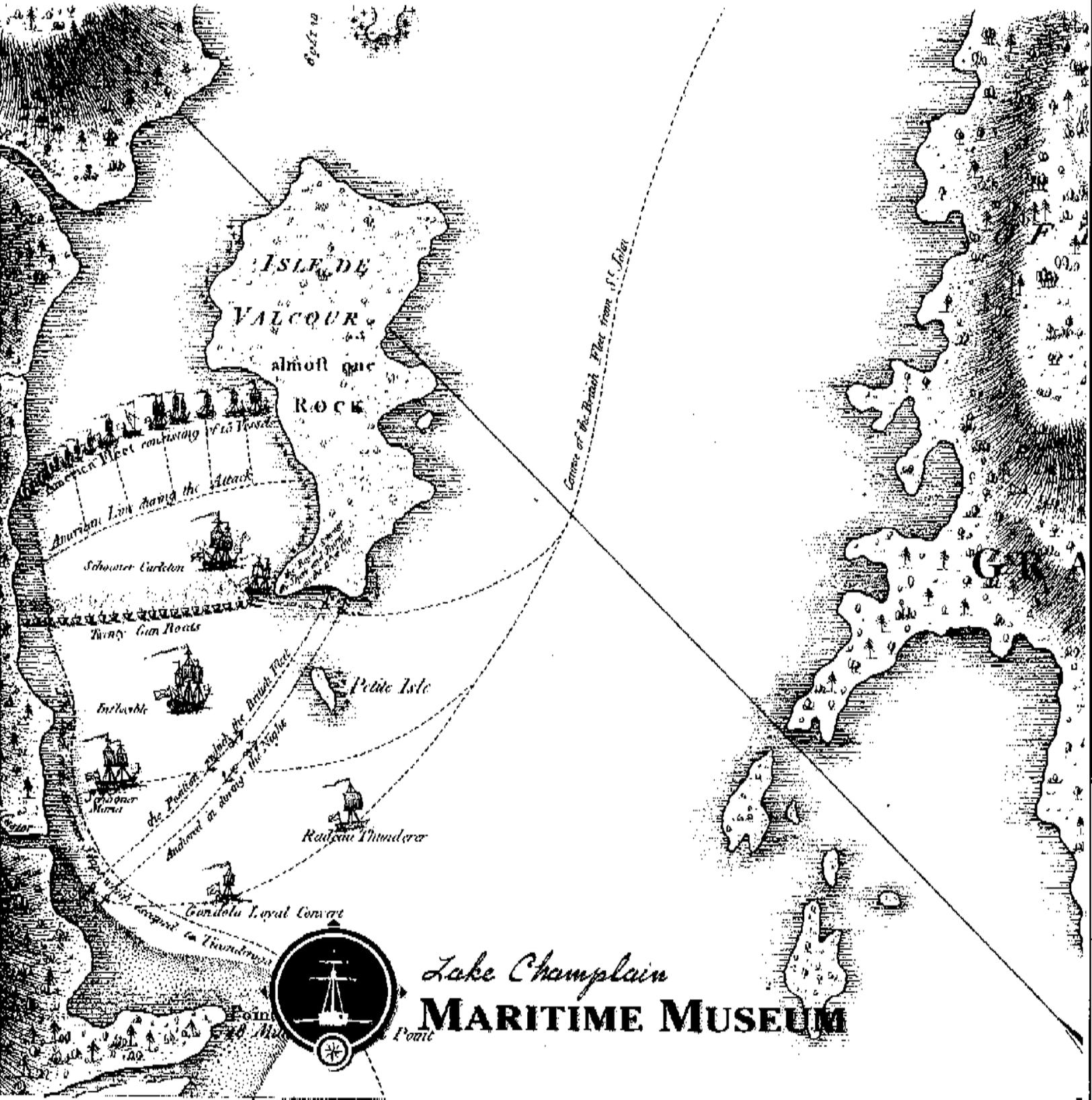


P<sup>te</sup>. Aqueductum

# Submerged Battlefield Protection Manual

Prepared by the Lake Champlain Maritime Museum



Lake Champlain  
**MARITIME MUSEUM**

Manual prepared by

**Lake Champlain Maritime Museum**

By Christopher R. Sabick & Joanne M. Dennis

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*Painted according to the original of William N. Barrett, in the Clerk's Office of the Dist. Court of the South Dist. of N.Y.*

2 1/2 PAGES 18 1/2 x 11 1/2

**M<sup>r</sup> DONOUGH'S VICTORY ON LAKE CHAMPLAIN.**

AFTER AN ACTION OF 2 HOURS, & 2 MINUTES.

*American Force. 14 vessels carrying 86 Guns, & 820 men.  
Loss. 52 killed, 58 wounded.*

*British Force. 17 vessels, carrying 95 Guns, & 1050 men.  
Loss. 84 killed, 110 wounded.*

*McDonough's Victory on Lake Champlain. Private Collection.*

**Kristen L. McMasters**

Grants Technical Representative, American Battlefield Protection Program

1201 Eye Street NW (2255) 6th floor

Washington, DC 20005

Kristen\_McMasters@nps.gov

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Lake Champlain Maritime Museum is a non-profit museum in Vergennes, Vermont with a mission to study, preserve and share the rich history and archeology of Lake Champlain. [www.lcmm.org](http://www.lcmm.org)

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# Introduction

Battlefield archeology has become an established archeological subfield over the last twenty years. Since the pioneering study of the Battle of Little Bighorn, Montana in the mid-1980s by Richard Fox, battlefield archeological studies have gone from using experimental methodologies to accepted practices. The study of battlefields provides a "unique insight into the anthropology of war....and can provide data on how decisions are made in the heat of battle" (Conlin and Russell 2006:22). America's historic battles left behind archeological evidence that help archaeologists and historians reconstruct, verify or dispute battle events that have become "common knowledge" in the history books. Richard Fox, one of the principal archaeologists of the Custer battlefield, has emphasized that archeological investigations help to establish a more precise understanding of a battle, as historic documents and oral histories are often incomplete or contradictory. He stresses that these sources of information may be accurate, but not necessarily precise (Fox 1997). Battlefield archeology provides a valuable tool for studying the tangible remains of historic events leading to a better understanding of their significance.

In the United States, many archeological battlefield studies and preservation efforts have focused on land-based battle sites (e.g. Battle of Little Bighorn in Montana; Coal Field War in Colorado). These battlefields have survived centuries of change and negative impacts, including modern development, artifact looting and destruction of surrounding landscapes. Battlefield preservation and research projects have aimed to commemorate and protect the places and landscapes where historic battle events took place. This is often a challenging task, but community awareness and government support has greatly assisted local preservation efforts in many cases.

Submerged battlefields have received little of the same attention or benefits that land-based battlefields have. The bottomlands of America's lakes, oceans, rivers and bays are not subject to the same development issues as land-based battlefield sites. These submerged sites are not tangible places to the general public, and are therefore often overlooked. Nevertheless, they represent battles and places of

great importance to America's foundation.

The American Battlefield Protection Program (ABPP) is a major supporter in the effort to study America's terrestrial and submerged battlefields and to protect them from current and future looting and destruction. The American Battlefield Protection Program Act was established in 1996 as a means of assisting "citizens, public and private institutions, and governments at all levels in planning, interpreting, and protecting sites where historic battles were fought on American soil during the armed conflicts that shaped the growth and development of the United States, in order that present and future generations may learn and gain inspiration from the ground where Americans made their ultimate sacrifice." Since then, funding has been granted each year to battlefield preservation projects around the country; submerged battlefield studies have benefited from this support.

However, the archeological study of submerged battlefields is not presently guided by explicit archeological methodologies or protocols. Submerged battlefields involve a different complexity and methodological basis than land-based archeology projects which use traditional survey techniques. It is for that reason that this manual was created. The current practices, projects and results of submerged battlefield studies are presented here. It is not written as an all-encompassing manual of how to carry out submerged battlefield archeology; rather, it is a guide for establishing a Battlefield Preservation Plan and Research Plan.

As this field of study evolves and submerged battlefield researchers and archaeologists are able to protect and study submerged battlefield sites more effectively, this manual can serve as a basis by which new projects formulate research and interpretive strategies. The myriad of considerations for project planning are presented (funding, environmental setting, research methodology, testing methodology, conservation considerations) and recommendations for further reading are offered.

# Research Potential of U.S. Submerged Battlefields

American battlefields are present in a variety of contexts, both historically and environmentally. The ABPP stresses that “each battlefield is a unique place with its own set of assets and challenges” (<http://www.nps.gov/history/hps/abpp/RevisedPlanGuidance.PDF>); there is not one set model for studying a particular battlefield or for establishing its preservation plan. This is true for both terrestrial and submerged battlefield sites; each exists in a differing landscape, context, and state of preservation.

Many of America’s historic battles made use of waterways as primary modes of transport and as territorial boundaries. Components of the Revolutionary War, War of 1812, Civil War, and World War II battles took place on the coastal oceans of the Atlantic and Pacific, and on inland rivers, bays and lakes. A large variety of maritime vessels, structures, munitions and fortifications were employed over the centuries, and many of these archeological remnants of war survive to this day. America’s eastern lakes, including the Great Lakes, Lake George and Lake Champlain, hosted numerous naval battles that helped to define our nation and have been the focus of many historic military studies based on the archeological evidence, such as shipwrecks, ordnance and forts. Each historic naval battle is unique based; they vary according to the historic context, the environmental context of the body of water, and the archeological remains that are the basis of submerged battlefield archeological studies. It is important to conceptualize the varying factors that make each battlefield unique prior to establishing the methodology and research objectives for the project. This section details some of the battle and battle site elements to consider.

## Environmental Context

The environmental context of any archeological site is just as important as its historic context. A battle’s logistics are dependent upon its location – on a river, lake, ocean or bay. This determines the site formation processes, and therefore the archeological methodology employed. Basic knowledge of the geological dynamics of an active river, a tidal bay or other bodies of

water and how these dynamics impact the landscape of the study site will allow a better understanding of the environmental context of the battlefield site and how these factors will influence archeological investigations. Projects will benefit from a basic consultation with a local geologist and/or geomorphologist that is familiar with the body of water.

## Varying Types of Naval Battles and Events

Many military actions throughout American history have had a waterborne component to them. Some battles took place completely on the water (i.e. the Civil War naval battle between the USS *Housatonic* and the H.L. *Hunley* off the shores of Charleston, South Carolina), while others involved both land and water components (i.e. amphibious landings such as the 1776 American retreat at Arnold’s Bay on Lake Champlain in Vermont.) Research designs and preservation plans must be customized to take into account the wide diversity of landscape. Additionally, differing battle tactics and strategies are reflected in the unique archeological remnants of the particular battlefield site. For instance the battlefield scatter from a Revolutionary War naval battle will differ greatly from a World War II naval battle due to radically different tactics and ordnance types employed.

The historical particulars of a battle gleaned from records and documents, combined with an understanding of the tactics and weapons employed at the time, will affect how the overall study area is approached, which methodologies are employed in studying the site, and how the archeological interpretation of the battle itself will contribute to a better understanding of the events of that time.

Additional considerations that will impact the study of a submerged battlefield are the historic contexts of the site. This includes the following considerations:

- A submerged battlefield may be part of a larger battlefield that extends onto land.
- A battle may have been stationed on land, but took place on the banks of a body of water, so parts of the battlefield are submerged.
- A battlefield site may have witnessed numerous battles over time.

# Jurisdictional Issues

The study of a submerged battlefield requires obtaining the proper permits and permissions. This involves both jurisdiction over the physical location of the battlefield, and ownership of the archeological remains that are to be studied. Within US waters there are a number of jurisdictional combinations to consider and they are listed below.

***In underwater battle sites, the actual artifacts, structures, shipwrecks and features fall under the ownership and jurisdiction of the United States military, or the foreign military to whom the items once belonged.***

It is important that any study of a submerged battlefield in American waters contact each governing entity that may have jurisdiction over the location of the battle site and the artifacts that lie on the bottomlands. The proper permits and permission to conduct work in the defined area are often prerequisites for obtaining project funding.

- The bottomlands of waters within the borders of the United States may fall under either state or federal jurisdiction, or in some cases both.
- Inland lake and river bottoms will almost always fall under state jurisdiction. This requires contact and consultation with the State Historic Preservation Office (SHPO) and the State Archaeologist.
- All navigable waterways within the US also fall under the jurisdiction of the Army Corps of Engineers.
- Coastal waters fall under state jurisdiction up to three nautical miles off shore.
- Bottomlands from 3 to 200 nautical miles offshore falls under the jurisdiction of the Federal government (see the United States Submerged Lands Act of 1953).
- Any work conducted in international waters should adhere to the standards set forth by the UNESCO convention of 2001 (<http://unesdoc.unesco.org/images/0015/001528/152883E.pdf>) and requires consultation with the nations involved in the battle.

# State and Federal Archeological Standards and Guidelines

Within the United States there are established archeological standards that may vary slightly from state to state. It is important to contact your local SHPO and familiarize yourself with their manuals, standards and procedures. This includes methodological standards as well as professional qualifications for administering an archeological study. Federal archeological and historic research standards should also be consulted, and are often similar to state standards. The National Parks Service Secretary of the Interiors Standards and Guidelines for Archeology and Historic Preservation can be found online. ([http://www.nps.gov/history/local-law/arch\\_stnds\\_0.htm](http://www.nps.gov/history/local-law/arch_stnds_0.htm))

Other sources that contain valuable information include:

National Historic Preservation Act (NHPA)

National Environmental Policy Act (NEPA) of 1969

National Marine Sanctuaries Act

U.S. State Submerged Lands Act

In general, *U.S. state submerged lands* (along ocean coasts) are considered those lands lying between the high or low tide line of a state and the seaward jurisdictional limit of the state, which is normally three nautical miles (except for Texas, Florida, and Puerto Rico within the Gulf of Mexico where the seaward jurisdictional limit is nine nautical miles).

*U.S. federal submerged lands* are considered those lands starting at the seaward extent of states' jurisdictional limits and extending further seaward to the extent of the U.S. Federal Exclusive Economic Zone (200 nautical miles).

The terms *intertidal lands* and *subtidal lands* are used somewhat consistently throughout the United States. In general, *intertidal lands* are considered those lands lying between the high tide and low tide while *subtidal lands* are considered those lands lying below the low tide. These functionally descriptive designations differ from the legal term *submerged lands*.

# Methodological Approaches

The study and preservation of a battlefield site requires long-term planning that takes into account a number of methodological approaches. The first step is to consult the National Parks Service manuscript *Guidance for Developing a Battlefield Preservation Plan* published in October of 2001 (<http://www.nps.gov/history/hps/abpp/RevisedPlanGuidance.PDF>) This document outlines important steps and considerations that help to garner local support and establish local partnerships during the preliminary stages of any battlefield study. It also assists in establishing long-term preservation goals for the battlefield site. Though this document is not specific to submerged battlefields and the different situations that these types of sites present, it still serves as a valuable tool for the initial stages of preservation planning that are an important prerequisite to any archeological study. Additionally, the ABPP emphasizes that “though many battlefields are nationally significant because the events that took place there had nationwide impacts, their fate is often determined at a local level.”

Below are some of the key factors this document emphasizes in Battlefield Preservation Planning.

Project planners should:

- Galvanize public attention about the need to protect the site and its surroundings.
- Educate and inform the public about this part of the community’s heritage and its continuing value.
- Clarify where the battlefield is located and inform property owners who own a piece of it.
- Locate, identify, and document historic features on the battlefield.
- Ensure that actions by the state and local governments enhance preservation of the site and minimize harmful actions.
- Encourage sensitive and compatible development in and around the battlefield.
- Demonstrate that battlefield preservation is a part of the community’s heritage and physical character contributes to local economic vitality.

- Address issues relating to land use regulation, tourism, interpretation, and design that affect the battlefield.
- Create an agenda for future preservation activities that will have broad support.
- Strengthen political understanding and support for preservation.

## Creating a Research Design

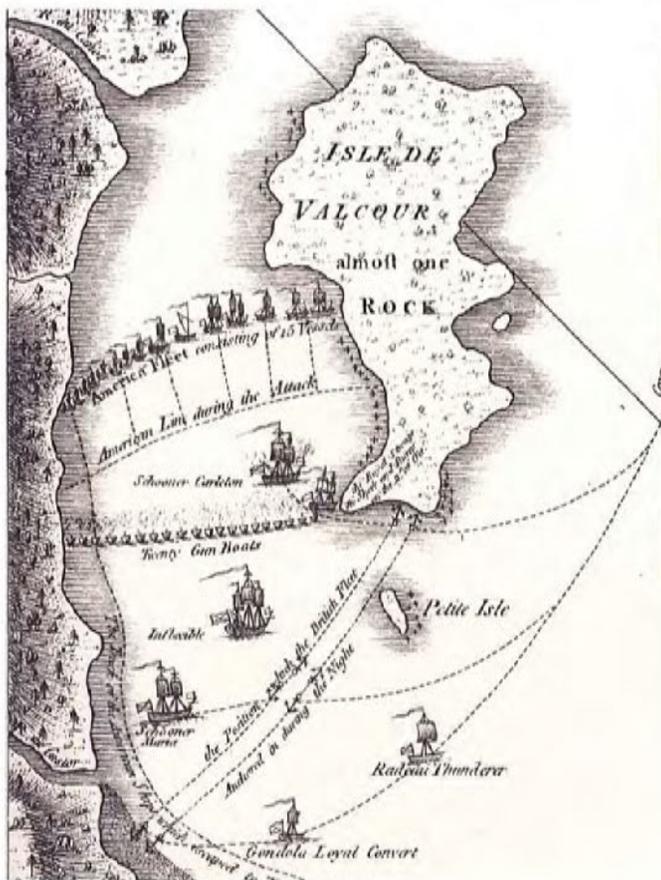
All archeological investigations begin with the creation of a Research Design document. Creating a Research Design involves outlining the goals of the overall project, with regards to planning, implementation, methodology and result reporting. This is different from the Preservation Plan in that it focuses on the methodology of carrying out an archeological study. This will guide the project from start to finish, be presented to state and federal officials that issue the permit for the project, and enable the many stages and components of the project to be detailed and presented to the community, potential partners and funding entities. It should complement the local and federal archeological standards and guidelines for carrying out an archeological and/or historical investigation.

## Developing an Historic Context

An Historic Context document should explore all of the available information on the site. In addition to a thorough investigation of the battle itself, it must also detail the history of the battle site before and after the battle event, as well as the history of the area in general. In order to fully understand the overall site, it is important to recognize the history of the site over time.

## Conducting Historic Research

Historic archeological research can be viewed as “checks and balances between two data sets [that] allow a more complete understanding of the nature of historical events” (Fox 1997:5). Historical documents can help identify the location of a battle and those historic individuals involved, but sometimes the ‘common knowledge’ about a battle events and places can prove to be inaccurate. One benefit of the archeological study of a battle is that it has the potential to provide an unbiased view of what happened at the



Both images depict the Battle of Valcour Island, October 16, 1776 on Lake Champlain. (left) William Faden, 1776; a primary source. (right) *Sinking of the Philadelphia*, Erinie Haas, 1991; a secondary source. (LCMM Collection)

site. The artifactual residue of both warring factions needs to be analyzed leaving aside the propaganda and the over-glorification of the narrative. How archaeological evidence is studied and most importantly, how it is interpreted, is of the greatest importance. It can and should be distinguished from the historical literary evidence, which is usually based on personal accounts of the event and is not always necessarily reliable. Few at a scene of conflict can give an accurate account of the entire event, as sites of conflict are by their very nature traumatic, confusing places that often cover large areas of ground. The larger picture of the conflict therefore depends upon a general overview and this was usually supplied by one of the leaders of one faction. Apart from the bias inherent in such a view, it also relies upon an interpretation of the event, rather than an objective account.

There are two types of sources to consult when conducting historic research: primary sources and secondary sources. Both are useful, but each requires cautious interpretation and critical analysis. The National Parks Service summarizes the applicability and value of these two sources:

*Often secondary sources are most valuable for gathering background information, while primary*

*sources are more useful to gather or confirm specific facts. Analysis of the accuracy and biases of source materials is critical in analyzing the information gathered from these sources. In general, the more the researcher knows about the general historical period and setting and limitations of the source materials under investigation, the better the individual is prepared to evaluate the information found in the documentary sources investigated. Peer review or consultation with other knowledgeable individuals about the information and the tentative conclusions can be an important part of the analysis.*

Below is a list of source types that fall under these two categories:

#### **Primary Sources**

- First-hand Accounts: correspondence (letters), writings (diaries, poems)
- Historical Records: town records, census records, military records, maps
- Eyewitness Accounts: these may be incomplete and contradictory, as the same event can be perceived very differently by two people, especially in the heat of battle.

Battle Maps: accuracy will depend upon the cartographer and how soon after the battle the map was created

### Secondary Sources

Paintings and Drawings

Battle Maps: maps that were produced by an individual who was not present at the conflict, or was drawn significantly after the battle

Books/Novels/Stories

Local Oral History: although informative, oral histories can change over many generations

## Archeological Fieldwork: Non-Disturbance Survey

There are a number of non-disturbance survey techniques that are common practice in underwater archeology. These techniques can be used to identify, survey, and delineate an underwater battlefield site with minimal impact on the site itself. Remote sensing tools are used to identify large artifacts and features related to the battle, such as a shipwreck or clusters of metal ordnance, while diver survey is more effective in mapping individual pieces of ordnance scattered across the site. This initial survey of the battlefield will define areas for further investigation and help identify actual areas of battle or components of battle. Below is a short description of geophysical and diver survey techniques that are commonly used in maritime archeology and information

on the effectiveness of these techniques in different environmental and historical contexts.

### Side-Scan Sonar

Side-scan Sonar is a remote sensing tool that is used for mapping the bottomlands of waterways. It is able to sense the topographical features of the land by emitting pulses of sonar toward the water bottom that then bounce back to the device as it is towed by a boat at the surface. The survey follows gridlines that allow overlapping coverage, and creates a map of the bottomlands. The location of anomalies on the bottom can be identified for further investigation. It is often used for the creation of bathymetry maps. This is an effective tool for identifying shipwrecks, structures and features associated with the battle, but it is not an effective tool for identifying and studying ordnance scatters and establishing project area parameters because it does not penetrate sediment and therefore buried items are easily missed. Also, side-scan sonar is not effective in waters shallower than 15 feet.

### Magnetometer

A magnetometer measures the strength and/or direction of a magnetic field in the vicinity of the instrument. It locates metal anomalies on the bottomlands, such as clusters of metallic objects. This is an effective tool in surveying battlefields since much of the ordnance and other objects used in battle were made with iron or other metals. A magnetometer can be used simultaneously with side scan sonar, and many towfish are designed to carry both pieces of equipment. However, it should be noted that a magnetometer requires closer lane spacing for the survey vessel than a sonar survey. A magnetom-



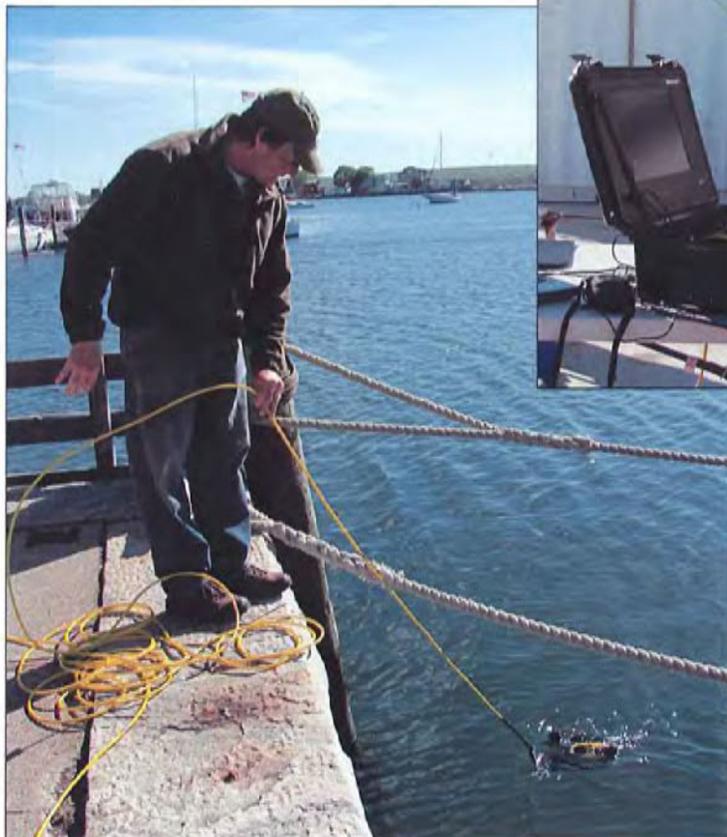
A magnetometer (above) and a side-scan sonar (right) can be useful tools for remote examination of a submerged battlefield site. (LCMM Collection)



eter does not create a visual map of the bottom lands like sonar; instead it identifies anomalies in conjunction with GPS coordinates that can then be mapped onto a sonar map of the bottomlands. The anomaly can then be examined by divers to determine if it is related to the battle. The value of a magnetometer survey may be limited by local environmental conditions. Recent magnetometer surveys carried out at Valcour Island Battlefield site on Lake Champlain, and at the site of the Battle of Lake Erie demonstrated the limited abilities of this technology to identify individual pieces of ordnance. It is unclear if they were unproductive due to the thick layer of sediment or other environmental factors.

### Sub-Bottom Profiler

Sub-bottom profilers use high frequency narrow band sonar to penetrate into the bottom and produce an acoustic image of items or features that are buried by sediment. While this technique has not been employed on a submerged battlefield site to date it has the potential to help locate buried items and delineate areas for more intensive study. This technology would be particularly useful in areas with high amounts of sediment deposition. It is unlikely that



it would be able to identify individual pieces of ordnance, though it would be capable of finding clusters of shot or larger buried features.

### Remotely Operated Vehicle

A remotely operated vehicle (ROV) is a tethered underwater camera that is controlled remotely at the surface. Some ROVs are equipped with other attachments to perform specific tasks. An ROV is an effective tool in the preliminary verification and documentation of submerged battlefield features, particularly in deep-water investigations where dive operations may be more technical, dangerous, and therefore expensive.

### Intra-site Archeological Study

Initial geophysical surveys of the battlefield site allow a basic delineation of the site boundaries, and identify areas that warrant more in-depth intra-site survey and documentation. The ultimate focus of an intra-site study will vary depending upon the nature of the

battle and the archeological remains. This would include such tasks as mapping ordnance scatters, excavating features, such as shipwrecks, or further investigating anomalies that could not be confidently identified during geophysical survey.

In almost all cases, intra-site investigations require diver verification and survey. In extremely deep waters the use of a remotely operated vehicle will assist in the verification process of larger features. Recent work by LCMM as part of the Valcour Bay Battlefield site has shown that geophysical survey alone is not an optimal methodology for identifying and studying ordnance



Remotely Operated Vehicles (ROVs) are available in a range of sizes, as small as this portable VideoRay unit, making them more accessible than ever before. (LCMM Collection)

scatter. It is more effective to identify larger features of the battle site during geophysical survey and plan for fieldwork that involves controlled archeological survey of the bottomlands, by mapping ordinance scatter within a grid system (see Case Studies, Valcour Bay, LCMM).

### **Visual Survey**

In areas that have a hard bottom with minimal silt deposition a visual diver survey may aid in locating battlefield artifacts. This search should be carried out in a systematic manner to insure thorough coverage of the search area. Typical underwater search patterns involve breaking an area down into grids or conducting circle searches using a line as a guide. Although this low-tech approach is not applicable in all environments, it has the advantage that it can be carried out by volunteer divers with little or no training.

### **Metal Detector/Team Survey**

Sometimes a diver survey using a handheld metal detector may be the most effective survey technique. Similar to land-based archeological survey, a systematic grid is established over the battlefield site and divers survey the area using a handheld metal detector. The gridded area is typically sub-divided into narrow lanes. These lanes keep the detector teams on the right path and allows for a small amount of overlap with the lanes to either side. This system insures thorough coverage of the bottom lands but is both labor and time intensive. When the detector indicates a metal object, the diver can then record its location. This type of survey is greatly aided by the use of volunteer divers who can be trained in the use of underwater metal detectors. An archaeologist may then be able to identify and document the artifact on the bottom, recover it temporarily for documentation and redeposition, or with the proper permits, recover the artifact for conservation.

### **Feature Documentation and Survey**

Some submerged battlefield studies focus primarily on shipwrecks associated with a battle. The documentation and excavation of a submerged shipwreck can be carried out following acceptable procedures that are detailed in many shipwrecks studies. Documentation of complex structures underwater should be carried out by archaeologists or volunteer divers that have had extensive training and experience.

## **Volunteers and Cultural Stewardship**

Many underwater archeology projects have found success through the incorporation and cooperation of local divers, dive organizations and those interested in the maritime history of their region. Just as land archeology is complex and requires patience and thoroughness, underwater archeology projects have the added logistics of underwater operations. The volunteer effort of trained scuba divers is a valuable asset and should be considered an important component to help carry out a project. Professional nautical archaeologists should initiate a system in which the local dive community has the opportunity to participate in underwater archeology projects in their area. This initiative is a crucial step in assuring that the local dive community is made aware of the fragile state of underwater cultural resources, and the great strides that archaeologists and government organizations take to assure the proper protection, study and access to these vulnerable resources.

It is important to consider the skill of each volunteer diver since this component will greatly affect how each individual can contribute. An experienced diver may only need to learn the basics of archeological investigation in order to be of great help. Underwater archeology classes can be offered through local dive shops and educational institutions, or each individual project can train the group of volunteers on the basics of underwater archeology. For instance, documenting a shipwreck requires the specialized knowledge of an underwater archaeologist, while surveying an underwater battlefield with a metal detector may be performed with modest training. Each project will have specific logistics to be considered when selecting and training volunteers.

One long-term benefit to using volunteer divers is an opportunity to develop a sense of cultural stewardship in the community. Recreational divers often already have an interest and knowledge in the submerged cultural resources, but involving them in archeological projects empowers them to be stewards. Long after the fieldwork is completed, these divers continue the message of the importance of documenting and preserving these finite resources.

# Archeological Interpretation

The interpretation of the archeological remains at a battlefield site should consult a few established military and theoretical models of battle. Archeological study and theory of battlefields is based on the premise that warfare is:

*one of the most organized, premeditated, regimented, and patterned forms of human behavior...the actions of military units on a battlefield are based on the tactics of the prevailing military wisdom of the day; they are not random. Therefore, one should not expect the debris of battle to be distributed randomly over a battlefield. The tactics employed on a battlefield do leave their traces in the archeological record. Subsequently, if natural forces or human activities do not significantly disturb, mix, or mask all or parts of the battlefield, it should be possible to identify and define artifact patterns created by the tactical positions and movements of individual military units.*

(Potter et al., 2000:13 emphasis his; from Conlin and Russell 2006:22)

There are two theoretical models of battle that are frequently consulted during the analysis of terrestrial battle remains, and used in the interpretation of these remains into combat behavior. Such models help to bridge the spatial and temporal relationships of the battle location and the archeological remains with combat behavior and events. These models are not totally applicable to the study of most submerged battlefields but are still worth reviewing. They are described below.

## Stability/Disintegration Models (Fox)

The Stability/Disintegration model was developed by Fox in the study of the Battle of Little Bighorn site. He based this model on the fact that:

*The success of modeling in discerning combat behavior is somewhat dependent on the proposition that there will be no two distinctly different sets of actions responsible for the same archeological patterning. Whereas tactics and technologies have changed dramatically over the centuries, behavior in war has remained remarkably predict-*

*able in fundamental ways. Either men fight or they do not. When armies fight, their actions are predictable. Tactics govern their behavior. The will to fight, prompted by leadership, sustains men in battle. When this will is lost, unity disintegrates, and defeat invariably ensues. Behavior resulting from collapse is also predictable. Shaped by this dichotomy, then, combat can be modeled on the basis of tactical stability and tactical disintegration, or stability/disintegration. Certain expectations in behavior attend each of these conditions of warfare. The archeological record should reflect these conditions.*

(Fox 1997, 39-40)

Additional information on Fox's model and its application to battlefield studies can be found in his many books on the Battle of Little Bighorn site.

## KOCCOA (National Park Service)

KOCCOA is an acronym for the systematic analysis of key battlefield terrain features that is used by military personnel in battle planning: Key Terrain, Observation and Fields of Fire, Cover and Concealment, Obstacles, and Avenues of Approach. This type of analysis has been used by military commanders for hundreds of years and continues to be employed today (though under differing names). The understanding of the military value of key terrain features and how they would have been exploited by historic commanders and troops can help archeological investigators focus on areas of a battlefield that are likely to contain significant battle residue. In brief these five battle/landscape components encompass:

Although the overarching ideas of the stability/disintegration model are wholly applicable to a submerged battlefield, both of these models need modification before they can be applied to the analysis of a submerged battlefield. While the majority of the universal military truths defined in the Stability/Disintegration model can be applied directly to submerged battlefield analysis it should be noted that naval units do not "disintegrate" in the way a field unit would. Ships and their crews live, fight, win, or lose as a unit unlike a land unit that can disintegrate into a mass of individuals.

The National Park Service developed the model **KOCCOA**, an acronym for the systematic analysis of key battlefield terrain features that is used by military personnel in battle planning.

**Key Terrain** is defined as “any locality or area that affords a marked advantage to whichever combatant seizes, retains, or controls it”.

**Observation** is defined by what can be seen from a given feature. Key observation points can either be natural or man-made.

**Cover and Concealment.** “Cover is protection from enemy fire. Concealment is protection from enemy observation.” In reference to a land-based battle, cover may be provided by small scale

features such as stone walls, buildings, or sunken roads, while concealment is provided by large scale features such as woods, hills, and ridges.

**Obstacle** “Any natural or man-made feature that prevents, delays, or diverts the movement of military forces.” Such a feature serves both to assist defenders and to impede attackers, and includes natural features such as rivers, ravines and forests, and man-made features such as fences, buildings, or field fortifications. In short, an obstacle

may be anything which hinders the timely and orderly movement of military forces in combat.

**Avenues of Approach** are any natural or man-made features which allow the attacking force to “get at” the defending force. During the build-up to battle this would include roads and railway lines, once a battle was engaged, tactical avenues of approach utilized by infantry and artillery units could be local roads, farm lanes, or open fields.

### **Key Terrain**

This component of the KOCCOA system must certainly be considered for those battles that have a land component. For purely naval battles, the key terrain might be more accurately referred to as the weather gauge. In the age of fighting sail the vessel or fleet that gained the upwind position, or weather gauge, controlled the battle and was able to determine when and where to engage the enemy. While controlling the weather gauge wasn't essential to victory it greatly enhanced one's chances of success. The same could be said for the upstream force in a battle that took place on a river.

### **Observation**

This component has only nominal application to a ship-on-ship conflict. The most common point of observation on a ship is from the top of the masts. With the flat plane of the ocean in front of them a sailor at the mast head can see to the curvature of the horizon. The taller the mast the further you can see. But as these vantage points are a part of the vessel itself they will have no impact on artifact distribution.

### **Cover and Concealment**

In a land battle, cover consists of any feature or object with which troops can shield themselves from enemy fire. In a naval conflict the ships carry cover with them in the form of the sides of ships (bulwarks) which offer some cover for the sailors and marines on deck. Merchant vessels that are pressed into naval service often have low bulwarks which offer no protection at all. This cover travels with the vessel and

therefore has little impact on artifact distribution on the battlefield.

Concealment could play a vital role in how ships were deployed during the course of a battle. Islands, points of land and other land forms could be used to conceal vessels or even entire fleets. Understanding what features might be able to hide a vessel may help to focus a search area on the battlefield site.

### **Obstacles**

In a naval battle obstacles can take on a number of forms. Natural obstacles can be islands, reefs, shoals, shallow water, high current or rapids, high winds or lack of wind, low overhangs, etc. Man-made obstacles include mine fields, intentionally sunken vessels, breakwaters, dams, floating bridges or chain booms, etc. These obstacles can significantly impact the flow of a battle by channeling forces into, or away from, a particular area. These strongly impact the KOCCOA component Avenues of Approach.

### **Avenues of Approach**

This component of KOCCOA has little application to the naval battlefield. The ships involved in the battle are their own transportation and other than the obstacles and possibility for concealment mentioned above, there is very little that will influence the path of the combatants. Perhaps it would be possible for a canal to be used as an avenue of approach, even if that canal were not constructed for that purpose. Dredging may also be used to widen the opportunities for approach.

## Case Studies

A number of in-depth submerged battlefield projects have been launched in recent years and these pioneering projects have helped to establish archeological methodology and protocols for these types of site. All are multi-year endeavors and represent different environmental conditions, battle types and survey methodologies that can be employed in submerged battlefield studies. This section provides a short description of these projects, with a brief story of the battle, and the research that has shed new light on these historic events.

### Valcour Bay, Lake Champlain Lake Champlain Maritime Museum

On October 11, 1776 at Valcour Bay on Lake Champlain, General Benedict Arnold engaged the British Navy in perhaps the most important naval contest of the American Revolution. After an intensive five-hour battle with heavy casualties on both sides, darkness ended the conflict. With some 60 men killed and wounded on the American side and three-quarters of their ammunition gone, Arnold and his officers executed a daring nighttime escape past a British blockade. Two days later, on October 13th, the British fleet caught up with Arnold and a second running battle ensued. Outgunned and surrounded, Arnold deprived the British of battle prizes



The VBRP is an ongoing project utilizing volunteer sport divers to systematically metal detect a submerged Revolutionary War battlefield on Lake Champlain. (Dick Heilman & Pierre LaRocque, LCMM Collection)

by intentionally destroying five of his own vessels at the spot known today as "Arnold's Bay" and escaped south to Fort Ticonderoga. These engagements deposited an invaluable collection of Revolutionary War materials on the bottomlands of Lake Champlain.

For more than a century, the submerged battlefield at Valcour Bay has witnessed numerous efforts to locate and raise archeological materials by interested, though archeologically untrained individuals. The non-systematic collection of historic artifacts from this area has led to the undocumented dispersal of a priceless archeological collection around the region and nation. But in 1999 a cannon was discovered in Valcour Bay, triggering the start of the Valcour Bay Research Project (VBRP). The VBRP is a cooperative effort between a dedicated team of volunteer sport divers and the Lake Champlain Maritime Museum.

The project has three objectives: 1) to systematically map the artifact scatter associated with the Battle of Valcour Island in order to gain a greater understanding of the battle, its participants, and site formation processes; 2) to interpret the history of the Battle of Valcour Island for the public; and 3) to incorporate local divers into the survey crew, thus instilling in them a sense of stewardship for the site and for submerged cultural resources in general.

By the end of the 2004 field season a total of 185,000ft<sup>2</sup> (17,187m<sup>2</sup>) of bottomlands had been surveyed, locating 209 Revolutionary War era artifacts, as well as 22 items from the recovery of the gunboat *Philadelphia*. The artifact scatter contains an area of debris resulting from the explosion of a cannon onboard the gunboat *New York*.

The first objective of the VBRP was implemented through a systematic inspection of the bottomlands of Valcour Bay using hand-held metal detectors.

## Penobscott Bay, Maine, Naval Historical Center

In June of 1779 the government of Great Britain established a new colony for loyalists fleeing the rebellious American colonies in New England. A fortification was built at the present-day town of Castine, Maine (formerly Massachusetts), at the mouth of the Penobscot River. On July 24, 1779 American naval and land forces, known as the Penobscot Expedition, entered Penobscot Bay and laid siege to the British fort. A month later the Americans were forced to retreat up the Penobscot River as a British relief squadron arrived on the scene. The American fleet was quickly overtaken, scuttling most of their ships to prevent their capture.

The location of the remains of a wooden shipwreck in shallow water just off the eastern shoreline of the Penobscot River in the 1990s initiated the first phase of the Penobscot Expedition Archaeological Project. Led by the University of Maine Darling Center, the Maine Historic Preservation Commission and the Underwater Archaeology Branch of the Naval Historical Center (NHC), this multi-year project began with a survey of what came to be known as the Phinney Site in the fall of 1999. Analysis of the small wreck and its associated artifact assemblages led NHC archaeologists to conclude that the site represented the remains of the

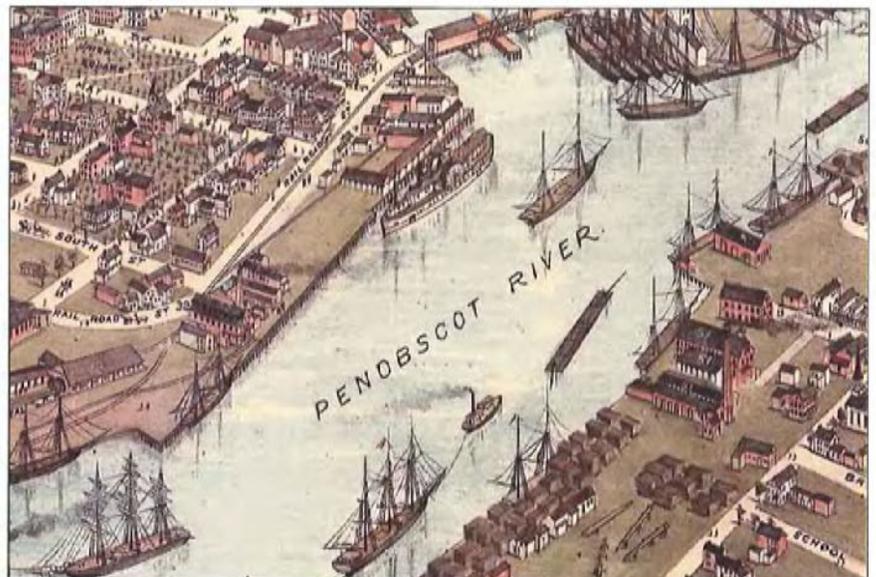
Focusing on the area of the bay where the American line was located, a depth range of 25ft to 55ft (7.62m to 16.8m), the bottomlands were divided into 50ft by 50ft (232.3m<sup>2</sup>) areas. These grids were surveyed along transects spaced at 3ft (.91m) intervals. Crew members used metal detectors to locate buried metallic objects. When an artifact was located, its provenience was recorded, and its location plotted on the master site map. The survey methodology ensured 100 percent coverage within each grid. During the survey, significant artifacts were raised from the lake bottom, photographed, measured, and then reburied in the same location from which they originated. Artifacts such as cannon balls and shot were not raised, but only measured and plotted on the site map.

The second objective of the VBRP, the interpretation of the battle to the public, was met through the recovery and display of a number of artifacts from the site. The artifacts were recovered under a permit issued by the Naval Historical Center and stabilized at the LCMM Conservation Laboratory which is open to the public. These materials were incorporated in the traveling exhibit "Valcour Bay Research Project: Rediscovering a Moment in Time."

The third objective of the VBRP was to incorporate local divers into the survey crew. The moderate depth of the site, and a workplan that included basic tasks opened up volunteer opportunities to even novice divers. The VBRP's volunteer base of recreational divers has remained strong during each year of the survey, due largely to extensive teambuilding efforts; volunteers have committed thousands of hours to the project. These volunteer divers are now outspoken advocates for the preservation of this historic battlefield. Some of these recreational divers regularly present our joint research to their community. This cultural stewardship is contagious, and could be the most significant measure of this project's success.

For further information:

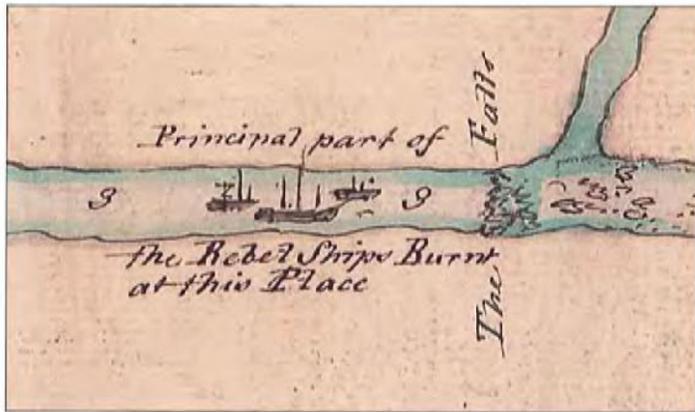
Lake Champlain Maritime Museum  
<http://lcmm.org/mri/projects/vbrp.htm>



Bird's eye view of the City of Bangor, Penobscot County, Maine, 1875, showing the location of the Penobscot Expedition Archaeological Project. Augustus Koch, Library of Congress Geography and Map Division, Washington, D.C.

ill-fated American fleet of the Penobscot Expedition.

It is believed that roughly 30 watercraft and various artillery and munitions scatters associated with the Penobscot Expeditions remain in the Penobscot Bay and River system; however, this area is highly populated and is threatened by erosion, development and looting.



Detail of 1780 map of Penobscot River, showing the approximate location of burned American vessels below the falls at Bangor. From the map *Penobscot River and Bay, with the operations of the English fleet, under Sir George Collyer, against the division of Massachusetts troops acting against Fort Castine, August 1779; with full soundings up to the present site of Bangor*. Author unknown. Library of Congress Geography and Map Division, Washington, D.C.

The Naval Historical Center initiated an intensive 10-day magnetometer survey along the Penobscot River in 2002 with the intent to locate the remains of at least ten American vessels and to pinpoint the wrecks of nine other smaller craft. Consequently, a large percentage of the navigable upper reaches of the Penobscot River have now been magnetically investigated. The survey identified approximately 700 localities, many of which exhibit magnetic signatures consistent with the size, duration, and complexity expected of historic shipwreck remains.

In March 2003, the Maine Historic Preservation Commission requested that the Underwater Archaeology Branch submit a letter report to the Maine Department of Environmental Protection (MDEP) that outlined the results of the Underwater Archaeology Branch shipwreck surveys conducted at Dunnet's Cove (near Bangor) in 2000 and 2002. The riverbed in Dunnet's Cove is slated for MDEP-sponsored hazardous material cleanup and mitigation projects to

remove large quantities of viscous coal tar that leaked into the cove from a nearby coal gasification plant.

For further information:

Naval Historical Center, Underwater Archaeology Branch  
[http://www.history.navy.mil/branches/UA\\_Penobscot.pdf](http://www.history.navy.mil/branches/UA_Penobscot.pdf)

## Putt-in-Bay Lake Erie Great Lakes Historical Society

During the summer of 2009 a team from the Great Lakes Historical Society initiated an examination of the Battle of Lake Erie Battlefield. In September of 1813 the British and American fleets that were struggling for control of Lake Erie met in pitched battle in the western end of the lake. The battle was a resounding American victory which resulted in the surrender of the entire British Fleet. The battlefield survey is in its preliminary phase and has consisted of sonar and magnetometer surveys. The survey area studied was approximately 3.5 mi<sup>2</sup> (9.1km<sup>2</sup>) and lane spacing for the survey was reduced to 50ft (15.24m) in hopes of detecting pieces of ordinance with the magnetometer. Results of the preliminary surveys have demonstrated the limitations of the current remote sensing equipment. While a number of targets were located and diver verified none of them turned out to be contemporaneous to the battle. The staff from the Great Lake Historical Society are reassessing their search area and planning for future examination of the battlefield.

For further information:

Great Lakes Historical Society  
<http://www.inlandseas.org/plesrc/index.html>

## USS *Arizona* (National Park Service) and other Pearl Harbor Studies

The site of the World War II attack on Pearl Harbor (December 7, 1941) is the only modern-day submerged battlefield on American soil and the only study of a modern war site in the US. Located off the southern coast of Hawaii's Oahu Island submerged below the Pacific Ocean, the archeological remnants of Pearl Harbor are represented by two large features: the wrecks of the USS *Arizona* and the USS *Utah*.

Study of this battlefield site began in the early 1980s with the mapping and photo-documenting of these vessels. Under the direction of the Submerged Resources Center of the National Park Service, this project involved highly experienced archeological divers and illustrators at a time when nautical archeology was at its infancy. Additionally, as a grave of nearly 1,000 U.S. servicemen and a highly respected war memorial site, the NPS was also tasked with develop-

ing a management plan for this battle site; there was no precedent for this type of project.

A sonar and magnetometer survey helped to delineate the battle site boundaries and the precise location of the vessels. Thousands of measurements were taken while working in water depths of 45ft (13.7m) with only 6ft (1.8m) of visibility. This was a daunting task, considering the USS *Arizona* is 608ft (185m) long with a beam of 97ft (30m).

Additional sonar and magnetometer survey was carried out to locate other battle related features outside of the harbor that had Japanese affiliation. Priority areas were selected based on historical research in the search for submerged Japanese aircrafts and mini-submarines. However, following World War II the US military scuttled many obsolete war materials off Pearl Harbor. Therefore, sonar survey of the area returned thousands of sonar targets interspersed among what could have been the mysterious mini-

subs. It was not until 2006 that a Japanese mini-sub was identified during routine training dives by the Hawai'i Undersea Research Laboratory. An international agreement signed on February 12, 2004 between the governments of Japan and the United States allowed for the National Ocean and Atmospheric

Administration (NOAA) to be the lead agency in an effort to protect and manage an historic sunken Japanese midget submarine that played a key role in America's entry into World War II. The primary plan is preserve the vessel in place.

For further information:

National Park Service Submerged Cultural Resources Study: USS *Arizona* and Pearl Harbor National Historic Landmark  
<http://www.nps.gov/archive/usar/scrs/scrst.htm>

Hawai'i Undersea Research Laboratory  
<http://www.soest.hawaii.edu/HURL/midget.html>

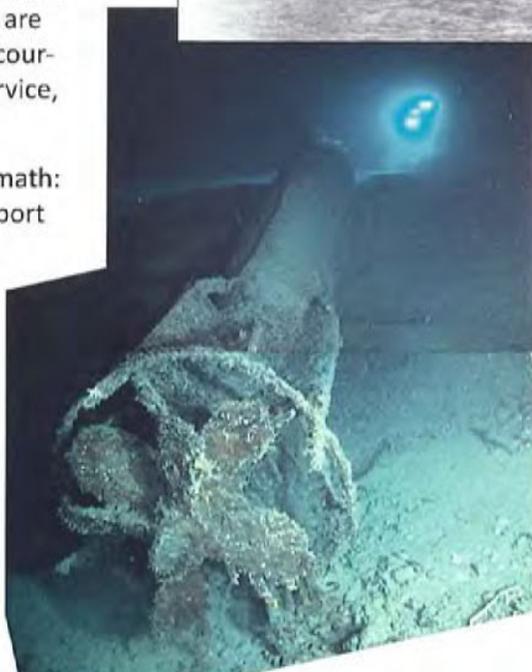


(Above) The USS ARIZONA from the air. Note that 14-inch guns of No. 1 turret are not visible. (Photo courtesy of Hawaiian Service, Inc.)



(Right Above) Aftermath: The ARIZONA from port bow looking aft. (National Park Service: USAR Collection).

(Right Below) Mosaic image of the stern of the midget submarine. (Hawai'i Undersea Research Laboratory, Terry Kerby)



## Ogeechee River/Georgia Panamerican Consultants

In 2007 Panamerican Consultants, Inc, in cooperation with the Georgia Preservation Division, under the Georgia Department of Natural Resources, carried out an underwater battlefield survey on the Great Ogeechee River in Georgia. The survey focused on Fort McAllister, the site of multiple Civil War naval and land battles, as well as the Revolutionary War battle of Ogeechee Neck. As a primary route to the city of Savannah, the Confederate Army established Fort McAllister on the Ogeechee River in an attempt to prohibit passage of Union ships en route to the city. Eight separate attacks on the fort ensued.



CSS *Nashville* burning after Union bombardment, Feb. 28, 1863 (Historic Preservation Division, Georgia Department of Natural Resources, taken from Panamconsultants.com).

The underwater survey project included archival research on the fort, remote sensing in the waters surrounding the fort, data analysis and GIS analysis. Five areas were surveyed within the 20mi (32.2km) project area, a total of 170 line miles (273.6km) at 50ft (15.24m) intervals. The survey included the areas that comprised the naval engagements, the location of the CSS *Nashville*, and a shoreline survey of the upriver portions of the Ogeechee. The magnetic data collected during the magnetometer survey was sorted for anomalies of high strength and short duration, characteristics that are attributable to a very localized and very high ferrous content of the shot in question.

For further information:

Panamerican Consultants  
<http://panamconsultants.com/ogweb/index.html>

## H.L. Hunley / USS *Housatonic* Naval Engagement site

A Civil War battle site off the coast of South Carolina offers a unique example of a submerged battlefield. Unlike other sites that have ordinance scatters and multiple features, this site consists of only two features: the Confederate submarine H. L. *Hunley* and the Union blockader USS *Housatonic*. USS *Hunley* became the first successful combat submarine in the world when it sank USS *Housatonic* in 1864 off the coast of South Carolina. Apparently *Hunley* was damaged in its attack on *Housatonic* and it also sank immediately after the engagement.

A 1995 magnetometer survey to locate H. L. *Hunley* initiated the H. L. *Hunley*/USS *Housatonic* Naval Engagement Site Research Project. Discovery of the confederate submarine was followed by a non-disturbance survey of the site in 2006 that used remote sensing techniques such as side-scan sonar, survey depth sounder, sub-bottom profiler and a RoxAnn bottom classification device. Researchers knew of the historically recorded site of the *Housatonic*, and both wrecks were then treated as “complementary components of a single archeological site, a battlefield affected by similar cultural and natural processes” (Conlin and Russell 2006:20).

For further information:

David L. Conlin, Matthew A. Russell, *International Journal of Nautical Archaeology*, Volume 35, Issue 1, pages 20–40, April 2006.

Friends of the Hunley  
<http://www.hunley.org/>

# Conclusion

The study of submerged battlefield sites is still an evolving field. Currently the practice is largely adapted from techniques that have been successfully employed on terrestrial battle sites. Nautical archaeologists modify the KOCOA and Stability/Disintegration models to make them applicable to the underwater environment, and to the deposition patterns of naval combat. This shapes and guides the survey planning, and when paired with detailed historical research, greatly enhances our understanding of the conflict events.

In the future as more sites are examined, new techniques and technologies will be developed that specifically address the challenges of submerged battlefields. Advances in underwater robotics, diving techniques and equipment, and remote sensing methods may propel the field of submerged battlefield studies even deeper than we can now imagine. The ongoing exploration and protection of these historic sites will bring to light the stories of the men and women who made the ultimate sacrifice in America's armed conflicts.

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<http://unesdoc.unesco.org/images/0015/001528/152883E.pdf>

*Guidance for Developing a Battlefield Preservation Plan*

National Park Service American Battlefield Protection Program, October 2001  
<http://www.nps.gov/history/hps/abpp/RevisedPlan-Guidance.PDF>

The Unesco Convention on the Protection of the Underwater Heritage  
<http://unesdoc.unesco.org/images/0015/001528/152883E.pdf>

*Standards and Guidelines for Archeology and Historic Preservation*

National Parks Service Secretary of the Interiors  
[http://www.nps.gov/history/local-law/arch\\_stnds\\_0.htm](http://www.nps.gov/history/local-law/arch_stnds_0.htm)

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<http://panamconsultants.com/ogweb/index.html>

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<http://www.lcmm.org>

Friends of the Hunley  
<http://www.hunley.org/>

Colorado Coal Field War Project  
<http://www.du.edu/ludlow/index.html>

Great Lakes Historical Society  
<http://www.inlandseas.org/plesrc/index.html>

National Park Service Submerged Cultural Resources Study: USS *Arizona* and Pearl Harbor National Historic Landmark  
<http://www.nps.gov/archive/usar/scrs/scrst.htm>

Hawai'i Undersea Research Laboratory  
<http://www.soest.hawaii.edu/HURL/midget.html>

A  
SURVEY  
OF  
LAKE CHAMPLAIN,  
including  
THE GEORGE, CROWN POINT AND ST. JOHN.

Surveyed by Order of  
CELLENCY MAJOR-GENERAL S<sup>r</sup> JEFFERY AMHERST,  
Knight of the most Hon<sup>ble</sup> Order of the Bath,  
Commander in Chief of His Majesty's Forces in North America,  
(now LORD AMHERST)

BY  
WILLIAM BRASSIER, DRAUGHTSMAN.

1762.

British Miles.



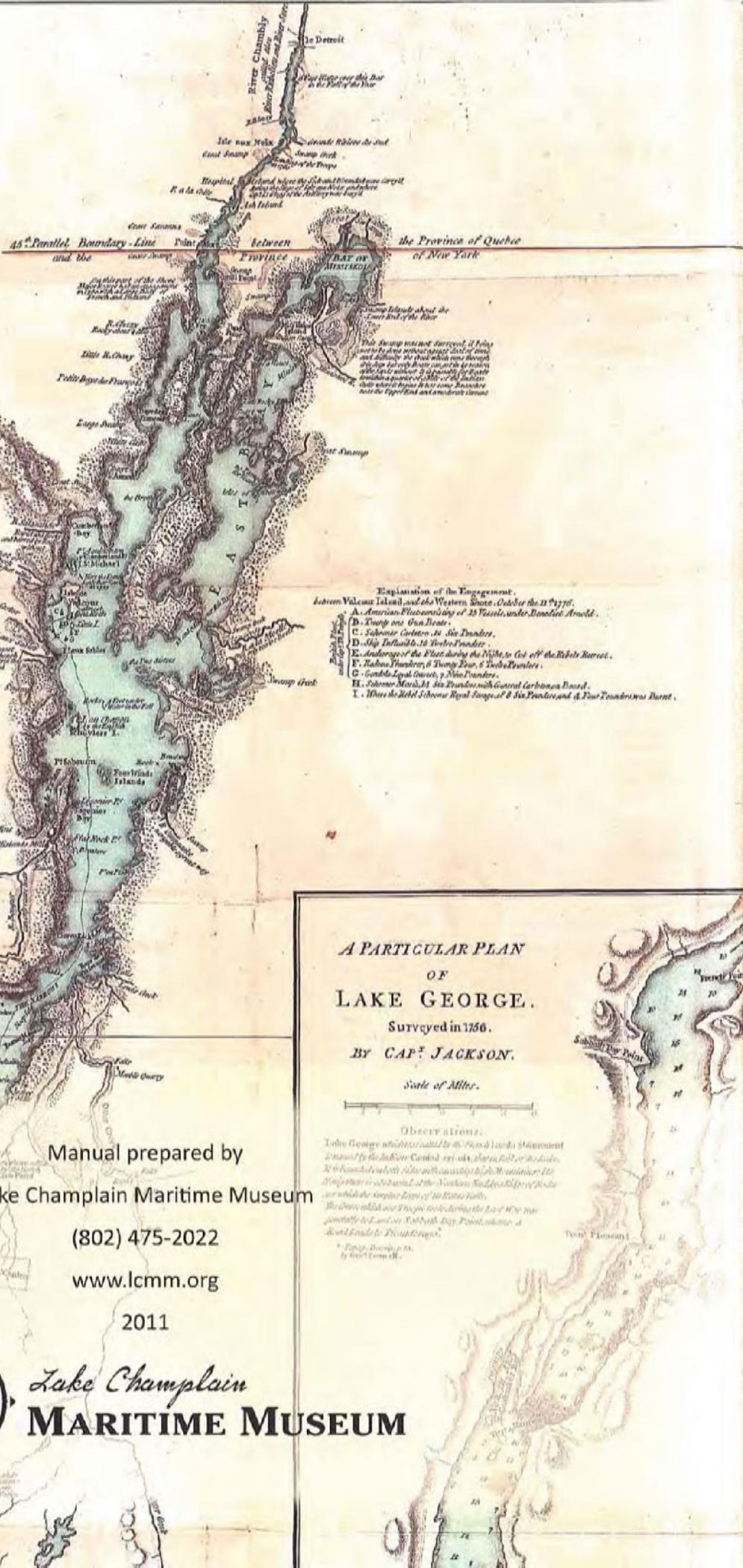
Places whose Latitude has been Observed.

Crown Point 45° 50' 7" }  
More Point 45° 0' 0" }  
157 Topog. Descr. of

OBSERVATIONS.

Lake Champlain in which the Dutch formerly gave the name of Corlaire, is called by the Indians Caniad erri - Guarunte signifying The Mouth or Door of the Country. It lies in a Deep Narrow Chasm of the Land, bounded up to the Waters Edge with Steep Mountains on the Western Shore, which continue thus to bound it as far as Cumberland Bay; the Branches of the Mountains then branch off North West, and the Shore is Low, and in many parts Swampy. Many Streams, some of which at times Issue in an Abundance of Waters full into this Lake on the West Side, but they cannot be called Rivers, they are mere Cataracts and so barred with Rocks and Sand there is no entrance to them. The Eastern Shore is formed by a low Swampy Tract of Land; the Mountains leap off at the distance of about 12 Miles. There are some considerable Streams which fall into the Lake on this Side. Otter Creek is the Largest. The Soundings of the Lake are very deep in general; in many Places 60, 70 and some parts 100 Fathoms.

\* See Topographical Description by Genl. Pennack p. 46.



Explanation of the Engagement, between Valcour Island, and the Western Shore, October the 11<sup>th</sup> 1776.

A. American Fleet consisting of 33 Vessels, under Benedict Arnold.  
B. Knapp one Gun Boat.  
C. Schooner Golden, 24 Six Pounders.  
D. Light Inflated, 10 Twelve Pounders.  
E. Landings of the Fleet during the Night, to get off the Rebel Barricade.  
F. Rebels, Thunders, 8 Swamp Boats, 4 Twelve Pounders.  
G. Corbets, Light Boats, 2 Nine Pounders.  
H. Schooner March, 11 Six Pounders with General Carletons Board.  
I. Where the Rebel Schooner Royal Sloop, of 8 Six Pounders, and 4 Four Pounders was burnt.

A PARTICULAR PLAN  
OF  
LAKE GEORGE.  
Surveyed in 1766.  
BY CAP<sup>t</sup> JACKSON.

Scale of Miles.  
0 10 20

OBSERVATIONS.  
Lake George which is called by the French La Grande Montaigne is named by the Indians Corlaire - erri - erri, the name of the Lake. It is bounded on both sides with mountains, the Western Mountains are the highest, and the Eastern lower, the latter are called the Eastern Hills. The distance between the two mountains is about 12 Miles. The Soundings of the Lake are very deep in general; in many Places 60, 70 and some parts 100 Fathoms.

Manual prepared by  
Lake Champlain Maritime Museum  
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2011



Lake Champlain  
MARITIME MUSEUM