Lead Corrosion In Exhibition Ship Models

BY DANA WEGNER

Introduction

LEAD HAS BEEN A POPULAR METAL for fabricating fittings for exhibition ship models. It has been attractive because it is easy to obtain, it is soft and easy to fashion, and it melts at a relatively low temperature. However, lead fittings frequently corrode. Corrosion may be so severe as to completely consume the piece, leaving behind a white or gray residue popularly, and aptly, called "lead disease," "lead rot," "lead cancer," or "lead bloom."

In the ship modeling community, there has been considerable speculation about what causes lead to severely corrode, how to arrest the process in pieces already installed, and how to prevent corrosion in the future. This report compiles some of the technical literature on the subject and relates that literature, in practical terms, to ship modelers and to museum staff who are unable to obtain the advice and services of objects conservators. (Figure 1)

The Problem

Lead parts or solder might be found in models made at any time. However, in quantity, ship models made by twentieth century artisans dominate many collections and these models are the focus of attention here. Solder, commercially produced fittings, home-made castings, parts fashioned from old toothpaste tubes, and even air gun pellets, all made from lead, are commonly found on ship models. By about 1922, commercial exhibition ship model kit and parts manufacturers used lead for their castings. Many of these early castings, seen on a number of models in the Navy’s collection, are today three-quarters of a century old and we observe the lead corrosion phenomenon frequently.

In addition to many full models, within the Navy Department’s ship model collection are hundreds of 1:500- and 1:1200-scale ship identification models made commercially between 1942 and about 1960. Some of these, especially those stored in contemporary wooden carrying cases, today show signs of lead deterioration or have completely decomposed to powder. (Figure 2)

Cause of Lead Corrosion in Ship Models

Lead is an ancient material and has been used by man for many centuries. Many examples of antiquarian coins, underground pipes, lead roofs on medieval churches, lead coffins, and lead bullets from...
American Civil War battlefields attest that lead can be nearly eternal. But why does lead sometimes turn to formless powder on our ship models? The chief category of substances acting harshly upon lead are organic compounds and acetic acid is among the most destructive of these carbon compounds. Acetic acid acts upon lead and transforms it into lead carbonate. Lead carbonate is the white, granular, powder we frequently see on lead ship model fittings. The museum objects conservation community has been aware of the phenomenon for several decades and the chemical process that causes it is well-understood.

The chemical process is this: Acetic and some other acids, in the presence of carbon dioxide, catalyze with lead to produce lead acetate and lead hydroxide. Lead acetate and lead hydroxide together react with carbon dioxide and form lead carbonate. Lead carbonate then releases acetic acid and the process becomes self-sustaining. It is important to recognize that the formed lead carbonate is not just a substance clinging to the surface of a casting, it is the surface of the casting transformed to powder. For practical purposes, a portion of the lead is gone and lead carbonate is left in its place. The lead carbonate releases acetic acid which can continue the process until the lead part is progressively consumed from the outside, inward. Acetic acid attacks not only lead, but to a lesser degree, zinc, aluminum, magnesium, brass, copper, nickel, and even steel.

During the nineteenth century, the artificial production of lead carbonate by using the "Dutch method" was a thriving commercial enterprise in the United States and England. In order to create lead carbonate, known as white lead, a valuable pigment used in high-quality opaque paint, earthen pots were filled with vinegar and covered with sheet lead or with cast lead waffles. The pots were stacked and then covered with a mound of tan — the bark from oak trees. The tan decomposed and heated the pots to about 180 degrees Fahrenheit. In about three months, the pots were recovered along with the dense white powder (lead carbonate) into which the lead had been transformed. In this process, carbon dioxide was in the air and was also formed as the tan decomposed. Acetic acid came from the vinegar (usually about 3 to 5 percent acetic acid and about 95 to 97 percent water) and from the oak bark. Heat generated by the decomposing bark accelerated the process.

**Micro-Environment of the Ship Model**

Exhibit cases provide an artistic framework to visually enhance the appearance of models and to provide protection against physical damage and dust. Even though most display cases are not air-tight, they do provide some buffering against abrupt changes in temperature and humidity and tend to limit the model's exposure to common airborne pollutants. Even relatively loose-fitted showcases can support an internal atmosphere one hundred times more stagnant than the surrounding room.

Lead fittings can be exposed to acids through the atmosphere within a ship model display case and by direct contact with wood. To a lesser extent, many commonly used paints and glues may also contribute to an acidic environment. Certainly, for many ship models, wood is the major contributor of acetic acid. Concentrations of this acid as little as half a part per million can cause damage to lead components.

The interior surfaces of an exhibit case may have a significant effect upon the micro-environment surrounding what is inside. The materials exposed within the confines of the display case consist of the
Resplendent in its beautiful contemporary mahogany and glass exhibit case, models such as these did not employ much lead in their construction. They present modern conservators with few lead-related problems. Perhaps the greatest lead-related conservation problem to be expected here is lead-bearing solder which might have been used for attaching parts together. The large glass plates of the exhibit case are set in a rabbet and simply are held in place with slim mahogany strip moldings. This relatively loose-fitted construction doubtless allows the air within the exhibit case to exchange at least once or twice a day, while still protecting the model from most dust and buffering the model from abrupt changes in temperature and humidity. NSWCCD Curator's Office photograph.

Table 1.

Woods Harmful to Lead.

<table>
<thead>
<tr>
<th>Harmfulness</th>
<th>Woods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Harmful</td>
<td>Unseasoned Oak (white and red), Plywood and Chipboard, Teak, Basswood, Sweet Chestnut, Fire-proofed Woods, Rot-proofed Woods</td>
</tr>
<tr>
<td>Moderately Harmful</td>
<td>Seasoned Oak, Larch, Ash, Birch, Beech, Red Cedar</td>
</tr>
<tr>
<td>Less Harmful</td>
<td>Sitka Spruce, Douglas Fir, Pine, Honduras and African mahogany, Elm, Ramin, Obeche</td>
</tr>
</tbody>
</table>

interior surfaces of the case itself, the model and all of the materials used in it, and any other objects placed within the case — like simulated water, figures, sails, background fabrics, cradles, name plates, and more. Other than glazing materials, probably the most prevalent material within many exhibit case interior environments is wood.

Sources of Acid in the Ship Model Micro-Environment

Wood

By the 1890s, museum staff members were noticing that some objects became corroded when stored for long periods of time in wooden drawers. In the 1960s, concerted scientific tests were conducted by museum professionals who specialize in the preservation of historic artifacts. They found that all types of wood release acetic acid and that certain woods emit more than others. End grain releases more than edge grain. Some of the acid is naturally released by the wood and some is released as a function of age as the wood decomposes. In a few cases, seasoned or kiln-dried woods emit more acid than the same wood unseasoned. A secondary lead-corroding product, formic acid, is also produced by wood, but in quantities only about one-tenth as great as acetic acid.

Wood exposed inside display cases with relatively stagnant atmospheres will create an acetic acid-laden micro-environment where lead artifacts will corrode even without being in physical contact with the wood. In addition to materials forming the surrounding exhibit case, the model itself may be made primarily from wood.

All woods will emit acetic acid to some measurable amount, but woods sometimes used by modelers that known to be harmful to lead are shown in Table 1. The woods listed have been tested by scientists primarily because they are occasionally used in the construction of museum display cases, shipping crates, or storage units. Ship model builders employ many more types of woods than those tested. Nevertheless, a general rule of thumb can be applied: Hardwoods emit more acetic acid than soft woods. But any wood will fall into at least the minimally harmful category.

Paints, Glues, and Miscellaneous Materials

Although wood is by far the major culprit, recent investigations have identified a large number of materials which also add to the acetic and formic acid exposure of lead fittings. Potentially destructive materials used by ship model builders include those in Table 2. The materials listed in the table are not in any particular order. They are general in nature and do not classify into groupings of high, medium, or low risk for lead corrosion. Some brands of the same material may be more or less harmful than other brands. As manufacturers change their formulas from time to time, items may fall into or out of the potentially harmful list. The creation of acetic and formic acids by these materials is a more complicated process than the emission of acids from woods and there is some disagreement among scientists whether some products, latex paint for example, release acid or not. Types of plastics found not to produce acids include polycarbonates, Mylar, and Nylon.

Paint Vapors

Vapors from drying solvent-based paints like enamels and lacquers, as well as paints containing common drying oils have been found to produce acids also. After drying several weeks, the vapor levels are usually low enough to be considered not harmful to lead. However, tests also show that the dried surfaces of these paints can also create acids.

Empirical Evidence

Our Experiences

The staff of the Curator of Ship Models at the Naval Surface Warfare Center [NSWC] has long experience in observing and treating the deterioration of exhibition ship models. We maintain the United States Department of the Navy's ship model collection containing over 1,900 models built between 1813 and today.

Museum professionals call the self-deterioration of objects inherent vice and some amount of decomposition is expected to be seen in all things. General observation has shown that older ship models made using a limited variety of materials are less susceptible to inherent vice than newer models which employ a mix of many types of commercially available products. For new models, it appears that if deterioration has not been observed within the first five to ten years, and if the climate is not altered, the model probably will be relatively stable for many future decades.

We have found that even a low level of acetic acid inside an exhibit case can be detected by the human nose. When the display case is opened, the inside
smells like vinegar. The human nose can detect the vinegar smell with a concentration perhaps as low as half a part per million. This amount also seems to be the lower concentration threshold for acetic acid to damage lead. The coincidence suggests that if an exhibit case interior carries even a slight vinegary smell, then acid is present in a harmful amount.\textsuperscript{18}

We have noted that thin pieces of lead, such as moldings made from toothpaste tubes cut into strips, corrode faster than more solid shapes. For example, model anchor flukes tend to show the effects of corrosion before the arms or shank. In general, lead corrosion is first observed along the thin edges of parts. This is probably because of the large ratio between the surface area of sheet stock, and thin edges, to the total volume of the piece.

When we started our investigation we had long stopped using lead parts in new models and repairs. We now use parts made from lead-free britannia metal. Britannia looks and behaves similarly to lead. It is commonly called pewter today and originated in the nineteenth century as a popular pewter substitute when the ill-health effects of genuine pewter (much of which contains lead) was discovered.\textsuperscript{19}

\textbf{Simple Experiment}

We decided to artificially create a corrosive micro-environment for lead parts so that we could watch the process occur. We employed a surplus ship model dust cover 20 inches long, 12 inches wide, and 8 inches high made from 3/16-inch-thick plexiglass and set it on an unpainted plywood sheet. Inside we placed two cereal bowls each filled with a few ounces of household white vinegar, labeled "5% acetic acid," and a paper towel wick. From our tackle box of old and reclaimed fittings, we selected about a dozen old lead items, none of which then showed any signs of corrosion. The fittings were unpainted, from unknown sources, and at least twenty years old, probably older. We arrayed them in various locations within the case and the entire setup was placed near a window facing south.

All of the fittings were observed to tarnish darkly first, then eventually form a light surface coating of white powder. The powder increased in thickness and then showed small surface eruptions (blooming) as more of the metal was consumed. Some parts corroded faster than others. The first white corrosion was seen on two parts after only seventy-two hours. Parts positioned in areas of the case occasionally struck by direct sunlight corroded faster than parts in other areas probably because the sun's warmth accelerated the chemical process.\textsuperscript{20} The parts continued to corrode when the bowls of vinegar had been removed from within the display case.

\begin{table}
\centering
\begin{tabular}{|l|l|}
\hline
\textbf{Material} & \textbf{Comment} \\
\hline
Polyvinylacetate (PVA) or "white" glue & some brands \\
Contact cement & \\
Plastic wood & \\
Latex varnish & \\
Natural varnish & \\
Polyurethane varnish & \\
Tung oil varnish & \\
Linseed oil varnish & \\
Enamel paint & \\
Oil-based paint & \\
Alkyd paint & \\
Lacquer paint & \\
Varathane paint & \\
Oil-based stain & \\
Wool & some kinds \\
Styrofoam & \\
Vinyl & \\
Wallpaper & some types \\
Velvet & \\
Burlap & \\
Rust inhibitors & some types \\
Polyesters & some types \\
Plastics & some types \\
Dyes used in fabrics & some types \\
Jute & \\
"Flame-proofed" fabrics and wood & \\
Products treated for rot and/or insect resistance & \\
Products containing ammonia & \\
Products that smell like vinegar & \\
Low quality paper and cardboard & \\
Vermiculite & \\
Pebbles and sand & unwashed \\
Cast acrylic plastic or "plexiglass" & suspected \\
Silicon room-temperature-vulcanizing (RTV) adhesive: tub and tile caulks & some types \\
\hline
\end{tabular}
\caption{Other Materials Harmful to Lead.}
\label{table:materials_harmful_to_lead}
\end{table}
Impurities in Lead

We originally started our investigation of lead corrosion on the wrong track. A casual discussion in 1980 with one of the Model Shipways Company employees suggested that their lead castings were made using "type metal." We thought what he meant was most likely expended metal type from printing presses. An examination of literature showed that type metal should contain mostly lead and some measurable amounts of antimony, tin, and perhaps copper. Based on our experience and bolstered by observations made during the simple experiment described in the previous section, we knew that under seemingly identical conditions, some lead parts corroded faster than others. We surmised that perhaps lead corrosion was triggered by "impurities" like antimony or tin in the lead used in the castings. We were wrong.

Recent tests done for us by the NSWC Materials Laboratory indeed confirm that there are minute amounts of antimony and tin in some lead ship model castings which have corroded, but the amount of lead corrosion created appears in positive proportion to the purity of the lead used in the castings. We were wrong. Contrary to our first thoughts, antimony, copper, and tin in lead castings apparently tend to retard or reduce the formation of lead carbonate.

Empirical Mystery

Finally, our general experience over a two-decade period is that lead fittings on models displayed in plexiglass (cast sheet acrylic) exhibit cases corrode more rapidly than those displayed in glass cases. Oddly, our office seems to be the only museum group actually experiencing accelerated deterioration of lead objects under acrylic. While polycarbonates have been rated as non-producers of acetic acid, there are some current conservational concerns about acrylic sheet. We cannot yet explain what causes what we surely see, and more study needs to be done.

Solving the Problem

Treatment of Corroding Lead Parts

The fact that lead carbonate combines with carbon dioxide to form acetic acid demands that lead carbonate powder frequently be removed from the surfaces of affected castings and from inside the exhibit case or storage crate environment. We have found that brushing off the corrosive byproducts and repainting the affected fittings only serve as a temporary and cosmetic repair. The parts will begin to bloom again if they remain within the same acid-laden micro-environment. A variety of paints, clear coatings, cyanoacrylate glues, and even automobile battery terminal paint have been tried with no appreciable abatement found. Indeed, many of these coatings may actually contribute to the problem.

One treatment that was suggested on the Internet to modelers was to wash parts in vinegar to neutralize the lead carbonate. While this treatment may facilitate cleaning the affected parts, obviously the vinegar wash itself may attack the lead until it is neutralized by liberally rinsing it in water. Thorough removal of lead carbonate from within the model's micro-environment is recommended, but we would suggest simply brushing it away. Although basic lead carbonate does not dissolve in water, mechanically rinsing corroded parts in running water would be preferable to applying more acetic acid to the piece. Wear a respirator when disturbing dry lead carbonate dust and be sure to wash your hands after handling lead fittings or lead corrosion byproducts.

The Gibbs & Cox Company ship model builders (1939 - about 1962) employed some lead castings and lead-based solder in their exquisite models. They chose to electroplate those fittings with a thin layer of copper, thereby effectively sealing the casting surface from the atmosphere. Time has confirmed that electroplating is a good way to prevent lead corrosion. There are two drawbacks to electroplating. Some superfine relief detail may be lost, and the process is somewhat complicated and fraught with safety, health, and environmental hazards.

Many model builders simply do not use lead fittings in new models and replace lead fittings on old models with duplicates made from a more durable metal. While brass, bronze, or copper is suitable, britannia metal, which is usually composed of 89 percent tin, 7.5 percent antimony, and 3.5 percent copper, is frequently used to replace lead because it is easy to cast. Replacement is a way around the problem for hobbyists. However, for museums the wholesale substitution of new fittings for old would, or should, present a dilemma in conservational ethics.

There appears to be no known product currently available which can be applied to lead fittings to
render them fully impervious to acetic acid. Other than electroplating fittings or replacing them with more durable castings, probably the best way to prevent lead corrosion is to isolate ship models from sources of acids.

Improving the Ship Model Micro-Environment

Solutions Which Don’t Help

One unrealistic way to prevent lead corrosion would be to hermetically seal exhibit cases and replace the interior atmosphere with one containing no carbon dioxide. In an environment without carbon dioxide, one key ingredient necessary to create lead carbonate would be missing and the process could not occur. Even for museums, the costs of creating a large-scale controlled-gas environment would be technically and financially daunting.

Another imperfect solution would be to forego putting ship models in display cases. The free movement of air surrounding them would minimize their exposure to concentrated airborne acetic and formic acids. However, the potential for mechanical damage, exposure to dust, abrupt changes in temperature and humidity, not to mention aesthetic concerns and tradition make this a generally unpalatable response to the problem.

A simple way to prevent woods from off-gassing acetic acid would seem to be to seal the wood using an acid-impervious coating. But most kinds of wood sealers, paints, and clear finishes are not impervious to the passage of acetic acid from woods, and indeed, the coatings might further contribute to the micro-environment problem. To date, researchers have found no product which can be applied as a liquid and which...
fully seals wood to suppress the emission of acids. Two-part epoxy and some urethane paints appear to offer a limited degree of barrier. Shellac, while not an acid producer, does not offer any protection. Sheet Melamine does not release acids and might be used for cladding, but the adhesive used to affix the sheet material to the underlay may, indeed, be undesirable.\(^{28}\)

**A Partial Solution**

In practice, the lead corrosion problem can be mitigated by introducing a relatively small amount of free air into exhibit cases. Generally, the air should change inside the case about once or twice a day. One rule of thumb suggests that a one-inch diameter hole in an exhibit case is enough to exchange the air in a case with a volume of about one cubic yard. Keeping the exhibit case interior and the model cool by avoiding direct sunlight, heat-generating lights, or other sources of warmth will retard the corrosion process, too. Air pollutant absorbers (*sorbents*) like activated carbon will sop acetic acid from the air but these materials, placed in shallow trays to reveal a large surface area, become saturated and must be replaced periodically. Large-volume display cases would require substantial areas of sorbent surface to be effective.\(^{29}\) (Figure 4)

**Lead is a Health Hazard**

Lead is a toxic substance which may enter the body by breathing or swallowing lead dusts, fumes, or mists. If food, cigarettes, or your hands have lead on them, lead may be swallowed while eating, drinking, or smoking. Once in the body, lead enters the bloodstream and may be carried to all parts of your body. Your body can absorb some of this lead, but if there is continued lead exposure, your body absorbs and stores more lead than it can eliminate. This stored lead may cause irreversible damage to cells, organs, and whole body systems. After exposure stops, it takes months or even years for all the lead to be removed from your body. One of the easiest ways to control lead exposure is by following good hygiene practices. Always wash your hands and face after being exposed to lead dust.\(^{30}\)

**Conclusions**

The implications from our experience and our investigation of relevant literature about the corrosion of lead and its prevention suggests that lead parts cannot yet be treated with a coating which conveniently will render them impervious to acids. However, models with lead fittings could benefit by the reduction and perhaps elimination of exposure to materials known to be highly destructive to lead. Considering that the model itself may be made of some acid-producing materials, perhaps not every acid source can be eliminated. But at least major sources, especially those sources not inherent in the model itself and which affect the model’s micro-environment, should be avoided.

Models with lead parts should not be displayed or stored in cases made from oak or made from other woods on the highly destructive list. Woods not on the list in this report, and there are many, may range from minimally to highly harmful. Lead carbonate which has accumulated should be removed from affected parts and from inside the exhibit case interior as frequently as possible. For models with lead parts, exhibit case interiors should be kept as cool as may be practical. Exhibit cases should exchange interior air about twice a day. World War Two-vintage waterline identification models should not be stored closed within their original wooden carrying cases. Do not use lead fittings when constructing new models or refitting old models. Wash your hands after handling lead.

Next, in declining order of risk, would be to reduce or eliminate the model’s exposure to less harmful woods, then reduce its exposure to large amounts of destructive materials other than wood, and finally limiting its exposure to even low-risk materials. Lead corrosion on ship models can be prevented or significantly reduced by eliminating or reducing the acidic environment within their exhibit cases or storage units.

The author would like to thank these persons for their help in preparing this report: Michael Condon, David Erhardt, George Long, and K. Patrick McKinney. The opinions expressed in this report are the author’s and not necessarily those of the Naval Surface Warfare Center or the Department of the Navy. Specific materials, products, and brands mentioned in this report are neither endorsed nor condemned by the Naval Surface Warfare Center or Department of the Navy. \(\star\)

**Notes**

1. For simplicity, the practice of attaching chemical symbols to the names of materials has been declined in this report.
2. Until recently, lead was commonly used to package a variety of consumer products. Extruded lead “collapsible tubes” contain toothpaste, shoe polish, grease, artist’s paints, and...
model glue. Lead foil could be found enveloping cigarette packs and cigars as well as adorning Christmas trees as tinsel. As a point of reference, one pound of pure cast lead occupies 2.44 cubic inches. It will melt at 621 degrees Fahrenheit and boil at 1777 degrees Fahrenheit.


Intact and nearly air-tight lead coffins, probably dating from the year 1680, have been found in St. Mary's City, Maryland. See: Henry Miller, "Mystery of the Lead Coffins," American History, September-October 1995, pp. 46-48, 62-65. George Washington was buried in a lead coffin in 1799. In 1905, John Paul Jones's corpse was found well-preserved by alcohol in a lead coffin buried in Paris in 1792. The coffin still surrounds his remains in the sarcophagus at the Naval Academy.


W.A. Oddy, Corrosion of Metals On Display (London: British Museum Research Laboratory, n.d.). Lead is resistant to most other acids including sulphuric and hydrochloric. Useful Information About Lead, p. 32.


Ralph K. Strong, ed., Kingsett's Chemical Encyclopedia (New York: D. Van Nostrand, 1946), p. 570; Horace Greeley, et al., Great Industries of the United States (Hartford, Connecticut: J.B. Burr & Hyde, 1872), pp. 496-500; and Henry C. Pearson, Crude Rubber and Compounding Ingredients (New York: India Rubber Co., 1889), pp. 83-84. Techniques were later developed which greatly speeded up the corrosion process. White lead, until recently, was the preferred ingredient in most high-quality paints. Former United States government specifications required that commercial paints have a minimum content of 60 percent white lead pigment. In 1931, the three greatest uses for lead in the United States were in storage batteries, cable shielding, and for the production of white lead pigment. Useful Information About Lead, pp. 10, 37.


Greeley, Great Industries, pp. 852-854; R.E. Peterson, ed., Familia Science (Philadelphia: Sower Ports & Co., 1832), p. 139; Edward W. Johnson, presidente of the University of Chicago Press, 1917, pp. 27-29. Apparently a few variations of britannia do contain measurable amounts of lead. On the other hand, some variations of pewter do not contain any lead at all. This would suggest that the terms "pewter" and "britannia" sometimes overlap. See George S. Brady, Materials Handbook (New York: McGraw-Hill, 1971), pp. 595-596. Regarding using britannia made with lead, electron microscopic tests done at the Naval Surface Warfare Center suggest that alloys with less lead content are less likely to corrode from acetic acid. A rule of thumb for britannia might be, "Less lead is better, but no lead is best.

On heat accelerating the corrosion process, see: Blackshaw and Daniels, "Selecting Safe Materials for Use in Storage and Display in Museums," p. 1.

John R. Rogers, Linotype Instruction Book (New York: Menteghenter Linotype Co., 1925), pp. 104-107. Fresh Linotype metal is 85 percent lead, 11 percent antimony, and 4 percent tin. Other printing type metals might include electrolyte, monotype, and stereotype alloys. Each has a different ratio of ingredients. The ratios change as the type metal is repeatedly recycled for reuse. Useful Information About Lead, p. 27. Of course, other sources for scrap lead might include old storage battery plates, automobile tire balancing weights, and firing range swepings.

Strong, Kingsett’s Chemical Encyclopedia, p. 569.

Corrosion testing our findings were based on that common virgin “pure lead” (99.7265+ percent to 99.931+ percent) is permitted to have minute amounts of impurities like silver, copper, tin, and arsenic. The purest form of lead (99.930+ percent) was called “corroding lead” and was used in several modern processes to manufacture white lead. Useful Information About Lead, p. 11.

Miles, "Wood Coatings," p. 121.

Useful Information About Lead, p. 43. To avoid airborne contamination, it would not be advisable to vacuum up lead carbonate dust using an ordinary vacuum cleaner.

Miles, "Wood Coatings," pp. 118, 121, 123.

Forced ventilation of exhibit cases is not recommended. See: Padfield, Erhardt, and Hopwood, "Trouble in Store," p. 119.

Miles, "Wood Coatings": 118, 121, 123. Conservators sometimes apply on objects a relatively benign and reversible clear coating called acrylic. (Cultural Heritage Foundation, 1990, p. 7) It appears that even B-72 is not impervious to acid. See, Miles, "Wood Coatings," p. 119.


The text for this section on health considerations when handling lead is courtesy K. Patrick McKinney, Naval Surface Warfare Center, Carderock Division, Safety Office.
For making rope with a model ropewalk, we use "yarns" that come to us in the form of manufactured linen, cotton, or polyester threads. The model ropewalk described in this article is designed for three strands, but we can vary the number of threads we incorporate into each strand. Figure 4 shows several three-strand miniature ropes with strands comprised of one, two, and four threads, making ropes with totals of three, six, and twelve threads, respectively. To get scale rope of varying weights, we twist varying numbers of natural- or synthetic-fiber threads into three strands, and the three strands into rope.

On a ropewalk, the strain of twisting is neutralized because after the threads are twisted together into strands in one direction, the strands are twisted into rope in the reverse direction. Thus, the finished rope has little or no tendency to unravel. (It will still fray at the ends like any rope, however, and this problem is easily corrected by serving.)

Making a Hand-Powered Ropewalk

The drawing and photographs show the design basics of my ropewalk. The principal parts are: 1) a driving end (on the right in the photos); 2) an idler/moveable end (on the left); 3) a grooved top or guide, to obtain an even lay (placed within the strands); and 4) some weight (held in a bucket) attached to the movable idler end, to provide tension.

Making the Driving End

Making a ropewalk is not difficult. The woodworking and metalworking skills involved are basic, and the materials are not hard to find (see Figure 5).

The Woodworking. Both the drive-end and idler-end assemblies are mounted on wood supports resembling bookends. I cut grooves (dados) in the wood bases to accept the upright pieces, and used both glue and screws to fasten the uprights to their bases. (The dados make the joints extra strong, but are not absolutely necessary.) The 3/4-inch-thick wood supports are hardwood—I used maple—so that the shaft bearing sleeves, described below, will not work loose in the wood.

Gearing. The only parts for a hand-powered machine that might be a little out of the ordinary for the ship-model builder are the gears. They can usually be obtained at hobby shops that sell radio-controlled cars. The larger gear (Traxxas item #3166), is a plastic, 66-tooth, 32-pitch gear, approximately 2 inches in diameter. The three smaller gears (RRP item #0200) are metal, 20-tooth, 32-pitch gears approximately 5/8 inch in diameter. Gears cost about $3.00 each. There should be a large difference between the diameters of the large and small gears, and the pitch (teeth per inch) of all the gears should be the same.
You are not restricted to this design or these materials. I have even made a ropewalk from Lego™ pieces. This toy construction system includes various sizes of gears that can be purchased separately. Lego gears do not have the smooth contact of remote-control-car gears, but that is not critical. On the other hand, the cost of the remote-control gears is really not significant.

Shafts and Sleeves. For the shaft of the large gear, use brass tubing that fits its center hole; and for the shafts of the small gears, use brass rod. Conveniently, the small gears have setscrews to hold them to their respective drive shafts. However, I could not find a large gear with setscrews, so I fabricated a mounting plate, soldered the plate to the tubing, and then screwed the plate to the face of the gear. When soldering the plate, I took particular care to be sure that it was square to the tubing to avoid any wobble in the large gear. I have since found that epoxy will hold the large gear on the shaft if all surfaces are clean and abraded, thus eliminating the trouble of installing a mounting plate.

Positioning the Gears. To position the gears, make a pencil mark on the vertical wooden piece to indicate the center of the large gear. This is near the top of the piece, to allow enough clearance for the handle. Align the large gear exactly to this center pencil mark, and temporarily put a small gear next to it, ensuring a tight fit. To provide a reference point for proper spacing, mark the center of the small gear on the wood. Remove the small gear, and adjust a compass so that it draws a circle whose radius is equal to the distance between the point marking the center of the large gear and the reference point just made, plus 3/64 of an inch. (This additional space will permit free turning of the gears and hopefully will compensate for any errors in drilling the wood.) Draw a circle with this radius around the center of the large gear. Conveniently, the radius of any circle can be ticked off around its circumference, giving six evenly spaced marks and six arcs of equal length. Make these six marks with the compass, and use three of them to locate and mark the centers of the holes for the shafts for the small gears. Space the shaft holes for the small gears equally around the large gear by using alternate marks as their center points.

The Driveshaft Sleeves. The driveshafts will fit inside brass tubing bearing sleeves, which are inserted into the wood blocks to assure smooth operation. Use one size larger than the shafts so the shafts fit snugly in the tubing but do not bind. The small gears have 1/8-inch shafts, so the outside diameter of the bearing tubing is 5/32 inch. Using that size, drill the holes, and do not enlarge the hole after drilling. Cut three lengths of tubing just slightly shorter than the thickness of the wood, and, using a rubber mallet—or at least some protection on the tube ends—carefully drive them into the holes. The tubing needs to fit in the holes very snugly and not come out. The goal is a “press fit.” If the sleeves are loose for some reason, apply some epoxy to hold them in. Use the same method for the bearing sleeve for the large gear.

Making and Installing the Driveshafts

The rod driveshafts for the small gears are long enough so that about 1 inch protrudes out one side and 1/4 inch out the other. Drill a hole on one end of each shaft, and solder a cup hook (screweye) into these holes. Slip each small gear onto its shaft, position it near the hooked end, and tighten the setscrew. Then slip each shaft into its bearing sleeve. On the power side of the wooden upright, place a washer and a collar with a setscrew on the shaft to keep it from being pulled back through the upright when tension is created. (These collars are for remote-control rods, and are available at hobby shops.)

There is no hook on the tubing used for a driveshaft for the large gear. And, since a remote-control rod setscrew collar with a large enough diameter is not available, we install another piece of brass tubing over it to rest against the shaft bearing sleeve and hold the gear in position. This tubing becomes part of the handle assembly, which is described below. The driveshaft tubing for the large gear and the handle tubing that slips over it need corresponding holes drilled through them to accept a small bolt that fastens them together.
Making and Installing the Drive-Handle Assembly

To make the drive-handle assembly, drill a hole near one end of a piece of brass plate, and solder the tubing mentioned above into the hole. Slip the tubing with the plate attached over the shaft on the power side; it should just slip over the driveshaft, and its hole should align with a hole in the driveshaft. Use a nut and bolt through the tubing and driveshaft to fasten the handle assembly to the driveshaft. Drill a hole in the other end of the handle plate, and screw on a wooden dowel to use as a grip. This completes and installs the handle assembly.

Making the Idler/Moving End

The shaft on the idler end of the ropewalk (Figure 6) has a hook on one end and a handle on the other. These are made and installed like the driveshafts and handle on the drive end, with one difference. I have found that for longer ropes it is convenient to have the idler end turn more freely, so I modified this assembly by placing a thrust bearing (used for model race cars) on the outside end of the shaft.

An eye or hook on the idler base is used as a fastening point for a rope attached to the weight bucket that hangs over the side of the table. Note: Although this point of attachment is seen at the bottom of the base in the photograph, a better location would be close to the idler shaft.

The final item is the top, the purpose of which is to keep the strands separated until there is enough twist to start the rope layup process, or closing, and to make the strands come together evenly. I turned my top on a lathe from a piece of dogwood that had been curing in my shop for several years. (The stub visible in some of the photographs is just leftover material. It does make the top a little easier to handle, but is not absolutely necessary.) Make your top into the shape of an elliptical cone, and cut or file three longitudinal grooves, equally spaced around the circumference. The exact shape is not critical, but the grooves should be filed and sanded smooth and coated with varnish and wax.

Operation of the Ropewalk

What intimidates modelbuilders most about ropewalks is that there are no set rules for their operation. It would seem that the size of thread, the number of strands, and the amount of twisting related to the finished rope size could all be set out nicely in a mathematical table, but this is not possible due to the many variables involved.

While watching the 1,135-foot-long ropewalk at Chatham Dockyard in England, I asked an operator if such a table existed. He told me no, they lay the rope based upon experience—more than one hundred years of experience. After practicing with various thicknesses of thread and various numbers of threads per strand, and after gaining experience with the amount of twist required, you can create and record data that works for your own particular ropewalk.

For practice, clamp both wood bases to a table, about 5 feet apart. Experiment with common thread. Starting at the hook on the idler end, lead the thread out and back, to and from each of the three hooks at the drive end, until there are two or four strands running between the hook at the idler end and each of the three hooks at the drive end. There needs to be tension on these threads, and it should be equal among all of them. Then, with a separate light line, tie off all the threads together where they converge at the single hook on the idler end.

Tie a bucket to one end of a length of line, and tie the other end of the line to the screw eye in the idler. Hang the bucket from the edge of the table, and put some weight in it. Place the top among the three sets of threads. Remove the clamp from the idler base and start turning the handle on the drive end.

Practice teaches what amount of twist and weight are required, but do take quite a few turns initially. Due to the gearing, the hooks will turn in the direction opposite to that of the handle. As you turn the handle, the idler end will move, since the threads are shortening as they twist around each other. Let the idler base move, but do not let the rope go slack; be sure there is enough weight to maintain tension in the threads. If there is not enough tension, they will bunch up as they are twisted. If this happens, do not throw away the layup—just reverse the twisting until the threads are back to normal, then add more weight, and continue. Too much tension, however, will break the threads.

After a while, you will have lengths of three individually twisted strands. When you think you have enough, turn the handle on the idler counterclockwise, when looking at the ropewalk from the side, so the strands lay up into a rope. (A few trial turns will quickly make the correct direction obvious.) As the rope lays up, the length will again become shorter. Be sure to keep tension on it, and control the top by hand as it moves along the rope, so that an even twist is achieved. (Do not let the top move freely, as is done in some ropewalks that use model railroad tracks and wheels to permit free movement.) The top performs the critical layup, and it must be well controlled. Also, as the rope lays up, it is necessary to provide more twist to the individual strands with the drive handle. Alternate turning the left and right handles.

When finished, the laid-up rope will be as much as twenty percent shorter than the length of the original threads. Neutralize the twisting of the rope by alternately applying and relieving tension, while also rubbing your fingers along the rope. There might still be a little twisting when the rope is removed from the ropewalk. Before you remove it from the machine, it is best to tie off the ends with a piece of thread or a knot to prevent the threads from unraveling.

Cautions and Concessions

When Laying-up Scale Rope

After some practice, you are ready to use good material, such as linen, to lay up the required rope for a model. Model rope laid up on a ropewalk will have an appearance similar to full-scale rope, and will be much better than large-diameter single-thread material available in sewing shops. Even much of the old, out-of-production, and highly coveted Cuttyhunk fishing line does not always have a nice laid-up appearance to it. Some that I have from several years ago looks squashed and flattened.
On the other hand, we do need to make a few concessions to the limitations of eyesight and simple technology when using a model ropewalk to make small-scale ropes. First, the number of turns in the rope is about half of its full-scale counterpart. In other words, if the full-scale rope has fourteen strands per foot, the model rope might have only seven per scale foot. This difference is not noticeable, and the discrepancy is far outweighed by its fine appearance. However, when splicing with model rope—when making an eye splice, for example—a three-tuck splice will be about twice as long as its counterpart in full-scale rope. This will look odd, and to correct it, take fewer tucks in the scale rope.

Second, in full-size rope making, right-hand rope is usually three strands, and left-hand rope is nine strands, being made up of three three-strand right-hand ropes. Although both right-hand (or "hawser-laid") and left-hand ("cable-laid") rope can easily be made with this ropewalk, three-strand left-hand laid rope, rather than nine strand, is usually adequate for the small scales involved in ship modelbuilding.

With this ropewalk design, turning the drive handle counterclockwise produces right-hand laid rope. Most thread you can buy has a right-hand twist; therefore the layup of right-hand rope requires single threads to be twisted in a left-hand direction. This takes the original twist out of the thread, and then twists it backwards. The result is a rope that is not as smooth as it would be if laid up left-handed. When more than one thread per strand is used, the threads twist upon themselves, and the original twist is not affected. But if you use only one thread per strand, take care to ensure the direction of twist does not unravel the thread. Some threads can be untwisted, while others will fall apart.

Making a Motor-Driven Ropewalk

The addition of a motor drive permits making much longer rope, because the operator does not have to be able to reach the drive end and therefore can stand at the top position to control the closing process. A motor-drive unit is shown in the foreground of Figure 1. I replaced the hand crank with an old 6-volt Dumas Pittman model-boat motor, mounted on a hardwood support. The additional drive gears I use, one on the large gear driveshaft and one on the motor driveshaft, are the same kind as those I used earlier for the hand-driven ropewalk (Figure 7).

Wiring is straightforward. The motor is run off four size D batteries—two sets connected in series, and these sets connected in parallel. This provides 3 volts and sufficient current to make a lot of rope. Control is provided by a wire-wound potentiometer and a reversing switch (double pole-double throw, center off) mounted in a utility box (Figure 8). All these supplies are available from electronics stores. Two short extension cords, cut in half, plus extension cords to suit your rope length requirements, provide all the wiring, plugs, and receptacles needed, as shown in the wiring diagram (Figure 9).

The control box can be kept near the idler end of the ropewalk so the operator can monitor and adjust the layup of the rope at the top. Using a motor-driven ropewalk, the bucket with the weight may have to be reset as the rope is formed because it may come all the way up to the top of the table. Starting with 50-foot threads, for example, 5 to 10 feet could be lost in the forming of the rope, and this is the distance the weighted bucket must travel. One additional improvement would be a motor at the idler end to assist the layup. Because there is a significant amount of tension and friction on the thrust bearing, the extra help might be desired.
Figure 8. The control box and battery holder allow the manufacture of any length of rope. Photograph by author.

Figure 9. Wiring a ship-modeler's ropewalk. Diagram by author.
Although linen line is certainly the best for scale rope making, it is difficult to find. It is sold in bulk to linen mills, but small bobbins are usually not available. As a last resort, polyester, poly/cotton, and certain types of cotton will do. Also look for carpet and upholstery threads. Phil Krol (Wheaton, Illinois) states:

A good alternative [to linen] is Egyptian cotton, which differs from regular cotton in that it has long fibers. Two good brands of tatting thread in this material are DMC Cordonnet Special and Anchor Cordonnet Crochet (made in Germany), generally available in stichery stores—especially those catering to the bobbin-lace folks. Both DMC and Anchor come in ten diameters from #10 through #100. Three strands of #100 yield .018-inch to .020-inch [rope], depending on [the] counterweight used in twisting. They also have finer Egyptian cotton such as 80/2, three strands of which will twist into .010-inch [rope]. That is as small as I go in twisted line, as any smaller, you cannot see the twist so there is no point in trying. Just use the finer material as is. This Egyptian cotton I speak of takes dyeing beautifully, produces first-rate rope, and is readily available.

And W. Kelley Hannan (Dedham, Massachusetts) says:

While linen is the standard, I have used surgical silk because it is available in smaller diameters. One source is Deknatel, Inc., 600 Airport Road, Fall River, MA 02720; phone: (508) 677-6600. The last time I ordered, size 6/0 was the smallest available. I measure that at 0.005 inch. It comes in black or white in spools of 100 yards. It lays up very nicely. Rigs as easily as linen.

Sources of materials for rigging are numerous. Some of them are listed on the Guild's Web site: www://Naut-Res-Guild.org.

References

**Nautical Research Journal**


**Other References**


Pier Books & Dupont Communications are pleased to announce a new publication:

The Illustrated Guide For Modeling

HMS Warrior (74), 1781

by Reverend William Romero

This four volume major work, produced in offset quality, on high grade acid free paper, will take you step by illustrated step through the building of an outstanding model of an English 74 gun Ship of the Line. The author's in-depth, well illustrated instructions guide you, from keel to top masts, through all the steps in the construction of a 1/8 or 1/10 scale model based on plans by Harold Hahn. Each volume will also include an ongoing chronological history taken from HMS Warrior's logs. An index is provided with each volume and a master index will be included in Volume 4.

NOW AVAILABLE!

Volume 1: Exterior Hull Framing
378 pages, 300+ photographs, 125+ line drawings,
65 true scale patterns
• Lay-Flat Comb Binding @ $80.00 + P/P
• Hard Cover Binding (100 signed/numbered copies) @ $110.00 + P/P
P/P fees = $7.50 Domestic (UPS) – $15.00 Foreign (surface mail)
M.O.'s/checks in US$ on Am. banks, Visa, MasterCard, Discover

FUTURE VOLUMES

Volume 4: Masting and Rigging (2001)

Pier Books Inc., P.O.Box #5, Piermont NY 10968 USA
Tel# (914) 268-5845 • Fax# (914) 268-8804
E-mail: pier.bks@icu.com

NORTH AMERICAN AGENT FOR:

Model Shipwright

A QUARTERLY JOURNAL OF SHIPS AND SHIP MODELS

THE DROMEDARY
Ship Modeler's Center
6324 Belton Drive
El Paso, Texas 79912
(915) 584-2445

SUBSCRIPTIONS

Orders for annual subscription to Model Shipwright should be sent to:

THE DROMEDARY

SUBSCRIPTION RATE

U.S.A. $45.00
Canada $55.00

All subscriptions mailed surface. All subscriptions begin in September.

RENEWALS: For those who began receiving four issues ago.

BACK ISSUES ARE AVAILABLE.

Price per individual copy: $10.00 plus $3.00 postage and handling

BASIC CATALOG No. 16
Everything you need to build ship models, except talent, can be found in this catalog.

U.S.A. .............................................$6.00 pp
Foreign ............................................$7.00 pp

Vol. 43, No. 4
**BOOK REVIEWS**

**HMS Beagle**  
Survey Ship Extraordinary  
by Karl Heinz Marquardt  
10" x 9-1/2", hardbound, 128 pages  
Drawings, photographs, index, references. £25.00/$42.95

As one who has attempted to winkle out the details of the ship that carried Charles Darwin on the 1831-1836 voyage that shaped modern biology, I was pleased, absorbed, but in the end disappointed by this book, the latest in Conway's Anatomy of the Ship series. Karl Heinz Marquardt has done a thorough and masterful job in searching out and merging the sparse and occasionally contradictory information available on the appearance of HMS *Beagle* on the best known of her three survey voyages. Although Admiralty drafts of the Cadmus-class 10-gun brigs exist at the National Maritime Museum in Greenwich, there are only verbal descriptions and some contemporary artwork to show the extensive modifications made to *Beagle* for her surveying duties. The deck and probably the bulwarks were raised, a forecastle and poop were added, and a small mizzenmast and large fore and main try sails were fitted for better maneuvering in the difficult waters off Tierra del Fuego.

The book begins with a twelve-page history of *Beagle*, from her launch in 1817 to her sale to a ship breaker in 1870. Marquardt then gives us seventeen pages of narrative about the construction and modifications of all parts of the ship and her equipment. He seems to have read everything, and tells us the sources of his facts and the reasoning behind his reconstructions in twenty-nine references, a bibliography, and a list of contemporary drafts and art work. He follows this text with seven pages of photographs of the 1:64 model that he built for the Deutsches Schifffahrtsmuseum in Bremerhaven.

The heart of the book is seventy-nine pages of sharp, detailed orthographic and perspective drawings (to varying scales, mostly about 1:40 or 1:80) of every visible and invisible part of the ship. Each spar, line, sail, boat, gun, and hatch is clearly depicted in more than one view. Several pairs of drawings contrast *Beagle*'s appearance when built with her revised configuration as a survey barque. Several halftone renderings and a rigged drawing nearly 24 inches long printed on the backside of the jacket complete the visual treat.

Of course, a few details of Marquardt’s reconstructions are arguable. The split spritsail spreaders on the bowsprit are not visible to me in the contemporary illustrations, the windlass crank handles are too short for useful leverage with any load at all, and the beagle figurehead (which is present on my model, too) is charmingly improbable on a small Royal Navy ship of this period. However, the short spars tabulated in Keith S. Thomson's book and the errors of Lois Darling’s early reconstruction are convincingly corrected. A reviewer is expected to find printing errors, and there are indeed a few (Thomson's middle name is misspelled and part of Figure G6/3 is missing.)

But to me the largest disappointment in this book is that I no longer have any reason to continue collecting tidbits of fact and inference about HMS *Beagle*, but must put my knife to wood and finish my model according to Marquardt’s most complete description.

—Richard Lindstrom

**Constructing the Munitions of War**  
The Portsmouth Navy Yard Confronts the Confederacy, 1861-1865  
by Richard E. Winslow III  
Portsmouth, N. H.: Peter E. Randall Publisher, 1995  
7-1/4" x 10-1/4", hardcover, xix + 432 pages  
Sparsely illustrated with photographs and facsimiles, extensive notes, bibliography, and index. $35.00

As indicated by the title, this book relates the history of Portsmouth Naval Shipyard during the Civil War, but there is much more and much less contained in this volume than is implied.

First, let us establish which Portsmouth Naval Shipyard it is that this book concerns. It is the yard that...
occupies an island in the Piscataqua River that separates Portsmouth, New Hampshire, from Kittery, Maine. If you are a citizen of the latter state, you very likely refer to the facility as "the naval shipyard at Kittery." In fact, the island on which the shipyard is located lies on the Maine side of the river and is connected to Kittery by a bridge. But it is called "Portsmouth" because when the shipyard was founded in June 1800 (making it the oldest government shipyard in this country), there was no post office in Kittery but there was one in Portsmouth, New Hampshire. The postal address became confused with the location, and thus began a lengthy and continuous interstate feud. (The other "Portsmouth," i.e., Norfolk Naval Shipyard in Portsmouth, Virginia, at least has the advantage that the rival cities are located in the same state.)

Being established early did not result in fast growth or a great amount of important work. Portsmouth Naval Shipyard (at Kittery) remained for six decades a backwater facility used mainly for repair work. The yard did not even launch its first ship, USS Washington, until 1814, and produced only thirteen more ships by 1860. One of these vessels was the ill-fated frigate USS Congress, burned at Hampton Roads, Virginia, by the Confederate ironclad CSS Virginia on 8 March 1862, the day before the latter vessel had her historic battle with USS Monitor.

Though Portsmouth Naval Shipyard was expanded into a first-class navy yard during the Civil War, insufficient events of great importance took place at this facility to justify a whole book. So Mr. Winslow wisely includes other information connected to the general area, ships that were built there and people who lived there, to flesh out the story.

During the course of the Civil War, Portsmouth Naval Shipyard completed construction of twenty-six ships for the Union Navy. One of the ships, USS Alabama, was actually laid down in 1818 as a 74-gun ship of the line, but her construction was halted for more than forty years due to lack of funds. She was finally launched in 1864 as a storeship, with her name changed to USS New Hampshire for obvious reasons. Likewise, USS Franklin, originally the prototype for the Merrimac class of steam frigates, was begun in 1854, but due to various delays and design changes was not completed for ten years. Portsmouth contributed one ironclad ship to the war effort at sea. This ship was the USS Agamenticus, a double-turreted monitor of the Monadnock class. The ship was completed too late to see action and was not placed in commission until 1870, at which time she was given the name USS Terror.

Without doubt, the most famous product of the yard was the steam sloop USS Kearsarge. Along with her unknown sister, USS Mohican, Kearsarge was begun in 1859 and completed in early 1862. She became a U.S. naval icon by sinking the Confederate raider CSS Alabama off Cherbourg, France, in June of 1864. Though this book is sparsely illustrated, it does feature some unusual and informative contemporary photographs, including two gems that I had never seen before: The first is an 1861 view of a marine steam engine of the type installed in Kearsarge as it was assembled at the firm of Woodruff and Beach in Hartford, Connecticut. Since this company was the builder of Kearsarge's machinery, there is a good chance that the engine shown actually was installed in Mohican or Kearsarge. The other view is of Kearsarge herself taken in 1877. Because it was taken from a very elevated position looking down onto the ship's deck, it shows details not usually seen in photographs of ships.

In 1865, the end of the war brought serious cutbacks to the yard. From a high of 2,563 employees in May 1865, the workforce was reduced to 876 workers in less than a year. Many of those who stayed on had to take cuts in rank and pay in order to remain employed. Postwar decline and decay were exemplified in a way by the fact that one of the Union Navy's most redoubtable sea dogs, Admiral David G. Farragut, died in one of the yard's officers' quarters dur-
ing a visit in 1871. But the war and the many improvements and expansions that had been carried out during those four years also guaranteed the yard's future. Even today—against heavy odds—Portsmouth Naval Shipyard has avoided becoming a victim of government downsizing, while other notable but younger government shipyards, such as Philadelphia, Mare Island, and Long Beach, have gone on the auction block.

Though this book is in a specialized niche due to its narrow focus, it does shine a spotlight on a whole community and its people during a great national conflict. Located far from the battle lines, war nevertheless affected this bucolic locale in many and varied ways, which are clearly laid out by the author. As is frequently true with such books, the author's source list is a gold mine of material, and a road map for future research in this area of history.

Unfortunately, Mr. Winslow does step into a few traps along the way. For example, he notes that USS Constellation, "the oldest [U.S.] warship afloat," docked at the shipyard for repairs in 1861. Although the facts were disputed for decades, by the time this book was published most historians had accepted that the frigate Constellation built in Baltimore, Maryland, in 1797, was broken up at Norfolk Naval Shipyard in 1854 and a year later a completely new ship, a corvette bearing the same name, was built in that same yard. Even the present-day custodians of USS Constellation in Baltimore have come to accept this fact. Thus, the ship that was repaired at Portsmouth in 1861 was only six years old. But she did have the distinction of being the last vessel powered only by sails built by the United States Navy.

Mr. Winslow also states that after the sinking of the Confederate raider Alabama, her captain, Raphael Semmes, "never again commanded a Confederate warship." After the defeat, Semmes managed to return to the Confederacy through the Union blockade, and he was promoted to the rank of rear admiral and given command of Confederate capital at Richmond, Virginia. In early April 1865, Semmes was forced to burn his ships when the Confederates abandoned Richmond. So in the strictest sense, it is true that Semmes never commanded another ship after Alabama, but the imputation that he was viewed with disfavor by his superiors is false. These and a few other errors are relatively minor, however, when compared to the cornucopia of information found in this book.

This book is number twenty-one in a series of publications of regional interest published by the Portsmouth Marine Society, Box 147, Portsmouth, NH 03802; phone: (603) 431-5667.

—J. R. MCCLEY

**Ocklawaha River Steamboats, 2nd edition**

by Edward A. Mueller

De Leon Springs, Fla.: E. O. Painter Printing Co., 1997

8-1/2" x 11", paperback, 156 pages

Illustrations, 135 photographs, maps, vessel plans, lists of vessels, footnotes, photo credits. $20.00

The Ocklawaha River is a tributary of the St. Johns River in northeastern Florida. This history of steam navigation on the Ocklawaha begins with a description of the limitations of the watercourse, which, to a large extent, determined the character of the vessels that used it. The book includes plans—reductions from the Historic American Merchant Marine Survey plans in the Smithsonian Institution collection—for two vessels: Okahumkee and Hiawaha. These plans, sufficient for modelbuilding, show the typical "wheelbarrow" paddlewheel configuration, the one most commonly used on Ocklawaha vessels. Overhanging branches, which would have tangled with conventional open sternwheels, made this the preferred design. Cabin windows were also shuttered because of shoreline hazards. Shallow water made flat bottoms mandatory for the larger steamboats. While none of the steamboats could be described as "handsome," they would make interesting models. And, because of their roomy and very stable design, these vessels are easily adapted to operation by remote control.

Settlers came to the area following the Second Seminole War (1835-1842), when the government made land grants to those who had served in the war. Early river traffic consisted mostly of barges and log rafts, which were poled laboriously upstream and floated downstream on a river that supposedly had 999 bends in its approximately 109 miles. The earliest known attempts to improve the river for navigation were made in 1835, but applications for federal funding for this purpose were rejected.

The historical narrative continues with the development of Silver Springs as a tourist attraction, which provided the initial stimulus to steamboat operations shortly before the Civil War. Then it takes the reader through each development over time: the war period; the latter part of the nineteenth century, when tourism grew; the period after 1910, when gasoline-powered craft emerged; and the early 1920s, when commercial navigation ended.

In the article "A Trip Over Crooked Water," which originally appeared in 1883 in Harpers Weekly (Volume 27) and is reprinted here, Kirk Monroe describes a typical steamboat journey—a trip from Palatka to Silver Springs—complete with nighttime operation using fire pans located atop the pilot house! The author later gives details of how this was done without setting fire to the vessels. Eventually, more conventional means of illumination were used.

The book also includes a second trip narrative, "Captain Howard and the William Howard," by Captain J. Hatton Howard II. This article, which originally appeared in the January 1942 issue of Motor Boating, contrasts the
G

reat Britain’s Arctic whale fishery is sparsely represented in published literature in comparison to its eighteenth-century voyages of exploration or the many South Seas whaling narratives published in the nineteenth century. Captain William Barron’s Old Whaling Days, originally published in London in 1885, is the reminiscences of a whaleman with seventeen years of almost continuous Arctic experience—in several famous British whaleships—in the middle of the nineteenth century.

Other books that document the British Arctic fishery include William Scoresby Jr.’s two-volume work, An Account of the Arctic Regions With a History and Descrip-

**Old Whaling Days**
by Captain William Barron
5-1/2” x 8-3/4”, hardbound, viii + 211 pages. $24.95

calack of river traffic in the early 1940s with the earlier, busier days of steamboat operations. When, as often happened at the height of the steamboat era, vessels heading in opposite directions needed to pass each other, this was a major event requiring the vessel heading upstream to stop at a wide place on the river to allow the boat heading downstream to slide by.

Modelers will find the many photos in this book very useful. They illustrate the many modifications vessels underwent over their years in operation. The book also includes photographs of conventional steam launches, ships’ boats, and rental rowboats, including the unusual glass-bottomed, canopied boats at Silver Springs. For those considering building a diorama, various scenes of Silver Springs—the landing, hotel, and railroad station—provide interesting material. A fine model of Okeehumkee is on display at the Jacksonville Maritime Museum.

The author, who has also written books about steam navigation on other Florida rivers, gives us a charming glimpse of an era when railroads and steamboats were the primary means of travel for both tourists and freight in northeastern Florida. This is a new, completely revised edition of the book originally printed in 1977 and reprinted sometime in the 1980s. It has twenty more pages and eighteen more photographs, and is desktop published. It is available from the author: Ed Mueller, 4374 Empire Ave., Jacksonville, FL 32207-2136 ($3.00 postage and handling).

—FORTIN POWELL

**SAIL THE COAST OF MAINE ABOARD**
**THE 1912 ALDEN SCHOONER**
**WENDA MEEN**

Relive the post-Victorian yachting age with an overnight cruise aboard the 67’ schooner WENDA MEEN. The Wenda Meen sails daily at 2:00 PM. The night is spent anchored in a quiet cove and by 10:00 the next morning we are dockside once more. The $155 fare includes dinner and breakfast.

Capt. Neal Parker • P.O. Box 252 • Rockland, ME 04841
207-594-1751

**Note:**
The book, **Old Whaling Days**, is a detailed account of the British Arctic whaling industry, focusing on the experiences of Captain William Barron during his twenty-seven years at sea. It provides a wealth of historical information and is illustrated with numerous photographs. The book covers the period from 1849 to 1865, with a detailed list from 1811, and includes a glossary, a very brief chronology of British Arctic whaling, and a list of ships from Hull engaged in the fishery from 1754 to 1869, with a detailed list from 1811.

The book begins in 1849 with the author's completion of maritime training at Trinity House School, Hull, after which he immediately shipped aboard the whaling bark **Truelove** as cabin boy and apprentice in the whaling trade. Captain J. Parker had him go in a Malamauck boat, in addition to his shipboard duties. (As stated on page 5, Malamauck was the name for the “two boats laid alongside the whale, and used for the harpooners to place their weapons in during the process of flensing.”)

He recounts his experiences of forty years aboard various vessels, including the bark **Truelove**, in which he sailed as master in the season of 1861; the steam-assisted ship **Diana of Hull**; the Dundee steamer **Polyhia**; the bark **Emma of Hull**; and the brig **Ann[e]f of Hull**. He discusses the wreck of the ship **McClellan** of New London, as well as many other shipwrecks caused by accidents in the ice. He describes the wrecks of the Peterhead ships Gipsy and Undaunted, and the manner in which ice docks were built, which seems not to have changed since Scoresby’s time.

Barron seems haunted by ice, and his descriptions become more illuminating and insightful as the book goes on. Relative to safety in the ice, he repeatedly comments on the advantage of steam-powered vessels over sail-driven; he also notes that observations of natural phenomena were essential to successful sailing in the Arctic, and how “meteorological instruments” replaced direct human observation. He tells of shearing off propellers in the ice and obtaining new ones at St. John’s, Newfoundland, and the manner in which propellers were jury-rigged at sea.

The book is relatively light on actual whaling technology, gear, and economics, but it is easy to gather that the use of harpoon guns was commonplace, blubber was
placed in barrels raw in chunks, and whalers did not receive a lot of pay.

The hardships of the fishery, evident throughout, are stated objectively and without melodrama, very much in the style of John A. Cook in Pursuing the Whale (Boston and New York, 1926). Encounters with bad weather, icebergs, frigid waters, and polar bears are routine occurrences for William Barron. There are some passages relating to the whalers' interaction with the Nugumut Eskimos in Cumberland Sound. These include descriptions of overwintering, diet, and fauna, and rudimentary descriptions of Eskimo architecture.

My only real complaint about this facsimile reprint edition has to do with the dust jacket illustration. It shows a painting by Abraham Jansz Storck (1644-1710) entitled "Fishermen Whaling at Sunset off an Arctic Coast," which depicts Dutch fluytships in the Arctic, probably around Spitzbergen or Jan Mayen Island, more than one hundred years before Barron ever even sailed. Why this picture was selected when the Town Docks Museum in Hull actually has period paintings of the very vessels mentioned in the text, engaged in whaling in the Davis Straits, is a complete mystery. For an accurate and engaging illustration of British Arctic whaling, see the 1829 print by William John Huggins (1803-1882) entitled "Northern Whale Fishery: A representation of the Ship Harmony, of Hull, & Other Vessels with their Boats & Crews in the various processes of attacking and killing the Whale in Davis' Straits and Greenland, with the mode of Flinching & taking in the Blubber" (London 1829). While it is still somewhat earlier than the time in which Barron is writing, it is consistent with almost everything he writes. [A part of this image is shown on our cover. —Editor]

Considering that there is such a dearth of published narratives about British Arctic whaling, this book serves as a valuable introductory primary source document and a good supplement to Scoresby.

—MICHAEL P. DYER

This book was first published by Conway Maritime Press in Great Britain in 1970; this edition was published in 1996 by Conway Maritime Press in the Conway Classics series. Conway Maritime Press is an imprint of Brassey's (UK) Ltd., 33 John Street, London WC1N 2AT; phone: 0171-753-7799; fax: 0171-753-7794. Available in the United States from Brassey's, P.O. Box 960, Herndon, VA 20170; phone: 800-775-2518; fax: 703-689-0660. —Editor


This is the second volume in Adrian Caruana's trilogy about British smooth-bore muzzle-loading ordnance. The first one was reviewed in NRJ 40:2 (June 1995). While the first volume covered a nearly bewildering array of plans for plank-on-frame ship models by Harold M. Hahn

December 1998
cannon types from two centuries of experimentation and development, this one describes the three much more limited "systems" or patterns of cannon that were used during a century of English-French wars, and the efforts to create "establishments" of armament for each class of warship. The earlier work concentrated on the cannon barrels themselves, but this volume deals with the cannon and everything associated with them: ever-more-powerful gunpowder; the difficult art of gunfounding in cast iron, which had largely replaced much costlier brass; ammunition, which was much simplified from earlier times; gun carriages; the equipment needed to serve the weapons; specialized weapons like howitzers and mortars; the introduction of the carronade; the nearly outmoded fire ships; various forms of infernal machines; and boat guns and their mountings. The book is nearly twice the length of its predecessor, and the amount of detail is almost overwhelming. But this is a book to be read in small segments, browsed through for its excellent illustrations, and treasured as a reference.

There are many highlights, but, sadly, the fine cannon drawings that are central to the book are not among them: Forty-two of the long-gun plans are printed across the gutter of this otherwise handsomely produced book. The modeler will have to photocopy them, cut the copy in half, glue the halves to another sheet, then fair the distorted middle sections, which often include the trunnions. Fortunately, the cannon are less ornate than their predecessors. Perhaps a separate book will be issued containing all the (undivided) cannon and carriage illustrations from all three volumes in uniform scale. The many carronade, mortar, and howitzer drawings do not suffer from this problem. Modelers should note the different proportions of iron and brass cannon of similar lengths and bores.

In addition to the official "establishments" of guns for ship classes and for individual ships, which might or might not reflect reality at any given moment, the guns actually carried are discussed in detail, often based on records of contractors' bills for painting the carriages. While many gun lists are printed in this book, a separate volume listing the guns of 2,500 eighteenth-century Royal Navy ships is planned. There will never again be an excuse for arming an English sailing warship model with "generic" guns.

Many technological innovations of interest to modelers are discussed and dated. Among them are the change from "bracket and bed" to "bracket and transom" carriages in 1724 to 1725, and the addition of the breast pieces at the turn of the nineteenth century. Carronade types and carriages are dealt with thoroughly. The introduction of separate train tackles (a side tackle was led amidships as needed in earlier times), the switch from firing by slow match to cannon locks, the tackle and equipment to be found around each gun, the number of men and their positions in the gun crews, and many other details are discussed and illustrated from many sources. How many modelers know that gun tackles in the wardrooms and officers' cabins were not tarred in Nelson's day, while those on the gun decks were? Or that the reason for not doing so was probably economy rather than officers' dislike of stained uniforms?

Finding obscure sources is one of the author's strong points, and this leads to his repeated warnings about the well-known printed books about gunnery, which are often badly outdated, opinionated, or just plain wrong. Caruana uses such sources as gunnery cadets' manuscript notebooks, which reflect practical reality at the moment they were produced.

Caruana's discussion of eighteenth-century design theory shows that scientific experimentation was virtually unknown and that experience, driven by the unfortunate results of using better gunpowder in old iron cannon, really drove design. The new designs were not necessarily significantly better than the old, however, and many poor ideas, such as decorative mouldings that weakened the cannon, survived throughout the period. Many experiments are covered, including the persistent attempts to create lighter guns, development of spectacular rockets ("the rockets' red glare"), and Fulton's mines, but most of them proved impractical and they were rarely mounted on the ships.

As in Volume I, the author makes some assumptions about the reader's ability to understand conventional plans and understand eighteenth-century nomenclature, but these are not likely to create problems for members of the Nautical Research Guild.

The price for this massive volume is steep, but the book will prove essential for anyone seriously interested in warships of the eighteenth century and the Napoleonic era. The final volume, to cover the changes created by the industrial revolution in the nineteenth century, is eagerly awaited.

—EDWARD P. VON DER PORTEN
Although it is essentially a polyglot marine dictionary (three languages in the first three editions, and five in the fourth edition), the value of Paasch today is mostly in the numerous and incredibly detailed engraved plates, which, in my fourth edition of 1908, include wood, composite, and iron ship structures of steam and sail ships; different types of steam ships; engine types (What, for instance, is a "grasshopper engine"?); early turbines; boilers; condensers; winches; steering gear; anchors; boats; capstans; pumps; rigging; sails; masts and spars; and small tools and parts. The fourth edition includes excellent definitions and numerous cross-references.

Although the turn-of-the-century period is not a favorite of many modelbuilders, it is good to have this book easily available to those interested in that era, and many others will find it a pleasure to browse through and handy to have when that odd term or unusual piece of hull or machinery needs to be looked up. As Christopher Morrison’s review (NRJ 43:1, 54) indicated, it will not help much with Patrick O’Brian novels, which are set long before the period covered by Captain Paasch’s masterpiece. But, the reprinting of From Keel to Track, to use its original title, should be warmly welcomed by anyone interested in turn-of-the-century ships, even if the reprint is of the first edition of 1885, rather than the more developed later editions. The cost of an original, if it can be found, is usually $200 or more.

—EDWARD P. VON DER PORTEN

Books listed here are new or recently published. The Nautical Research Journal welcomes written critiques of new publications from qualified reviewers. Please apply to the editor.


Henry B. Hyde: Downeaster by R. W. Bragdon. Privately printed. The most detailed record of this great ship; a description of her hull, deck furniture, masts, spars, and rigging; useful for building a model. Drawings, photos. 161 pp. plus four fold-out scale drawings, $23.95.

Tidewater Triumph: The Development and Worldwide Success of the Chesapeake Bay Pilot Schooner by Geoffrey M. Footner. Mystic Seaport Museum. A survey overview of this type’s "family tree" in text and illustrations; includes hull lines. Most of the seventy illustrations are archival images. Extensive notes, and appendices. 300 pp., $39.95.


Twilight on the Bay: The Excursion Boat Empire of B. B. Wills by Brian J. Cudahy. Cornell Maritime Press. A man builds a small entertainment and transportation conglomerate on the East Coast in the waning days of the steamship. Maritime history with a business twist. Vessels are well documented. 242 pp., $29.95.


Searching for the Franklin Expedition: The Arctic Journal of Robert Randolph Carter edited by Harold B. Gill Jr. and Joanne Young. Naval Institute Press. The author was twenty-four when he served in the brig Rescue during her search for the lost Franklin Expedition in 1850-51: he wrote this private daily account, never before published, of the voyage. Informative introduction, epilogue, and notes. 201 pp., $28.95.

More Scrimshaw Artists by Stuart M. Frank. Mystic Seaport Museum. A new study of 139 practitioners, including Alaskan native artists, and a discussion of faked scrimshaw. Thirty-one illustrations, appendices, bibliography, index to vessels, taxonomic and geographical index, cumulative index of artists. 189 pp., $45.00.
NOTICES

**USS Constitution Museum**

Phone: (617) 462-1812; Web site: www.ussconstitutionmuseum.org

8 February-13 March: Annual Exhibit of the USS Constitution Model Shipwright Guild of New England.

9 February: "No Common Lot: An African-American's Half-Century at Sea." Julie Winch, professor of history at the University of Massachusetts, Boston, will discuss her recent research on the merchant and naval career of James Forten Dunbar, who served aboard "Old Ironsides" from 1848 to 1851.

10 March: "Ann Hull Abroad and on the Homefront." Elizabeth T. Kenney presents her recent research on the experiences of Ann Hull while aboard "Old Ironsides" with her husband, Captain Isaac Hull.

Both lectures: 12 noon, bring a bag lunch; sign language interpreted.

**Maritime History Symposium in Maine**

The Maine Maritime Museum's spring Maritime History Symposium is a long-standing weekend tradition—an annual event eagerly anticipated by professionals and enthusiasts alike. If you are "from away," it is well worth the trip. The next one will be 30 April-2 May 1999; an information and registration brochure will be mailed to those who request it. Contact: Nathan Lipfert, library director, Maine Maritime Museum, 243 Washington Street, Bath, ME 04530; phone: (207) 443-1316, extension 328; fax: (207) 443-1665; E-mail: lipfert@bathmaine.com.

**Endeavour's West Coast Tour**

The replica ship Endeavour will be setting sail on the second half of her North American tour shortly after the first of the year, beginning in San Diego in February and ending in Vancouver in October. This visit will include more than a dozen ports of call. Contact: Stephanie Record, H M Bark Endeavour Foundation, 164 East 37th Street, Apt. 3B, New York, NY 10016; phone: (212) 679-5457; fax: (212) 679-8944; E-mail: srecord@ibm.net; Web site: www.greenwichuk.com/endeavour.

**Professional Mariner: Working Models**

See the article about the ship handling training facility at Grenoble, France, in the August/September 1998 issue of Professional Mariner. Trainees in the program there use 1:25 scale working models, about 35 feet long, in their exercises. The article gives several specific scaling factors related to the performance of models versus the actual ships. Contact: P.O. Box 569, Portland, ME 04112-0569; phone: (207) 772-2466; fax: (207) 772-2879; E-mail: subscription@ProMariner.com.

**Women and the Sea Network**

The goal of the international Women and the Sea Network, based at the National Maritime Museum in Greenwich, England, is to promote and publicize research in the field of inquiry after which it is named. The network welcomes new members, seeks proposals for hosting seminars, and solicits contributions to its newsletter. The network will soon host a discussion group on the World Wide Web. See the National Maritime Museum's Web site for details: www.nmm.ac.uk/rcs/index.html. Contact: The Women and the Sea Network, c/o Research Department, National Maritime Museum, Greenwich, London SE10 9NF England; E-mail: jo.stanley@dial.pipex.com.

**WoodenBoat**

See the December 1998 issue of WoodenBoat for articles about three vessels of historic interest: a medieval cog (hull ZO 36) recovered near Kampsden, Holland; Amistad America Inc.'s new topsail schooner under construction at Mystic Seaport; and Effort, a turn-of-the-century Monhegan Island, Maine, packet schooner.

**ADDITIONS & CORRECTIONS**

Additions and Corrections to NRJ 43:3

"Aspects of a Global Maritime History"

Addition: An earlier version of this article was read by the author at the Maine Maritime Museum's 1998 Maritime History Symposium.

"Nashua and the Long Island Sound Steamers"

Addition: This article was developed from a slide presentation the author gave at the Nautical Research Guild's 1997 annual conference, hosted by the U.S.S. Constitution Model Shipwright Guild of New England. Correction, p. 147, text and Figure 7: The straight at the western end of Long Island is the Narrows; the name Verazzano applies to the bridge that crosses it. Correction, p. 151, footnote 13: Alan Frazier's lecture was presented at the 1986 Guild conference in Boston.

"Despite All Odds"

Correction, p. 155: In the first paragraph, the third sentence should read, "As the crews matured and Canada and its navy became of age, the gunshell graffiti was eliminated and simply replaced with a green maple leaf on the funnel to identify a ship as Canadian."

Correspondence: "Panama Canal Reprise"

Correction, p. 165: The second sentence in the caption for Figure 3 should read: "The heavy cruiser U.S.S. Houston in Miraflores locks on 11 July 1934."

Vol. 43, No. 4
Fay proposes that there has been a near miss on the target as it was being towed and, somehow, the towline got fouled in the tug's propeller and is being cleared. Williams proposes that the tug is under tow "because under its own power it would be late" for target practice. Because of the hawser's gauge and its lead over the tug's bulwarks, Blevins does not believe the tug is under tow, but he agrees with Williams that the target is being deployed because it shows lack of damage from successful shooting. Wilterding and Geyer agree the tug is helping arrange the target for towing and Geyer thinks it will later help the schooner; he thinks the hawser is for towing the target, not for towing the tug, and the target towing vessel, not in the frame, actually has the photographer embarked. Herrick agrees and suggests there may be another target in the tow, and Wilterding says this is because the numeral 7 is painted on the one in The Photograph. This opinion is supported by Von der Porten, who sent a xerographic copy from Reynold's book that shows another target clearly numbered "8."

Geyer thinks the target "looks a little small for the long-range targets" needed for a battleship's big guns and guesses it "was designed for cruisers and destroyers." However, Von der Porten writes that "the lightly built target portion is about 30 feet high and 60 feet long. It is made of a wood grid covered by coarse net that is later retrieved for analysis. The lower portion is a solid timber raft." In one of the photocopies Von der Porten sent, the bulk and cage masts of what could only be a U.S. battleship are clear behind a target of similar size, and the caption tells us that "the area of the target is about one-tenth that of the broadside of a modern battleship." Wilterding tells us that "the target was either towed or kept in a stationary position. Practice ranges varied from 2,000 to 3,000 yards in 1903, to 5,000 to 6,000 yards in 1905 and 8,000 yards in 1908. Visual spotting was suitable up to 3,000 yards," and spotters estimated the locations of splashes. A direct hit would hole the lattice work. He also suggests the target is being used by submarines for practice with dummy-warhead torpedoes. Von der Porten observes that the gunnery exercise photographs in Reynold's book bear the credit, "copyright, F. Muller, Jr." Williams thinks Muller may have made The Photograph.

Glenn N. Wright of Carrollton, Georgia; Blevins; Geyer; Herrick; Von der Porten; Williams; and Wilterding are obviously able to count better than I, for they found six masts in the schooner where I only saw five. Beyond this, concord regarding the schooner's presence beyond the tug and target fades. Herrick sees a slight bone in her teeth and says this indicates she is already "being towed outside before raising sail" with a cargo of coal she loaded at Norfolk or Newport News and will carry to New Eng-

land. Blevins thinks she is anchored outside, awaiting a tow into port that Fay guesses might be Portsmouth, New Hampshire. Geyer also thinks the schooner, which he tentatively identifies as Fort Laramie, awaits a tow that will be provided by the tug when she's finished with the target, but he suggests the schooner carries timber for San Diego and is "probably caught unexpectedly in the venue of the navy's battle practice plans." Wilterding writes that she "is probably being used as a range ship. All sails are furled and she was probably towed to the target site." According to Von der Porten, the "schooner probably has no relationship to the event, although what she is doing in the practice zone is a good question, and why she has no sail set is puzzling." Williams thinks her "passage may [be] restricted by the maneuvers planned by the navy on this occasion."

Wright says the six-masted schooner "is one of the ten ships of her type," and that this places her and The Photograph on the American East Coast in the first quarter of this century. Blevins agrees. Fay's broader dating from the 1880s to the 1940s is outside the reign of the great six-masters. Herrick and Williams limit dating to a collective but narrow span from 1914 to 1917, the years prior to U.S. entry into World War I, and Wilterding implies this period by stating the tug is of that war's vintage. Von der Porten favors "the end" of the war. Geyer's dating is 1924 or 1925, based on the tug, the schooner, and his memories of West Coast naval gunnery drills.

—ROB NAPIER

Sources


Here we have a remarkably crisp image of a sailing vessel underway. The poor state of the paint on the topsides makes it difficult to see the false, painted ports. Why is the vessel so weathered? Is the condition of the paint normal or extreme? Why is there more streaking below the after-most mast's rigging screws and chains? Is all the deterioration a result of rust? Is there a way to identify the vessel's age, name, nationality, or specific rig? Why is there a cover on the cowl vent? Most of the running rigging is taut or hangs in smooth catenaries; why are a couple of pieces of gear so squiggly? Answers received by 24 January will compiled in the next issue of the Nautical Research Journal. Send them to Rob Napier, The Photograph, 62 Marlboro Street, Newburyport, MA 01950.

We have a record number of replies on our desk for The Photograph in the September issue. The consensus of Albert C. Blevins of East Greenbush, New York; Dudley B. Fay of Marblehead, Massachusetts; Robert L. Geyer of Tulsa, Oklahoma; George C. Herrick of Exeter, New Hampshire; Edward Von der Porten of San Francisco, California; Peter Williams of Boston, Massachusetts; and John H. Wilterding Jr. of Algoma, Wisconsin, is that the vertical lattice structure is a floating gunnery target. Fay suggests the target is for training field artillery or forts along the U.S. eastern seaboard; the others believe it is for naval use.

Geyer thinks the steam-powered tug is civilian and the scene is set on the West Coast, where he remembers window-rattling naval target practice off the Coronado Islands, which are "south of San Clemente Island and 30 to 40 miles southwest-by-west of San Diego." Blevins, Von der Porten, and Wilterding say the steamer is a United States Navy tug. Wilterding continues that the image was made off a major navy base like those at San Diego, Norfolk, or Boston. Herrick suggests the tug is from the Norfolk Navy Yard or Naval Base and the image was made at Hampton Roads. Fay favors a New England location. Von der Porten refers to a series of photographic images in a book entitled The United States Navy From the Revolution to Date by Francis J. Reynolds. The same tug and schooner are shown, although not the same photograph, and the location is identified as the "Southern Drill Grounds," which he presumes are in the Caribbean Sea outside of Guantanamo Bay, Cuba, or near Puerto Rico. This site name is supported by Williams, who thinks the area may be off Norfolk.

—continued on page 255
SHIP MODEL PLANS BY ERIK RONNBERG
Boston Pilot Schooner
HESPER
Designed by Dennison J. Lawlor
Built at Chelsea, Massachusetts, 1884

- Hull drawings, scale 1/4" = 1' line, deck arrangement, outboard profile, run of copper.
- Spar drawings, scale 1/4" = 1': spar lengths, tapers, and sections; details of hardware to larger scales.
- Rigging profile, scale 3/16" = 1': rigging leads, sails, belaying points.
- Construction and rigging notes, spiral-bound booklet; tables, color scheme, keys to drawings, references.

Plans show vessel as sparred and fitted in her first year. Lines to outside of planks for solid (lift) hull construction.

Price: $28.00 (Massachusetts residents add 5% sales tax), postpaid for folded plans, shipped flat.

For plans in mailing tube, add $3.00. Overseas shipments, add $8.00.

ERIK A. R. RONNBERG JR.
P.O. Box 1499
GLOUCESTER, MASSACHUSETTS 01931-1499
The Nation’s Premier Dealer of
Museum Quality Ship Models

Mystic Maritime Gallery represents the best artists and
shipmodelers from this country and from around
the world. We are the nation’s largest gallery specializing
in contemporary marine art and ship models.

We occupy a prime location at the nation’s major
maritime museum, Mystic Seaport, along the Mystic
River on Long Island Sound, just off Interstate 95 be-
 tween Boston and New York City. The Gallery was
established in 1979 and, in order to accommodate rapid
growth, expanded into a brand new facility in 1985 with
combined natural and artificial lighting. Like the
Museums, we adhere to high standards of integrity,
research and connoisseurship.

Please contact us to inquire about consignment sale
of your ship models.

Box NR • Mystic Maritime Gallery
Mystic Seaport Museum Stores, Inc.
Mystic, CT 06355 • (860) 572-5388

Old & Rare
Maritime Books
for sale at reasonable prices

We are eager to purchase fine
books or collections on these topics:

Whaling, Yachting, Lighthouses, Fisheries,
Costal and Island Histories, Voyages & Travels,
Polar Exploration, Shipwrecks, Pirates, Privateering,
Marine Art, Antiques & Instruments, Logbooks,
Maps and Charts.

Please call or write for free catalogues.

ten pound island book company
76 Langsford Street, Gloucester, MA 01930
(978) 283-5299

Now Shipping

Pier Books & Dupont Communications are pleased to announce the publication of:
The Illustrated Guide For Modeling

The Royal Yacht FUBBS, 1724
by Reverend William Romero

- 8.5” x 11” lay-flat design, of about 675 pages
- two styles of hull construction: F. T. B. T. and H. Hahn
- step-by-step construction techniques, tested by
  student modelers during a two year Practicum
- over 1200 photos and line drawings
- 100+ pages of true scale reproducible patterns
- 3 color photos of completed model
- Foreword & endorsement by Harold Hahn

This major new work on shipmodeling will be a valuable
reference for the serious modeler, regardless of skill level. The
useful techniques described are applicable to other modeling
projects besides FUBBS, and will make this volume a standard
reference as Petrejus’ Brig-of-War IRENE.

$95.00 • surface P/P ($5 domestic & $15 foreign)
checks in US$ on Am. banks, Visa, MC, Discover

Pier Books Inc., P.O.Box #5, Pierton NY 10968 USA
Tel# (914) 268-5845 • Fax# (914) 268-8804
E-mail: pier.bks@icu.com