of an unknown number of Spanish treasure galleons from the Plate Fleet, which sank off the Florida coast in 1715, while bound from the New World to Europe. Cobb Coin, Inc., formed after the president of Treasure Salvors' dissolved that company, began a search in 1978 for remains of the fleet. After locating and recovering artifacts thought to be part of a galleon, he then initiated an action in Federal admiralty court requesting either a declaration of ownership of the shipwreck or compensation for salvage carried out at the site. Because the site lay well within Florida's 3-nautical mile offshore limit, the State intervened, asking the court instead to declare it the owner and order restitution for all items culled from the wreck. The State justified its claims on the basis of its antiquities law, the Florida Archives and History Act and sought criminal action against Cobb Coin, Inc.

The Federal district admiralty court declined to apply certain parts of Florida's marine archaeology statute, seeing it in conflict on certain points with preemptive Federal admiralty law.[55] It deemed the State's requirement for a license to explore State waters in conflict with the maritime principle that potential salvors or finders be free to search the open waters for salvable sites. Maritime law clearly encourages prompt recovery of goods; Florida's would accomodate painstaking and time-consuming scientific research. Florida's

[52]See, for example, *Maritime Underwater Surveys, Inc.* v. *Unidentified, Wrecked and Abandoned Sailing Vessel*, 717 F.2d 6; *Subaqueous Exploration & Archaeology, Ltd.* v. *Unidentified Wrecked, and Abandoned Vessel*, 577 F. Supp. 597 (d. Md. 1983); and *Cobb Coin I*, 525 F. Supp. 186 (S.D. Fla. 1981).

[53]Douglas Reid Weimer, *Legal Issues Relating to Abandoned Shipwrecks*, Congressional Research Service, 1986.

[54]John H. Kennedy, "State Comes Up Empty in Hunt for Treasure," *Boston Globe*, Tuesday, May 19, 1987, pp. 19-22.

[55]Douglas Reid Weimer, *Legal Issues Relating to Abandoned Shipwrecks*, Congressional Research Service, 1986 for a discussion of the legal issues clouding the treatment of historic shipwrecks in U.S. waters. See also Douglas Shallcross and Anne G. Giesecke, *Recent Developments in Litigation Concerning the Recovery of Historic Shipwrecks*, Syracuse Journal of International Law and Commerce, 10:371-404. See further, Douglas A. Shallcross and Anne G. Giesecke, "The Status of Federal and State Regulation of Underwater Cultural Resources: Lessons of the Treasure Salvors and Cobb Coin Cases," *Underwater Archaeology: The Proceedings of the 14th Conference on Underwater Archaeology*, 1986.

law permits a licensee the exclusive right to salvage an area "regardless of diligence or success." This allowance is at odds with the maritime principle that a salvor's right to act on a wreck is valid only as long as the salvor perseveres as quickly and efficiently as possible, and is reasonably successful in recovering submerged property. Florida grants salvors fixed percentages of artifacts, challenging the maritime concept of reward based on "risk and merit." As a result, the court ruled that historic shipwrecks are subject to the traditional admiralty law of salvage. Although the courts in *Cobb Coin* did acknowledge the cultural value of historic shipwrecks and the importance of their provenance to the public, they still held that such value and importance do not override long established and observed principles of maritime law.

The Abandoned Shipwreck Act of 1987

Since 1979, interested parties have sought passage of legislation to strengthen the ability of States to locate, evaluate, and protect historic shipwrecks located within their submerged lands. Without clear Federal legislation establishing public interest in government ownership of historic submerged vessels, these resources remain at risk through the activities and claims allowed by treasure hunters under admiralty law.

Abandoned shipwreck legislation[56] has been reintroduced before the 100th Congress (H.R. 74; S. 858).[57] The bills, which as introduced are nearly identical,[58] seek to treat historic properties on the seabed more like historic properties on land and:

- assert U.S. ownership and transfers to the States title to abandoned shipwrecks that are embedded in the submerged lands of a State, in coralline formations, or included in or determined eligible for inclusion in the National Register of Historic Places;[59]
- declare that the laws of salvage and of finds do not apply to these abandoned shipwrecks;
- specify that the Act will not affect any suit filed before the date of enactment;
- confirm Federal ownership of abandoned shipwrecks on Federal lands;
- retain any existing Federal admiralty and salvage law for all shipwrecks not covered by these bills; and
- direct the Advisory Council on Historic Preservation to develop guidelines to assist the States and the Federal Government in carrying out their responsibilities and to allow for non-injurious recreational exploration and private sector salvage of shipwreck sites.

The bills do not effect admiralty claims for the ownership of shipwrecks within the Nation's waters between the 3-mile offshore State-controlled limit and the 200-nautical-mile limit of the Outer Continental Shelf.

While treasure hunters and others resist legislation to limit their exploitation of any shipwrecks for profit or recreation, some preservationists express serious misgivings about the bills because they do not explicitly prohibit salvaging at culturally significant sites. They fear that the differing approaches to managing submerged cultural resources, legalized in 27 States so far, would render appropriate and consistent policies difficult to implement nationwide. They also point out that they regard as critical the ability of State programs to allow for the retention of artifacts. They cite the inadequacy of models, such as Florida's, which permits treasure hunters to contract with the State, survey and excavate, and retain 75 percent of what they find as payment for services.

[56]The Abandoned Shipwreck Act of 1985 (H.R. 3558 and S. 2569) failed to pass the 99th Congress.

[57]On August 5, 1987, shortly after this background paper went to press, H.R. 74 was marked up and reported out of the Oceanography Subcommittee of the House Committee on Merchant Marine and Fisheries. It must still be considered by the full committee and by the House Committee on Interior and Insular Affairs. The Senate has not yet acted on S. 858.

[58]The markup made several important changes in H.R. 74. It now provides for an Advisory Committee to "prepare and publish . . . guidelines for use by the States in developing legislation and regulations to carry out their responsibilities under this Act." It also provides that if, "within 5 years after the date of the enactment of this Act," a State has failed to develop a plan consistent with guidelines established by the Advisory Committee, the title to a State's historic shipwrecks then reverts to the United States. Finally, the markup added a provision that the Secretary of the Interior was responsible for managing "all abandoned shipwrecks to which the United States reasserts title . . . in a manner consistent with the guidelines . . ."

[59]This transfer clearly resolves the issue of legal jurisdiction over shipwrecks and the authority of the States to regulate salvage in their waters.

Texas' model, by contrast, is one of the few which do not allow the transfer of publicly owned historic artifacts to private ownership.[60] However, as demonstrated by the cases cited above, legislative action may be necessary to impart across-the-board protection for shipwrecks, which are important elements of the heritage of the United States.

ISSUE C: Underwater and maritime cultural resources are vulnerable to a wide variety of natural and manmade threats.

Table 6 summarizes the various threats to which underwater archaeological and maritime cultural resources are subject. Historic coastal settlements are jeopardized by changes in land use; historic lighthouses are endangered by land subsidence, erosion, and neglect when technological advances render them obsolete as aids to navigation. Historic floating vessels, if not maintained and renewed, are rendered unusable by the rapid spread of rot and rust. "Ships are less accomodating than buildings, which can stand untouched for generations and survive."[61] In addition, traditional boatbuilding and navigation skills are being lost as a result of the introduction of modern technology in the practice of these skills.

Prehistoric sites close to shore are damaged by wave action and by oil and gas exploration when they lie on the Outer Continental Shelf. As noted earlier, treasure salvors can inflict grave damage to historic shipwrecks and may, in the process of searching out and extracting treasure and other commercially valuable features or contents, completely destroy them and any significant archaeological information they might convey.

Even though many treasure salvors cannot afford the kinds of sophisticated and powerful remote sensing locational techniques developed for the space program and the oil, gas, and mineral industries, a few have acquired other marine technologies and, in recent years, gained access to many significant sites. Table 7 lists a few significant historic shipwrecks that have been exploited for treasure. Shipwrecks are attracting the interest of increasing numbers of groups and individuals able to invest in underwater exploration. One of the most dramatic examples involves the *R.M.S. Titanic*, which is located 2½ miles below the surface in international waters, about 350 miles southwest of Newfoundland. An American oil company executive and a Hollywood broadcasting group, among others, are collaborating with scientists from the Institute for Research and Exploitation of the Sea, an agency of the French government, to retrieve artifacts and open three safes from the wreck. The project, which will involve spending at least $3 million, will consist of a series of 10 dives by miniature submarine, and broadcasts of the event live from the seafloor. The project's expedition team has used a three-man mini-sub to retrieve a leather, "doctor's-style valise" filled with jewels, bank notes and other valuables, and a safe which is believed to have be-

Table 6.—Threats to Underwater Archaeological and Maritime Resources[a]

Natural threats:
- Corrosion/concretion of metals
- Earthquakes
- Erosion—of the coastline, river, and stream banks
- Floods
- Storms
- Subsidence
- Wave action
- Wood-borers
- Volcanoes

Man-made Threats:
- Anchoring—particularly of freighters
- Federal projects—dredging, naval base development, dam and reservoir construction, channelization, etc.
- Looting
- Lack of maintenance (maritime resources)
- Neglect
- Non-conservation of materials recovered from underwater
- Oil/Gas/Mineral extraction
- Pipelines
- Pollution
- Salvaging/Treasure hunting
- Shellfishing
- Shore facility expansion—ports, marinas, recreation areas, airports
- Sport diving
- Vandalism

[a]Not listed in priority order.

SOURCE: Office of Technology Assessment, 1987.

[60]Daniel J. Lenihan, National Park Service, personal communication, March 1987.

[61]Statement of Marcia Myers, Vice President for Maritime Preservation, National Trust for Historic Preservation, before the Subcommittee on National Parks and Public Lands of the House Committee on Interior and Insular Affairs, on H.R. 1044, a bill to establish the National Maritime Museum at San Francisco, March 26, 1987.

Table 7.—Representative Historic Shipwrecks Exploited for Treasure

- *Espiritu Santo*: One of the 1554 New Spain fleet wrecks located off Padre Island, Texas;
- *Nuestra Senora de Atocha*: A 16th century Spanish galleon off the Florida Keys;
- *Whydah*: An 18th century English pirate ship off the coast of Massachusetts;
- *H.M.S. DeBraak*: An 18th century Dutch-built English privateer off Lewes, Delaware;
- *Nuestra Senora de la Maravilla*: a large 16th century Spanish galleon 50 miles north of Grand Bahama Island.

SOURCE: Office of Technology Assessment, 1987.

longed in the ship's assistant pursor's office.[62] The recovery venture began in the summer of 1987, with completion scheduled for September 10.

Recovery of items from the *R.M.S. Titanic* is being protested by many who believe that the site should remain untouched as a memorial to those who perished in the ship's sinking.[63] Others argue that items from the *Titanic* possess historical value precisely because they come from the shipwreck and that salvage operations should continue on the basis that international law provides for the salvage of vessels lost at sea.[64]

Some treasure salvors employ archaeologists to oversee or carry out tasks that can minimize damage to sites. Many archaeologists, however, believe that the basic goals and interests of archaeological research and treasure salvaging are inherently antithetical, and that when profit is the motive for exploitation of shipwrecks, scientific research and the shipwrecks themselves must inevitably suffer. Particularly when excavation of a wreck requires the application of expensive technology, or the salvor is operating on a speculative financial shoestring, as many do, it is likely that the recovery of objects having financial value will take priority over the recovery and conservation of material that may be priceless to archaeological research but of little or no commercial value.[65]

Treasure salvors who have become aware of the importance of historical research, may contract for the study of historical documents such as those found within two particularly rich archives—El Archivo General de Indias in Seville, Spain, and El Archivo General de la Nacion in Mexico City, Mexico. These archives, which are highly valued for a broad range of historical research, contain thousands of records from the 16th through the 19th centuries on all aspects of exploration, seafaring, and trade sponsored by the Spanish crown in the New World. Much of this documentation provides detailed information on the passengers and cargos carried by the ships that traveled back and forth between Europe and the Americas, as well as on disasters at sea.[66]

ISSUE D: There is a critical need for a Federally sponsored facility for underwater archaeology and maritime preservation.

Most participants in the OTA study urged the formation of a federally funded institution devoted to providing:

- accurate information on current preservation technologies for the research, location, analysis, and management of prehistoric and historic structures, objects, and sites;
- information on technologies developed in other fields for possible application to preservation, namely—technology transfer;
- training in preservation technologies;
- ongoing research;
- conservation laboratories;
- interdisciplinary teams capable of intervening on an emergency basis in response to particular technical preservation problems;
- a clearinghouse for preservation project information (Federal, State, local, private) to expedite coordination; and
- the leading technical preservation database.

[62]Ken Ringle, "Breathtaking Collection of Jewels Discovered at Titanic Site," *Washington Post*, Friday, August 21, 1987.

[63]"Television Special From Titanic Is Planned," *New York Times*, February 1987.

[64]See, for example, William F. Buckley, Jr., "Let Them Sell the Titanic's 'Treasure,'" *Washington Post*, August 17, 1987, p. A19.

[65]Thomas F. King, Advisory Council on Historic Preservation, personal communication, 1987.

[66]Stanley Hordes, Historical Consultant, personal communication, 1986. See also "Translated Documents Capture Ambience and Aroma of the Nina," *The New York Times*, Oct. 14, 1986.

The facility could be either fully or partially funded by the Federal Government, in keeping with its long-standing role as the Nation's principal conservationist.[67] It would include within its agenda technologies for underwater archaeology and maritime preservation.

A center for preservation technology would likely encourage closer interactions among underwater archaeologists, maritime preservationists, dry-land archaeologists,[68] historians, scientists, and engineers. It would be the primary source to which individuals could look for state-of-the-art technical information for *all* relevant disciplines in the field. A center could also take advantage of the expertise built up within, for example, the National Park Service's Submerged Cultural Resources Unit (SCRU) a valuable source of technical advice and publications on the preservation of submerged archaeological and maritime sites.

Perhaps most important, a center could strengthen the partnership among Federal, State, and local government and private enterprise established by the National Historic Preservation Act of 1966 and its amendments of 1980. Enhanced communication should stimulate closer cooperation and greater coordination of research, project planning, and technology sharing.

Such organizations as the Society for Archaeological Sciences and the Association for Preservation Technology were founded specifically to promote the development and use of new technologies in the research and conservation of prehistoric and historic cultural resources. These and other such groups, however, have not directed much attention toward problems in underwater archaeology and maritime technology. Likewise, although the American Association for the Advancement of Science attracts a broad membership, including social, as well as natural, scientists, it is not the locus within which underwater archaeologists have learned of methods adapted from other disciplines to enhance their research.

Research and development are crucial to the transfer of technologies developed for other scientific and engineering purposes to the disciplines of underwater archaeology and maritime preservation. The technologies developed for other fields may need considerable adaptation before being applied to archaeological research and preservation. Underwater archaeologists would benefit by more actively injecting themselves into R&D processes. Their record in exploiting technical advances made in other disciplines has been spotty, largely because aspects of these advances are still very expensive. However, there exist middle range devices, not quite so sophisticated, that universities or Federal agencies could develop.

Technology Sharing

Many archaeologists have not cultivated Federal agencies or private organizations as assiduously as they might have to explore the possibilities of sharing experts and equipment. Yet the Navy is often very appreciative of archaeological expertise in such programs as its Submarine Development Group. It runs manned and unmanned deep-water submersibles and remotely operated vehicles to depths as great as 20,000 feet. It also operates the *U.S.S. Pigeon* (ASR-21) which is capable of deploying saturation divers to depths as great as 850 feet. The vessel has supported scientists during many deep dives to collect specimens for biological-oceanographic research. The group's charter obligates it to support and aid civilian scientists, such as geologists from institutions of oceanography. Some of its personnel and equipment were involved surveys of the *U.S.S. Monitor* and *R.M.S. Titanic*.

A recent example of technology sharing which benefited underwater archaeology occurred during the summer of 1986 between the National Park Service and the U.S. Navy at Pearl Harbor, Hawaii. Teams from the Park Service and the Navy Reserve's Mobile Diving and Salvage Unit One (MDSU ONE) examined and mapped the hulks of the battleships *U.S.S. Arizona* and *U.S.S. Utah*, which had been destroyed in the Japanese attack on the Island of Oahu, December 7, 1941.

[67]See *Technologies for Prehistoric and Historic Preservation*, Ch. 7, "Technology and Preservation Policy" for a discussion on several approaches to structuring such a facility.

[68]See Richard A. Gould, *Shipwreck Anthropology* (Albuquerque, NM: University of New Mexico Press, 1983) for discussions of the slow acceptance of shipwreck archaeology within archaeology and anthropology.

The collaboration assisted both agencies; the Park Service acquired new information for better long-term maintenance of the wrecks at the Pearl Harbor National Historic Landmark site and the Navy conducted diver training exercises. This pilot project has led to further cooperation between the two agencies. In May and June of 1987, Naval Reserve divers from MDSU ONE trained at the Ship Repair facility in Guam, by working with Park Service staff from SCRU to survey World War I and II historic shipwrecks on Navy property. These efforts will also aid the Naval Station in fulfilling its historic preservation obligations.[69]

Communicating With Universities and Oceanographic Institutions

Some experts have expressed the desire for a stronger academic base in support of underwater archaeology and maritime preservation, and have suggested that these subjects be included in the various historic preservation programs offered throughout the country. Enhanced communications between the universities offering programs in underwater archaeology and maritime preservation and the scientific and engineering departments of other institutions could result from a center for preservation technology. Such programs as those established at Texas A & M University's Institute of Nautical Archaeology, East Carolina University in North Carolina, and Arizona State University could then be linked to the technology information network operating from it. These two programs offer students the opportunity to earn degrees at the masters level. No university offers a degree in maritime preservation.[70]

Oceanographic Institutions (table 8) employ many kinds of research vessels in conducting both publicly and privately supported marine scientific projects at sea. Much of their work should be of interest to archaeologists.

The Joint Oceanographic Institutions, for example, is a consortium of 10 U.S. academic oceanographic institutions and four foreign institutions (France, Japan, Canada, and Germany) that coordinates and facilitates the work of individual institutions on large oceanographic research projects. Joint Oceanographic Institutions, Inc. is the systems manager of the member institutions and subcontracts operating activities to other academic institutions and industrial groups as well as its members. At present, under the Ocean Drilling Program the consortium is analyzing core samples to study the structure and history of the earth beneath the oceans for evidence of ancient ocean and climatic conditions, as well as tectonic plate movement. The progress of such projects could be followed by a technical preservation center, and the results disseminated among archaeologists.

[69]J.K. Otto Orzech, University of California, San Diego, Scripps Institution of Oceanography, personal communication, March 1987.

Photo credit: National Park Service, Submerged Cultural Resources Unit

U.S. Navy Mobile Diving and Salvage Unit Reservists and the National Park Service Submerged Cultural Resources Unit cooperate to map *U.S.S. Arizona*.

[70]Lynn Hickerson, National Trust for Historic Preservation, personal communication, August 1987.

Table 8.—U.S. Oceanographic Institutions

Duke University
Johns Hopkins University
Lamont Doherty Geological Observatory
Oregon State University
Scripps Institution of Oceanography
Texas A & M University
University of Alaska
University of Georgia
University of Hawaii
University of Rhode Island
University of Southern California
University of Washington
Woods Hole Oceanographic Institution

SOURCE: Office of Technology Assessment, 1987.

There is a great need for more underwater archaeological and conservation training programs. In current graduate programs, there are neither sufficient emphasis on the assimilation of a large technological component nor opportunities for retraining professional archaeologists in the latest methods. A preservation technology center could help achieve that end by highlighting, in addition to its own activities, those conducted at the Institute of Nautical Archaeology at Texas A&M University. Such facilities as the Conservation Center of the Institute of Fine Arts in New York, Cooperstown Graduate Programs in Conservation and Artistic Works in New York, and The Winterthur/University of Delaware Art Conservation Program in Delaware provide training in the conservation of bone, ivory, wood, leather, pottery, gold, silver, copper, lead, tin, iron and metal alloys. However, they do not concentrate on once-submerged materials, and the special problems associated with stabilizing and maintaining such items as hulls or encrusted iron cannon and anchors.[71]

ISSUE E: The lack of National and State inventories has seriously impeded efforts to protect underwater archaeological sites and maritime historical resources.

"The United States has not undertaken a national inventory of underwater cultural materials which include submerged terrestrial sites as well as shipwrecks. Although some States have made substantial progress in surveying their own coasts, lakes, and rivers and locating submerged cultural resources, no States have comprehensive data on file."[72] No more than 162 historic vessels and small craft are listed in the National Register of Historic Places, a compilation of over 45,000 prehistoric and historic structures, objects, and sites. The total number of shipwrecks is unknown; only 41 are listed on the National Register. Listings range from individual wrecks such as the *C.S.S. Florida*, a Confederate, British-built sail-steamer sunk in 1864, to the 15 to 25 American Revolutionary War ships of the Penobscot Expedition sunk off the Maine coast in 1779. The site of the *U.S.S. Monitor* is a National Historic Landmark as well as a National Marine Sanctuary. Of only 32 vessels designated as National Historic Landmarks, 22 are of World War II vintage. Warships outnumber trade vessels listed on the Register. Shipwrecks illustrating American history from the age of Spanish exploration to World War II are included, but neither prehistoric craft nor common fishing vessels are listed.[73]

Twenty years have passed since enactment of the National Historic Preservation Act. Yet, the first serious effort to undertake a computer-based resource survey did not begin until 1986, with the National Maritime Initiative. The Federal Government long ago gave up a valuable opportunity to identify, study, document, and record thousands of ships and other water-going craft when it disbanded the Historic American Merchant Marine Survey (HAMMS) only 18 months after its formation during the New Deal in 1937. Its sister program, the Historic American Buildings Survey (HABS) has, in 53 years, documented and recorded thousands of buildings and other structures.[74]

The first phase of the National Maritime Initiative's survey is a compilation of known lists and inventories from a variety of sources scattered among the maritime community. It includes listings from the South Street Seaport Museum in New York, the International Congress of Maritime Museums, the World Ship Trust, the National Register of Historic Places, and the National Trust for Historic Preservation. Thus far, the sur-

[71]Lynn Hickerson, National Trust for Historic Preservation, personal communication, August 1987.

[72]See U.S. Congress Office of Technology Assessment, *Technologies for Prehistoric and Historic Preservation* (Washington, DC: Government Printing Office, September 1986). Several participants in the OTA assessment noted the irony inherent in the States surveying their waters for cultural materials. If States do not dedicate the necessary resources toward protecting them after discovery, they are in danger of loss. Typically, State law enforcement agencies are scarcely aware of archaeological protection statutes, whether Federal of local. Inventorying must become part of a comprehensive program that also includes adequate law enforcement. The National Conference of State Historic Preservation Officers (NCSHPO) notes that over the past 20 years the Department of the Interior could have advocated more funding for meaningful State surveys at "realistic levels." The organization cites Minnesota, for example, a State whose historic preservation staff is most interested in identifying shipwrecks in Lake Superior. At their current allocation level ($345,332 less 10 percent entitlement to local governments) the SHPO cannot undertake the task.

[73]Anne G. Giesecke, Statement on H.R. 3558 before the House Subcommittee on Oceanography, Oct. 29, 1985.

[74]Editor's Column, "Listing Ships," *Preservation News*, June 1986.

vey covers one maritime resource category out of eight identified, namely, preserved historic vessels over 40 feet long, and over 50 years old (table 8).

Certain types of maritime historical resources are addressed under current HABS/HAER (Historic American Engineering Record) standards and guidelines for documenting and recording structures and buildings. Prehistoric and historic shipwrecks and other vessels are not. Neither are they addressed by standards or guidelines for restoration, conservation, or maintenance. Such standards and guidelines are planned under the National Maritime Initiative, as well as guidebooks on national inventory format to serve Federal agencies, State Historic Preservation Offices, historical societies, preservation constituencies, and others. This level of technical assistance, along with the publication, *National Register Bulletin #20*, "Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places," is designed to increase National Register listings of maritime resources.

A stated objective under The Maritime Initiative relates to closer interaction between the Federal Government and the States in correcting deficiencies in cultural resource inventories. Both levels of government have neglected underwater archaeological and maritime resources in their inventories. All inventories will be computerized eventually. Government agencies now have a chance to develop fully compatible databases, and might examine the efforts of the Texas State Antiquities Commission to computerize their Shipwreck Reference File as a possible model. The Texas file is based on information culled from both historic and contemporary sources such as maps and field reports. It should help determine the locations of unidentified wrecks. The file has been useful in justifying the employment of nondestructive surveys in the face of potentially destructive Federal activity, such as dredging or harbor facility expansion. Since 1972, the Commission has listed over 1,000 shipwrecks, of which approximately one-half have proved historic.[75]

The State of Maryland has begun a survey of its maritime resources. As noted earlier, the Chesapeake Bay Watercraft Survey, completed in 1982, led to the nomination of the Skipjack fleet to the National Register. The Patuxent River Project, which was begun in 1978, has gathered physical and documentary information in a systematic survey that has included shipwrecks, wharfs, ferry landings, and inundated shore areas. The project has carried out an oral and visual historical documentation of the maritime heritage along the river and created an exhibit of artifacts representing the commercial fishing activities throughout the estuary.[76]

[75]J. Barto Arnold, III, "Underwater Cultural Resource Management: The Computerized Shipwreck Reference File," *Underwater Archaeology: The Proceedings of the Eleventh Conference on Underwater Archaeology*, Calvin R. Cummings (ed.), (San Marino, CA: Fathom Eight, 1982) pp. 85-95.

[76]Ralph E. Eshelman, Calvert Marine Museum, personal communication, 1987.

TECHNOLOGY, UNDERWATER ARCHAEOLOGY, AND MARITIME PRESERVATION

Although haphazard and unpredictable, a variety of simple techniques and random searches have yielded many important underwater archaeological finds through the years, particularly in northern Europe, the Mediterranean Sea, and more recently in the waters off the States of Texas and Florida. Some of these strategies have included interrogating local divers and fisherman or operating hand-held coring devices from small boats. As early as 1664, only 30 years after the sinking of the *Wasa* in Stockholm Harbor, Hans Albrekt von Treileben of Sweden and Andreas Peckell, a German salvor, employed a primitive diving bell to recover artifacts from the wreck. Struggling in 100 feet of bitterly cold black water, the pair recovered many items, including 50 bronze cannon, each weighing between 1 and 2 tons. It was an underwater technical feat that was not matched until the end of the 19th century.[77]

In the early 1940s, Jacques Yves Cousteau and Emile Gagnan perfected the aqua-lung with its self-contained underwater breathing apparatus (SCUBA). It was a revolutionary improvement over bulky, restrictive hard-hat diving gear, which could not permit genuine archaeological activity. Since the end of World War II, SCUBA, portable and easy to use, has permitted the kind of underwater mobility necessary to archaeologists. It has also made more of the world's waterways accessible to treasure hunters, and collectors of antiquities.[78] Not until the 1960s was the utility of SCUBA in over 30 meters of water tested and proper excavation and site recording carried out. A University of Pennsylvania Team led by George Bass demonstrated the effectiveness of SCUBA and pioneered the development and application of technologies for use both underwater and in the conservation lab. They were first employed in a series of research and excavation projects off the coast of Turkey on a Bronze Age ship which sank around 1200 B.C. in Cape Gelidonya and on several wrecks near Yassi Ada that date from the fourth and seventh centuries A.D.[79]

The "high technology" on which underwater archaeology is most dependent includes a group of highly sophisticated, costly,[80] locational instruments designed primarily for the oil and mineral extraction industries and military missions—side-scan sonar, sub-bottom profiler, proton magnetometer, and remotely operated vehicles (ROVs). These technologies have opened up vast areas for exploration previously unavailable to archaeologists, particularly in the deepest parts of the oceans. Of course, technological applications extend beyond the search and identification phases of any underwater archaeological or maritime preservation project. They also encompass preliminary research, excavation, mapping, recording, documentation, restoration and stabilizing sites in situ, as well as conserving recovered cultural materials. Although the solutions to saving delapidated historic floating vessels, under attack from neglect and weather, do not require complicated technology, they are nevertheless expensive because they are generally labor intensive and require special training.

Technology Transfer

For the most part, advances in the locational technologies applied to preservation have been driven by the oil, gas, and minerals industries and the Federal Government, rather than by underwater archaeologists, whose budgets are modest.[81] The tailoring of those technologies to archaeological requirements has occurred largely through the efforts of professionals in the oil and mineral business, geophysical survey, or the U.S. Navy who possess keen personal interest in solv-

[77]Anders Franzen, *Vasa: The Strange Story of a Swedish Warship From 1628* (Stockholm: Bonniers-Norstedts, 1963).

[78]Keith Muckelroy, *Maritime Archaeology* (Cambridge, MA: Cambridge University Press, 1978).

[79]George F. Bass, *Archaeology Beneath the Sea* (New York, NY: Walker & Co., 1975).

[80]See *Technologies for Prehistoric and Historic Preservation* for examples of equipment costs, p. 155.

[81]The relatively high costs of these technologies deter underwater archaeology. For an overview of what these costs can be, see U.S. Congress, Office of Technology Assessment, OTA-E-319, *Technologies for Prehistoric and Historic Preservation* (Washington, DC: U.S. Government Printing Office, September, 1986), p. 155.

ing marine technological problems. They have, at times, donated equipment and services to underwater archaeological projects throughout the world. Some adaptations are also sparked by archaeologists who keep abreast of technological trends. In addition, as their field grows in complexity, more archaeologists have realized the value of acquainting themselves with the capabilities and limitations of available scientific and engineering technologies. Technological developments must generally be subsidized by grants because underwater archaeology has not proved a strong enough market for generating commercial innovations in technology. As one participant in the OTA study noted, "there is a hit-or-miss aspect to all of the above . . . Technology will be transferred if someone is interested or an archaeologist reads the right journal." Ideally, a logical progression governs the modification of available technologies or the development of new ones to meet selected needs. Such a progression is rarely followed in archaeology, a highly specialized discipline chronically short of funds to support systematic R&D efforts.

Experts contacted by OTA cautioned that the latest underwater locational devices cannot, of themselves, ensure project success. Some users often select equipment because it is available, not because it is appropriate, or they lack the training and experience to operate it properly. "Running a sonar search with inadequate navigational control . . . could lead to failure . . . both too much or too little technology can be a problem."[82]

[82]Charles Mazel, "Technology for Marine Archaeology," *Oceanus*, vol. 28, No. 1, spring 1985, pp. 85-89.

TECHNOLOGIES FOR SURVEY, IDENTIFICATION, NAVIGATION, EXCAVATION, DOCUMENTATION, RESTORATION, AND CONSERVATION

Preliminary research undertaken carefully before any project can save time and money, and also provide a focus for applying technologies in the field and a basis for evaluating cultural significance. Developments in various kinds of archival technology, for example, can make record searches more efficient and cost-effective, although they have not yet been brought to bear on the types of widely scattered information of value to underwater archaeologists and maritime preservationists.

As noted under *Major Issues*, underwater archaeologists require a substantial array of technologies to work in often difficult and perilous conditions. These help them find, record, and recover components of submerged cultural sites and cope with formidable limitations on breathing, seeing, moving, and communicating in frequently cold, dark, rough, and turbid environments.

Identification and Survey

Surveys made with the first three of the four following remote sensing methods result in electronic records, patterns of images, or signals in either analog strip charts or digital records. These images indicate both normal and anomalous bottom and sub-bottom phenomena. As in land archaeology, the character of sources of anomalous signals can only be determined through examination in situ. It is important for underwater archaeologists to continue building a "catalog" of representative signals matched with specific anomalous image sources in order to examine and test new underwater contexts such as estuaries and deep water more effectively and efficiently.

The side-scan sonar sends out acoustic frequency signals from a torpedo-shaped towfish located beneath a survey ship. Reflected signals received by the towfish then travel through the tow cable, and are processed on board the survey vessel in a graphic recorder, which produces hard-copy output. They can also be recorded on magnetic tape for post-processing and analysis. The signals produce excellent images of the floor's topography, including structures and shipwrecks, but cannot detect materials covered by sediments. The side-scan sonar can cover wide areas of the ocean bed, enabling the quick and accurate mapping of such geological phenomena as drowned river systems. It is portable, battery-powered, and can be operated from small boats to enable searches in difficult or remote locations.[83]

The sub-bottom profiler[84] uses low-frequency sound (3.5 to 12 kilohertz) to penetrate ocean bottom sediments. It directs acoustical signals downward beneath its towing vessel. Where different layers of sediment meet, some fraction of the incident acoustic energy is reflected to the vessel, while the rest continues downward. The device generates a cross-sectional view of the oceanfloor on strip charts, revealing sediment layers and underlying bedrock. Buried hulls show up as localized anomalous reflections below the bottom. Resolutions of less than a meter are possible. Sub-bottom profilers, designed originally for use in deep water can now operate in as little as 3 meters of water. Because they cover only narrow paths, they must make many closely spaced sweeps per survey tract.

Magnetometers sense magnetic field anomalies created by ferrous materials on the oceanfloor. Therefore they can only locate shipwrecks and other historic sites containing such metals. Their major shortcoming is that they must remain relatively close to their target because its magnetic field attenuates rapidly as the distance between them and magnetometric sensors increases. Magnetometers cannot easily trace weak signals or anomalies, such as those detected from under sediments, to their sources. Greater use

[83]C.J. Ingram, "High-Resolution Side-Scan Sonar/Sub-bottom Profiling to 6,000 Meter Water Depth," paper presented at the Pacific Congress on Marine Technology, Hawaii, Mar. 24-28, 1986.

[84]Milton B. Dobrin, *Introduction to Geophysical Prospecting* (New York, NY: McGraw-Hill, 1976.)

Photo credit: Garry Kozak, Klein Associates

Side-scan sonar of the *The Atlantic*, a wooden side-wheel U.S. steamship sunk in 1852, in the Canadian waters of Lake Erie. The ship rests nearly upright, 160 feet below the surface. Because it lies in cold, freshwater, it is remarkably well-preserved.

of airborne magnetometry could lead to faster, broader, and more accurate coverage within survey perimeters.

Remote sensing from aircraft and space, when it is refined to penetrate more deeply below the water's surface, could be applied to underwater archaeological site identification and management, as it has been to hydrography.[85]

Remotely operated vehicles have been undergoing rapid change and development, going deeper to bring clearer pictures than ever before of the seabed.[86] Developed in response to the needs of the military and oil, gas, and minerals exploration companies, they are replacing human divers in a great many underwater tasks. They can remain submerged for weeks to survey huge areas of the oceanfloor. For example, the historic discovery of the wreck *R.M.S. Titanic*[87] in April 1986 was achieved through an unmanned craft, the *Argo*, tethered to a ship by 13,000 feet of cable. Outfitted with television cameras, high-powered lights, and sonar scanners, it revealed new information about an environment that had previously been closed to archaeological research. The *Titanic* was later explored by a manned vehicle, the *Alvin*, and a remotely operated craft, *Jason*, Jr. in an attempt to gather visual

[85]J. Barto Arnold, III, "Remote Sensing in Archaeology," *The International Journal of Nautical Archaeology and Underwater Exploration*, 1981.

[86]Craig T. Mullen, Eastport International, Inc., personal communication, 1986.

[87]Robert D. Ballard, "How We Found the *Titanic*," *National Geographic* vol. 168, 1985, pp. 696-722.

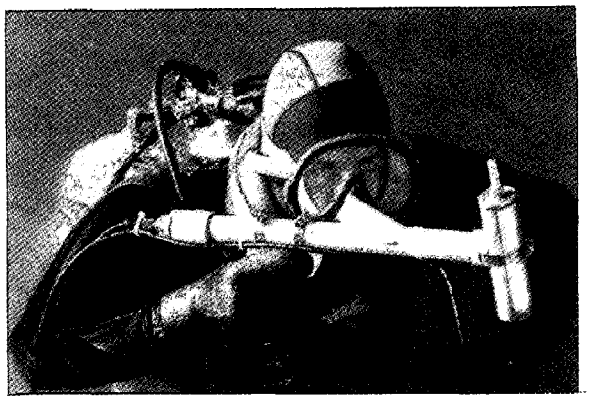
and other data on the wreck's condition.[88] The *U.S.S. Monitor* has been surveyed by the Navy's Deep Drone, a highly sophisticated ROV that was also used in the recovery of the remains of the *Challenger* space shuttle.[89]

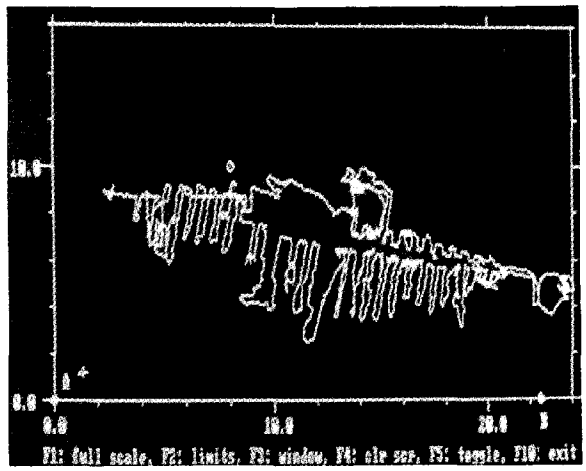
Information technologies make a substantial contribution to research and management of maritime and underwater cultural resources. Although the various technologies for archiving, retrieving, and manipulating the many research and historical records related to underwater archaeology and maritime preservation are not unique to these subjects, they are an integral part of the preservation process. Of particular interest to underwater archaeologists and maritime preservationists are automated databases, and the use of optical disks for the storage and retrieval of both visual and textual information. Both technologies require the extensive use of computers to be effective.[90]

Navigation

Archaeologists can acquire a variety of navigation tools, depending on the nature of their search and desired accuracy. In the coastal waters of the United States, the LORAN-C system maintained by the U.S. Coast Guard enables site relocation within around 10 meters. Microwave positioning systems allow "repeatable fixes" within 3 meters or less. Space-based navigation systems allow positions to be fixed within several meters.[91]

A new satellite-based navigation and positioning system known as Starfix, a joint venture between John E. Chance & Associates and Analytical Technology Laboratories, is now available. This system allows accuracies of better than five meters throughout the lower 48 States, including both Atlantic and Pacific coastlines and the Gulf of Mexico, out to around 600 nautical miles. Originated for civilian marine use, primarily by the oil exploration industry in drill rig situating, pipeline laying, and geophysical prospecting, Starfix is the first privately developed satellite positioning system. Starfix offers continuous coverage, 365 days per year in all types of weather.





Photos copyright National Geographic Society

(Above) Diver surfaces with SHARPS 300Khz sound source. (Below) SHARPS image (Copyright, Applied Sonics Corp.) of the remains of the Henrietta Bach were constructed in less than an hour and were accurate to within an inch.

Sonic High Accuracy Ranging and Positioning System (SHARPS)

This system is a new, extremely rapid, and highly accurate means of achieving detailed maps of shipwreck sites. It represents a technological advance over the usual method of charting a submerged area, in which investigators establish a hand-placed grid comprised of plastic lines or

[88]Walter Sullivan, "Manned Sub Descends To View the Titanic," *New York Times*, July 15, 1986, p. C1.

[89]Michael D. Lemonick, "Probing the *Monitor* with a Deep Drone," *Time*, June 22, 1987, p. 77.

[90]See U.S. Congress, Office of Technology Assessment, OTA-E-319, *Technologies for Prehistoric and Historic Preservation* (Washington, DC: U.S. Government Printing Office, September 1986), ch. 5, for a discussion of preservation information technologies.

[91]Charles Mazel, "Technology for Marine Archaeology," *Oceanus*, vol. 28, No. 1, spring 1985, pp. 87.

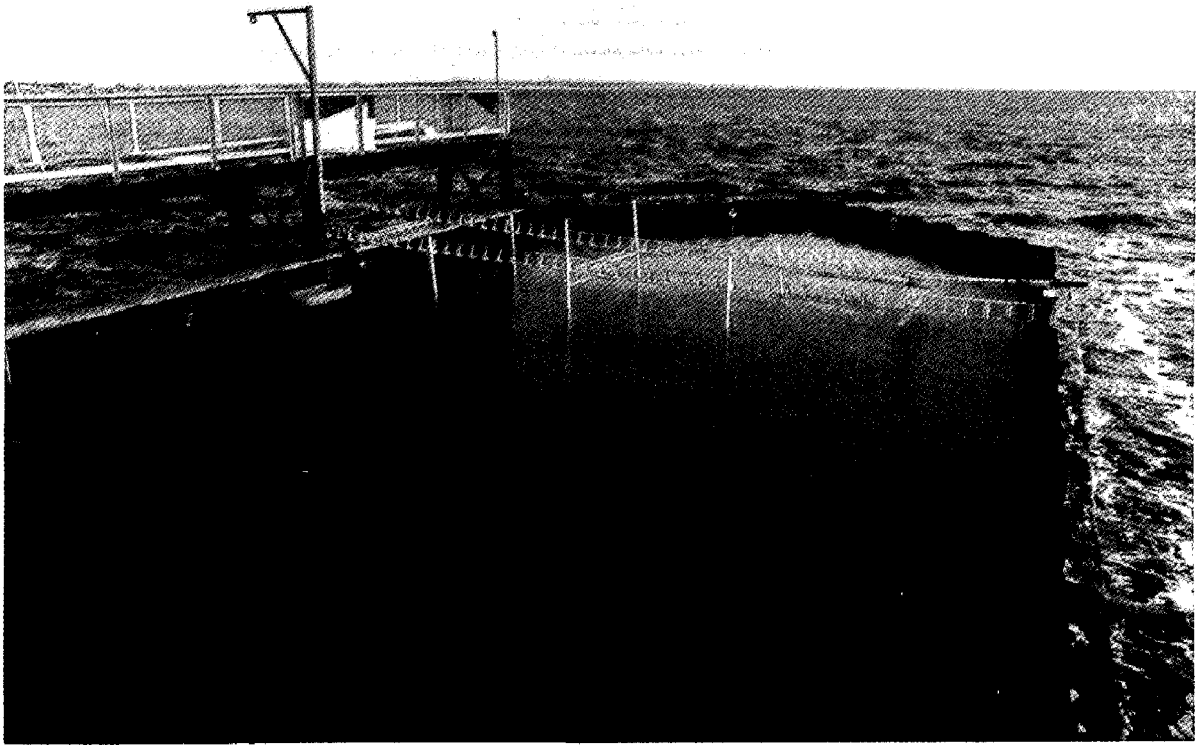


Photo credit: Ray A. Williamson

Coffer dam around shipwreck site, Yorktown Archaeological Project.

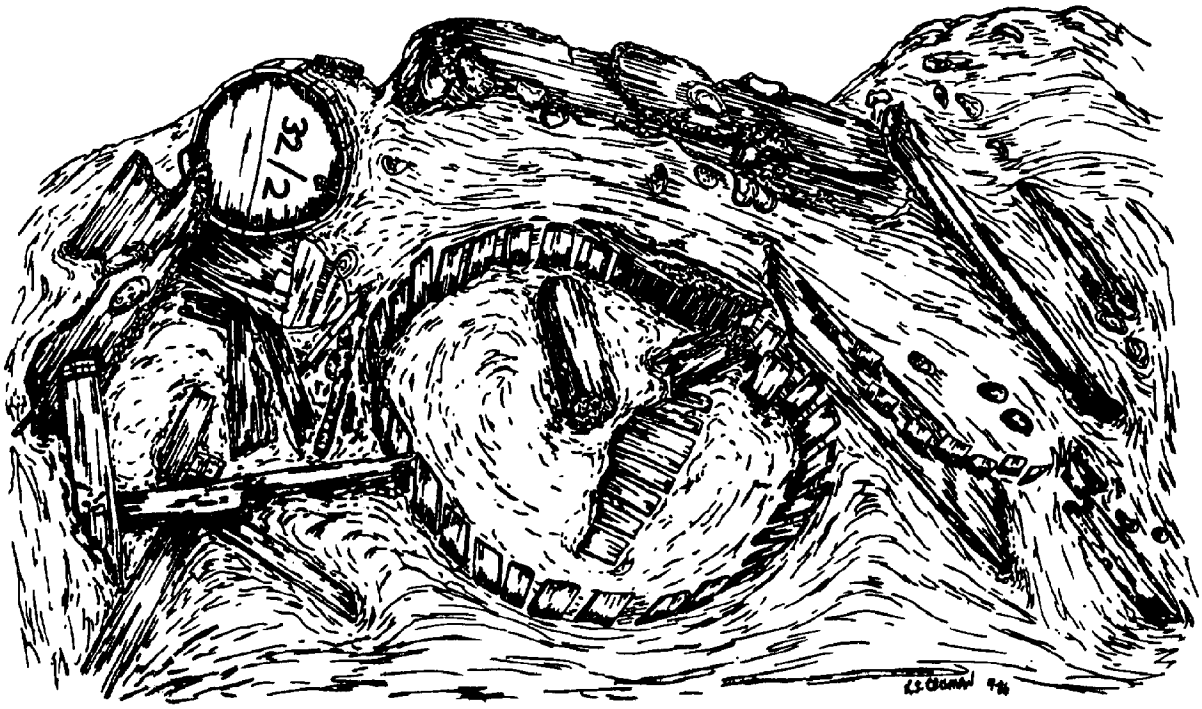


Photo credit: Kevin Crisman, Yorktown Archaeological Project

Yorktown Shipwreck Archaeological Project Shipwreck.

tubing, stretched from a series of posts, over a wreck to enable the hand calculation of thousands of reference points. The usual approach can take months or even years to complete, is labor-intensive, and can be dangerous in deep water because of diver's susceptibility to nitrogen narcosis or "the bends." In the deepest waters, it can be virtually impossible.

SHARPS involves setting up around a site three electronic transmitter-receivers. These transmitter-receivers detect signals from an electronic gun held by a diver at points the diver wishes to measure. When the diver pulls the trigger, the points are recorded by computer on shipboard. This technique allows accuracies to within less than half an inch. The system enables archaeologists to outline vessels and artifacts, create two and three-dimensional maps, and label objects.[92]

Excavation and Documentation

Individuals exploring the sea bottom have a wide array of technologies at their disposal. Deep-water technologies such as tethered and free-roaming ROVs and saturation diving could exert a profound effect on data recovery in underwater archaeology and maritime preservation.

Underwater Excavation Technologies

These techniques range from the extremely simple, such as hand-fanning, to the complex, such as controlled blasting, and include the use of blowers, prop wash deflectors, air hammers, and chisels. Excavation required in dark or "black" water is extremely difficult to carry out, even in relatively calm, shallow water. Specially designed coffer dams such as that developed for the Yorktown Archeological Park in Yorktown, Virginia (box H), are improving the ability of divers to find their way in heavily silted waters. In Yorktown, excavation of an 18th century shipwreck is carried out within a steel enclosure filled with river water that is clarified by commercial filtration units.

SCUBA Diving

As noted earlier in this background paper, archaeologists make extensive use of SCUBA diving equipment and techniques for exploring and excavating sites in shallow waters.

Deep Sea Diving

The use of saturation divers and deep-diving systems to collect samples at depths totally unattainable to conventional divers has been a major technical innovation. Saturation divers are now able to work at extreme depths for prolonged periods. Bottom times are no longer a function of depth, as they are with SCUBA diving, and each dive can last for many hours instead of minutes. Breathing an atmosphere of mixed helium-oxygen, divers can attain depths of over 1,000 feet, although decompression afterward may require several days. Habitats, lockout submersibles, and tethered deep-diving systems deploy saturation divers to their destinations.[93]

Remotely Operated Vehicles (ROVs)

ROVs also have an important role in gathering data, and can be used to collect samples or to photograph or videotape a wreck site. Scorpio, a particular type of new ROV,[94] is now being equipped with remotely controlled manipulators. ROVs are now capable of achieving depths

[92]Recently, a research team completed several experiments in the Chesapeake Bay demonstrating that placing grids and artifacts can be done as much as a thousand times more quickly through the use of a small shipboard computer and electronic mapping gun. Emory Kristoff of the *National Geographic* and associate, Donald Shommette, with over 1,200 reference points, mapped the remains of an 1883 oyster boat located in the shallow waters near the mouth of St. Leonard's Creek in Calvert County, Maryland, in 1 hour. Previous methods would have required about 6 weeks for the same results. The researchers assert that SHARPS can change the field of underwater archaeology, putting all sites within easier reach. This technology is the product of government and private sector cooperation, and was developed with the participation of the U.S. Navy, NOAA, several Maryland State agencies, and the National Geographic Society. See *The Washington Post*, Science Notebook, "Reading Tales of Shipwrecks," Susan Okie and Philip J. Hilts, Mar. 23, 1987, p. A3.

[93]Otto Orzech, Scripps Institution of Oceanography, personal communication, 1986.

[94]Jonathan B. Tucker, "Submersibles Reach New Depths," *High Technology*, February 1986.

Box H.—Applications of Technology on the Yorktown Shipwreck Archaeological Project

The Yorktown Shipwreck Archaeological Project has provided an excellent test site for applications of technology to underwater archaeology. From the intial surveys to the current full-scale excavation, advanced technology has been applied in all phases of the project.

During the period 1976-1979 the project team conducted a series of remote-sensing surveys in the York River using a variety of positioning systems—side-scanning and bottom-penetrating sonars and magnetometers. These surveys, followed by hands-on inspection by archaeologists, resulted in the location and mapping of nine shipwrecks from the 1871 Battle of Yorktown, including the 44-gun British warship HMS *Charon*. Throughout the survey period, investigations were hampered by hostile site conditions. Normal visibility in the York River is usually less than 1 foot. Strong currents and stinging jellyfish added to the difficulty of working in the river.

In order to offset adverse site conditions and to permit more thorough and accurate documentation, funds were obtained for the construction of a steel enclosure, or cofferdam, around the best-preserved of the Yorktown shipwrecks. The cofferdam allows the enclosed water to be filtered and clarified, utilizing a commercial filtration system, thus improving speed, accuracy, and efficiency, and permitting a photographic record of the site to be made. The filtration process increases the visibility inside the protective coffer dam to more than 20 feet.

A pier connecting the cofferdam to the shoreline, just under 500 feet away, permits visitors to observe the work in progress and to learn, from staff interpreters, the importance of maritime preservation and the Yorktown shipwrecks. This is the first such project in the world.

As excavation has proceeded, the staff continues to employ additional advanced technology. Measurements are made using three tape measures, with the resulting data converted to cartesian coordinates by a micro-computer program. Recently, the cofferdam was the site for the first field test of a new sonic positioning system, called SHAR/PS. This system allows a diver to record hundreds of data points, in three dimensions, accurate to a centimeter, on a single dive. Advanced Marine Enterprises, Inc., a naval architectural firm, is using their computer-aided design (CAD) system to analyze, record, and plot hull and artifact remains. Efforts are currently underway to mate the two systems, thus allowing site locational data to be fed directly into the CAD system for analysis and plotting. This system should allow field data to be analyzed and plotted on publication-quality drawings within days of initial recording.

Although visibility in the cofferdam now reaches as much as 30 feet, many of the techniques being developed there, including the SHAR/PS system, will be even more effective in poor-visiblity conditions.

SOURCE: John D. Broadwater, Commonwealth of Virginia, Department of Conservation and Historic Resources, 1987.

of up to 13,000 feet and are armed with specialized work packages capable of cleaning oil rig platforms and recovering a vast array of objects.[95]

Conservation

Conservation is "the documentation, analysis, cleaning, and stabilization of an object . . . to protect the artifactual, faunal, and other archaeological material and prevent their reacting adversely with the environment after recovery."[96] Participants in the OTA study agreed that no submerged site should be excavated unless archaeologists can guarantee the proper conservation of the recovered materials. The conservation and protection of underwater cultural resources, like other underwater archaeological procedures, tend to be expensive, require specialized knowledge and facilities, and are complex and time-consuming. Concreted metal, waterlogged wood,

[95]The University of New Hampshire owns possibly the most advanced ROV, EAVE-EAST, autonomous, outfitted with five microprocessors to sense data on altitude, depth, obstacles, and power consumption. Research continues to impart greater dexterity of manipulation and better systems for autonomy.

[96]D. L. Hamilton, "Conservation in Nautical Archaeology," *Underwater Archaeology: The Challenge Before Us*, The Proceedings of the Twelfth Conference on Underwater Archaeology, Gordon P. Watts, Jr., (ed.) (San Marino, CA: Fathom Eight 1981).

and other organic materials such as leather or fabric begin almost instantaneously to deteriorate when exposed to the open air after having been submerged or buried under sediments. They must be immediately reintroduced to water, via holding tanks, or wet-packed for transport to permanent conservation facilities.

In the United States there is a shortage of conservation facilities as well as a dearth of trained, competent conservation personnel to deal with the ever-increasing numbers of cultural materials being recovered from the deep. Some successful conservation must rely, in large measure, on the services of volunteers working under supervision. In addition, many projects are directed by non-research-oriented organizations and individuals whose ignorance of appropriate conservation methods ultimately destroys recovered materials.

The following approaches represent the range of conservation treatments available:

- *Full-Scale Conservation.*—This approach calls for the stabilization and continuing care of all waterlogged objects, including ship's hulls. This is the most complex and expensive method, but permits scholars and the public to examine thoroughly historic shipbuilding techniques and any culturally significant contents. This approach necessitates fully staffed conservation facilities with highly controlled environments (humidity, temperature, light, etc.). Conservation processes are time-consuming and tedious and demand a long-term commitment on the part of any agency or institution that assumes the responsibility for applying them.

  For example, the Swedish Government has assumed responsibility for the *Wasa* for the past 26 years at a cost of over $20 million. The Mary Rose Trust is in the early stages of conservation of the *Mary Rose*. The Mariner's Museum in Newport News, Virginia, has taken on the *Ronson Ship* bow using private funds.[97]

  Even thoroughly stabilized materials remain extremely fragile. Polyethylene glycol is the commonly used wood consolidant and is very costly. However, recent successful experiments using sucrose promise to lower some stabilization costs. Sucrose is very inexpensive and seems highly stable.[98]
- *Combined Conservation and Documentation.*—This approach involves stabilizing all small, portable waterlogged cultural materials and documenting large objects such as the hull; it dramatically reduces conservation costs. Though a significant amount of study is still feasible, some technical knowledge is lost. However, articles must still be housed in properly staffed conservation facilities. For example, the State of Maine conserved the small artifacts recovered from the *Defence*[99] and documented the hull through drawings for only $20,000. The Canadian Government conserved all the small objects from the *San Juan*, molded sections of the hull, and recorded the remaining sections with drawings.[100]
- *Conservation Through Technology.*—This technique, as yet unadopted, would involve recording all small artifacts with holographic techniques and all large artifacts through molding and documentation and require only holding areas and seasonal conservation staffs. The host institution's commitment would be minimal because its staff can easily transport and store all information. A drawback to this controversial approach is that it does not yield any tangible artifacts.
- *No Action.*—This approach leaves sites submerged or buried beneath the seafloor. Deterioration of shipwrecks and other objects is slow and advances in conservation technologies may significantly improve our ability to conserve artifacts taken from a submerged environment. Currently, this approach postpones the detailed acquisition of knowledge

[97]Sheli Smith, Mariner's Museum, Newport News, VA, personal communication, 1986.

[98]See James M. Parent, "The Conservation of Waterlogged Wood Using Sucrose," *Proceedings of the 14th Conference on Underwater Archaeology*, Calvin Cummings (ed.) (San Marino, CA: Fathom Eight, 1986).

[99]After they completed drawings of the vessel, archaeologists reburied her in situ, using sandbags to hold her in place.

[100]Sheli Smith, Mariner's Museum, Newport News, VA, personal communication, 1986.

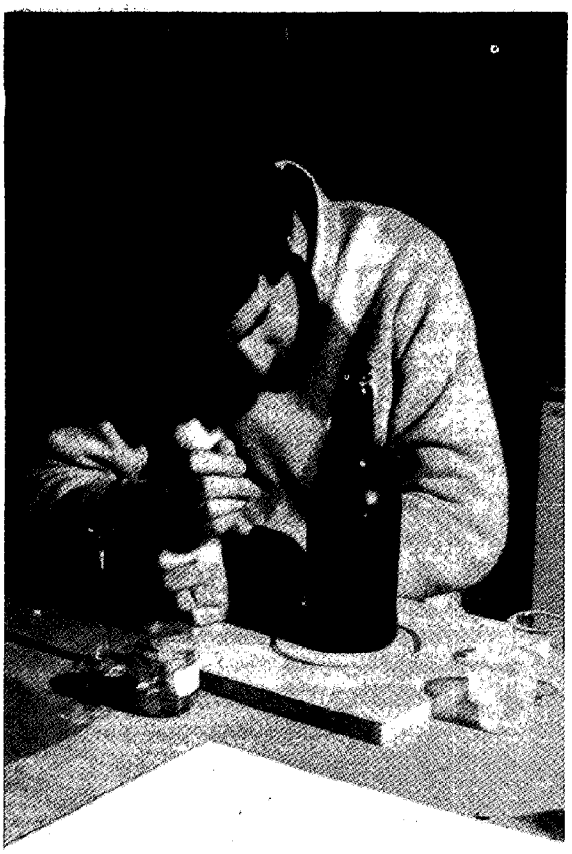


Photo credit: National Trust for Historic Preservation

Technicial conserving bottle taken from shipwreck, Maine Maritime Museum, Bath, ME.

about a site. Future technologies might enable the analysis and interpretation of certain buried underwater archaeological components in situ. For example, the Turkish Government has left several shipwrecks at Yassi Ada to be investigated in future years. The State of Maine selected one ship for study after a survey of the entire Revolutionary War Penobscot fleet. The Commonwealth of Virginia reburied the Revolutionary War period Cornwallis Cave wreck in anticipation of more information on the scuttled British fleet.

These alternatives represent different emphases in terms of costs, commitment, and conservation facility readiness and capability. Realistic consideration of the pros and cons inherent in each of the above conservation methods should be explicitly reflected in project research plans. Otherwise, archaeological investigations will result in only unsatisfactory data bases and poorly conserved artifacts.

FEDERAL POLICY TOWARD UNDERWATER ARCHAEOLOGY AND MARITIME PRESERVATION

The Federal Government is responsible for providing leadership in preserving the Nation's prehistoric and historic structures, objects, landscapes, and archaeological sites. This section outlines several options for improving its efforts to preserve and protect submerged cultural and maritime cultural resources.

National Park Service

As the lead agency in providing technical preservation assistance, NPS could focus far greater attention than it has on the identification, evaluation, and protection of submerged cultural and maritime resources. It could, for example, develop and articulate a clear national policy to guide the preservation of maritime and underwater cultural resources and coordinate NPS programs for preserving these elements of the country's history. In recently creating the position of Maritime Historian, the Service has highlighted the importance and visibility of its maritime programs and created a means by which such policy could be developed and clarified.

In devoting increased attention to the health of maritime and submerged cultural resources NPS could place greater emphasis on the critical role of technological applications. It could also do more to include underwater and maritime issues in its publications series. The *National Register Bulletin #20*, which gives uniform guidelines for nomination, should result in the listing of more shipwrecks and other types of craft on the National Register of Historic Places. "The National Register has been under utilized for maritime resources, particularly historic vessels." By 1976, the 10th year of the National Register Program, only 44 vessels and 8 shipwrecks, 4 of which had been fully recovered, had been listed.[101] As noted earlier, of 45,000 properties on the Register only 162 have been included.

NPS attempts to address underwater archaeological and maritime historical matters under the Maritime Initiative are timely. Commercial exploitation of the Nation's coastal zones has intensified and threatens wholesale obliteration of significant sites before they are even recorded. However, this initiative is limited to objects of maritime interest, for example, commerce, warfare, and navigation. Yet, as noted in the previous section, the resource base requiring attention is far broader. Archaeologists and historians would welcome an initiative that would aggressively identify, study, and manage non-maritime submerged sites. Such sites would include, for example, historic and prehistoric habitations and work areas located within little-studied environments such as estuaries.

The National Historic Preservation Act

The National Historic Preservation Act contains no impediment to the identification and protection of underwater archaeological and maritime historical sites; neither does it specifically mention them.[102] However, having no explicit reference to maritime or underwater historical sites allows agencies to overlook them in cultural resource planning. Some preservationists have suggested that it may be appropriate to amend the National Historic Preservation Act to include these specific categories. Likewise, it may be appropriate to amend Public Law 96-95 (16 U.S.C. 470aa et seq.) the "Archaeological Resources Protection Act of 1979" which outlines the consequences of damaging, looting, and destroying archaeological materials within public lands. This legislation does not explicitly indicate the underwater context or refer to submerged cultural resources,[103] though portions of ship-

[101] James P. Delgado, "The National Register of Historic Places and Maritime Preservation," *APT Bulletin, The Journal of the Association for Preservation Technology*, vol. IX, No. 1, 1987, p. 35.

[102] For example, see Sec. 101(a)(1)(A): "The Secretary of the Interior is authorized to expand and maintain a National Register of Historic Places composed of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering and culture."

[103] See Sec. 3(1): "The term 'archaeological resource' means any material remains of past human life or activities which are of archaeological interest, as determined under uniform regulations promulgated pursuant to this Act. Such regulations containing such determination shall include, but not be limited to: pottery, basketry, bottles, weapons, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal materials, or any portion or piece of the foregoing items."

wrecks are mentioned in the final uniform regulations [49 FR 1016]. Others have expressed concern that including explicit reference to maritime or underwater historical sites would subject these laws to unnecessary and potentially harmful experimentation.

Congress may wish to address the need for greater attention to maritime and underwater cultural resources by creating additional legislation that specifically recognizes their importance. Alternatively, Congress may wish to use its oversight authority to encourage the inclusion of maritime and underwater archaeology concerns in the regulations and guidelines issued by Federal agencies that treat prehistoric and historic preservation.

The Abandoned Shipwreck Act

Under current law, shipwrecks are treated according to dual standards and are not afforded the same consideration and protection as are archaeological remains on dry land. If Congress wishes all classes of cultural resources to enjoy full protection under the law, it could consider passing The Abandoned Shipwreck Act of 1987 (H.R. 74 and S. 858). This legislation should end much of the courtroom fighting and maneuvering over ownership of and responsibility for historic shipwrecks. It would also relieve the States, desirous of preserving their underwater cultural resources, from having to sacrifice enormous sums out of decreasing financial resources on protracted legal actions.[104] Federal historic preservation legislation has clearly been applied to such maritime cultural objects as lighthouses and land installations. It is not being applied to shipwrecks. As noted in Issue B, because admiralty law is being invoked in the case of this particular resource, the States have been unable to assert ownership of an especially vulnerable cultural asset. The result is that historic shipwreck sites in the United States are suffering rapid attrition. Passage of the Act would remove historic shipwrecks from the purview of admiralty courts and place them expressly under historic preservation law. In hearings during the 99th Congress, the Department of the Interior and the National Trust for Historic Preservation recommended that protective legislation for historic shipwrecks be extended to the OCS, in order to bring that vast area under tighter management for the purposes of cultural conservation.[105]

Participants in the OTA study suggested that the Federal government undertake a review of State programs to ensure that the public's interest would be served. Removal of the threat of admiralty court from historic shipwrecks would be insufficient if States retain "business as usual" commercial salvage programs.

The National Maritime Initiative

As noted earlier in this background paper, Congress funded the National Maritime Initiative in its fiscal year 1986 appropriation for the National Park Service. Congress directed that a collaborative effort be established involving the National Park Service, the National Trust for Historic Preservation, and the "maritime preservation community" to begin . . . "to conduct a survey of historic maritime resources (table 9), including those of the Service; recommend standards and priorities for the preservation of those resources; and recommend the appropriate Federal and private sector roles in addressing those priorities."[106]

[104]See *Technologies for Prehistoric and Historic Preservation*, for a discussion of historic preservation funding levels.

[105]Testimony of J. Jackson Walter, President of the National Trust for Historic Preservation, before the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries, April 21, 1987.

[106]*Congressional Record*, Oct. 10, 1984. p. 11922.

Table 9.—Maritime Historic Resource Categories

1. Preserved historic vessels (more than 40 feet long, more than 50 years old)
2. Hulks (substantially intact vessels neither afloat nor completely submerged)
3. Relevant documentation (logs, journals, nautical charts, ship plans, and photographs)
4. Aids to navigation (including life-saving and U.S. Coast Guard stations)
5. Marine sites and structures (canals, docks, wharves, ropewalks, waterfront warehouses, sail lofts, etc.)
6. Small craft (less than 40 feet long, weighing less than 20 tons)
7. Intangible cultural resources (traditional shipwright and rigging skills, oral traditions, sea music, folklore, etc.)
8. Maritime collections (parts of vessels, tools, artifacts, art, furnishings).

SOURCE: *National Maritime Initiative: Phase One*, A Report to the Congress of the United States, prepared by the National Park Service, 1986.

Box I.—Lines Lifting and Lines Drawings

Lines lifting: The process of obtaining accurate measurements of a hull's shape from which to produce lines drawings. Lines lifting requires the set-up of an arbitrary three-dimensional reference system which must be used consistently for all measurements. Beyond this, specific techniques are numerous and range from simple hand methods (tapes and plumb bobs) to "high-tech" electronic and photographic procedures (laser distance ranging, photogrammetry). As long as a method is geometrically sound and used accurately within its limitations, satisfactory results are achievable. Hand methods have been used most often because of their simplicity and low cost. Lines lifting has been practiced for centuries by shipbuildiers, more recently by historians and hobbyists.

Lines drawings: A series of topographic "maps" or contours describing the compound curves of a vessel's hull from the three cartesian axes. Lines drawings are abstract in the sense that they show only hull shape and give little or no indication of materials, fittings, or construction details. Ordinarily, only the starboard (right hand) side of a vessel is shown since symmetry is assumed.

SOURCE: Richard K. Anderson, Jr., Historic American Buildings Survey-Historic American Engineering Record (HABS-HAER), National Park Service, personal communication, 1987.

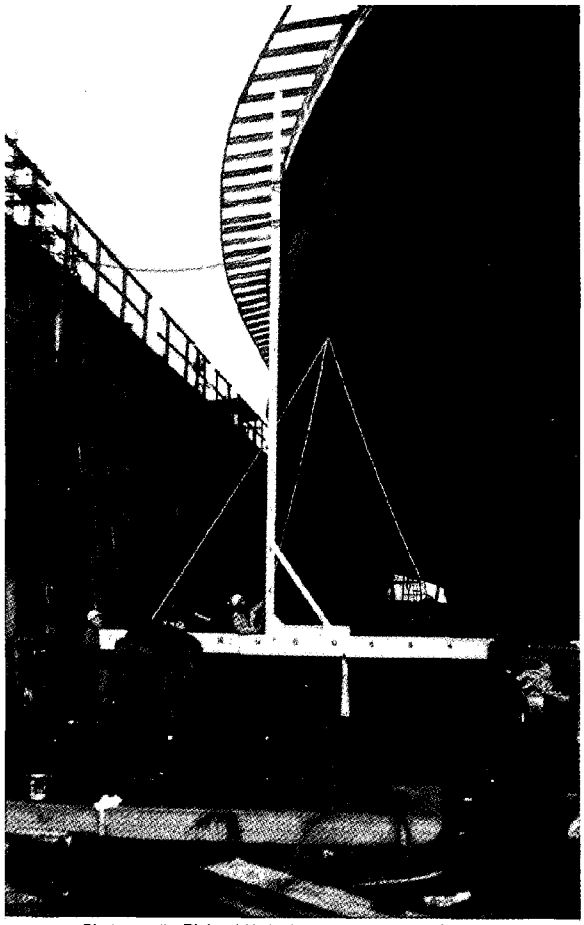


Photo credit: Richard K. Anderson, Jr., Historic American Buildings Survey/Historic American Engineering Record

Lines lifting. Triangulations in process near the bow of schooner *Wawona*, Seattle, WA.

Phase I accomplishments to date include the following:

- undertaking an exhaustive literature search in preparation for inventorying the nation's maritime resources, including shipwrecks;
- drafting guidelines for the documentation of vessels as a result of projects completed by the Historic American Buildings Survey/Historic American Engineering Record:
  - a 1985 lines lifting (box I) of the 1897 schooner *Wawona* in Seattle, Washington, listed in the National Register of Historic Places. A private interest group, Northwest Seaport, Inc., participated;
  - a 1986 documentation of small sailing craft at Mystic, Connecticut with the Mystic Seaport Museum, and the Calvert Marine Museum at Solomons Island, Maryland;
  - drawings of the archaeologically recovered engine from the 1848 steamer *Indiana*, the earliest extant marine steam engine in North America, which is listed in the National Register of Historic Places;
- drafting guidelines to stimulate the nomination of maritime resources to the National Register of Historic Places for inclusion in *National Bulletin #20.* "How To Nominate Historic Vessels and Shipwrecks."[107] For the first time, maritime resources will be evaluated according to uniform criteria;
- completion of a computerized inventory of 250 preserved historic vessels over 50 years old and more than 40 feet long.

[107]National Park Service.

Among Phase II goals for fiscal year 1988 are the following:

- to continue the "maritime inventory";
- to conduct National Historic Landmark Theme Studies for aids to navigation, Pacific coast maritime history, Great Lakes maritime history, etc.; and
- to continue HABS/HAER documentation of a major steamship and engine.

Center for Preservation Technology

A federally supported center for preservation technology could make a major contribution to the development of technologies for the study and preservation of underwater and maritime cultural resources. NPS could take the lead in examining which cost-effective technologies for the special requirements of underwater archaeology and maritime preservation such a center should focus on. Candidate technology areas include survey, location, navigation, recording, and materials conservation. NPS could assess, among other things, the potential utility of a central technical facility, or coordinated set of regional facilities, as the primary focus for the development of preservation technology and for intergovernmental technology sharing.

Incentives for the Restoration and Rehabilitation of Floating and Dry-Berthed Vessels

Since 1976, tax incentives have been available to owners of qualified, income-producing privately-owned structures. These incentives have resulted in the preservation of many historic structures all over the country, and have increased local property values dramatically. It may be appropriate to make similar tax incentives available for privately owned, income-producing floating and dry-berthed historic vessels. Such tax incentives would likely promote the protection of such historic resources.[108] Congress might also consider providing incentives for encouraging salvors to follow established archaeological procedures in excavating shipwrecks.

[108]Editor's Column, "Listing Ships," *Preservation News*, June 1986.

National Survey of Maritime Historic Resources

If Congress wishes the national survey of historic maritime resources to continue, it should continue to fund the National Maritime Initiative (table 10). As indicated previously, the first phase, which focused on preserved vessels more than 40 feet long and at least 50 years old, is complete. However, seven other categories of maritime resources exist (table 9) and are poorly inventoried.

Of possible interest to those engaged in developing and institutionalizing a national survey of maritime historic resources is the International Survey of Underwater Cultural Heritage being sponsored by the United Nations Educational, Scientific, and Cultural Organization, and managed by the Scientific Committee of the World Confederation of Underwter Activities. The scope of the project is worldwide and will include sunken vessels, artifacts (table 11), and habitation sites from every period. It will also include all types of marine and inland underwater resources and review mechanisms for their protection, discuss the findings of recent investigations, and recommend areas for further research.[109]

[109]J.A. Gifford, M. Redknap, and N.C. Fleming, "The UNESCO International Survey of Underwater Cultural Heritage," *World Archaeology*, vol. 16, No. 3, Sept. 1985, pp. 1-4.

Table 10.—Institutions and Agencies Participating in National Maritime Initiative Activities

Association for Preservation Technology
Calvert Marine Museum, Maryland
Council of American Maritime Museums
Historic Naval Ships Association of North America
National Maritime Museum Association, Inc.
National Oceanic and Atmospheric Administration
National Park Service
National Trust for Historic Preservation
Northwest Seaport, Inc.
Tri-Coastal Marine, Inc.
U.S. Navy
U.S.S. Arizona Memorial Foundation, Inc.

SOURCE: *National Maritime Initiative: Phase One*, A Report to the Congress of the United States, prepared by the National Park Service, 1986.

Table 11.—Artifacts Representative of Maritime Historical Collections

Paintings
Drawings/illustrations
Sculpture
Scrimshaw
Large vessels
Small craft
Ship models
Canal-related objects
Maritime construction-related implememts
Hunting/trapping/fishing implements
Rigging/outfitting
Ship equipment
Forecastle artifacts/personal items
Figureheads
Needlework
Macramae/rope work/knot work
Sea shanties/foc'sle songs
River, lake, and canal-related music
Dioramas
Account books
Builders' models
Films
Maps/charts
Lighthouse lenses
Tales/legends/stories
Musical instruments
Logs
Diaries
Manuscripts
Letters
Ships orders
Records
Recipes
Prints
Shipwrecks/hulls/remains
Whaling artifacts
Plans/blueprints
Lifesaving equipment
Oral histories
Photographs
Tape recordings

SOURCE: National Trust for Historic Preservation.

Other Federal agencies could improve their attention to underwater archaeology and maritime preservation. For example, the National Oceanic and Atmospheric Administration could develop its own program-wide maritime archaeological program, particularly if it intends to designate more nationally significant cultural resources as National Maritime Sanctuaries. Federal agencies could also give attention to developing a set of comprehensive data bases for underwater archaeology and maritime preservation.

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