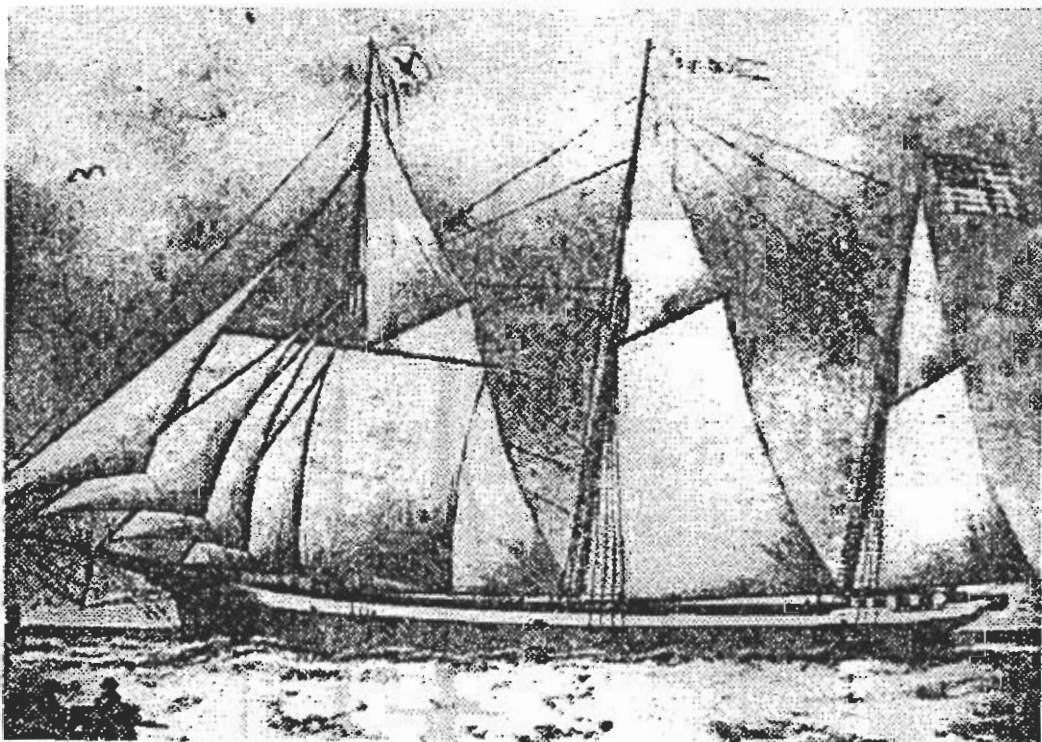


1994 *Samuel P. Ely* Restoration

Project Report

by

Kenneth Merryman
August 11, 1995



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This report is a brief description of the efforts by an independent group of divers and interested participants working in cooperation with members of the MN Historic Preservation Dept., Lake County Historic Society, and Duluth's Canal Park Museum to stabilize the deterioration of the shipwreck *Samuel P. Ely*.

Background: The shipwreck *S.P. Ely*, built in 1869, is a relatively intact 200 foot long schooner, which sank in a storm in 1896 at Two Harbors, Minnesota. It is located inside of the west breakwall of the Agate Bay harbor of Two Harbors and is visited by many sport divers each year. In 1991 the Army Corps of Engineers and their contractors repaired and significantly changed the structure of the breakwall in which a part of the *Ely* is imbedded. In spite of a reasonable effort to minimize the damage to the *Ely* by the Corps et al, the fragile stability of the *Ely* was disturbed. The change to the environment seemed to accelerate the rate at which the sides of the ship were spreading causing the collapse of two major sections of its deck. We who dive and enjoy visiting the wreck were concerned that within five years the wreck would be reduced to a pile of timbers.

Elmer Engman and I suggested informally to several government agencies including the DNR, the Corps of Engineers, and the State Historic Preservation Dept. that they do the repairs to stabilize the deterioration of the shipwreck but ran into little enthusiasm. At the 1993 annual diving and shipwreck symposium Gales of November, in Duluth, Scott Anfinson, the Minnesota State Archeologist, suggested that repairing the wreck was a good idea. He proposed that someone should do it. Since it appeared that no one else was going to step forward to do it, I decided to organize the effort with guidance from the experts in the archeological field and commercial diving fields that I had worked with in previous projects.

Site Description: To understand the deterioration that was occurring a background in early shipwreck construction is useful. Wooden ships built for the great lakes trade were basically flat bottomed wooden boxes with one pointed end. This construction was inherently weak in the corners of the ship where the sides met the bottom. The beams in the ship sides called futtocks were fastened to the bottom beams by wooden splices. The top of the box was the ship's deck. The deck of a wooden ship was supported by deck beams that were set on a shelf built into the sides of the ship (See figure #1). In later wooden bulk freighters there was often two decks although the lower deck was mostly only the beams and not fully decked over. The decks were also of much lighter construction than the sides of the ship. In order for the ship's hull to stay intact all four sides of the box need to be intact. If a ship's deck is removed or collapses there is no support to hold the sides erect and the whole structure can collapse.

As a shipwreck deteriorates, the lighter weight deck erodes away first. The splices at the junction of the sides to the bottom of the hull are not strong enough alone to hold the sides erect. Eventually the sides will fall over leaving only a pile of timbers or pieces of the hull. The *Ely* site has always been unique because, unlike most other wooden schooner shipwrecks, over half of it is intact. Its bow and stern broke apart long ago, but over 120 feet of the midship portion of the wreck is still upright and intact (See figure #2). The existing deck appeared to be holding the sides together and upright. The forward portion of the sides, however, protrude about 60 feet beyond the deck.

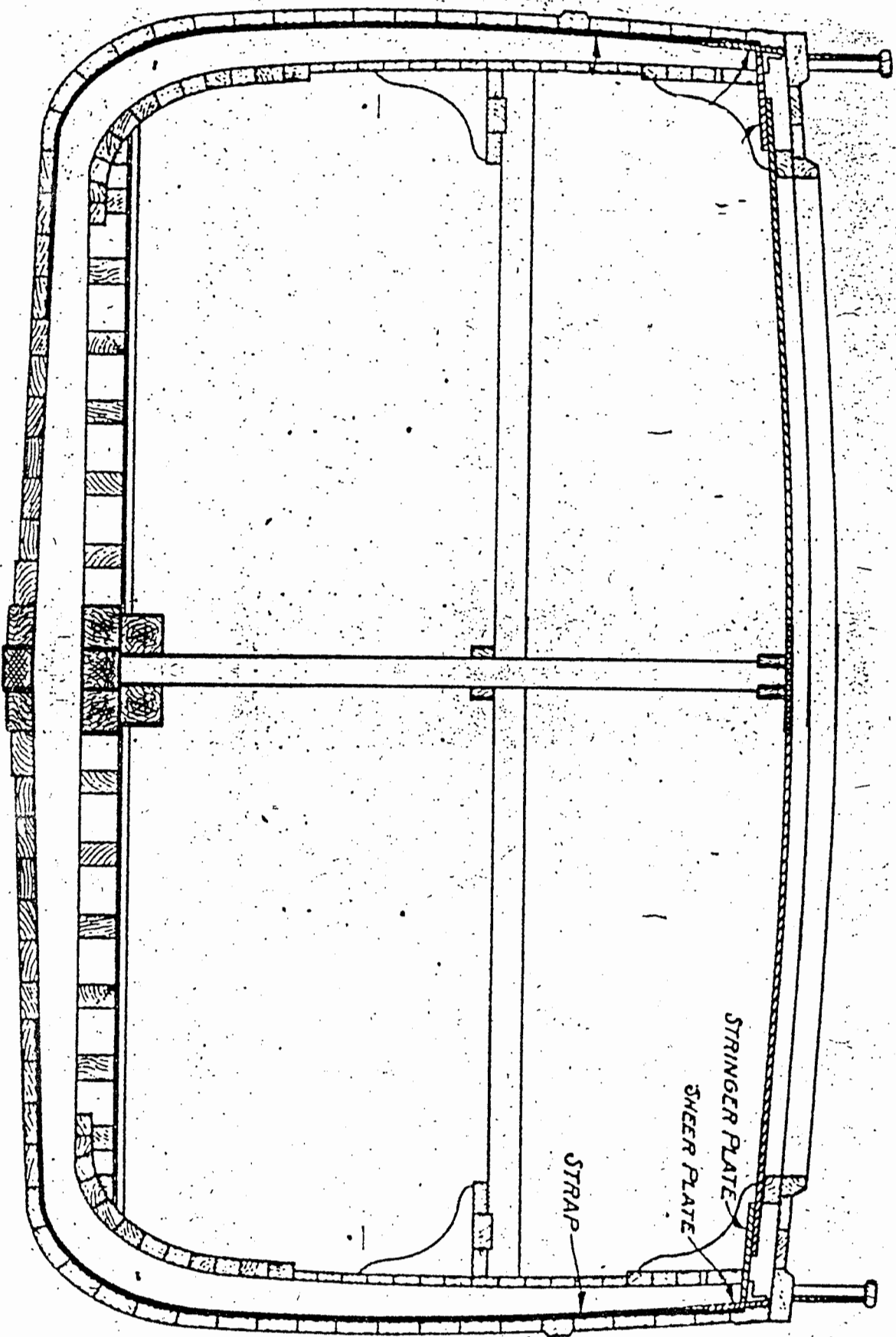


Figure 1 Typical Great Lakes Bulk Freighter Wooden Hull Construction

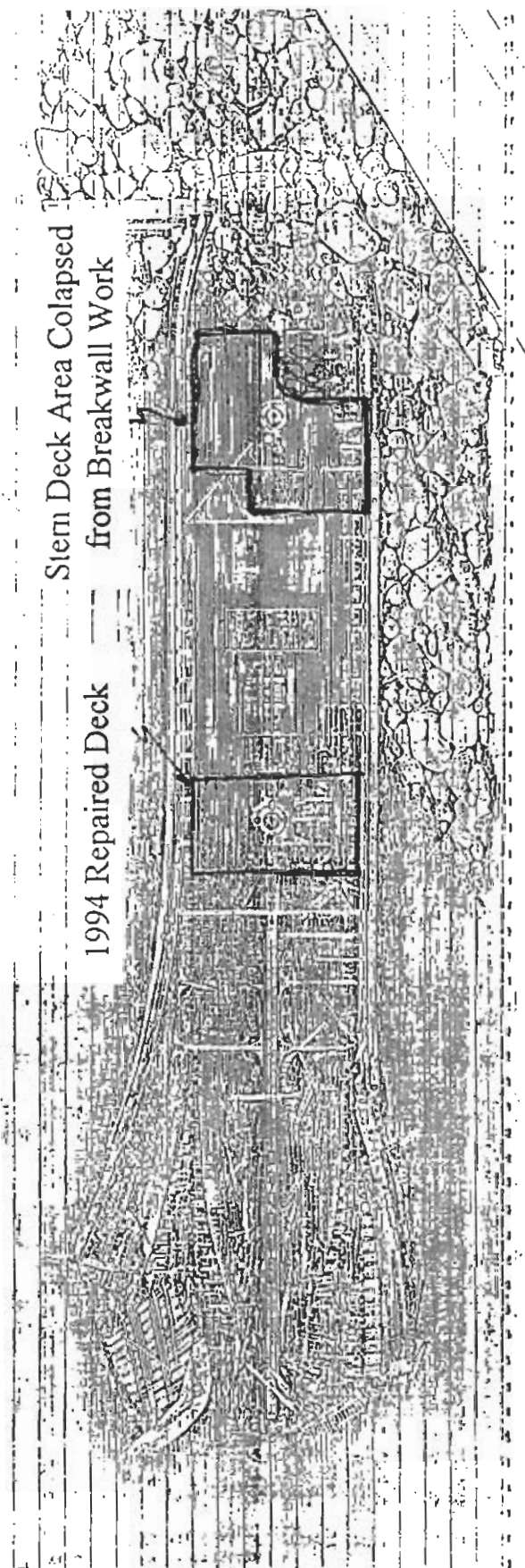
As they lean out, the weight of the structure has caused the sides that support the deck to spread. As the fasteners and deck beams have deteriorated, the hull has spread to the point that at the forward part of the deck the hull was wider than the deck beams. This caused a 20 foot section of the deck to collapse. If this process were allowed to continue, eventually the entire starboard side of the ship would fall to the outside and the entire deck would collapse. (See figure #3). For the *Ely* the rate at which this spreading was occurring accelerated considerably after the breakwall construction. Those of us that were monitoring the deterioration estimated that, if left unchecked, it would be less than five years until the wreck collapsed entirely.

Restoration Proposal: The main object of the project was to do something to hold the sides together and stop the hull from spreading. We considered a number of options. We had heard of at least one other shipwreck that had been strengthened by adding steel tie rods across the ship to do this. This practice was even done to strengthen the ships when they were in service. We also considered using beams angled from the lake bottom in addition to support the weight of the starboard side that was already leaning over. We even considered cutting off the starboard side of the ship that was leaning out the farthest to remove the weight from the upright portion of the hull.

The least destructive, easiest, and the approach most likely to succeed was to be to add the tie rods. As mentioned previously, the forward portion of the deck had collapsed the year before as a result of the breakwall changes. Once the rods were in place, it would be difficult to fix the deck. We, therefore, wanted to lift the deck and get it back up on the shelf before adding the tie rods. Doing this from a floating platform either a boat, barge, or lift bags presented problems of cost and structural stability. It could certainly be done, but we were concerned that we might damage the fragile deck if we could not lift the deck slowly and at the proper angle. (The weight of the deck section was estimated to be less than 1000 lb. from figures I got from Gordon Watts of Tidewater Atlantic Research.)

The clear solution seemed to be to do it through the ice in the winter. The deck could then be lifted and supported by several winches while the sides were pulled together with the tie rods. The ice would form a perfectly stable platform to work from. The deck could be maneuvered slowly up at an angle that would allow us to slide it to the starboard to clear the port shelf. It could then be pulled back again to the port side to set it down on its final resting place. (See figures #4 and #5). We had decided on putting five 3/4" tie rods across the spreading section. These would be placed at five foot intervals and with the exception of the forward rod would be located up under the deck above the shelf. In this way there would be virtually no way anyone could become entangled in them. The forward most rod was planned to be added ahead of the deck where the distance between the sides was a couple of feet more than the deck width. This rod was never added because the centerboard trunk was in the way. Instead we chose to locate it at the stern of the ship just forward of the other collapsing deck section to stabilize that erosion. This will be discussed later.

Financing: All financial support was provided by the group members. Originally it appeared that the Historic Society might be able to help, but they cannot grant funds to restore public property. The Shipwreck Act of 1987 made all shipwrecks public property. Although we did not expect to receive it, we asked for support from the Corps of Engineers, since it was their project that basically accelerated the deterioration (although the structure was already weak). I considered asking for a grant from the Minnesota LCMR fund but the project was contingent on having a cold enough winter to freeze sufficient ice to support the equipment. I did not care to go through a grant process and then have to do it again if the weather did not cooperate. As a last resort I solicited



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C. Pätzsch, D.

Figure 2

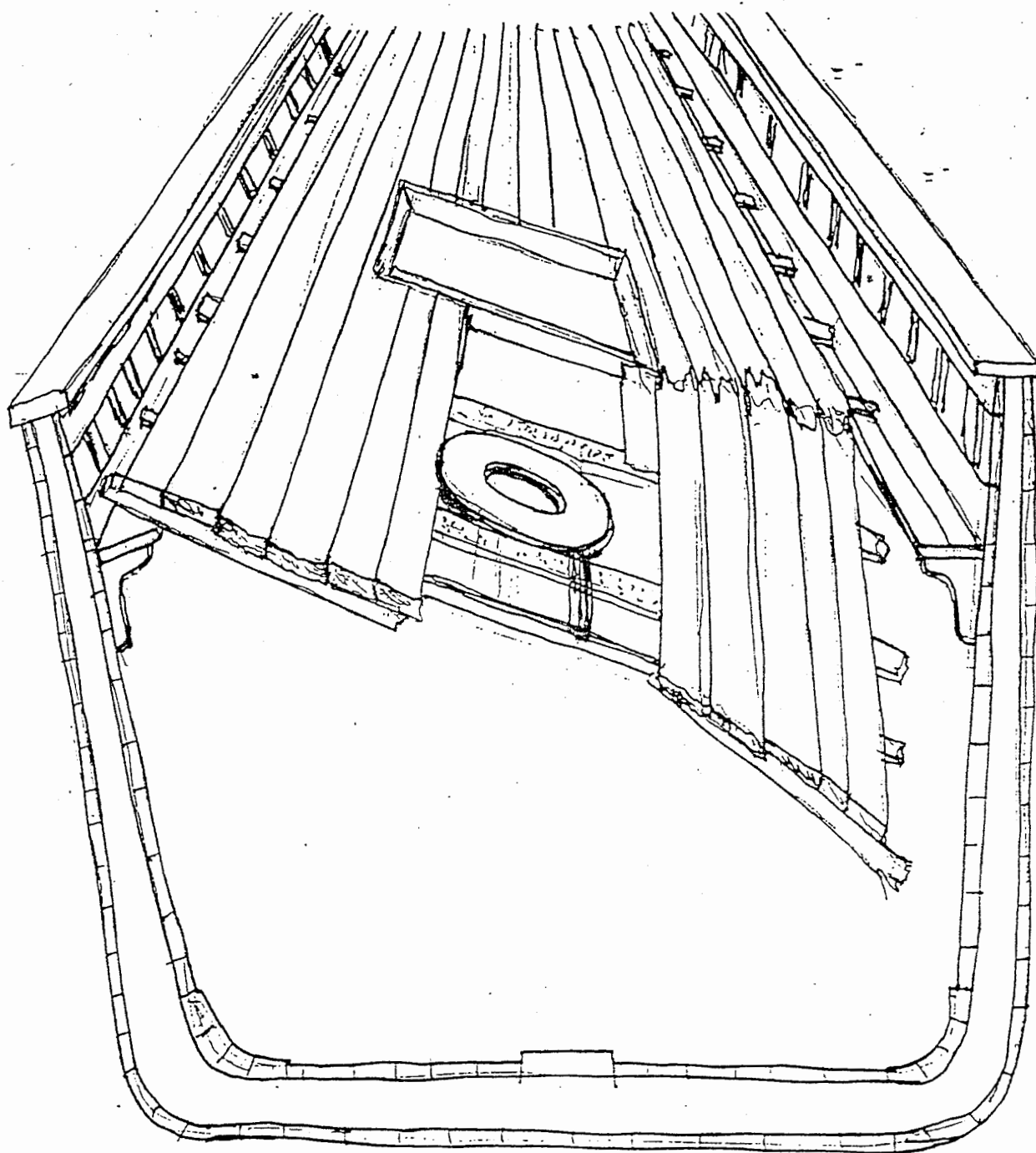


Figure 3 Ely Cross-Section Showing Deck Damage
Prior to 1994 Restoration

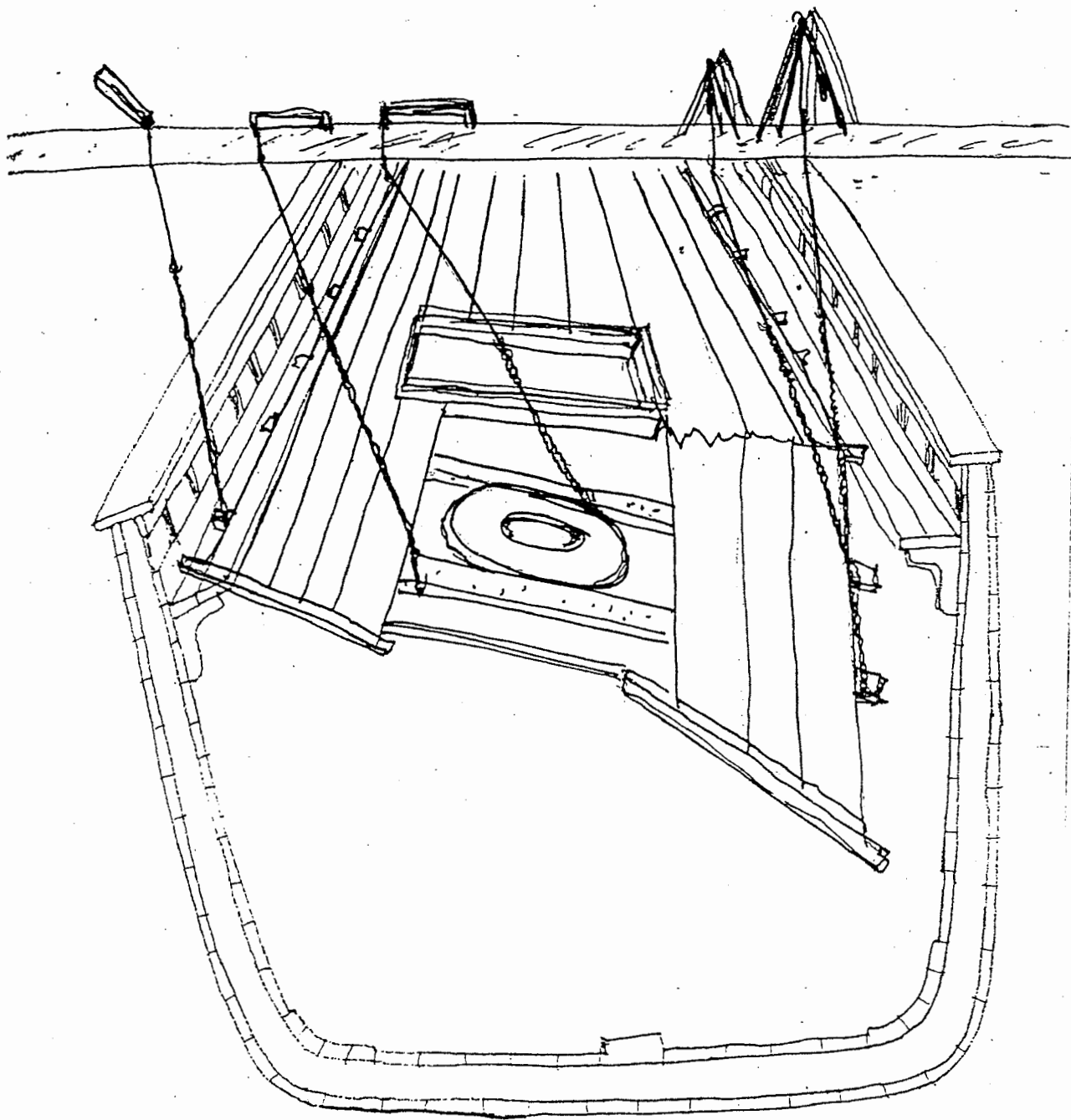
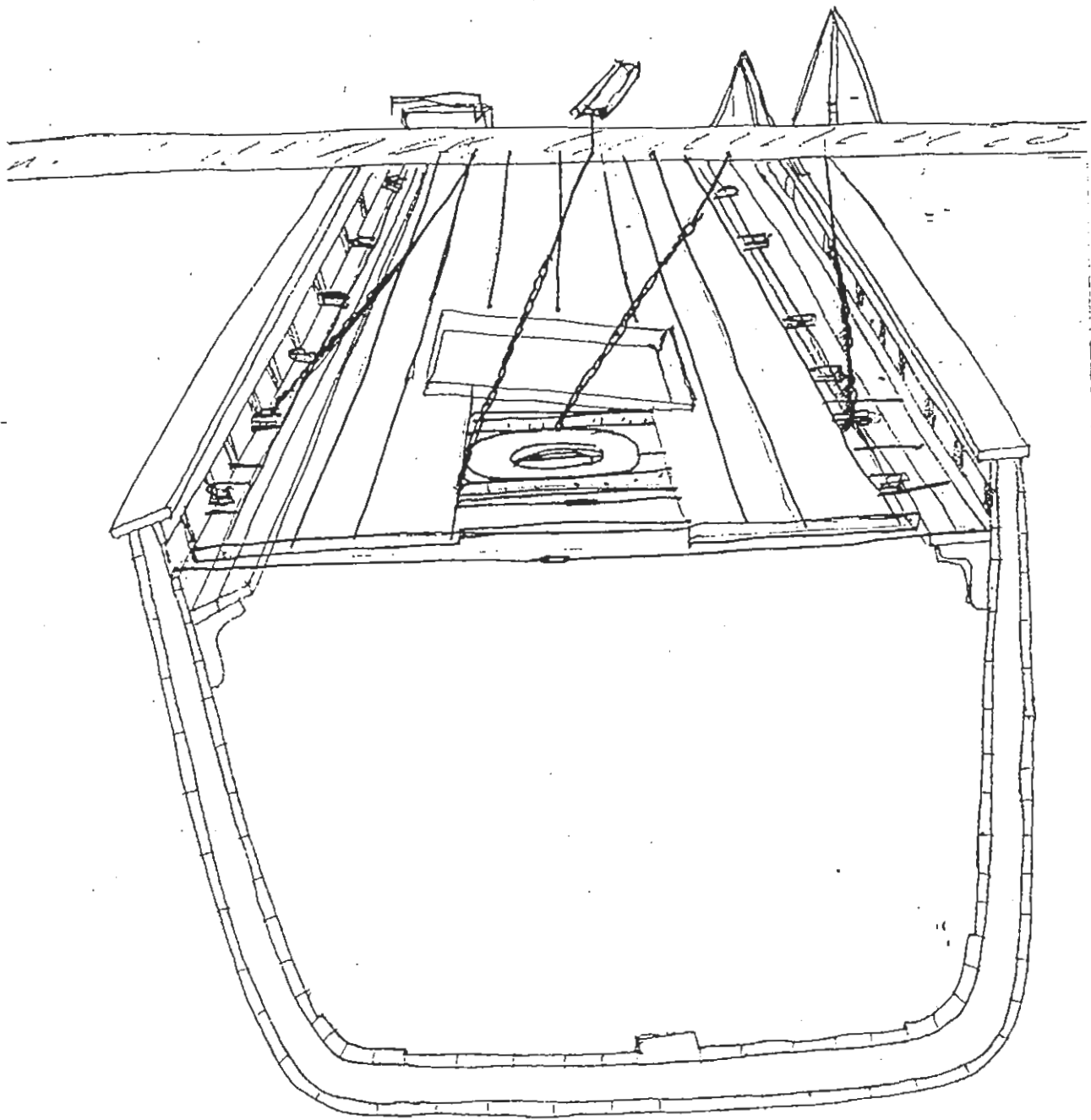
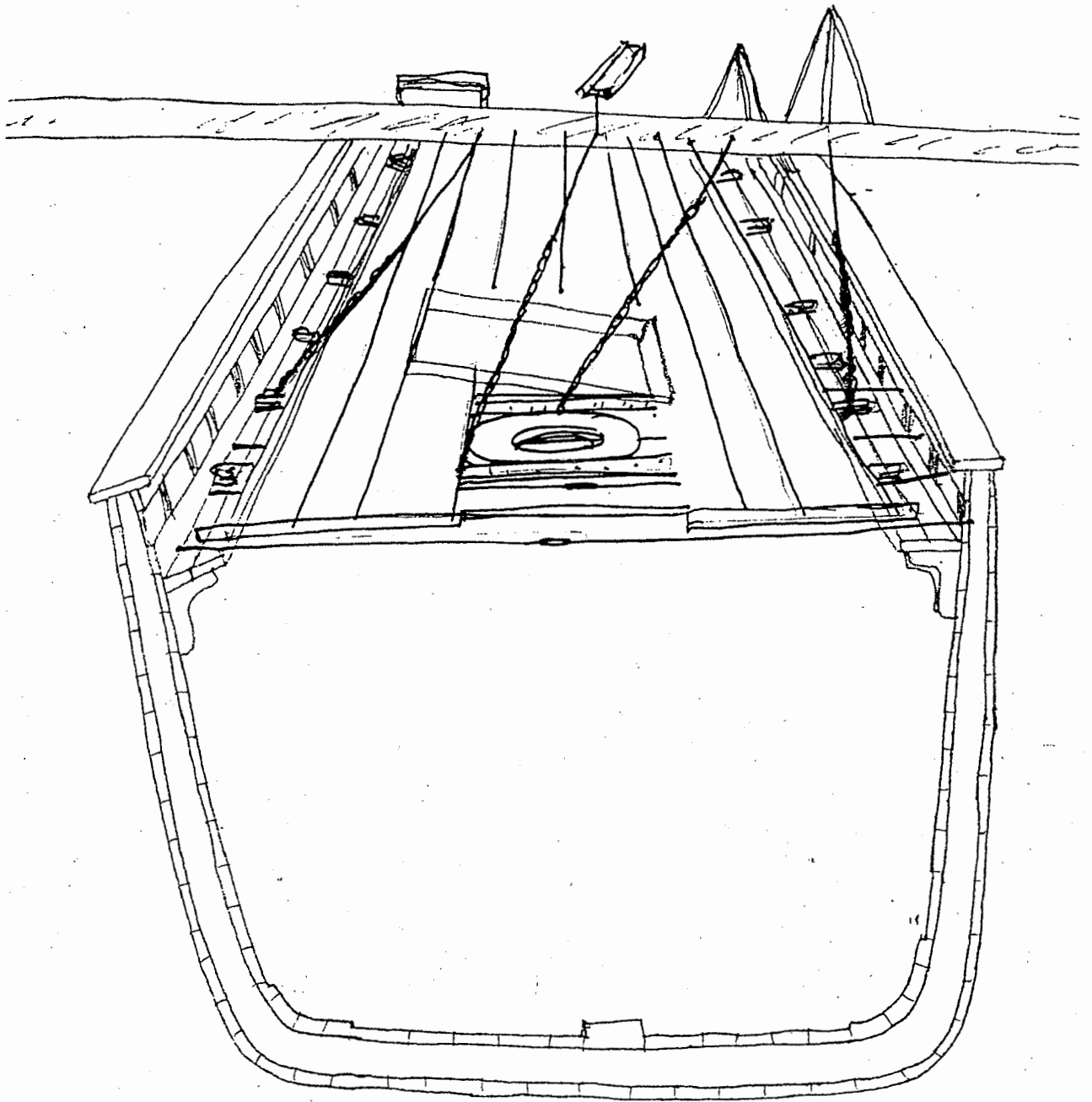


Figure 4 Winches Set to Lift Deck Up Toward Starboard



Deck Lifted
Figure 5 Winches Set to Pull Deck Back to Port



Deck Successfully Set Back On Shelf

two dive shops for a donation and one shop Northland Divers contributed \$50 toward the cost of the tie rods. I paid the other \$50. Luckily no major equipment was damaged other than the video camera I flooded, and that was covered by my insurance.

Organization: I have never worked on a project that seemed to fall together as if directed from above like this one did. Willing and very capable team members volunteered weekly with the skills and equipment that we required. I conceived of the approach with the help from three hands-on mechanical experts Ken Knutson, Dan Gates and Bob Olson. It was obvious from the start that at least the lifting and drilling was really a job for commercial divers. Gently maneuvering the lifting of the deck required the communications of the hard hat divers. The hours of drilling through the oak sides could not have been done in the cold water without the efforts and equipment of the hard hats. Since financing was never a certainty the approach had to be something that we could finance on our own.

Basically I concentrated on making sure we had the personnel qualified to do the job then let them tell me what they needed. The bulk of the project needs were non-consumable equipment. The commercial divers supplied most of their own equipment. Chains, winches, come-alongs, and the come-along frames were borrowed, built, and donated. Housing the operations on the surface was handled by two avid ice divers Dave Schmidt and Tom Brushaber who handled all the ice diving logistics and supplied the ice houses and ice cutting equipment. The tie rods, turnbuckles, and steel reinforcing plates were supplied for the cost of the steel \$100 by a Minneapolis business Lagune Steel.

Off site housing for the crew was one of the major financial concerns. As avenues of financing dwindled, we asked for help from the Pat Labadie. Pat talked to Jeff McMorrow of the Lake County Historic Society, and Jeff graciously agreed to house us in his home, the Two Harbors Lighthouse Keeper House for the project duration.

On site efforts: The whole project required four different efforts at the site. For participants in each effort see Appendix A

Effort 1. Four team members made an initial trip and ice dive about a month before the main effort to do one dive and make some final measurements. The goal was to check ice conditions, photograph the initial condition, and make a final feasibility check before committing everyone's time and effort to the project. They made final measurements for the tie rods. They also marked out on the ice the area where the work was to be done so the second contingent would not waste time cutting holes in the wrong place.

Effort 2. The second effort was the main effort that involved the most people. This took place on the weekend of March 20, 1994. By March 18, the ice on the lake was eroding by the day and the ice breaker from Duluth was working to break a path from Duluth into the Two Harbors Dock. I was in daily communication with Pat Labadie and Jeff McMorrow as the project date drew near to make sure we had enough ice to carry out the plan. Pat Labadie kept us informed on the ice breaker's progress and let the captain of the ice breaker know of our plans. Luckily Mother Nature blew in a northeast gale that piled a 12 foot ice ridge across the lake which delayed the ice breaker enough to allow us to complete the project. (The ice breaker made it into Two Harbors the day after we finished.) Ken Knutson and I went up Friday to check the ice conditions and arrange television coverage with the KDLH Channel 3 Duluth station. The rest of the crew arrived bright and early Saturday morning. All equipment was unloaded at the boat ramp and towed with Dan

Gates' four wheeler, trailer and sleighs a half mile to the site. Two portable warming houses one 10'x12' and the other 8' x 8' were set up to house the equipment and provide the divers with warm changing facilities.

The main entry hole was cut through the ice at the forward end of the construction area and multiple 8" holes were augured through the ice along the sides of the deck. These holes were for the winches and also to vent the air from the air tools and divers' exhaust. This had to be done to prevent the water circulation caused from the air exhaust from eroding the ice around the winch holes. Kent Myhrman photographed the initial state and throughout the project to document the progress on slides. Unfortunately, the video housing that I had borrowed flooded the first dive so we had no underwater video of this effort.

We originally started with two hard hat divers, one on each side of the hull, two compressors running two drills to drill the holes for the tie rods. After drilling for an hour neither diver had managed to make it through the 7 inches of one-hundred year old oak. After evaluating the situation we shortened the air hoses to give better air supply, used one diver with the best drill, and auger bit and started again. The first hole took over an hour to complete, and we thought we were in for a long day. The second hole took 17 minutes as Ben Erickson, an experience commercial diver, finally figured out how to prevent the bit from binding in the oak. After that he managed to drill the remaining six holes in five minutes each. Ken Knutson, Tom Brushaber, Jerry Provost, Dan Gates and I did the dive tending.

Since we did not have enough daylight remaining in the first day to raise deck we decided to set the rods into the holes and just let them hang out the sides for the night. This was probably a mistake since the rods bent from their own weight that night. This made it slightly more difficult to connect them with the turnbuckles, although by rotating each rod it could be done.

The next day the deck was lifted. Since the deck had dropped down under the shelf on the port side, we connected the chains so the winches would pull the deck up and to the starboard. We almost totally cleared the port shelf with this approach except for one deck beam. The decision was made to notch the shelf two inches to allow the beam to clear. Jerry Provost did this by auguring holes side by side in the shelf along the width of the beam. We had to use the auger since we neglected to bring a saw. I might add a saw was the only piece of equipment we lacked in the project, which is pretty good considering the size of the project.

Once the deck was lifted above the shelf, Al Lesinov, Bob Olson, Dave Schmidt and Tom Brushaber on scuba connected the tie rods with the turnbuckles and put the plates and nuts on. At this point we made a disturbing discovery. Three of the tie rods were too long. We solved this temporarily by using the 8 inch long 1 inch pipe sections, we had cut for the come-along frames as spacers for the rods. This allowed us to tighten the rods and bring the sides together a couple of inches so the deck could be set back on the shelf. The rods could be cut to size on a later dive from a boat in the summer. The main task that had to be completed through the ice was the placement of the deck.

Once the rods were in place and tightened the deck was ready to be set back down. We reached that point late Sunday evening. While most of the crew was tearing down equipment in the rain which had started in the afternoon, Ben Erickson and I directed the lowering of the deck. To do this we reconnected the chains - one by one to pull the deck back to the port side. As we lowered the deck it moved over a little but not enough to get the deck beams on the port side shelf. We

needed to move it another six inches to make sure it was firmly on the shelf. Ben and I both stood on the starboard edge of the deck and jumped a few times. We hoped to bounce the deck enough to get it to move. The trick worked and the deck slid nicely into place just where we wanted it. After clean-up that is the way the deck sat until spring when we made the next effort.

In the spring I returned to the sight for one dive with my teenage son and daughter to check the status of the wreck and try to tighten the rods a little more. The part of the deck that we worked on looked good but I was disappointed to see the continuing erosion of the deck near the stern. The corps contractor had sawn across the deck to prevent its collapse after they dropped a large bolder on the back portion of the deck. This saved the main portion of the deck but caused about a thirty foot section of deck behind the cut to start to collapse.

Effort 3. This effort was a half day effort done in mid July. The object of this effort was to shorten the tie rods so we could remove the pipe spacers from the rods that we had left from the winter project. We successfully removed the front two rods, brought them to the surface, cut them off, and re-cut threads on the cut end. The hull was held in place by the back two rods while the front two rods were removed. Both were then re-installed and tightened. This left us with two of the eight ends clean.

Effort 4. This was the final effort of the project. It was done from my boat and breakwall. The object was to finish shortening and cleaning up the ends of the four rods we had installed at the forward end of the deck and install the fifth rod near the stern of the ship. We hoped to stabilize the deterioration at the stern proceeding from where the corps contractors had sawn the deck. By this time the port side of this deck section had dropped off the shelf. We just wanted to keep the deterioration from spreading forward. This effort was completed in one day. The back two rods installed in the winter were removed shortened and re-threaded. All four rods were then tightened as tight as we could get them.

We then drilled and installed the fifth rod ahead of the stern deck damage so it will not hinder any future restoration of that section but should contain the damage to that area. All rods were then trimmed and sharp edges ground off.

Results: I am comfortable in saying that the project was a complete success. I think each participant felt good that he had contributed to a worthwhile effort and had fun in the process. In subsequent visits to the sight I enjoy seeing the *Ely* deck back in the condition that it had been for at least 20 years prior to the breakwall changes. I am disappointed to see the rate at which the stern deck is collapsing. We considered the possibility that our changes to the forward portion of the wreck may have affected the stern portion. After discussing this with Dan Gates and Ken Knutson I do not believe this to be the case, however it is a remote possibility.

Future Plans: After we completed this project we talked about taking on the restoration of the collapsing stern deck.. This project will be larger since the size of the deck to be lifted is larger. The boulder sitting on the deck would either have to be moved or the deck would have to be cut around it. It would be best to do the drilling for the rods and the changes around the boulder in the summer and the deck lifting in the winter for this job. I think if it is done this way it might be completed in a weekend effort again. The drilling is also easier in the summer since the divers do not have to contend with the drills freezing up which was a minor problem in the winter project.

The other project that needs to be done is to install a system to monitor the movement of the wreck so we can better understand and plan any other future efforts. This wreck and I assume many other shipwrecks are not static structures. Surges, currents, and wave action cause certain areas to move. Dan Gates reported seeing the forward protruding side of the *Ely* hull move four inches in the surge on a rough day on the lake. Who can guess what this movement might be in a major storm. I suspect that this movement may cause a loose deck to "walk" or slide to one side. It also causes the surfaces and ends of the beams to abrade each other causing gouges where the beams touch. If we are to do a good job restoring these wrecks, we need to understand the dynamics of the system. Dan Gates and I have some ideas on some inexpensive ways to do this.

I elected not to take on this project during the winter of 1994-1995, since I hate to keep asking the same people to donate their time and the use of their expensive equipment without any compensation. We need to work on some better ways of financially supporting these efforts. If we are to continue these efforts, and I believe it is important that someone does, we will need to form some kind of an organization that can handle financing and creating standards for this work.

Appendix A

Participants in Each Effort:

Effort 1 Doug Benoit, Jim Lacey, Ken Merryman, Steve Petschel

Effort 2: Tom Brushaber, *Dan's Welding & Machine*, Elmer Engman, Ben Erickson, Dan Gates, Ken Knutson, Al Lesinov, Ken Merryman, Kent Myhrman, Bob Olson, Jerry Provost, Dave Schmidt, *Vets Salvage*, Cliff Young

Effort 3: Jerry Provost, Jerry Provost Jr., Tom Provost, Ken Knutson, Andrew Merryman, Ken Merryman and Randy Saulter.

Effort 4: Participants in this effort were Dave Schmidt, Bob Olson, Andrew Merryman, Cari Merryman, John Rogers

Off Site Contributors : *Dan's Welding & Machine*, Dick Hagen, Pat Labadie, *Laguine Steel*, Jeff McMorrow, *Northland Divers*, Tom Powers, Chuck Slehta