Wisconsin's
UNDERWATER HERITAGE

Vol.20 No. 2 *A publication of the Wisconsin Underwater Archeology Association* *June 2010*

GPS For Amateur Underwater Archeology

by Dick Boyd
with photographs by R. Bennett and G. Kent

Around the Great Lakes, the Global Positioning System (GPS) has become the gold standard among boaters, fishermen, wreck divers and underwater archeologists for routinely locating various marine sites, above and below water. The predecessor of GPS, LORAN (Long Range Navigation), was the first truly accurate and reliable electronic navigation / location system to be accepted and trusted by underwater explorers. Based on radio signal triangulation, LORAN regularly had precision of about plus or minus 15 feet anywhere within the lake basins. Unfortunately, LORAN was frequently plagued by poor meteorological conditions and also suffered occasional transmitter failures. Between 1978 and 1994, the U. S. Defense Department created the Global Positioning System (GPS), based on 24 satellites that emit high frequency signals timed by an atomic clock that can be detected by low power receivers anywhere on Earth. By timing the incoming signal from three satellites and knowing the exact orbital position of each, a GPS receiver could pinpoint a location within about 20 feet.

When GPS first appeared, its accuracy was not as good as LORAN because its signal contained a "military scramble feature," called Selective Availability, said to prevent terrorists from using GPS for clandestine purposes. This meant

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Museum ship SS Meteor – *photograph by Steve Wagner*

Wisconsin Underwater Archeology Association

SS Meteor Project – 2010

by Russel Leitz
with photographs by Steve Wagner

On April 24 and 25 WUAA members Steve Wagner and Russel Leitz joined about 50 volunteers working on the whaleback museum ship *Meteor* in Superior. This has been an annul event since 2002, when WUAA started the project. Since then, the Great Lakes Shipwreck Preservation Society has taken over and has expanded the scope from just scraping and painting to scraping, painting, cleanup, preservation and much more, as you can see from the list of this year's accomplishments, on page 6. Anyone wishing to participate next year may contact Phil Kerber, *Meteor* project chairman, at pkerber@glsps.org.

Meals were furnished Saturday noon, Saturday evening and Sunday noon for the volunteers by Susan Anderson, Director of the Superior Public Museum. Susan also provided

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Association News

Norlond Survey

The 2010 WUAA/GLSRF survey project will be on the wreck of the *Norlond*. The *Norlond* was a wooden steamer built in 1890. In 1922 she was caught in a heavy storm and foundered just south of Milwaukee with the loss of all on board.

Dives will be made on Thursday evenings during the summer. A fee of $20 per diver will be collected. If you would like to participate contact Kimm Stabelfeldt at kimms@ghost-ships.org or check the WUAA webite.

Maritime History Class at UW-Milwaukee

The following is a synopsis of a short course series Brendon Baillod will be teaching this Fall at UW-Milwaukee. The dates are not set yet. Register can be done through UW-Milwaukee.

Course 1

Title: 19th Century Milwaukee Shipwrecks

Time: Wed. 6:30–8:30 pm

Text: *Fathoms Deep But Not Forgotten: Wisconsin's Lost Ships*

Description: The course will consist of four 45 minute presentations followed by a question and answer period and will cover the following topics.

Week 1, Hour 1

Milwaukee Maritime History, Vessels and Wrecks. This hour will include an overview of the development of water-borne commerce on the Great Lakes and the development of Milwaukee as a major port. Attention will be given to the reasons for the high volume of vessel traffic and shipwrecks during various periods of history as well as vessel and commerce types and the major figures in Milwaukee's maritime history.

Week 1, Hour 2

Researching Area Shipwrecks. This hour will include a detailed overview of the various techniques and resources for learning about area shipwrecks, including information on how to find accounts of wreck events, crew losses, captains' names, vessel dimensions and history and wreck locations. Online resources as well as local repositories will be reviewed and handouts will be distributed. Emphasis will be on the distinction between primary versus secondary sources. Students will also have the opportunity to examine original archival books and ephemera related to area shipwrecks.

Week 2, Hour 1

Milwaukee Shipwrecks 1830–1875. This hour will include an overview of some of the more interesting, obscure and important shipwrecks in the Milwaukee area between 1830 and 1875. For each wreck, we

Wisconsin's **Underwater Heritage**

is published quarterly by the Wisconsin Underwater Archeology Association, a nonprofit association of individuals and organizations interested in studying and preserving the underwater cultural resources and historical sites of Wisconsin.

In addition to publishing this newsletter, the Association also holds semiannual meetings and provides support to members' research and publication projects. Annual membership dues are $20. For membership information write to the postal or email address below.

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www.wuaa.org

will explore the vessel's history, the cause of the wreck, its impact and its current status. If it is divable, we may view underwater or sidescan images. If undiscovered, we will discuss techniques for locating it.

Week 2, Hour 2

Milwaukee Shipwrecks 1875–1900. This hour will include an overview of some of the more interesting, obscure and important shipwrecks in the Milwaukee area between 1875 and 1900.

Course 2

Title: 20th Century Milwaukee Shipwrecks

Time: Wed. 6:30-8:30 pm

Text: *Fathoms Deep But Not Forgotten: Wisconsin's Lost Ships*

Description: The course will consist of four 45 minute presentations followed by question and answer period and will cover the following topics.

Meteor *project painter*

Week 1, Hour 1

Searching for Great Lakes Shipwrecks: Technologies, Techniques and Responsibilities. This hour will review the tools and techniques used to locate historic Great Lakes shipwrecks. We will review recent area wreck discoveries and we will discuss the responsibilities that come with searching for new historic wreck sites. Emphasis will be placed on analysis of wreck factors for the construction of a search grid.

Week 1, Hour 2

Great Lakes Shipwreck Underwater Archeology, Conservation and Laws. This hour will review the technologies used to document and preserve historic wreck sites on the Great Lakes and will review the current laws protecting Great Lakes shipwrecks. We will also discuss the Abandoned Shipwreck Act of 1987, the National Register of Historic Places and some of the recent developments that have effected Great Lakes shipwreck law.

Week 2, Hour 1

Milwaukee Shipwrecks 1900–1930. This hour will include an overview of some of the more interesting, obscure and important shipwrecks in the Milwaukee area between 1900 and 1930. For each wreck, we will explore the vessel's history, the cause of the wreck, its impact and its current status. If it is divable, we may view underwater or sidescan images. If undiscovered, we will discuss techniques for locating it.

Week 2, Hour 2

Milwaukee Shipwrecks 1930–Present. This hour will include an overview of some of the more interesting, obscure and important shipwrecks in the Milwaukee area between 1930 and the present-day.

Instructor Biography

Brendon Baillod is a well known Wisconsin Maritime Historian and author. He is a founder of the Great Lakes Shipwreck Research Foundation and Milwaukee's Ghost Ships Festival as well as the current president of the Wisconsin Underwater Archeology Association. Brendon also currently serves on the board of trustees of the Wisconsin Maritime Museum and is a director-at-large of the Association for Great Lakes Maritime History, an umbrella group of over 100 Great Lakes maritime museums and historical groups. Brendon is the author of the recently released book *Fathoms Deep But Not Forgotten: Wisconsin's Lost Ships* and has published over 50 articles and papers in regional journals and magazines. He was awarded the 2008 AGLMH Award for Historic Interpretation and has appeared on the History Channel, Discovery Channel and Science Channel discussing Great Lakes shipwrecks and maritime history. He has the largest private collection of antiquarian Great Lakes books and ephemera in Wisconsin and frequently searches for undiscovered Great Lakes shipwrecks.

GPS For Amateur Underwater Archeology

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that the degraded signal as received at the Earth's surface could be anywhere within a 300-foot circle. Since this accuracy was insufficient for many applications, a correction system known as Differential GPS (D-GPS) was created. This employed additional, land-based, low-frequency transmitters to correct the incoming satellite signals at the planet's surface. This gave very high accuracy, but involved rather expensive additional equipment, including a special receiver that had a maximum range of only about 200 miles.

President Bill Clinton had the "scramble system" deactivated in 2000, thereby resulting in GPS locations as precise as those of LORAN. Once this enhanced performance became available, the demand for D-GPS dwindled, and widespread new GPS applications appeared, such as automotive and marine navigation, anti-theft devices, and wilderness orienteering. Within the last several years, the Federal Aviation Administration has developed a new correction system called WAAS (Wide Area Augmentation System) that corrects for even minute inconsistencies in GPS signals, as caused by orbital shifts, timing fluctuations, and ionospheric disturbances. Currently available only in North America, receivers with WAAS enhancement possess accuracy equal to that of D-GPS, often better than 10-feet. This augmentation has been so successful in North America that many other countries are developing equivalent systems.

Among rather eclectic maritime applications, GPS has become the "tool of choice" for locating underwater entities, including archeological sites, shipwrecks, or even just productive fishing spots. Since most sites will be submerged and offshore, obtaining GPS coordinates usually requires a ship-board unit. This may not always be possible or convenient: for example, a shipwreck on a shallow reef presents a problem for a boat with deep draft. Near-shore sites may be worked from the beach itself where no boat is involved, yet GPS readings must still be procured.

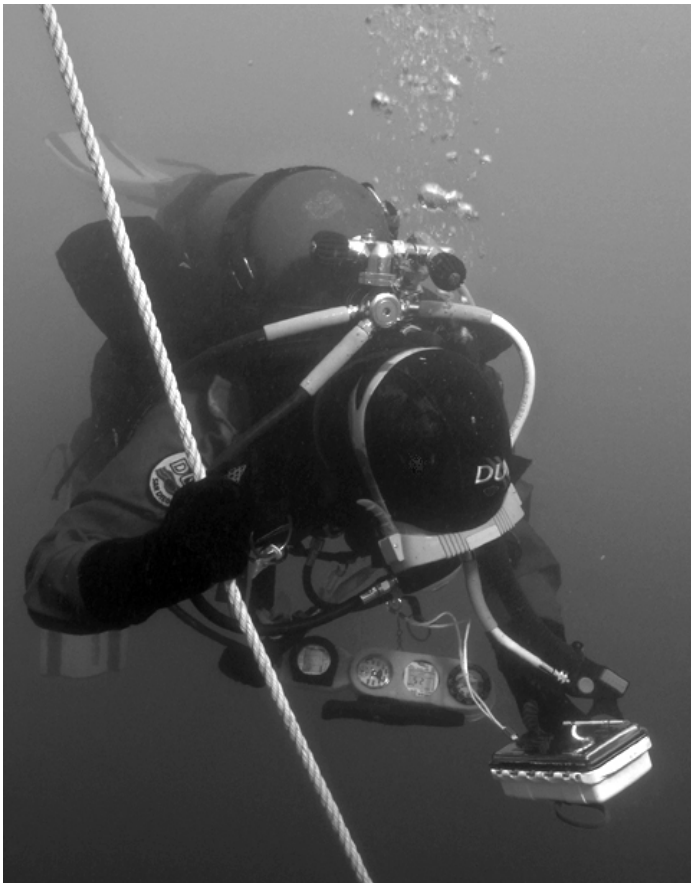
For such situations, WUAA created a "GPS Box," consisting of a small handheld GPS encased in a waterproof housing that has a clear plastic lid. The box itself is foam-lined and the GPS is held in place with additional foam shims, so that the readouts are clearly visible through the transparent cover. The particular case in the photos shown here is made by Underwater Kinetics and is available in most dive shops. It is waterproof down to 100 feet, and the encasement does not significantly interfere with incoming GPS signals. To facilitate the recording of GPS data, we mounted a small diver's slate and pencil on the back of the housing, so information can be jotted down as needed.

The GPS selected was a "Garmin eTrex H," available in many sporting goods stores and marine suppliers for around $100.00. The unit measures about 5 x 2 x 1.5 inches, is powered by two AA batteries, possesses WAAS enhancement, and

features multiple functions designed for personal navigation applications. Interestingly, the unit itself is waterproof to 3 feet for 30 minutes, so the inevitable exposure to water and wet conditions in general should not harm the device. Its acquisition time for incoming signals is about three seconds with continuous updates every second. It also gives a "confidence deviation" in feet for each position taken.

This watertight package can readily be taken out to any dive site, attached either to a diver's BC harness or to any type of surface float. Once on site, a general GPS fix can be easily obtained. If various specific areas must be defined, a submerged diver can tow the "GPS Box" along the surface by means of an attached line to a point immediately above any given submerged entity. Drawing the line taut, he signals the surface by several tugs on the line, thereby making the "Box" jiggle like a fishing bobber. A surface tender then simply records the position. If several discreet points must be determined, the order in which they will be taken should be predetermined and listed on the slate. Then the GPS data is merely filled in as the diver visits each submerged site. This system works even if no surface tender is present. The dive team merely attaches the towline at any selected underwater position, surfaces to take the readings, and then descends to repeat the procedure at other points of interest.

An often asked (but seldom answered) question is: Does GPS actually work underwater and if so, how deep? The answer is both "yes" and "no." The GPS signal is quickly attenuated by water, but the "Box" will usually give suitable readings to about 10 feet down. By 15 feet, the signal becomes intermittent and is lost completely around 20 feet. These results would likely change somewhat with other GPS units and under varying geophysical conditions, but probably not significantly.



For many years, there have been various electronic devices for underwater position-finding, some useful for subaquatic surveying, but none targeted at the sport diver or amateur underwater archeologist. Some of these apparatus utilize GPS by employing a floating GPS receiver that, in turn, transmits an acoustic signal down to the diver. This "sonarized" signal, as received by the diver, has been corrected for the distance and depth from the surface beacon and is displayed on a waterproof readout.

In 2010, a Caltech company plans to introduce sport diver-friendly, wrist-mounted GPS receiver using the surface beacon technology just described. It is called the Navimate. The first version of this device was shown at the recent International Diving Trade Show at Orlando and was a big hit. The unit is claimed to be waterproof to about 200 feet with a range of about a mile with an accuracy of approximately 20 feet. Unfortunately, this product is not yet in actual production and will initially cost about $1,000 - $1,300, which means it will be rather pricey for most weekend divers. It will no doubt find widespread use in commercial and scientific diving.

The "Box" discussed in this article is available for use by any WUAA member who is conducting official fieldwork. However, it is also very easy to build and any private dive team could assemble a similar unit for under $150.00.

SS Meteor Project – 2010

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some volunteer sleeping facilities, and arranged the Saturday evening presentation on Superior Public Museum's long term restoration vision, which includes restoring the whaleback to its 1925 glory when it was the *Frank Rockefeller*. The whaleback will be moved westward a little over its width from its present location and raised about 15 feet so the entire hull is 3 to 4 feet above ground level and resting on piers. It then can be preserved in perpetuity as the *Frank Rockefeller*.

Bow of the Meteor

List of Accomplishments

Painted upper and middle engine room.

Scraped and primed lower engine room.

Set tables in galley.

Swept and changed linens on all beds.

Sanded and painted double doors in exhibit area.

Welded, on port side, patch plates over entire length of state rooms.

Painted exterior of state rooms.

Polished all brass in pilot house.

Scraped and painted floor in galley.

Jack hammered a section of concrete to reconnect city water supply to ship.

Dusted artifacts and cleaned glass in display cabinets.

Photographed documentation of work plus structural pictures to aid in restoration process.

Removed a large shaft and gear for repair. The mechanism allows an electrical motor to rotate engine for demonstration.

Repaired wooden frames of the pilot house windows.

Painted port life boat.

Scraped and painted roof of pilot house.

Painted light bulb cages.

Repaired compressor air valve which feeds the whistle.

Work on wheel and compass

Work at stern of Meteor

Existing museum ship Meteor *site*

McDougall's Dream

Superior Public Museum's annual celebration of McDougall and his whalebacks is scheduled for Sat. Sept 25. There will be a series of guest speakers presenting topics relating to maritime history and the whalebacks. Following the presentations, there is an evening of socializing and fun, including great food, music, silent auction and an update on the preservation efforts. The funds raised go toward the *Meteor* project. For more information check their web site at *www.superiorpublicmuseums.org*.

Future plans for museum ship Meteor *site*

Wisconsin Underwater
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Wisconsin Underwater Archeology Association

For those interested in the study and preservation of Wisconsin's underwater history and cultural resources.

Coming Events

Sept. 4–6, 2010	**Association For Great Lakes Maritime History Annual Meeting**, in Muskegon, MI. For information check their web site at *www.aglmh.org*.
Sept. 25, 2010	**McDougal's Dream**, in Superior. Annual social event with speakers and an update on the plans for the *Meteor* Museum site. For information check their web site at *www.superiorpublicmuseums.org*.
Oct. 23, 2010	**Wisconsin Underwater Archeology and Maritime History Conference**, at Discovery World in Milwaukee. For information check the association web site at *www.wuaa.org*.
Nov. 12–13, 2010	**Gales of November.** In Duluth, MN. For information check the Lake Superior Marine Museum Association web site at *www.lsmma.org*.