

The First Experimental Preservation Project

of the Shipwreck *SS America*

written by

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of the

Great Lakes Shipwreck Preservation Society

Only a part of what was observed in the past was remembered by those who observed it; only a part of what was remembered was recorded; only a part of what was recorded has survived; only a part of what has survived has come to the historians' attention; only a part of what has their attention is credible; only a part of what is credible has been grasped; and only a part of what has been grasped can be expounded or narrated by the historian.

Louis Gotschalk
Understanding History



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Abstract

After two years of planning and one year of working through National Park System procedures, a historic project was undertaken and is now near completion at Isle Royale National Park. It was the experimental underwater reconstruction and stabilization of four crew quarter rooms in the Shipwreck *SS America*. The *SS America*, which sank in 1928, is a historic site and a popular dive site. Many of its rooms and furnishings have badly deteriorated in the last five to ten years. In the once intact crew quarters, diver visitors used to see three bunk rooms and a wash room. Four years ago a divider wall collapsed between one bunk room and the wash room. This caused the attached bunks and steam pipes to slide out of place and collapse. The once interesting set of rooms became a maze of unrecognizable entanglements. A group of dedicated professionals formed the Great Lakes Shipwreck Preservation Society. This group with the support of the park Cultural Resource Management Specialist, park personnel, several businesses, and individuals planned and implemented a reconstruction effort. The successes, problems, and future plans associated with this effort is the topic of this report.

Acknowledgments

I would like to acknowledge and thank all of the people involved in this historic project. From Isle Royale National Park, our sincere thanks to Liz Amberg who put in the extra effort in spite of a heavy workload to walk our proposal for an out of the ordinary project through the NPS procedures. Our thanks also to Bob Whaley and Dean Martinson, who supervised us on site, and Pete Armington. Our thanks to David Cooper, Scott Anfinson, John Halsey, Pat Labadie, and Dan Lenihan for reviewing our proposal and supporting the experiment. Our special thanks to David Cooper for participating in the project to insure what we were doing was archeologically responsible.

Our special thanks to Dana Kollars of the *Grampa Woo* who hauled our equipment to Isle Royale with only two passengers, and Ron Polomski, the photographer who did a beautiful job of the before and after documentation for us.

I would also like to thank the project participants and supporters listed in the appendix. The participants gave of their time, talent and equipment. The supporters did likewise. Some sold our T-shirts, loaned us equipment or facilities, or supported us financially. The project was well supported throughout the diving community.

Purpose

This report has several intended purposes. It will document not only the physical changes made to the *America* wreck site, but also, the process followed to do the work. Since the stabilization effort or more precisely called a preservation effort, itself was a historic event, it is important to document this step in our progress to preserve these historic underwater sites. Additionally, we hope thorough documentation of the process will help other groups interested in doing similar efforts to learn from our experience. Of course, by NPS standards and archeological ethics, it is incumbent on any person or group doing preservation work on a historic site to document all changes made to the site.

Background

The packet freighter *SS. America* sank in 1928 in the fog in North Gap, Isle Royale. The *America* which serviced many North Shore communities is an important part of the Lake Superior North Shore and Isle Royale history. Today it is a very intact 180 foot long shipwreck that is on the National Register of Historic Places and is dived about 500 times each year. It is the most dived wreck at Isle Royale National Park and has been a primary attraction for recreational scuba divers for more than thirty years. (Current Statistics: About 400 divers per year dive Isle Royale with an average of 4 to 5 dives/diver or 1600 to 2000 total dives per year. The total *America* dives were 534 dives out of 1756 in 1996, 534 dives out of 1506 dives in 1995, and an unrecorded percentage of the 2277 total dives in 1994.)

In the last five years, the level of deterioration seen on the *America* and some of the other Isle Royale shipwrecks has been growing more and more disturbing to many of the diving visitors. The cause of this deterioration is dive pressure related and is not unique to the Isle Royale wrecks. As these wrecks age, the steel fasteners used to construct the wooden portions of the ship rust and disintegrate and when bumped by divers can come apart. The speed at which the deterioration occurs depends on the age of the shipwreck, the types of fasteners used, and the amount of physical contact the wreck is subjected to from the diving visitors. The charter services do their best to encourage gentleness and care toward the wrecks when diving. Nonetheless, scuba diving with bulky equipment, buoyancy changes, and visual limitations is often difficult to make a graceful pursuit. The result is unintentional damage to our somewhat fragile underwater historic resources. At the current level this damage certainly degrades the historic value and user enjoyment of the resource and is starting to become a safety concern.

In countless above the water historic sites we have, through public and private efforts preserved, rehabilitated, restored, and reconstructed our historic resources so they can be maintained for this and future generations to enjoy. Our shipwrecks are no different from any other historic site. If we are to have them in the future, we need to do some maintenance now. The only difference is the skills required and the methods used to do the work. For those of us that use this resource, the need for this maintenance is only too obvious.

The GLSPS contends that this maintenance is eminently feasible and can be done very safely and effectively in a cooperative effort between sport and commercial divers, archeologists and the National Park Service. It not only can be done, but it is crucial to the survival of our shipwrecks that it be done soon. As more and more pieces of the interior of wrecks like the *America* fall down, the puzzle of where the pieces go gets more and more complex. Eventually, if we do nothing, we will be left with hollow hulls containing piles of wood where rooms used to be.

Who is GLSPS

The Great Lakes Shipwreck Preservation Society was incorporated in Minnesota on May 28, 1996 as a non-profit organization. Our purpose as stated in our bylaws is the following: "The purpose of the GREAT LAKES SHIPWRECK PRESERVATION SOCIETY shall be the discovery, preservation, and restoration of shipwrecks; the dissemination of knowledge about shipwrecks and underwater historic sites; and the creation of underwater recreational dive sites in the Great Lakes Region." We are an organization of divers, historians and individuals who have an interest in preserving shipwrecks.

Before incorporating the GLSPS, the founders of the organization had successfully implemented a previous shipwreck preservation effort in 1994 on the schooner *S.P. Ely* in Two Harbors, Minnesota. This project is the subject of a separate report. It basically involved lifting a collapsed section of the deck and installing five steel rods through the hull to keep the sides of the ship from spreading and collapsing. The major effort of the project was performed in the winter through the ice which provided a stable platform for lifting the deck.

Planning Effort

There were actually two planning efforts for the project. The initial planning effort was started in the winter and spring of 1994-1995 with the intent of implementing the project in September of 1995. Unfortunately we were unable to complete all of the approval process in time to hit the narrow window of opportunity in September just following Labor Day. This is the optimal time for the project since the water temperature is at its warmest allowing longer bottom times and the best manual dexterity. Visitation is also minimal so there is little disruption of work or visitor expectations. As September wears on the winds and weather grow increasingly unpredictable making even the sheltered North Gap location a tenuous work place.

Although simpler in scope all of the technical and logistical planning was completed for the planned 1995 effort. After a disappointing false start, it was relatively easy to re-plan the effort for 1996. We used the additional year to make a number of improvements in all of the project areas. We improved our newly designed equipment like our underwater lighting system, created a formal organization GLSPS for our heretofore loosely organized group, enhanced the safety plan by adopting OSHA standards, and

implemented a fund raising project to underwrite the bulk of the project expenses. These improvements were originally charted to follow the *America* project as enhancements for the second project. They were however welcome additions to the implemented plan.

The initial planning effort was started in the winter and spring of 1994-1995 in discussions between Dan Gates, Ken Knutson, Ken Merryman, and Bob Olson. Most of these discussions were preliminary and brought up the need to finish the ***Ely Restoration Report*** and make a formal proposal to the NPS with a step by step plan. The formal proposal was started in April of 1995. After several dives during my early charter season in July 1995, we had enough of the sequence of steps figured out to allow the proposal to be written. The proposal included an appendix of questions that needed to be answered before the last details of the restorations needs could be determined. The proposal also included a simple safety, materials, and financial plan. (Reference *America Crew Quarters Restoration Proposal - Rev A*) This was submitted to Liz Amberg, the park Cultural Resource Management Specialist, on July 28, 1995 along with a copy of the ***Ely Restoration Report***, to establish some level of credibility to our proposal. We also submitted a video tape to show the underwater damage in the crew quarters.

The proposal was well received both from Liz Amberg, and from comments in discussions with Scott Anfinson, Pat Labadie, and Dave Cooper. We felt confident enough that we would be permitted to do the work to take the next steps of investing the time and money into building the special equipment we needed to do the work. This was mainly the underwater lighting system and the underwater battery powered drills.

After submitting the proposal we continued to survey the rooms to answer the questions enumerated in the proposal appendix. By mid-August the technical questions were pretty well answered. With permission from the park, I tested the pneumatic and electric screw drivers by running about a dozen screws into a part of the collapsed wall. We needed to know if the screw holes would need to be pre-drilled, or if we could drive through the soft wood. The wood was soft enough that we did not need to pre-drill fastener holes. This left the equipment, materials, project personal accommodations, and financial planning.

The 1995 equipment planning was handled in two meetings of the group, in which we did a walk through of the step by step process from the plan and noted equipment needed for each task. A checklist of who was responsible for what equipment was prepared.

Materials were also determined in the project walk through meetings and numbers of fasteners were determined by wall area estimates and knowing the number of cross-members and the dimensions of the tongue and groove paneling. Additionally we allotted quantities for post brackets, bunk reconstruction, pipe hangers, deck repairs, stair well, and chain tunnel stabilization. Since the bronze screws are expensive, we did not want to over do the quantities. Bronze screws were chosen because of their corrosion resistance, ease of installation in the non-rigid structures and their ease of removal (if changes need to be made in the future). The total number for completing the entire effort was estimated at about 2,000 screws.

We proposed using bronze angle brackets to fasten the approximately 47 vertical wall and bunk posts to the floor and ceiling. We discovered that nowadays there are numerous alloys of bronze (copper-tin-zinc) and many are so close to brass (copper-zinc) that it is virtually impossible to tell the difference unless you buy new metal. This would have added considerable expense to the project so we settled for either brass or bronze since either should really suffice for the purpose. We cut, drilled and counter-sunk about 120 brass brackets plus spares from brass angle stock, which turned out to be more than we needed. Additionally we planned to have on hand miscellaneous spare hardware and construction materials to handle unplanned situations. Due to the remote location of Isle Royale, missing hardware can cause considerable project delays. These extras included wood of various dimensions and types -- oak, cedar, pine. Miscellaneous hardware included threaded rod, nuts, bolts, screws, bronze plate, brass angle, steel angle, pipe hanger strap, and bronze annular ring nails. Almost all of this was purchased or donated for the 1995 planned effort.

The 1995 project personal accommodations were assumed to simply be the park shelters and boats and we would all evenly divide expenses for the food and boat gas bills. We expected to solicit a couple hundred dollars from various scuba stores to pay for the fasteners and material. We never did solicit this money since, we did not want to ask for donations until we were sure we had permission to do the project.

After Pete Armington assured us that the problem with the 1995 implementation was not with the philosophy of repairing shipwrecks but more with the time table we had set for doing it, we proceeded with our plan to implement the project in 1996. From November 1995 through May 1996 the group's time was consumed in biweekly and eventually weekly meetings to hammer out the foundations and bylaws for the GLSPS. Since we believe the need for this work is widespread but the best organizational structure to do it was unknown, we tried to build a flexible organization so it could grow in a number of ways. To some extent we modeled it after a typical historic society but gave ourselves the flexibility to grow by either adding regional chapters if the work remains as mainly volunteer efforts, or by growing larger with a professional staff, if need be, to handle a larger area.

In earnest planning restarted in June of 1996 with a better but still inexperienced organization. The project plan was revised then resubmitted with new dates, one change in the boats to be used, and an improved safety plan. Our new safety plan required training in CPR, and first-aid for all participants and an optional hard-hat and tender introduction class. Two of our members Ron Benson and Jerry Provost are certified to teach these classes. Both classes were scheduled and run during the summer. Since our efforts to form the organization took far longer than planned, we had to scramble to implement a simple fund raiser. Since I needed souvenir T-shirts for my charter service customers anyway, I agreed to underwrite the initial purchase of 140 project T-shirts that we would sell and solicit the other charter services and local dive shops to sell with all proceeds going to the *America* project.

In July I tested the underwater lighting system and discovered that the brown and rust colored rooms were much harder to light to a reasonable background level than we had suspected. We redesigned and tested a second lighting system to augment what we had. Additionally we had to plan on carrying work lights (battery powered flashlights) for seeing work detail.

In August we resumed the equipment planning sessions repeating the step by step walk through. Each team member was given a personal checklist to maintain for his portion of the equipment. Where possible individuals were assigned responsibility for equipment for tasks since trying to tally all equipment was overwhelming. I kept a master list that was the sum of all of the individual lists. It was very difficult to estimate the weight and size of all of the equipment plus backups. From our best estimate, it became apparent that the best plan would be to get some help transporting the equipment to the island. Originally we had planned to leave all backup equipment i.e. dredge, compressors, generators etc. in Grand Portage. However, if we did have a breakdown in essential equipment, this would require a minimum of one-half day to retrieve the equipment and return, assuming good weather. We asked Dana Kollars if he would transport our heavier equipment in his 110 foot excursion vessel *Grampa Woo* so it could be staged at Windigo. This put us less at risk for losing time. It also guaranteed that all of the required equipment could be transported in one trip.

One of the Minneapolis television stations agreed to cover the project well in advance of the project date but backed out the week of the project. We scrambled again to get another station to do the coverage. With time short and more basic priorities preempting this effort we ended up without the on site media coverage. This had some advantages since it would have made the boats more crowded.

There were minor changes in personnel as a couple group members had to bow out at the last minute. Meals quantities were planned for the final crew size along with minimal storm provisions. Sleeping accommodations were again planned to be the boats on site and one park shelter in Windigo which the park reserved for us. Keeping the boats on site saved setup time each day, but made it difficult to get a good nights sleep since we had northwest winds and small waves all but one night.

With planning complete travel arrangements were made to car pool to Grand Portage. This was a little complicated since we decided to extend the project one day to allow extra time to clean-up and pack if needed. Half of the crew returned with the *Grampa Woo* the fourth day and the other half returned the morning of the fifth day. With the details addressed we were ready to implement what we had been planning for a year and a half.

National Register of Historic Places Permit Process

The *AMERICA* is listed on the National Register of Historic Places. In order to protect sites, structures, and shipwrecks listed on the Register, Section 106 of the National Historic Preservation Act (1966 as amended) requires Federal agencies to assess the effect proposed actions will have on National Register properties. Liz Amberg completed a Section 106 assessment form (ISRO 95-06, MRO-95-200) in August 1995, and submitted it to the NPS Midwest Region for review by cultural resource professionals in accordance with the 1990 Programmatic Agreement Among the NPS, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers. The project was found to meet the programmatic exclusion requirements for preservation maintenance and was approved as submitted in September, 1995.

The park also submitted the project proposal for review and comment to Daniel Lenihan, Director of the NPS Submerged Cultural Resources Unit; David Cooper, Wisconsin State Underwater Archeologist; Scott Anfinson, Minnesota State Archeologist; and John Halsey, Michigan State Archeologist.

NPS Permission Process

Isle Royale National Park actively manages all natural and social science research, data gathering, and monitoring projects taking place within in the park. Researchers are required to submit a proposal for work and receive a "Research and Collecting Permit" prior to undertaking any fieldwork. The permit specifies the scope of the project and authorizes (or prohibits) collection of specimens. Researchers are required to submit a report at the end of each year.

This was the first project of its type proposed for Isle Royale National Park. Park management decided to use the research permit process to document and track the project. A Research and Collecting Permit (ISRO-26-228) was issued to Ken Merryman in August 1996. The Permit did not authorize any artifact collection.

Plan

The whole project started with a proposal called *SS America Crew Quarters Restoration Proposal*. To document the process the following is a simple discussion of the general outline.

Background: The background section covers the context of the project. It includes a brief history of the ship, its significance, a description of the degradation, and the rationale for the changes. It also included a brief documentation of our credentials, a discussion of feasibility, and financing. Since the *America* project was the first project of its type ever done, the rationale for the changes was probably longer than it may need to be in the future.

Project Goals: The project goals contrasted the original state and the current state of the rooms to be worked on and gave an itemized list of jobs we hoped to complete in each room.

Repair Plan: The repair plan was divided into three sections -- Preliminaries, Main Effort and the Step by Step Plan. In hind sight there probably should also always be a follow-up section. This part of the plan will by necessity be less concrete since it usually involves the finishing work that could not be completed in the main effort due to a lack of time, equipment or materials caused by unforeseen situations.

Preliminaries: This effort was an extension of the planning process and was used to answer questions that the planning process raised. The answers to this level of questions should only affect the final details of the work and not the project feasibility. The initial plan left questions pertaining to the detail design of replacement parts and dimensions and quantities for final material estimates. Additionally it defined tests needed to determine the integrity of the wood, the best fastening approach, and attempt to locate essential pieces of the puzzle. We also found it beneficial to do a final checkout of newly designed equipment like the screw guns and lighting system ahead of the main effort so changes could be made before they impacted the main effort.

Main Effort: This section gave the step by step sequence we planned to follow to complete the tasks. This plan was used in walk-through planning discussions to determine equipment and material needs for the project. It was also used on site for task assignments and task management.

Summary: The summary gave the rationale for doing the preservation effort which for this first project was probably more justification than it should need to be in the future. The appendices of course covered in specific topics that were not worth detailing in the report.

Appendix A Fasteners

Appendix B Safety Plan

Addendum: Answers to Preliminary Questions:

Participant Prerequisites

Our adopted safety standards required a level of training for all on-site participants in the project. Each diver was required to have a minimum of an Advanced Diver certification as well as logged dives that verified his experience. Additionally all participants were required to be certified in CPR and Basic First Aid. Additional training or certification was required for any participants using the hard hat equipment or tending the commercial divers.

A file was created and maintained on site that contained the certifications, medical history, and background of each participant in the project. All participants were requested to have a preliminary physical with chest X-ray to be kept on file at their medical facility.

The personal file kept on each participant included the following documents.

1. Padi Medical Statement which documents medical history
2. Signed Liability Releases
3. Signed Padi Standard Safe Diving Practices Statement of Understanding
4. Personal Resume with a brief description of diving experience and certifications.
5. Copies of CPR, First Aid, Advanced diving or higher certifications, and DAN Membership.

Training

To meet these requirements three classes were scheduled during the summer. Ron Benson taught the CPR and First Aid classes. Jerry Provost taught the basic hard hat and tending class. Both are certified instructors in their fields.

Required Equipment

The project was very equipment intensive. Many of the members of the group own or have access to a large selection of needed equipment. Tools and machines that we did not own were solicited from other supporters, dive stores, or commercial diving operations. The use of all equipment was donated which is a relatively easy thing for most businesses to do. We allocated \$400 for equipment repairs if needed. From our *Ely* Restoration experience we recognized that this allocation would be necessary. So far we have not had to dip into the allotted money, although one of the compressors appears to have some minor damage. We may have to pay a small amount for parts. After the *America* Project we are starting to think in terms of some kind of a standard tool allowance, since all of us are seeing some degradation in our carpenter and mechanics tools that are not coated or meant for underwater use. Each time they are used underwater they get a little rustier. Some of the dive equipment like the dry suits which are often recreational weight are suffering more wear than the owners care to see happen. Dry suits are probably the most expensive and most likely to be damaged piece of personal equipment for the participating divers. A complete set of the equipment checklists are included in the appendix.

Actual Implementation

The entire project took a total of 64 dives and 3782 minutes or 63 hr. 2 min. total dive time. We basically followed the steps set forth in the plan. A few comments on each step is probably justified.

Transportation- Equipment and personnel were transported to Grand Portage in three pick-up trucks and two full size vans. All were reasonably full. Everyone arrived Friday night or the early Saturday morning.

Equipment Dispatch & Loading. Wake-up time was 6:00 AM since all extra equipment had to be sorted dispatched and loaded on the *Grampa Woo* for his planned 8:00 AM departure. He ended up leaving much later than this due to only two passengers showing up for his charter. The remaining equipment was loaded on the *Nobility*, *Heyboy*, and

Hang-Time. We took advantage of the departure delay time to construct and install the compressor pedestals on the *Heyboy*.

Crossing: Four of the group members crossed with the *Grampa Woo* to do the unloading at Windigo. The other three boats departed at 10:15 AM two hours later than planned.

Check-in, Unloading & Equipment Staging: The other three boats arrived at Windigo at 2:00 PM CDT where the park permit paperwork was finalized. Backup equipment and equipment not planned for use until the next day was stacked and covered on Windigo Dock. Lunch was served during the shuffle.

On-site setup: By 4:00 PM CDT the boats were on site and the lines were being placed to securely station the *Nobility* over the crew quarters hatch and the *Heyboy* to its side. Air hoses and power chords were strung between the two boats being careful to not obstruct walkways.

Diving Steps

Mooring: The mooring setup is shown in figure 1. Lines were fastened from the *America* bollards and the NPS mooring anchor to the *Nobility*. The *Heyboy* was similarly fastened with the addition of being made fast to the normal wreck mooring line. The boats were also fastened to one another to allow safe passage between the two boats. *Hang-Time* was moored on the starboard side of the *Heyboy* away from the diving activity so it could be used as a shuttle. It would have been difficult to moor another large dive boat on our sides, although the *Grampa Woo* had no trouble anchoring near the mooring buoy for his passengers' dives. Alpha flags and dive flags were flown during all daylight hours of the project.

Initial Video & Still Photography: Ron Polomski had shot a roll of slides in the crew quarters the week before the project to document their initial condition. Additional "initial condition" still photographs were shot by Dave Cooper. Ron Benson covered the process with video. Both documented the first dives, but good photographs were difficult to take during the project due to the low visibility. At the start of day four we managed to get good video of the wall reconstruction before the activity lowered the visibility.

Safety Inspection: Our safety officer Jerry Provost did an initial survey of the rooms to determine any safety hazards. Afterwards he held a safety briefing and the absolute number one priority of zero accidents was strongly emphasized.

Dredging & Loose Wood Removal (set on deck), & Artifact removal: It was 5:00 PM CDT before the real work began. The first task was to dredge out silt from the lower corners of the rooms. After a brief time we discovered several things we had not expected. Although the trash pump can pass gravel through it, the small slivers of rusty metal from the deteriorated steam pipe hangers would wedge between the impeller and case of the pump and jam it. Our resident mechanics rapidly learned how to rebuild the pump. After the second hang-up, we were down for repairs through the end of day one.

Several artifacts had been uncovered in the silt and in our evening discussions and debriefing, we made a few adjustments. After consulting with Dave Cooper, our archeologist, and Jerry Provost our experienced commercial diver with hundreds of hours of dredging experience, we made a minor change to the dredging operations. All silt was removed by fanning and lifting with one hand and suctioning with the other, so the hose was not pushed down into the silt.

All artifacts discovered were documented and stored underwater for later replacement in the corners. Of course, the hose ends had already been screened.

The terminology originally used in referring to the rooms i.e. forward and aft crew quarters was too vague. There were really four rooms we were working in, once the divider was replaced. For directing operations we referred to them as rooms one through four. Room one was the most forward room and rooms three and four were the starboard and port sides of the aft crew quarters.

The dredging reduced the visibility to near zero making it almost impossible to do anything else while it was going on. The next time we do this we will schedule the dredging as a separate preliminary effort with a small crew so the silt has time to settle before reconstruction begins.

Day 2

Day two was mainly spent dredging and doing some other concurrent stabilization tasks that could be done in two feet of visibility. As Jerry removed the silt he would pass the loose pieces of wood to another diver, who in turn passed them out to the next diver on the deck. Wood was stacked and sorted by location of removal.

Light installation Lights were installed by OSHA standards, which says install then turn on. The four bulb fluorescent was installed in rooms one and two and the two single fluorescents were installed in rooms three and four.

Refastening of Rm. 1 Port Wall This was one of the simpler tasks done concurrently with the dredging once the dredging had moved to room two and three.

Refastening of Rm. 1 Chain Chute Again this was one of the simpler tasks done concurrently with the dredging once the dredging had moved to room two and three.

Refasten Horizontal bunk sides to vertical posts in all rooms The task of rebuilding bunks especially in room four was a continuing concurrent effort. Ron Benson returned the bunks in room four to almost totally intact condition.

Day 3

The main focus of day three was to get the components of room two into place and assemble the framing of the wall between room one and two. Concurrent to the wall rebuild a number of other tasks were carried out.

Temporarily Hang Pipes & Untangle wall and bunks - Temporarily stand and clamp wall - This operation was done at the start of day 3. Untangling this mass of intertwined debris took two hard hat divers with communications to lift, pull, move pieces in concert. It had to be done in stages to get the pieces to fit. The pipes were moved first and hung from clamps with short pigtailed rope. The wall was then stood up and temporarily clamped in place. Once the relative positions of the wall and pipes were established both were eased into place.

Reposition Pipes and Bunks in Rm. 2 Splint Pipe - Once the exact position of the steam pipes had been reached Dan Gates splinted the athwartship pipe using a split piece of white PVC pipe and wire. This established the former position of the pipe so the wall could be set.

Final Positioning of Wall in Rm. 2, install brackets and new base plate - The PVC pipe splice had to be left for replacement with a steel splice next year. Once the pipes and the wall were set, and the pipe fit through the notch in the wall a new base plate was cut and fastened into place. Angle brackets were installed to hold the wall posts in place. The new base plate was screwed to the floor boards with a little difficulty since the new wood wanted to float up. Using weights to hold it down was impractical because of the slope of the deck.

Locating & Sorting T&G for Rm. 2 wall reconstruction - The wall framing was in place by the end of day three. An effort was made to collect the loose wood needed for the next day so the silt stirred up in the process could settle over night.

Refastening vertical posts in Rm. 3 We discovered that simple two inch angle brackets did not work for refastening a number of the vertical posts, because the posts were too short. This was caused either because of a sagging deck or from the ends of the posts being worn away from abrasion on the deck. The abrasion had occurred during the years the posts had been loosely swaying. Additionally many had been toe nailed into the ceiling (upper deck) which left remnants of the rusted steel nails imbedded in the ends of the posts. We could not drive a screw into the results. To solve this we cut 3/4" x 2" x 8" oak blocks to extend the posts and give more area to drive the screws into the posts.

Refasten Stair Treads Rm. 1 - This was done simply with 2" bronze screws. We were very glad we had purchased an assortment of screw lengths since several of these odd jobs required longer screws.

Refasten all posts in Rm. 2 - Same scenario as posts in room 3.

Day 4 - Half of the crew and the *Hang-Time* was scheduled to leave on day four along with or aboard the *Grampa Woo* at 2:00 PM. Consequently we were in the water by 7:00 AM to make the best use of the departing talent.

Reconstruction of T&G paneling on to wall in Rm. 2 - Tom Brueshaber our professional carpenter did the bulk of the wall reconstruction. He started with the full length pieces of tongue and groove paneling and eventually found that there were not enough full length pieces to do the whole wall. Since the wall was tongue and groove, the ends of the paneling pieces did not need to align with the cross frames. This meant that the pieces were any length they needed to be. To finish the wall completely will require some time consuming sorting of the pieces to get the right combination of boards for each strip. We also discovered that the pine was so soft and crooked from laying in a pile that it was impossible to get the tongues into the grooves if either still existed. Tom assembled the wall the best he could in the time. We will finish the sorting and piecing on the next effort. After the visibility cleared and the lighting improved, we also discovered that several of the pieces were facing the wrong way. This puts the paint and rust marks from the cross framing on the wrong side. This is not a big deal and we will flip them around in the next effort. It does emphasize the value of using easily removable fasteners like bronze screws in this kind of project.

Survey rest of ship - Our intent was to do a video and audio survey of the rest of the ship to use in the planning effort for the rest of the restoration effort. We had planned one or two dives to do this. After the first dive, it became very obvious that this in itself is a significant undertaking and could easily consume a dive per room just to tabulate a simple list of tasks. This should probably be the major part of the next phase.

Refastened posts in Rm. 4 port side - same scenario as in rooms two and three.

Screwed down floor around hole in Rm. 4 (port side) - We made an attempt to fasten down the flooring around the hole in the deck in room four. Unfortunately the flooring and some of the beams are very soft. The soft ends of the flooring have been abraded and rounded to a point that made simply screwing these boards down almost futile.

Afterwards we decided that a better approach would be to put a light frame of new wood around the hole and use long screws to fasten it into the deck beams. This will spread the force out on the soft wood and should be a much stronger solution. It should be noted at this point that many of the deck beams are no longer fastened to the hull and shift easily. The deck flooring needs to be refastened to the beams and this will help stabilize the structure. This is a low profile change that we will plan for the future.

Refastened forward half of longitudinal divider wall between Rm. 3 and Rm. 4 -

This wall has been stabilized in the section that was intact. We just ran one line of screws in the intact cross framing as a first installment on its refastening. We did not get to refastening any of the boards that had already shifted. I think a new base plate is probably warranted for this wall.

Clean-up Pick-up loose screws, tools and clamps - Due to the slope of the deck and low visibility, we found that spillage was significant for the fasteners and tools. We started late on day 4 to round up our pieces as we finished the major tasks.

Day 5 - Originally we had hoped to get a few hours of work done on day five, but the weather forecast was for 30 knot winds from the northeast by the afternoon. The wind started picking up from the northwest about 3:00 AM in the morning, and we made a decision to wrap things up as early as possible so we could leave by 10:00 AM. Work started a 6:00 AM.

Final Video documentation - This was done at the start of day five to take advantage of the best visibility. By that time our still photographer had gone but Ron Polomski had agreed to take the “after” project photographs later that week.

Hang pipe in Rm. 2 - During removal of the temporary pipe hanger clamps we discovered we had missed the hangers in room two. We added two hangers but will need to add a few more next effort.

Return Artifacts - All artifacts uncovered in the dredging were replace to their appropriate corners. The locations and descriptions are in a confidential Appendix for park documentation. All unused loose wood and wooden structures were returned to the appropriate corners of rooms.

Final Clean-up - A final pass was made to remove any remaining loose tools, screws or materials. Both the deck and the ceilings needed to be checked for sinking and floating equipment.

Remove lights, and Moorings - The last step was to remove the lights and special moorings and fasten the boats to the park mooring while we stowed the equipment for the crossing home.

Stow Equipment for trip home - All equipment was secured for the potential of a rough crossing.

Trip Home - We departed by 10:00 AM. Luckily the seas were less than three feet for the entire crossing. Both boats arrived safely although the *Nobility* had a transmission fail during the crossing.

Results

The following is a list of the status of each item from the list of items that we proposed to do in the project proposal:

In Forward Crew's Quarters

- Rehang pipes. Done - We would like to replace the hangers we installed with thicker more original looking hangers. The material we used was thinner than the original and because of the uneven bends did not look as good as thicker strap will look. We also had to install a temporary PVC pipe splint in one of the steam lines. We need to replace this with a piece of steel as soon as possible. Additionally we should re-hang the drooping electrical conduit. Originally I was not sure and how it was routed and how it would look if re-hung. After untangling the mess and fastening a couple pieces of it as a test, I think it will be a good improvement.
- Stabilize existing walls by screwing tongue & groove paneling to cross members - Done
- Refasten tongue & groove paneling on collapsed wall - This is mostly done but finishing work needs to be done. There are a few gaps in the wall due to not being able to find the matching pieces of wood. Some of the boards are flipped with the wrong side forward and the tongue and grooves of the restored boards do not fit together. We need to do the finishing work on this task. Maybe after a few months to straighten we might be able to get the tongue and grooves to fit better. I am sure we can repair the gaps and flipped boards.
- Re-install and rebuild starboard collapsed wall - Done as well as can be done with the above exception.
- Refasten bunk boards to vertical posts - Mostly done but we are missing two bunk vertical posts and a number of the bunk end boards were not located and replaced in the project time.
- Move bunks back to original positions - Done
- Refasten vertical posts (bunk & wall uprights) to ceiling beams or ceiling - Done although we may have missed one or two of the more intact posts on the port side. A better inventory of this work item needs to be done. Also we need to see how the extension blocks we used look after a period of time to decide if we need to replace them with something more natural looking.
- Stabilize pump well on forward wall of crew quarters - Done
- Stabilize (refasten) stairs into forward crew quarters - Done except for adding brackets from the stairs to the deck or floor.

In Back Crew's Quarters

- Stabilize (refasten) existing wall between cargo hold and back crew quarters - Not done
- Stabilize (refasten) divider wall - Not done - Only one line of screws were added to the portion of the wall that was already in place. A new base plate potentially needs to be added.
- Stabilize (refasten) bunks in back crew quarters - Done and done well in room 3. Bunks in room 4 were only partially completed.

Additionally we proposed fixing the hole in the floor of the aft crew quarters. We made an attempt to do this but the wood was too soft for just a screw to hold. After thinking about it, I think we can fix it by adding a wooden strip over the top of the boards that can be screwed into the deck beam. This should really be done before we loose all of the flooring in room 4.

As I stated in the original proposal, estimating how much of the proposed work could be completed in the five days was very difficult since no one has never done this type of job before. Our priorities were to complete the forward room reconstruction first then complete whatever more we could do in the back crew quarters. I believe we met our goals.

Just like the *S.P. Ely* Restoration Project, there is some work that needs to be done in a supplemental effort to complete the job. This appears to be a good general approach. In a large effort involving ten workers and a relatively short period of time, we need to do the tasks that keep the most people working and make use of the available equipment and talent. The pace of work is fast and conducive to getting the larger rough tasks done. The finishing work needs to be done at a slower, more exacting pace so we can take the extra time to do a quality job.

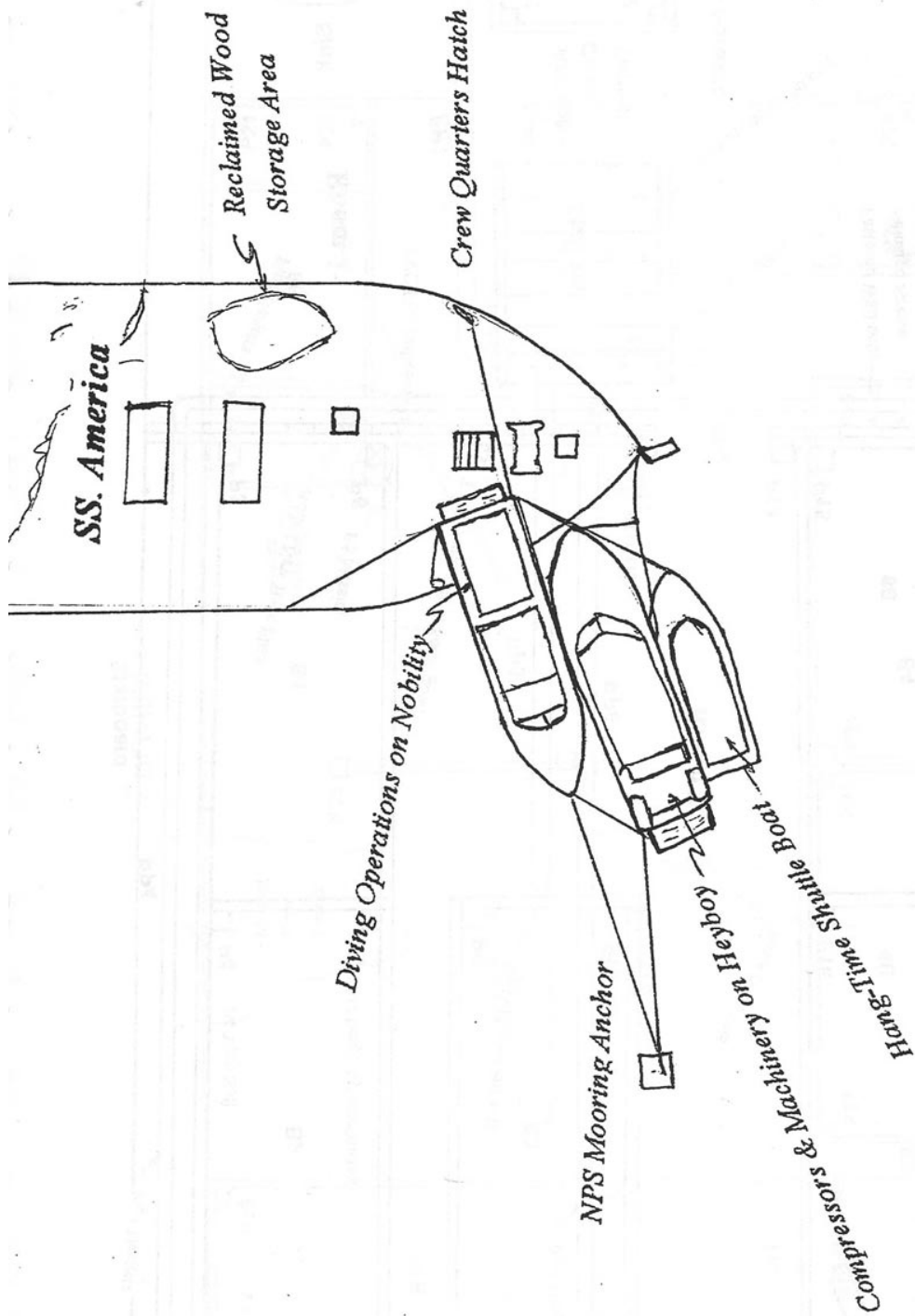


Figure 1 Mooring Set-up Over the America

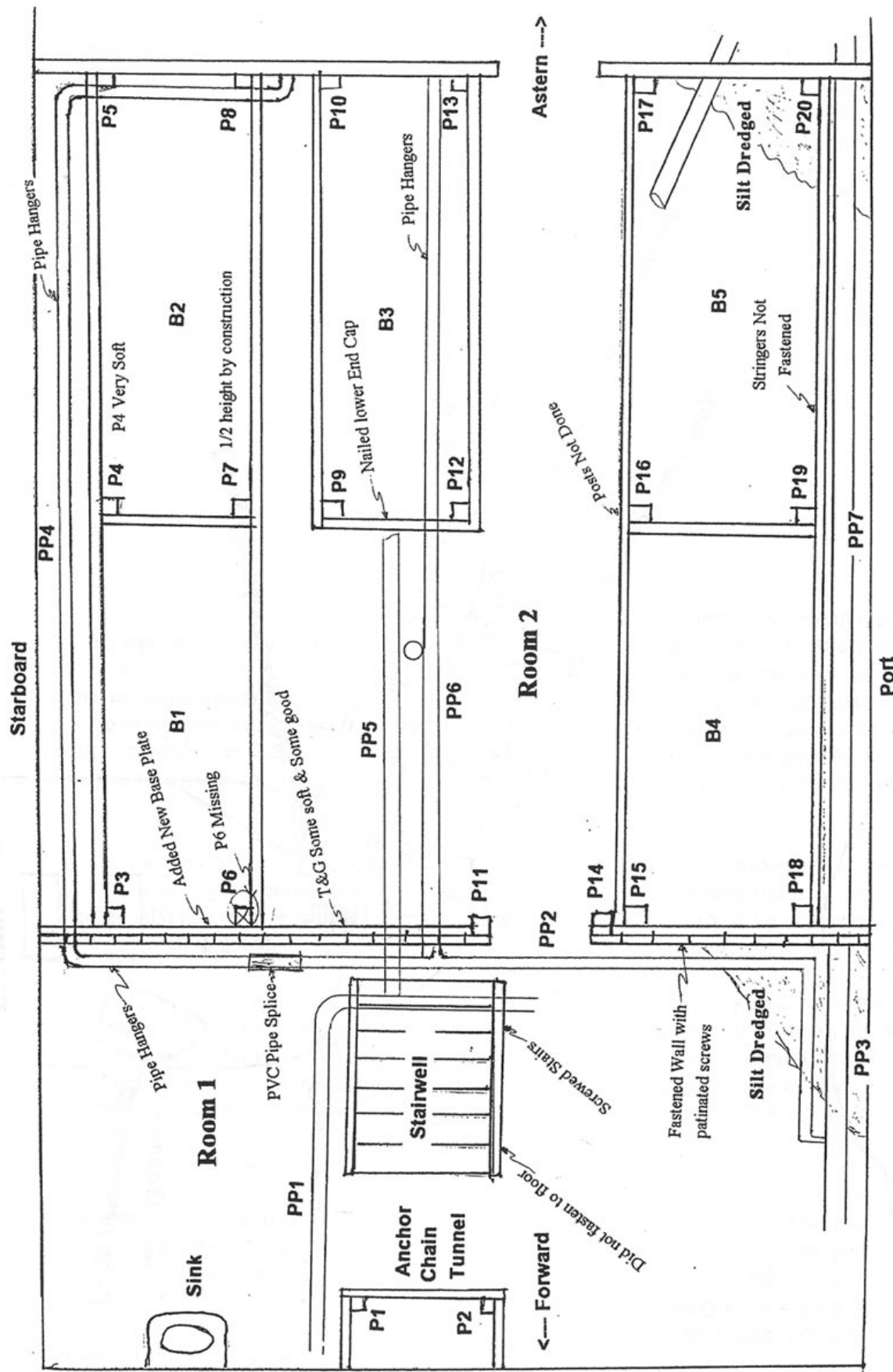


Figure 2: Documentation of Changes in the Forward Crew Quarters

Forward

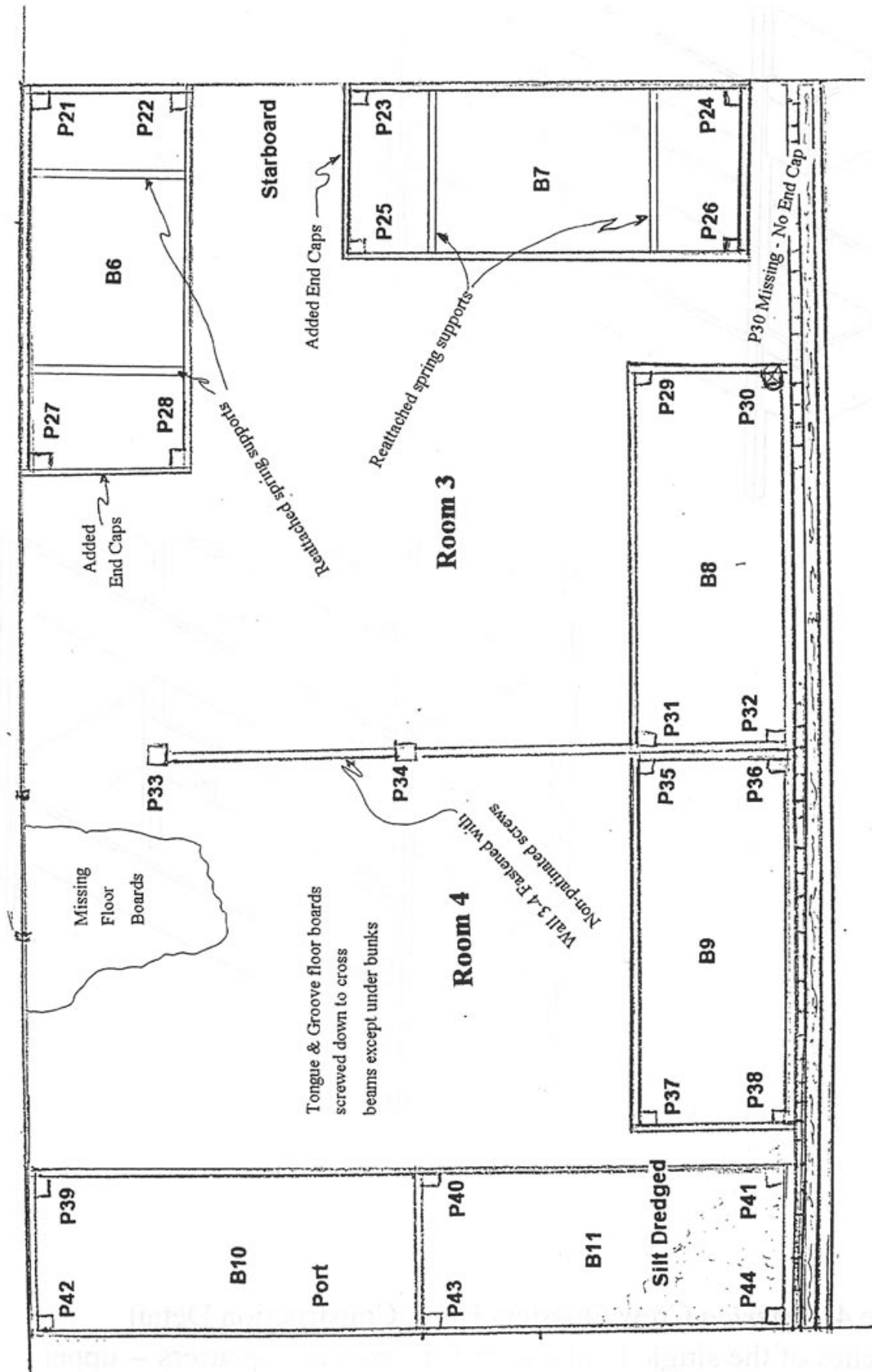


Figure 3: Documentation of Changes in the Aft Crew Quarters

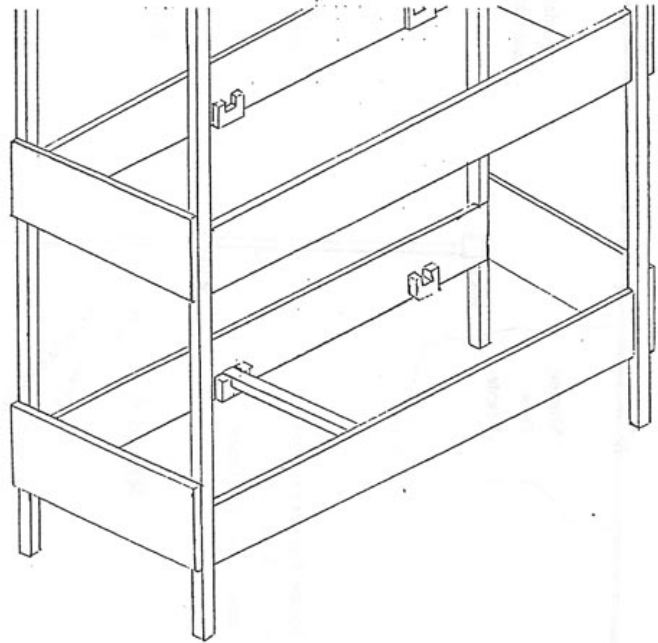
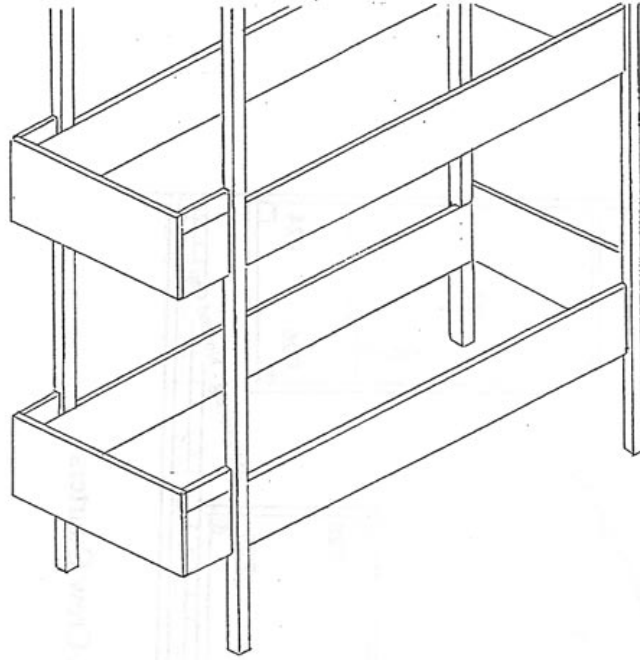


Figure 4 *America* Crew Quarters Bunk Construction Detail
(Sketches of the single bunks from forward crew quarters -- upper
and aft crew quarters -- lower)

Documentation of Structural Changes

For the purposes of describing the work done in the four crew quarters I have created a naming convention to describe the rooms and the structures in the rooms. The convention refers to deck plans in figures 2 and 3. The rooms are numbered from one to four ordered bow to stern starboard to port. The following structures are numbered according to alpha numeric designation:

Bunks B1- B11 (The sequence is continuous for all four rooms)

Posts P1- P44 (Again the sequence is continuous for all four rooms)

Pipes PP1 - PP7 (For simplicity this includes all pipes and conduit. Since we did not document all piping the numbering system for the piping will likely be redone when we finish the work.

Bulkheads or walls will be referred to by the rooms they divide and starboard or port of the door.

There were several operations done in the rooms -- preservation which involved rebuilding or reassembling structures that were broken apart and stabilization -- which involved adding supplemental fasteners to structures that were still intact. All fasteners were bronze square drive flat head screws unless otherwise specified. Except in two test locations these were a mix of plain and patinated screws. Posts were fastened to the upper and lower decks with brass angle brackets. If the post was too short, the end too soft, or if there was too much rusted fastener remaining in the end to use the bracket by itself, we added a short piece of 3/4" oak to extend the post. This gave us more area in the side of the post to screw into.

Room by room description:

See the figures 2 and 3 for pictorial documentation. Also note that the correct bunk construction details are shown in figure 4. It differs slightly from the deck plan diagrams.

Room 1 - Room 1 will be called the wash room because of the presence of a sink on the starboard side. The Anchor Chain Tunnel was basically intact but all paneling was refastened. Posts P1 & P2 were not fastened. The treads of the stairs were refastened to the sides but the sides of the stairs were not fastened to the upper and lower decks. Port side wall 1-2 was intact and refastened. Post P14 was not fastened. All screws in this wall were patinated for the patination test.

Starboard side wall 1-2 was collapsed and all but the six outside tongue and groove paneling boards were loose and scattered on the floor. A new 2"x2" base plate of cedar was installed and screwed to the deck. The cross members were refastened to the posts. Posts P3, P6 and P11 were fastened top and bottom to the decks with brackets. T&G paneling was replaced as best as could be done from the pieces scattered on the floor. There were not enough full length paneling pieces to complete the wall. It is apparent that some of the board positions were made up of two pieces. There are still gaps where

there are short boards and two end boards missing. The tongue and grooves on the reclaimed wood do not fit together well if at all.

Pipe run PP2 had collapsed. Pipe runs PP1 and PP2 were hung with pipe hanger strap. A temporary white PVC pipe splice was added to run PP2. Silt was dredged from the aft port corner of Room 1.

Room 2 - Room 2 is the forward crew quarters. Post P6 is missing and we temporarily tied the upper bunk stringer for bunk B1 with a piece of rope to keep it from breaking off. Posts P3 through P12 were fastened top and bottom with brackets. Posts P15 through P20 were not fastened. Note that P7 is a half height post by design. Bunk stringers for bunks B1 through B5 were refastened with the exception of the outside stringers of bunks B4 and B5. The bunk end caps were replaced on B3. These end caps were fastened with bronze annular nails as a fastener test. Pipe run PP4 had collapsed and was rehung with one hanger.

Silt was dredged from the aft port corner of Room 2 so wood could be reclaimed from the area. There was originally a major pile of wood debris in this corner.

Room 3 - Room 3 is the aft starboard crew quarters. Post P30 is missing. We found one post in the wood debris and I assume its original location was P30. Remaining Posts P21 through P32 were fastened top and bottom with brackets. Bunk stringers for bunks B6 through B8 were refastened with the exception of the joint on the missing post P30. End caps of bunks B6 through B8 were reclaimed from the debris and replaced with the exception of the end caps that were fastened to the P30. Bunk B7 was reconstructed to near perfect condition including spring supports. One hanger was added to an unlabeled run of conduit over bunk B7 as an experiment. No changes were made to the aft wall between Room 3 and the cargo hold. No silt was dredged from the aft port corner of Room 3, but should have been. We missed that corner. Many of the pieces of the bunks in this room were reclaimed from the corner.

Room 4 - Room 4 is the aft port side crew quarters. Posts P39 through P41 were fastened top and bottom with brackets. Posts P33 through P38 and P42 through P44 were not fastened. Bunk stringers for bunks B10 and B11 were refastened with the exception of the outside stringers of bunks B10 and B11. Stringers on bunk B9 were not done. The bunk end caps were not replaced on B9 through B11. The deck boards except under the bunks were fastened down to stabilize the floor from coming apart around the hole in the floor. The wood around the hole is very soft, and I do not expect this stabilization to last very long. Wall 3-4 was stabilized in its forward half with one row of screws through the T&G paneling that was still in place. This wall was done with plain unpatinated screws as the patination test control group. The T&G paneling on the aft half of the wall is loose and will require careful placement before fastening. A new base plate will also need to be added. No changes were made to the aft wall between Room 4 and the cargo hold. Silt was dredged from the aft port corner of Room 4. Much of the wood from all of the rooms was reclaimed from the aft port corner of this room.

Remaining Work

For a complete explanation of the remaining tasks see the results section. I will itemize the tasks remaining to be done to complete the project in this section. I have listed these tasks in the order or priority they need to be done with a comment on their importance.

- Replace two missing bunk posts - Several bunk sides are dangling and in danger of being knocked loose until we add these posts. We also may have missed adding brackets to one or two of the more intact posts on the port side. A better inventory of the post bracket status needs to be done and where the brackets are missing, they need to be added. Also we need to see how the extension blocks we used look after a period of time to decide if we need to replace them with something more natural looking.
- Replace temporary PVC pipe splice with steel - This is cosmetic but the white plastic is a real eye sore. We also believe the final splice will be stronger.
- Fix hole in floor in room 3 - The floor is very loose and needs to be fastened down to avoid further deterioration. We proposed fixing the hole in the floor of the back crew's quarters in the 1996 project. We made an attempt to do this but the wood was too soft for just screws to hold. After thinking about it, I believe we can fix it by adding a wooden strip over the top of the boards that can be screwed into the deck beam. This should really be done before we loose all of the flooring in room 4.
- Room 2 Starboard Wall completion - Refasten tongue & groove paneling on previously collapsed wall. There are a few gaps in the wall because we could not find the matching pieces of wood. Some of the boards are flipped with the wrong side forward and the tongue and grooves of the restored boards do not fit together. We need to do the finishing work on this task. Maybe after a few months to straighten, we might be able to get the tongue and grooves to fit better. I am sure we can repair the gaps and flipped boards. This is mostly cosmetic but it will answer some questions on when and if we need to use new wood, and how reversible is the work.
- Stabilize and rebuild divider wall between rooms 3 & 4. Only one line of screws was added to the portion of the wall that was already in place. A new base plate potentially needs to be added.
- Replace current pipe hangers with heavier more original looking hangers & rehang electrical conduit. This is strictly cosmetic but will make the room look more like the original. The material we used was thinner than the original and because of the uneven bends did not look as good as thicker strap will look. Additionally we should re-hang the drooping electrical conduit. At the time of the first proposal, I was not sure how it would look if re-hung and how it was routed. After untangling the mess and fastening a couple pieces of it as a test, I think it will be a good improvement and will remove a potential entanglement hazard.
- Finish reconstruction of all bunks - Much of this is done, but where we were missing two bunk vertical posts it could not be completed. Also a number of the bunk end boards were not located to be replaced in the project time. We would like to finish as

much of this as possible. This just completes the job and makes the entire structure more stable.

- Add brackets to hold stair well to deck - We did not have the right size bracket to do this in the first effort. This will keep the stairs from coming loose.
- Final survey and documentation of all changes in the rooms - This needs to be done first, during, and at the end of the 1997 work.
- Screw down decking - Not proposed in the original plan but should be done in the future.

What We Learned

It is impossible to quantify all that we learned in this experiment but I will try to itemize the things that were or could have been a major impact on the project.

Estimating equipment size and bulk for transportation and staging purposes was a major concern. Luckily with the help of Dana Kollars on the *Grampa Woo*, it turned out to be no problem since we had all the transportation capacity we needed. However, on future projects where we might not have this capacity, we need to develop a better way to quantify our hauling capacity and equipment bulk and weight.

Vacuuming Silt - There were several things we learned related to vacuuming accumulated silt from the corners of the rooms. If vacuuming is to be done, it should be scheduled as the only task done on that day. It reduces visibility to one to two feet and makes doing parallel tasks unproductive. Additionally plans need to be in place to document and disposition artifacts that are uncovered. Luckily Dave Cooper was on site and Liz Amberg was in communication with us to guide us in dispositioning the few items that were uncovered. The disposition of these artifacts needs to be thought out and addressed in future plans. For now, we still view the vacuuming as necessary when we are reclaiming the original materials for the construction. Even with the vacuuming the visibility during the major work was in the six to eight foot range. Dave Cooper has suggested some techniques for minimizing stirring up the silt when removing the wood from a silt pile. We will use this technique especially on the smaller subsequent efforts and will hopefully minimize the need for vacuuming the silt on later projects.

Condition of the Wood - The condition of most of the wood was disappointing to say the least. The soft pine that was the construction material for much of the interior was softer than we had hoped. The tongue and groove portions of the paneling was often just non-existent. After reconstruction the wall between rooms 1 and 2 was soft and spongy. We are committed to using original wood wherever possible, which is what the "The Secretary of the Interior's Standards for Historic Vessel Preservation Projects" suggests. However, I think it would be wise to start experimenting with some wood patination techniques and try some new pine in some less obvious areas. The integrity of the areas restored with original wood is less than desired and for the amount of effort involved, I would hate to see the restoration be too short lived. We will continue to monitor our work for signs or deterioration.

Follow-up work - After our two restoration projects, I am starting to conclude that a reasonable and necessary approach is to do the heavy rough work in a large project, then follow up with several smaller low key efforts to do the finishing work. The rationale is that the heavy equipment intensive work is expensive and requires the experienced commercial divers. Making the best use of their time and their talents is important. The finishing work and documentation is less expensive and needs to be done at a slower more exacting pace. This should insure a quality outcome.

Working in the environment - Maintaining stability while working underwater is sometimes a problem. In typical commercial diving operations the solution is to add weight so the diver can stand and work. This allows the diver to apply force to the tools, like the power screw drivers, without drifting back. In a sloped environment like the *America*, when you add weight you simply slide down the slope. Finding a stationary member to wrap a leg or arm around is usually the solution. In a fragile environment this can also damage the structure you are trying to preserve. One proposed solution is to add some temporary stabilizer bars, which we envision as ratcheted variable length posts that could be wedged between decks. We are considering experimenting with the poles used in the trucking industry to stabilize loads that do not fill the entire trailer for this need.

Equipment degradation - From the perspective of the volunteers using our own tools, we are starting to see more rust and deterioration to our tools and equipment than we like. I think long term if we continue using borrowed tools, we will have to make some kind of tool allowance to reimburse tool owners for this depreciation.

Diving Safety and Management - After committing to use the current OSHA Standards, we learned how badly certain rules needed to be updated to address the use of modern equipment like the wireless communications. OSHA Standards do allow for organizations to create their own safety standards if they are administered by a Diving Safety Control Board. This appears to be the way many organizations operate. We are considering this approach for our organization.

One of the simple problems we had on site with the multi-tasking we were doing was keeping track of who was running the communications. Occasionally the designated communications person was necessarily called away to fix something, get a tool or piece of equipment, or answer a question. When he left he would delegate the responsibility to someone else who in turn was also sometimes called away. A few times there was a confusion on who was doing the task. This was unacceptable. To remedy this we have decided to use a simple system of hats for the next large project. He who wears the hat for the task is the responsible party -- no mistakes.

Survey and documentation takes time. - Our original plan was to allocate a couple of dives to survey the rest of the shipwreck to determine the next critical area that needed stabilization and itemize what needed to be done in our next project. I thought with the communications this could be accomplished much more efficiently. To do this you need to understand a little about the construction of the room. I would now estimate that it will take a minimum of two dives per room just to get an idea of its needs. To document

it enough for building a future plan, I would estimate more like six dives per room. This will vary depending on the size and condition of the room. After the documentation we will still not have all of the detail questions answered, but I think we will have enough to make a reasonable plan. Final questions will then be answered before doing the work.

Future Plans

The *SS. America* restoration is a gigantic project and will be ongoing, most likely, for many years. Through the winter I have had the opportunity to discuss the project direction with our members and a number of professionals from the National Park Service and the archeological community. In October at the Duluth Shipwreck Conference, I solicited help from the gathered professionals to establish standards for doing our work. In response to this request Hallie Brooker, of the National Maritime Initiative, sent me a set of standards called "The Secretary of the Interior's Standards for Historic Vessel Preservation Projects" used in restoring above water historic vessels. These standards are general in nature and appear to be applicable to underwater projects. Included in the document are guidelines for applying the standards. This appears to be the area that needs some refinement for our purposes.

To work these areas we have formed a working group including Liz Amberg, Isle Royale Cultural Resource Manager Specialist; Dave Cooper, Wisconsin State Archeologist; Pat Labadie, Canal Park Marine Museum Historian; Scott Anfinson, Minnesota State Historic Preservation Office Archeologist; and several of our members. Our plan is to review and create a set of guidelines that we would follow and test on the *America* Project. I look at the GLSPS contribution to be that of driving and coordinating the effort, as well as, being responsible for determining the feasibility of the underwater work. Most of the discussion will be carried on through email.

The current standards basically divide a project into four phases:

Phase I - For our purposes this is the documentation and planning phase. In this phase the detail condition of the vessel at the start of the project is documented and construction information is collected. This information is used to plan the preservation and stabilization measures to be taken on the vessel.

Phase II - "consists of implementation of stabilization measures" and completion of detailed comprehensive work plans for the future. In this phase we would stabilize areas that might deteriorate significantly before they could be preserved.

Phase III - "is the implementation of the selected treatment goal: restoration, rehabilitation or preservation."

Phase IV - "is preservation maintenance routine, cyclic, and emergency work performed to mitigate deterioration of the preserved vessel."

This seems to be a real common sense responsible approach. It may be more documentation than we had originally planned, but it seems to be the right way to do the job. Based on these standards the next logical step would be to enter Phase I. This would suggest the following projects for this summer:

1. Complete the finishing work on last year's project which was termed an experiment. Although we completed the lion's share of what we had planned last year, there are areas that need completion. This finishing work insures that the restored areas remain intact and are as natural looking as we can make them look. This work can be done based on the previous permit granted from the National Register committee.
2. Undertake a major documentation effort to record the current state of each room and area that we envision working on. The exact approach for the documentation is still being worked but will probably involve adding to the detail of the existing deck plan and supplementing this with some combination of perspective sketches, photographs and video.

This documentation will then be used to develop a comprehensive stabilization and preservation plan over the winter of 1997-1998. We would then go through the effort to present this plan to the national committee that oversees the National Register of Historic Places one time for the entire set of projects. These projects could then be done over a ten year period, if necessary.

To accomplish the 1997 work I would suggest several shorter two to four day projects. These would be low key, light weight and less equipment intensive than the 1996 project. The intent is to do the finishing work and documentation at a slower more exacting pace than the initial resetting of the wall and bunks. Pending working the details with the park, it would seem that delegating the documentation of individual rooms to groups of divers would also be an efficient approach. The scope of these projects will be outlined in the next proposal.

Artifact Disposition

During the course of the project several artifacts were uncovered and dispositioned with the direction of the park Cultural Resource Management Specialist Liz Amberg. Three articles were uncovered in the dredging of the lower corners of the rooms and two were discovered during the construction work. The articles uncovered during dredging were two leather shoes and one cigar can lid. All three were recorded and photographed by Dave Cooper. Each was stored underwater during the work in a mesh bag then returned to their original corner at the end of the work.

Additionally a rosary and a pocket knife were discovered during the work in room 3. The pocket knife was not in the way of any construction and was left in its original position. The rosary was photographed, stored in water during the construction work, and replaced in a location described in the NPS attachment to the report.

Experiments Performed

Although admittedly the entire project has been termed an experiment, we had defined several equipment and materials experiments to help us improve our restoration techniques. As mentioned earlier some of this experimentation was done prior to the main project effort. These tests included testing the underwater electric drills or screw

drivers, and the lighting systems. Photos of this equipment are in the Photo Documentary Section. Early testing was also done to determine if we would have to pre-drill the holes for the screws. This would have doubled the time to fasten a wall and would have required two drills being available to the working diver.

Fastener Tests: We are convinced that bronze is the fastener material of choice due to its longevity in the fresh water. Whether the fasteners should be screws or nails is a question that we wanted to answer. We were not sure if we could drive nails underwater without damaging the surrounding wood. Additionally with unsupported backing wood hammering can be difficult even above water. However, bronze nails are much cheaper than screws, potentially could be driven faster than screws, and may actually be less obtrusive or visible since the heads do not have the square driver hole in them. Also the shape of the shank to head profile is more of a "T" shape instead of a tapered wedge "Y" shape (flat head screws). This would make them less likely to drive deep into the wood than the screws. Because of this the nails might be less likely to pull through the paneling surface. The main disadvantage to the nails are they are not easily removed without damaging the surrounding soft wood. This may not be an issue if they were used to stabilize an already intact wall or side of the ship. The first question we had to decide was if they could even be driven. The technique that we chose to drive them was a pneumatic hammer and we are contemplating testing a palm nailer in the future. We used bronze annular nails in one place in room 2 bunk B3 to attach the end plate to the bunk. In this application the fastener had to be driven into the end grain of the bunk stringer and the thinner nail had less tendency to split the board. The nail and nailer worked just fine with little or no apparent damage to the surrounding wood although care needs to be taken not to over drive the nail. The nailing approach looks feasible and will be an option where applicable.

Screw Paddles: Our ability to complete a gigantic task like that of stabilizing an entire shipwreck like the *America* is very dependent on the rate we work. The task of just refastening the interior wooden divider walls and bunks in the four crew quarter rooms was estimated to take 2500 screws. This says that you need to be able to be efficient in handling and driving fasteners. This is not an easy task underwater wearing heavy gloves, in a low lit, sloped floor, buoyant environment. Nailing or screwing has always been a task that seemed best suited to a three handed worker. This would allow a hand to hold each the driver, the fastener and the material being fastened. Add to that the need to hold yourself in place so you can apply a force to the driver and hold a container of screws, and the task becomes a bit more difficult. Future improvements to holding the diver in place will be discussed later. As a first experiment in holding the screws and the container of screws we designed a screw magazine or paddle shown in the photo section. The goal was to give the diver the ability to use one hand to hold the wall piece, the fastener and the magazine of screws. The approach worked for some applications and not for others and was a matter of personal preference. The real advantage we had in this project was that the water was warm enough to allow us to work without gloves. This significantly improved our productivity and made the screw paddles less important. The paddles were a reasonable way to hold the screws but had a disadvantage when they were

mixed and stacked with other tools. The screws laid over and had to be set up again. The concept basically worked in many cases and we will continue to improve the design.

Metal Patination: Patination is a process of coloring or corroding materials to give them an appearance of being old. It is typically used in building and statue restorations to make new material appear in context with its surroundings. Certainly it is not our desire in underwater restoration to pepper the environment with shiny metals or new wood. In underwater restoration we suspect that the corrosion of the screws and metal brackets will probably occur within a year and will not be a long term issue. However, if it is easy to make them appear in context at the time of application and it does not adversely affect the long term appearance, then it would seem a reasonable thing to do. I inspected the screws in July of 1996 that were used in the August 1995 tests of the screw drivers. I found that the heads of the screws that were flush with the surface of the wood were nicely corroded to a yellow green appearance. However, the screws that were sunk into the wood by an 1/8" were still shiny. I assume this was due to the difference in the circulation of water over the surface of the metal.

As an experiment we decided to try some simple patination techniques on a portion of the fasteners used on the project. These were applied in several areas but one wall, the port side divider between rooms 1 and 2, was totally fastened with patinated screws and one wall, the center divider between rooms 3 and 4, was totally done with non-patinated screws. These two walls will be monitored over time to determine any advantages or disadvantages in doing the patination. The screw paddles made excellent holders for the application of the patination chemicals.

The patination process can also be applied to wood, if and when we need to add major amounts of new wood to the structure. It is a different process and involves contacting the wet wood with iron or iron filings. Paul Storch of the Minnesota Historic Society Preservation Lab has been advising us on techniques and chemicals needed to give the proper color to the patinated materials.

Zinc's: Our desire is to slow down the oxidation and deterioration of the metal components of the ship including the steam piping. As an experiment we planned to add shaft zinc's in some obscure locations on several pipes so they could be monitored long term for any difference they made. Since the pipes are already significantly rusted, it will be difficult to determine the affect. Additionally we noticed that the shallower portion of the divider wall between the aft crew quarters and the cargo hold seems to be encrusted with algae. It is difficult to determine the long term affects of the algae on the wood, but I suspect it may contribute to its decay. A possible solution may be to apply zinc plates near the area much like they are used to control moss growth on a north facing roof. No zinc's were applied to any areas during this project due to the lack of time and preparation. We would like to start this experiment next year but recognize that results would be a long time off.

Expenses & Financing

Both the initial budget and final expenses are included in the appendices. Our initial cost estimate was \$1285 which included a \$400 contingency equipment repair allocation. We managed to avoid any major tool breakage's but other expenses brought our total expenditures back to \$1,176, which is close to the original estimate. The expense report has several columns that need explanation. The first column "Cost" includes all actual costs including materials that were donated and capital equipment that was purchased or built but was paid for and retained by a member. This cost of \$3225 represents the total out of pocket cost if all materials and new equipment had been purchased. It includes a mileage allowance for the trucks, and transportation services estimate, but does not include services expenses like chartering the work boats, or hiring professional divers.

GLSPS currently does not have facilities to store or maintain equipment so for now we felt it was better not to try to accumulate equipment. Several of the participants were willing to foot the bill for the unique equipment. The Expense column was the actual expenditure from the GLSPS treasure which was \$1,176. The Donation column (total \$1,390) was the estimated value of all donated materials, truck mileage, and transportation services of the *Grampa Woo*. The Personal Capital column (total \$681) would be the cost to the contributing member of the specialty equipment that was built. This included an reasonable value for the donated machine shop service(based on \$25/hr which is very inexpensive for machining). I did not attach a value to the use of the boats.

Our T-shirt sales more than provided for the planned expenses and we had little trouble recruiting help selling the shirts. All of the diving charter services sold the T-shirts along with a number of dive shops in the Twin Cities. Jackie Polomski of Superior Diver made a major sales contribution as did Dana Kollars of the *Grampa Woo*. A total of 244 T-shirts were ordered although only about 150 were sold at the time of the project. The sales have continued and we believe we will eventually sell them all.

We recognize on a sustained basis our expenses will probably need to be much higher. The GLSPS applied for and received its tax exempt 501C.3 status in with the IRS in March 1997, so we can look for donations to extend this work.

Participants

Ron Benson - Diver - Video Photographer
Dennis Bentilla - Historian - Documentor
Tom Brueshaber - Diver - Carpenter
Dave Cooper - Archeologist - Still Photographer
Dan Gates - Diver - On Site Equipment Manager - Project Consultant
Ken Knutson - Dive Coordinator - Diver
Al Lezunov - Boat Operator - Diver
Ken Merryman - Project Manager - Boat Operator - Diver
Bob Olson - Boat Operator - Diver
Jerry Provost - Safety Officer - Hard Hat Diver
Dave Schmidt - Steward - Diver

Boats

Heyboy
Nobility
Hang Time

America Project Supporters

Our deepest gratitude to the following businesses and professionals who supported our efforts in the first *America* Restoration Effort.

Adventure Sports Scuba
Dan's Welding & Machine,
Grampa Woo
NPS Isle Royale National Park
Over E-Z Dive Center
Royale Diver Inc.
Scuba Dive & Travel
Superior Trips
Vets Salvage

All Fire Test
Going Under Dive Center
Jamestown Distributors
Northland Divers
Producer's Choice Inc.
Scuba Hut
Superior Diver Inc.
Transportation Training Services

Appendix A1. Equipment and Material Checklists

Equipment Checklist For *America* Project

Equipment Item	Qty	Responsible Person
Trash Pump + Hose	1	Olson
Diaphragm Pump + Hose	1	Provost
Clamps	12	Gates
	3	Olson
	2	Lezunov
	4	Schmidt
	12	Merryman
+ (3' pipe clamp)	12	Brueshaber
Electric Screw Guns	1	Brueshaber
	1	Merryman
Backup + Extra Batteries	1	Gates
Extra Batteries	1	Olson
Pneumatic Screw Guns	1	Provost
	2	Gates
	2	Olson
Pneumatic Hammer	1	Gates
U/W Light Systems	1	Merryman
	1	Olson
Compressors & Accessories		
- LP for Tools (Ternes)	1	Olson
- LP for Hard Hats (Provost)	1	Provost
- LP Backup	1	Gates
- HP for Pumping Tanks (On boat)	1	Merryman
- HP backup for Tanks	1	Gates
- 200 cu ft backup air tanks	2	Gates
Compressor Hoses	300'	Gates
Hard Hat hoses	2-100'	Provost
Diving Equipment		
Hard Hat Walk & Talk Comms	2	Provost
Hard Hat Communication Box	1	Provost
Dive Helmet (Super Lights) Complete w/Bailouts	2	Provost
AGA Full Face Masks w/comms	2	Benson
Wireless Surface Comm Box	1	Benson
Mouth Piece Comms (Stitch)	2	Merryman
Listen Only Comms (Northlnd Dvrs)	2	Merryman

Equipment Checklist For *America* Project cont'd

Equipment Item	Qty	Responsible Person
Diving Equipment cont'd		
Cut-off Fins	2,1	Provost, Olson
Cut-off Fins Erickson's	1	Merryman
U/W Flashlights	1,1,2,3	Schmidt, Merryman, Provost, Benson
Scuba Tanks	4,2,3,1	Merryman, Gates, Olson, Lezunov
Pony Bottles		
Tools		
Chests of Misc. Hand Tools	2,1,2	Merryman, Lezunov, Brueshaber
Engraver	1	Brueshaber
T&G Driver Block	1	Brueshaber
Folding Scaffold Ladder	2	Brueshaber
Ice Picks	1	Gates, Schmidt, Merryman
Circular Saw	1	Merryman
Hand Saw	1	Brueshaber & Merryman
Chalk Line	1	Merryman
Counter Sinks	various	Merryman
Hand Square Drive Screwdrivers	4	Merryman
Surface Drills	3	Knutson, Merryman, Gates
Various Power Tools Grinders, Saws		Merryman
Cut-off Wheels	3	Merryman
Construction Square	1	Brueshaber
Tape Measure	1	Merryman
Miscellaneous		
Boat Ladder	1	Lezunov
Alpha Flag	1	Merryman
Cell Phone	1	Gates
Pipe Insulation for cable floats	1	Merryman
Ground Fault Insulator Supply	1	Gates
Slates & Mylar	3	Merryman
Mooring Lines	Assorted	Gates, Merryman
1/2" Polypropylene	600'	Merryman
Bungy Chords	6	Brueshaber & Merryman
Large First Aide Kit	1	Benson & Merryman
Duct Tape	4	Benson, Merryman
5 gallon Pails	3	Gates, Knutson
Gas Cans	2 + 1	Gates & Bentilla

Equipment Checklist For *America* Project cont'd

[illegible]

Personal Equipment Checklist

Personal Paperwork for Folder

- Padi Medical History Form
- Liability Releases (Two)
- Padi Diving Standard
- Personal Resume with a brief description of your diving experience and certifications
- One Xerox of your CPR, First Aid, Advanced diving or higher certifications, and DAN Membership?

On File at your Health Care Facility

- Current Physical within the last year
- One chest X-ray

Personal Equipment

- Sleeping Bag & Pillow
- Personal Effects
- Personal Scuba Diving Gear if you are diving scuba
- _____ Scuba Tanks
-

Project Equipment

Notes:

Materials Checklist For *America* Project

[illegible]

Appendix A2 Budget and Expenses:

Preliminary Budget

America Project #1 (Crew Quarters Restoration) 1996 Budget

[illegible]

Item	Qty	Cost	Expense	Donation	Psi Capital
Materials					
Bronze Screws	1900	\$228.26	\$228.26		
Bronze Screws &	200				
Driver Bits	12	\$40.37	\$40.37		
Bronze Screws & Bits &	300				
Bronze Nails (lbs)	3	\$68.11	\$68.11		
Thrd rod & nuts, nylon line, steel blade		\$32.23	\$32.23		
Brass sheet+A9, steel angle		\$19.05	\$19.05		
Construction Wood Cedar, Oak (est)		\$20.00		\$20.00	
Pipe Hanger Rolls (est)	6	\$30.00		\$30.00	
Duct Tape, Elect Tape		\$8.62	\$8.62		
Batteries C-cell & 9v (for lights & coms)		\$83.45	\$83.45		
Metal Self Taping Screws	50	\$7.87	\$7.87		
Zincs		\$16.99	\$16.99		
Brass Angle (This year)		\$3.00	\$3.00		
Brass Angle (Last year)		\$50.30	\$50.30		
Equipment & Tools					
Plywood Benches 3/4" sheet (est)	1	\$30.00			\$30.00
U/W Drills	3				
Pump Shaft Seals	3	\$36.66			\$36.66
Bearings	3	\$19.48			\$19.48
Innertube	3	\$28.74			\$28.74
Drill Chuck	3	\$47.88			\$47.88
Plate, pipe, shaft (est)	3	\$30.00			\$30.00
End Plug (est)	3	\$6.00			\$6.00
Hose Clamps (est)	3	\$5.00			\$5.00
Machining Labor hrs	4	\$100.00			\$100.00
U/W Lights Bobs	2				
Power Chords (approx)	2	\$20.00			\$20.00
Plastic Tubing feet	4	\$24.00			\$24.00
Light Sockets (est)	4	\$10.00			\$10.00
Ferco Fittings (est)	2	\$6.00			\$6.00
Chord seals, wire nuts, wire (est)	2	\$5.00			\$5.00
Flourescent Bulbs (est)	4	\$80.00			\$80.00
Machining Labor hrs	2	\$50.00			\$50.00
U/W Lights Kens	1				
Power Chords (approx)	2	\$20.00			\$20.00
Plastic Tubes	5	\$32.10			\$32.10
Ballast & Bulbs	5	\$46.39			\$46.39
PVC & Ferco Fittings (est)	1	\$20.00			\$20.00
Chord Seals	5	\$10.00			\$10.00
Copper end pieces (est)	4	\$4.00			\$4.00
Machining Labor hrs (est)	2	\$50.00			\$50.00
Bits, Saw Blades, Sq Screwdrivers		\$34.26	\$34.26		
Oxygen Fittings for Hat inflators	6	\$17.34			
Food					
Rainbow Foods Bill (Main)		\$345.87	\$345.87		
Cub Foods (Chix Breasts)		\$8.49	\$8.49		
Boat Gas					
Nobility		\$22.00	\$22.00	\$40.00	
Hang-Time		\$33.30	\$33.30		
Heyboy	75.2	\$124.00	\$124.00		
Island gas for HT + Compressors		\$50.00	\$50.00		
Grampa Woo Trans Equip & Pas	4	\$400.00		\$400.00	
Travel Mileage					
Brueshaber Van	600	\$180.00		\$180.00	
Provost Truck	600	\$180.00		\$180.00	
Benson Truck	600	\$180.00		\$180.00	
Leszunov Truck	600	\$180.00		\$180.00	
Olson Van	600	\$180.00		\$180.00	
Total		\$3,224.76	\$1,176.17	\$1,390.00	\$681.25

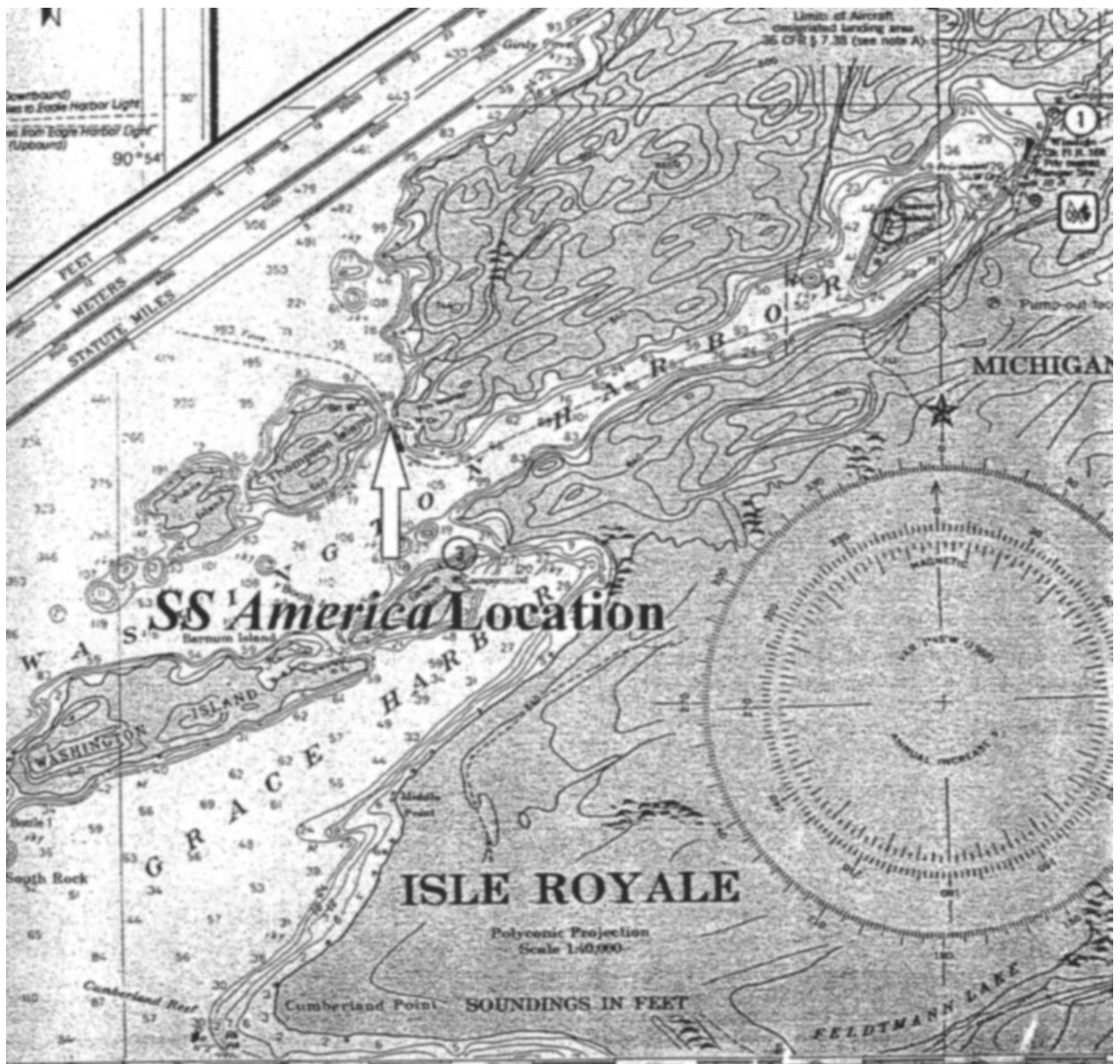
Photo Documentary Section

Only a part of what was observed in the past was remembered by those who observed it; only a part of what was remembered was recorded; only a part of what was recorded has survived; only a part of what has survived has come to the historians' attention; only a part of what has their attention is credible; only a part of what is credible has been grasped; and only a part of what has been grasped can be expounded or narrated by the historian.

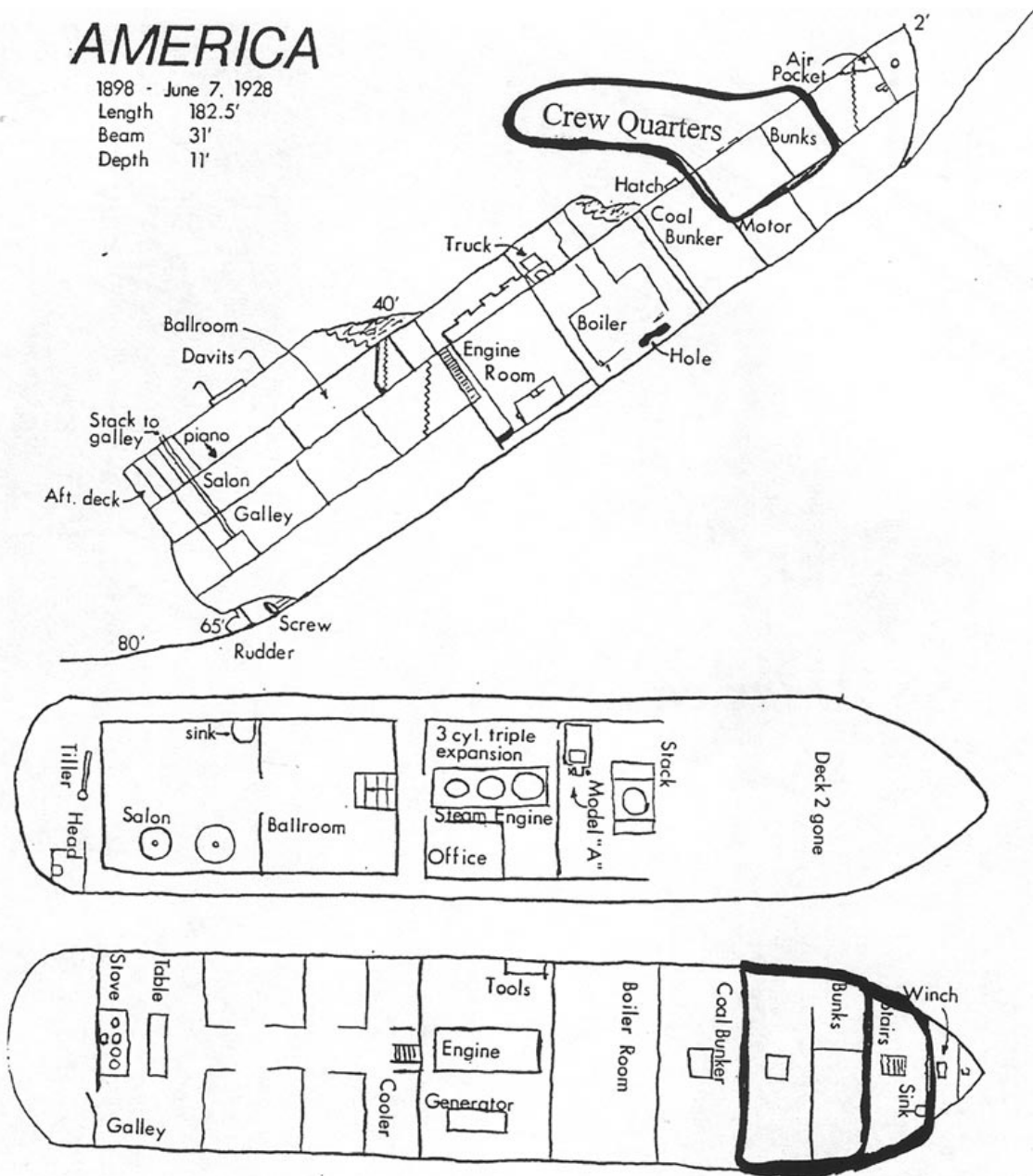
Louis Gotschalk
Understanding History



Photo from *Lake Superior Shipwrecks*:
courtesy of Lake Superior Port Cities, Inc and Canal Park Museum



The 182 foot SS America sank June 7, 1928 in the fog with no loss of life. It lies in 2 to 70 feet of water in North Gap of Isle Royale near Washington Harbor. The site is relatively sheltered from the open seas of Lake Superior. Now divers visit this underwater historic attraction on 500 dives per year. At this level of usage it is easy to see why the fragile structures are deteriorating.



It can be seen from this underwater map, that the SS. *America* is very intact and contains many rooms to explore and numerous points of interest. The crew quarters which were restored are in the shallowest portion of the wreck, having a maximum depth of 30 feet.

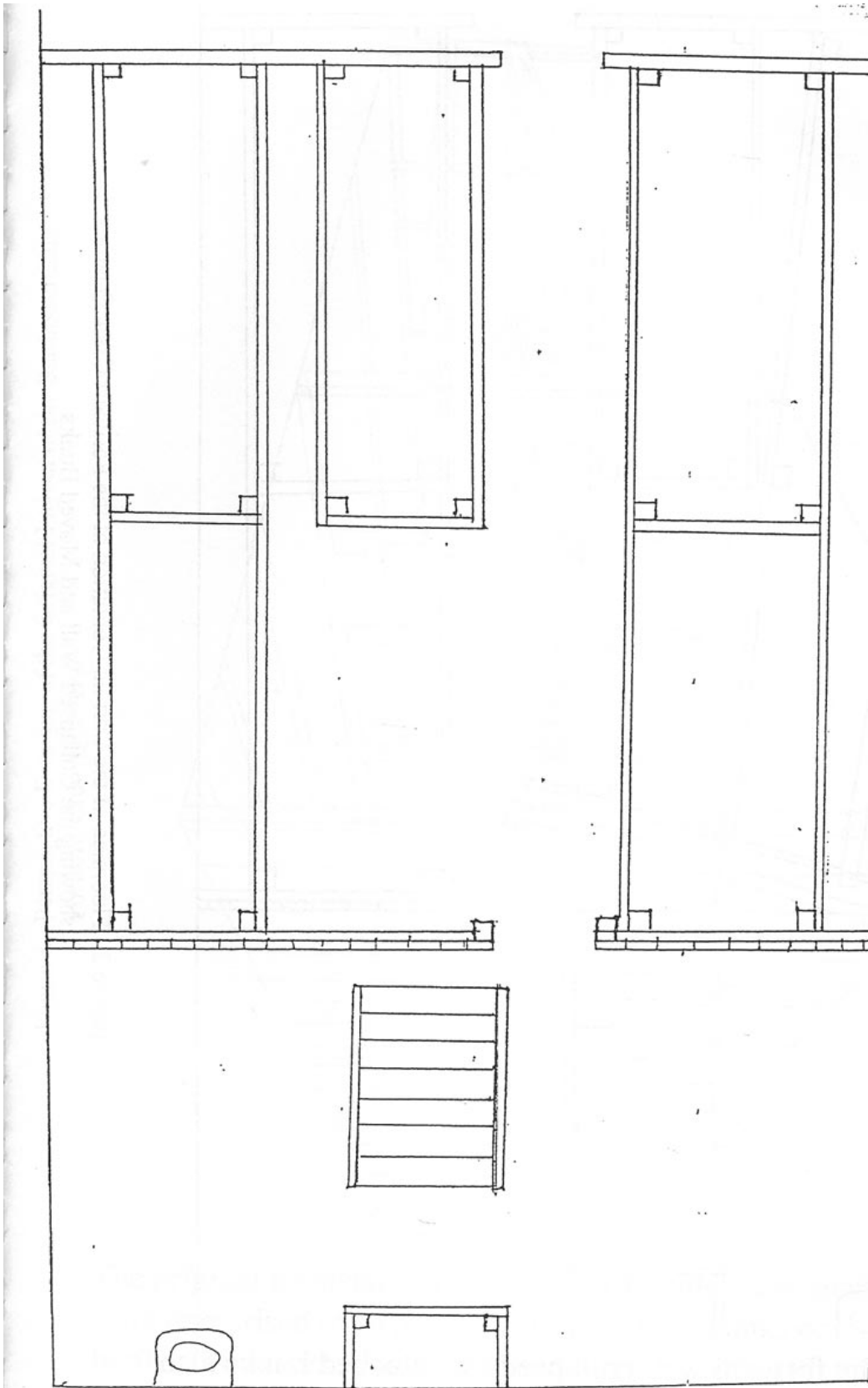


Figure 2. Floorplan of the Original Layout of the Forward Crew Quarters

The deck plan of the crew quarters shows the original layout of the bunks and walls.

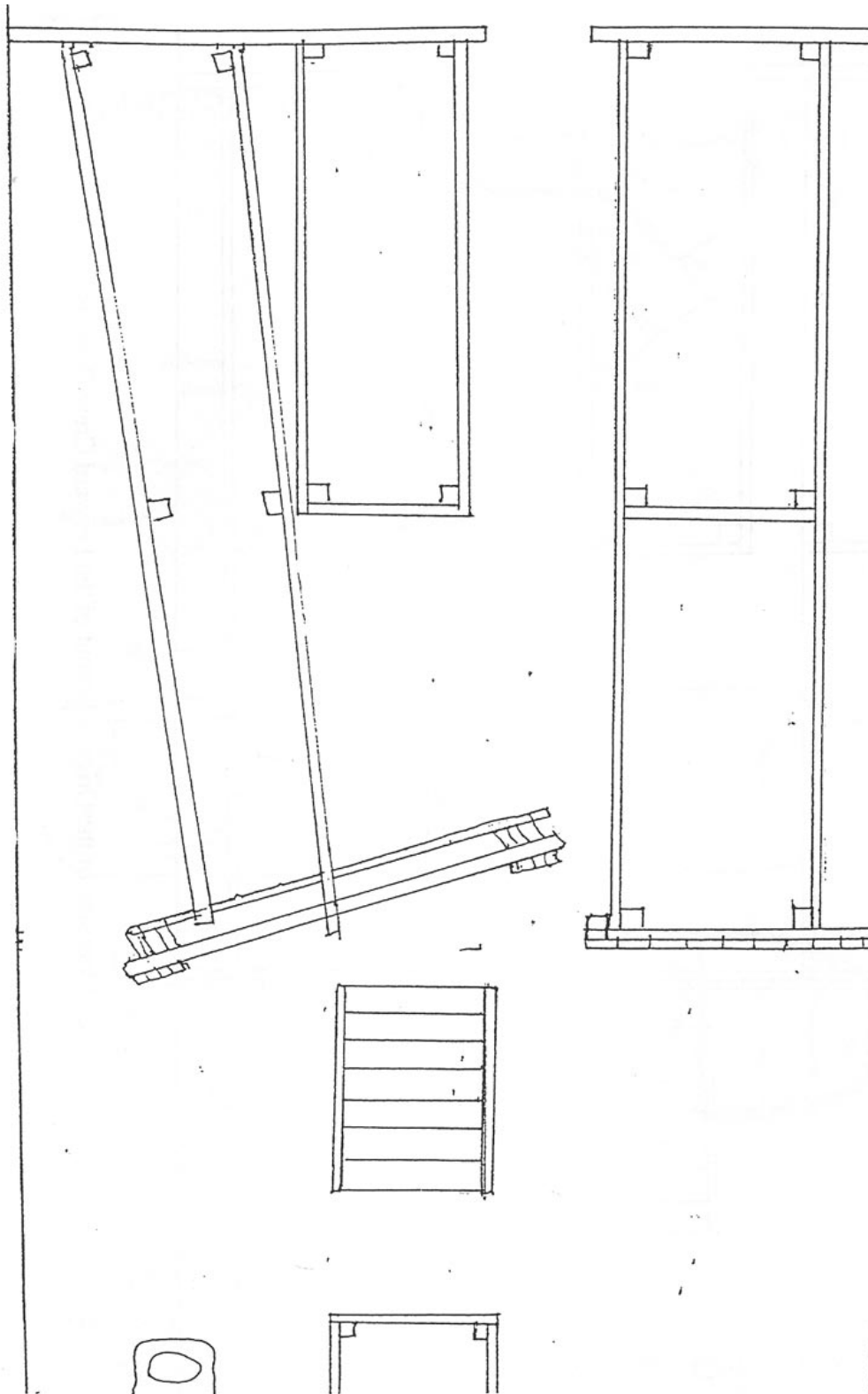
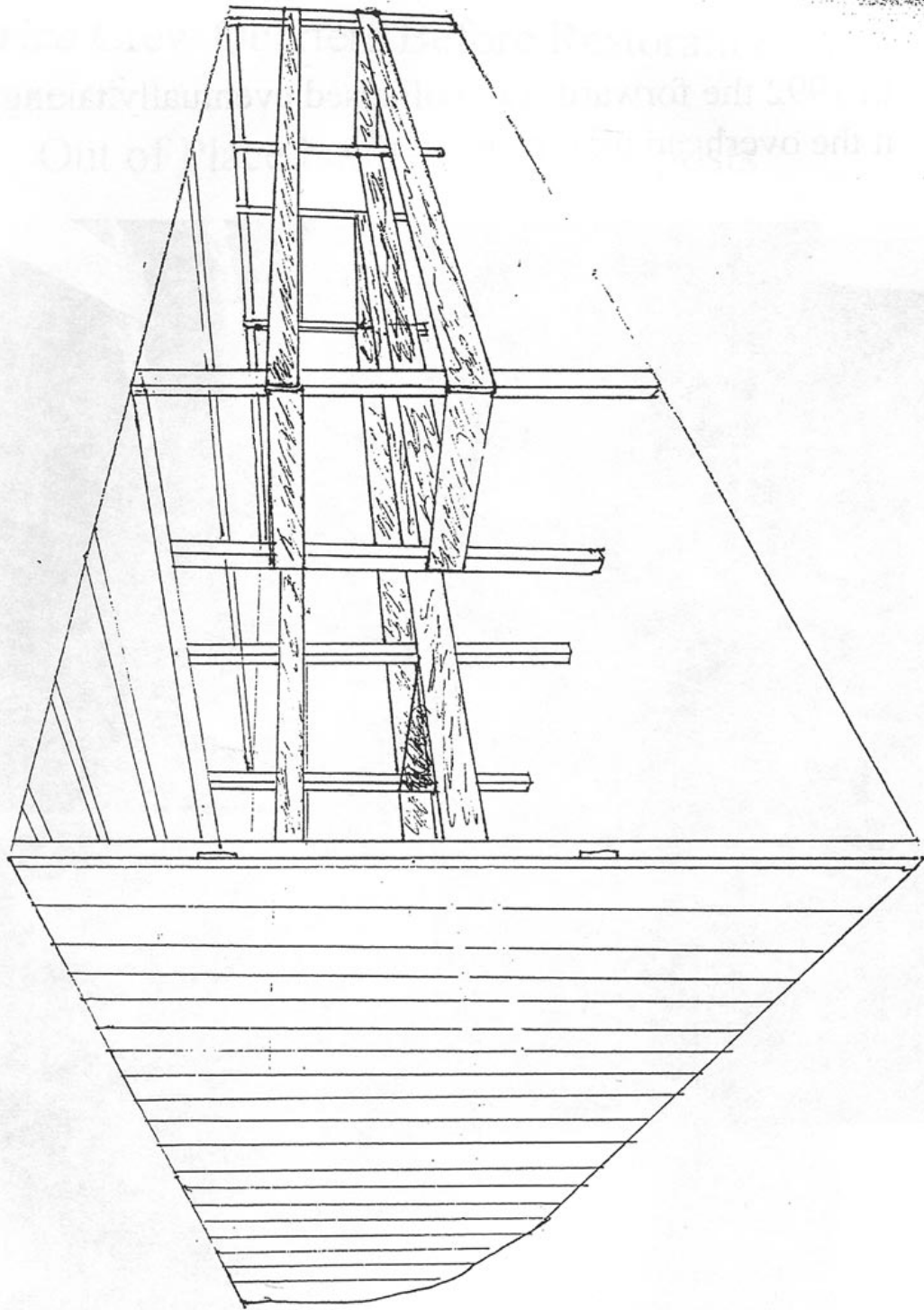


Figure 3. Floorplan of the Current Condition of the Forward Crew Quarters showing the Collapsed Wall and Moved Bunks.

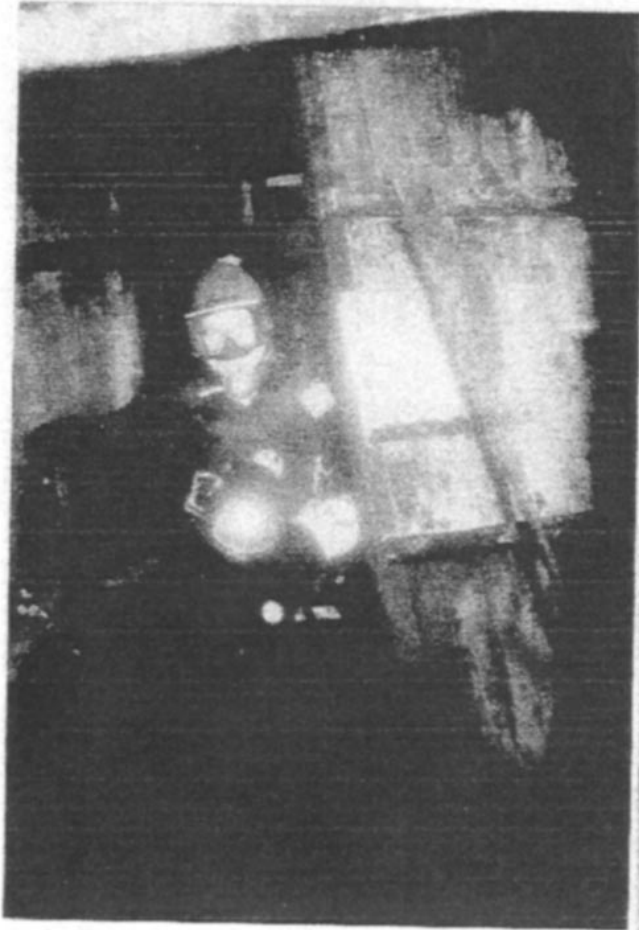
After the forward wall collapsed the attached bunks also toppled leaving the deck area looking more like the above drawing.

Figure 1. Perspective Drawing of the Original Layout of the Starboard Side Forward Crew Quarters



The original furnishings of the starboard side crew quarters were comprised of two rows of double high bunks or berths. The outside row consisted of four berths two upper and two lower in tandem. The inner row was just one upper and lower set of berths.

In 1992 the forward wall collapsed eventually taking with it the overhead piping and bunks.



The maze of debris made it difficult to retake the photo from pre 1991 since every movement the photographer made in the room created entanglements that stirred up the silt. This is however the same perspective as the photo on the left.